WEBSITE INTERFACES AS REPRESENTAMEN OF ORGANISATIONAL BEHAVIOUR

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ABSTRACT
Due to the increasing sophistication of the Internet, the role of computers as mediators becomes more apparent through their interfaces. Despite being a symbolic machine, only in the last decade Semiotics has attracted the attention of researchers in studying interfaces and human-computer interaction. This paper summarises some of the main contributions in the field of Semiotics and Interfaces, while pointing out the needs of broadening the referential framework to cope with social issues involved in the new interfaces being created for Internet applications. We draw upon concepts of Organisational Semiotics to propose a framework to analyse interfaces of e-commerce applications under aspects that include the underlying organisation that the interface represents, making explicit aspects that would not be apparent in other approaches.

KEYWORDS: Human-Computer Interaction, Organisational Semiotics, user interface evaluation.

1. INTRODUCTION
The computer appeared in our culture as a tool for the exclusive domain of specialists: physicists, programmers and hardware engineers. As a consequence, the first thirty years of the computer history were marked by the design centred in the technology; people's interaction with computational artefacts had to fit a machine centred perspective. That scenario changed radically in the last two decades; computers became integrated in most of the human occupations being, therefore, adopted by a wide spectrum of users, not to mention the widespread use of the Internet which diversified and amplified the reach of computational applications.

The areas of Human Factors in computer systems, and Ergonomics grew in the very beginning as a result of the difficulties that computer scientists and engineers faced when they needed to consider the relationship between the systems that they built and their potential users. The Human Factors as a field of research was defined by that time as an unruly mixture of theoretical issues and practical problems (Shneiderman and Thomas, 1983). Since then, the central problem for psychologists, professionals of human factors and computer scientists, has been to develop theories and models of the human behaviour adequate to interactive

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systems. In the attempt to understand and accommodate human abilities of learning, memory constraints and problem solving in interactive systems, aspects of the user's human nature have been considered mainly in the cognitive approaches (Card et al., 1983; Norman and Draper, 1986; Laurel, 1990), extending and refining theories of the Psychology. These theories, in the eighties, led to a paradigm shift in software design: from a focus on the technology, to the user centred perspective. In that new approach, the users' needs should drive the design of the interface, and the needs of the interface should drive the design of the remaining system.

Norman (1986) has proposed the Theory of Action to understand how people interact with computer systems. According to that theory, people have goals expressed in terms relevant to them (psychological). On the other hand, the mechanisms and states of the system are expressed in terms relative to it (physical). The discrepancy between the psychological variables, on one side, and the physical, on the other, he named “gulfs”, should be observed in the design, analysis and use of systems. The designer should diminish the gulfs, moving the system closer to the user; i.e. building interfaces capable of matching the user's psychological needs.

The user centred approach taken to its extreme and misled view, allied to the sophistication of the available technological resources for designing interfaces have confused more than simplified the user's life. The web has good examples of this type of phenomenon. In general, moved by commercial pressures, many websites present all types of features in its interface. This in general affects the user's performance in addition to the already chaotic elements presented in the interface.

The computer is not an exclusive tool for specialists anymore, and as the increase of sophistication of the software through the Internet, the demand for “interpretability” grows. Secretaries and managers cannot use their time “deciphering code” anymore (Nadin, 1988); not to mention ordinary people using the Internet at home. They need to access their bank account balance, or buy a new book for the weekend, or just buy food without going physically to the supermarket: a good interface is a requirement for the new e-business enterprises survival.

Instead of being used as tools computers are more and more mediating our actions through their software interfaces. Even being a member of the class of symbolic engines, only in the last decade the symbolic nature of computers has attracted the attention of groups interested in studying interfaces and human-computer interaction through Semiotics. This paper summarises some of the main contributions in the field of Semiotics and Interfaces, while pointing out the needs for broadening the referential framework to cope with social issues involved in the new interfaces being created for Internet applications. We draw upon Organisational Semiotics concepts to propose a framework for analysing interfaces of Internet applications under aspects that include the underlying organisation that the interface represents, making explicit aspects that would not be apparent in other approaches.

The paper is organised in the following way: Section 2 presents a brief chronological view of the main paradigms contributing to our understanding of human-computer interfaces. Section 3 presents the semiotic framework of Organisational Semiotics, which is used as a foundation for our approach to the interface analysis. Section 4 shows our understanding of the interface as a
representamen in a triadic relation with an object it refers to and an interpretant. Section 5 draws upon the OS theoretical foundations and in our understanding of communication as sharing to propose the framework for interface analysis and evaluation. Section 6 illustrates the application of the framework and Section 7 comments on related work.

2. User-Computer Interaction Issues: A Brief Retrospective View

In the very beginning, the computer was considered as a tool to facilitate human tasks with reliability and speed. The development of cognitive theories applied to the Human-Computer Interaction brought us a vision of the computer as a cognitive tool to enable people extending their capacity of understanding, memorisation and decision-making. In the semiotics perspective, computers are seen as media (Andersen et al., 1993) in the same way as books, cinema, theatre, television, etc. The computer is a medium through which messages should be interpreted. We understand that the cognitive and the semiotic points of view are not antagonistic but represent different perspectives for the same phenomenon.

The traditional cognitive approaches focus on the human nature of the user interacting with the interface, his motor system, his perception, learning and other mental processes. The semiotic approaches facilitate an interpersonal, social, cultural perspective, focusing on the expression and interpretation of the elements in the software interface.

The cognitive tradition to the user interface

The tradition that has characterised the research in Human-Computer Interaction lays on the cognitive approach. Cognition refers to the process by which we become conscious of things or, put in other words, the way we acquire knowledge. This includes understanding, ability to memorise, reasoning, attention, learning, and creation of new ideas. The main objective of the research using this approach has been to understand and to represent the way human interacts with computers, in terms of the way knowledge is exchanged among both. The theoretical basis for this approach rests on Cognitive Psychology, which explains how humans reach their objectives in performing cognitive tasks that involve information processing. Thus, humans are characterised as information processors. The basic idea is that the information enters and leaves the human mind through an orderly series of processing steps (Preece et al., 1994, p. 62). The human model as a processor of information has influenced the development of several models of human-computer interaction as, for example, GOMS (Card, Moran and Newell, 1983) and the Theory of Action (Norman, 1986).

The cognitive approach can be applied with success to many problems of Human-computer interaction. However, there is an emergent consensus that this approach has its limitations. The information loop is closed, so it is difficult to take into consideration phenomena that are out of it (Kaptelinin, 1996, p. 105). For example the purely cognitive approach doesn't provide basis to take into consideration phenomena of linguistic nature and of interaction among groups of people.

Semiotic approaches, on the other hand, allow considering not only the immediate aspects of the human-computer interaction but, also, the underlying aspects of the cultural and social context where the interaction happens.
Semiotic approaches to interface analysis

Semiotics is the science of the signs and it has the aim of examining the constitution of any phenomenon of signification and creation of meaning. The Peircean School of Semiotics, one of the most influential, defines a sign as anything that stands for something else for somebody under certain aspects or capacities (Peirce, 1931).

Interface has been widely defined under several points of views. For Andersen (1997, p. 201), *interface is a collection of computer-based signs, i.e., all parts of the system processes that are seen or heard, used and interpreted by a community of users*. This definition presents a relationship between the perceptible parts of a computer system and its users. He also differentiates the nature of the objects present in the interface, from the common sense meaning of these objects as “tools”. To illustrate this idea, he exemplifies it with the “pencil” present in most drawing applications.

*The pencil of the drawing program is no real pencil that can be used to chew on, it is merely stands for a pencil, represented by a collection of pixels on the screen.* (Andersen, 1997, p. 1)

Therefore, the “pencil” in the interface differs from the concrete tool for not being used primarily as a physical object, but as a sign. Andersen proposes a paradigm change for the interface concept that involves our understanding of the computer science itself: from the computational system seen as a self-sufficient mathematical object, the focus is gradually moved toward the relationships between the system and the work context. In this sense, *the role of the computer system is basically that of a medium - a physical substance in which signs can be manifested, one that can be - and is - used in communication* (Andersen, 1997, p. 333). In particular, this perspective seems to fit better in the new scenario of using the Internet technology, where the function of communication among people plays a fundamental role. Furthermore, the environments based on shared virtual spaces and on sharing messages have similar functions to other media as for example the printed text (newspapers, literature), the cinema, etc. where the importance of the sign concepts and of semiotics are already well established.

Having recognised the fact that computers are basically sign processors and that Semiotics is the science of the signs and their life in society, we can draw upon semiotic principles to improve the communication function of the interfaces. In that direction, Jorna (1996) suggests three perspectives to be differentiated in the analysis of the information contained in the interface of computational systems: high level theories about interaction among task-computer-user, general structure of the information in the screen and elements inside that structure of presentation. While the signs on the screen *instigates users to accomplish actions* (Jorna, 1996, p. 241), the amount of signs in the interface influences the time required for human processing, and the type of signs affects the species of involved processes (Nadin 1988). Therefore, the type and number of signs that compose the interface, as well as ways of inferring aspects of their interpretability should be considered in a semiotic framework for interface analysis.

Current literature concerning methods for user interface analysis and evaluation has not paid sufficient attention to the social and organisational aspects that surround the user experience. The need to take into consideration social aspects involved in the design and use of software applications seems to be much
more significant with the Internet as medium of communication. Communication is essentially a social affair. As pointed out by Cherry (1980, p.3), when people are in communication with one another, they are associating, cooperating, and forming an "organization". This paper aims to bring some Organisational Semiotic principles to the user interface analysis, as a way of coping with both the social and the technical aspects involved in Internet applications.

3. ORGANISATIONAL SEMIOTICS AS A THEORETICAL FOUNDATION

Organisational Semiotics is a discipline that explores the use of signs and its social effects within a social setting. An actualist position has been accepted as the basic philosophy for developing organisation semiotics as a discipline (Stamper 2000, Chong 2001). In contrast to the realist account, which assumes that the world consists of an absolute truth and can be readily observed and expressed, the actualist account of the nature of reality assumes a world to which we have access only via our actions or behaviour. In this work we are considering the semiotic approach of Stamper (1973), which is based on Peirce and Morris (1985) works and has evolved into a set of semiotic methods for Information Systems. Stamper, quoted in Liu (2000), proposed a new paradigm for Information Systems Design grounded in the information field concept. As opposed to the concept of information flow, which is the basis for most of the conventional information systems approaches, the information field paradigm helps us to obtain a macro perspective for system design. This paradigm is based on the analogy with the several internal and external fields an object is subject to (gravitational, electromagnetic, tensional, etc.). In the same way, the human agents involved in the use of computational systems are all governed by the forces of information fields and therefore behave accordingly. These forces are present in the forms of formal and informal rules, beliefs, cultural habits and conventions, which can be called norms. Underlying this approach there is a stance that rejects the position taken by many practitioners in the field in which information systems are seen as devices for representing and interacting with an objective reality. On the opposite, Stamper’s approach is based on the assumption that the world is constructed socially and subjectively. This subjective view of information systems is in line with assumptions we must make when considering the user experience enabled by its interface.

The Organisational Semiotics approach takes a step towards an understanding of the whole organisation, stressing the distinctions as well as the interdependent links between the organisation, the business process and the IT system (Liu, 2000). Organisation is taken here in a broad sense, meaning a group of people, a society, a culture, which not only share rules of language, custom, habit, but also participate in the social construction of these rules. According to Stamper’s approach, an organisation can be characterised by a structure of three embedded layers: the informal, the formal and the technical, which Stamper (1992) names “the organisational onion”. The whole organisation is regarded as an informal information system in which its culture – values, beliefs, habits and pattern of behaviour of each individual member – plays an important role. It is in this layer that meanings are established, intentions are understood, beliefs are formed, commitments are made and responsibilities are negotiated through discussion and physical actions. Inside the informal layer there is the formal information system layer, where literate culture dominates through rules that specify how the work should be done and how the tasks should be performed. In this layer, form and
rule replace meaning and intention. The third layer concerns the technical system that is placed inside the formal layer to automate part of the formal system. It presupposes well-defined work processes, clearly understood human responsibility for the jobs and explicitly specified rules for operations. Therefore, in evaluating the user interface, we must be aware that the system is a reflex of the formal and informal layers of the organisation that it represents.

Thus, on the one hand we have the subjective reality constructed by the user through his/her experience using the interface. On the other hand, the interface is a reflex of the formal and informal layers of the organisation it represents.

Besides syntactics, semantics and pragmatics in the original Semiotics, which deal with structures, meanings and usage of signs, Stamper has added other three divisions of semiotics: physics, empirics, and social world (Figure 1). The physics and empirics are concerned with the physical aspects of signs, and its statistical properties when different media are involved. Together with syntactics they constitute the infrastructure to support the other three layers: semantics, pragmatics and social world. The three lower layers will answer questions as to how signs are organised and expressed, the physical properties they have, while the upper layers are concerned with the use of signs, how they function in communicating meanings and intentions, and the social consequences of the use of signs.

From the user interface standpoint, these six layers determine the experience a user will have as an active participant (an agent) in the interface signs system. The two main categories of the construction blocks of the world from the OS perspective are the concepts of agent and affordance. Despite having a context-sensitive definition, in the next section we discuss the concepts from the OS and from the HCI standpoints.

4. AGENTS, AFFORDANCES AND COMMUNICATION THROUGH THE INTERFACE

In the OS framework, an agent is an entity capable of acting responsibly in an environment. It can be as simple as an individual person, and as complex as a cultural group, language community or society (Liu, 2000). In the agent–computer relationship established through the interface, many other agents, besides the user,
play important roles. Designers and usability engineers communicate with the marketing people; the customer support team intermediates between developers and users; external consultants help the developers and the users organisations, as well, etc. The interaction and communication processes taking place among all these agents also impact in the interface of the product.

Behaviour affords behaviour. Agents possess affordances through their patterns of behaviour and, at the same time, are subjects of the affordances of the objects they interact with. The concept of affordance has been mentioned by influential authors in the HCI field (Norman, 1988; Winograd, 1996; Preece et al., 2002; Shneiderman, 1998) usually to refer to the affordances of objects. Nevertheless, the richest and most elaborate affordances of the environment for the humans are provided by other people as they interact with the observer and with one another (Gibson 1968, 1979; Michaels & Carello 1980).

The concept of “affordance” was first proposed by Gibson, in the ecological approach to visual perception, for designating the behaviour of an organism made available by some combined structure of the organism and its environment. The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill (Gibson, 1979, p.127). As an example, the terrestrial surface affords support, if it is horizontal, flat, sufficiently extended and firm for the human body, while a surface of water in a swimming pool affords sink-into-it. In the same way, artefacts of our culture afford its use. For example the shape of a doorknob affords the type of movement we should make in order to open the door. In the same way a button in the desktop interface can be perceived with the affordance of pressing it; the difference here is that the interface button is not a real button, but it stands for one: it is a sign.

Understanding how we could take advantage of this concept in the context of interface design still needs investigation. It seems to exist a correspondence between the concept of norm (in the social level) and the concept of affordance in an individual level, as norms are social constructs that drive, coordinate and control our actions inside an organisation.

The important thing to mention is that the properties of the object (for example the surface), when measured as an affordance (of support in this case), have to be measured relative to the agent (the animal in this example), not just treated as a physical property alone. In the same way, affordances in interfaces should be measured relative to the users, not just treated as a sign property alone. This explains why different cultures provide different affordances, hence different perceptions of reality. Semiotic approaches derived from Peircean theory support this relativity in the core concept of sign as a triadic relation between the representamen, the object it refers to, and the interpretant.

Affordances in the interface could be perceived in the ways the user and the system communicate. We need to stress here our use of the concept of communication not as a message-passing mechanism, but as sharing. As stated by Cherry, (1980, p.30) communication is an act of sharing. The word communication comes from the Latin, communico, and means to share. As this author discuss, we do not "send" messages; we always “share” them. Messages are not goods or commodities, which can be exchanged or sent from one person to another. When someone tells you something, s/he still has that information and you both have it shared, although not with necessarily equal interpretants. Whereas goods are sent or exchanged, messages are always shared. Thus, communication means a sharing of elements of behaviour, by the existence of sets
of rules of sign usage. This notion of communication as *sharing* (instead of transmission) is in line with Stamper’s idea of *information field*, instead of information flow, as discussed in previous section.

According to this understanding for the concept of communication, we can say that there is communication between the user (an agent) and the system through the interface. During the interface design, several other types of communication take place towards the common objective, which results in the design. Besides the user-system communication, other groups are also engaged in some type of communication through different channels: designers communicate with users, designers talk to marketing people, the customers support mediates between developers and users, external consultants help both users’ and developers’ organisations. A Fractal Model of Communication (FMC) proposed in previous work (Salles et al., 2000, Salles, 2001) captures the structure of the communication process involved among agents in the system design process. It stresses the fact that the interface is a primary message and, in order to design it, other fractionated messages must be carefully designed and appropriate channels must be chosen to convey them. Figure 2 illustrates the main concepts of the fractal model of communication.

![Figure 2. The Fractal Model of Communication](image)

In this diagram, nodes represent the agents in communication (A and A’) and the channels (C and C’). The links are bi-directional, which means that the agents share messages. Nodes C’ represent the fractal nature of communication. Different foci of the design process can be highlighted: the designer-user communication (A-A’) using the interface as message, in a first level, as the interface is the message conveyed by the computer (which is the first channel). The designer-artefact communication, in the sense discussed by Schon (1996) (A-C), and the user-system communication (A’-C) are represented in a second level of the fractal, having C’ as channels.

In the next section we draw upon this semiotic basis to propose a framework to analyse website interfaces considering the organisational dynamics behind them.

5. AN OUTLINE OF THE PROPOSED FRAMEWORK FOR WEBSITE INTERFACE ANALYSIS AND EVALUATION

The first aspect to highlight in the semiotic framework is our understanding of agents and communication. In e-commerce, for example, users (clients/customers) communicate with the store through the website. This corresponds to the level 1 in the fractal geometry of the communication process, illustrated by Figure 3. Thus, in the Peircean definition of sign, we have here a triadic relation between
the website as the representamen of an object (the store) for an interpretant (the user agent), as shown in figures 3a, 3b.

At the second level of the fractal geometry, the user communicates with the website through interface features (the user side). The store communicates with the website through interface features (the manager side). To illustrate other levels of this geometry, we could say that the user communicates with the interface through the help system. This type of repeated pattern can grow or shrink, as we need to focus the analysis in different aspects of the interface.

More important to observe is that other agents are involved and participate in this communication process. We must be aware that during the creation of the website, the design/usability team communicates with the website through heuristic evaluation, prototype evaluation, etc. for example. This extension in the diagram is illustrated in Figure 4a. Incidentally, the triadic relation can be adapted in a recursive fashion to a few levels to reflect the direct orientation to the extension, as shown in figure 4b.
Figure 4a. Other agents participation

We must reinforce here our understanding of the interface design and evaluation as two intertwined processes of an iterative process, in which the interface is designed, evaluated and redesigned. It is also worth noticing that the agent “Store” encompasses the whole organisation, which in fact is composed by a fractal structure with agents in communication, as indicated in Figure 4a. Therefore, the dynamics underlying the organisation is part of the whole structure and also has impact in the interface and in the user experience with the website.

In considering the context of Internet applications in general, and a website for e-commerce, in particular, the traditional approaches for user requirement analysis and elicitation do not apply straightforwardly. Considering the broad reach of the
Internet as media, it is much more difficult to have a clear understanding of who the users are.

Looking at the website as a representamen for “store”, a business organisation, the most important question we must answer from the interface point of view is: Does the interface afford appropriate actions? To answer this question we can apply Stamper’s semiotic framework to understand how each layer, which constitutes part of the semiotic of the interface, informs and contributes to the communication of the interface. More important, this question must be answered from the perspectives of the several agents in communication with the website: the user, the usability team, the design team, etc. and the agents on behalf of the company.

Starting from the layers that constitute the infrastructure of the system, the physical world, empirics, and syntactics tell us about the physical properties of the sign, its physical tokens, the channel capacity and efficiency, the structure and vocabulary of the interface. Considering the context of Internet applications, the physical world layer can be used to answer questions about the infrastructure of Internet access and the compatibility to different browsers. In the empirics layer, factors that interfere directly in the user experience, are related to time spent with downloading, percentage of http errors and time spent to update actions. The syntactic layer should be used to tell us about the typology of signs used in the interface, its composition and factors that influence its interpretability.

The three upper layers concern the human aspects involved in the meaning negotiation, usage and social implications of the sign system; the relationship between the signs in the interface and what they refer to, the purposeful use of signs and its social effects. The semantic layer can tell us about the affordances a web site has and how those affordances reflect the business substantive area. Also the determiners for the affordances can be listed to inform about aspects of redundancy, unpredictability, the use of metaphors as shorthand of expression of meaning, and absences and contradictions present in the site. The layer of pragmatics can tell us about the “silent messages beneath the surface” (ideological content), and the business mechanisms implied by the interface compared to the real practice. Finally, the social world layer concerns affordances at the social level, informal and formal norms afforded by the interface, and the social commitments and obligations of the parts implied by legislative aspects of the business.

Drawing upon the semiotic framework proposed, Table 1 summarises a set of guidelines to inspect an e-commerce website interface.

<table>
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<tr>
<th><strong>Semiotic Layers</strong></th>
<th><strong>Inspection Guidelines</strong></th>
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| 1. **Physical world** | Does the site inform about the technology needed/used?  
Are the webpages compatible for different browsers?  
Are there features concerning accessibility for people with special needs?  
Are there features for localisation? |
<p>| 2. <strong>Empirics</strong> | Is the time spent with downloading and updating acceptable? |</p>
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<td><strong>3. Syntactics</strong></td>
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| Signs and their relations to other signs | What can be said about the typology of signs used in the interface?  
What can be said about the typology of computer-based signs in the interface?  
What can be said about the relationships among signs in the interface (presupposition, interdependence, and constellation)? |
| **4. Semantics** |                                                                                                           |
| Signs and their relation to the meaning to users, perceived by the humans | What are the functions afforded by the website?  
Do they reflect the business substantive area?  
Are there information redundancies in the website?  
What can be said about its unpredictability in information presented?  
What can be said about absences in the website?  
Are there contradictions in the website?  
What can be said about the use of metaphors in the website? |
| **5. Pragmatics** |                                                                                                           |
| Signs and their effect on users | What can be said about ideological content for the website?  
Are there advertisements present? In what ways?  
What can be said about the negotiation mechanisms for buying?  
Do they reflect the cultural aspects of the real commerce practice?  
Is there a search facility available for finding a specific product? |
| **6. Social World** |                                                                                                           |
| Signs and their relation to social implications | What are the implications of the operations afforded at the social level?  
Which laws regulate the use of the site?  
Must the user subscribe to become a customer?  
What can be said about the formal rules supported by the interface?  
How does the interface support informal rules?  
What can be said about the social commitments and obligations of the parts? Are they symmetric?  
Are there possibilities of returning or substituting products? |
6. Instantiating the Proposed Framework Towards the Analysis of an E-Commerce Website

As an example of applying the proposed framework, an inspection of a supermarket website in the UK, here called T.com was conducted using the Help as a representamen for the interface features and the pages of the website itself. As it is out of scope in this paper to show the complete analysis, the following discussion illustrates some findings of applying the framework.

The physical world layer
At the physical layer, the direct relevance of knowing the physical properties of signs in T.com website is that one can design more efficient devices and infrastructure for storage and transmission. For example, for the website to function with technical precision, one has to get the right cable connection, network infrastructure, data storage devices and so on.

Concerning this layer, the site presupposes the user has already everything necessary in terms of infrastructure of communication for his connection, as s/he is already in the site, even if s/he is using the web from an Internet Café, for example. Nevertheless, some information related to the physical level is found in the Help Section, concerning security issues of payment through the Internet, and in the General Terms and Conditions document, concerning excluded services and the organisation’s liability. The sentences below suggest some of the physical aspects revealed in the website and supporting the business:

“…our Secure Server Software encrypts your credit card information to ensure your transactions with us are private and protected as they travel over the Internet. We accept orders only from Web browsers that permit communication through Secure Socket Layer (SSL) technology…”

“the services provided by the T.com site do not include the provision of computer or other necessary equipment to access the T.com Site. To use the T.com site you will require Internet Connectivity and appropriate telecommunication links. We shall not be liable for any telephone or other costs that you may incur”.

Considering the website as a physical channel for shopping online, it is worth noticing that there are no special features in it to facilitate the use by disabled people or considerations related to the elder people, who would benefit of shopping from home.

The empirics layer
The main objects of study at the empirics layer are the channel capacity, optimal sign transmission, correctness of transmission, reduction of noise in transmission and so on. The collection of signs can be seen as some signs that must be transported from one location to another, regardless of the meaning they may carry. Concerning this layer, there is a “Quick Tour” link, in the bottom of the Home Section through which the novice user can have a look and experience
the whole structure of the site. Besides being in a very discreet place of the page, some errors and unexpected inconsistencies are found, such as:

- The blue tabs in the quick tour, which should be indicating possibilities of navigation in the site, do not correspond to the blue tabs in the website.
- The quit button in the quick tour returns to the beginning of the tour, trapping the user.
- The quick tour link in the quick links section of the shopping page links to another page related to graduate careers!

**The syntactics layer**

The *syntactics* layer is concerned with the formal structure, logic and language of signs. This layer is concerned with the rules for composing simple signs into a more complex sign. Concerning syntactics, we could say that the syntactical signs in the case being considered affords “clicking”. The types of signs used in the site are mostly from the interactive category. Furthermore, the links with graphical representation are mostly iconic, facilitating the user’s interpretation. The actor and object types are also present, providing a good feedback for the user’s actions on the interface. Some examples of the sign types found in the site are illustrated below:

- Interactive signs: links and buttons.

- Actor signs: the progress bar; the change of colours when we pass the mouse through the interactive signs; the change in the cursor shape when passing the mouse through interactive signs (the arrow and the hand); the tips in the links (hints).

- Object signs: texts that are not links. E.g. 30 October 2001 in the *Today at T Section*.

- Layout signs: the blue tabs that are not links; e.g. *Shopping Directory*, *More to Explore*. The lines drawing to separate the items.

Redundancy is present in the syntactical level: we found in the same region of some pages, at least 4 types of representations for each link representing the categories of goods the user can buy: 2 graphical (iconic and symbolic signs), with hints and 2 textual. E.g.:
The semantic layer

The Semantic layer is concerned with issues related to the meaning of signs. Concerning this layer, first of all we could say that the frontier between the .com and the physical store (supermarket) is not clear. In some sections (e.g. the Help Section) the user is encouraged to think in the site as the equivalent supermarket and some of the metaphors used contribute to this. In other sections (e.g. Terms & Conditions) it is suggested that they are separate organisations, owned and operated by different registered companies.

At the semantic layer, we are equally interested in the different metaphors used for representing the meanings of the terms. Choosing the wrong metaphor could have an adverse effect leading to a different meaning. “Warehouse” seems to be an important concept in the website, as its redundancy is the biggest. Only in the Home Section the word appears 22 times! The concept of a warehouse as explicitly shown in the site could suggest other type of business interaction, much closer to buying from a catalogue than being in a virtual supermarket. Other metaphors present in the website, include:

- The site is presented in the Help Section as a set of seven stores. However the seven stores are not distinguished among the links and there is not an explicit representation for them in the interface. Also, the concept of “store” is used in some places to mean the real store (the supermarket) as in the figure below:

- “Navigation” in the site is presented in the Help Section as “moving around” the stores. Blue tabs along the top of the page are presented as important “locations”. However they are not related to the stores of the website or to the “departments” of the real supermarket.

- Quick link on the left of the pages are presented as a “quick” move to the different stores or different departments in a store. How quick? Quick seems to mean here more accessible as they are all located on the left of any page and the user does not need scrolling to find it. Actually it means more redundancy, and more “clicking” affordance.

- The basket metaphor is used to choose the goods the user wants to buy. There are some inconsistencies between information presented in the
Help of the Home Section and the Help of some stores, concerning how to buy. A “buy” button is referred to in the Help of the Home Section, while in fact the button to put things in the basket is labelled “add”.

- Putting things in the shopping basket is easier than removing it. The reverse operation (to remove items from the basket) uses a different procedure: change quantity to 0 and click on recalculate/update basket. If there is an “add” button to add things in the basket, the user probably would expect a “remove” one to do the opposite operation. There is not a symmetric relation to the meaning and representation of these operations.

The pragmatics layer

The pragmatics layer deals with the intentions, communication, conversation and negotiation of signs. Concerning pragmatics, the site uses the concept of “stores” from inside the supermarket. However, the stores are not distinguished in the site or in its Home Section, or in the Shopping Section, and the list of the 7 online stores is different in different parts of the Help Section. This set of stores seems to reflect the structure of the business organisation. Also reflecting that structure, the customer needs to register separately for 2 subsets of the stores. Personal Finance could be understood from the Help Section as one of the “stores”. Also, among the stores it is the only one with a distinguishable place in the interface: it is one of the 7 being represented with a blue tab on the top. Nevertheless, the Personal Finance is not a store; actually, it is a different organisation with its proper regulations and a different style of webpages. Some other inconsistencies related to the pragmatical aspects of the interface include:

- The “search engine” is only present when the user is “inside” one of the stores, to buy something, and it looks only through the contents of the store the user is in. This support does not seem to be consistent with the intentions of a user entering the website.

- Some concepts common to the two types of organisation, T.com and T supermarket, are not applicable to both. For example, there is no way of using vouchers online. The vouchers sent by post in the “normal” mailing can only be redeemed in the supermarket and not in the .com

- The customer cannot return items to a T store, or to the closest supermarket. If the user needs to return something, for example a product bought from the music warehouse, s/he needs to contact some special customer service team by telephone or email. This also suggests the idea of the .com and supermarket being different organisations.

- Changing details is not a direct operation of filling forms, as it is the first time the user gets registered. If the customer changes address, for example, s/he needs to phone or email the site in order to change it.
The social world layer

This social world layer refers to issues related to beliefs, expectations, commitments, contracts, laws and culture. No intentional sign can be fully understood without considering its potential and actual social effects on the human agents. Concerning this layer, there are some social implications for shopping online, and the interface itself is the way to have access to that knowledge.

The General Terms and Conditions for T.com is a written document containing the regulations and are accessible through the last link in the bottom of the home page (and in the bottom of the shopping page as well). Despite not having much visibility in the interface, considering its physical location in the page, the document itself stresses the importance of it for the user:

“Please, read them carefully as they affect your rights and liabilities under the law. If you do not agree to these Terms and Conditions, please do not register for or use the T.com Site. Please, note that to use any of the services provided on the T.com Site you are required to register as an authorised user on the site.”

In addition to the General Terms and Conditions, there is also the Product Terms & Conditions for 10 different types of products.

To get authorisation to use the site as a customer, i.e. buying products, the user must register. This operation is done using a blue tab (on the top) Register &Sign in. Starting the registration process the user reaches the Privacy Policy, a document explaining the privacy police of the organisation and providing options to let the user choose how his/her personal data will be used. However, the text says that anyway, even if the user stated s/he do NOT want to receive information or be contacted, the user still will receive communications that are integral to the .com service:

“These may include but are not limited to details of new products, special offers, Internet developments and other .com services.”

The “Privacy Policy” form and the “Terms and Conditions” document are signs by themselves and, as so, the framework can be applied to them to reveal more detail, as we get closer. Some brief considerations about the social implications from the General Terms and Conditions document:

- Social commitments and obligations of the parts are not symmetric. For example, commitments from customers are secured by their payments (by credit cards or T’s accounts of the customer), while commitments from the store are not explicit; the website does not provide access to “the rights of the customer”. Furthermore some important operations such as the possibility of returning goods are only found as a FAQ in the Help Section and have not a clear answer. There is not mention about the possibility of substituting products. The email is the channel for anything that is not covered by the Help Section. Other signs of this asymmetry, include issues concerning liability, as illustrated below:
"The T.com Site is provided by T.com without any warranties or guarantees. You must bear the risks associated with the use of the Internet."

"In particular, we disclaim all liabilities in connection with the following:

Incompatibility of the T.com Site with any of your equipment, software or telecommunications links
Technical problems including errors or interruptions of the T.com Site

Unsuitability, unreliability or inaccuracy of the T.com Site
Inadequacy of the T.com site to meet your requirements."

The interface inspection, as proposed in this work, considered the perspective of analysts and could be part of the process of design and development of the website. The same framework based on the semiotic layers could be adapted to a context of user testing, where the analysts would be observing users interacting and buying online. Also, the same framework could be applied to different levels of the fractal geometry shown in Figure 4, for a more complete picture of the interface issues of a website. The analysis could focus the Help System, for example, as it is also a sign (a representamen for the website features). More important, the same framework could be applied at the level of the organisation, to capture the different perspectives of the groups whose work affects or is affected by the design of the website.

7. COMMENTS ON RELATED WORK

Methods for analysis and evaluation of websites have mostly been derived from the approaches based on the traditional heuristic evaluation of user interfaces and do not capture the complexity and organisational dynamics behind the website. Contributions from semiotic approaches have appeared very recently. Despite not addressing the context of Internet applications, Connolly and Phillips (2001) have shown insights offered by OS that help to deepen theoretical and practical appreciation of established user-system interface design principles.

Other approach to website evaluation based on Semiotics was proposed by Vile in a personal communication (Vile, 2000;Tim and Vile 1999) He applied the Social Semiotic text analysis (Hodge and Kress, 1988), to evaluate websites of e-commerce business.

The Social Semiotics proposal draws upon Saussure’s work on diachrony and transformations and in reflections of the own authors to construct its principles (Hodge and Kress, 1988, p.35). In the Social Semiotics framework, the smallest unit of meaning that can have an independent material existence is the message. The material existence of a message is determined by the existence of at least two signs organised into a syntagmatic structure. Thus, a sign is a portion of the syntagmatic plane that is treated as a unity. It can be ranged on a continuum between “transparent” and “opaque”. Semiotic phenomena have both social and referential dimensions, and as so, must be described in terms of both: a mimetic and a semiosic plane. The mimetic plane implies some version of reality as a possible referent. The semiosic plane implies some semiotic events linking producers and receivers, signifiers and signifieds into a significant relationship. The semiosic plane is the context for the mimetic plane and the mimetic plane is
constituent part of the semiosic plane. The interaction of both is necessary for the social production of meaning to occur.

The Social Semiotics approach uses the word text to refer to a structure of messages or messages traces which has a socially ascribed unity, and proposes six principles for text analysis, briefly described here. The semiosic determination concerns the conditions of the semiosic plane to be fixed before analysis of the mimetic plane. The mimetic anchorage concerns the specification of the world of referents. The ideological content is related to the competing versions of reality implied by the text. The analytic anchorage concerns the position of the analyst in a semiosic structure that incorporates the text. Homology refers to possible homologies between mimetic and semiosic structures, syntagmatic and paradigmatic structures, etc. Also, patterns of redundancy and absence, and contradictions should be investigated in the text.

While it is not the focus of this work to go deeper in the analysis of the SS approach, we must highlight in what ways our approach differs from it. First we must say that our framework for interface analysis derives from a different school of Semiotics. We draw upon the work of Stamper (1973), that is based on the works of Peirce and Morris. As so, the differences between the theories start with the fundamental concept: the sign. As discussed earlier in this paper, the Peircean definition of sign as a triadic relation among the representamen, the referred object and the interpretant is in line with our concept of the interface. We understand the interface (or the website) as a representamen of an object (the store) for an interpretant (the sense made by the agent or user). The social dimension of the sign, besides being implicit in the core definition of sign, it is made explicit in the Stamper’s extended layers, mainly the sixth layer - the social world. Furthermore, this understanding of sign supports the core concept of affordances in interfaces not being treated as a sign property alone, but as a measure relative to the users. Second, the SS concept of message as having direction seems to be only appropriate in understanding communication by sending electronic signals at the empirical level. In our scenario an agent (the user) is in communication with another agent (an store for example) through a computational interface. This type of communication, as discussed in our previous work (Baranauskas et al. 2001, Baranauskas et al. 2001) is much more like a conversational process. Thus, our concept of communication as sharing differs fundamentally from the concept of the school that understands communication as a message passing mechanism.

8. CONCLUSION

The Internet considered as a medium brought us the need to broaden the referential framework of user interface analysis, taking into consideration the semiotic nature of the interface as well as in its social aspects. Current literature concerning methods for user interface analysis and evaluation has not paid sufficient attention to the social and organisational aspects that underlies the interface design and influences the user experience with Internet applications. Drawing upon input from Organisational Semiotics, this paper proposes a framework for user interface analysis of websites and illustrated its use for websites of e-commerce. Our findings point out issues concerning the organisation and the business that should be afforded by the interface and should be taken into consideration in the analysis, design and evaluation of websites. The proposed framework enables the analysis of the affordances in the interface under
different levels, and under different perspectives, moving the focus to the organisation itself by including other groups and responsibilities associated with the website design.

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