

Organizational Learning with a Multi-Perspective Hypertextual Interface for Knowledge Management

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Abstract:

This article describes the Panteon Interface for Constructing and Diagnosing Hypertextual Case Studies as a means for sharing knowledge and fostering organizational learning. Panteon employs the principles of Cognitive Flexibility Theory to avoid oversimplification resulting from linear, single-perspective approaches to complex subject areas. We argue that ill-structured knowledge domains, such as organizational environments, are more richly explored with non-linear, hypertextual mini-case studies than possible with traditional descriptive approaches. Panteon uses the web to provide a simple to use interface creating and diagnosing self-reflective business cases built around non-linear interweavings of individual company personnel's perceptions of a situation. We describe how Panteon may be used by business organizations for knowledge management.

KEYWORDS: Knowledge Management, Organizational Learning, Hypertextual Interfaces, Cognitive Flexibility Theory, Panteon

Lima, M., Koehler, M.J., & Spiro, R. (2002). *Organizational Learning with a Multi-Perspective Hypertextual Interface for Knowledge Management*. Paper presented at the 5th International Symposium on Knowledge Management, August 2002, Brazil.

1 Introduction

Strategic planning requires top-executives to interpret information available through staff reports, market analyses and economic forecasting. Although high-ranking executives usually can count on extensive knowledge of the external environment, many overlook key informational details about internal operations, such as customer service, maintenance and quality control. Increasingly sophisticated knowledge management applications target internal sources of information to supply top decision-makers with enough information about organizational strengths and weaknesses for decision making. Nevertheless, important information about the business environment (both internal and external) remain concealed in the minds of employees in positions that are not usually taken into account by reporting systems. An assembly-line operator, for example, may often have better insights about procedural changes that could lead to incremental innovations in the productive process than the line supervisor, as so many episodes of learning-by-doing have demonstrated (Lima, 1999). Likewise, a front-desk clerk frequently grows more familiar with customer needs than marketing strategists. Thus, the need for personnel at all levels to participate in the decision-making and learning processes increasingly becomes a characteristic of the Knowledge Society. Such participative decision-making requires the mediation of information systems capable of conciliating the ideas of dozens of individuals with multiple perspectives about the same problem-situations, preferably sharing a common theoretical framework.

This article presents one such approach that uses the web, non-linear interactivity, and dynamic information manipulation for business knowledge creation, storage, presentation, and navigation, and how this process may lead to the discussion and diagnosis of typical problem-situations by groups of personnel at all organizational levels. Before presenting the Panteon system for creating and diagnosing business cases we discuss the organizational learning principles that underlie it.

2 Organizational Learning in the Knowledge Society

Technology has ushered in increased access and distribution to information. Paradoxically, using the wealth of information in decision-making has become increasingly challenging. According to Prusak (2001),

“as access to information dramatically expands, so that people increasingly have access to almost all the information they might need at any time and in any place (and, surprisingly, at low or no cost), the value of the cognitive skills still unreplicable by silicon becomes greater. Subsequently, knowledge components such as judgement, design, leadership, better decisions, persuasiveness, wit, innovation, aesthetics and humor become more valuable than ever before.”

Organizational Learning is one attempt to characterize the skills that are needed in an information-rich decision-making environment. King (2001) describes Organizational Learning as the process of “developing and using [organizational capabilities] in order to create higher-

valued information and knowledge, to change behaviors, and to improve bottom-line results”. While machines can perform data processing fairly well, it remains a human trait the ability to transform loose pieces of information into useful and applicable *knowledge*, particularly within the context of business organizations. Even though organizational learning should make use of information technologies as a tool, it is humans that must transform information into knowledge. Levine (2001) argues for ways that technologies can appropriate support decision-makers:

“multimedia technologies and practices supporting process change, modeling, simulation, and collaborative and distributive work will be [a key issue in 21st-century learning organizations]. Skill sets in the new workforce that allow flexibility, speed, experimentation with rival hypotheses, and collective responsiveness will prevail.”

She further argues that systems affording information capture, structuring, visualization and retrieval may help us evolve from the taylorist-fordist sense of discipline towards a more creative and critical workforce. In her words, “by mobilizing multiple perspectives, experiences and expertise from across an organization and channeling these for decision making, the organization, as a whole, can monitor relevant market conditions”, thus satisfying changing technical and business needs.

Jonassen also argues for the use of computers as cognitive tools, or “mindtools” (Jonassen, 1996). In this view, meaningful learning is simultaneously active, reflective, collaborative and authentic (Jonassen et al., 1999). A network databank, for example, could be used as a mindtool for meaningful learning if users are able to actively contribute with new contents, reflect about existing contents and their relationships, and collaborate by discussing the application of the available information. Furthermore, all these interactions must take place in an authentic and complex enough environment to make it stimulating for participants. Jonassen argues that meaningful learning tends to lead to what he calls “complex thinking”, or the ability to combine metacognitive skills of problem-solving and decision-making with creative thinking skills (imagining, elaborating, synthesizing) and critical thinking skills (establishing connections, analyzing and evaluating). Such complex thinking skills are in greater demand than ever in the world of business.

On the other hand, as previously argued, organizations should not expect knowledge management systems to entirely replace face-to-face interaction. According to Birkinshaw (2001), many knowledge databases end up being poorly used simply because “most people would much prefer to talk to a colleague about their latest ideas rather than try to find something he or she wrote”. If the ultimate goal of knowledge management is to encourage knowledge transfer and support knowledge sharing and reuse (Duffy, 2001), then information systems should be thought of as a stimulus to direct human interaction rather than a substitute for it.

Ideally, the praxis of these guidelines will produce what Mohr and Dichter (2001) call a “mature learning community”, in which better decisions are made because people are actively involved in decision making, hence playing a more creative and critical role. The more points of view are taken into account, the more likely decisions will reflect the complexity of the environment. This is precisely the goal of the Panteon Interface, the knowledge management tool presented in this article. We will describe how Panteon may help build a learning organization in which the creative and critical thinking skills of its members are taken into account during decision-making

and strategic planning. Before we introduce the tool itself, however, we must briefly discuss the interactive features of what we call “Dynamic Hypertextual Interfaces” and their underlying theoretical framework, the Cognitive Flexibility Theory.

3 Dynamic Hypertextual Interfaces

“Dynamic Hypertextual Interfaces” are hypertexts (e.g., web-pages) in which the individual elements are not previously determined in a static structure of hyperlinks, but rather whose outputs vary according to search criteria established by the user. As opposed to traditional HTML pages, these so-called “active server pages” (ASP) are generated dynamically from information-dependent sources, such as a database.

There are a few interactive features of databank-driven hypertextual interfaces that make them well suited to meaningful learning, namely:

- **sorting:** the ability to classify information according to any chosen criterion;
- **searching:** being able to retrieve specific information from a databank according to any chosen criterion;
- **“click-capturing”:** the ability to instantly transfer the contents of multiple record-sets to a personal databank for later retrieval and analysis;
- **annotating:** being able to write new information into previously defined record-sets in a databank for later retrieval and analysis.

Traditional Cases	Hypertextual Cases
Unrealistically linear presentation of info; one or few perspectives of problems.	More realistic presentation of information, allowing diagnosing students to crisscross the problems from multiple perspectives.
Requires sophisticated heuristics for complex treatment.	Scaffolded heuristics for helping inexperienced students in the process of applying complex models of analysis.
Novelist-like skills required for authoring.	Potentially easier to write cases without any special literary skills.
Hard to update and redistribute.	Instantly updatable and accessible world-wide over the web.

Table 1: Hypertextual versus traditional case studies (selected features)

Table 1 offers a number of other potential advantages of hypertextual interfaces over traditional, printed case studies. Evidence of the presented limitations of traditional cases may be found in Koehler (2002), Ronstadt (1993), Maher & Pu (1997) and Naumes & Naumes (1999).

We believe that the combination of these features affords powerful means of storing, manipulating, and retrieving data that has import to organization knowledge systems, which can be used to incentive active, reflective and collaborative learning.

To simulate cognitively flexible, critical, and creative thinking has been the driving force behind the Panteon System.

4 A Few Key Aspects of The Cognitive Flexibility Theory

The cognitive possibilities of Dynamic Hypertextual Interfaces are best described by a set of principles known as the "Cognitive Flexibility Theory". CFT describes potential benefits associated with the use of hypertextual interfaces for case-based reasoning. Originally, it was conceived by a group of researchers at the University of Illinois to help physicians understand better the subtleties involved in diagnosing cardio-vascular problems (Spiro, 1992). According to CFT principles, in ill-structured knowledge domains, such as history, business or medicine, traditional learning methods based in generic prescriptions may not help students understand how they can transform their declarative knowledge (inert information, without structural links) into procedural knowledge (the capacity to deal with new situations). In other words,

“Knowledge that is complex and ill-structured has many aspects that must be mastered and many varieties of uses that it must be put to. The common denominator in the majority of advanced learning failures that we have observed is oversimplification, and one serious kind of oversimplification is looking at a concept or phenomenon or case from just one perspective. In an ill-structured domain, that single perspective will miss important aspects of conceptual understanding, may actually mislead with regard to some of the fuller aspects of understanding, and will account for too little of the variability in the way knowledge must be applied to new cases Instead, one must approach all elements of advanced learning and instruction with the tenet of multiple representations at the center of consideration” (Spiro et al., 1991).

Therefore, CFT proposes that in order for learners to grasp the complexity of the "real world", they should be able to subjectively understand and reconcile several interpretations of the same reality. In ill-structured knowledge domains, the multi-faceted nature of real problem-situations will only present itself through the "crisscrossing" of multiple schemes, concepts and perspectives of analysis (Jonassen et al., 1997). More specifically, it argues that in such ill-structured knowledge domains, the following premises hold true: a) the complexity and case-to-case variations represent an obstacle to knowledge acquisition in traditional teaching methods; b) oversimplification, a typical flaw of traditional teaching methods, often keep learners from grasping the complex aspects of problem-situations, thus adding to the difficulty to transfer the acquired knowledge into new situations; c) learning with cases from multiple perspectives favors the ability to transfer knowledge in new situations; d) hypertextual interfaces, due to their dynamic informational possibilities, are an adequate environment for developing cognitive flexibility.

The last part of this article describes the Panteon project, a dynamic hypertextual interface for creating and diagnosing case studies for organizational learning purposes.

5 Panteon: a Knowledge Management Interface Based on CFT Principles

Panteon is a Portuguese acronym for “Applied Project of New Technologies for On-Line Education”, but it also suggests the interdisciplinarity of its greek epistemological origin *Pan + Theos*, a shrine where “all gods” have their place. Initially, the project consisted of an attempt to create a single multimedia case study on a CD-ROM using video, still images with voice dubbing and computer animations. Such idea later evolved towards the concept of a web-based databank

allowing business professionals to create and diagnose hypertextual case studies about their own organizational environment.

When a user first visits the Panteon web page — presently available only on the Intranet of the institution where it is being developed — he or she may log in with a previously saved password or register as a new user. New users may choose to create their own hypertextual case study or diagnose cases readily available in the databank. The subsections below illustrate the procedures involved both while creating new case studies and while diagnosing existing ones.

An Organizing Committee (OC) must be appointed to set forth the background for a collective construction of a new case study. The OC will be responsible for defining structural elements such as the model of analysis, the problem-situations and the introductory text of the case studies. The OC will also be in charge of training employees to use the interface and to become acquainted with the categories of analysis; furthermore, it will establish deadlines for participants to create characters and character perceptions. Finally, it is also responsible for scheduling meetings for collective diagnoses after individual diagnoses have been produced.

5.1 Creating Hypertextual Case Studies with Panteon

The process of creating a case study consists of six steps: defining the model of analysis, an introductory text, the organizational structure, the problem-situations, the involved characters and the character perceptions. Figure 1 presents the six steps as shown on the upper left corner of the user screen during the process of creating a case study. These will be discussed below.



Figure 1: Menu for creating / editing a case study.

- 1. Model of Analysis:** by “model” we mean a business heuristic or framework that is used to understand the current problem analysis. The SWOT model, for example, traditionally used for case studies, consists of four categories: **S**trengths (positive factors within corporate control), **W**eaknesses (negative factors without corporate control), **O**pportunities (positive factors within corporate control) and **T**hreats (negative factors without corporate control). Solutions based on this model consist of identifying and “maximizing” elements belonging to the “S” and “O” categories while “minimizing” elements belonging to the “W” and “T” categories. Other examples of models of analysis include Porter’s Added Value Chain (Porter, 1991) and Kotler’s 4P analysis (Kotler &

Armstrong, 1992). The choice either to create a new model of analysis or to use existing models should be made by the Organizing Committee.

2. **General Aspects and Introductory Text:** here the OC is expected to describe the history of the organization, the competitive scenario, the current crisis and/or apparent dilemma, the main characters involved in decision-making, the organizational culture, informal aspects of internal social networks, and any other aspects they may find useful in a contextual introduction to the problem-situations.
3. **Organizational Structure:** the structure of the organization being investigated in the problem is presented to users. Panteon supports two levels of organization structure: departments and sub-departments. For every new department created (e.g. “marketing”, “finance”), users may attribute any number of sub-departments (e.g. “sales”, “logistics”, “controlling”, “accounting”, etc.). Users may also wish to add to the positions characters may occupy within this structure, such as “director”, “vice-president”, “assistant”, etc. The perspective of every character is partially determined by his or her position in the organization structure. For example, “director” + “marketing” or “assistant” + “production” + “infantile shoes assembly line”. Even though the Organizing Committee may choose to create the main elements in the organizational chart, different participants may add others as they create their own characters reflecting perspectives as unique as a customer’s, a competitor’s or a supplier’s, which are not necessarily contemplated in the original structure.
4. **Problem-situations:** consist of paragraphs detailing the main problems identified in the introductory text, such as “new competitor entered the market” or “lost of competitiveness in segment XYZ”. Such descriptions may be accompanied by any electronic attachments supporting the involved decision-making, such as balance sheets, costs spreadsheets, sales reports, newspaper articles, etc.
5. **Characters:** in order to create a character, users must give them a name and assign them a position in the organizational structure (using pull-down menus whose options will have been set according to the previously defined structure). Characters must also be given a psychological profile and a job description. Based on dozens of “avatars” available from a photo databank, users must also choose a face to represent the character according to its biotype (age, gender, dressing style, etc.). All of these will replicate real-life biases that people usually have when judging another’s perception. Characters may reflect either any employee’s own perspective (i.e., his/her own position, name and perceptions) or fictitious positions by newly created characters such as clients, salespeople, government agencies, suppliers, etc.
6. **Character Perceptions:** here lie the key elements of case investigations in the Panteon system. Character perceptions (or viewpoints) are available for every problem situation and category of analysis paring. For example, the director of marketing (character) may have the following to say (perception) about a threat (category of analysis) associated with the “increased costs” issue (problem situation): “If we can’t cut down production costs in the near future by reducing the number of employees and acquiring more up-to-date technology, competitors are bound to conquer even larger chunks of our market share

on the long run”. Each participant may input new perceptions only for his/her own characters.

According to the principles of the adopted Theory of Cognitive Flexibility, the greater the number of different perspectives about the same aspect of an ill-structured knowledge domain, the greater the capacity to represent its inherent complexity. In an averagely complex case study, if *twelve* characters “issue” a perception about *four* problem-situations according to every one of the *five* categories of any given model of analysis, a maximum of 240 perception paragraphs will be written. However, usually not every character has something to say about every problem-situation according to every category of analysis, thus the actual number of perceptions is often significantly smaller than the maximum number of possible perceptions. Even so, in the above example, users will still have to deal with an enormous amount of perceptions; these are sometimes complementary to each other, sometimes contradictory, sometimes merely ambiguous — just as it happens in real life. The emulation of real-life organizational complexity lies precisely in the fact that such a myriad of perceptions will be presented in a non-linear fashion according to the navigational strategies of diagnosing users. Hence, users will deal not only with the objectivity of factual data (balance sheets, sales reports, etc.), but also with the subjectivity inherent to human interactions in complex organizational structures. How this is achieved is further described in the following sub-section.

5.2 Diagnosing Hypertextual Case Studies with Panteon

When the deadline established by the Organizing Committee for creating characters and character perceptions expires, participating individuals are given some time to work on their personal diagnosis of the problem-situations. By clicking on the “Diagnosis” section of the main menu toolbar, they obtain a sub-interface with diagnosing options, displayed on the upper left corner of their screen as presented by Figure 2.



Figure 2: Menu displaying tools for diagnosing case studies

1. **Board Meeting:** here every participant will play the role of a “consultant” reviewing the information currently available about the organization. The user is presented the introductory text, the model of analysis (usually a power-point presentation saved as HTML), the organizational structure, the problem-situations and their related documents (appended as hyperlinks), and all the created characters. Any of these pages can be

revisited at any moment during diagnosis by clicking on the appropriate spot beside the “meeting table” icon above.

- 2. Research Room:** after getting acquainted with the overall elements of the case, users must choose among six alternative perception-searching strategies available at the Research Room: by keyword (e.g. all perceptions containing the words “cost” or the fragment “prod”, if one suspects there is a lot to learn about production costs, productivity, etc.), by department (e.g. everything people in the marketing department think about all the problem-situations as perceived through all categories), by position (e.g. only perceptions by directors, or by auxiliaries), by character (e.g. all the opinions by Chris Teller, marketing director), by category of analysis (e.g. all the “threats” or all the “opportunities”), or by problem situation (e.g., everything available in the databank about the “new competitor” problem). Every search option has its own pull-down menu where those elements are available to choose from (with the exception of the keyword search option, which is a text-box rather than a pull-down menu). After choosing a category, the user clicks on the “search” button and is presented with a list of characters followed by their respective avatars, hierarchical position, and their perceptions that match the specified criteria. Each perception is related to a specific problem-situation as seen through the lens of a specific category of analysis (see Figure 3). One may make use of these perceptions by “click-capturing” the perception they find the most relevant. This is done by clicking on the notepad-like icon that accompanies every perception below the character picture. Panteon then copies the specific perception into the user’s personal databank along with all the related data (name and position of the character issuing the perception, associated problem-situation and category of analysis — see indicative arrow in Figure 3). With the aid of the “PantPad” sub-interface on the lower left corner of the screen (Figure 3), users may then add their own commentaries to each captured perception. Later on, these perceptions and personal comments will help users write their final diagnosis. The Organizing Committee may want to set up a constraint as to the maximum number of perceptions every user is allowed to collect in order to force participants to prioritize their collecting decisions.
- 3. Collected Perceptions Report:** here users may view all the captured perceptions and sort them according to any of four available criteria: characters, departments, problem-situations or categories of analysis. Such dynamic reorganization of collected perceptions allows users to easily identify “unexplored zones” in their databank research strategy. One may, for instance, realize that he or she has not yet collected enough perceptions about a certain category of analysis or about a certain problem situation. Or maybe they will have enough perceptions related to these two criteria, but from the perspective of higher-ranking personnel only. In any case, users can always go back to the research room and capture more perceptions that will fill in those analytical gaps.
- 4. Writing the final diagnosis:** For every combination between category of analysis and problem-situation (e.g. “strengths” associated with “new market segment”), the interface will retrieve the collected perceptions and prompt users to write a diagnosis and a plan of action based on those perceptions and the related annotations. The quality of the diagnosis will depend on how one deals with the contradictions among different perceptions, as well as the areas of synergy and ambiguity. Arguments in favor of certain perceptions at the

expense of others (or in favor of one’s own personal synthesis of perceptions) should be supported by an analysis of the objective data available (balance spreadsheets, sales reports, cost appraisals, etc.). The interface prompts users to describe a proposed plan of action after every diagnosis. There should be as many diagnosis and plans of action as the number of possible combinations between categories of analysis and problem-situations. If any given case, for example, has three categories of analyses and two problem-situations, at least six partial diagnoses followed by specific plans of actions should be produced. In order to avoid repetition where appropriate, students are encouraged to cross-reference among diagnoses and plans of actions.

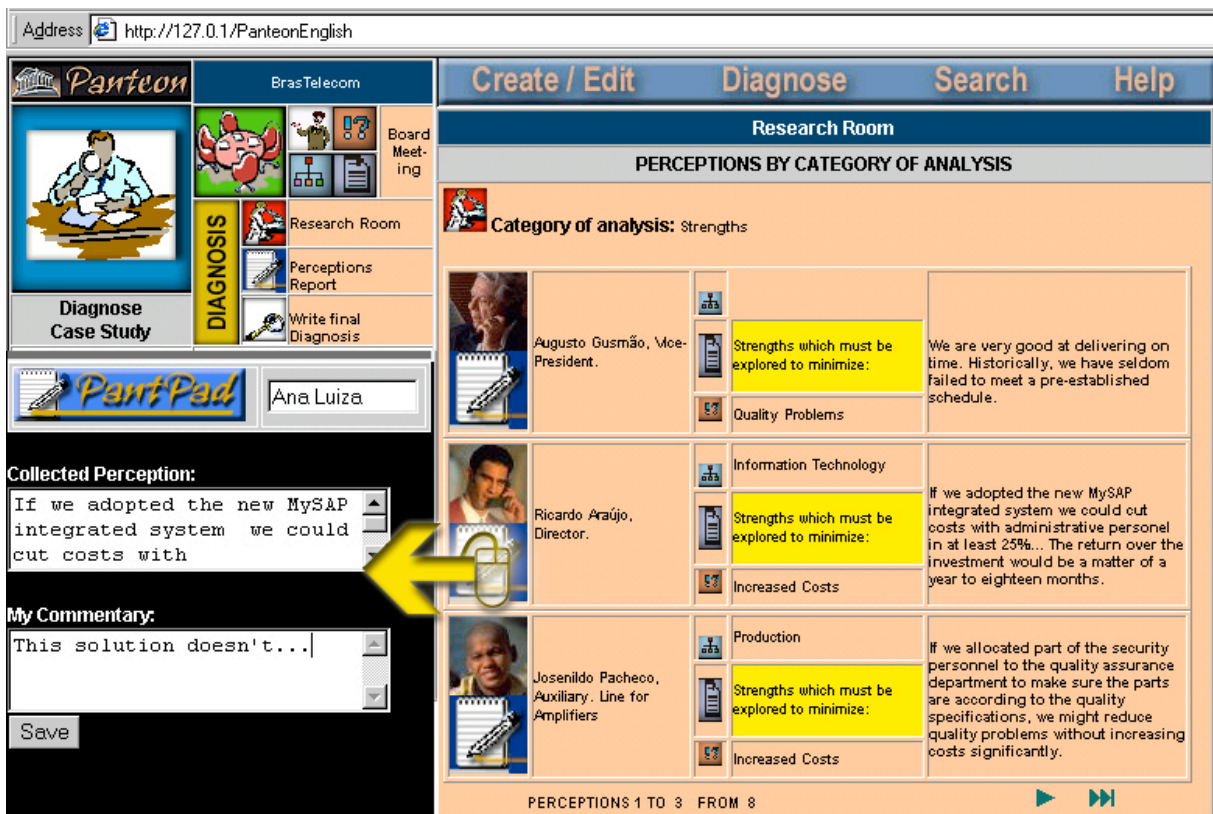


Figure 3: User Ana Luiza is “Click-capturing” and annotating a perception from a list originated by a specific search criterion (Strengths) in the Research Room.

The richest part of the proposed methodology begins when participants are done diagnosing and proposing plans of action individually. Now starts the true collaborative nature of this method, as participants are asked to collectively negotiate their results and produce a synthesis. Owing to each person’s own biases, priorities and preferences, each user will have pursued different research strategies through the available perceptions. Just like in that anecdote about the blind wise-men touching different parts of an elephant and describing the animal as being either a snake (the nose), a tree (the legs), a whale (the belly) or a whip (the tale), it is very likely that every user will come up with different aspects of the same problems during their individual diagnosing processes.

At this stage the Organizing Committee must form small groups of three to six people to produce intermediate collective results by having them negotiate the perceptions they find most valuable and why. Each group must select which perceptions, diagnoses and plans of actions best represent the group's notion of what are the most important aspects of the problems and their respective solutions. This is achieved by cutting and pasting character perceptions, fragments of diagnoses and plans of actions into a sketch document. Then, each group must log in as a new user and produce a perceptions report, final diagnosis and plan of action by copying and pasting back from the sketch document. This newly created "collective user" will reflect the group's consensus.

Depending on the size of the organization, successive rounds could be held by having each group pick a leader or representative who will carry the group's results onto the next stage of negotiation. In the end, a group of three to six final participants will have in their hands a diagnose and plan of action that represents the critical and creative thinking of (potentially) all personnel involved.

When this process is repeated with different models of analysis at a time, we achieve the "crisscrossing" effect of Cognitive Flexibility, resulting in a more critical and creative perception of problems, hence deriving better solutions.

6 Final Commentaries

We believe knowledge management is more than simply "capturing, organizing and storing knowledge and experiences of individual workers and groups within an organization" (Gilbert and Jones, 2001); we believe it is about actively stimulating knowledge workers to interact with each other and to share their tacit knowledge. Because tacit knowledge is hard to codify, human interaction is a fundamental aspect of knowledge management. Furthermore, because information is not knowledge, merely sharing information on a need-to-know basis often does not result in "the serendipity and creativity that drive unexpected results from Knowledge Management" (Guenther and Braun, 2001). Technology should be seen simply as a means toward this end.

The Panteon Interface was conceived as one such means. It enables employees at all hierarchical levels to express and negotiate their perceptions about concretely experienced problem-situations, either openly or anonymously. The collective process of creating and diagnosing hypertextual case studies with Panteon will stimulate unique perspectives to be taken into account during strategic planning, thus tapping the critical and creative thinking skills of personnel who often have a much more privileged vantage point on specific issues than top executives. Once created, case studies will remain available on the Intranet for future reference and for training purposes. The several levels of previous diagnostic rounds in each case can be retrieved as a separate case study at any time, so that discarded syntheses and plans of actions can be looked up with the ease of a regular web search engine. Thus, solutions found in the past may help deal with new problems.

Besides its use as a knowledge management tool, the Panteon may also be used as an educational resource in business schools (Lima, 2001). Case studies created by experienced instructors may

be used to stir debate among several groups of diagnosing students, for example, or students could create their own case studies and have others diagnose them. By dealing with different models of analysis applied on practical and realistic issues, students acquire an interdisciplinary, diversified “analytical vocabulary” to apply in practical contexts. The Panteon prototype is ready to be tested in medium-sized businesses as well as business schools in Brazil. An English version is also available for international users. A book on the Panteon methodology is being prepared.

Even though hypertextual browsers have become commonplace in offices and universities around the world, some of the benefits of interactivity remain little explored. Students and professionals worldwide still use the Internet simply as another source of information, often underestimating its potential as a cognitive tool. This article tried to describe how it is both possible and opportune to involve business professionals at all levels in the critical and creative thinking processes of strategic planning, thus living up to the increasingly complex demands of the Knowledge Society.

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