COGNITIVE FLEXIBILITY HYPERTEXTS: AN ALTERNATIVE TO HARVARD-STYLE CASE STUDIES

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Abstract

This article discusses how Interactive Communication Technologies, in general, and Hypertexts of Cognitive Flexibility, in particular, may contribute to business learning based on organizational case studies. The proposed hypothesis suggests that the properties of information storage, processing, and distribution inherent in those interfaces may facilitate the use of critical and creative skills during organizational analysis, particularly in socio-constructivist learning environments. Proceeding from such an assumption, we created the PANTEON Interface, a web-based tool for organizational analysis supported by a data base structure. We have applied the interface with a group of students while conducting a series of participant observation experiments in a Business School in Salvador, Brazil, followed by focal group interviews with some of the participants and observers, aiming at comparing the digital case studies interface with the traditional Harvard method in terms of their potential to stimulate “Collaborative Interactivity” and “Integrated Thinking” skills. According to the perception of the 29 senior undergraduate business students and 5 experts involved in the experiments, the unique informational characteristics of PANTEON may indeed stimulate the use of higher cognitive skills in ways that traditional paper-based media cannot, thus presenting itself as a valid alternative to the Harvard method.

KEY WORDS: hypertextual interfaces, constructivism, cognition, business education
PALAVRAS-CHAVE: interfaces hipertextuais, construtivismo, cognição, educação de gestores

1 The Problem

Decision-making is an inherently ambiguous process because not only are different judgments made by different people on the same situation, but also because the same individual will often make different decisions with the same information available at different moments in time (Mantovani, 1996:128). Particularly in the wake of the Knowledge Society, characterized by an unprecedented amount of information available at one's fingertips, decision-making requires of knowledge workers the ability to convey information searching strategies which allow them to “identify priorities amongst a rather inconsistent system of preferences and to attribute plausible meaning to an ambiguous and confusing external environment” (Mantovani, 1996:32). Paradoxically, for those who do have access to the Internet, the lack of information if frequently a smaller problem than deciding which pieces of information among the many sources available are the most relevant for analyzing a particular situation and choosing a particular set of actions.

In order to deal with the complexity of the informational environment that surrounds business problems, it is necessary to articulate higher cognitive functions such as critical and creative thinking skills. Solutions to business problems often cannot be achieved by merely using pre-established algorithms, as is also the case in most domains of the Social Sciences. Unfortunately, evaluation systems in business schools tend to focus on the learner's conceptual memorization capacity, instead of using criteria that reflect a student's ability to establish analytical connections, to formulate hypotheses and to conceive alternatives to complex problems. Jonassen and Carr (2000:166) recently analyzed a series of tests used to evaluate the performance of business students in American universities, concluding that 65% of the questions (all were multiple choice) in the course examinations assessed recall, memorization, or knowledge of what students were taught in lectures or read from the text; 25% were at the concept level; and 10% assessed higher order thinking (such as rule, principle, inference, and implication). Based on a series of examinations like these, business faculty are willing to certify (by virtue of a bachelor's degree) that graduates are competent to
conduct business. Graduates' business competence, however, relies on their ability to recognize instance of the concepts that they memorized for those examinations in the real world and to know how to apply them in real-world practice, which requires understanding that was never examined or practiced in the large lecture courses.

Establishing a complex and interdisciplinary approach to organizational problems in business education is a necessary step towards adjusting to the increasingly diverse decision-making environment of the Knowledge Society (Senge, 1990:34). It is essential to stimulate higher order thinking and collaborative problem solving skills in business classes in order to prepare students to face the challenges of this new environment. The convergence between telecommunication and computer technologies, one of the very reasons why our informational environments have grown so complex, may provide the best solutions to deal with those challenges.

This is not equivalent to stating that the mere introduction of Information and Communication Technologies (ICT) in classrooms or in the office will solve the question. We agree with Lemos, Palacios and Cardoso (1999:69) that “technology has been erroneously adopted as a magical solution to all the problems of communication and education, as though a simple instrumental approach would suffice. We insist that it is an error to come up with purely technical solutions to deal with problems that are eminently political and cultural in nature”. Nonetheless, as those same authors seem to agree, new technologies will not necessarily bring about a radical innovation, but force users to deal with their inherent dynamics. Without technological support, virtualization processes are entirely dependent on the competence of the professor. Thanks to ICT, however, teachers and students feel inclined to explore the hypertextual possibilities of the new medium... How may one even try to use Internet for education without inherently practicing non-linearity, interactivity, simulations and real-time processes? Hence its importance. New Technologies used in education may help reposition teachers and students in their roles as agents of virtualization (idem: 69).

Because of its unique interactive potential, ICT (which may as well stand for “Interactive Communication Technologies”) can prove to be better “cognitive tools” to certain advanced thinking activities than the pencil or the book. Increasingly complex informational environments require students to overcome historical limitations of paper-based reading and writing, both in the classroom and in professional business environments. Such limitations are related to traditional media characteristics of information storage, processing and distribution (Mowshowitz, 2002:70). According to Mowshowitz, traditional media are particularly well suited to dealing with declarative knowledge. A book's information storage system, for example, has proven to be an effective means of registering and retrieving any conceivable human idea. It relies not only on the reader's ability to make sense of the alphabetical characters in ink, but also on the underlying structure of page numbering, cross-references and tables of contents. Unlike hypertextual interfaces, however, books lack the ability to autonomously pre-process information, leaving it up to the readers the task of re-arranging the contents according to their particular informational needs.

Mowshowitz argues that books are also more limited than the interactive displays of ICT from the point of view of information presentation and distribution. Unlike the digital contents of a computer network, printed pages require physical distribution systems to reach their audiences, with all the implied inconveniences of time and space. In contrast, from a single computer terminal duly connected to the Internet it is possible to have dynamic access to a virtually unlimited amount of information anywhere and any time. In a word, ICT combine the unprecedented flexibility of multimedia with the ubiquity of computer networks to present words, sounds and animated images in a controlled environment of interaction.
In our research, we are particularly interested in how these new information storage, processing and presentation potentials of ICT may be explored to present an alternative to the traditional method of business learning through printed case studies. In order to compare the two approaches, we developed a hypertextual tool for interactive case studies, called Panteon, and submitted it to a number of senior business students in the city of Salvador, Brazil. After 12 hours of exposition to the Panteon method, those students (who considered themselves very familiar with the traditional case method) were asked to compare paper-based cases with the newly experienced hypertextual cases in terms of selected aspects of creative and critical thinking, as well as the potential of collaboration and interaction in both methods.

2 Theoretical Framework

The Harvard Business School has been adopting the case method as a means to stimulate critical and creative thinking amongst its students for nearly a century (Bhatti, 1985). Before 1912, the technique was most commonly used in Law and Medical Schools. One of the early adopters of the so called “Harvard Method”, Charles Gragg defined a typical case as an organizational problem described with the surrounding facts, as well as the opinions and preconceptions of the involved personnel, based on which students are expected to make decisions and propose an adequate course of action (Gragg, 1954:8). The presentation of the problem is usually made in the form of a report (Roesch, 1997) with one or few points of view concerning the available evidence (Pemberton, 1995). Traditionally, case studies include a chronology of meaningful events during organizational development, brief statements or tables presenting cost and profit related numbers, information regarding competitors, the market and a few comments by key decision making characters (Edge & Coleman, 1982:3).

Cases vary enormously both in size and content. In undergraduate business courses in Brazil, for instance, most so called “Harvard-style” cases consist of one or two pages describing some sort of organizational dilemma as a background for classroom discussion or as an illustration of a theoretical context. Full-fledged cases, however, may be much larger and more complex than those simplistic approaches to the Harvard method. The presented problem situations are often based on real events, even though frequently disguised to preserve the anonymity of persons and institutions involved. Some consist of a retrospective presentation of a flawed strategy while offering the reader the opportunity to suggest more efficient tactics. Others require students to identify a central problem in a complex situation and to suggest ways of solving it. Others will ask them to determine the possible outcomes of a series of actions. They all have in common the fact that they are a means to stimulate students to analyze data, identify problems and make decisions (May, 1984:4).

For these reasons, case studies seem to properly address the cognitive challenges of critical and creative thinking in the complex informational environment of the Knowledge Society. Three years ago we decided that if we could adapt the case study method to a hypertextual environment, making extensive use of the unique informational characteristics of digital interfaces, it would be possible to shed light on the potentials and limitations of ICT as a means of stimulating higher cognitive functions in business students. We then started working on a prototype of the Panteon Interface.

In order to establish a framework of comparison between Harvard and Panteon cases, we decided to focus on two aspects of the case study method which we think are key to its success: its inherently socio-constructivist nature and its capacity to foster critical and creative thinking as a basis for decision making and problem solving. In fact, we assumed as a premise that the stimulus to creative and critical thinking in the case method is very closely related
with its built-in constructivist principles. Therefore, in order to be at least as effective as the traditional method, a new case study tool would have to allow at least the same degree of constructivist elements.

David Jonassen's (1999:3-9) model of “Meaningful Learning” seemed particularly suitable as a basis of comparison, considering his extensive application of its principles in technology-rich constructivist environments. In producing his synthesis of “technological constructivism”, Jonassen assumes that: a) knowledge is constructed, which means it can not be directly transferred; b) knowledge construction results largely from action and symbolic manipulation, hence learning is closely associated with active participation; c) knowledge is deeply related with the context in which the action takes place; d) meaning is intrinsic to the mind of the knower. As a corollary of these assumptions, he argues that: a) there are multiple perspectives of the objective world; b) learning is enhanced by problem-situations with high levels of relevance to the learner; c) knowing requires the capacity to articulate, express and represent what has been learned; d) meaning must be shared and socially negotiated; e) technological tools may help improve the experience of learning. Jonassen's model of “Meaningful Learning” can thus be summarized as a constructivist environment in which interactivity, reflection and collaboration in an authentic context play a significant role in learning with technology. We called this set of four Meaningful Learning characteristics “Collaborative Interactivity”. According to the premise adopted earlier that the higher the degree of constructivism the higher the potential for critical and creative thinking skills, if the Panteon method was perceived as having greater degrees of Collaborative Interactivity, that could mean it is a valid alternative to the traditional Harvard method as a means to stimulate higher cognitive functions in business students.

Besides learning about how students perceive the degree of constructivism in the Panteon Method as compared to Harvard, we also wanted them to rank the new tool in terms of the extent to which it actually promotes critical and creative thinking. If the adopted premise were consistent, higher perceptions related to the degree of Collaborative Interactivity would translate into higher perceptions of critical and creative competences. In order to assess those skills, we used a cognitive model created by the Department of Education of Iowa called “Integrated Thinking” (Jonassen, 1996:28). According to that model, the ability to conceive new ideas, solve problems and make decisions is related to the capacity to reorganize knowledge (through critical thinking, based on the ability to analyze, evaluate and establish connections between several pieces of information) and to generate knowledge (through creative thinking, based on the ability to synthesize, elaborate and imagine possible relationships among pieces of information).

The compatibility of the Integrated Thinking model with our field of study can be verified by looking at what Naumes and Naumes (1999:22-4) consider relevant mental processes that take place during business case study analyses, namely: a) focusing skills (defining problems and setting goals); b) information gathering skills (observing and formulating suggestions); c) remembering skills (encoding and recalling information); d) organizing skills (comparing, classifying, ordering, and representing); e) analyzing skills (identifying attributes and components, identifying relationships and patterns, identifying main ideas, and identifying errors); f) generating skills (inferring, predicting, and elaborating); g) integrating skills (summarizing and restructuring) and h) evaluating skills (establishing criteria and verifying). As we shall see during the presentation of the experimental results, the vast majority of these abilities find a corresponding skill in the Integrated Thinking model.
Finally, before developing the interface that would be used as a basis for comparison with the Harvard method, we looked for theoretical evidence that our overall premise was valid. Namely, we needed to find reports of previous experiments with hypertextual interfaces in socio-constructivist environments that had led to increased critical and creative skills through the use of case studies. That is precisely what the Cognitive Flexibility experiments by Spiro et al. (1992) and Jonassen (1997) were all about. Cognitive Flexibility Theory (CFT) suggests a series of principles to make advanced learning with hypertextual interfaces a richer experience, by taking advantage of the random, non-linear representational capabilities of computers to represent multiple perspectives of complex problems in ill-structured knowledge domains. Spiro calls “ill-structured” those domains of knowledge which present a large degree of variation from case to case, thus not being subject to algorithmic or pre-conceived solutions, as is known to occur for instance in social study fields such as political science or business administration. CFT suggests that case-based learning through hypertextual interfaces may facilitate learning in those domains of knowledge, as well as the ability to transfer what has been learned to new situations. In ill-structured domains, it is argued, the multi-faceted nature of realistic problem-situations can only be revealed through the use of multiple schemes, concepts and analytical perspectives (Jonassen et al. 1997:122). If this is true, then the ICT characteristics of information storage, processing and distribution will indeed prove to be ideal to promote Cognitive Flexibility.

Computer interfaces with those characteristics are called “Cognitive Flexibility Hypertexts” or CFH. According to the creators of the concept, “Cognitive Flexibility Hypertexts provide exploration environments, organized around building blocks for knowledge assembly, that are useful for a process of constructivist thinking” (Spiro et al., 1992:123). In other words, CFH are constructivist-learning environments that stimulate creative and critical thinking by allowing users to look at the same problem-situations from multiple perspectives within a self-controlled, interactive environment. Previous experiments with CFH have shown that they can indeed be more effective than traditional learning methods in terms of the learner’s capacity to transfer the acquired knowledge to new situations (Jonassen, 1997:132).

3 The Panteon Interface

Panteon is a Cognitive Flexibility Hypertext in the sense that it presents ill-structured problems of business organizations in a non-linear fashion and from multiple perspectives with the aid of a graphic computer interface. However, unlike some CFHs that use static HTML interfaces (Jonassen, 1997:127), Panteon is based on dynamic, database supported web pages. Not only do databases allow users to input their own contents, but also most importantly – it allows them to crisscross the available content using different search criteria, filtering the results obtained according to their investigative interests (Lima, Koehler & Spiro, 2002).

Panteon is a Portuguese acronym for “Applied Project of New Technologies for On-Line Case Studies”, but it also suggests the interdisciplinary aspirations 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 students to create and diagnose hypertextual case studies about complex organizational environment.
When a user first visits the Panteon web page — presently available only on the Intranet of the Brazilian 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 to diagnose cases readily available in the databank. The subsections below illustrate the procedures involved both in creating new case studies and in diagnosing existing ones.

Figure 1 presents an overview of the Panteon Interface, with its four frames marked with letters. The “Top Menu” (a) allows users to create a new case study or edit an existing one, diagnose a case, search the database for case studies that match specific learning needs or read a tutorial on how to use the interface. It is the only fixed frame; the other three vary according to the environment the user is navigating. The “Process Window” (b), for instance, may present either the create/edit menu (Figure 3), the diagnose menu (Figure 4) or the online tutorial menu, according to the user’s clicking choices on the Top Menu. Contents of the “Main Window” (c), by its turn, vary according to the clicking options on the Process Window. It may present forms for creating a case study, introductory notes about characters for diagnosis or detailed online help on a specific topic. Every button in “b” produces a different window in “c”. The fourth and final frame (d), called “Pantpad”, is a personal sub-interface where users can “capture” and comment bits of information from the Main Window to support their diagnosis, as will be detailed further. It permanently displays the name of the current user. The “capturing” mechanism and how it supports analytical thinking will be discussed in more detail further below.

![Figure 1: Overview of the Panteon Interface](image)

3.1 Creating Hypertextual Case Studies with Panteon

Case studies can be entirely fictional, entirely real or something in between these two extremes. If a case author feels he had gathered enough exposure to a certain organizational environment to create a realistic case study based on his experience, he does not need to do any fieldwork of collecting data. Most Harvard-style cases, however, describe actual situations in existing organizations, albeit the identifying characteristics may often be disguised. In order to maintain a certain degree of authenticity, Panteon cases will require authors to visit actual organizations and interview several people using specific categories of a certain theoretical model as a guideline. Once they have gathered these perceptions and
transcribed them, authors may begin the process of actually inputting these data, along with character profiles and other organizational characteristics into the Panteon Interface.

Creating a case study consists of six steps: inputting the categories of the chosen model of analysis, creating an introductory text, outlining the organizational structure, describing the problem-situations, the profile of the involved characters and, finally and most importantly, entering the character perceptions. Figure presents the six steps as shown on the upper left corner of the user screen (part “b” of the interface) during the process of creating a case study.

Figure 2: Menu for creating / editing a case study.

Figure 3: Menu displaying tools for diagnosing case studies

3.2 Diagnosing Hypertextual Case Studies with Panteon

The first phase of this process is called “individual diagnosis”, during which participating individuals are given some time to work on their personal investigative approach to 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 3.

The sequence for diagnosing a case is as follows: 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 slide 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; b) **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 “produc”, 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).
The options above are partially visible on Figure 1. 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. 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 follows every perception, shown below the character picture (Figure 4).

Panteon then copies the specific perception into the user’s personal databank called “PantPad”, along with all the related data (name and position of the character issuing the perception, associated problem-situation and category of analysis). In PantPad (shown on the lower left corner of the screen) users may then add their own commentaries to each captured perception. Later on, these perceptions and personal comments may be retrieved and categorized during final diagnosis; c) **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; d) **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 user-created annotations. The quality of the diagnosis will depend on how one deals with the contradictions between 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, students are encouraged to cross-reference among diagnoses and plans of actions where appropriate.
The richest part of the proposed methodology begins when participants are done diagnosing and proposing plans of action individually. Here lies 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, complementing each other’s research efforts.

At this stage the teacher or facilitator can have students 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 the most important aspects of the problems are 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. Groups then present and discuss their final diagnosis with each other, producing a “class synthesis”. This, in turn, may be used as a starting point to discussions with other groups of students, separated both in time and space. Distance learning tools used to support group discussions on Panteon case studies can be quite valuable in this phase. So far, however, the prototype of the interface does not offer its own tools to support collaboration at a distance.
Large, complex cases offer yet another potential approach to collaborative diagnosis. The facilitator may want to subdivide each group into business specialists according to the nature of the problem situations at hand. One member of the group may be in charge of looking into the Human Resources implications of the problems, another may be in charge of Marketing, a third may be a Financial specialist and so on. Each member will use the searching and filtering capabilities of the interface to tailor the diagnosis experience to his or her own informational needs as a “specialized consultant”. The teacher may also wish to assign a “generalist” role to someone in each group; this person will be a sort of coordinator, tying the different threads of analysis together. Contrary to the specialists, generalists will not pursue a single thread of investigation, but try to get the “big picture” during their exploration. If enough time is available, teachers may have groups split up according to their roles and get together in “Marketing conventions” or “HR debating groups” before regrouping for a final diagnosis.

4 The Experiment and a Few Preliminary Results

We chose to use a combination of participant observation with focus groups as a method of data collection during field experimentation with Panteon. Participant observation allowed us to identify contextual cues on the behavior of participants (Cottle, 1998) while focus groups offered us their qualitative insights in their own words (Morgan, 1997; Lindlof: 1995). Furthermore, we used post-test forms with both open questions and Likert-scale grading tables containing constructs that reflected the user’s perception of the degree of Collaborative Interactivity and Integrated Thinking in Panteon as compared with the traditional Harvard case study method.

Participant observation took place during 12 hours in the months of October and November 2002, at the school of Business Administration in a private university in Salvador, Brazil. It involved two senior classes (4th year students), amounting to a total of 29 participants. These formed seven groups of about four individuals, each assigned a role either as a “generalist” or a Marketing, Human Resources or Organizational Systems specialist.

We used two hours to clarify the purposes of the experiment and to instruct students on how to use the interface, eight hours of computer laboratory time for individual diagnosis and two hours for collaborative diagnosis and final discussion. Two business teachers were invited to observe student behavior during diagnosis. Students were confronted with three real-life problem-situations of Condor Technology, a small firm in Salvador, as perceived by 9 of its employees.

After the participant observation stage, two focus groups were formed: the first, called “GED” for the abbreviation of “Student Group” in Portuguese, consisted of eight students chosen among the 29 participants. The second, called “GEX” (standing for “Expert Group”), was formed by six persons: the two teachers who had observed the students, plus two other business teachers who had observed the Panteon being used as a diagnosing tool at Condor Technology, plus the owner of Condor (himself a 4th year business student) plus one representative of GED, chosen for his thought-provoking remarks in the first focus group.

The post test form submitted to GED and GEX were respectively called FED and FEX. Other than a few introductory remarks addressed to the different publics consisting of students and experts, the contents of both forms were identical. Table 1 presents a profile of the participants according to their response to the post test forms. Tables 2 and 3 present the statistical results for Panteon and Harvard, sorted by the difference between their attributed scores.
### Table 1. Average / standard deviation of participant’s responses to selected questions about their profile

<table>
<thead>
<tr>
<th>Item</th>
<th>GED (n=29)</th>
<th>GEX (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant’s Age (in years)</td>
<td>23.58 ± 2.90</td>
<td>32.33 ± 7.74</td>
</tr>
<tr>
<td>Participant’s Experience as Internet User</td>
<td>3.17 ± 0.38</td>
<td>3.00 ± 0.63</td>
</tr>
<tr>
<td>(4. Very Experient, 3. Experient, 2. A little experient, 1. Inexperient)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participant’s impression about the navigability of the Panteon Interface</td>
<td>3.17 ± 0.54</td>
<td>3.17 ± 0.75</td>
</tr>
<tr>
<td>(4. It’s very easy to use; 3. It’s easy to use; 2. It is difficult to use; 1. It is very difficult to use)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participant’s previous experience with diagnosis of Traditional Case Method:</td>
<td>3.79 ± 0.49</td>
<td>3.67 ± 0.52</td>
</tr>
<tr>
<td>(4. more than 10 cases; 3. between 5 and 10 cases; 2. less than 5; 1. None)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Comparison between Panteon and Harvard in terms of Collaborative Interactivity as perceived by GED and GEX group participants.

<table>
<thead>
<tr>
<th>Degree of Collaborative Interactivity Perceived by GED and GEX Participants (1. Very Low; 2. Low; 3. High; 4. Very High)</th>
<th>Panteon (P)</th>
<th>Harvard (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Interactivity</strong> (How easy it is to manipulate available pieces of information)</td>
<td>1.53 ± 1.08</td>
<td>8.26 ± 0.000</td>
</tr>
<tr>
<td><strong>2. Authenticity</strong> (Degree of realism and relevance of the presented problems)</td>
<td>1.12 ± 1.15</td>
<td>5.67 ± 0.000</td>
</tr>
<tr>
<td><strong>3. Reflectivity</strong> (degree of stimulation to creative and critical thinking)</td>
<td>0.91 ± 0.97</td>
<td>5.51 ± 0.000</td>
</tr>
<tr>
<td><strong>4. Collaboration</strong> (degree of stimulation to conversation and negotiation among team members)</td>
<td>0.59 ± 1.44</td>
<td>2.39 ± 0.023</td>
</tr>
</tbody>
</table>

### Table 3. Comparison between Panteon and Harvard in terms of Integrated Thinking as perceived by GED and GEX group participants.

<table>
<thead>
<tr>
<th>Degree of Integrated Thinking Perceived by GED and GEX Participants (1. Very Low; 2. Low; 3. High; 4. Very High)</th>
<th>Panteon (P)</th>
<th>Harvard (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Establishing Connections</strong> (comparing, contrasting, logical thinking, inferring, identifying causal relationships)</td>
<td>1.50 ± 0.93</td>
<td>9.41 ± 0.000</td>
</tr>
<tr>
<td><strong>2. Analyzing</strong> (recognizing patterns, classifying, identifying assumptions, identifying main ideas, finding sequences)</td>
<td>1.21 ± 0.91</td>
<td>7.69 ± 0.000</td>
</tr>
<tr>
<td><strong>3. Designing</strong> (imagining a goal, formulating a goal)</td>
<td>1.18 ± 0.76</td>
<td>9.05 ± 0.000</td>
</tr>
<tr>
<td><strong>4. Evaluating</strong> (assessing information, determining criteria, prioritizing, recognizing fallacies, verifying)</td>
<td>1.12 ± 0.95</td>
<td>6.89 ± 0.000</td>
</tr>
<tr>
<td><strong>5. Problem solving</strong> (sensing the problem, researching and formulating the problem, finding alternatives, choosing the solution, building acceptance)</td>
<td>0.97 ± 0.97</td>
<td>5.84 ± 0.000</td>
</tr>
<tr>
<td><strong>6. Synthesizing</strong> (analogical thinking, summarizing, hypothesizing)</td>
<td>0.97 ± 1.00</td>
<td>5.66 ± 0.000</td>
</tr>
<tr>
<td><strong>7. Decision Making</strong> (identifying an issue, generating the alternatives, assessing the consequences, evaluating the choices)</td>
<td>0.94 ± 0.74</td>
<td>7.46 ± 0.000</td>
</tr>
<tr>
<td><strong>8. Imagining / Elaborating</strong> (forecasting scenarios, extending projections, concretely expressing abstract ideas)</td>
<td>0.74 ± 1.19</td>
<td>3.61 ± 0.001</td>
</tr>
</tbody>
</table>
4.1 Discussion of Results: Collaborative Interactivity

Not surprisingly, interactivity ranked as the Panteon characteristic that most contrasts with the traditional method, with 1.53 points above Harvard. Indeed, this is one of the main contributions of Dynamic Hypertextual Interfaces: the possibility to use search engines to trim down one’s informational needs and filter the obtained results according to one’s current interests. There seems to be some sort of natural affinity between this “Internet generation” public and the “friction-free”, all-digital environment of Panteon. Fábio Pepe (FED) states that “the possibility of having a paperless approach to the analytical process of an entire organization (…) makes the process much more appealing”. Apparently, this preference for the digital medium has to do with some of the convenient features of “click-capturing” and “writing down” perceptions while you read them.

Also unsurprising was the 1.12 point difference attributed to “Authenticity”. The digital medium may have played a role in the overall perceived authenticity of the Panteon case due to its inherent capability of reorganizing hundreds of informational fragments according to user-determined searching and filtering criteria. It would be arguably very difficult to deal with as many first-person perspectives using traditional paper-based media and narrative structures. The possibility to investigate hundreds of transcribed speeches using search criteria such as problem-situation, category of analysis or self-determined key words seems to have been quite appreciated by the participants. The following FED statements seem to validate this assertion: “through Panteon it is possible to have a broader and more truthful perspective of the organization. You can perceive small details in how the employees express their frustrations and motivations, as though you were interviewing them” (Lucas Barbosa); “those are very real opinions, which appear coherent with reality, which motivates us to use [the interface]” (Pedro Hohlenwerger).

The degree of reflexivity in Panteon received a score 0.91 higher than Harvard’s. It looks as if the possibility to annotate every captured perception somehow forces the users to think about every single aspect of the problem before they move on with their reading. In Renata Magalhães’ (GED) view, this active role makes some difference in the degree of reflexivity, for “it is not an academic text which you are supposed to read in its entirety before you start analyzing, it is almost as if you were talking with those people”. In the opinion of Sarah Rodrigues (GED), “this involvement occurred basically because of the possibility of writing your commentaries while capturing perceptions; this breaks the monotony of reading only; as you write your partial insights on the screen you end up interacting more”.

Understandably, the degree of collaboration was the least distinguished feature of the Panteon approach to case studies, perceived as only 0.59 points above Harvard. We had actually expected Harvard to have a higher score in this regard, as this is the main emphasis of the method, oftentimes taking up more than a two-hour class to collaboratively discuss a case. In our experiment, users in their own individual diagnosis spent most of the eight hours of computer laboratory time, with hardly any interaction with their fellow participants. In spite of the limited exposure to the collaborative dynamics of the proposed method, quite a few students seem to have understood the potential for extended collaborative work after the stage of individual diagnosis with Panteon. Renata Magalhães (GED), for example, feels that the non-linear nature of the method allows the possibility of dealing with only those parts of the case study that concerned her specialty as a “consultant”, which stimulated debate with her peers about their own slightly different navigational strategies and findings.
4.2 Discussion of Results: Integrated Thinking

“Establishing Connections” was the feature of Integrated Thinking perceived to be the most distinguished aspect of the Panteon approach to case studies, an average 1.50 points higher than Harvard. Transcriptions from the GED focus groups may help us better understand how this aspect of the model is perceived by students: according to Sahara Rodrigues, “the ability to easily manipulate pieces of information helped us compare and contrast opinions”; this seems to have allowed participants to “compare how the lower levels of the organization see the problems with the perceptions of the upper levels” (Fábio Reis). José Lopes, on the other hand, feels that again a crucial aspect of a non-linear case study is the possibility of dividing investigating students into specialized consultants, using specific navigational strategies to concentrate on certain aspects of the problem.

Panteon’s stimulus to “Analyzing” was ranked 1.21 above Harvard’s. A few students mentioned this feature as one of the most distinguishing aspects of the hypertextual method in their FED forms. Marcela Ferreira suggests that the graphical displays of the interface allowed her to “clearer visualize the characters and their statements, facilitating the analysis of organizational problems”. The transcription of the direct speeches of actual decision-makers into a searchable database structure also seems to have contributed to a more authentic analytical environment. According to Emerson Casali (GEX), “in a conventional analysis it is very hard to get in contact with certain subtleties of the process, such as the way the leader is actually perceived by his/her followers, what the organizational context feels like, what are the underlying human aspects of the problem”.

“Designing a plan or strategy” was the next highest distinguishing characteristic of Panteon (1.18). Once more, the possibility of annotating captured perceptions was seen a facilitating device. The fact that the interface allows users to categorize their captured perceptions along with their own comments during diagnosis seems to enrich the process of suggesting a course of action in the final stage of the procedures. This is confirmed by GED participants such as Marcela Ferreira (“I had a chance to write my thoughts about everything I read, [in the end] these annotations helped me think the entire case over”) and José Lopes (“when you write down [your thoughts about a perception], you are creating the very fundamentals of your plan of action”).

As to the item “evaluating” (1.12), the possibility of looking at the same fact from multiple points of view was perceived as the most distinguishing characteristic of the hypertextual case. Panteon seems to make it easier to identify “character comments that often have nothing to do with the actual problem” (José Lopes, GED). He goes on to say that the search engines help separate useful statements from misleading ones; by refusing to capture superfluous or misleading comments into one’s Pantpad, “you avoid taking into account perceptions that won’t help you diagnose the problem” and suggest an adequate plan of action.

“Problem solving” (0.97) is an inherent part of interacting, reflecting and collaborating during the three stages of diagnosis with Panteon. The fact that, contrary to most Harvard-style cases, Panteon explicitly presents the problem-situations upfront is not necessarily perceived as making it less challenging, for “even though the issues are pre-identified, one can always find during the investigation that undeclared, subtle problems may lurk beneath the presented situations” (Fábio Reis, GED).

“Synthesizing” is seen as one of the main advantages of Panteon by Rubem Santos (GEX), who believes that it may help “deal with larger quantities of information than you find in a
traditional case, while allowing you to summarize the essential bits”. In the context of the
diagnosing process, this competence seems to be associated with the possibility of
establishing hypothesis with every annotation of captured perceptions, which may be later
retrieved under specific categories to produce a final diagnosis and a plan of action. The very
built-in functionality of sorting the transcribed statements by character, keyword, hierarchical
position or category of analysis may facilitate synthesizing.

“Decision Making” (0.94) is a crucial skill to be developed by any businessperson. In
Panteon, users have to make decisions not only about the final courses of action an
organization should take, but also about which “versions of the truth” to rely on. In this
respect, it tries to emulate the complex decision-making environments of actual organizations,
which is based not only on objective data but also on how fellow managers perceive the
problem. As Rodolfo de Veras put it in his FED statement about the main virtues of the
interface, “Panteon allows us to collect and to cross larger quantities of data, involving several
levels of organizational decision making, before actually deciding on an appropriate course of
action. Besides, because opinions may be captured from characters occupying different
positions, with different perspectives, it is easier to analyze which organizational issues seem
to be the most urgent”.

Finally, it must be said that the “Imagining / Elaborating” construct (0.74) was the object
of some dispute within the two focus groups. Apparently, it did not become clear to the
participants just what “forecasting scenarios, extending projections, concretely expressing
abstract ideas”, meant. In Angelo Agulha’s (GEX) point of view, “a traditional case study
allows for more imagination and elaboration than does a Panteon case, because amidst as
many Panteon perceptions one is left with little room for personal extrapolation”. Likewise,
Rubem Santos (GED) states “in a traditional case we have to guess and speculate … as in
Panteon the problem-situations are previously defined, one’s own imagination is less
demanded”. These views, however, are not in accordance with Renata Magalhães and Roberta
Costa (GED), who countered Rubem by respectively objecting that “in Panteon it is actually
easier to visualize organizational situations because you are looking at them from multiple
perspectives” and “elaborating scenarios is much easier with Panteon than with paper,
because [traditional cases studies] hardly ever present enough arguments, you don’t get as
many different points of view”. The majority of participants seem to agree with these two, as
indicated by the significant difference of average scores in this matter.

4.3 Problems and Criticisms

Most of the limitations of the interface and suggestions for improvement were written in
the FED and FEX forms, under the open questions “What aspects of the Harvard method you
think are superior to Panteon?” and “What do you think could be improved in the interface?”.

Concerning the first question, most of the shortcomings fell under three categories: a)
Panteon depends on too complex an infra-structure, b) it’s method is more difficult to
implement and c) it presents too much information. The first criticism is particularly
understandable if we consider that the prototype is not available on the Internet yet.
Therefore, students couldn’t use their extra time at home or at work to further their individual
diagnosis, having to attend one specific computer laboratory to have access. It is also
understandable that students perceived Harvard as a simpler, more straightforward method.
Panteon does require a few hours of getting used to the interface and its tools for creating and
diagnosing case studies. The issue of Panteon presenting excessive information, however, is
actually part of its learning principles rather than one of its faults. Based on the constructivist
premise that emulating the complexity of professional environments increases the feeling of authenticity, Panteon seeks to incorporate not only to-the-point, relevant character perceptions but also less relevant, subjective commentaries and superfluous evidence.

Regarding suggestions for improvement, some of the most noteworthy include improving the navigational system, including a bibliography on the adopted models of analysis as part of the appendices, creating an off-line module for dial-up access and enhancing the filtering capabilities. The latter is probably the most urgent upgrade, as the current version of the prototype does not allow multiple-criteria searching and this could prove critical in larger, more complex cases. All in all, the entire interface certainly needs to be professionally redesigned to improve its looks and functionality.

5 Conclusions

Panteon was not developed as a substitute to the Harvard-style case study, but as a possible alternative. In fact, as demonstrated by other recent experiences using the interface in postgraduate courses in Salvador, it is possible and desirable to work with both techniques simultaneously, enjoying the best either the printed and digital media can offer. Harvard-style narratives may be used to present the objective elements of the case study, including the historical context, tables and charts, while the Panteon may be used to explore the subjective aspects of the problems at hand from multiple points of view.

Even though this research has focused on the potential advantages of hypertextual interfaces as compared to ink and paper, we do not mean to imply that one medium is generically superior to the other, but rather that certain media may address certain cognitive needs in a better way under certain circumstances. From this perspective, we realize that the fact that Panteon average scores were consistently higher than Harvard’s does not necessarily mean that the new method is superior to the older, but rather that the traditional case study method is frequently not explored to its full potential at undergraduate levels in Salvador Business Schools. Indeed, as noted earlier, these students often think of the “Harvard-style case studies” as consisting of a superficial class discussion on an oversimplified dilemma, presented as a two page long anecdotal account. The widespread use of this simplified conception of the traditional case study is confirmed by the several statements made by the students (either during the group interviews or while filling out the post test forms) about the shallow or laconic character of “typical cases”.

Contrary to that perception, however, full-fledged Harvard cases may be up to 30 pages long, containing an enormous amount of details and demanding several hours of sophisticated analysis and quali-quantitative inferences. Such an advanced approach to case studies is very seldom in undergraduate level business schools of that part of Brazil. If repeated elsewhere, the same experiment might produce drastically different results, with Harvard-style cases having the upper hand in many aspects of the adopted model.

Nonetheless, we do believe that some of the unique features of hypertextual interfaces may not be easily emulated using ink and paper. ICT’s informational storage, processing and distribution characteristics are already having a deep impact in how the new generations learn. It was a gratifying experience to witness how most students participating in the experiment became involved with the Panteon, to the point of being fully immersed in the organizational environment of Condor. As many of the statements from the focus groups show, these students found themselves in a “web-chat-like environment” they are very familiar with, taking full advantage of the same two-fingered skills they are used to employing on their
everyday Internet surfing to analyze and diagnose complex organizational problems. In an era in which hypertextual interfaces are used not only at school or at work, but also for daily leisure activities, it is necessary to find out more about how the non-linear rationale of the web may help us cope with the increasingly complex challenges of the Information Age.

We also believe that new generations have an unique opportunity to get a broad understanding of the world, shaped by new ways of simultaneously accessing information and liberal values which are not the status quo. Through Dynamic Hypertextual Interfaces, they learn everyday new techniques, tools and theoretical components that will make their messages stand out.

Our results with Panteon indicate that the Cognitive Flexibility potential of Dynamic Hypertextual Interfaces may indeed foster both Collaborative Interactivity and Integrated Thinking skills in learners dealing with ill-structured knowledge domains such as Business Administration. As previously remarked, however, these findings are very preliminary. More research on the potentials and limitations of digital media is called for in order to understand how its flexible characteristics of informational storage, processing and distribution could be further explored. On the other hand, it has become clear that hypertextual environments need to be seen less as a mere repository of data, and more as a cognitive partner to help users develop their critical and creative thinking. Wider use of similar techniques may help complete the transition from the declarative knowledge acquiring mechanisms that still linger in many institutions of higher education to the diffusion of procedural knowledge instruments such as the one we have proposed.

There are excellent perspectives of development of the Panteon interface in the near future. With adequate institutional support, we intend to redesign the interface to better suit its present purposes and to adjust it to other ends. One of such alternative uses, currently being implemented, is to offer Panteon as a tool to help actual business people to take a more theory-oriented, collective approach to their decision-making process.

In the future, besides being used for organizational analysis, it could also help problem solvers in other ill-structured knowledge domains such as epidemiology, sociology or teacher education deal with their complex problems using a non-linear, multiple-perspective approach. It is intended as a freeware, internationally available tool, available to any who might be interested in using Panteon.

6 Bibliographical References


