

Mastering the Semiotics of Information-Intensive Web Interfaces

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*I dedicate this work
to my parents Anna and Mimmo,
to my brother Carlo,
to all my friends,
and to the pleasure of music
...the never missing support to my studies.*

Board

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Abstract

Communication is virtually impossible when interlocutors lack the ability to negotiate meanings. The intended semantics of the language used by a sender should be perceived and mastered by its receiver/s. For this reason the sender should always vision and identify himself in the receiver in order to design the most clear and proper signs with respect to her/his knowledge.

Web sites are complex interactive communication tools. In order to let users manage and control their content and services, they make use of different languages, different families of signs involving different sets of knowledge that the user should be somehow familiar with. Web designers (senders) should design interface signs so that their intended meaning could be correctly interpreted by the envisioned users (receivers).

This work presents a novel approach for analyzing the different kinds of signs composing web interfaces and better understanding their relationship with the process of user's understanding. Starting from Linguistic/Semiotic theories and key achievements in Hypermedia Interface Design, this research developed a semiotic framework (W-SIDE Framework) for analyzing and evaluating the user's understanding of the interface language of web applications.

W-SIDE Framework comprises a conceptual toolkit (W-SIDE Model) and an evaluation technique (W-SIDE Evaluation Technique) for modeling and evaluating the clarity of web interface language with respect to critic user profiles. W-SIDE represents a useful conceptual tool supporting web interface design and evaluation, by making experts aware of potential user misunderstandings caused by a gap between the knowledge presupposed by web signs and the one owned by targeted users.

The empirical validation of the framework has been carried out in two ways. Firstly, the method has been employed in web projects on the field. The results obtained from analyzing and evaluating web applications through W-SIDE have been compared with the ones obtained from observing real users while interacting with the same applications, in order to check the reliability of the method.

Secondly, the framework has been constantly reviewed by experts from both the linguistic/semiotic and the web design field: the feedback gathered is encouraging for further improvements.

Foreword

The interface, through its signs, creates a “language”, and a general rule of communication states that the language used by a “sender” (a Web site) should be perceived and mastered by its “receiver/s” (users). Whereas the need for speaking a “proper language” with the user has been much investigated by researchers in the area of information-architecture design [Rosenfeld, 2002] and content authoring [Alexander, 1999][Nielsen, 1999], little has been done so far for the language of the interface (i.e. besides the pure content).

Interfaces of interactive applications, in general, and of Web sites specifically, are populated with “signs” i.e. labels, icons, lines of text, etc. which play a double role: they suggest a “content meaning” (e.g. the link “bibliography” on a web page about Dante Alighieri refers to the real world concept of *bibliography*) and also offer a “functional meaning” (e.g. *if you click here you navigate to a page about Dante’s bibliography*). These signs should be understood by users in both senses: the user should be able to understand the term (and concept) of *bibliography*, and, at the same time, to be able to anticipate (or at least to quickly learn) what interaction-navigation will result from clicking here or there.

From the above description it would seem obvious that a great deal of attention should be paid to the choice of the signs, after carefully balancing possible alternatives or options. However, very little attention has been paid to this aspect of the interfaces, while most of the research seems to focus upon aspects of lay-out, page organization, visual communication, etc. Also interface elements (like labels, for example) seem to be an obvious outcome (or a side-effect) of designing the content, rather than the result of an independent motivated decision. If for bibliography the question can be academic, the reader is invited to consider the case where the piece of content is called (by the content authors) “oinokoe”, a wine jug from the classic period of Greek pottery: what should be the corresponding sign on the interface for letting the user reach and manage that content? Possibilities are “oinokoe”, “vases-for-wine”, “vases-for-pouring wine”, “an icon suggesting the shape”, “a thumbnail picture showing a typical oinokoe”, etc. Is it obvious which one is the best sign? Does it make any difference to the users? It turns out, as it is probably obvious, that signs on the interface make a lot of difference for the users, and that different signs mean something different to different users.

This work has the following aims:

- To induce HCI experts the idea that paying attention to interfaces elements should focus first of all on their comprehension by users and only subsequently on their efficiency and effectiveness with respect to user goals/tasks.
- To introduce a theoretical model (W-SIDE Model), based upon semiotic theories, that allows a better understanding of the phenomenon of user interpretation of web signs.
- To introduce a semiotic method (W-SIDE Evaluation Technique) for systematically evaluate users' understanding of web interfaces, using a combination of heuristic-driven inspection (with expert analysts) and empirical testing (with samples of users).

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1 Introduction

Interface design methods and theories applied to web-based applications have considered mainly the interface effectiveness and efficiency with respect to user goals, often giving for granted the user's understanding of the interface and its language. Web application development still needs to employ effective methods to analyze the interface language and its semantics, in order to verify its comprehension by critic user profiles. The interface language and the concepts staying behind it are often different and misaligned with the ones used and known by the user, thus risking to compromise a successful user experience.

This work proposes a conceptual tool for analyzing the semantics of signs composing the web interfaces and evaluating their comprehension by users. The thesis arises from the lack in current literature of conceptual tools helping designers and evaluators in considering the “language” of web interfaces as a stand-alone dimension, that is, analyzing how the application “speaks about itself” and about the content that can be reached.

In order to better explain the nature and the motivation of this thesis, the next paragraphs of this chapter are devoted to briefly illustrate the issues that inspired and contributed to conceive this work.

1.1 A Dialogic Perspective

Over the last decades, many research studies compared interactions between a user and a website as a sort of dialogue [Andersen, 1990][Dix, 1997][Schneidermann, 1998]. A website can be considered a form of “dialogue generator”, i.e. a device capable of supporting several different conversations with different types of users. The website proposes topics that can talk about and the user asks questions and manages the dialogue by clicking on links. These considerations are the ground for modeling and designing the interaction between a Web application and its user as a particular kind of dialogue. Web designers try to imagine all the possible interesting conversations for the user and provide navigation mechanisms in order to make them possible. The designer thus plays a crucial role in the dialogue process, because the range of possible interactions available to the user

is actually defined by his intentions and expressed through the content, the navigation and interaction capabilities offered by the Web application.

Designers discuss which dialogues should be communicated on the website with respect to the goals of the potential users and of the main stakeholders involved. Many methods, techniques and models help planning *what to say*: as pointed by Cantoni [Cantoni. 2001], in ancient rhetoric terms such activity is somehow similar to the so called *inventio*, that is, the activity through which a person wishing to communicate something collects all the ideas for preparing the speech. Current techniques also help to design and evaluate *how argument and structure each dialogue*, through which informative and navigational structure: in ancient rhetoric terms, it is similar to the so called *dispositio*, the activity carried on by the speaker for ordering the elements according to the overall text's strategy.

Even if the effectiveness of these activities is determinant for the success of the dialogue, designers should carefully consider also “how to tell”, that is, how the application should actually “talk” to the user: in ancient rhetoric terms, it is related to the so called *elocutio*, that is, the activity carried on by the speaker for defining the actual words and phrases to be used in the speech. With respect to the goal of the website, the designer could define the best *inventio* and *dispositio* strategy, but if the *elocutio* is badly designed, the user will never understand what the website wants to communicate.

As regards web applications, *elocutio* design has always been associated to the content writing activity, that is, how write content - through which style and which language – in order to satisfy user goals. However, as regards interactive applications, the most fundamental issue related to elocution design is interface or semiotic design, that is, how design the interfaces letting the user reach, understand and manage the content.

In the last ten years there has been a growing interest in conceiving structured and comprehensive methodologies to hypermedia and Web applications. In order to cope with the different problems that Web designers have to deal with, requirements, design and evaluation issues must be solved in a systematic and modular way [Schwabe D. 1998]. The assessed conceptual design methods and models that have been developed (such as HDM, OOHDM, UHDM, RMM, WSDM, WebML and many others) try to grant that each design activity addresses different concerns at the proper stage and at the proper level of abstraction. However, very few structured models and techniques have been developed for supporting interface language design and evaluation. Web Semiotics is a fundamental discipline, since it is strictly related to the interface, the only channel through which the application (and indirectly their stakeholders) can “talk” and interact with the user. Currently, there is a huge gap between conceptual design choices and how translate them in interface language choices (see figure 1).

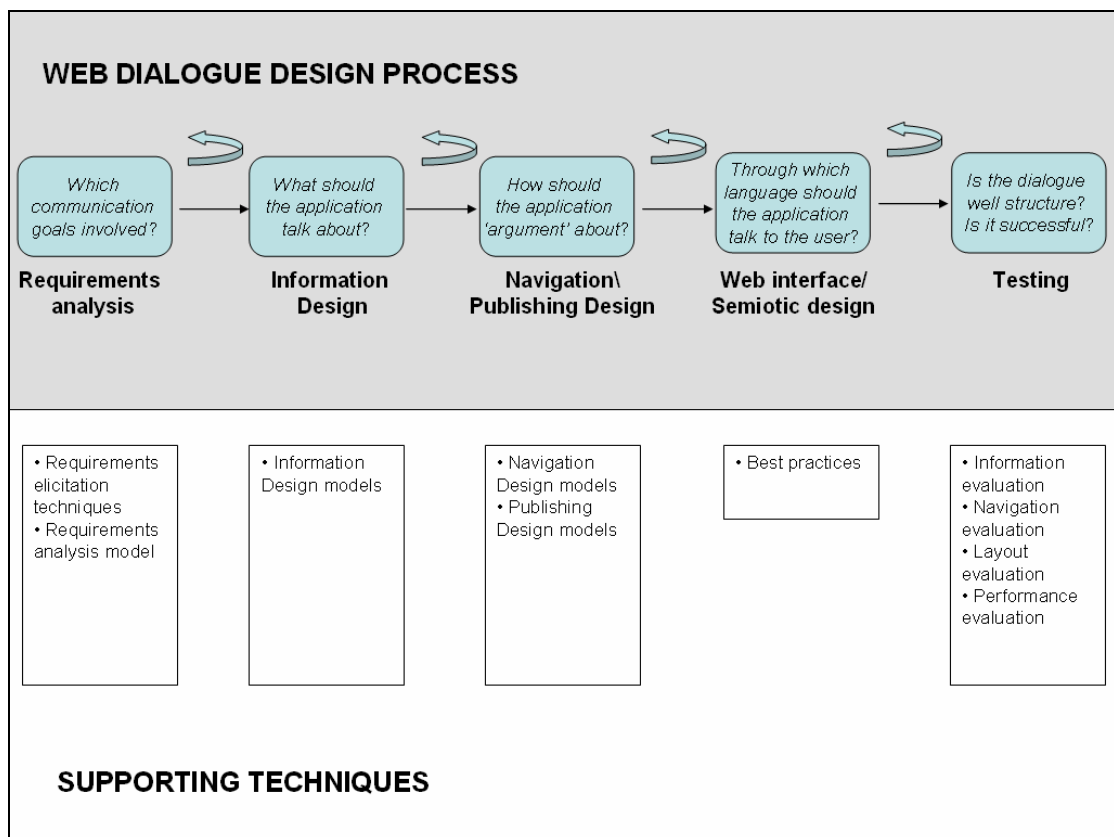


Figure 1. Tools and techniques supporting the web application's lifecycle

Moreover, as regards usability methods and techniques, great attention has been paid to the evaluation of the so called *user satisfaction*, that is, evaluate if a user can accomplish in an effective and efficient way a predefined goal [Badre, 2002] [Nielsen, 1999][Cato, 2001]. In such techniques, the evaluation of the interface language of a website as a separate activity is often missing or confused with other dimensions. Interface aspects have always been considered as generic criteria for evaluating user satisfaction, but they are often confused and blended with other usability problems (i.e. problems related to navigation, to content, or to layout design). Very few methods are giving the right importance of semiotic design and evaluation as a standing alone problematic, influencing more the *user's understanding* than the *user satisfaction*, the former being a necessary element for the latter.

1.2 Semiotic Discipline to Master Web Interface Language

Typical usability problems encountered in user testing concern apparently “superficial” elements of an interactive application, such as the link labels which are not at all understood by the user, the names of the menus whose meaning is hard to predict, the vagueness or technicality of the content categories, the “mysterious” significance of an icon, and so on. These crucial breakdowns for the user experience have to do with a bad *Interface/Semiotic Design*. Being semiotics the science of studying the signs, web signs should be coped with a proper semiotic approach, which may support designers and usability experts in properly analyzing the semiotics of a web interface and anticipate potential usability breakdowns.

This work considers semiotic design an important communication discipline and design aspect, which should be distinguished from already assessed and well-known disciplines. It should be distinguished from “content writing” in strict sense: content providers produce and shape content but are usually not able to write clear link labels for the users. To make successful interface-semiotic design, designers should understand their user profiles, their knowledge and their expectations. Users may be familiar with the site content but not in surfing the web, or viceversa; they may be first time users, or recurrent users and may have different strategies to process and understand the signs on a page. Content providers seldom do not (and are not asked to) consider such elements.

Semiotic design should also be distinguished from “navigation design” in a strict sense. Being able to shape accurate connections among pieces of information does not necessarily imply being skilled in properly communicate these decisions to the users, or anticipating whether the user will understand and will be intrigued by the names of links and graphic elements on the pages. Taking the same navigation architecture and changing the semiotic design on it, the user experience may drastically change (e.g. information may not be found because labels are wrong for that user profile). Finally, interface-semiotic design is also something more and broader than graphic design, devoted more to finding graphic solutions (concerning the look&feel and the layout of the application) on the basis of semiotic requirements.

1.3 Research Goals

The research aimed at defining a novel approach for designing and evaluating web interface-semiotics by setting out elements for analyzing the different kinds of signs used in web design and their relationship with the process of user's understanding. However, it is not at all intended as a definitive solution to all the issues concerning the activity of web semiotic design, which remains a complex and crucial task to be carefully addressed case by case.

The work provides insightful guidance to analyze and evaluate semiotics elements of web interfaces with respect to their impact on usability. This will be done by showing synergies between linguistic and semiotic theories and usability methods and techniques, outlining the importance of an ad-hoc and in-depth semiotic analysis for identifying interface problems and guessing the causes staying behind them.

The aim of the work is twofold. On the one hand it is addressed to professional web usability experts who would like to improve the outcome of the activity of web evaluation, providing them with new conceptual tools for *analyzing the semantics* staying behind signs composing a web application and detecting user misunderstandings.

On the other hand, it is aimed at moving a step forward in the research of communication design over the web and to suggest to the scientific community concrete advances in the state of practice in web semiotic/interface design.

1.4 Research Questions

As shown in Figure 1, while other activities (from the elicitation of requirements to the evaluation of the web site) are quite well supported by models, techniques and practices, proper conceptual tools dealing with the activity of web semiotic design are quite missing. The fact that web semiotic models have not been defined yet does not mean that such activity does not happen in practice.

The overall research question to be explored is: *how should a web application actually "talk" to the user?* According to that, relevant research questions that remained as far as now uncovered in web semiotics design and evaluation concern the following:

- Which processes are involved in the user's understanding of web signs and web interfaces in general?
- Which are the hidden concepts staying behind web signs and that should be mastered by the user in order to understand them?
- How can this presupposed knowledge be modelled?
- How can user knowledge be modelled and compared with the knowledge presupposed by web signs?
- How can inspectors predict the interpretation of web signs by different users?
- Which conceptual tools and techniques can support them to evaluate web interface semiotics in a systematic and efficient way?
- How could web semiotic design be considered and fit in the design phase? Which design guidelines or methods could help designers in preventing semiotic errors?

1.5 Research Boundaries

The research scope of this work is constrained by the following dimensions:

- *Kind of channel considered*: this thesis is not on semiotic design in general, but on the activity of semiotic design related to a particular kind of interaction paradigm, that is, the interactive dialogue between a website and its users. Moreover, the work does not consider user profiles for which there is a drastic shift in the interaction paradigm and the channel used – i.e. blind users interacting with a web site through a screen-reader, particular context of use limiting or changing the kind of interaction (while driving a car, walking, etc.), where user interpretation of signs relies on different elements and processes.
- *Activity of the development cycle*, the work does not consider the overall *user satisfaction* – which is given by many factors composing a website (i.e. a proper information architecture, navigational strategies, content writing, layout with respect to specific user goals) – but focuses mainly on the *user's understanding* of the website interface, which is the first fundamental step for creating successful and satisfactory interactive dialogues.
- *Family of applications at issues*, this work does not treat semiotics related to web systems in general (at least not directly), but focuses on content-intensive web applications characterized by communication objectives.

1.6 Research Method

This research has been conducted through two parallel and intertwined processes. On the one hand, an analysis has been carried out as to the capability of the current semiotic frameworks to cope with semiotics issues related to web applications, and, in particular, with those involved in hypermedia-intensive environments. This activity considered both the Human Computer Interaction field and the Linguistics/Semiotic field, in order to find useful analogies and links among the different disciplines.

As a result, limitations and synergies among the studied theories have been identified, and extensions to the current semiotic models have been defined for tailoring them to the web domain. As this top-down method proceeded, the features identified for coping with web application semiotic design and evaluation converged to defining a new model (W-SIDE).

On the other hand, the described process was stimulated, supported and led by empirical evidence, thanks to the opportunity to work on real case studies and analyse concrete semiotic issues related to the web design and web evaluation process. The study focused mainly on projects related to cultural heritage and e-government sectors, in which applications are still poor in designing clear interfaces and in making unfamiliar terms and concepts – unfamiliar outside the specific community - intuitive to users.

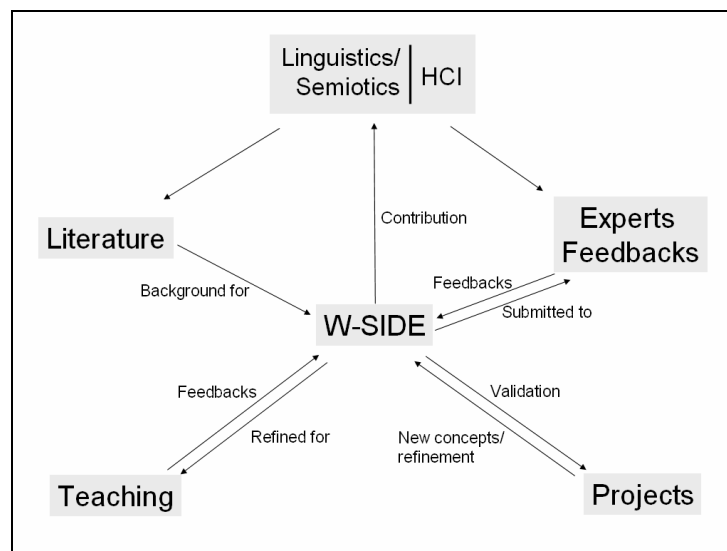


Figure 2. W-SIDE Research Method

The experience gained in these projects (some of them are reported in Chapter 4) allowed to strengthen, consolidate, refine and validate the features of the model as they became available. Applying the features of the model to real projects provided input for improving W-SIDE. Besides, the research work was also accompanied by a continuous gathering of feedback from analysts, students, web designers and researchers. Activities such as publishing the results of the work, training students, and conducting limited surveys to professionals also supported the refinement of the model. This bottom-up approach enabled a continuous reflection on the project practice, and paved the way for future validations of the model.

1.7 Overview of Remaining Chapters

The rest of the thesis is organized as follows. Chapter 2 presents a review of the related work, highlighting key achievements relevant for this research in the field of linguistics, semiotics, communication studies, human-computer interaction and web design. As a result, this chapter will point out lacks of the current approaches to semiotics in coping with the issues relevant for web applications and the user's understanding of interface elements.

Chapter 3 presents the W-SIDE Framework, illustrating the key conceptual constructs of the W-SIDE Model with the support of application examples. It is shown how the outcome of the semiotic analysis conducted with W-SIDE Model may be tied up with usability evaluation activity in a coherent fashion (W-SIDE Technique).

Chapter 4 offers an overview of the method and the results of the initial empirical validation of W-SIDE. The validation was carried out by applying W-SIDE to empirical projects by the Museum of Modern Art of San Francisco and the Cleveland Museum of Art and it is intended to be a first step in the assessment of how W-SIDE may be perceived and used by practitioners.

The conclusions, that summarize the novelty introduced by W-SIDE, are presented in Chapter 5. Benefits, downsides of the proposal, outlooks for future work emerging from the current state of the art of the model are also discussed. Research action will focus on the further validation of the model, on the extensions of the model and on the ongoing enhancements of the features of the approach.

ANNEX I illustrates excerpts of the application of W-SIDE Evaluation Technique on real web projects. ANNEX II explains in details and through examples the heuristics to

be used for evaluating user's understanding of web signs; Annex III shows the material used to teach W-SIDE in university courses and an example of analysis carried out by some students; Annex IV proposes an explicative example of modeling the dialogic structure of a website; ANNEX V proposes a glossary for facilitating the consultation of the main concepts of the WIDE Framework.

2 Review of Related Work

This chapter is aimed at highlighting the salient contributions coming from a variety of research fields that served as basis for the development of W-SIDE, a semiotic framework for the analysis and evaluation of the interface language of web applications.

Web interface design and web semiotics are transversal disciplines attracting many researchers from different fields. Therefore, it should be not surprising that inputs from different disciplines are needed in order to cope with and understand the consequences of a semiotic analysis of web applications.

Leading authors presented in this background section acknowledge that the involvement and adaptation of communication theories in the development and conceiving of interactive applications could not only improve their fruition by users but communication theories themselves could derive benefits from the obtained results.

Figure 3 shows the fields whose results are held as essential and interesting to this work.

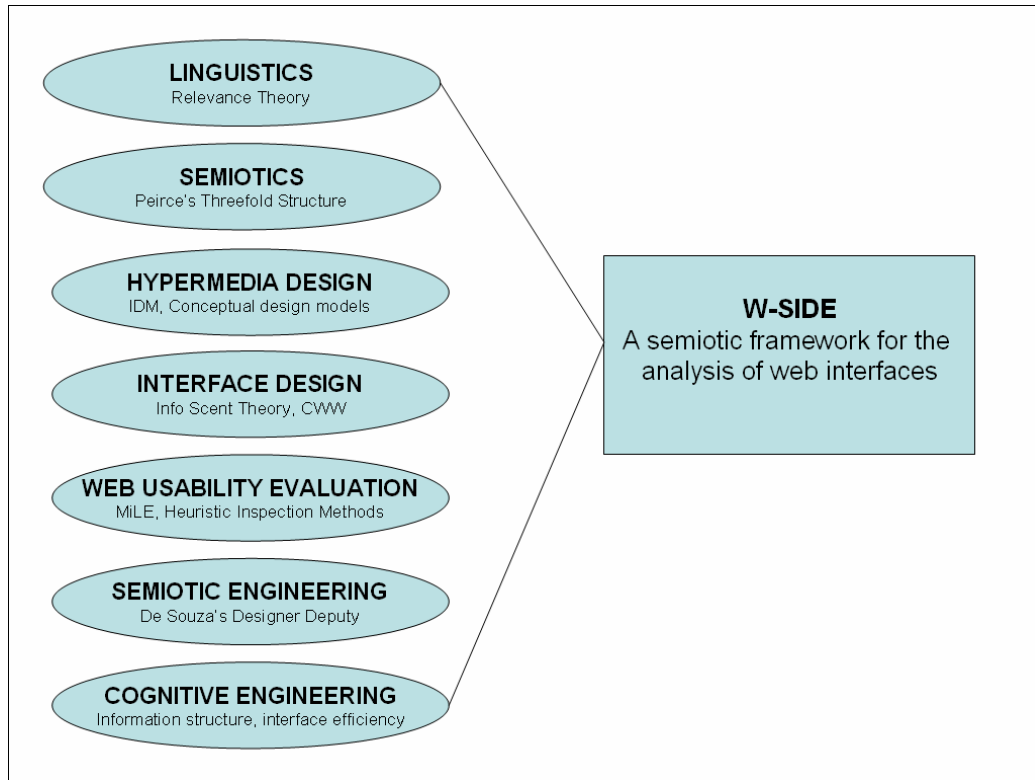


Figure 3. Research fields involved in W-SIDE conception

It is not the intent of this chapter to cover all the achievements and theories concerning the analysis of the interface of web applications. Indeed, as the review will show, researchers considered the analysis of interface elements in many different ways and through various concepts and theories, often grasping viewpoints from semiotics and linguistics field and applying them to HCI applications.

However, very few studies considered the semiotics of web interfaces as a standing-alone discipline: current theories either focus on very peculiar semiotic problems and provide ad-hoc solutions or consider semiotic aspects blending them with other studies and techniques related to the design of efficient information and navigation structures.

As a consequence, there are very few efforts in proposing conceptual and ready-to-use semiotic tools to be applied to the design and evaluation phase and aimed at supporting the user's understanding of the language of the application, independently from the efficiency of the structure staying behind it.

Moreover, current approaches in Semiotic Engineering focus on generic software systems only, regardless of any specific type of application or domain. Each family of application, however (e.g., electronic publishing applications, multimedia systems, hypermedia, Web sites, etc.), has different scopes, fulfills different users' purposes and establishes a specific kind of interaction. Each type of interactive application calls for specific and new conceptual models able to interpret the human-computer relationship that is established through it. Semiotic approaches always focused on applications aimed at making users *do* something through system operations. They focused on informative systems, operative systems, document or graphic editors, where the interface has the main goal to let the user understand the application and manage the interaction. Very few attention has been paid to the analysis of the interface language of information-intensive applications, that is, meta-tools having communicative goals designed by institutions/organisations/corporations in order to inform and train users on some content. Currently, no model has been developed for modelling and analyzing the language used by such applications in order to evaluate and better design them. A specific and tailored semiotic approach to interpret the language of the dialogic interaction established by information-intensive web application is needed.

The chapter reviews the relevant models and conceptual tools identified as crucial background for defining a semiotic model *specific* for web applications and aimed at analysing the interface language. Before introducing relevant studies from the field of Human Computer interaction and Semiotic Engineering, the chapter will introduce some concepts and theories from the Linguistic/Semiotics field that have been determinant cues for the development of the W-SIDE model. These concepts wish also to give the needed background to the reader for better understanding the limitations\potentialities of current approaches in HCI studies.

2.1 Intellectual Artifact and Presupposition Theory

According to de Souza [de Souza, 2005], HCI artefacts are intellectual products, that is, the result of choices and decisions guided by reasoning, sense making, and technical skills. Like all other intellectual products, HCI artefacts are communicated through signs, in a particular kind of discourse that we must be able to interpret, learn, use and adapt to various contexts of need and opportunity. De Souza sets out the features composing an intellectual artefact as following:

- It encodes a particular understanding or interpretation of a problem situation;
- It also encodes a particular set of solutions for the perceived problem situation;
- The encoding of both the problem situation and the corresponding solutions is fundamentally linguistic (i.e., based on a system of symbols – verbal, visual, aural, or other – that can be interpreted by consistent semantic rules);
- The artifact's ultimate purpose can only be completely achieved by its users if they can formulate it within the linguistic system in which the artifact is encoded (i.e. users must be able to understand and use a particular linguistic encoding system in order to explore and effect the solutions enabled through the artifact).

With respect to these features, the designer and the user of an intellectual product must share the same language, that is, the same system of symbols with a defined vocabulary, grammar, and set of semantic rules. The encoding of the designers' intent in the interface, how users interpreted them and how they use them to express their own intent during interaction refer essentially to linguistic processes, though not necessarily involving only natural language signs.

This means that during the interface design of an interactive application designers and inspectors should wonder which signs and which concepts the user can cope with and, if the case, propose adequate explanations for the ones s/he is not familiar with. According to the presupposition theory [Rigotti, 1988], every message, in order to be meaningful, entails something which is not said. To have a good communication, the sender has to presuppose only what is shared by the receiver, otherwise the communication fails. As an example, the link "Buy your mp3 player" on the Apple web site is meaningful for the user if and only if the user knows what lies beneath the notion of *mp3 player* and what it means. Moreover, the knowledge presupposed by the link goes beyond the literal meaning of the label. As an example, the user should also know and recognize that it is a hyperlink and that s/he can interact with it, that by clicking on that the item will be added to the shopping bag, etc. As it will be shown in the following sections, a web site is a complex interactive communication artefact and, as a consequence, the language used to let the designer and the user express their intents refers to different kinds of knowledge and set of rules.

2.2 Outlook on Linguistic\Semiotic Field

Among the striking variety of approaches to Linguistics - the study of the language - and Semiotics - the study of the sign - it is single out here a number of research strands and theoretical approaches, which are more directly relevant to the development of W-SIDE.

2.2.1 Charles Peirce and the Threefold Structure

Semiotics - also known as semiology - is the study of signs, both individually and grouped in sign systems, and includes the study of how meaning is transmitted and understood.

Charles Peirce defines a sign as “*anything that stands for something else, to somebody, in some respect or capacity*” [Peirce, 1931-1958]. His definition underlines the fundamental role of interpretation in semiotics. Nothing is a sign unless it is interpreted by somebody. It follows from this definition that the same signs may have very different valid meanings, that mutual intelligibility widely depends on cultural conventions and mechanisms to negotiate shared meanings, and that ultimately there is no such thing as *the meaning* of a sign. One consequence of this definition, for example, is that meaning cannot be framed as a fixed and permanent entity, but it is a process. Peirce’s used the concept of *abductive reasoning* for saying that mind assigns meaning to things by building plausible hypotheses about the sign that is taken to represent them. As long as these hypotheses are confirmed by positive evidence, they concur to build the meaning of the sign being interpreted.

Peirce proposes that signs have a threefold structure and that their interpretation, as stated above, function as a process. The three constituents of the Peircean sign are the representation or sign-vehicle (representamen), its referent (object) and its meaning (interpretant).

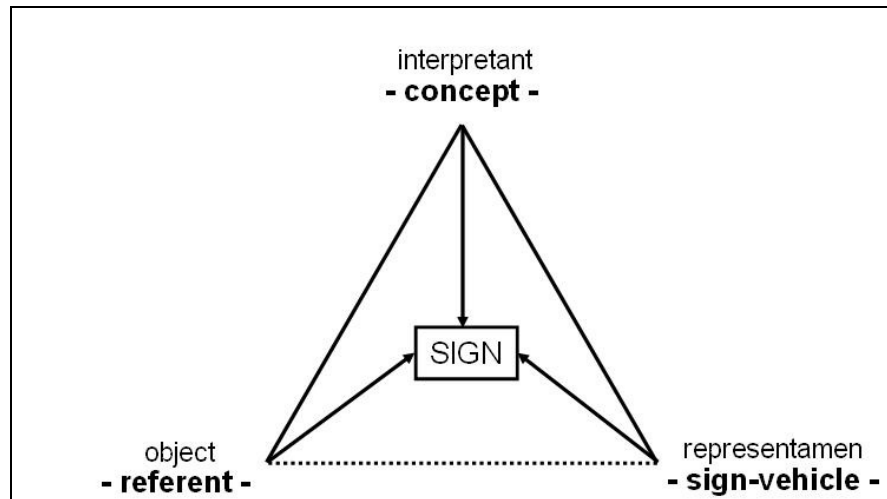


Figure 4. Peirce's Threefold Structure

A sign requires the concurrent presence of these three constituents. Let us make an example: consider a panel at the entrance of a university with “Dean’s Office” written on it. The textual shape of the sign (the text string “Dean office”, the font used, its color, its background, its size, etc.) is the sign-vehicle. The concept that the sign makes arise in the mind of the reader, that is, the idea of a *dean’s office* and what it means is the interpretant. The actual object in the real world, that is, the dean’s office as physical object is the referent.

In the example the sign is in a particular position (on the wall in front of the entrance, at a certain height from the floor, etc.), above and below the sign there are other signs – referring to other offices in that university - with different textual strings but having the same size, the same font and the same color. Above these families of signs there is another sign, with a different size, a different font and a different color, with written “3rd Floor”.

In the example, the understanding of the sign “Dean Office” and its purpose, that is, its meaning is given by many factors: the perception and understanding of the sign-vehicle (“Dean Office” string), the association of the string with the correct interpretant/concept (the concepts of ‘dean office’), the position of the sign (helping the understanding of the sign and its scope), the relation with other signs – in the example the reader understands the meaning and the scope of the sign only if s/he relates it with the above sign “3rd Floor”. Without this relation the reader could not understand that the purpose is to indicate where the Dean Office is located (the meaning of a sign is not always identifiable without its relations with other signs).

Moreover, the reader can infer many things from the sign and the context in which it is being used: for example that ‘dean’s office’ means that the sign is the indication of the office where students can claim about something related to the courses, or that the Dean is a very important and known figure in this university because there is an explicit sign on the main entrance of the building, etc.

On a website, a sign can be designed and evaluated considering the same elements. Web signs, like signs in general, make use of a complex sign system composed not only by words and grammar from natural language but also by other languages and other grammars that must be understood in order to correctly interpret the interface.

A web sign is usually created considering the following features:

- the *sign-vehicle*, the actual shape, the surface of the sign, designed through different forms. The textual label of a link, of a title, of a heading, its color, its font, the image representing an icon, is the sign-vehicle of that sign; the sign-vehicle is given also by the position on the page, which is very often a determinant factor for comprehending the meaning of a web sign;
- the *interpretant*, that is, the concept the sign-vehicle refers to. As an example, the textual label “Current collections” of a link in a museum website refers to the concept of a *museum’s collection*, that the user should know in order to understand the sign and its purpose. As will be shown, for the particular nature of a web sign there are different concepts it can refer to and the user should master all of them in order to correctly interpret it.
- the *relation with other signs*, the meaning of a sign is often defined by its relation with other elements on the same page or on already visited pages. In a company website a menu button with written “Info” is meaningless and ambiguous if not related to the menu main title “Our company”.

Problems regarding the interpretation of a web sign could depend on one or more of these elements. Let’s make an example: let’s assume that on a museum web page there is a link “The Collection” in the main menu. The user may rightfully assume that the *sign-vehicle* (i.e. the menu button with the textual label “the collection”) refers to the concept of museum’s collection (*interpretant*), but s/he should not assume that this is the *meaning* of the link. From the designer perspective (e.g. the website perspective in a dialogic viewpoint), the intended meaning of this representation would be “Visit the permanent collection of the museum” or “Have a virtual tour of some artworks of our collection”. From the user perspective, the sign may mean different things from the ones intended by the

designer, or the user could infer further and find more meanings like “this link will show a page with a list of artworks” or “I can browse the artworks through some categories” etc. Peirce considers interpretation a potential infinite semiotic process, because there are indefinitely many meanings to a sign, and it is impossible to predict the exact path and length of meaningful associations that will be made during interpretation.

In the example, the meaning given to the link makes sense if the user can assume the existence of a rule that says that the link “the collection” means that I can look at some artworks of the museum. The hypothesized rule is only a plausible assumption (given by common sense or by some experience with museum websites). The link might in fact mean something else (for example a link just giving a textual explanation of the definition of collection)¹.

Obviously, it is up to the sign-vehicle to be as explicit as possible – through the label, the color, the position, the shape of the link - and let the user correctly guess the intended semantics of the link.

Current studies on web semiotics pay little attention to the relation among a sign-vehicle composing a web interface, the concepts staying behind it and the actual meaning/purpose that the user can draw upon when interpreting the sign.

As Chapter 3 will show, W-SIDE Framework arises from the effort to consider these concepts and reuse them in order to define a systematic and detailed analysis tool able to model the semantics of web signs and predict their interpretation by users.

2.2.2 The Relevance Theory

Many studies prove that web users want to save time and efforts while navigating the web [Brinck, 2002][Wirth, 2002], and therefore need an “economical guessing instinct” that will offer a hint as to which link is worth following with respect to their needs. The interaction between “guessing instinct” and “economical navigation” constitutes a standard

¹ Eco states “[...] everything can be understood as a sign if and only if there exists a convention which allows it to stand for something else” [Eco, 1979]. On the web, regardless web conventions and rules, the identification of a sign and the interpretation of its meaning are two hard-to-predict processes. Web signs – due to spatial and information overload issues – are very cryptic and synthetic. For this reason, users interpretations are not intuitive and can be very different and variegated since they often rely upon very few and ambiguous elements.

of relevance that has the same systematic status as Sperber and Wilson's principle of relevance, namely "to have a substantial contextual effect, at a low processing cost" [Horn, 2004].

According to the Sperber & Wilson's Relevance Theory, people speak because they think that what they are saying is relevant, that is, that the information they are communicating helps the recipient understand a part of the world better. Sperber and Wilson call this useful information "cognitive effects".

The speaker tries to achieve the greatest cognitive effects with the smallest processing effort possible, whereas the recipient interprets a message choosing the context that maximizes its cognitive effects, and stop searching for implicatures² when a reasonable level of relevance is achieved. What actually happens is that addressees always try to look for a context in which the information received is relevant. The presumption of relevance gives rise to a comprehension procedure that hearers use in their interpretation: following a path of least effort, they look for an interpretation which satisfies their expectation of relevance, and when they find one they stop.

It follows from the relevance-driven processing that encoded elements should take account of the addressee's immediately accessible assumptions and the inferences he can readily draw.

Relating the theory to a sign on a web interface, if in a university website a user is looking at the page about a Master course and besides the content describing the course there is a link with written "teachers", following the theory the user makes implicatures guessing the context in which the sign is more relevant and goes on in the process until s/he is satisfied. In the example, possible implicatures are:

1. "teachers" is a navigational link that I can click on for having some information;
2. The link gives me some information about some teachers;
3. The link gives me some information about the teachers of the course I am looking at;
4. The link gives me a page with a list of teachers related to the course I am looking at;
5. I can reach information about any single teacher;
6. I can find information about how to contact the teacher;
7.

² In Linguistics, an implicature is the aspect of meaning that a speaker conveys, implies, or suggests without directly expressing it. Although the utterance "*Can you pass the salt?*" is literally a request for information about one's ability to pass salt, the understood implicature is a request for salt.

The process of interpreting and implicating meaning could be infinite. While implicature 1, 2 and 3 are very strong, the others are more or less unnecessary. The user, depending on its needs and its person, could infer from the sign much more or much less than in the example, but usually and above all on the web the user tries to minimize her/his efforts in searching for implicatures that gives him a reasonable level of relevance [Tosca, 2000]. Web designers, in order to maximize the information on a web page, to propose as many dialogues as possible to the user, to let him easily manage them must give shape to very synthetic and substantial signs but having the maximal cognitive effort and needing the minimum processing effort by the user.

2.2.3 Conceptual and Procedural Semantics

Diane Blakemore has developed the idea that there are two different ways in which linguistic meaning can act as the input to the inferential processes involved in making implicatures [Blackmore, 2000]. On the one hand, expressions may encode concepts which are the constituents of the conceptual representation that undergo inferential process. On the other hand, they may encode procedures, or the means for increasing the salience of a particular kind of inferential process. Most nouns, verbs, adjectives and adverbs seem to encode a concept, which bears logical relations with other concepts. As an example, in the sentence “Squirrels love peanuts” the conceptual representation corresponding to the proposition expressed may consist of a structured string of the concepts encoded by the three words - love (squirrels, peanuts). But in sentences like “*Moreover*, squirrels love peanuts” or “*they* love *them*” some meaning is given not through concepts but through something else that finds in the discourse their content and that provides instruction to the hearer to guide her/him in the pragmatic inferential phase of understanding an utterance.

Blackmore considers textual/linguistic signs, that is, “words” in a strict sense. However, this approach could be used broadly and applied to the study of signs in general. In particular, it could support the analysis of web signs, in which the understanding of a sign can be given by conceptual semantics and procedural semantics as well. As an example, the link “Next artwork” in a guided tour about Raphael’s collection at the National Gallery of Art website entails both conceptual and procedural semantics: on the one hand, the word “artwork” refers to the concept of *artwork* and all what it can represent in the real world; on the other hand, the word “next” refers to the dialogue and the context in which the link is being used (i.e. suggesting to the user that the link will give content about the next artwork in the Raphael’s gallery guided tour).

As it will be explained in the introduction to W-SIDE Framework (Chapter 3), conceptual and procedural semantics are the key elements for analyzing web signs.

2.3 HCI Field

Recently, relevant branches of HCI (Human Computer Interaction) pointed out the linguistic and semiotic issues involved in the interaction between the user and an interactive application. Within this heterogeneous and wide research field, main streams of research – such as Semiotic Engineering and Computer Semiotics – tried to interpret each man-computer interaction as a message conveyed from the designer to the user through the application [Garcia, 1995][de Souza, 1993][Andersen, 1990].

Referring to Scolari [Scolari, 2001], current studies related to HCI and semiotic issues can be summarize with the following picture:

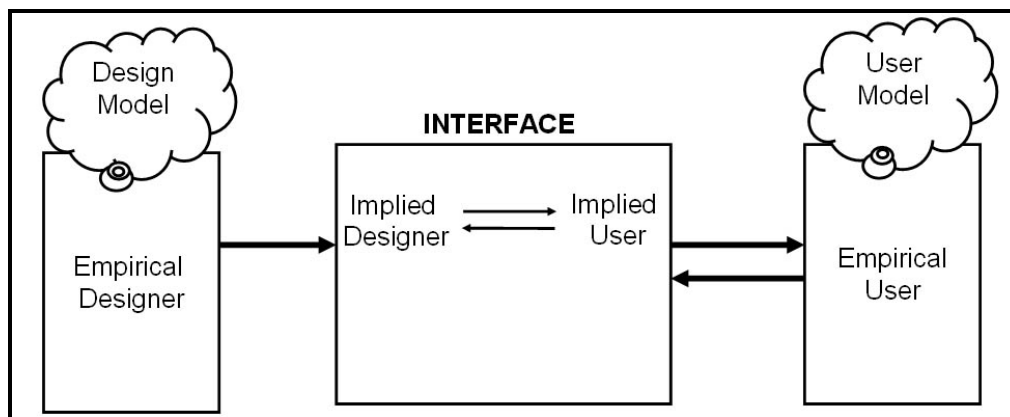


Figure 5. Semio-Cognitive Interactive Framework

In figure 5, there are four virtual characters: two inside designer's and user's mind (Design and User Model) and other two inside the system's interface (Implied Designer and Implied User):

- Design model: it is the mental representation of the system and its potential user inside a designer's mind.
- User model: it is the image of the system inside user's mind.
- Implicit designer: it is the representation of the designer inside the interface. Empirical/actual designers "delegate" their functions in this virtual character.
- Implicit user: it is the representation of the user inside the interface. The Implied user is a hypothesis of user behavior, knowledge, competence and expectations. If the user recognize himself in this virtual character, the proposal of interaction will be accepted and the interaction will start and be successful.

The Implied Designer and the Implied User are imprisoned inside the interface and only semiotic approach can restore their presence. Interfaces are complex semiotic devices that constraint users to cooperate with designers and to contract with them for the sense of interaction process.

In HCI field interactive applications have been analyzed through different approaches and focusing more on one of these characters than the others. In particular, the so called Cognitive Engineering approach focused more on the first two characters (i.e. design model and user model), while semiotic engineering focused more on the last two. Semiotic Engineering is more interested in analyzing the *meaning of interface elements* and evaluate their understanding by users. Cognitive Engineering focuses more on issues like user perception, user memorization, user recall and is usually more interested in the design of *efficient* and *learnable* information structure in order to facilitate such processes.

Even if semiotic-interface design is mainly related to Semiotic Engineering, Cognitive Engineering in some way influences and supports it. In fact, the study of the language and the interface is strictly related to the study of the information structure staying behind it. The user's understanding of the language is given not only by how much the signs and the concepts staying behind them are clear to the user, but also for example by how much the information structure is complex. As an example, even if on a single web page each interface element is potentially comprehensible by the user, there could be information overload problems and the user would have difficulties in accomplishing her/his goal because of the complexity of the page.

A web site could be well-designed in terms of structure, but if it is not effectively communicated to the user it could be not correctly understood and memorized. At the same time, the language used to communicate the structure could be intuitive and easy to interpret, but if the structure is too complex and not efficient the user experience will not be

successful. In the following sections, a summary of the main research streams tailored for W-SIDE and regarding cognitive and semiotic engineering is given.

2.3.1 Cognitive Engineering

Cognitive Engineering is born as a discipline aimed at studying the user processes involved in creating a mental model of the application and of its structure. It is related more to the study of the effectiveness and efficiency of the structure of the application at different levels, from the overall information architecture to the structure of the information given on single screens. Cognitive Engineering is related to cognitive load, memorization, recall, learnability of interface elements rather than on their actual comprehension [Kintsch, 1998].

Models like GOMS, OAI [John, 1996][Schneiderman, 1998] are methods for predicting time and errors for goal-directed task and routine cognitive skills. Such methods produce quantitative and qualitative predictions of how people will use a proposed system, estimating the execution time of tasks that skilled users are likely to perform. Indeed, interface elements are not studied as signs in strict sense, but rather as information that the user should easily grasp, manage and remember. Many design guidelines raised from these approaches helped designers to define the structure of the application rather than to define the language for communicating it.

Cognitive Engineering started considering generic interactive applications, but in the last years many researches focused on hypermedia applications, pointing out very interesting results also from a semiotic perspective.

2.3.1.1 Cognitive Engineering and Hypertext

Different studies have considered cognitive issues related to hypermedia and web applications. In particular, web cognitive engineering focus on defining guidelines for improving the design of the information architecture and the navigation structure of web application, so that the user could efficiently use, remember and recall them [Larson, 1998][McDonald, 1998][Neerincx, 2001][Soderston, 1996]. Web cognitive engineering focus also on the structure of single web pages and in particular on the study of issues like “cognitive overload” , “screen scannability”, “paths memorization”, that is, to the study of interface elements more as means for the efficiency and coherence of the information structure than as the language for communicating it and its actual content. Structure has been studied at many levels, from the structure related to a single page or a single message to the

structure related to the overall application. For each level some guidelines have been defined. As an example of single page structure guideline, Horn [Horn, 1989] suggests solutions to the typical disrupted discourse of hypertextual applications grouping information into small, meaningful chunks of no more than seven sentences that are consistent and clearly labeled. A chunk may consist of a single interface element or can also be a table or graphic, as long as it is within the capacity of humans to process it in working memory. As regards studies on the structure of the overall application, Katz [Katz, 2003] made empirical studies about how improve the effectiveness of the information architecture of a web page considering information retrieval user tasks. He defined a formula for defining the right balance between “breath” and “depth” of hierarchical categories, that is, the efficient number that each category should show with respect to the overall depth of the tree structure.

Cognitive Engineering also studied the coherence in hypertexts: Thuring, Hannemann and Haake in their famous *Hypermedia and Cognition: Designing for comprehension* [Thüring, 1995] stress how comprehension is often characterized as the construction of a mental model that represents the objects and semantic relations described in a text. In their study the authors prove that two factors are crucial in this respect: coherence as positive influence and cognitive overhead as negative influence on comprehension. Empirical studies of linear text indicate that establishing coherence at a local and global level is facilitated when a document is set out in a well-defined structure and provides rhetorical cues reflecting its structural properties. Applying this result to hyperdocuments implies that designers should provide cues for both types of coherence at two levels, at the node/page level and at the net level (between nodes/pages).

The last remarkable approach interesting for the aim of this work regards the study of user behaviors, that is, how people read, how navigate, how choose in the interaction with web applications [Morrison, 2001][Smart, 2000][Brinck, 2002]. Brinck observed different user behaviors while interacting with web applications (the author called them navigation models) and provides ad-hoc design solutions. He defines 7 different models of human navigation. As an example, the *information foraging* model states that users try to get as much as possible at one location before going elsewhere and that they refine their goals as they explore information: the design implication is to enable spontaneous discovery by providing context, structure, and related topics. Another example is the *information costs* model, stressing that users have limited knowledge and reasoning ability, and that they can make tradeoffs to determine what mental resources to apply and therefore which strategy to utilize in navigating: the design implication is to minimize the mental costs of sense-making, remembering, and planning, and to support multiple strategies of navigation. Following his

approach, designers should take the best design choices in order to satisfy as many navigation models as possible.

These approaches do not wonder how users interpret interface elements, which knowledge is involved by each sign and if they can master it. They give guidelines about how structure the elements on the page in order to support or provoke particular user behaviors, but they do not consider their semantics and which processes are involved in the user's understanding.

Therefore, while such studies helped designers in better understanding how structure the information and support navigation behaviors, the study about how communicate them to users falls in the Semiotic Engineering Field.

2.3.2 Semiotic Engineering

Semiotic Engineering observes and analyze the *implied designer* and *implied user* (see Figure 5). Semiotic Engineering is a theoretically-based approach to interface design in which computing systems are taken to be meta-communication artifacts [de Sousa, 2005]. The designer should create a good conceptual model and communicate it using an adequate repertoire of user interface signs. Semiotic Engineering can be considered the founding discipline that paved the ground for interpreting a computer system as a system of signs communicating with the user. The theory claims that, apart from senders and receivers, a third party is always involved in computer-based communication, namely the designer. He or she sets the boundaries for communication and creates a stock of signs that users may activate but not produce themselves in the same sense they produce words. The actual sign usage partly presupposes the users, partly presupposes the system structure, which in turn presupposes the system's designer [de Souza, 2005].

Current approaches in Semiotic Engineering focus on generic software systems only, regardless of any specific type of application or domain. However, as already stated each family of application, has different goals, establishes a specific pattern of interaction and makes use of a different vocabulary and signs' system. Each type of interactive application calls for specific and new conceptual models able to properly interpret the user-application relationship being established. Given their growing and mature use, websites represent today one of the major electronic communication channels involving highly-structured signs, which need to be properly designed and interpreted for the success of the user experience. In this context, a systematic semiotic approach is needed to analyze and evaluate website semiotics, in order to give useful guidance to designers.

Danesi stresses that the role of culture in human communication is to function as a container of signs and meanings that “*cohere in predictable ways into patterns of representation which individuals and groups can utilize to make or exchange messages*” [Danesi, 1999]. In an HCI context, there are two types of meanings whose distance from each other can be measured: interface language meanings (which are fixed, they convey a complete and immutable content encoded in and made available by the system’s interface) and culturally determined meanings that appear in various segments of the user’s semiotic process. The goal of HCI design is to maximize the ratio of culturally determined signs and meanings in the system’s signifying and communicating competence.

2.3.2.1 The Designer’s Deputy

Semiotic Engineering emphasizes that designers should represent their understanding and their intent in such a way that the users of their products can see what they mean. The system must speak for the designer. The system is thus the designer’s deputy, that is, a communicating agent that can tell the designer’s message. Because the user communicates with the system, the designer’s deputy must of course have elaborated communicative capacities. Through the designer’s deputy theory de Sousa defined a communicability evaluation method, consisting in modeling user’s interaction through *communicability tags* [de Souza, 2005]. It consists in observing user interactions and identify the hidden motivations staying behind them. Tags are “words put in the user’s mouth”, in a kind of reverse protocol analysis. Thirteen basic communicability utterances characterize breakdowns in user-system communication. Examples of utterances are: “What happened?”, used to tag interaction where the user repeats an operation because he cannot see its outcome; “Oops!”, where the user momentarily makes a mistake and immediately realizes his slip; “Where I am?”, where the user is interpreting signs in the wrong context of the application, etc.

De Sousa defined a method for modeling the *semantics of user actions*, that is, the motivations leading the user to make some interactions with the application. The study is not actually related to the causes of user misunderstanding but rather on the consequences that misunderstanding brings in the user actions. It is a communicative evaluation aimed at understanding the semantics of the interactions rather than the semantics of the interface.

Furthermore, De Souza’s tagging considers generic interactive applications, and in particular operational applications (i.e. operative systems, editors, etc.) and does not provide ad-hoc tags for modeling the interaction with information-intensive applications, in which

interface elements *talk* not only about the system but also about the content it provides to users.

2.3.3 Hypermedia Semiotic Design

From the field of Linguistics and Semiotics, different approaches focused on hyperlinks and their importance in the process of text's coherence building [Mazzali, In Press][Smart, 2000]. Many linguistic studies aim also at observing how well known linguistic concepts and theories could be reinterpreted considering hypertextual applications and their differences with traditional media [Bernstein, 2000][Calvi, 2000][Wirth, 2002].

In the following section a review of the relevant approaches identified as crucial background for the definition of W-SIDE is given.

2.3.3.1 Relevance Theory and Hyperlinks

Susana Pajares Tosca in the paper "A pragmatics of links" [Tosca, 2000] applies the Dan Sperber and Deirdre Wilson's relevance theory to the experience of a user while interpreting a web link. The aim of her research is to understand the user's interpretation process of a link in the domain of hypermedia applications for literature studies. The study revealed that the semiotic structure of the link is essential for making the reader build text's coherence and make important improvements in the learning process. The author stresses how on a hypertext there are links for which there should be minimum processing effort and maximal (informational) cognitive effects and links for which there should be increased processing effort and maximal (lyrical) cognitive effects. The former are links mainly devoted to information retrieval tasks, where the user already knows what to look for and wants to find it efficiently. Descriptive links like "List of Italian paintings of the 15th century" belongs to this category. The latter are links for which the user needs more implicatures for understanding the link. These are evocative links, with words or symbols highly meaning-charged in their relationship to the rest of the text and the context. Evocative links like "learn more", "Read here for your safety" or "other related topics" belongs to this category. Users need to infer their meaning by relating the link with other elements, such as titles, heading, other links.

The author gives some generic guidelines with respect to the designer's purpose: if the user has ill-defined goals and needs to be provoked, to be incurious or stimulated to follow a particular proposed dialogue, lyrical links are suggested. If the user has a very

specific goal in mind and wants to find what s/he is looking for in an efficient and quick way, informational links should be preferred.

The approach is very interesting since it focuses on specific interface elements (hyperlinks) and provides some guidelines about how to design them with respect to user kinds of goals. However, the approach does not consider user's interpretation and user's understanding of the link as a sign, independently from her/his goals.

2.3.3.2 Modeling Hyperlinks

As already stated, many studies from linguistics/semiotics field tried to apply and adapt theories related to the analysis of text, the speech acts, the dialogue analysis, in order to model hyperlinks and their dialogic function [Calvi, 2000].

An interesting approach is the one proposed by Anders Fagerjord [Fagerjord, 2001] stressing the difference between linear and non-linear consultation of a document, proposing an interesting taxonomy for differentiating navigational links with respect to their dialogic purpose. The author stresses how a reader deduce the meaning of a link not just by relating the link label to the real world concept it refers to (i.e. the link "Raphael's artworks" refers to the concepts of *Raphael*, *artwork* and *ownership*), but by considering also the function that the link has within the application and the current dialogue. The author differentiates between:

- *navigational links*, having the purpose to make the user navigate among the macro-categories of the website,
- *presentation links*, having the purpose to propose new content about the topic the user is looking at (similar to the page turns in a book)
- *relation links*, which is a jump to another place in the hypertext that is related in some way to the present page or paragraph.

Following his approach, links need to be doubly signified. First links need to be activated, their presence needs to be signified: there are many different codes that enable the user to understand where the links are, and the author stresses how codes are not universally shared, thus often giving frustration to users who click on parts of text or images that they believe are links. Secondly, the destination of the link needs to be signified. If the reader is to form any expectations of what is to come when activating a link, the content of the destination page must be signified. This is done differently for the different kinds of links the author describes. As an example, presentation links does just have to signify that they are

presentation links, using labels like “next”, “previous”, “read full story”, etc. The destination is thus implied, that is, *more of what the reader has already started*.

Fagerjord approach is very interesting since it is one of the first researches trying to define a taxonomy of hyperlinks with respect to their *dialogic function*. However, the approach focuses on links and do not consider other interface elements having no navigational purpose but very important in the user dialogue management, like titles, headings, decorative signs, etc. Furthermore, the author focuses on modeling the dialogic function of a link but do not model the knowledge that it presupposes. The understanding of a link is given both by the understanding of its dialogic purpose but also by the understanding of the concepts staying behind it, that is, the actual content it refers to: as an example, on the page describing a particular prospectus in a university website there is the link label “See current prospectus details”. The link makes clear that the link is a presentation link (i.e. proposing new content about the topic the user is looking at) but the user could not understand it because s/he is not familiar with the concept of *prospectus* in a university environment. The semantics of hyperlinks is given by both the understanding of its function within the interactive discourse and by the understanding of the referential content (i.e. the real world concepts it refers to).

2.3.3.3 Hypermedia Semiotic Design Limitations

These and other linguistic approaches to hypermedia are remarkable since they are the first attempt coming from the semiotic/linguistic field to extend current theories and observe how they could be reinterpreted considering new communication paradigms and channels. However, such studies are incomplete and have two main limitations. The first regards the “signs” considered: they focus on the hyperlink, which is only one kind of sign composing an interactive interface and in particular a web application. The second regards the analysis viewpoint: such studies analyse the function of a hyperlink with respect to the structure of the application. In other words, such approaches focus on the ability of a hyperlink to communicate and make clear the structure of the application – i.e. how hyperlinks talk about the application’s structure – but do not consider and are not able to model how hyperlinks talk about the application’s content, that is, how a hyperlink suggests the topic/s the application can talk about.

Moreover, these studies often propose a reinterpretation of linguistic/semiotic theories without developing a well-structured and ready-to-use conceptual toolset to be applied in web interface analysis and evaluation.

2.3.4 Web Interface Design and Evaluation

From Web Interface Design and Web Usability Evaluation field many studies and guidelines have been defined³. Nielsen [Nielsen, 1999] stresses the importance to carefully organize the elements composing a web page, in order to let the reader easily scan them. Nielsen's guidelines refer not just to the page structure but also to the language to be used, that is, which terms and concepts should be used in order to make them comprehensible. The problem is that they are very generic and hard-to-follow guidelines, "*writers should use words and concepts appropriate to the reader*", or "*Information should be provided in the right amount*". A more in-depth conceptual tool should be provided in order to support experts in defining which words and concepts should be used with respect to particular user profiles.

Furthermore, when Nielsen talks about language he often refers to content: he defined interesting and useful guidelines related to content writing rather than to interface language design: he suggests – through empirical observation of user satisfaction - which writing styles and strategies should be used on web applications. However, the study of the language should not only be related to the content but also to how the application talks about the content. Next sections will present some remarkable approaches that are defining innovative theories and methods for analyzing the web interface language and how it is interpreted by users.

2.3.4.1 The Information Scent Theory

As previously said (see section 2.3.3), over the last decade a more in-depth research on to the study of hyperlinks (in hypermedia applications, both offline and online) has been carried on. An important stream of research involving both scholars and practitioners is dealing with the so called Information Scent theory [Chi, 2001][Morrison,2001].

Information scent is the shade of meaning in a label and its description that suggests the full meaning that people are seeking. In other words, people need meaningful local cues to help them locate distant content.

This theory assumes that a user searches for information on a website similarly to how an animal hunts for its prey. The semiotics of the web interface spreads out some

³ "A major problem is that a large number of guidelines have been developed in the HCI field that may guide software development, but there is overlap, inconsistency and deficiency" [Neerincx, 2001]

“scent” (for instance, in term of comprehensibility and richness of the link labels) the user can perceive and which makes her/him more or less confident to be on the right path to “catch” the content of interest. One of the key results of this research is a set of guidelines for writing link labels which spread proper scent for their users.

Users would search for a scent trail. Once they had picked one up, would follow it toward their content. As the scent got stronger, they grew more eager. When they lost the scent, they backtracked until they picked it up again.

Information Scent theory is used in computational studies with the aim to predict user behaviors. They predict the most probable path that the user will follow with respect to the previous navigational choices. The approach is not really focused on user’s understanding of links. In some way they give that for granted, starting from the assumption that the user correctly interprets them, and predict what the user will click with respect to what he clicked in the previous navigational steps.

Spool applied the theory for observing interface language problems from empirical evidence [Spool, 2004]. He observed that there are many factors influencing user perception and understanding of the interface language, like the position of the elements, their shape, their linguistic terms, consistency among elements, etc. He named these kinds of problems giving an explanation through examples and suggesting guidelines.

Spool focuses mainly on the page structure, that is, he provides guidelines about how facilitate the user to look at an element, how to make links jump out, or how make clear the relation among different elements on the same page, etc. He does not provide guidelines for predicting user interpretation of an element with respect to the concepts/knowledge it presupposes. In linguistic terms, he does not focus on the semantics of an element but rather on the effectiveness of its syntactics - that is, on the user perception of the sign and on the understanding of the relation that a sign has with other signs.

2.3.4.2 The Cognitive Walkthrough for the Web

Starting from the Information Scent Theory, the Cognitive Walkthrough for the Web inspection method makes use of automated analysis (Latent Semantic Analysis) to objectively estimate the degree of semantic similarity (information scent) between representative user goal statements (i.e. a short textual description about the motivations leading a user to interact with a website) and heading/link texts on each web page [Blackmon, 2002]. The computational analysis gives a higher/lower score to each label with respect to the semantic similarity that it has with the user goal statement, thus predicting

which links the user would click on with respect to her/his goal, and, on the contrary, which are ambiguous, unfamiliar or too generic [Blackmon, 2005].

CWW works by analyzing likely user behavior when the user is pursuing a given goal, and is looking at a particular web page. The technique can be used to critique a design page by page as a site is being designed, or to evaluate the pages in an already completed design, or in an implemented site. The automated analysis returns a table of values, which are estimates of the semantic similarity between the goal and each of the elements of the page.

The CWW calls attention to three sets of interrelated attributes of a web interface. The first is the knowledge needed to interpret the vocabulary used in heading and link labels. The second is potential problems arising from the relation of a link label with other interface elements (i.e. headings, titles, other links) that are meaningful to users but may still pose difficult decision problems. The third is the repertoire of conventions used in a site to represent page elements, such as links, on which users must act.

CWW is a very efficient goal-oriented technique for detecting user misunderstanding in information-retrieval processes. The approach has the value to be an objective evaluation, based on an computational analysis of the interface language. However, the approach have some limitations:

- It considers only linguistic elements of the interface, while all the other features composing a single web sign and highly influencing its semantics – i.e. its color, its size, its shape - are missing in the automated analysis.
- CWW does not consider the user's understanding of the function of an interface element, that is, not only its content semantics but also its functional semantics (i.e. its dialogic and interactive purpose). The computational analysis could predict that the linguistic term/s composing a link label are comprehensible with respect to a user goal statement, but it does not predict that the user will understand for example that it is a link, that the link will provide additional information to the current content rather than being a landmark and providing unrelated topics. As an example, through LSA it is very hard to predict if there could be misunderstanding with a link label like "find more", since it does not refer to any specific concept it could be compared to but it is up to the user to infer its meaning within the context in which it is used (i.e. the meaning could be *find out more information about Raphael's artworks*).
- An automated linguistic analysis risks to be dangerous in predicting user misunderstandings of web interfaces where designers opted for more lyrical labels:

considering a museum website and a goal statement like “find more about contemporary art in the museum” the two link labels in the Collection Section like “Modern Art” and “What is Modern Art?” would be considered with quite no difference in the LSA, since the analysis would check the semantic similarity of the term “Modern Art” with other terms in the user goal statement. However, the actual semantics for the user is drastically different: while in the first example the user can guess that by clicking on “Modern Art” would find a list of selected artworks about modern art in the museum (the links are in the museum’s collection page) the second one would probably give a general overview about Modern Art as artistic movement. The interrogative formulation of the label drastically changes its dialogic function.

CWW is devoted to the evaluation of a particular kind of user goals, that is, information retrieval goals, where the user has a very clear statement (i.e. find information about product X) and s/he has to browse within categories for reaching the goal. Moreover, CWW focuses on the effectiveness of the interface language with respect to a user goal. However, the web and hypertextual applications rely very often on ill-defined goals, where the user has in mind a very generic need (like for example “Understand if it is worth going to visit the museum”) and the goal is continuously adjusted and modified while interacting with the application. Information-intensive web applications are often designed for providing the user with dialogues in order to make them curious, suggest interests or just train them on some topics. Such applications make often use of lyrical and dialogic labels, not directly explicating the content they refer to but letting the user infer it.

2.3.4.3 Heuristics-Driven Inspection Methods

Usability Inspection is the generic name for a set of methods that are all based on having expert evaluators instead of final users inspect or examine usability-related aspects of a user interface [Nielsen, 1994]. During usability inspection an inspector (called also usability reviewer) judges the application but the results of his analysis strictly depend on the different usability criteria that have been used. Indeed, the comments or critiques on the application under inspection are derived on the inspector’s skills and competences, on usability principles, or a set of previously-defined guidelines. The focus of usability inspection methods is set on usability problems or breakdowns of the user-interface which can be anticipated before involving final end-users. There is a general acceptance that the design feedback provided by the inspection methods is valid and useful. As regards web

applications, there are many heuristics inspection methods aimed at evaluating a web site at different levels and dimensions [Nielsen, 1999][Brinck, 2001][Cato, 2001]. In the last years, some heuristics strictly related to interface semiotics as a different dimension with respect to information and navigation structure have been added, since empirical studies proved that the language used on an application is a key-element towards user satisfaction.

A remarkable heuristic-base inspection method is MiLE+ [Triacca, 2005]. MiLE+ is one of the first methodologies that explore the usability problems related to semiotic design, by using cognitive/semiotic heuristics in order to evaluate user comprehension of the interface.

MiLE+ workflow proposes two types of inspection activities, namely *Technical Inspection* and *User Experience Inspection*, and an empirical activity called *Scenario-based User Testing* (see figure 6).

The method is based upon the concepts of *Scenarios* and *Heuristics*. Scenarios are “stories about use” [Cato, 2001][Carroll, 2002], describing a typical user, one or more goals, and elements of the context of use (place, time, circumstances of use, etc.). Heuristics are usability guidelines/principles that allow the evaluation of an application. MiLE+ provides two sets of heuristics that should help the evaluation: *Technical Heuristics and User Experience Indicators (UEIs)*. Technical Heuristics are a set of heuristics enabling to evaluate the design quality (in all its aspects) and to spot implementation breakdowns. Technical Heuristics are organized in design dimensions (e.g. content, navigation, graphics, semiotics) and associate each design dimension to a list of guidelines which help the inspector to analyze it. *User Experience Indicators (UEIs)* refer to aspects of usability which cannot be evaluated by those who are not final users. In other words, User Experience Indicators allow anticipating the potential problems that end-users may encounter during their experience with the website. Therefore, they allow the evaluation of each scenario’s quality with respect to these user experience characteristics.

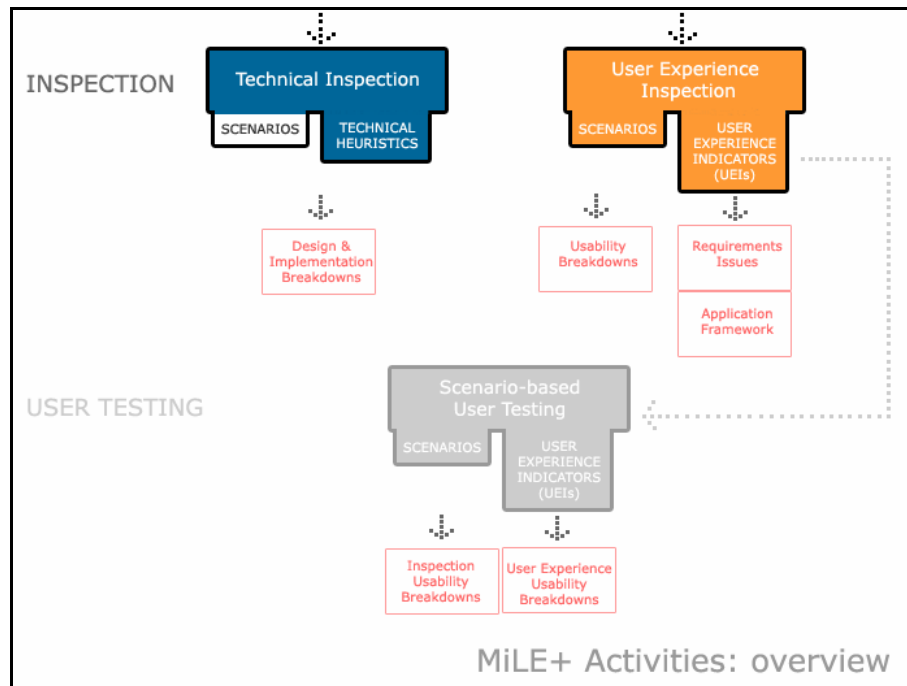


Figure 6. MiLE + Activities and Workflow

As figure 6 depicts, technical inspection aims at finding technical problems detectable independently from particular user profiles and user goals: they are problems related to the structure, the syntactics of the application regardless of its context of use. Instead, in User Experience Inspection inspectors “put into the shoes” of critic users with critic goals and judge how the application answers to them. Finally, problems detected in the User Experience Inspection are double-checked by observing through user testing real users while interacting with the application.

As already stated, MiLE+ defined some heuristics for evaluating the semiotics of the interface. However, such heuristics are a first incomplete attempt to define a method for deeply analyzing the semantics of the interface and its understanding by critic users. The method proposes generic heuristics like “check link predictability”, that is, the ability of a link label to anticipate the content it refers to, but it does not really analyze the semantics of the link and do not provide a conceptual tool for predicting critic user interpretations of the link with respect to the knowledge it presupposes.

As it will be introduced in Chapter 3, W-SIDE borrows MiLE+ evaluation activities and workflow and adapts them for defining an in-depth web semiotic evaluation method.

2.3.5 Hypermedia Conceptual Design

The interface language of an interactive application is highly influenced by its information and navigation structure. This is even more true for hypermedia applications, where there is always a meta-language talking about the structure of the application and of the dialogue that is currently instantiated [Speroni, in press]: the interface is also the way the application talks about itself. Therefore, in order to analyze and model the semantics of the interface it is also needed to analyze the structure of the application and check that is correctly and clearly communicated to the user.

Over the last decade, web conceptual design techniques and methodologies have been developed for managing the complexity of a website and its interactive features. These techniques support both the design of the coherence within and among different pages composing the website - in terms of information architecture, navigation, interface and layout solutions – and also the modeling at a higher and abstract level of their structure and interactive features. Many of them are also considered economic strategies to be used in the implementation phase – i.e. they encourage the reuse of similar templates and predefined abstract schema for developing pages having similar dialogic function.

Web conceptual design defines through an abstraction process the structure of possible dialogues with its users, before designing and creating the real content. In general, these approaches share a main objective: provide concepts and notations to describe hypermedia features of complex web sites at the proper abstraction level (i.e. implementation-independent).

Models like HDM [Garzotto, 1993], RMM [Isakowitz, 1995], OOHDM [Güell, 2000][Schwabe, 1998] and WebML [Ceri, 2002] basically enables to define:

- a) the information conceptual schema (i.e. the dialogic structure) of the web site; it enables to design the overall information architecture and the detailed the structure of the types of information objects;
- b) the navigation schema (i.e. the argumentation strategy): it shapes the navigational paths available to the user to locate, reach and explore the content of interest;
- c) the presentation schema; these constructs usually allow to design the abstract interface and the logic structure of the page types (in term of graphics and spatial organization).

Systematic approaches to web conceptual design are advocated to enhance the quality and the efficiency of design in large projects, mainly for two reasons. On one hand,

separation of concerns helps the project team manage complexity; on the other hand, the definition of design patterns provide a basis for the reuse of effective practices across different projects [Paolini, 1999].

Hypermedia Conceptual Design helps defining the dialogic structure and strategy of a web application, but it should be supported by a method supporting also the way it should be communicated to the user. There is a huge gap between conceptual design choices and how translate them in interface choices.

As explained in Chapter 3, an innovative approach to hypermedia conceptual design is IDM (Interactive Dialogic Model)⁴, a technique based on proven hypermedia/web design models and dialogue theories and aimed at describing the essential interactive and navigation features of information-intensive applications at the proper conceptual level, by focusing on the dynamics of the dialogue. IDM models the structure and navigational strategy of a website interpreting it in dialogic terms. W-SIDE framework refers to this particular design technique and borrows the main concepts composing it in order to model the dialogic function of web signs. By relying on IDM concepts, W-SIDE aims at suggesting a tool for supporting the shift from conceptual to interface design through a better understanding of the semantics of web interfaces.

2.3.6 Web Semiotics and Semantic Web

A last remark regards the boundaries between the field of Web Semiotics as intended in this work and the different research field called Semantic Web. Even if terms like “ontologies” and “semantics” are here frequently used, their meaning should be distinguished from the ones assumed in Semantic Web and Web Ontology sectors, where these terms are related to the representation of data on the World Wide Web through formal languages (e.g. XML, RDF) in a manner “understandable” by machines [Marshall, 2003]. In such studies, the term semantic refers to the aim to make this formal representation “meaningful” for a machine, at defining new formal languages and models able to represent information in order to be automatically managed by an artificial agent. Semantic Web is not strictly related to HCI problematic, to usability issues or user’s understanding of web signs. Therefore, the reader should keep in mind this difference and interpret the terms with respect to the overall purpose of the dissertation and the contexts in which they are being used.

⁴ For details about the model see [Di Blas, 2003][Bolchini, 2005]

2.4 Summary

This chapter provided an overview of the relevant background work for a semiotic perspective on web interfaces. To summarize the contributions and pave the ground for the next steps, Figure 7 compares the approaches discussed in this chapter in regards to the relevant issues for a semiotic analysis of web interfaces. This synopsis aims at highlighting the issues that each method addresses:

	Approach or Method						
	Cognitive Engineering	Semiotic Engineering	Semiotics and Hypermedia	Information scent	CWW	MILE+	IDM
Issues Addressed							
<i>Web Sign Comprehension</i>		✓	✓		✓		
<i>Web Sign Effectiveness</i>			✓	✓	✓	✓	
<i>Web Sign Efficiency</i>	✓					✓	
<i>Web Sign Modelling</i>		✓					
<i>Dialogue Comprehension</i>	✓	✓	✓			✓	
<i>Dialogue Effectiveness</i>							✓
<i>Dialogue Efficiency</i>	✓					✓	
<i>Dialogue Modelling</i>		✓					✓
<i>User Modelling</i>	✓			✓			
Techniques or Tools Provided							
<i>Design Best Practices</i>	✓	✓	✓				
<i>Design Methods</i>							✓
<i>Design Guidelines</i>	✓	✓	✓	✓			✓
<i>Evaluation Methods</i>					✓	✓	
<i>Evaluation Heuristics</i>	✓	✓	✓		✓	✓	

Figure 7. Synoptic comparison of main approaches to Web Semiotic Design

For each approach, the addressed issues and the provided techniques/tools for designers/inspectors are listed. Some issues are relevant to web sign analysis and serve for pointing out some distinctive aspects of the methods presented. Other issues are instead considered specific for the analysis of the dialogue structure, that is, the information and navigation structure staying behind web signs and web interfaces.

In particular, this work focuses only on some of the issues taken under analysis. The dissertation stresses the importance of providing designers and inspectors with a well-structured and complete method for analysing the *user comprehension* of web interfaces. Many approaches from many disciplines focus more on the interface effectiveness and efficiency giving for granted the user comprehension. Other approaches observed user interpretation of interfaces and of hypertexts but very often they focused on user's understanding of the structure of the application rather the understanding of the content the interface refers to and that the application wants to talk about. Moreover, these approaches provide incomplete guidelines or suggestions raised from best practices. A complete and ad-hoc method for evaluating the user's understanding of web interfaces, considering the understanding of how the application talks about both its structure and the content it proposes, is quite missing. In particular, what is missing is a method aimed at modeling the knowledge staying behind signs composing web interfaces and matching it with the one owned by the user. As Figure 7 shows, among the presented approaches there is not a method addressing interface comprehension and proposing a technique for modeling users, which should be the first needed step in order to understand and predict if the targeted users the application has been designed for can correctly interpret its interface.

On the basis of these considerations, the next chapter will introduce and present the specific contribution of the W-SIDE Framework.

3 W-SIDE Framework

This chapter will firstly set the W-SIDE (Web-Semiotic Interface Design Evaluation) Framework within the development cycle of a web application. In particular, the specific contribution of W-SIDE within the activities characterizing the evaluation of the interface will be highlighted (3.1 and 3.2). A summary of the essential constructs of the framework (3.3) is followed by the in depth presentation of the conceptual tools devoted to model and analyze the interface language of a website (3.4 and 3.5). Then, techniques for evaluating the correspondence between the knowledge presupposed by web interfaces and the one owned by critic users are introduced (3.6 and 3.7). Finally, the chapter introduces W-SIDE notation (3.8), aimed at supporting and documenting the semiotic analysis and at keeping track of the detected user misunderstandings.

3.1 Motivations

In the design phase, designers discuss what should be communicated on the website with respect to the goals of the potential users and of the main stakeholders involved [Bolchini, 2003b]. If we think to a museum website wishing to persuade visitors to come and visit the museum, the role of the designers is to understand what the website should talk about and how the user experience on the website has to be shaped (that is, how the user can interact and navigate within it). Current design techniques and guidelines support the identification of the dialogues to be talked by the website and the definition of their structure in order to be easily reachable and manageable by the user.

In the evaluation phase, inspectors and experts check if envisioned users are able to reach their goal in an efficient way and if their overall experience while interacting with the website is satisfactory [Cato, 2001][Nielsen, 1999].

In both research streams, the study of the interface language is often confused and superficially considered [Speroni, 2005]. Design techniques focus on the identification of effective dialogues with respect to user goals but do not consider which language should be used in order to let the user understand and manage these dialogues. Moreover, literature provides many guidelines regarding content writing techniques, that is, how write actual

content on the website - for example how long the description of a product should be, which style should be used in order to facilitate user reading, etc. However, very few structured models has been developed for better understanding how write *about* the content, that is, an analysis of the interface language and the semantics staying behind it.

3.2 Scope Definition

The goal statement that the user has in mind is usually composed by terms and concepts that are different from the ones used by the website, and the user must decompose, re-describe them in order to find a correspondence with its language [Blackmon, 2002]. In the interaction with a web application, there is always an activity of adjustment in which the user interprets the interface and tries to match it both with her/his knowledge and with the goal statement in her/his mind. There is always a process of interpretation of the interface and refinement of the goal statement.

W-SIDE focuses mainly on the user interpretation and understanding of the interface language rather than its effectiveness with respect to user goals. Interface studies often give for granted user comprehension and the correct interpretation of the interface and focus on interface effectiveness and efficiency. However, many problems regarding user attempts in reaching a goal and regarding user satisfaction in general are due to incorrect interpretations of the interface. An in-depth semiotic analysis aimed at predicting user comprehension of web interfaces is the first step for evaluating their effectiveness and efficiency with respect to user goals.

W-SIDE analyses the language used by the website and its “semantic distance” with the one owned by the user, in order to evaluate its comprehension and consistency. It does not consider (not directly) its effectiveness with respect to particular user or stakeholder goals. In particular:

- the framework does not focus directly on interface efficiency, that is, on the ability of the interface to make “jump out” from the page elements (for example a link) helping the user in reaching her/his goal. W-SIDE analyses the understanding of interface elements and not if they are easily visible with respect to a particular goal in mind. In the existent literature, many guidelines and empirical studies related to cognitive engineering and layout design have been defined for better understanding how optimize interfaces in order to make them more efficient (see section 2.3.1.1).

However, this research claims (see chapter 5) that the design of clear and intuitive interface signs also improves interface efficiency and its overall scannability by a user.

- the framework is based on the assumption that if the interface language is comprehensible but the user is still not able to accomplish her/his goal, very often the problem is not in the language but it is related to other design dimensions such as information architecture, navigation strategies and layout.
- the framework does not focus on the ability of the interface to persuade and stimulate particular user goals or actions. Even though such studies are very interesting, currently there are no methods (just few guidelines) helping designers to understand how design the layout of the interface in order to stimulate particular user actions. Interface effectiveness to satisfy stakeholder goals goes beyond W-SIDE objectives.

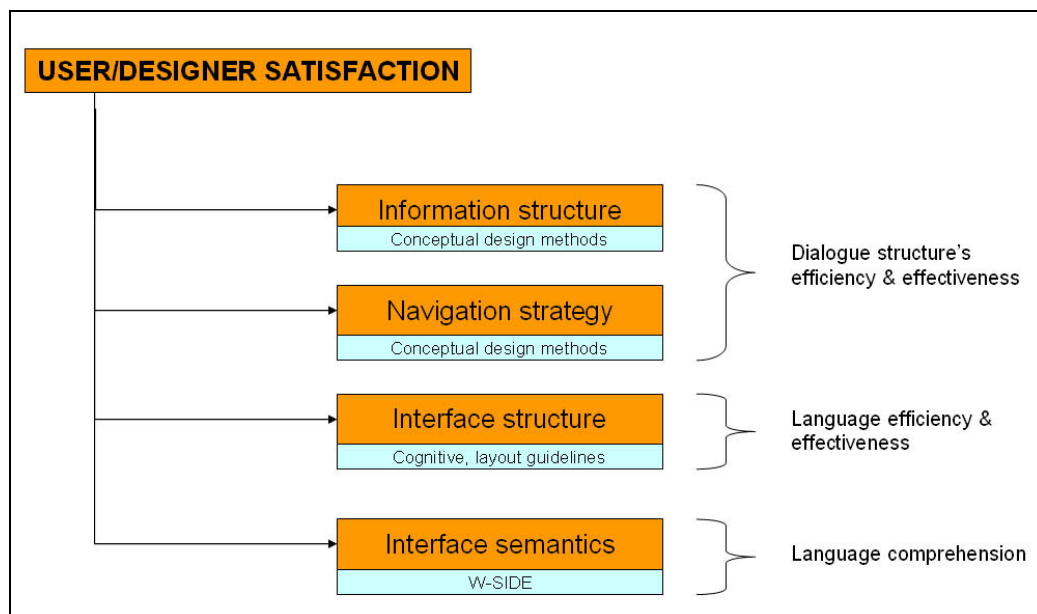


Figure 8. W-SIDE scope in the design of web interactive dialogues

Figure 8 clarifies W-SIDE scope. Regardless of the quality of the actual content/service provided by the application, there are many elements involved in facilitating users and designers to reach their goal. In particular, the dialogic structure and the way it is

communicated through the interface should be shaped towards them. But the first fundamental assumption upon which user satisfaction is based on is that the user should understand and correctly interpret the interface, which is the first needed process leading to a reasoned interactive choice. W-SIDE focuses on the interface language comprehension by analyzing the semantics of interface signs and predicting their comprehension by users.

3.3 W-SIDE in a Nutshell

W-SIDE Framework is composed by a semiotic model (W-SIDE Model) defining the set of concepts needed for analyzing the semantics of web interface elements and a semiotic evaluation technique (W-SIDE Technique) that uses these concepts within an evaluation process for checking and predicting the user's understanding of the web signs composing the interface. Shortly, W-SIDE provides analysts and inspectors with the following tools for analyzing web interfaces:

- **W-SIDE Model**, consisting of:
 - conceptual tool for modeling the knowledge/concepts presupposed by web signs;
 - conceptual tool for modeling the knowledge/concepts mastered by critic users;
 - conceptual tool for modeling the interactive and dialogic function of web signs in the interactive dialogue with the user;
- **W-SIDE Evaluation Technique**, consisting of:
 - W-SIDE Heuristic-driven Inspection Method, aimed at comparing the knowledge presupposed by web signs with the one mastered by users, in order to detect potential user misunderstandings. The inspection method is composed by:
 - a set of technical heuristics (user-knowledge independent) for detecting problems related to the syntactics and consistency of interface elements, independently from particular user profiles;
 - a set of semantic heuristics (user-knowledge dependant) for detecting problems related to the interpretation of the semantics and function/purpose of interface elements;

- W-SIDE User Testing Technique for observing real users while interacting with the application and detect actual misunderstandings;
- **W-SIDE Notation**, consisting in a set of graphical tools supporting the semiotic analysis and the presentation of the evaluation results.

The following paragraphs are devoted to introduce and explain in detail the W-SIDE Model (section 3.4) and the W-SIDE evaluation technique (3.5).

3.4 W-SIDE Model

W-SIDE Model is a conceptual toolset aimed at analyzing and better understanding the semantics of web interfaces. The model paves also the ground for W-SIDE Evaluation Technique, that makes use of these concepts and applies them within the process of evaluation of web interfaces and their comprehension by users.

W-SIDE Model is composed by 7 main concepts: *semiotic unit*, *conceptual semantics*, *procedural semantics*, *ontology*, *referential content*, *interactive function* and *dialogic function*.

The following sections explain the concepts in detail.

3.4.1 Web Semiotic Unit

W-SIDE Model is based upon the concept of semiotic unit, which is the unit of analysis for modeling the semantics of web interfaces. A semiotic unit is a sign⁵ or group of strongly interrelated signs composing a unique meaningful and functional message to the user. A semiotic unit could be a single sign like a link (composed by the label, its color, its position, etc.) but also a group of signs being part of a more complex “sign”. An example of semiotic unit consisting of a single sign is the SF-MoMA logo in the Architecture+Design

⁵ Considering the Peirce’s threefold structure of a sign (see section 2.2.1) sign here is intended as sign-vehicle (or representamen), that is, the symbol, textual string, gesture or sound that is used to convey meaning. As an example, the underlined label “Contact us” on a museum website, with its size, its position on the page, its color, its font, etc. is the sign-vehicle used for letting the user reach a page giving information about how to contact the museum.

Collection page of its web site (see ❶ on Figure 9). The function of the logo is to be a link to the homepage, and its meaning is not dependent on other signs composing the Web page.

Examples of complex semiotic units are the items in the list of artworks on the same page (see ❷ in Figure 9). The user can click on each item of the list and have more information about the artwork. Each item is a semiotic unit even if composed by and depending on different signs - i.e. a thumbnail, a label and some info besides it, the relation of the item with a heading contextualizing the items (“Architecture+Design selection”), etc.

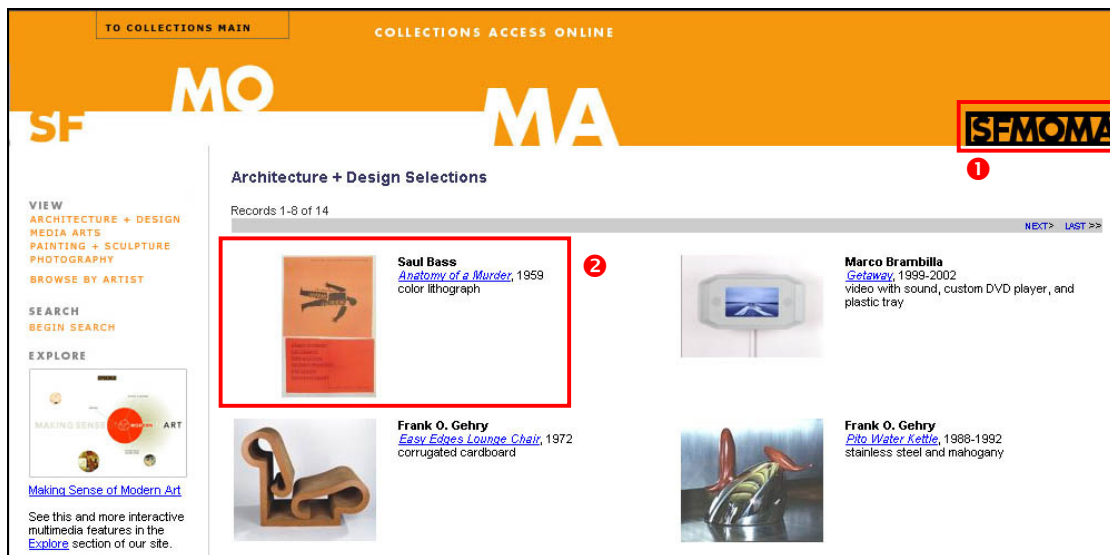


Figure 9. Examples of semiotic units – SFMoMA website

When a group of signs is considered, individual signs can be understood only at the light of the meaning of the group they belong to. In fact, semiotic units are first of all functional units, that is, they are signs or group of signs on the page having a specific and singular function in the interaction with the user. When a single sign on the page has no functional meaning if not related with other signs on the page, it means that it is just a part of a more complex semiotic unit.

3.4.2 Web Semiotic Unit and Duplex Semantics

The interaction with hypertextual applications can be considered the first kind of dialogue in which there is always a more or less explicit meta-language devoted to the

management of the dialogue. For this reason, very often the interpretation process relies on a duplex semantics.

Referring to the relevance theory and the contribution given by Blakemore (see section 2.2.3), the interpretation of a linguistic sign can be given by both a conceptual and a procedural semantics. Procedural and conceptual semantics are two modes of interpretation of signs that can be applied also in the interpretation of web signs.

A web semiotic unit is almost always composed by both a conceptual semantics and a procedural semantics, since there are many different pragmatic meanings that the user should correctly guess. In fact, in order to correctly and completely guess the overall intended meaning of a semiotic unit, the user should correctly guess:

- The **referential content**, that is, concepts and states of affairs belonging to the real world and that the sign refers to – i.e. the sign “exhibitions” in the main menu of a museum website refers to the real world concept of *exhibition* and its meaning.
- The **interactive function**, that is, how the user can interact with the web sign and for which purpose (see section 3.4.4). As an example, an underlined string usually means that interactive function of that sign is navigational, i.e. it is a link that the user can click on and find new content.
- The **dialogic function**, that is, which is the navigational/dialogic function of that sign within the current dialogue taken by the user (see section 3.4.4.). As an example, a particular dialogic function of a link would be to take the user to already visited content, or to propose additional content strictly related with the content the user is looking at, etc.

In order to make an effective use of the application the user should correctly figure out the referential content, the interactive function and the dialogic function of a web semiotic unit. The process by which the user can correctly interpret these three elements is given by two kinds of semantics:

- A “**conceptual semantics**” relating the semiotic unit to preexisting knowledge of the user about the “world” the web site talks about. In order to understand the label “permanent collection” on a museum webpage, for example, the user must have a previous idea of what the concept *permanent collection* means.
- A “**procedural semantics**” relating the semiotic unit and its meaning to the interactive dialogue and context in which it is used.

The user's understanding of a semiotic unit is given by the reference to both the semantics. Let's make an example: let's consider the link highlighted in figure 10. The understanding of the overall meaning of the referential content, interactive and dialogic function is given by both conceptual and procedural semantics.



Figure 10. Semiotic Unit Duplex Semantics – NGA Website

In fact, the user in order to understand the semiotic unit should not only correctly interpret and be familiar with the concepts that the textual label makes arise (i.e. be familiar with the concept of *Early Renaissance in Florence*), but s/he should also refer to the procedural semantics of that semiotic unit, inferring for example that it has a navigational purpose, that it will give more information about the topic in a detailed and structured way, showing a sequence of artworks related to that particular artistic movement (the position of the link suggests that it belongs to the Online Tours section).

The overall meaning of such semiotic unit could be translated and made explicit in words in something like: “*For more information about Early Renaissance in Florence through a guided tour click here*”.

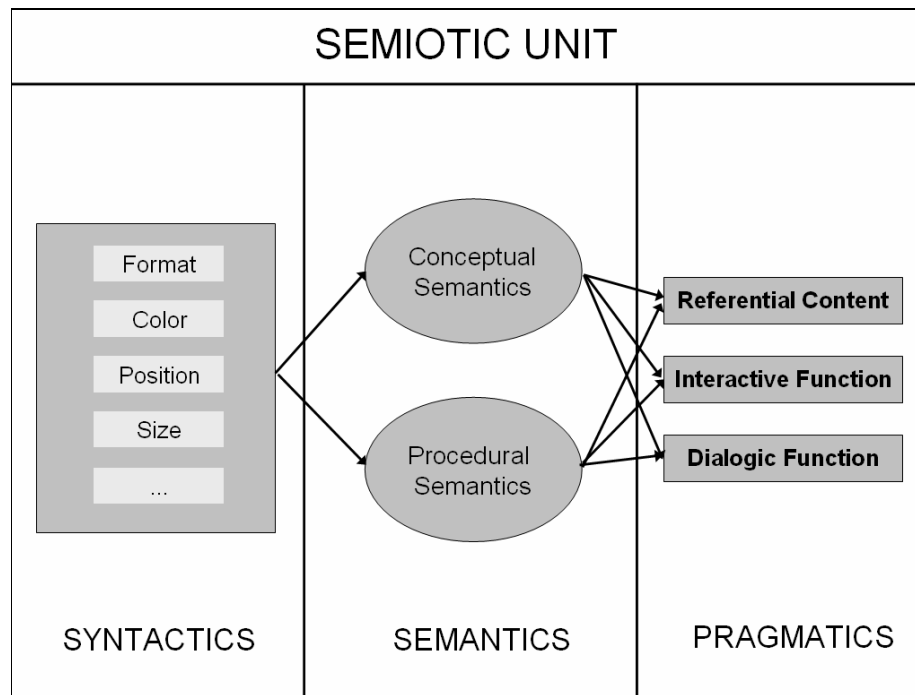


Figure 11. Semiotic unit, duplex semantics and pragmatic meanings

On the web, there is very often both a conceptual and procedural semantics, since the interface language should always talk about the content it proposes and about the dialogue in itself in order to let the user manage it. Sometimes the referential content is explicit to the user and its function must be guessed considering the discourse, sometimes only the function is explicit and the content semantics must be guessed. As an example, the link “back” in a guided tour is a semiotic unit that refers to conceptual semantics as regards the dialogic function (i.e. it proposes already visited content) but it is up to the user correctly infer (through procedural semantics) the referential content that the link “back” refers to (i.e. back to previous Raphael’s artwork shown in the guided tour).

The user’s understanding of a semiotic unit depends upon the understanding of the referential content, the interactive and dialogic function through a conceptual and procedural semantics. Therefore, in order to design and evaluate the semantics of a web sign, designers and inspectors should pay attention to make always clear both the knowledge that a semiotic unit directly refers to and make explicit the one given by the dialogue in which it is being used.

3.4.3 Modeling Interface Presupposed Knowledge

Web semiotic units refer to concepts belonging to different sets of knowledge. This knowledge must be shared by the user in order to understand the meaning of the sign. Since a sign is something that stands for something else [Peirce, 1931-1958], a web user, in order to understand the meaning of links, titles, menus, and semiotic units in general, should be somehow familiar with the “world” a sign refers to.

Let us consider a generic museum website. On the homepage there is a textual link having the label “Exhibitions”; the user can understand the meaning of the link and if it is worth clicking on it only having somehow clear the concept of a *museum exhibition* and what it means. The link “Exhibitions” could be well designed in terms of sign-vehicle, position, relation with other signs, but if it refers to a concept unknown (or barely known) by the user it will not trigger any understanding.

This reference “corpus” of knowledge of the world which should be mastered by the user and which is pointed by web signs may be synthetically named “ontology” or knowledge domain. The term “ontology” is used often in computer science with slightly different meanings (see section 2.3.6); however, W-SIDE makes use of the term ontology in a broad sense: it is the set of concepts and skills that the user should own for understanding web semiotic units and what they want to communicate.

From the receiver perspective (web user), an ontology is the “corpus” of knowledge that should be mastered in order to understand and correctly interpret a semiotic unit. From the sender perspective (designer/website), it is the “corpus” of knowledge presupposed and pointed by a semiotic unit.

A good way to understand how a user reacts to a web interface is to examine which ontologies are being used (or presupposed) by the web semiotic units and how they relate to the user previous knowledge. The more there is a matching between ontologies presupposed by the sender (website) and the one mastered by the receiver (user), the more the interpretation of the sign can be correct.

As regards web-based information intensive applications, it turns out that the set of ontologies is rather typical, in the sense that many web sites make use of a relatively small set of ontologies. In the remaining of the section, an explanation of the most common ontologies is given.

3.4.3.1 Interlocutor/Institution Ontology

A website is a communication tool developed by a group of people in order to inform or provide services to other people [Cantoni, 2003a]. There is always an institution, corporation on behalf of which the website talks and very often there are semiotic units referring to this “world”. The interlocutor is the “sender” of the message.

InterLocutor/Institution ontology (ILO for abbreviation) is the knowledge concerning the institution staying behind the website. The term interlocutor suggests that, in a dialogic perspective, it is the set of concepts belonging to the world of the partner who use the website as a meta tool for communicating something to the user. As an example, the textual link “Permanent Collection” in a museum website (see Figure 12) uses a term that is comprehensible only to users who know the concepts typical of this kind of institution. Such a link, in order to be understood, presupposes that the user is familiar with the “museum world”.

Depending on the kind of analysis and the kind of website, ILO can be defined as a set of concepts belonging both to the generic sector the institution belongs to (i.e. concept related to the “museum’s world” in general) and to the specific institution staying behind the website (i.e. the Metropolitan Museum of Art). As an example, “permanent collection” is a concept known to all museums (and unknown to most users) - while “Cloisters” (see figure 12), for example, refers to a concept known and shared within a *specific* museum (it is a particular collection of the Metropolitan museum).



Figure 12. Semiotic Unit referring to Interlocutor Ontology – MetMuseum Website

3.4.3.2 Topic Ontology

Topic Ontology (TO for abbreviation) is the knowledge concerning the particular topic or subject the interlocutor talks about. In the Metropolitan Museum website any semiotic unit referring to concepts strictly related to art, artworks, techniques, artists, etc. are samples of signs referring to the topic ontology.

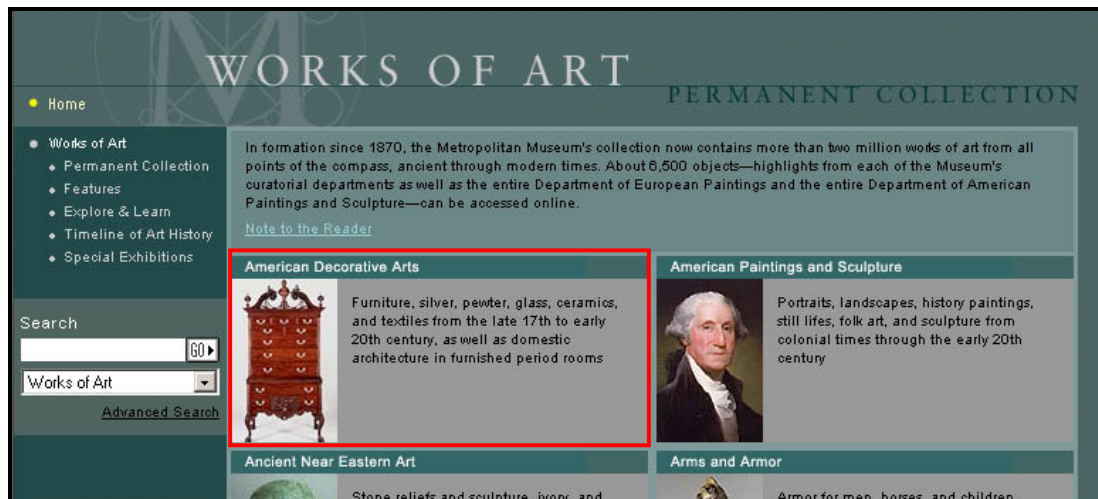


Figure 13. Semiotic Unit referring to Topic Ontology – MetMuseum website

In Figure 13, the highlighted semiotic unit refers to a concept belonging to “American Art” ontology. In this example, designers probably thought that some users could not be familiar with the ontology and added a short but useful explanation of its meaning within the box.

Like ILO, TO can be considered very general (i.e. in the Metropolitan Museum website it could be related to “art” in general) or narrower and decomposed in sub-ontologies focusing on particular sub-topics (for example “American Decorative Art”, “Italian Paintings”, etc.). The granularity by which the ontology can be decomposed and modeled is up to the kind of analysis to be carried on. Analysts could be interested in understanding the presupposed knowledge related to a particular section of the website, or to a particular topic that they think some users could not be familiar with⁶.

3.4.3.3 Context Ontology

Context Ontology (CO for abbreviation) is the knowledge not directly related to the topics the website talks about but relevant for making the dialogue possible and comprehensible. In a museum website there could be semiotic units referring neither to the InterLocutor Ontology nor to the Topic Ontology but to contextual concepts helping the user better understand them. As an example, the Getty Museum website contains a section

⁶ See Annex 1 for an example of semiotic analysis regarding a section of the SFMoMA website.

devoted to teachers, with some pages providing educational resources (see Figure 14). In this section, many semiotic units refer to concepts belonging to the Education world in order to suggest the teachers how reach and use the content about art in an educational environment. Even if *art* is the topic the website talks about, some semiotic units refer to the “educational world” for triggering user’s understanding.

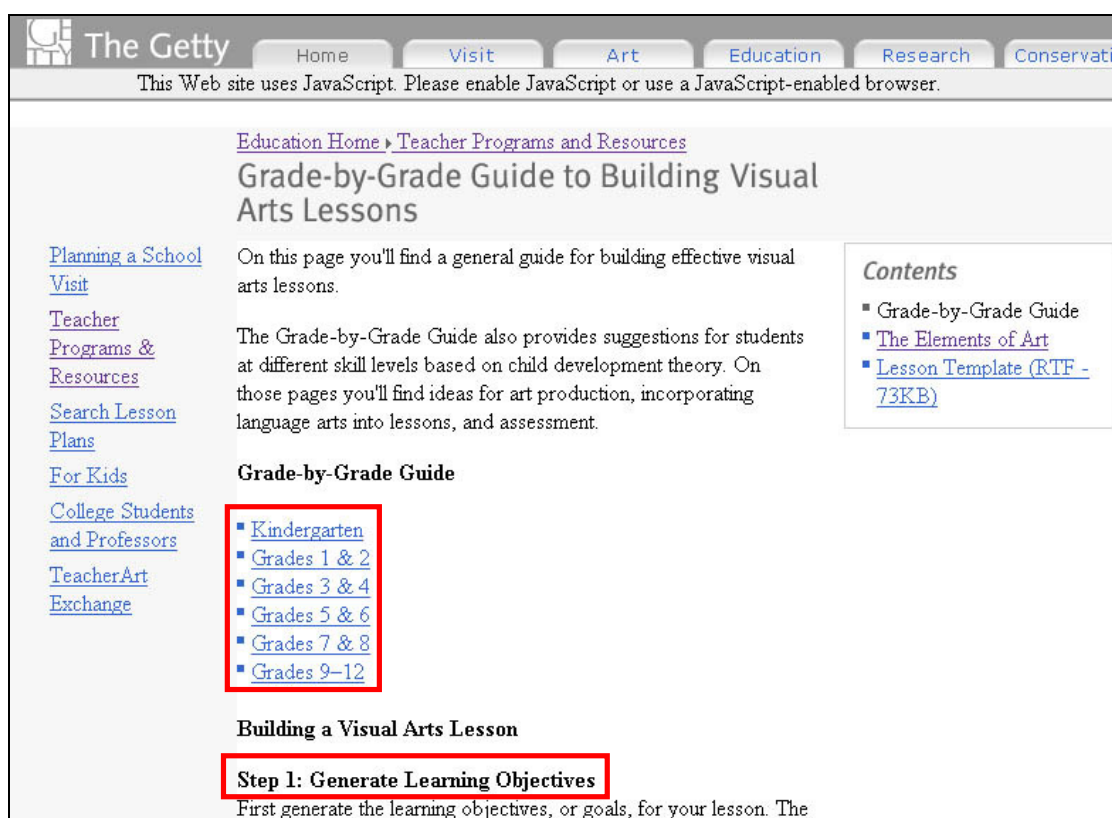


Figure 14. Semiotic Unit referring to Context Ontology – Getty Museum website

3.4.3.4 Website Ontology

Website Ontology (WO for abbreviation) is the knowledge regarding the website in itself. A website can become generator of knowledge or creator of conventions which are valid and shared only within the boundaries of that specific site. For instance, a museum website could use symbols for representing the different section of the website, such as a special icon for representing the collection, another icon for representing the exhibitions, a

symbol or a metaphor for programs & events, etc. The user can intuitively understand and recognize the meaning of each symbol and associate it to a section of the website only if s/he is familiar with the website itself, or if s/he is helped in this interpretation process by supporting signs (e.g. a text string accompanying the icon).

A semiotic unit can rely on WO both in terms of referential content but also in terms of interactive and dialogic function. As referential content, the semiotic unit refers to concepts created ad-hoc for the website; as an example, in the Amazon website the highlighted icon is created ad-hoc for the website. The semiotic unit means that by clicking on the link the user can find a list of Amazon's last offers to buy by the end of the day. A user can understand its content meaning only if s/he is familiar with the website.

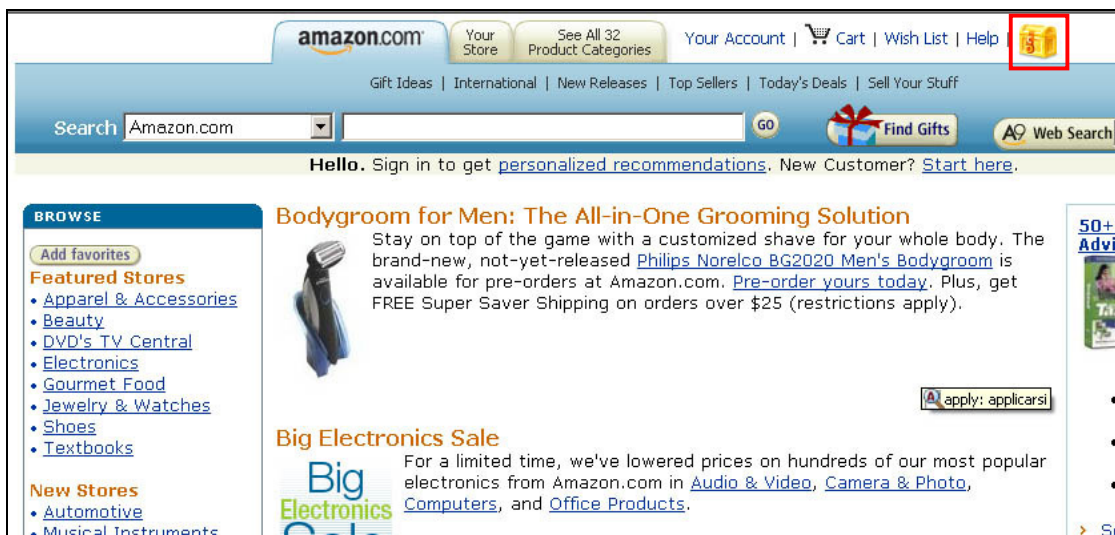


Figure 15. Semiotic Unit referring to Website Ontology as referential content

As functional meanings, a semiotic unit can refer to WO suggesting what is its interactive function within the website and in the dialogue with its user. As an example, the particular position of a semiotic unit, its color, the fact that a label is underlined, suggest that a semiotic unit has a particular navigational purpose (see section 3.4.4.2), for example that is a landmark, that it proposes additional content related to the one currently proposed on the page, etc. Also in this case, the semiotic unit could make use of conventions and concepts belonging and valid only within that website. As an example, the National Gallery of Art Website makes use of ad-hoc conventions in order to convey the dialogic function of the semiotic unit "Cezanne in Provenance" (see figure 15). Designers always make use of that position, color, font for suggesting that the link proposes information about a special

event/exhibition in the museum. For a frequent user, the dialogic meaning is quite clear to guess but for a first-time user it is quite obscure.



Figure 16. Semiotic Unit referring to Website Ontology as dialogic function

3.4.3.5 Internet Ontology

Internet Ontology (IO for abbreviation) is the knowledge of concepts, skills, conventions shared among typical web surfers or among people familiar with web browsing in general. When referring to this ontology, semiotic units are understandable only if the user is familiar with the “world” of the web and knows its concepts and conventions.

Like for WO, a semiotic unit can refer to IO both as referential content and as functional meaning. As referential content it could refer to concept like “shopping bag”, “my wish list”, “add to cart”, “myBlog”, which are terms intuitive only for users who know the concept of *shopping bag*, of *wish list*, or special kinds of forums, and so on. As functional meanings, a semiotic unit very often entails conventions and rules belonging to the Internet

world: the fact that a word is underlined suggests that it is a link, the logo of the institution on the top-left corner suggest that it is a link to the home-page, a search box suggests that it is possible to type some strings and check if the website “talks” about that, etc.⁷



Figure 17. Semiotic Unit referring to Internet Ontology – MetMuseum website

3.4.3.6 Web Domain Ontology

Web Domain Ontology (WDO for abbreviation) is the knowledge shared among websites belonging to the same sector/domain or “business sector”. Museum websites typically make use of similar signs for referring to the same informative objects – the term “Collections highlights” (see Figure 18) for referring to the possibility to browse the online version of artworks, or “Education” for referring to the online resources to be used in didactical environments. Users could understand the referential content of a semiotic unit not because they are familiar with the museum’s world but because they are familiar with museum’s Web sites and indirectly learned museum concepts from there.

⁷ Walton [Walton, 2003] observed how south-African students use websites and the study revealed the difficulties experienced by many novice web users in interpreting websites, their structure and the web’s navigational conventions that rely on an understanding of such structure: “[...] the knowledge work performed on the web is always associated with a particular, highly specialized domain and requires specific forms of literacy or communicative practices. These practices can include knowledge of the domain and its discourse, academic conventions, written English, but many of them rely on Western visual and user-interface design”.

Also for WDO, a semiotic unit could refer to this ontology in terms of functional meaning, referring to some conventions/rules typical of the particular web genre for communicating its interactive and dialogic function.

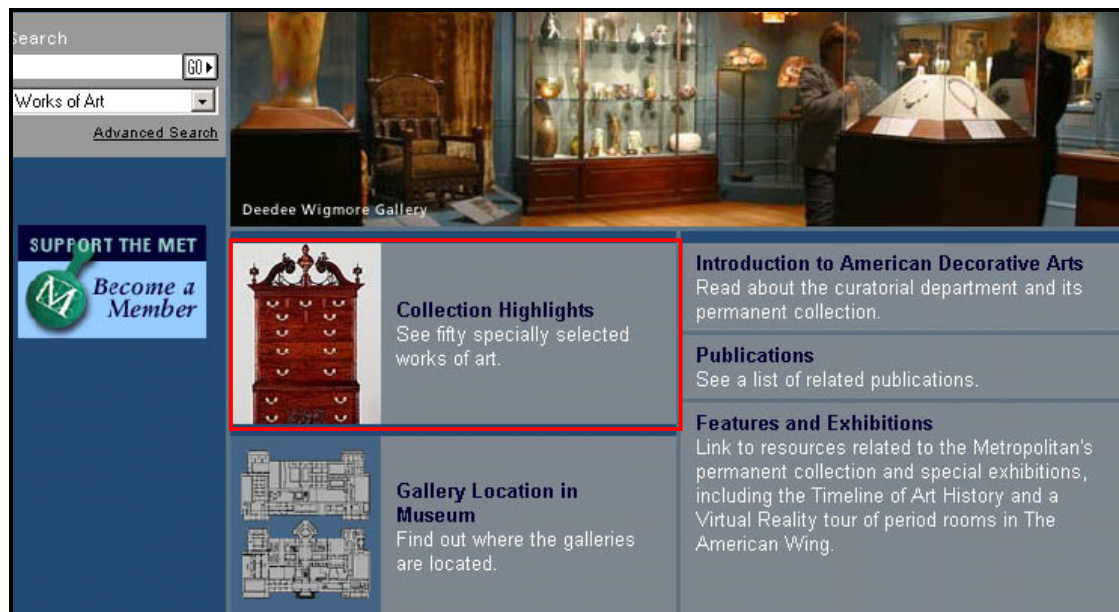


Figure 18. Semiotic Unit referring to Web Domain Ontology – NGA Website

3.4.3.7 Common Sense Ontology

Common Sense Ontology (CSO for abbreviation) is the set of concepts belonging to the common background, and semiotic units can count on this shared knowledge to trigger understanding. Common Sense ontology refers to common and everyday terms that users should master in order to correctly interpret the sign. As an example, the link “calendar” (see figure 19) makes use of the common concept of *calendar* from the real world and uses it to refer to the page in which the user can find the list of museum events chronologically grouped.

CSO can also be considered as the cultural background owned by critic users: as an example, in a museum website there could be a section devoted to kids and the website could make use of particular terms belonging to the youthful slang and consider them as the cultural background shared among these particular users. In fact, obviously, what belongs to

common background depends upon the cultural environment and the geographic area/culture of origin can be of great relevance. What is common knowledge in Italy - say, for example, the Colosseum building (a large amphitheatre in Rome) - may be not so common in Asia or elsewhere.



Figure 19. Semiotic Unit referring to Common Sense Ontology – Met website

Figure 20 shows that, on the one side, a web page is composed by semiotic units standing for concepts belonging to different ontologies (for example, a semiotic unit could refer both to a particular Topic ontology concept TO_b and to an Internet Ontology convention IO_a). On the other side, a common user owns only some of the concepts that semiotic units refer to. The more there is a matching between ontologies presupposed by the website and the ones owned by the user, the more the interaction with the website is successful and satisfactory.

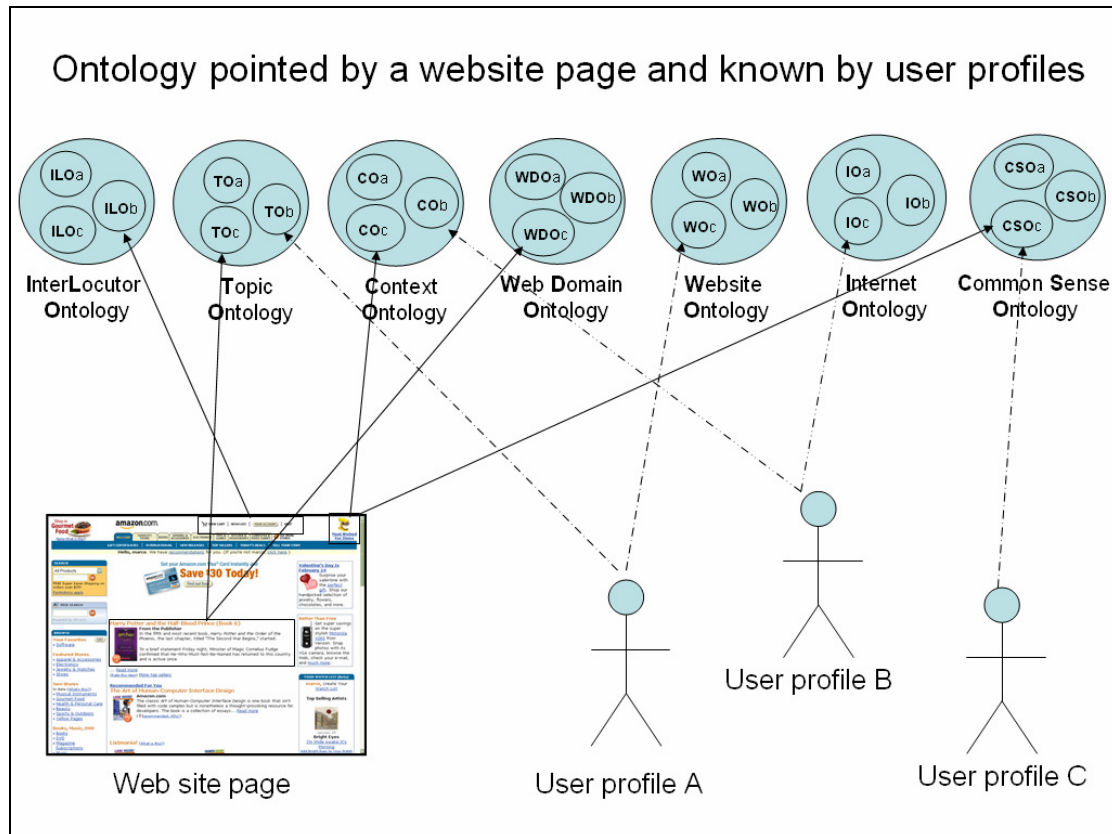


Figure 20. Matching interface presupposed knowledge with users knowledge

3.4.4 Modeling Interactive and Dialogic Function

As previously stated, in order to analyze the semantics of a semiotic unit, both its referential content and its function semantics should be considered. Functional meaning regards the function of a sign, that is, its purpose within the interactive paradigm of the website and within the dialogue with its users. In particular, a semiotic unit, regardless of its referential content, can have an *interactive function* and a *dialogic function*.

3.4.4.1 Modeling Semiotic Unit's Interactive Function

On Web pages there are signs having different interactive functions with respect to the different activities that users can accomplish on the page or in a overall web session. In particular, a semiotic unit can have the following interactive functions:

Interactive Function	Description
Towards Content	Supporting user consultation. These are titles, headings, keywords helping the user to understand and scan the content; for instance, in a page describing a painting of Botticelli in a museum website, the title of the painting, the headings, the keywords bolded in the text, the thumbnail images are semiotic units referring to the main content of the page and helping the user grasp relevant elements of the proposed content.
Towards Context	Supporting user orientation. Through contextual semiotic unit/s, the user can realize what the current page is talking about with respect to the macro-topics covered by the website or with respect to the navigational path followed to that point. In Botticelli's painting page, contextual semiotic unit/s help the user understand how s/he reached that page and in contextualizing the painting in a broader topic (i.e. semiotic units suggesting that the painting belongs to the guided tour of Italian Painters of '500 century).
Towards Navigation	Supporting user navigation. It is the case of any semiotic unit having the function to put forth pointers to new content or to already visited content. It is the case of menu buttons, textual links, anchored images, content maps, and so on.
Towards Operation	Supporting the system modification. Operational signs let the user modify the state of the application or of the external world. For instance, a button for inserting an item in the shopping bag, a "submit" button for sending personal information, a button for subscribing to a newsletter, a button for "confirming an order", etc.
Towards Decoration	Supporting look&feel and website identity. These are semiotic units which do not have a real interactive purpose, but aim at modifying the user perception, at instilling a mood or a feeling, at

	conveying the brand and identity of the website and of the institution staying behind it through a proper orchestration of decorative elements.
Towards Interaction Paradigm	Supporting user's understanding of the interaction paradigm of the medium. Examples are the hourglass while waiting for the page to load, the mouse-hand, the links changing state when passing over them, etc. Interaction paradigm semiotic units are meta-language signs, talking <i>about</i> the interactive language used by the website and the medium.

Table 1. Taxonomy of semiotic unit' interactive functions

In practice, many usability problems are due to users' misunderstanding of the interactive function, which brings to perform an action on the sign that does not correspond to what the sign has been designed for (e.g. not recognizing a link, or trying to click on a non-active element) or which simply creates a feeling of confusion while trying to understand a web page.

Web interfaces should make self-evident to the user the interactive function of the employed signs for facilitating common tasks in a single-page fruition process - facilitating consultation of the proposed content, supporting orientation within the application and the current dialogue, making clear possible navigation and operation actions.

3.4.4.2 Modeling Semiotic Unit's Dialogic Function

Semiotic Units having a navigation purpose (i.e. hyperlinks) need a further analysis. In hypertextual terms, a link is the possibility to go from a piece of information to another piece of information having some relation with it. From the designer viewpoint, a link is a proposal to the user, a proposal of starting a new dialogue regarding a topic, or of going back to something already told to the user [Rocci, 2005]. From the user point of view, a link is the creation of an expectation, an expectation which will be or will be not fulfilled by clicking on that link (i.e. by following that proposal). Both from the designer and from the user perspective, a link is a sign, that is, something staying for something else. Many links invite the user to talk about different things and, at the same time, they limit the user expectations (we can only talk about the topics chosen by the designers and not about others). Therefore, the function of a link (communicated through a label, an image, an icon) should be easily and clearly interpreted by the user at least for two reasons: to avoid creating expectation the website will not be able to satisfy and to let the user easily reach what

designers propose to him. Links are also the key-elements for creating coherence within the website and within the dialogue with its user [Thüring, 1995]. They not only open new dialogues but let the user manage them.

In order to understand the meaning of a link, users should correctly interpret its *dialogic function*, that is, its dialogic purpose within the session/dialogue set by the user [Di Blas, 2003]. W-SIDE makes use of IDM (Interactive Dialogic Model) concepts for modeling the dialogic function of a link with respect to the kind of content it proposes. IDM models the information structure and navigational strategy of a website interpreting it in dialogic terms (see section 2.3.5). IDM is based upon the concept of *topic*, *relevant relation* and *group of topics*⁸:

- A *topic* is the subject of conversation between the user and the interactive application. It is the web page containing the final content that the user wishes to reach through access paths. In a museum website, topic pages could be pages proposing content about an artwork, about the museum, about an artist. There is a distinction between “kind of topic” and “topic”: a “kind of topic” represents the category of subjects of conversation (e.g. “technique”, “painting”, “artist”); a “topic” is an instantiation of the category (e.g. “drypoint” is an example of instantiation of the “technique” category). In other words, the kind of topic represents the abstract schema/strategy through which the actual content (topic) is structured.
A topic can be decomposed in more than one web page: as an example the drypoint technique can be described through 3 different pages, the first giving an introduction, another for details and another for the full-screen image.
- A *relevant relation* determines how the dialogue can switch from a “topic” to another one having a strict relation with it; as an example, “authorship” is a possible change of subject relating any “author” to its “paintings”.
- A *group of topics* determines the entry points or access paths to the topics as possible subject of conversation; as an example, “Masterpieces” is a specific group of artworks, while “All artworks” is another, larger group. Obviously, more groups of topics create hierarchic structure, that is, families of group of topics. The group of topics “Artworks of technique X” generates a *higher-level* family of group of topics that allows to select each list of artworks grouped by technique X; e.g. the family “All techniques” allows selecting “technique X” and have the list of artworks belonging to that technique.

⁸ An explanation through examples about how IDM can model the structure of a web application is given in Annex IV.

IDM concepts paves the ground for identifying a taxonomy of dialogic functions that the user should correctly guess and become familiar in the interaction with the application.

In particular, navigational semiotic units can have the following dialogic functions:

Dialogic Function	Description
Member Topic	The link proposes content about a topic belonging to a higher category. As an example, in a page about “Paintings of the XVI century” each link in the list proposing content about a painting is a link having the dialogic function to propose a member topic.
Unrelated Topic/ Group of Topics	Landmark links, that is, links proposing dialogues that the user can always start from any part of the website. As an example, the links “About the museum” or “our collections” or “home” are usually buttons of the always visible main menu of a museum website. They are always opened proposals of dialogues and the user can activate them at any point of the website.
Additional Topic Content	The link proposes additional content belonging to the current topic the user is looking at. As an example, in the page proposing an introduction to the Da Vinci’s Gioconda, there could be other links like “artwork details” or “anecdotes” or “big image”, which propose additional content to the current topic. In a dialogic perspective, these links are still talking about the same topic.
Topic Switch	The link proposes other topic/s related to the current topic. As an example, in the Gioconda’s page/s there is a link providing information about the “author” of the artwork. In this case the link does not propose additional content because <i>author</i> is a kind of topic, and the link takes the user to a different section of the website (<i>author</i> is not part of the current content but is a different kind of content related to it). In dialogic terms, the link switches the topic that partners are talking about.
Related Group of Topics	The link proposes a list of topics or a list of group of topics strictly related to the current page. As an example, in the Gioconda’s page there is the link “All Da Vinci’s Artworks” or “Other Masterpieces”. This links propose group of topics strictly related to the current topic.
Previous Content	Link providing already visited content. As an example, “Back to

	previous artwork” or “Back to the list” are links proposing already visited pages.
--	--

Table 2. Taxonomy of semiotic unit's dialogic function

The dialogic function of a link is very important since it conveys to the user the structure of the dialogue. Many usability problems are due to the user misunderstanding of the dialogic function of a link: as an example, a user could interpret an ambiguous link label as a semiotic unit having the function to propose other content related to the current topic s/he is looking up, but the actual dialogic purpose of the link is just to be a landmark and propose other topics not related to the current one.

Usually, such misunderstanding are due to problems with the label, the position and the shape of the link, which could be ambiguous or in conflict with internet conventions or simply with layout rules.

3.4.5 Modeling User Knowledge

Most Web sites address a variety of users, with different cultural backgrounds, different knowledge and different skills. It is clear that the “signs” on the interface may be interpreted differently, according to different user profiles. The first task is therefore to understand which features of a user profiles may affect the interpretation of web interfaces and how they affect it.

Ontologies can be used both for modeling the knowledge presupposed by the website and the one owned by the user. User familiarity with ontologies influences the interpretation and understanding of both the referential content and the functions of a semiotic unit. While the user's interpretation of the referential content can depend upon her/his familiarity with all the ontologies, the interpretation of the function is mainly given by the familiarity with the Internet Ontology, the Website Ontology and of the Web Domain Ontology.

There are many methodologies supporting the definition of critic user profiles in the design and usability evaluation phase of a web site [Carroll, 2000][Kuniavsky, 2003]. However, in order to model the knowledge underneath the dialogue between a website and its user only specific criteria should be considered. W-SIDE user profiles are defined considering the level of familiarity with the different “ontologies” presupposed by the website.

Figure 21 shows a summary of the semiotic model and the relation between user knowledge and the knowledge presupposed by a semiotic unit. A web user having some

knowledge of the reference ontology/ies interprets a web semiotic units considering its main elements and guess its overall meaning.

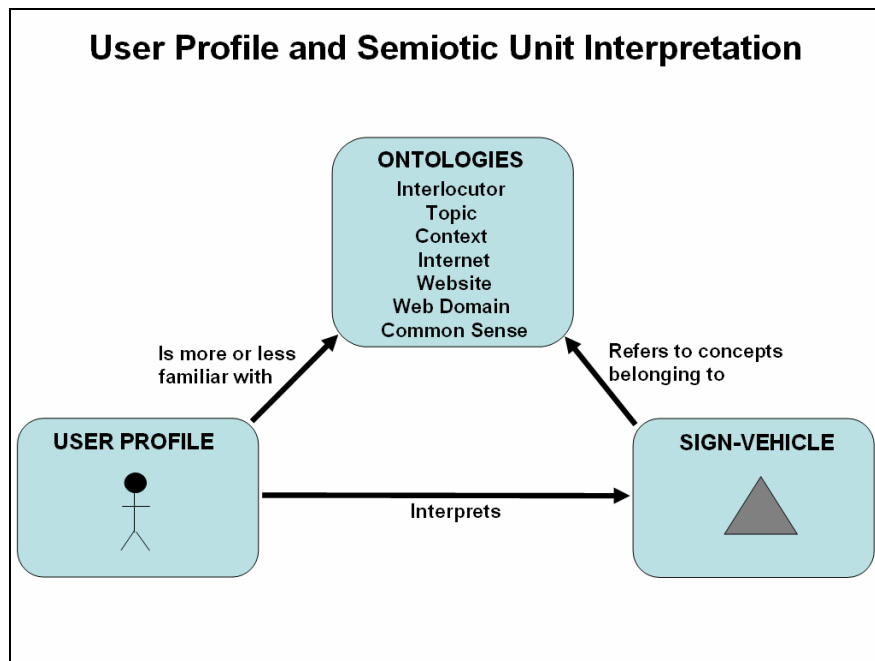


Figure 21. W-SIDE model: relation between user and interface knowledge

In the example below a critic user profile used in the analysis of the SFMoMA website is shown. The level of user familiarity with an ontology can be low (3), medium (6) or high (9). Empirical validation (see Chapter 4) proved that three values are enough for comparing the user and the presupposed interface knowledge and for evaluating misunderstandings due to a misalignment between them.

USER PROFILE X

Knowledge	Ontology	Sub-ontology	Level of familiarity
InterLocutor			
<i>Generic</i>	Museum's world		6
<i>Specific</i>	SFMOMA		3
Domain			
<i>Generic</i>	Art		6

<i>Specific</i>	Modern Art		6
		Minimalism	3
Context			
	-		-
Internet			
	Internet conventions		9
Web Domain			
	Museums' Web sites		9
Web Site			
	SFMOMA website		3
Common Sense			
	American, Education level		9

Figure 22. Example of W-SIDE user profile

Obviously, the user's understanding of a semiotic unit is not only related to the familiarity with the presupposed knowledge, but also by other criteria, like for example the correctness of the semiotic unit's syntactics, independently from the knowledge staying behind it.

Therefore, as it will be explained in W-SIDE Evaluation Technique (section 3.6), the design and evaluation process of semiotic units should both verify the matching between the knowledge mastered by the user and the one presupposed by the sign and also verify the clarity and correctness of the semiotic unit in itself, its consistency overall the website, its capacity to clearly convey the dialogic-interactive function, the relation with the referred ontology/ies and with other semiotic units on the same page.

3.4.6 Summary

The W-SIDE Model is a conceptual tool supporting the modeling and analysis of the semiotic elements composing web interfaces, making the experts aware of the hidden semantics and its consequences in the user interpretation process.

The model is built upon the following concepts:

SEMIOTIC UNIT		
Referential content	Modeling Tools	Concepts
	SET OF ONTOLOGIES	InterLocutor Topic

		Context Internet Website Web Domain Common Sense
Function	Modeling Tools	Concepts
	INTERACTIVE FUNCTION	Towards content Towards context Towards navigation Towards operation Towards decoration Towards interaction paradigm
	DIALOGIC FUNCTION	Member Topic Unrelated Topic/Group of Topics Additional Topic Content Topic Switch Related Group of Topics Previous Content
USER PROFILE		
	Modeling Tools	Concepts
	SET OF ONTOLOGIES	InterLocutor Topic Context Internet Website Web Domain Common Sense

Table 3. Summary of W-SIDE conceptual toolset

3.5 W-SIDE Evaluation Technique

W-SIDE stresses that many usability problems are due to the fact that there is a crucial gap between the knowledge of designers who created the website and that of a generic user interacting with the application. Unfortunately, it happens that designers do not wonder whether their user is familiar with the terms and concepts which are shared within a specific community of people. As a consequence, the interface language used by the website is often different and misaligned with the one used and known by the user, thus risking compromising a successful user experience.

A usability inspection dedicated to the evaluation of semiotics aspects may reveal problems of the interface which pose severe challenges and risks for the success of the interaction.

W-SIDE Evaluation Technique is composed by a W-SIDE Heuristic-Driven Inspection Technique and a W-SIDE User Testing Technique. Both the techniques wish to help usability experts not only to detect potential user misunderstandings while interacting with web interfaces, but also to deeply analyze them for better understanding the causes staying behind and, indirectly, guessing possible solutions. From the theoretical viewpoint, the method is based upon W-SIDE Model, by setting its conceptual toolset in a structured evaluation process. In particular, the model has been adapted and simplified in order to define a light and easy-to-use evaluation technique that could efficiently fit in the current existent evaluation processes.

From a more procedural viewpoint, the method refers and supports current inspection methods (like MiLE)⁹ - mainly devoted to the user satisfaction – by introducing new semiotic heuristics able to grasp specific causes of bad design and user misunderstanding.

In the following section, the evaluation process is explained. Some example are shown in order to exemplify and document in practice how the concepts discussed so far may effectively assist in performing a semiotic-based interface evaluation. For complete examples of W-SIDE in practice and for a detailed explanation of the heuristics please refer to Annex 1 and 2.

⁹ See section 2.3.4.3 for a review of the method.

3.5.1 W-SIDE Evaluation Process

The figure below shows the complete W-SIDE evaluation workflow.

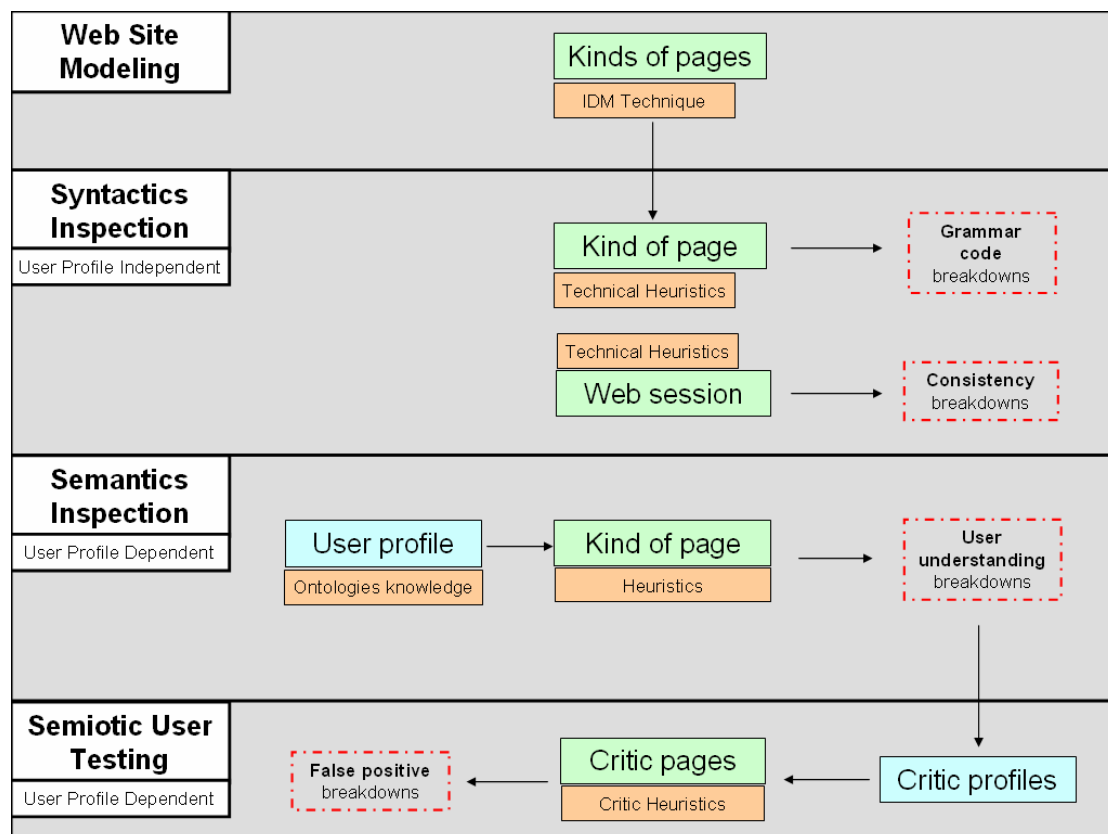


Figure 23. W-SIDE Evaluation Technique workflow

As depicted in the figure, W-SIDE evaluation process is composed by the following activities:

1. *Website Modeling*, experts/inspectors identify the kinds of pages that give shape to the structure of the website and focus the semiotic analysis on these pages.
2. *Syntactics Inspection*, inspectors detect technical/grammar breakdowns causing user misunderstandings. Such problems are user-profile independent, since the problem is not related with the misalignment between the knowledge presupposed by semiotic

units and the one owned by the user but rather on the clarity of their structure, of their relations and their overall consistency.

3. *Semantics Inspection*, inspectors “put into the shoes” of critic user profiles and predict misunderstandings in the interpretation of interface semantics.
4. *Semiotic User Testing*, doubtful results detected by inspectors are double-checked and validated by observing real users while interacting with critic pages.

In order to analyze and predict user interpretations - that is, the actual meaning of each interface element for a given user - the interface language used by a website must be evaluated analyzing both its syntactics (the correctness of its grammar) and its semantics¹⁰. In fact, the understanding of the interface is given not only by the familiarity with the presupposed semantics but also by the clarity and consistency of semiotic units as sign-vehicle/s and their ability to convey their semantics and their relation among each others.

In the following sections the four main activities will be explained in detail.

3.5.2 Modeling the Website

As stated before, the interface shows not only the actual content to the user but also the structure of the website and the dialogic function of each element, in order to let her/him comprehend the interactive paradigm of the website. Well-structure websites are usually designed defining few page templates and reusing them with respect to the kind of content to be shown, since it facilitates user orientation and dialogue coherence [Garzotto, 1995][Brinck, 2001]. Considering a kind of page, for example the template describing an artwork in a museum website, independently from the actual content of the particular artworks, the language of the interface, its structure and strategy remain the same. What changes is the content, but the way it is presented and the way the website talks about the

¹⁰ Charles Morris in his *Foundation of the Theory of Signs* [Morris, 1938] defined three basic areas for analysing semiotics: *syntactics*, dealing with the structure of signs and sign systems (such as the structure of a sentence, novel, film, fugue, or ceremony). It refers to the study of the structural relations of signs to one another; *semantics*, dealing with the relationship of signs to what they stand for. It studies the meaning of a signs and sign systems - meanings of words, sentences, gestures, paintings, mathematical symbols, etc – with respect to a particular culture; *pragmatics*, dealing with the actual interpretation and meaning of the sign by the receiver.

content follow the same schema. Based on this assumption, W-SIDE analyses the interface of “kinds” of pages – i.e. of templates - rather than analyzing all the single pages composing the website, which would be a very expensive and difficult-to-manage activity.

Referring to IDM concepts¹¹, inspectors model the website and identify the kinds of pages/templates composing a website. In particular, the following kinds of pages can be identified:

- *Kind of topic* page/template, that is, the schema used for presenting the different instances belonging to a particular topic. As an example, on a museum website the template used for presenting an artwork belonging to the museum collection is a kind of topic template.
- *Single topic* pages, that is, pages which are not instances of an abstract template but exists as single pages. As an example, the “About the museum” page or “contact us” page present a unique topic for which designers created an ad-hoc page schema.
- *Relevant relation* page/template, that is, the page/template used for proposing topic/s having a relation with another topic. As an example, the schema that, from an artist page, proposes all the artworks belonging to that artist is a relevant relation template, having the purpose to switch the dialogue from a topic to a different related topic.
- *Group of topics* page/template, that is, the schema used for presenting a structured list of topics the web site talks about. As an example, the template proposing the artworks belonging to an “artistic period x” is a group of topics template.
- *Home page*, that is, the first page making start and proposing the main dialogues that the website can talk about.

For each kind of page inspectors choose one instance - that is, one example of real page with real content – and analyze it through W-SIDE syntactic and semantic inspection.

The expected result of the modeling activity is a list of actual critic pages to be analyzed. Besides the instances of the kinds of pages identified, inspectors can obviously add to the evaluation activity any other critic page that they consider worth being evaluated.

¹¹ See section 2.3.5 and Annex IV for a more detailed explanation of IDM technique.

3.5.3 Evaluating Syntactics

In Semiotics, syntactics deals with the structure of signs and sign systems and refers to the study of the structural relations of signs to one another [Morris, 1938]. Regardless of the concepts a semiotic unit refers to, it could be badly designed considering its sign-vehicle and the relation with other sign-vehicles.

Inspectors analyses kinds of pages and check that semiotic units are structurally and grammatically comprehensible through the following set of heuristics¹²:

SYNTACTICS EVALUATION	
SINGLE PAGE	
<i>Criteria</i>	Sign Readability
<i>Explanation</i>	The sign-vehicle - that is, the shape of a semiotic unit - should be easily readable in itself by the user. Small fonts, text-background contrast, typing errors, incomplete images are samples of bad readability.
<i>Criteria</i>	Structural Clarity
<i>Explanation</i>	Regardless of the ontology the sign refers to, it could be unclear the relation with other signs on the page. It should be intuitive to the user the dependence of a sign with other signs on the page in order to let him correctly interpret it as part of a whole/broader semiotic unit.
<i>Criteria</i>	Grouping Adequacy
<i>Explanation</i>	Semiotic units composing a single page can be grouped in macro-areas, that is, in groups of semiotic units having a similar meaning, a content relation or satisfying a common goal/functionality. Some semiotic units could be grouped with other semiotic units on the page in a wrong way, thus creating misunderstanding in the user.

Table 4. List of syntactic/technical heuristics applied to a single page

¹² For a detailed explanation of the heuristics and how to apply them through some examples see Annex 1 and 2.

The expected result of the activity is a list of technical problems due to the sign-vehicle in itself and not to the comparison between the knowledge staying behind it and the one mastered by particular user profiles. Such problems are usually caused by the shape of the sign-vehicle (its color, size, font, etc.) and its position.

Moreover, the use of a sign-vehicle must be consistent with respect to its meaning and its function. Labels, colors, positions, shapes, sizes are elements composing sign-vehicles that should be used consistently in the whole website. If a semiotic unit has a particular content and functional meaning the sign/s composing it should not be used improperly but always have a unique meaning. Checking semiotic consistency is a user-profile independent activity since it support the detection of technical problems true and valid for any kind of user. The activity makes use of the following heuristics:

SYNTACTICS EVALUATION	
ALL PAGES	
<i>Criteria</i>	Grouping Strategy Consistency
<i>Explanation</i>	The chosen strategy for grouping semiotic units and suggesting the macro-areas composing a web page should be the same in the whole website, otherwise it can badly influence user's understanding and orientation both at single page and web session level.
<i>Criteria</i>	Content Semantics Consistency
<i>Explanation</i>	The same sign-vehicle, if used more than once within the website, should be used consistently with respect to the content/concept it refers to, whatever it is.
<i>Criteria</i>	Functional Semantics Consistency
<i>Explanation</i>	The same sign-vehicle should be consistent with respect to its interactive and dialogic function. If a particular strategy (i.e. the color, the position on the page, etc.) is used to convey that a link is a landmark, all landmarks should use a similar code.
<i>Criteria</i>	Web Session Consistency
<i>Explanation</i>	If there are sign-vehicles referring to previous user actions (i.e. a navigation sign like the "go back" button or "your wished CDs") they should be consistent with the actual user actions made in the current session, otherwise it is not clear to the user what those signs are referring to. A "go back" link taking the user back to a

	previous page has no meaning if the user never visited that page.
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Table 5. List of Syntactic/Technical heuristics applied to multiple pages

3.5.4 Evaluating Semantics

The semantic evaluation activity models the concepts that semiotic units refer to and predict their comprehension by critic users. In particular, the activity checks that both referential content (content semantics evaluation), interactive function and dialogic function (functional semantics evaluation) are clear and comprehensible by critic users.

Inspectors consider kinds of pages, vision critic user profiles and check the existence of potential misunderstandings in the interpretation of each semiotic units through the use of ad-hoc heuristics. In a well-structured design process, the criteria used for modeling user profiles in the evaluation activity should match with the ones identified in the requirements analysis, so to observe if the critic users the application has been made for can really use and appreciate it [Cantoni, 2003]. Therefore, inspectors should consider critic user profiles and, for each, guess their level of familiarity with the knowledge presupposed by the website (see section 3.4.5).

3.5.4.1 Evaluating Content Semantics

Inspectors vision critic user profiles and check both the user familiarity with the ontology/ies each semiotic unit refers to and any misunderstanding arising from relating it with its referential content. In fact, content semantics could be misleading both because it refers to an unfamiliar ontology and because it potentially can refer to more than one ontology and some conflicts can arise.

The following heuristics are applied¹³:

CONTENT SEMANTICS EVALUATION	
SINGLE PAGE	
Criteria	Ontology Familiarity

¹³ For a detailed explanation of the heuristics and how to apply them through some examples see Annex 1 and 2.

<i>Explanation</i>	The user could be unfamiliar with the ontology the sign refers to and not able to guess its meaning. Little familiarity with one or more ontologies is one of the most common sources of problems, and also one of the easiest to evaluate. As an example, in a museum website labels like “Exhibitions” or “Collections” refer to concepts belonging to the InterLocutor Ontology (the museum’s world) that the user could be unfamiliar with and, as a consequence, not able to correctly interpret them.
<i>Criteria</i>	Ontology Conflicts
<i>Explanation</i>	A semiotic unit could potentially refer to more than one ontology, and it is not clear to the user which one/ones should be considered. As an example, in the main menu of a museum website the link label “architecture” could potentially refer both to <i>architecture</i> as artistic discipline (Topic Ontology) or it could refer to the museum collection (InterLocutor Ontology). Such ambiguity could cause in the user a misunderstanding in guessing the content that the link proposes (i.e. a general introduction about architecture as artistic discipline or information about the museum collection?) ¹⁴ .
<i>Criteria</i>	Conceptual Conflicts
<i>Explanation</i>	Even if the referred ontology is clear and familiar, the sign used could have different meanings within the referred ontology. In particular, this could be due to the fact that the sign used is <i>too general</i> or in <i>competition</i> with other semiotic units on the same page. As an example, the label “Info” in the main menu of a museum website is too general. Even if the user is able to related it to a particular ontology (i.e. InterLocutor ontology, information about the museum) it is not clear what kind of information it provides (practical information about how to reach the museum,

¹⁴ “The term ‘cane’, if it is communicated out of context and without any indication of code, can be either a Latin imperative, or an Italian common noun (dog) or an English common noun. Thus there must always be a code indication which refers to a precise vocabulary.” [Eco, 1979] Referring to Eco, an ontology is what he calls a semantic system - that is, a system of cultural units - and each concept composing it is a cultural unit : “In every culture a unit is simply anything that is culturally defined and distinguished as an entity. It may be a person, place, thing, feeling, state of affairs, sense of foreboding, fantasy, hallucination, hope or idea” [Eco, 1979]. On the web, the same term or sign could potentially refer to more vocabularies/ontologies, and it up to the designer clarify what the sign is referring to.

	historical information about the institution, information about departments, etc.). Moreover, on the same page there is another link with a label “visit us” competing with “Info”, creating even more confusion and ambiguity in the user mind because it can have a similar semantics.
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Table 6. List of Semantic Heuristics evaluating content semantics

3.5.4.2 Evaluating Functional Semantics

Many misunderstandings arise not because the user is unfamiliar with ontologies related to the real world but because s/he does not understand the function of the sign within the complex communication paradigm of the website. As already outlined, such problems have already received a great deal of attention. In fact, several approaches to usability, including Nielsen [Nielsen, 1999] and Brinck [Brinck, 2002] for example, focused upon the functional meaning of interface elements (conventionality of the navigation behavior, its comprehensibility, etc.). However, few of them observed the problem from a semiotic-dialogic perspective helping inspectors in better understanding the causes and in providing ad-hoc solutions.

Inspectors check any misunderstanding related to functional semantics by applying the following heuristics:

FUNCTIONAL SEMANTICS EVALUATION	
SINGLE PAGE	
<i>Criteria</i>	Interactive Function Clarity
<i>Explanation</i>	The user should correctly interpret the interactive function of a semiotic unit - i.e. if it is a semiotic unit helping consultation (titles, headings), navigation (links, linked images, linked icons), orientation (labels, colors, images contextualizing the section of the website, the path taken by the user), operation or simply decorative sign (logos, decorative widgets).
<i>Criteria</i>	Dialogic Function Predictability
<i>Explanation</i>	The user should correctly interpret the kind of link and the kind of content it proposes (i.e. a member topic link, a group of topics link, a Topic Switch link, etc.).
<i>Criteria</i>	Designer's Deputy Clarity

<i>Explanation</i>	Apart from the interactive and dialogic function, a semiotic unit can be unclear because the motivations of the designers are not clear. The user should be able to guess the designer's deputy of the website (i.e. why a particular sequence of topics in a guided tour, why some topics are related with each others, why some links are emphasized, etc.). In a dialogic perspective, some design choices could be unclear and the user could be unable to grasp the argumentation strategy staying behind it, thus causing misunderstandings.
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Table 7. List of semantic heuristics evaluating functional semantics

3.5.5 User Testing

Borrowing MiLE method and its advantages¹⁵, W-SIDE proposes a healthy balance between heuristics inspection and user testing technique. User testing is used for further validating results obtained during the inspection. Only for conflictual or hardly interpretable results user testing is used for double-check.

3.5.5.1 User Testing Process

W-SIDE User Testing receives the following documentation from the inspection activity:

INSPECTION RECORDS	DESCRIPTION
List of critic pages	List of pages or elements of pages that need further validation
List of critic user profiles	User profiles that revealed ambiguous or inconsistent results in the interpretation of web interfaces
List of critic heuristics	Selection of criteria to be used in the user testing.

Table 8. Inspection records to be considered in user testing activity

Critic pages or a whole sequence of pages simulating a critic web session are given to real users matching with the critic user profiles. Users are asked to talk aloud and

¹⁵ See section 2.3.4.3

informally interpret semiotic units composing them. The observer, as far as the testing is active and rich of user feedbacks, should not interfere in the user description of the interface. If user interpretation are not relevant and do not deal with the critic heuristics borrowed from the inspection, observers can lead the user testing by making simple questions regarding the critic criteria.

Interpretation can be recorded through audio-video devices and/or the observer can keep track noting down the main misunderstandings and causes. Recording the test can be very useful, since words and terms used by the user to describe the interpretation often can be reused in the re-design phase.

3.5.5.2 More Effective Screening and Testing Activity

Current user testing techniques make use of complex user profiles: they screen users considering many criteria in order to observe how they interact with the application, accomplish a specific task or goal and have feed-backs about the overall experience. In such activities, user testing has always been considered an expensive evaluation activity, not only in terms of costs for the actual testing but also in terms of costs/efforts for identifying and screening critic samples of users [Kuniavsky, 2003]. Since during user testing there are many factors to be evaluated – website's capacity to let the user accomplish a goal, user's understanding of the interface, user satisfaction, website persuasive capacity, etc. – many criteria are used for selecting critic users – age, profession, hobbies, provenance, education, etc.

W-SIDE testing is focused on a particular dimension, that is, the user's understanding of the interface elements, not directly considering the user satisfaction or capacity to accomplish a goal. W-SIDE user testing supports and simplifies user screening and optimize the actual user testing. As regards screening, W-SIDE makes use of profiles that facilitate the identification of the *persona* to be looked for. Screening focuses on the user knowledge rather than on demographic and social criteria, since this is the only criteria needed for evaluating user's understanding of the interface. The profile is composed by the level of knowledge with respect to the ontology the website refers to.

As regards actual user testing activity, each user can be asked to interpret only specific semiotic unit composing a webpage, that is, the semiotic units for which a particular knowledge is involved. Inspection could find that a particular presupposed ontology could be unfamiliar or unclear for one or more user profiles. User testing considers only semiotic units referring to the critic ontology and users are asked to interpret only them. As an example, if inspectors need to double-check if the website is too complex for users having

few familiarity with internet, they screen people having few Internet Ontology Knowledge and ask them to interpret only semiotic units presupposing Internet Ontology.





Moreover, if problems found in the inspection are not strictly related to content semantics but rather to functional semantics, W-SIDE taxonomy of the interactive function of semiotic units suggests simple micro-tasks on the page that observers could ask user to accomplish in order to check user's understanding and, indirectly, evaluate also interface efficiency. Examples of micro-tasks could be "Try to understand in which section of the web site you are" (e.g. find *towards orientation* semiotic units) or "where would you click for having more information about what you are looking at?" (e.g. find *towards navigation* semiotic units) or "what the page is talking about?" (e.g. find *towards consultation* semiotic units), etc. W-SIDE User Testing can be used at different levels with respect to the kind of doubtful results that need further validation.

3.6 W-SIDE Notation

W-SIDE notation has been developed considering the following factors:

- any semiotic evaluation result/comment needs a visual support - that is, an image of the interface - in order to be understood. It is neither easy nor justified to define a notation able to model and describe semiotic problems without referring and being independent on actual screen-shots of the interfaces considered.
- W-SIDE wishes to be an easy-to-use technique that can be applied both to the early and final design phases of a web application. The notation must be very efficient and let experts discuss easily on the results in an informal environment.
- Interface choices are usually made when the application has not been implemented yet, and the discussion is based on sketched pages. In this case, a very simple and informal notation is needed.

Considering the above factors, the following notation has been defined:

GRAPHIC NOTATION	DESCRIPTION
 Interlocutor	Single semiotic units composing a screen-shot of the application are circled by using these colors, in order to indicate the ontology a semiotic unit refers to.
 Topic	
 Context	
 Internet	




 Website  Web Domain  Common Sense	
1 2 3 4 5 6 7 8 9 0	Numbers are written besides semiotic units and are used for identifying semiotic units having problems with their syntactics.
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	Ringed numbers are used for identifying semiotic units having problems with their content semantics.
1 2 3 4 5 6 7 8 9 0	Squared numbers are used for identifying semiotic units having problems with their functional semantics
{ }	Brackets are used when more than one semiotic unit refer to the same ontology or entail the same semiotic problem.
.....	Hatched lines are used for circling areas of the page already analyzed in other pages (i.e. main menus present in all the pages, page footnotes, etc.). Besides the circled area it is written the reference to the page in which the relative analysis can be found.
P1, P2, P3, ...	Each page is identified by a number for easy recall.

Table 9. W-SIDE notation toolset

Interface breakdowns are indicated by circling (with simple pencils of different colors) the problem on the screen-shot (a digital image or a printed page) of the page under evaluation and by writing a unique number besides it identifying the problem. Different colors are used with respect to the kind of ontology the semiotic unit refers to: if for example a semiotic unit referring to the Internet Ontology has a problem (i.e. the ontology is unfamiliar for the user) a blue pencil is used for circling the semiotic unit and for writing the number besides it. If the problem is related to the content semantics, the number is ringed, while if it is related to the functional it is squared.

Here below, a screen-shot analyzed by using W-SIDE notation:

HOME PAGE – P1

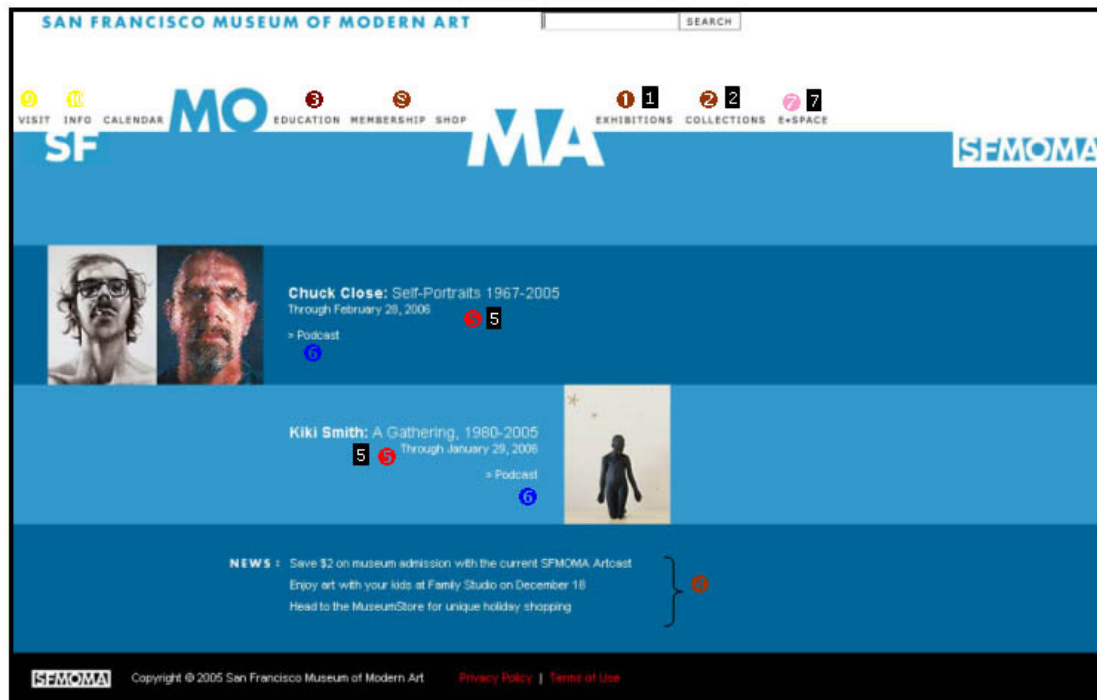


Figure 24. Example of W-SIDE notation at work on web screen-shots

The explanation of detected problems and their categorization with respect to W-SIDE heuristics can be reported right below the screen-shot by using simple tables and referring to the problems highlighted on the screen-shots through the numbers identifying them:

CONTENT SEMANTICS EVALUATION	
ONTOLOGY FAMILIARITY	
PROBLEM	COMMENT
① ② ③ ④	Unfamiliar concepts for a user with low knowledge about museums
⑤	Some more information about the topic should be given: a user having no knowledge about these artists cannot understand the kind of art and the subjects proposed.
⑥	Even for expert web surfers, the term could be unknown
⑦	The label is absolutely not intuitive for a first-time user.
ONTOLOGY CONFLICTS	
PROBLEM	COMMENT
⑧	<p>INTERLOCUTOR VS INTERNET</p> <p>A user unfamiliar with museums could guess that membership means to become a member of the website instead of a member of the museum</p>
CONCEPTUAL CONFLICTS	
PROBLEM	COMMENT
⑨ ⑩	<p>WIDENESS</p> <p>The term “info” is too general and the user cannot guess which ontology it refers to and what kind of content is provided.</p> <p>COMPETITIVENESS</p> <p>The user could guess that it refers to general information about the museum (actually it gives information about the website), but it is in conflict with the other semiotic unit “visit”, which should also give information about the museum.</p>

FUNCTIONAL SEMANTICS EVALUATION	
INTERACTIVE FUNCTION CLARITY	
PROBLEM	COMMENT
All links	Apart from the main menu, it is not clear at a first glance which semiotic units have navigational purpose and which not.
DIALOGIC FUNCTION CLARITY	
PROBLEM	COMMENT
1 2 7	It is not clear what kind of content these links refers to: does collection refers to general info about <u>SFMOMA</u> collections or can the user browse them?
DESIGNER'S DEPUTY CLARITY	
PROBLEM	COMMENT
5	It is not clear the purpose of these semiotic units within the dialogue with the user: they are two current exhibitions at the mauseum, but it is not explicated to the user if they are highlights or the only two ones.

Figure 25. Example of W-SIDE notation at work in reporting semiotic problems

4 Validation

The validation of W-SIDE has two main objectives. Firstly, to validate the effectiveness of the inspection method in terms of reliability of detected interface problems. Secondly, to evaluate the efficiency of W-SIDE inspection in terms of needed time and efforts for carrying out the evaluation.

For both the aims, W-SIDE has been tested, refined and validated by applying it to different projects, both in the early design phase and in the final testing. W-SIDE has also been presented at International Conferences and Workshops - receiving fruitful feedbacks from experts in the field - and taught in Bachelor and Master Courses, with the opportunity to observe its quick learnability and its capacity to stimulate discussion among students (see Annex III).

The core of the validation activity regards the working experience by the Interactive Educational Department of the San Francisco Museum of Modern Art and the IT Department of the Cleveland Museum of Art. Thanks to their collaboration and support, the research received many feed-backs from IT experts and had the opportunity to collect empirical data for improvements and refinements.

4.1. Teaching W-SIDE

4.1.1 Method

W-SIDE has been used as a didactic tool for better understanding semiotic implications regarding web interfaces within the second academic year course “Theories and Techniques for New Media” and within the TEC-CH (Technology Enhanced Communication for Cultural Heritage) Master of the Faculty of Communication Sciences at the University of Lugano. Both the courses are devoted to present and explain methodologies to be used for designing hypermedia applications. The introduction of a method for mastering the interface language of a website has been a challenge in the course program, since it proposed an interdisciplinary approach to the study of communication

through interactive media. W-SIDE framework has been simplified and explained in 2 theoretical lessons and applied through hands-on sessions in the subsequent 1-2 lessons: students, organized in groups of 2-3, received 3 pages of a website and were asked to analyze the interface and detect potential semiotic problems. Final results were presented to by each group and discussed with the whole class. Annex III presents an example of analysis carried out by students.

4.1.2 Results

Students revealed great interest in the method and in the research in general. The analyses made by students were useful for refining the method and sometimes also for defining new evaluation criteria. In particular, the opportunity to teach W-SIDE within the TEC-CH Master Course made arise many issues related to intercultural elements of interfaces and their different interpretation from different cultures: the course is attended by students interested in the Cultural Heritage sector and coming from all over the world. Results of the analyses revealed that, with respect to the same sign-vehicle, different cultures could differently interpret them. As a consequence, these results gave important cues and hints for considering intercultural analysis in W-SIDE Evaluation Technique (see section 5.3.1).

4.2 Presenting W-SIDE

4.2.1 Method

W-SIDE has been presented and discussed at international conferences and workshops. Moreover, W-SIDE has been introduced to web practitioners in order to gather insights and feedback from their experience. Informal interviews helped understand limits and potentialities in the use of the method with respect to the typical and structured workflow adopted by industries for building web applications.

4.2.2 Results

The most interesting feedbacks came from web practitioners. Interviews helped understand if and how W-SIDE Technique could fit within the typical design workflow of web agencies and software houses when building web applications. The main feedbacks received can be so summarized:

- A structured approach for evaluating the user's understanding of web interfaces is currently missing in the typical lifecycle of an interactive application: interface design choices are usually based on personal design skills/experience and good-sense. However, they believe that such activity is worth and that could be considered a unique and separate design phase: the main problem that they pointed out is that interface design is often a blended work, where graphic designers (usually s/he is the real interface designer), content experts and conceptual designers discuss in order to find solutions. A deep analysis of chosen labels, signs, symbols with respect to more user profiles is quite missing and sometimes (above all as regards intercultural websites) it could be useful. The challenge of such conceptual tool would be its efficiency and cost-effectiveness.
- The first versions of the W-SIDE received critics regarding the complexity of the model. Their feedbacks helped to simplify the framework in order to facilitate not only its use but also its learnability.
- Web practitioners stressed the importance to develop an informal and easy-to-use notation that could lead discussion;
- They appreciated that W-SIDE makes use of concepts grasped from conceptual design, because this could lead to the creation of a strong and structured "bridge" between two phases (conceptual and interface design) that very often are not a continuum but two separate activities with different methods and rules; interface design should refer to a structured model able to consider the motivations staying behind conceptual design - i.e. critic user profiles with their needs and goals, stakeholder goals, etc. – and lead experts to take reasoned and motivated interface solutions. They considered W-SIDE a first step towards this direction.
- They also stressed that a library of ad-hoc semiotic patterns with respect to recurrent problems (i.e. user unfamiliarity with a particular ontology) would be very useful.

4.3 Testing W-SIDE on Real Projects

4.3.1 Method

W-SIDE has been tested on different projects. The main validation has been carried on through the following activities by the San Francisco Museum of Modern Art and the Cleveland Museum of Art.

1. W-SIDE Inspection activity

- Ask the IT departments that developed the web-based applications which website or which section they preferred to evaluate.
- Ask the IT departments which user profiles should be considered during inspection. Users were chosen with different profiles, i.e. different levels of previous knowledge concerning the ontologies relevant for the interface.
- Analyze web-based applications developed by the departments using W-SIDE Inspection Method;
- Keep track of the detected interface problems;

2. User observations activity:

- Screen museum visitors corresponding to the user profiles considered in the inspection; they were asked to participate to the activity in exchange of one free-ticket to the museum;
- Make selected visitors fill a very short questionnaire to get an indication of their level of knowledge with respect to the set of ontologies presupposed by the application;
- Ask selected visitors to informally interpret 4 to 6 web pages, talking aloud and describing their understanding of each element composing the webpage; They were asked to provide comments (tape-recorded) about the possible meaning of semiotic units/interface elements;
- Translate the detected problems in W-SIDE terms;

3. Comparing results

- Compare the results found in the Inspection and in the User testing activities
- Keep track of false-positive problems

The overall validation activity considered the following applications:

Application	Pages considered	User interpretations
SFMoMA Website ¹⁶	6	24
SFMoMA Discovery Interface ¹⁷	3	9
Cleveland Museum Website	3	9

Table 10. Web applications considered by the SFMoMA and the CleMusArt

4.3.2 Results

The activity revealed the effectiveness of W-SIDE Inspection Method in detecting user misunderstandings. With regards to SF-MoMA empirical evaluation, about 90% of misunderstandings found through user observation were detected through W-SIDE Inspection. But 35% of the problems “identified” by the inspection were not real problems for the users (false positives). A refinement of the inspection technique reduced the percentage of false positive to 16% and 14%, still identifying a high percentage (93% and 85%) of actual user problems.

Application	W-SIDE detected problems	W-SIDE false positive
SFMoMA Web site	90%	35%
SFMoMA Discovery Interface	93%	16%
Cleveland Museum Web site	85%	14%

Table 11. Empirical data regarding W-SIDE reliability

Figure 26 shows a summary of the profiles interviewed at SFMoMA, showing the number of interviewed visitors having a certain level of familiarity with the ontologies presupposed by the applications.

¹⁶ The evaluation activity focused on the Collection’s section of the website, since the IT department considers it the most visited section of the website and is worth analyzing it.

¹⁷ SFMoMA Discovery Interface can be considered the main and most complete (in terms of content provided) application at the SFMoMA. It is an off-line application accessible only from and within the museum, providing deep content about the museum’s artworks, artists, artistic periods, techniques, etc.

Knowledge	Ontology	Low	Medium	High
Interlocutor	Museum's World	12	14	7
	SFMoMA	20	9	4
Topic	Art	6	20	7
Internet	Internet conventions	9	16	8
Web Domain	Museums' Web sites	20	9	4
Web Site	SFMoMA Website	24	9	0
Common Sense	Education Background	-	11	22

Figure 26. Interviewed visitors and their level of knowledge at the SFMoMA

Some excerpts of problems observed during the user observation and detected by W-SIDE are reported below:

Page considered: SFMoMA Artwork Web page

User profile 1:

Museum's world familiarity = medium

Art's world familiarity = medium

SfMoMA's familiarity = low

Internet familiarity = medium

Web domain = medium

SFMoMA Web site = low

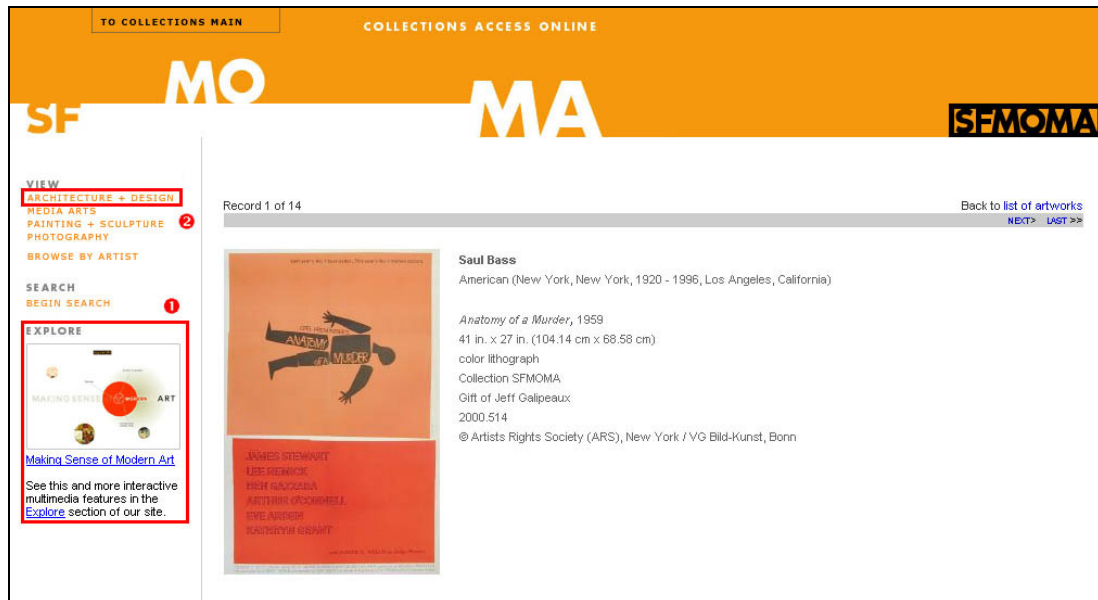


Figure 27. Screen-shot showing examples of detected problems at the SFMoMA

Observer: “What about this image on the page and the link below it?” (see ❶ in figure 27)

Visitor: “I can’t read the thing on the left there. So it is ‘Does it make sense in Modern Art, See this and more interactive multimedia features in the Explore section of our site’ ...I do not know what that means. If that is like a search engine, how do I use that? I suppose they lie it up every time you turn the thing, but that is not a normal thing to click on to change. I suppose I can figure it out but it would take a while, and I am very impatient”.

This excerpt from one of the user tests shows a typical problem of user unfamiliarity with the Web site ontology. The semiotic unit makes use of signs (i.e. images and labels) meaningful for users accustomed with the website, but difficult to typical visitors of the museum.

Page considered = Artwork Web page

User 2 Profile:

Museum’s world familiarity = medium

Art’s world familiarity = high

SfMoMA's familiarity = low
Internet familiarity = medium
Web domain = medium
SFMoMA Web site = low

Observer: "What does it mean to you 'Architecture+Design'?"

Visitor: "Well, the architecture of the museum [...] Maybe there is a special unit of other things about architecture, I do not know that, but I know that the architecture of the museum is important, so maybe there is something about that in the museum." See ❷ in figure 27.

In this case the visitor wrongly interpreted the semiotic unit assuming that the link would give information about the museum's building. Indeed, it takes the user to the list of selected artworks of the Architecture+Design collection. The causes of such misunderstanding are due to the ambiguous relation of the semiotic unit with other semiotic units on the page: the visitor could not guess that the link refers to the list of the SFMoMA permanent collections.

In many other problems emerged during testing and detected by W-SIDE inspection, visitors had problems in correctly interpreting these semiotic units, mainly because the Web site does not clarify if terms like "architecture+design", "sculpture", "photography" refer to a topic ontology - i.e. refer to artistic disciplines/subjects - or refer to interlocutor ontology - being the names of the SFMoMA curatorial departments. They wondered why the museum chose such categories for letting users find artworks and which was the purpose.

Page considered = Collections Main page

User 3 Profile:

Museum's world familiarity = high
Art's world familiarity = high
SF-MoMA's familiarity = low
Internet familiarity = medium
Web domain = low
SFMoMA Web site = low

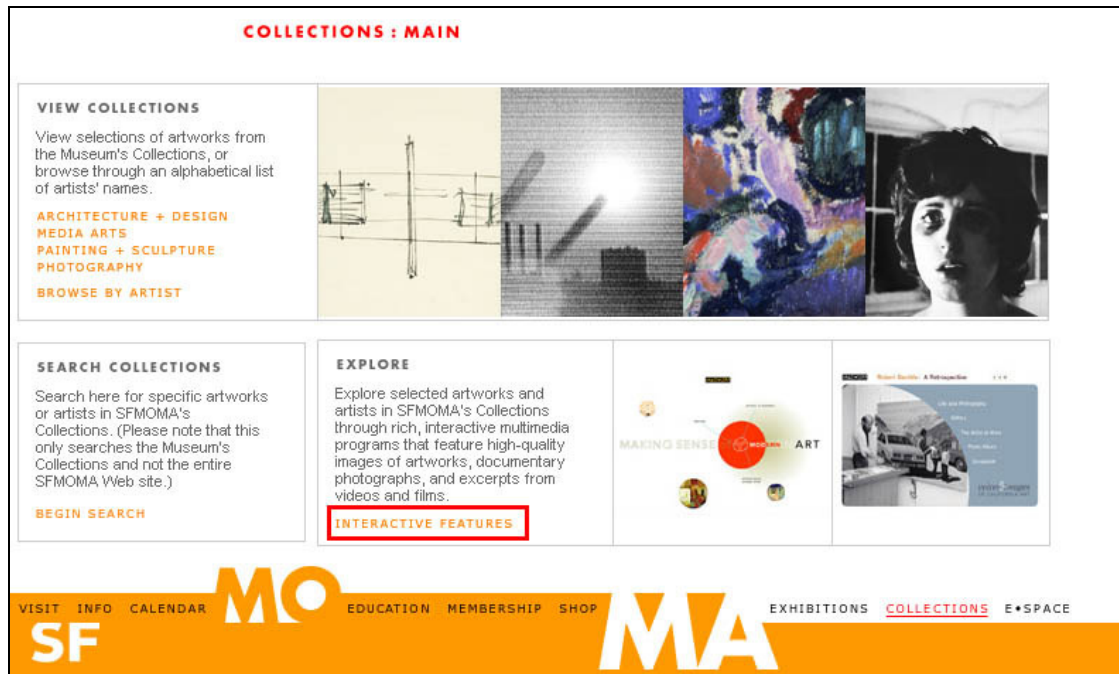


Figure 27. Screen-shot showing examples of detected problems at the SFMoMA

Observer: “What does it mean to you Interactive Features?”

Visitor: “Interactive features, I don’t know, probably links to other Web sites or pages within this Web site, with some examples of contemporary art made with new media”.

Very often users do not understand interface elements not because they are not familiar with the topic ontology (i.e. art or modern art) but because they have little knowledge about the Interlocutor ontology, that is, about the museum as institution and the concepts underlying it. In fact, often museums make use of terms and concepts shared and well known within the museum but obscure to visitors and people having no familiarity with the type of institution “museum”. In the SFMoMA Web site many visitors could not understand the meaning of “Interactive features”, which is a well known and used term among people working in the museum. Visitors could guess that it was something dealing interactive “things”, but few understood that it provides a deepening about particular topics and that by clicking on it they could learn and find rich-media information.

Another common general problem was the conflict between Interlocutor and Web site ontology. There was often a misunderstanding about the difference between the “real world” and the one modeled by the Web site. For example, very few visitors understood that the artworks in the on-line collection are just a selection of all the artworks owned by the museum. They believed that the on-line collection corresponds to the real collection, and if they do not find an artwork or an artist on the museum’s Web site, they assume that the museum does not have it. Museum Web sites often do not make this difference clear and explicit to the user.

4.4 W-SIDE Cost-Effectiveness

W-SIDE Inspection is a quite efficient method since it refers to conceptual design models and focus the analysis only on the kinds of pages giving shape to the whole website instead of analyzing each single page. The evaluation activity revealed that an average of the efforts needed for analyzing and evaluating web interfaces can be so summarized:

Activity	Object Under Analysis	Man/Hour
Web Site Modelling	Whole web site	$\frac{1}{2}$ to 2
Syntactic Evaluation	Kind of page	$\frac{1}{4}$ to $\frac{1}{2}$
	All kinds of pages (evaluating consistency)	$\frac{1}{2}$ to 1
Semantic Evaluation	Kind of page/N user profiles	$\frac{1}{2} + 2\text{Log}_n$

Table 12. W-SIDE Cost-Effectiveness

The identification of the kinds of pages composing the website, depending on the complexity of the application, takes from $\frac{1}{2}$ to 2 hours. In a quite complex but well structured web site the kinds of pages composing it are usually between 10 and 20. The syntactic evaluation, considering also the needed time for keeping track and reporting the detected problems, usually never takes more than $\frac{1}{2}$ hour per page. However, the efforts can range depending on the complexity of the web page (very complex pages like for example Amazon homepage would obviously take more time for being analyzed). As regards evaluating among the kinds of pages, it usually takes no more than 1 hour. Semantic evaluation is the most complex activity and takes about $\frac{1}{2}$ hour per page considering 1 user profile. The subsequent analysis on the same page considering other profiles requires a

decreasing effort: after having analyzed the page visioning a user profile the inspector already modeled the conceptual and functional semantics and gained sensibility on potential misunderstanding problems. The subsequent analysis on the same page require much less time.

5 Conclusions

The quality of web applications may be improved by paying particular attention to the semiotic analysis of their interfaces, where strategic issues are considered. W-SIDE is a user-centered semiotic framework aimed at analyzing the language of web interfaces and evaluating its comprehension by critic user profiles. W-SIDE represents a useful conceptual tool supporting web interface design and evaluation, by making experts aware of potential user misunderstandings caused by a gap between the knowledge presupposed by web signs and the one owned by targeted users. The framework has been developed and constantly improved through refinements gathered while using it in project experiences and by considering feedbacks from experts from both the linguistic/semiotic field and the hypermedia design field.

5.1 Scientific Key Contributions

W-SIDE is the first semiotic framework aimed at analyzing and evaluating the user's understanding of web signs. W-SIDE model makes designers and analysts aware of the interpretation process of web signs and how their meaning is given by many factors. W-SIDE model is a step forward also for making scientists more aware of the synergies between Linguistics/Semiotic theories and HCI field. The attempt to reinterpret current linguistic theories and observe how they can be used in other domains and for other media opens new challenging questions in both research fields. As far as semiotics is concerned, the novelty of this approach lays in the analysis of the functional/interactive meaning since, traditionally, semiotic studies have much focused on the conceptual/content meaning. As far as Web sites are concerned, the novelty lays more on the conceptual/content meaning, since the functional meaning has already received a great deal of attention. In fact, several approaches to usability, including Nielsen [Nielsen, 1999] and Brinck [Brinck, 2002] for example, focused upon the functional meaning (conventionality of the navigation behavior, its comprehensibility, its learnability, etc.).

Moreover, W-SIDE Framework proposes a challenging model not only for the HCI field but also for the Linguistics/Semiotics field. The use of ontologies for modeling the presupposed knowledge of a sign could be extended to the analysis of any kind of sign and

new interesting research stream could raise. As an example, W-SIDE can model the presupposed knowledge staying behind a traditional and common *panel sign* just like it can model a *web sign*.

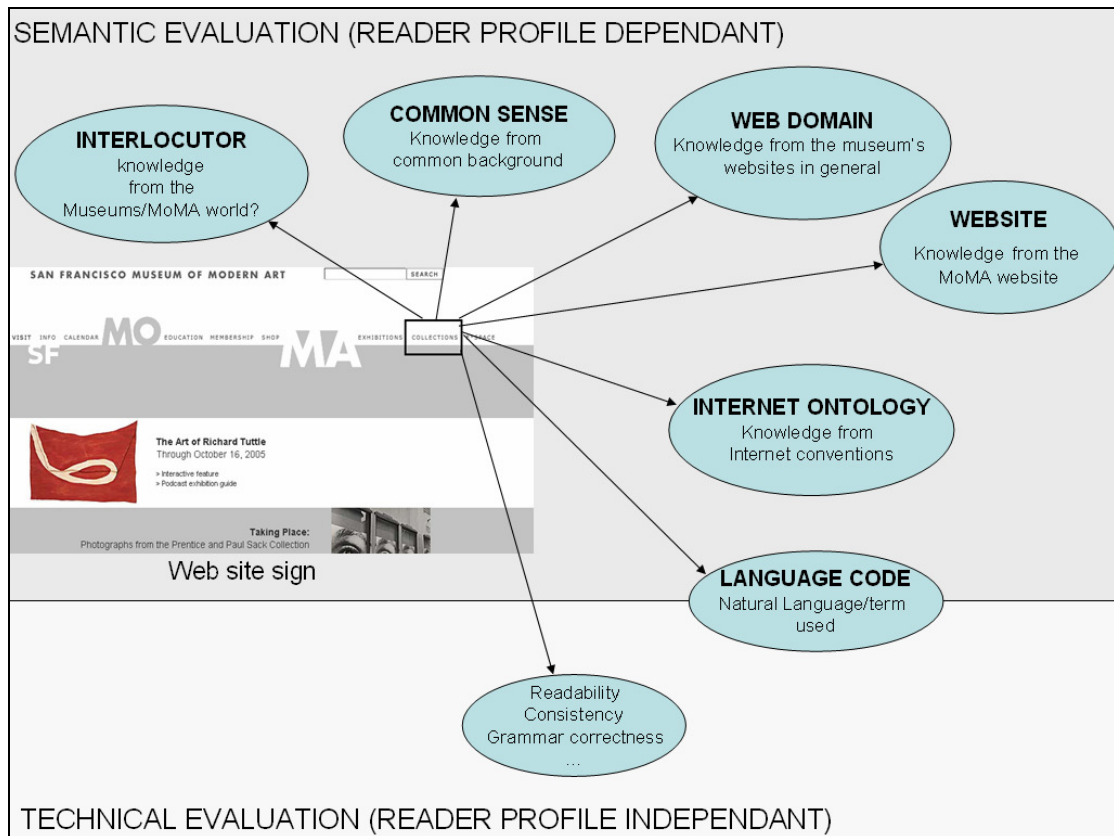


Figure 28. W-SIDE applied to the analysis of a web sign

As chapter 3 already exposed, a web sign can for example refer to the InterLocutor ontology, to Common Sense Ontology, to the Internet Ontology, etc. Moreover, the sign-label makes use of a particular language code and it should follow some generic syntactic/structural rules like consistency, readability, etc. in order to be understood by users (see figure 28).

In the analysis of a common panel sign at the entrance of the UCLA university the same set of ontologies can be used (see figure 29). In order to understand the panel, a reader should be familiar with the InterLocutor Ontology (with the university/UCLA world and for example the concept of “Human Resources Dep”), the Common Sense Ontology (for

understanding terms like “3rd Floor”), the panels ontology in general, with their common symbols, icons, etc. (comparable to Internet Ontology) , the UCLA panels ontology, with its ad-hoc symbols, icons, etc. (comparable to the Web Site ontology). Moreover, the panel makes use of a specific natural language and should follow some syntactic/structural rules like consistency, readability, etc. in order to be understood by users.

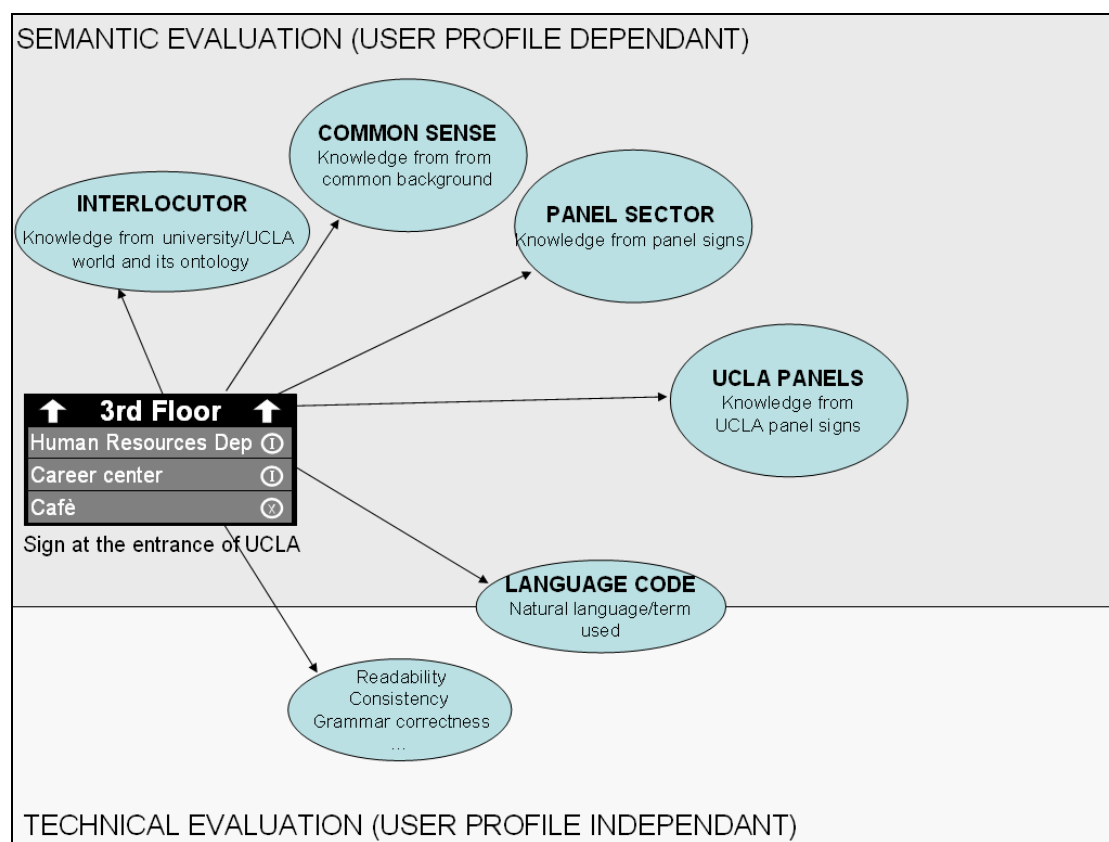


Figure 29. W-SIDE applied to the analysis of a traditional sign

W-SIDE is a fertile framework that could be easily adapted for proposing new hints in the analysis of traditional signs and in particular in modeling the presupposed knowledge and its influences in the user’s understanding process.

5.2 Usefulness of W-SIDE

W-SIDE Framework may be used by analysts, evaluators and designers to deliver comprehensible web interfaces while striving to define the most comprehensible *language* with respect to different user profiles.

W-SIDE Model enables to model the knowledge presupposed by interface elements and their functional meaning within the interactive dialogue with the user. W-SIDE also enables to model the different user profiles representing the target audience of the site, taking into account their own knowledge with respect to the one presupposed by the website. W-SIDE Evaluation Technique allows an in-depth evaluation of the structure and semantics of web interfaces, detecting potential misunderstandings due to the gap between user knowledge and the one presupposed by the website.

Regardless of W-SIDE contribution to interface design, in the overall lifecycle of a web application W-SIDE provides direct and indirect benefits also to the following activities:

5.2.1 Requirements Analysis

Requirements capture is an important part of all software engineering methodologies but often this activity focuses primarily on functional requirements of the system – what the system must be able to do – with less emphasis on non-functional human issues such as usability and communicability.

W-SIDE enables the definition of simplified user profiles by modeling the knowledge that targeted audience can master. This could lead to the definition of language/interface requirements, which is a new dimension in current taxonomies used to classify hypermedia requirements¹⁸. Semiotic requirements are not about the functionality of the system but about its communicative features and in particular about the language that the application should use with respect to visioned users. As an example, a museum website devoted to kids should make use of a particular interface language. A semiotic requirement could be: “use as common sense ontology the one typical of the kids generation” or “translate interlocutor concepts in common sense concepts”. Interface requirements are not

¹⁸ See [Bolchini, 2003b] for a taxonomy of hypermedia requirements.

only related to look&feel and layout issues, but should also identify semiotic cues for leading interface design choices with respect to the particular user target/s considered.

5.2.2 From Conceptual to Interface Design

There is an existent and well-known gap between the activity of conceptual design and the activity of translating design choices in interface elements. During conceptual design designers pay attention to the structure of the application and not to the language to be used in order to communicate that to the user. If in conceptual design experts settle that some content should be structured through a guided tour, in the interface design experts should find the best strategies (i.e. the best set of signs) in order to communicate the content and that navigation strategy to the user. W-SIDE can support conceptual and interface design and facilitate a bridge among them.

In conceptual design, W-SIDE heuristics can work as design guidelines: criteria used for evaluating the clarity of semiotic units are also useful criteria to keep in mind while designing the application. W-SIDE makes designers more sensible in providing content explaining the interface, its content and its functional semantics. As regards content semantics, designers should wonder which knowledge can be given for granted and which one should be considered as new knowledge to be explained and communicated. Designers, keeping in mind semiotic user profiles, can design interface elements paying attention to make the content semantics as clearer as possible and, if the case, provide content explaining it. As an example, if a website is devoted to users having few knowledge about InterLocutor ontology conceptual designers should consider this factor and plan the existence of content (through tool-tips, small boxes, etc.) explaining new terms and concepts.

As regards functional semantics, W-SIDE refers to concepts belonging to already existent hypermedia design techniques (IDM, W2000, HDM). This facilitates the creation of a bridge between design concepts and how translate them in interface elements. As an example, during the conceptual design of a museum website experts decided to create a “collection” page, which in IDM terms is a *group of topics* page, that is, a page proposing a list of topics (artworks) that the user can click on. By using W-SIDE framework, interface designers pay attention to make clear the dialogic function of the page and, consequently, of the link letting the user reach it, by naming the link not just “collection” but “browse the collection”, suggesting to the user that by clicking on the link s/he can reach a list of artworks to click on. This label explicates the functional semantics of the link and in particular makes clearer its dialogic purpose.

Indirectly, W-SIDE framework can also make arise other design guidelines going beyond simple user's understanding but also supporting interface efficiency. An example of first preliminary interface design guidelines are:

- In a list of semiotic units (i.e. in a list of links), do not mix the ones referring to different ontologies, but group them with respect to the particular ontology they refer to. This should facilitate user scanning activity;
- Group and separate navigational semiotic units with respect to their dialogic function – i.e. separate links providing additional content from the ones providing a topic switch, from the ones being landmarks, etc.
- Make clear the difference between semiotic units with respect to their interactive purpose – i.e. semiotic units having consultation purpose should look differently from the ones having navigation purpose, etc.

Obviously, such guidelines need validation through empirical case studies, but the fact that they derive from problems detected in the evaluation activity makes them quite reliable.

5.2.3 Interface Evaluation

W-SIDE Evaluation Technique is devoted to the evaluation of the interface language and in particular to its understanding by the website audience. Current evaluation methods (all of them) consider the language of the website a very important aspect but very often they evaluate it blending other dimensions, causing confusion in the analysis. Interface evaluation is very often goal-oriented and focus on the efficiency and effectiveness of the interface giving often for granted its understanding by users. W-SIDE focuses on the user's understanding, paying particular attention to the understanding of the linguistic meaning of web signs, which is the first step towards user satisfaction and should be used as a complement to current goal-oriented evaluation methods.

5.3 Enhancements and Future Works

W-SIDE Framework has been tested considering information-intensive applications related to cultural heritage and education sector. A deeper evaluation should consider other information-intensive families of applications like for example e-government, where the knowledge presupposed by the website is very often misaligned with the one owned by users. A deep study about the ontologies involved in e-government sector and how communicate them to users and citizens would be a challenging and socially useful study.

Moreover, more feedbacks from the industrial field would be needed: W-SIDE proposes a quite new discipline and therefore its use would require new resources, new skilled people and a shift in the actual design and evaluation workflow adopted by web practitioners.

5.3.1 Intercultural Dimensions

The empirical activity upon which W-SIDE Framework has been refined and validated did not consider intercultural dimensions and did not observe how the same sign-vehicle used on a web interface could refer to a different concept and have a different semantics with respect to the culture considered. In fact, obviously, what belongs to common background depends upon the cultural environment: what is Medieval period in occidental countries has a different meaning for oriental cultures and corresponds to different historical events. Moreover, colors, symbols, shapes can drastically change their semantics with respect to the culture/country considered. In a semiotic model aimed at analysing the semantics of web interfaces intercultural dimensions would need a deeper analysis. As regards content semantics, W-SIDE could be supported by already existent studies regarding intercultural communication [Martin, 2003] and how traditions and beliefs can drastically influence the interpretation of “signs”. However, ad-hoc empirical studies should be carried on with respect to particular sectors/domain (i.e. museum sector), in order to detect a list of misunderstandings caused by cultural origins.

As regards functional semantics and how different cultures interpret the interactive paradigm of websites, very few studies have been carried on [Walton, 2003]. Empirical activities involving user profiles having different cultural background should be considered, in order to observe if the functional language used for managing the interactive dialogue

with a web site is really comprehensible and suitable for all cultures or if some misunderstanding can arise.

5.3.2 Diachronic Modeling of Knowledge

An indirect result of W-SIDE Model is the ability to give, even though in a primitive way, a diachronic perspective of the process of *knowledge exchange* among the ontologies with the advent of the new technologies. As an example, terms and concepts coined years ago on a particular website have been borrowed and reused on other similar websites, thus shifting their ownership from *website ontology* to a broader and more shared knowledge belonging to *web domain ontology*. Similarly, from web domain ontology terms and concepts were further used on other websites and contexts, shifting their ownership from web domain ontology to the more generic *Internet ontology*. Then, some concepts started being used in everyday life and in different context, shifting from internet to *common sense ontology*. As an example (see figure 30), the concept and metaphor of “shopping bag” probably started as website ontology (i.e. somebody used the metaphor and coined its use for e-commerce functionality) and other e-commerce websites borrowed the metaphor (web domain ontology) until it became a concept well known and shared in the more generic Internet Ontology, and then, step-by-step, it is/will be a common concept belonging to everyday life and then belonging to common sense ontology (just think to concepts like *download*, *zip*, *homepage*, etc. which are naturally used in everyday conversations).

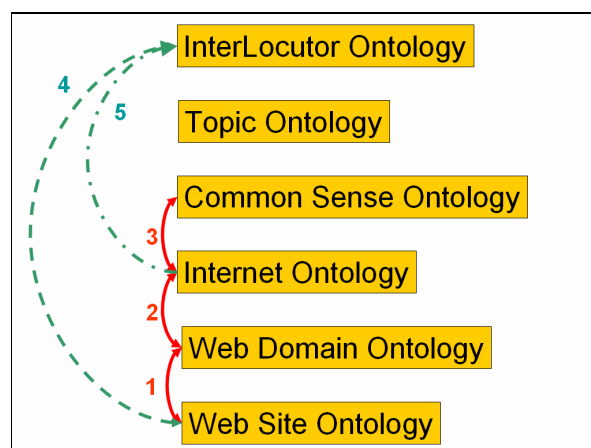


Figure 30. Diachronic perspective of knowledge creation

The figure stresses that in the definition of a new communicative tool the flux of knowledge is bidirectional: a website obviously grasps knowledge from the real world, but creates also new knowledge (new concepts/terms/symbols) that in a more or less short period becomes common knowledge that people refer to in contexts and conversions going beyond the boundaries of the interactive dialogue with the application.

5.3.3 Ontologies and Interpretation Process

One of the indirect results grasped from the empirical activity and in particular from the observation of real users is the identification of a common pattern that users follow while interpreting web signs. It should be strongly emphasised that such pattern is not confirmed through a great corpus of data and statistic analysis, but is only a personal and shared insight of the experts while observing users interpreting web signs.

It seems that users start interpreting a web sign considering and referring to the most sophisticated sets of knowledge and only if they are not familiar with them they rely on the more common and shared ones.

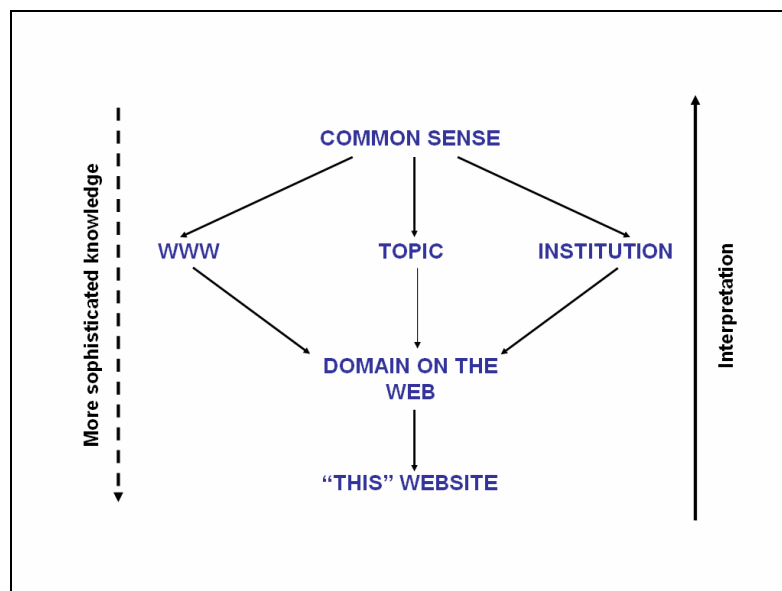


Figure 31. Sophistication of ontologies in the interpretation process

When a user tries to interpret a web sign and is familiar with the website ontology, s/he refers to that in order to guess the meaning of the sign (see figure 31); if s/he has no knowledge about the website but some knowledge about the web domain ontology s/he skips the website ontology and refers to that; if s/he has no knowledge about both the website and the web domain ontology then s/he refers to her/his knowledge about the Internet, Topic and Institution Ontology; finally, if it is the case in which the user has no knowledge about all these ontologies s/he just relies on her/his common sense and knowledge while interpreting the web sign.

In other words, it seems that users give a lot of confidence to the website and to the work of the designers, believing that they made a good job and that it is a good choice to rely on sophisticated ontologies in order to understand web signs. Such an impression raised during user observation since it happened very often that a user misunderstood a web sign because s/he firstly referred to the web site ontology or a sophisticated ontology in order to interpret it and then s/he realised that actually there was no relation with that ontology.

Currently, the pattern identified seems to be confirmed also by other experts in the field that attended with interest the presentation of such insight during international conferences. However, a deeper quantitative analysis would be needed for real validation.

5.3.4 User-Stakeholder Satisfaction and Interface Efficiency

W-SIDE Model focuses on *interface understanding*, not on *interface effectiveness* or *efficiency* with respect to a particular goal or motivation. Interface understanding is the first step towards user satisfaction, but it is obviously not sufficient: interface should also facilitate the user to find quickly the information s/he is looking for. Even if the semantics is clear, semiotic unit could be badly designed with respect to user goals. As an example, a semiotic unit could not jump to the user (problem with the semiotic unit's visibility), or the web page could be too complex for letting her/him find easily what s/he is looking for (overload of information), or, in a group of topic page (list of items), the information given for each items is not enough for letting the user make a well-reasoned choice (sign effectiveness).

There is always a motivation staying behind any singular user action: the user clicks on a link because s/he could be interested about the proposed topic, or just because that topic let her/him reach another topic, or because s/he is bored about the current page, or because s/he did not understand something, or because s/he wants to recall something. There is always a more or less clear motivation leading the user to start a dialogue with a website.

W-SIDE model could be supported by other heuristics aimed at evaluating interface effectiveness and efficiency with respect to user goals and motivations. Already existent Inspection Methods like MiLE [Triacca, 2003a] make use of predefined heuristics aimed at evaluating the effectiveness of the interface with respect to user goals. Such heuristics could be integrated in W-SIDE Framework in order to evaluate not only the user's understanding of the semiotic units but also their effectiveness and efficiency.

Moreover, very often designers create signs as a strategy for satisfying stakeholder goals. Even doubtful labels are intentionally designed for creating curiosity in the user or for conveying particular moods or feelings [Bernstein, 2000]. Web Semiotic Units and the overall interface are designed also for persuading the user and stimulating particular user actions. The position, the size, the shape, the linguistic label can be designed considering stakeholders goals rather than just user goals. As an example, on the website of the Cleveland Museum of Art one of the main goals of the museum is to make the user aware that the permanent collections of the museum are currently closed for their renovation and expansion project. User observation proves that very few users get this important message while navigating the homepage, probably because of a bad design of the semiotic unit, i.e. its shape, its position, etc. This is a problem of semiotic unit's perception and visibility rather than comprehension. As introduced in chapter 2, there are some studies related to Cognitive Engineering and focused on interface effectiveness to communicate messages. W-SIDE could be integrated or integrate such approaches in the analysis of the interface language, evaluating both its comprehension and its effectiveness/efficiency with respect to users and stakeholders' goals.

5.3.5 Higher-Level Semiotic Analysis

The semantics of a website can be analyzed at different levels. W-SIDE Model analyses the semantics staying behind semiotic units, but do not analyze, at least not directly, the semantics of a whole webpage that, in some terms, could be considered as a single complex sign. Understanding single semiotic units does not necessary means understanding a whole webpage or a web session: even if semiotic units are correctly interpreted by the user, the consultation of a web page involves a higher level of interpretation. Even if each single semiotic unit composing a website is potentially comprehensible by a user, s/he will obviously try to focus only on some of them. The user should first of all understand how to accomplish simple tasks like “understand the reading strategy and how read the content” or “quickly understand where s/he is in the website

structure” or “quickly understand how navigate towards content related to the one proposed in the current page”. Such analysis is a higher-level semiotic analysis related to interface efficiency: giving for granted that each semiotic unit is correctly interpreted by a user the analysis evaluates if the interface efficiently proposes them and let the user quickly accomplish common tasks. W-SIDE indirectly can already support such analysis: the W-SIDE taxonomies¹⁹ regarding possible interactive and dialogic functions of semiotic units can be reused for defining micro-tasks to be accomplished on a page and check interface efficiency. As regards *interactive* tasks users could be asked to accomplish tasks “towards orientation” (understand where they are in the website), towards consultation (understand what the page is talking about) and towards navigation. As regards *dialogic* tasks, users could be asked to accomplish tasks like “where would you click if you like to have more information about the current topic?” (i.e. find *additional topic content* link/s) or “where would you click if you want to go back to previous content” (i.e. find *previous topic/group of topics* link/s) or “where would you click if you want to browse the category in which you are” (i.e. find related *group of topics* link/s). Such micro-tasks help inspectors understand the efficiency of web interfaces with respect to common actions that users very often try to accomplish while interpreting a web page.

5.3.6 User Scenarios and Multichannel Applications

The interaction with hypermedia applications can be very different with respect to user physical limitations, whether they are real or given by the particular context in which the application is being used. Visually impaired users interact with a website in a very different way with respect to a user that can rely on visual support. At the same time, a sighted user interacting with a website while walking or driving a car – that is, in a special context – has similar physical limitations (s/he cannot look at the screen). In such contexts, the process and the elements needed for understanding the interface are very different with respect to a traditional interaction.

W-SIDE Framework has been tested considering interactions with no limitation except for the ones typical of the hypermedia/web channel in general. However, the framework could be extended considering the interaction in particular contexts or for particular users: physical limitation can highly influence the dialogue understanding.

¹⁹ See section 3.4.4.

The table below shows an example of relation between an uncommon user profile and the corresponding semiotic analysis.

		USER PROFILE	WEB INTERFACE	UNDERSTANDING
		PHISICAL LIMITATIONS	PARADIGM SHIFT	INVOLVED KNOWLEDGE
SEMIOTIC DIMENSIONS	SYNTACTICS	VISUAL LIMITATIONS	FROM GRAPHICAL TO LINGUISTIC ELEMENTS	SCREEN-READER ONTOLOGY
	CONTENT SEMANTICS	VISUAL LIMITATIONS	FROM GRAPHICAL TO LINGUISTIC ELEMENTS	ALL ONTOLOGIES
	FUNCTIONAL SEMANTICS	VISUAL LIMITATIONS	FROM GRAPHICAL TO LINGUISTIC ELEMENTS	INTERNET ONTOLOGY, SCREEN-READER ONTOLOGY, WEBSITE ONTOLOGY, WEB SECTOR ONTOLOGY

Table 13. Example of a semiotic scenario from visual to oral-based interaction

If we consider a user interacting with a hypermedia application having no possibility to look at the screen (i.e. visual impaired users or users in particular contexts), s/he makes use of a screen-reader, that is, a software that “reads” through a synthesized voice the content on the page and inform the user when a content has an interactive purpose²⁰. In such a scenario, the understanding of the interface requires a different analysis because the interaction paradigm has been highly modified: it does not rely on visual aids and everything is “told” through an oral channel. Even if the concepts that the semiotic units refers to are the same, the way they are shown to the user is totally different. This means that the process for understanding the syntactics and the semantics relies on different elements. The spatial position, the size, the color, the shape, conveying the content and functional semantics are missing in the shift to an oral and sequential channel. This means for example that such semantics must be explicated through linguistic elements instead of graphic elements.

Within the Help Project²¹ – a EU-funded research project aimed at defining new design methodologies for developing websites optimized for visually impaired users – many interesting results regarding interface design were found, and W-SIDE has been refined considering them, since such design guidelines proved to be very useful for any kind of user [Speroni, 2003]. As an example, one of the guidelines suggested to group links with respect to their kind of destination (very similar to the W-SIDE dialogic function) so that, in an oral interaction, the user could skip the group of links s/he was not interested in. In fact, one of the problem regarding oral-interaction is that the links are “read” sequentially and therefore

²⁰ For more information about screen-readers, visit W3C Consortium website: <http://www.w3.org/WAI/EO/Drafts/PWD-Use-Web/>.

²¹ For more information about the project, visit <http://www.munchundberlin.org>.

it is quite frustrating listen to all of them without having the possibility to skip the groups/categories the user is not interested in. Such guideline can be applied also to a traditional interaction, helping user understand the dialogic function of a link and also supporting interface efficiency. W-SIDE could be extended to the analysis of web interfaces used in particular context or by particular users, finding fruitful results for designing web interfaces in general, both in their reinterpretation through an oral channel and in a traditional visual-based interaction.

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Annex I

SFMoMA Website Evaluation

W-SIDE at Work

Marco Speroni © February 2006

Abstract

An excerpt of the evaluation of the SFMoMA website through W-SIDE Inspection Method is given, reporting the very simple survey used for screening user profiles, an example of user profile considered in the evaluation and the corresponding results.

W-SIDE SCREENING

SFMoMA Website

VISITOR PROFILE NAME _____

1. How many times did you visit museums or art exhibitions in the last 6 months?

Never	At least 1	More than 5
-------	------------	-------------

2. Your education level?

3. Your profession?

4. Did you already visit any gallery in the SFMoMA museum? If yes, which one?

5. How many times did you access museum websites in the last month?

Never	At least 1	More than 5
-------	------------	-------------

Can you remember some websites?

6. How familiar are you with the SFMoMA website?

Never used	At least 1	More than 5
------------	------------	-------------

7. How often do you use internet during the day?

No more than once a week	Few minutes	More than 1 hours
--------------------------	-------------	-------------------

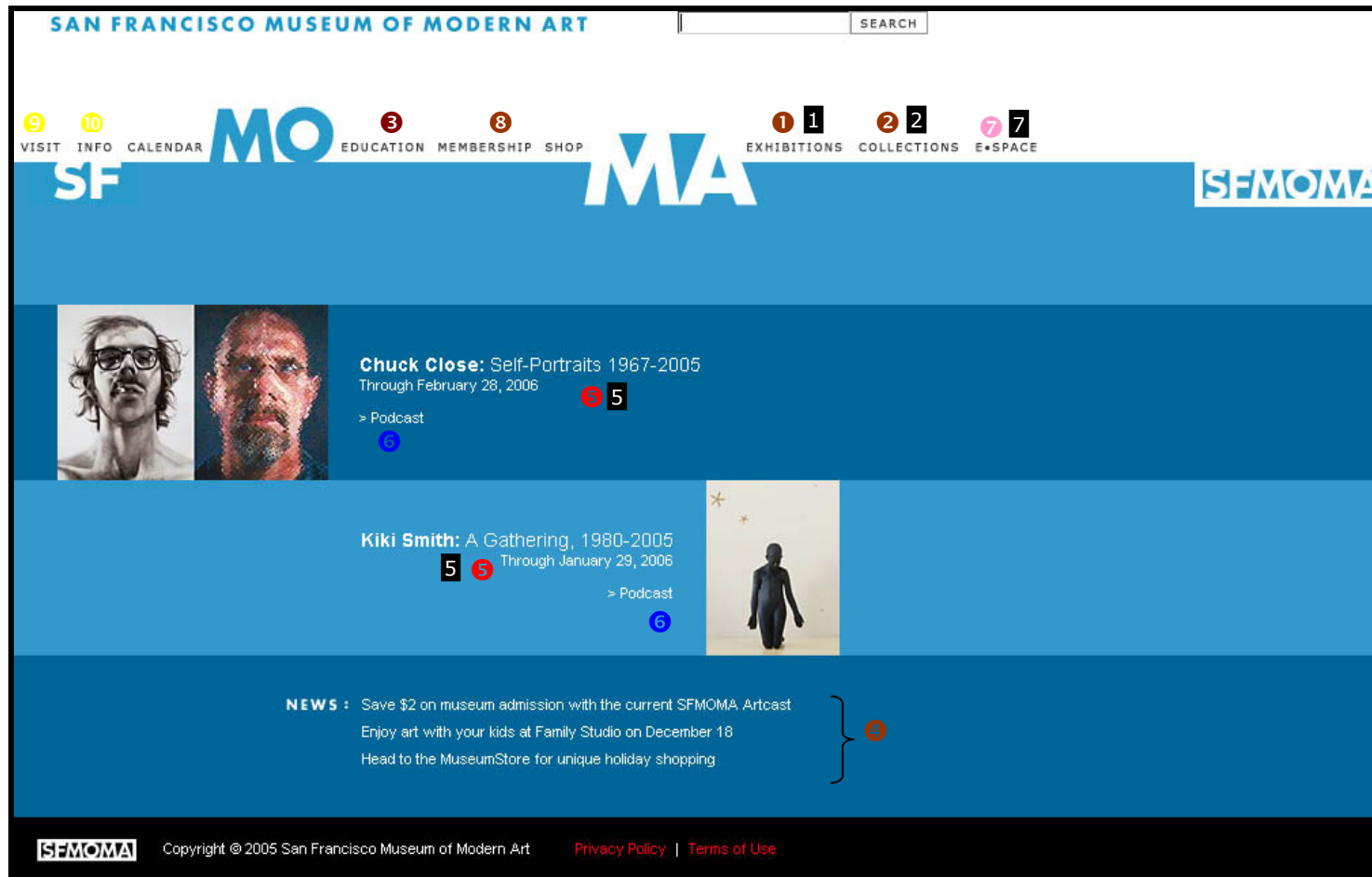
W-SIDE EVALUATION

SFMoMA Website

USER PROFILE 1

KNOWLEDGE	ONTOLOGY	SUB- ONTOLOGY	FAMILIARITY
Interlocutor			
<i>Generic</i>	Museum's world		medium
<i>Specific</i>	SFMoMA		low
Domain			
<i>Generic</i>	Art		medium
<i>Specific</i>	Modern Art		low
Context			
	Education		high
Internet			
	Internet conventions		medium
Web Domain			
	Museum websites		medium
Web site			
	SFMoMA website		low
Common Sense			
	Education background		high

HOME PAGE – P1



CONTENT SEMANTICS EVALUATION	
ONTOLOGY FAMILIARITY	
PROBLEM	COMMENT
① ② ③ ④	Unfamiliar concepts for a user with low knowledge about museums
⑤	Some more information about the topic should be given: a user having no knowledge about these artists cannot understand the kind of art and the subjects proposed.
⑥	Even for expert web surfers, the term could be unknown
⑦	The label is absolutely not intuitive for a first-time user.

ONTOLOGY CONFLICTS	
PROBLEM	COMMENT
⑧	<p>INTERLOCUTOR VS INTERNET</p> <p>A user unfamiliar with museums could guess that membership means to become a member of the website instead of a member of the museum</p>

CONCEPTUAL CONFLICTS	
PROBLEM	COMMENT
⑨ ⑩	<p>WIDENESS</p> <p>The term “info” is too general and the user cannot guess which ontology it refers to and what kind of content is provided.</p> <p>COMPETITIVENESS</p> <p>The user could guess that it refers to general information about the museum (actually it gives information about the website), but it is in conflict with the other semiotic unit “visit”, which should also give information about the museum.</p>

FUNCTIONAL SEMANTICS EVALUATION	
INTERACTIVE FUNCTION CLARITY	

PROBLEM	COMMENT
All links	Apart from the main menu, it is not clear at a first glance which semiotic units have navigational purpose and which not.

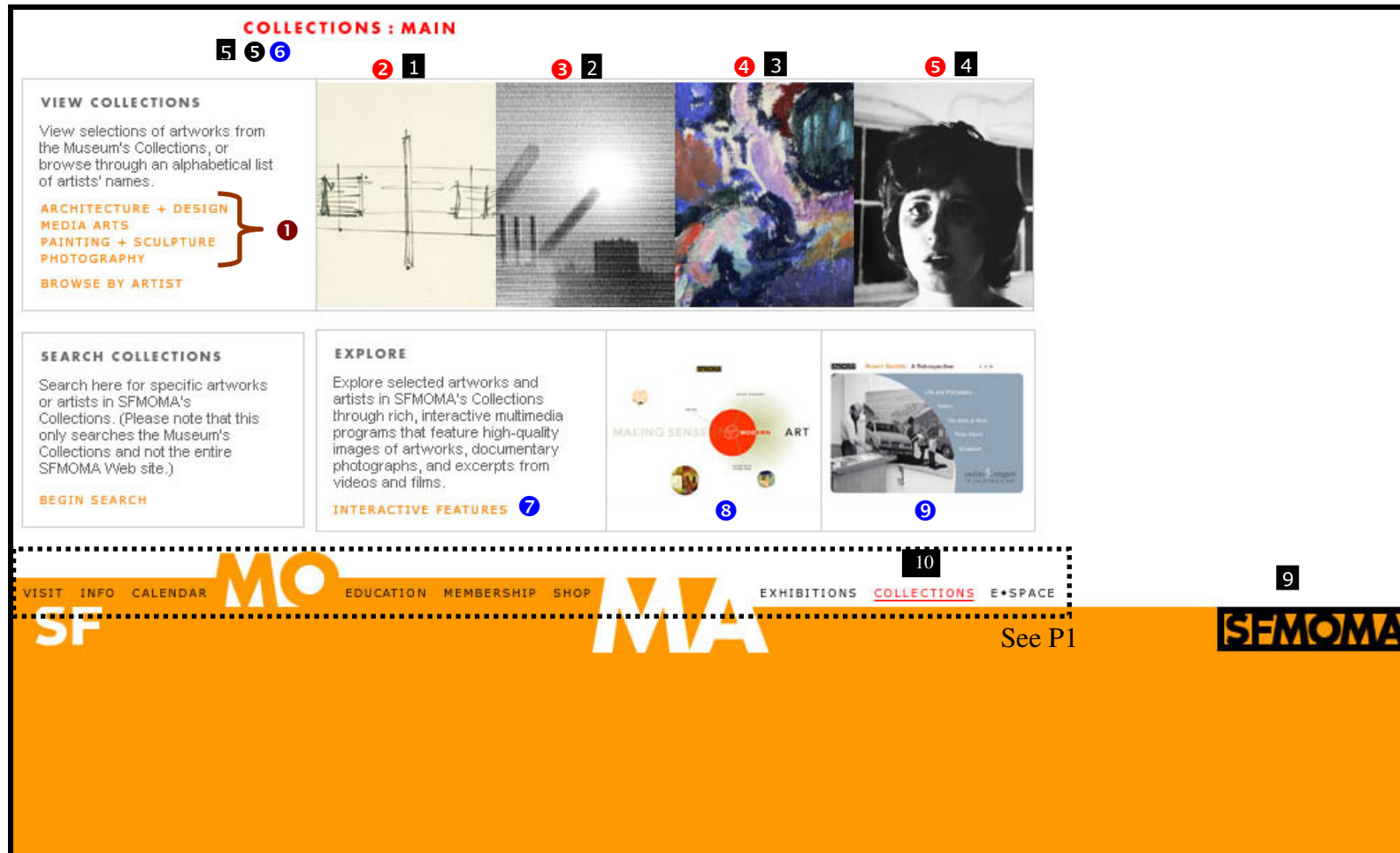
DIALOGIC FUNCTION CLARITY

PROBLEM	COMMENT
1 2 7	It is not clear what kind of content these links refers to: does collection refers to general info about SFMoMA collections or can the user browse them?

DESIGNER'S DEPUTY CLARITY

PROBLEM	COMMENT
5	It is not clear the purpose of these semiotic units within the dialogue with the user: they are two current exhibitions at the museum, but it is not explicated to the user if they are highlights or the only two ones.

COLLECTIONS MAIN PAGE – P2



CONTENT SEMANTICS EVALUATION	
ONTOLOGY FAMILIARITY	
PROBLEM	COMMENT
2 3 4 5	The images are not at all recognizable for a common user.
6 5	The semiotic unit refers to a concept understandable for a user knowing internet conventions and the structure of the website
7 8 9	They refer to the terms and signs created ad-hoc for the website. They are not comprehensible for a common user.

ONTOLOGY CONFLICTS	
PROBLEM	COMMENT
1	INTERLOCUTOR VS INTERNET The user could believe that the categorization is the shared and accepted categorization in the field of art while it is a categorization belonging to the SFMoMA departments. It does not actually refer to artistic disciplines (topic ontology) but follows the museum departments

FUNCTIONAL SEMANTICS EVALUATION	
INTERACTIVE FUNCTION CLARITY	
PROBLEM	COMMENT
5	It is not clear that the semiotic unit has a contextual purpose (i.e. supporting user orientation)
9	It is not clear that the semiotic unit has a navigational purpose (it seems to be a decorative sign).
10	It is not clear that the semiotic unit has a contextual purpose and not a navigational purpose

DIALOGIC FUNCTION CLARITY	
PROBLEM	COMMENT

1 2 3 4	It is not clear what kind of content the linked images bring to. The user would expect to have information about that artwork, but the links take the user to the category that the image represents.
---------	---

COLLECTION OVERVIEW – P3

[TO COLLECTIONS MAIN](#)

COLLECTIONS : ARCHITECTURE + DESIGN

1

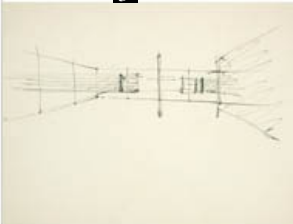
ARCHITECTURE + DESIGN

SFMOMA's architecture and design collection comprises architectural models and drawings, furniture, and other design objects, as well as print work, prototypes, and Web sites. The Department of Architecture + Design focuses on regional, national, and international architecture and design achievements.

VIEW SELECTIONS : [ARCHITECTURE + DESIGN](#)


EXPLORE : [LINDY ROY](#) 2 1

3



Ludwig Mies van der Rohe
Courthouse Perspective
ca. 1931-1940

3



Greg Lynn
Embryologic House (steel model)
1998

[VISIT](#)
[INFO](#)
[CALENDAR](#)

MO

[EDUCATION](#)
[MEMBERSHIP](#)
[SHOP](#)

MA

[EXHIBITIONS](#)
[COLLECTIONS](#)
[E•SPACE](#)

SF

SFMOMA

See P2

CONTENT SEMANTICS EVALUATION	
ONTOLOGY FAMILIARITY	
PROBLEM	COMMENT
1	The user does not know who the artist is.

FUNCTIONAL SEMANTICS EVALUATION	
INTERACTIVE FUNCTION CLARITY	
PROBLEM	COMMENT
1	It is not clear that the semiotic unit has a navigational function beside having a contextual function.

DIALOGIC FUNCTION CLARITY	
PROBLEM	COMMENT
2	It is not clear if the link takes the user to information about the artist, to its artworks or something else.
3	It is not clear if by clicking on the image the user goes directly to information about the artwork, to a bigger image or something else.

COLLECTION - LIST OF ARTWORKS – P4

TO COLLECTIONS MAIN

COLLECTIONS ACCESS ONLINE

1

SF MO MA

3

SEMOMA

See P2

VIEW

ARCHITECTURE + DESIGN

MEDIA ARTS

PAINTING + SCULPTURE

PHOTOGRAPHY

BROWSE BY ARTIST

SEARCH

BEGIN SEARCH 2

EXPLORE

MAKING SENSE OF MODERN ART

Making Sense of Modern Art 1

See this and more interactive multimedia features in the [Explore](#) section of our site.

2

Architecture + Design Selections

Records 1-8 of 14

NEXT> LAST>>

Saul Bass
[Anatomy of a Murder](#), 1959
color lithograph

3

Marco Brambilla
[Getaway](#), 1999-2002
video with sound, custom DVD player, and plastic tray

3

Frank O. Gehry
[Easy Edges Lounge Chair](#), 1972
corrugated cardboard

3

Frank O. Gehry
[Pito Water Kettle](#), 1988-1992
stainless steel and mahogany

3

LOT/EC
[TV-LITE](#), 1997-1998
televisions and mixed media

3

Greg Lynn
[Embryologic House](#) [flat model], 1998
rubber

3

Greg Lynn
[Embryologic House](#) [steel model], 1998

Ingo Maurer
[Willydilly Light](#), 1983

CONTENT SEMANTICS EVALUATION	
ONTOLOGY FAMILIARITY	
PROBLEM	COMMENT
① ②	They both refer to terms and concepts created ad-hoc for the website and they are hardly comprehensible for a first-time user
③	The strategy to make explicit the material used for creating the artwork could be useless and not understandable for a user who is not an art expert.

FUNCTIONAL SEMANTICS EVALUATION	
INTERACTIVE FUNCTION CLARITY	
PROBLEM	COMMENT
①	It is not clear that the semiotic unit has a navigational purpose.
③	The user cannot understand that the semiotic unit has a decorative purpose instead of a navigation purpose (to the HP)

DIALOGIC FUNCTION CLARITY	
PROBLEM	COMMENT
②	It is not clear if the link let the user search within the whole website or just within the collections.

ARTWORK PAGE – P5

[TO COLLECTIONS MAIN](#)
[COLLECTIONS ACCESS ONLINE](#)

See P2

VIEW


[ARCHITECTURE + DESIGN](#)
[MEDIA ARTS](#)
[PAINTING + SCULPTURE](#)
[PHOTOGRAPHY](#)

BROWSE BY ARTIST

SEARCH

BEGIN SEARCH

EXPLORE




[Making Sense of Modern Art](#)

See this and more interactive multimedia features in the [Explore](#) section of our site.

See P3

Record 1 of 14

[Back to list of artworks](#)
[NEXT>](#)
[LAST >>](#)




Saul Bass
American (New York, New York, 1920 - 1996, Los Angeles, California)

Anatomy of a Murder, 1959
41 in. x 27 in. (104.14 cm x 68.58 cm)
color lithograph
Collection SFMOMA
Gift of Jeff Galipeaux
2000.514
© Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn

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CONTENT SEMANTICS EVALUATION	
ONTOLOGY FAMILIARITY	
PROBLEM	COMMENT
❶	The content describing the artwork refers to ILO, it gives data about the artwork as an object within the museum catalogue. They are unclear to the user having no knowledge about museum catalogues.

SEARCH COLLECTIONS PAGE – P6

[TO COLLECTIONS MAIN](#)[COLLECTIONS ACCESS ONLINE](#)

SFMOA

SFMOMA

See P2

VIEW

ARCHITECTURE + DESIGN

MEDIA ARTS

PAINTING + SCULPTURE


PHOTOGRAPHY

BROWSE BY ARTIST

SEARCH

BEGIN SEARCH

EXPLORE



[Making Sense of Modern Art](#)

See this and more interactive multimedia features in the [Explore](#) section of our site.

See P3

Search Collections

See P2

Search here for specific artworks or artists in SFMOMA's Collections. (Please note that this only searches the Museum's Collections and not the entire SFMOMA site.)

Artist:

Enter the artist's **last name** or **last name, first name** (example: Picasso or Picasso, Pablo)

Not sure of spelling? Use [Browse by Artist](#) to find the artist's name in our alphabetical list.

Title:

Medium:

Subject:

SEARCH

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SYNTACTIC CONSISTENCY	
CONTENT SEMANTICS CONSISTENCY	
PROBLEM	COMMENT
Collection categories (p2 vs p6)	The term “Architecture”, “Design”, “Media Arts”, “Painting”, “Sculpture”, “Photography” are used differently within the website: in the “collection section” it refers to the “Architecture+Design” museum department, while in the Search section it is related to architecture as a discipline in general. The user finds that by clicking on the first obtains results that are totally different from the ones obtained by clicking on the second, and the reason is not explained.
FUNCTIONAL SEMANTICS CONSISTENCY	
PROBLEM	COMMENT
Linked images (p2 vs p3)	In the collections overview the images presented as highlights sometimes take the user to a category (p3) while sometimes to the description of the artwork (p4)
WEB SESSION CONSISTENCY	
PROBLEM	COMMENT
“Back to list of artworks” (p5)	The website refers to user actions that could have never been accomplished by the user: the “back to list of artworks” link appears even if the user has never visited that page.

Annex II

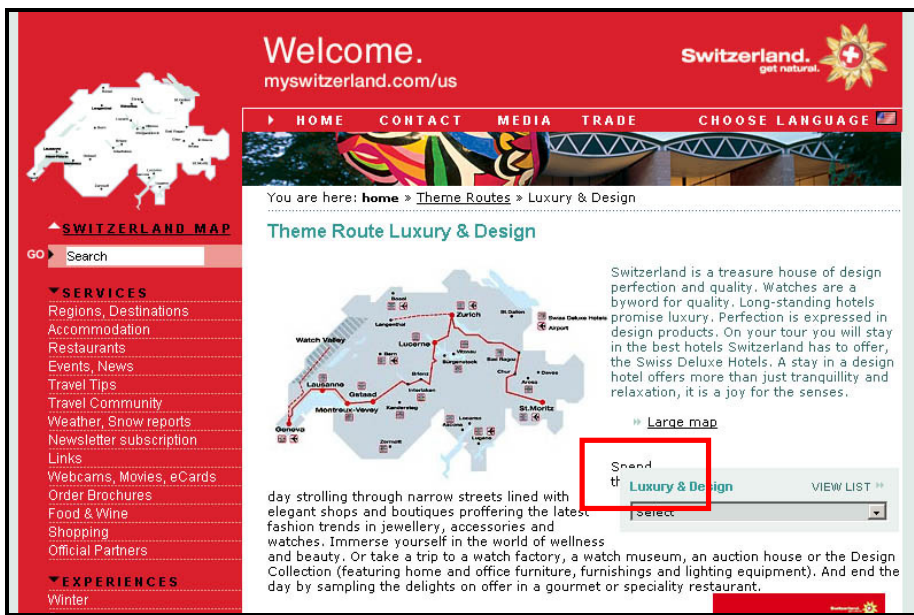
W-SIDE Heuristics

Marco Speroni © February 2006

Abstract

This document explains each W-SIDE heuristics through some examples and provides guidance to how apply the heuristics in the evaluation process.

W-SIDE HEURISTICS – EXAMPLES


SYNTACTICS EVALUATION – USER PROFILE INDEPENDANT	
KIND OF PAGE	
<i>Criteria</i>	Sign Readability
<i>Explanation</i>	The sign-vehicle - that is, the shape of a semiotic unit - should be easily readable in itself by the user. Small fonts, text-background contrast, typing errors, incomplete images are samples of bad readability.
<i>Example</i>	<p>In the example below the drop-down box “Luxury & Design” overlaps a semiotic unit behind it that becomes unreadable.</p>  <p>The screenshot shows the Switzerland Tourism Website. On the left is a red sidebar with a map of Switzerland and a list of services. The main content area has a red header with 'Welcome.' and navigation links. Below the header is a map of Switzerland with a red line indicating a 'Theme Route Luxury & Design'. A drop-down menu is open over the map, showing 'Send to' and 'Luxury & Design'. The menu overlaps the map and text, making some elements unreadable.</p> <p>Switzerland Tourism Website – www.myswitzerland.com</p>
<i>Actions</i>	Check that all the sign-vehicles are readable.
<i>Criteria</i>	Structural Clarity
<i>Explanation</i>	Regardless of the ontology the sign-vehicle refers to, it could be unclear the relation with other sign-vehicles on the page. It should be intuitive to the user the dependence of that sign with other signs on the page in order to let him correctly interpret it as part of a whole/broader semiotic unit.
<i>Example</i>	Because of the position, the small size and the label used (which can have more than one valid meaning) the semiotic unit “società” (“corporation” in

English) can be wrongly interpreted as a structural link (i.e. giving information about Juventus soccer team as corporation) instead of a landmark (a link to the list of all the society in the Italian first league).

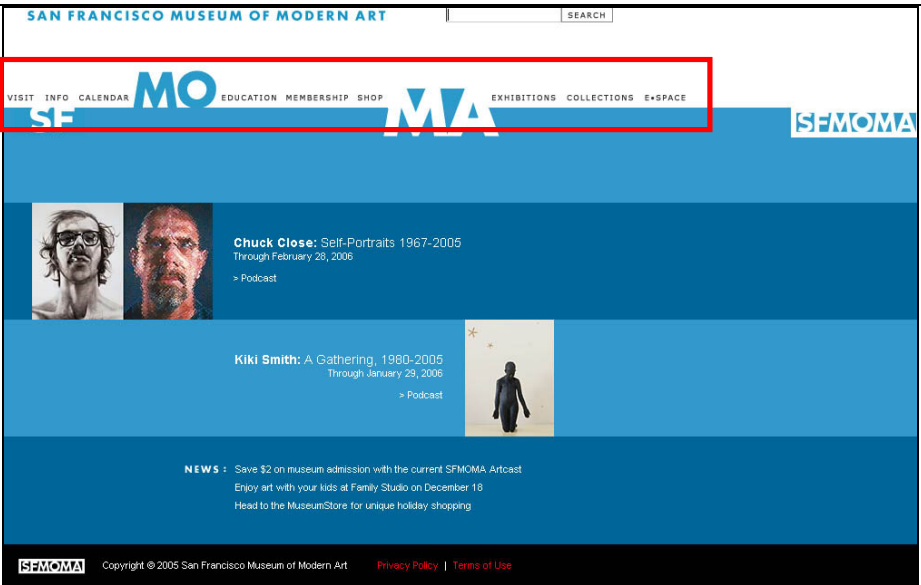
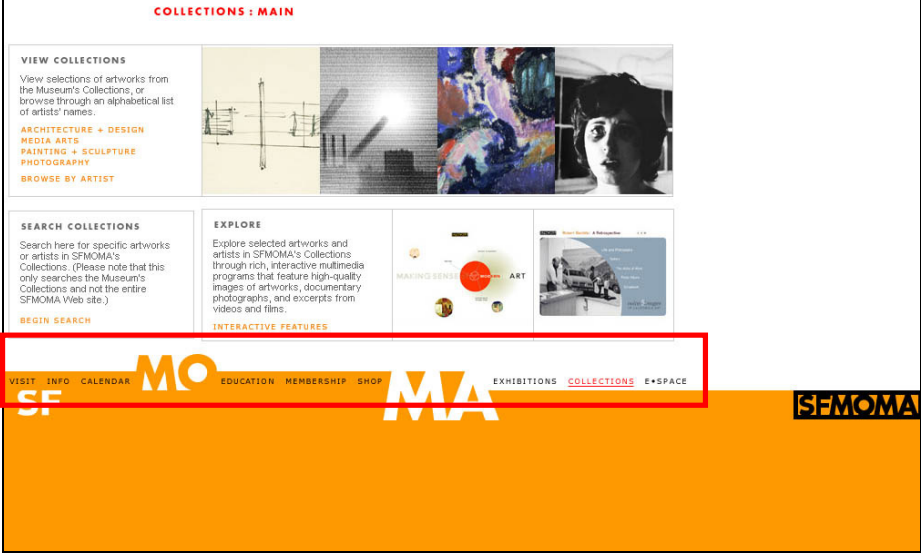


Italian Soccer First League website – www.lega-calcio.it

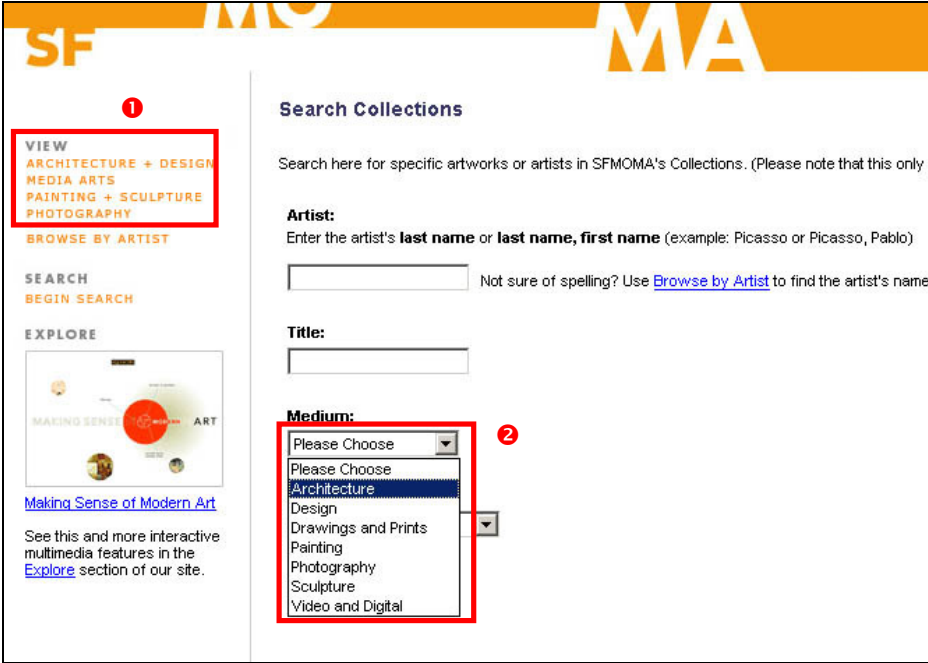
<i>Actions</i>	<p>Independently from a particular user profile:</p> <ul style="list-style-type: none"> - Identify single semiotic units on the page; - For each, find possible related semiotic units considering spatial position, size, color and shape; - Check that the relations among semiotic units are clearly conveyed to the user;
<i>Criteria</i>	Grouping Adequacy
<i>Explanation</i>	Semiotic units composing a single page can be grouped in macro-areas, that is, in groups of semiotic units having a similar meaning, a content relation or satisfying a common goal/functionality. Some semiotic units could be grouped with other semiotic units on the page in a wrong way, thus creating misunderstanding in the user.
<i>Examples</i>	In the example below, the link “Student Exchange Programme” is under the macro-group “Information for current students”. This relation makes the user guess that by clicking on the link s/he will find only information

	<p>devoted to current students, while it gives an overview about the student exchange opportunities, which are very interesting for a potential student too.</p>  <p>University of Lugano website (Faculty of Communication Science) – www-com.unisi.ch</p>
<i>Actions</i>	<p>Independently from a particular user profile:</p> <ul style="list-style-type: none"> - Identify the main macro-areas composing the page (i.e. main menus, secondary menus, content area, etc); - For each, check that the semiotic units graphically part of it have actually a relation with the macro-area

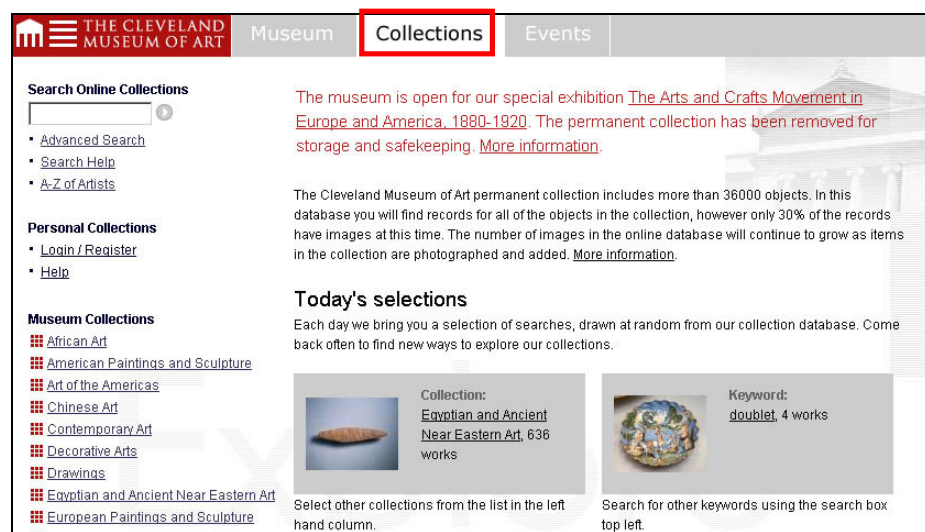
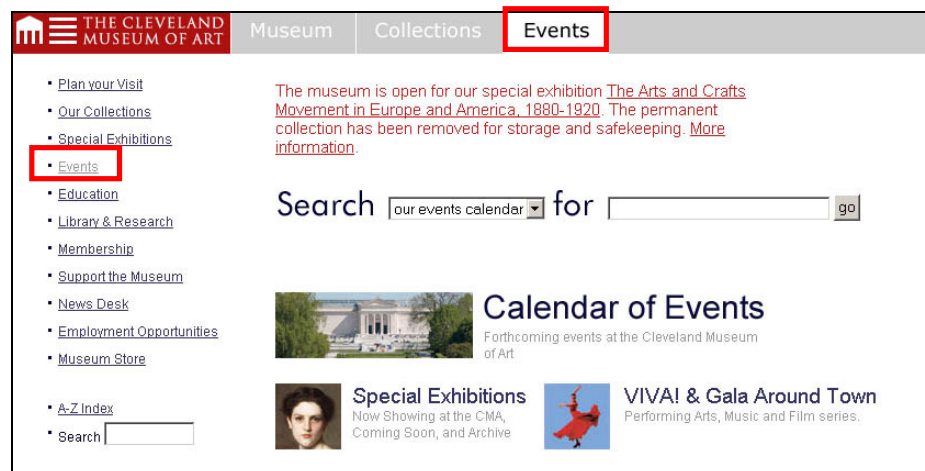
ALL PAGES	
<i>Criteria</i>	Grouping Strategy Consistency
<i>Explanation</i>	The chosen strategy for grouping semiotic units and suggesting the macro-areas composing a web page should be the same in the whole website, otherwise it can badly influence user's understanding and orientation both at single page and web session level.
<i>Example</i>	In the example the main menu on the homepage is positioned above the content, while in the other pages it is below it. This can cause disorientation and misunderstanding in the user of the dialogic function, that is, which links have the function of landmarks.

	 <p>SAN FRANCISCO MUSEUM OF MODERN ART</p> <p>VISIT INFO CALENDAR MO EDUCATION MEMBERSHIP SHOP MA EXHIBITIONS COLLECTIONS E+SPACE</p> <p>Chuck Close: Self-Portraits 1967-2005 Through February 28, 2006 > Podcast</p> <p>Kiki Smith: A Gathering, 1980-2005 Through January 29, 2006 > Podcast</p> <p>NEWS : Save \$2 on museum admission with the current SFMOMA Artcast Enjoy art with your kids at Family Studio on December 18 Head to the MuseumStore for unique holiday shopping</p> <p>SFMOMA Copyright © 2005 San Francisco Museum of Modern Art Privacy Policy Terms of Use</p> <p>SFMOMA – www.sfmoma.org - Homepage</p>  <p>COLLECTIONS : MAIN</p> <p>VIEW COLLECTIONS View selections of artworks from the Museum's Collections, or browse through an alphabetical list of artists' names.</p> <p>ARCHITECTURE + DESIGN MEDIA ARTS PAINTING + SCULPTURE PHOTOGRAPHY BROWSE BY ARTIST</p> <p>SEARCH COLLECTIONS Search here for specific artworks or artists in SFMOMA's Collections. (Please note that this only searches the Museum's Collections and not the entire SFMOMA Web site.) BEGIN SEARCH</p> <p>EXPLORE Explore selected artworks and artists in SFMOMA's Collections through rich, interactive multimedia programs that feature high-quality images of artworks, documentary photographs, and excerpts from videos and films.</p> <p>INTERACTIVE FEATURES</p> <p>VISIT INFO CALENDAR MO EDUCATION MEMBERSHIP SHOP MA EXHIBITIONS COLLECTIONS E+SPACE</p> <p>SFMOMA website – www.sfmoma.org</p>
Action	<ul style="list-style-type: none"> - Consider the kinds of pages composing the web site; - Check that the elements for differentiating the macro-areas composing the page (colors, shapes, position) are used consistently;
Criteria	Content Semantics Consistency

Explanation	The same sign-vehicle, if used more than once within the website, should be used consistently with respect to the content/concept it refers to, whatever it is.
Example	<p>In the example the link label “Burattini, Cortili e Giardini” (“Puppets, Courtyard and Gardens”) is not consistent with the title of the page the user reaches by clicking on it, that is, “Rassegna Provinciale Teatro di Figura” (Provincial exhibition of figural theatre).</p>  <p>Provincia di Varese website – www.provincia.va.it</p>  <p>Provincia di Varese website – www.provincia.va.it</p>

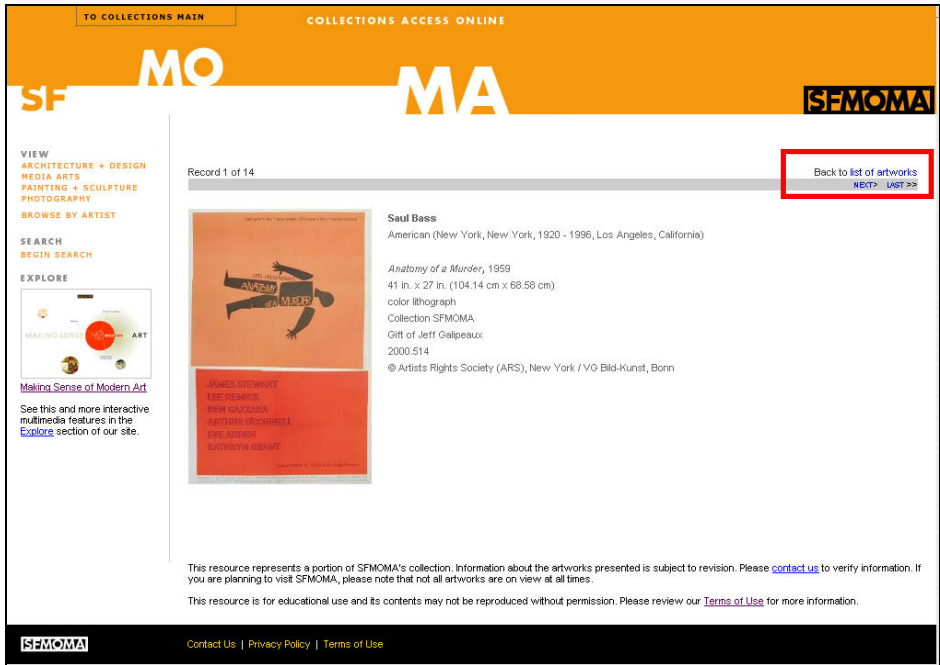
<p><i>Example 2</i></p>	<p>In the example the SFMoMA website is considered. The website makes use of terms like “architecture”, “sculpture”, “photography” sometimes referring to common artistic disciplines (see ❷ in figure below) and sometimes referring to the collection departments of the museum (see ❶ in figure below). Such inconsistency creates confusion in the user that does not understand when these sign-vehicles refers to what.</p>  <p>SFMOMA website – www.sfmoma.org</p>
<p><i>Actions</i></p>	<p>Browse the kinds of pages and check that the content semantics staying behind semiotic unit is consistent with respect to the sign-vehicle used.</p>
<p><i>Criteria</i></p>	<p>Functional Semantics Consistency</p>
<p><i>Explanation</i></p>	<p>The same signifier should be consistent with respect to the particular designer’s deputy staying behind it. If a particular strategy (i.e. the color, the position on the page, etc.), is used for saying to the user that a link is a landmark link all other landmark links should use the same code. Inspector should consider each signifier and check if they are used consistently overall the website with respect to the interactive and the dialogic function.</p>
<p><i>Examples</i></p>	<p>In the example on the left side of the page there is the list of landmarks with a highlighted one indicating the current section of the webiste (events). It has both a navigational purpose (back to macro-category) and a contextual purpose (supporting user orientation). This kind of sign-vehicle is not used</p>


consistently within the website. If the user clicks on Our Collections the other page appears, in which the list of landmarks is lost, and the user is disoriented.






Cleveland Museum of Art – www.clemusart.com

Actions	Check that the interactive purpose and the dialogic function of semiotic units are consistent with respect to the sign-vehicle used.
Criteria	Web Session Consistency
Explanation	If there are sign-vehicles referring to user actions (i.e. a navigation sign like the “go back” button or “your wished CDs”) they should be consistent with

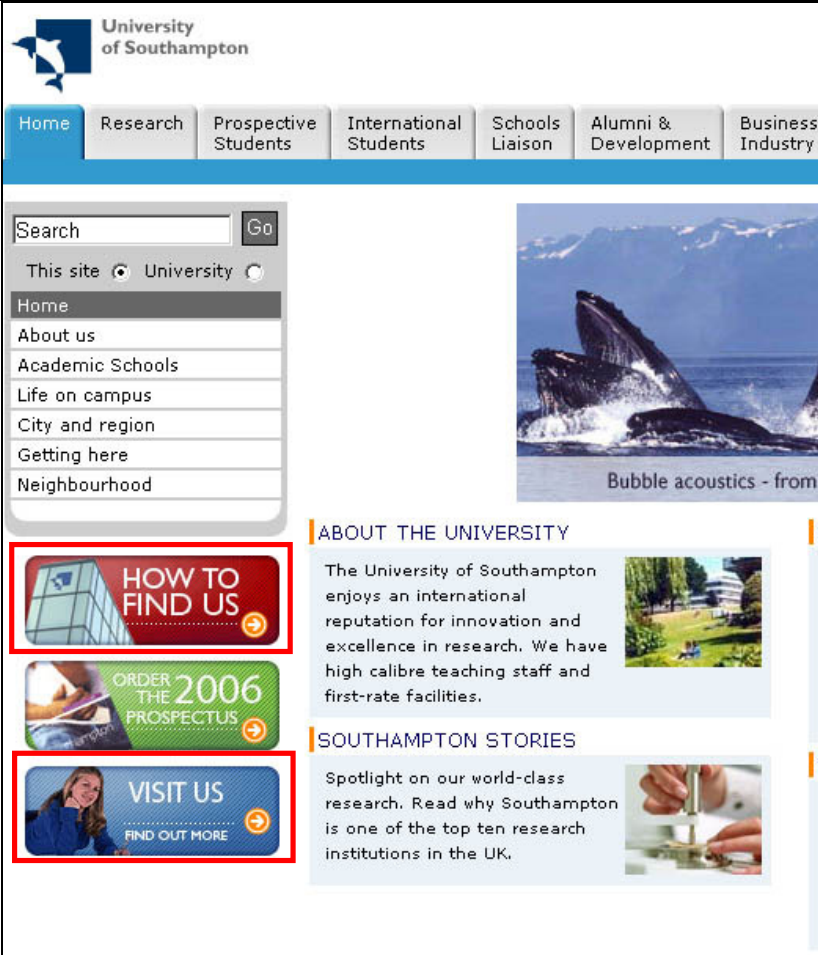
	<p>the actual user actions made in the current session, otherwise it is not clear to the user what those signs are referring to. A “go back” link taking the user back to a previous page has no meaning if the user never visited that page.</p>
<i>Example</i>	<p>The website refers to user actions that could have never been accomplished by the user: the “back to list of artworks” link in the SFMoMA website appears even if the user never visited that page.</p>  <p>The screenshot shows the SFMoMA website interface. At the top is an orange header with 'TO COLLECTIONS MAIN' and 'COLLECTIONS ACCESS ONLINE'. Below this is the 'SF MO MA' logo. On the left, there are navigation links: 'VIEW' (Architecture + Design, Media Arts, Painting + Sculpture, Photography), 'SEARCH' (Begin Search), and 'EXPLORE' (Making Sense of Modern Art). The main content area displays a search result for 'Anatomy of a Murder' by Saul Bass, including a thumbnail of the artwork and descriptive text. A red box highlights a 'Back to list of artworks' link with 'NEXT' and 'LAST' buttons. At the bottom, there is a footer with 'SFMoMA' logo and 'Contact Us Privacy Policy Terms of Use'.</p> <p><i>SFMOMA website – www.sfmoma.org</i></p>
<i>Actions</i>	<p>Check if semiotic units referring to previous user actions are consistent with respect to the actual actions made by the user.</p>

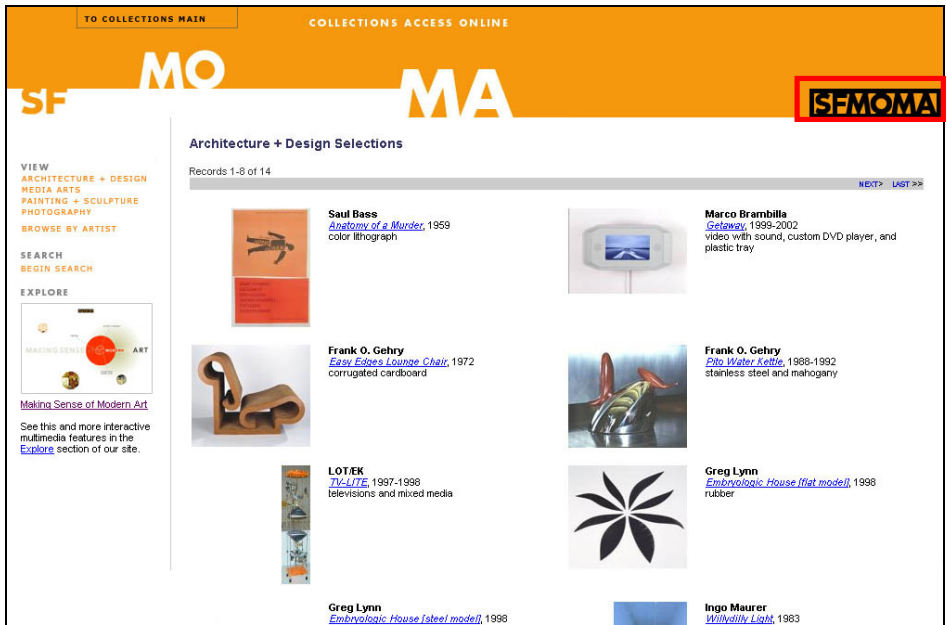
CONTENT SEMANTICS EVALUATION – USER PROFILE DEPENDANT	
KIND OF PAGE	
<i>Criteria</i>	Ontology Familiarity
<i>Explanation</i>	The user is not familiar with the ontology the sign refers to and is not able to guess its meaning.
<i>Example</i>	<p>In the example the SFMOMA homepage and a user having a low knowledge about museums in general are considered. Semiotic units like “Exhibitions” or “Collections” are not understandable since they refer to concepts belonging to the “museum’s world” that the user is not familiar with.</p>  <p>SFMOMA Homepage – www.sfmoma.org</p>
<i>Actions</i>	<ul style="list-style-type: none"> - Consider a user profile; - Identify the semiotic units composing the page; - Visioning the user profile, identify which semiotic unit refers to an ontology the user is not familiar with;
<i>Criteria</i>	Ontology Conflicts
<i>Explanation</i>	The sign could potentially refer to more than one ontology, and it is not clear to the user which one/ones should be considered.
<i>Example 1</i>	<p><i>Interlocutor vs. website ontology</i></p> <p>In the example the linked logo “Become a member” could be misleading. Its shape makes the user guess that it refers to the internet/website ontology and means to subscribe to the website, while it is a subscription to the museum as institution (referring to the interlocutor ontology).</p>


	 <p>Metropolitan Museum website – www.metmuseum.org</p>
<p>Example 2</p>	<p><i>InterLocutor vs. Internet Ontology</i></p> <p>In the example, the Italian label “Ricerca” can mean both “search” (referring to the Internet Ontology and suggesting a link to a search engine) and “research” (referring to Interlocutor Ontology and suggesting a link giving information about the scientific research carried on at the university).</p>  <p>University of Lugano website – www.com.unisi.ch</p>
<p>Example 3</p>	<p><i>InterLocutor vs. Website Ontology</i></p> <p>Some websites describe and model the real world without getting clear the user</p>

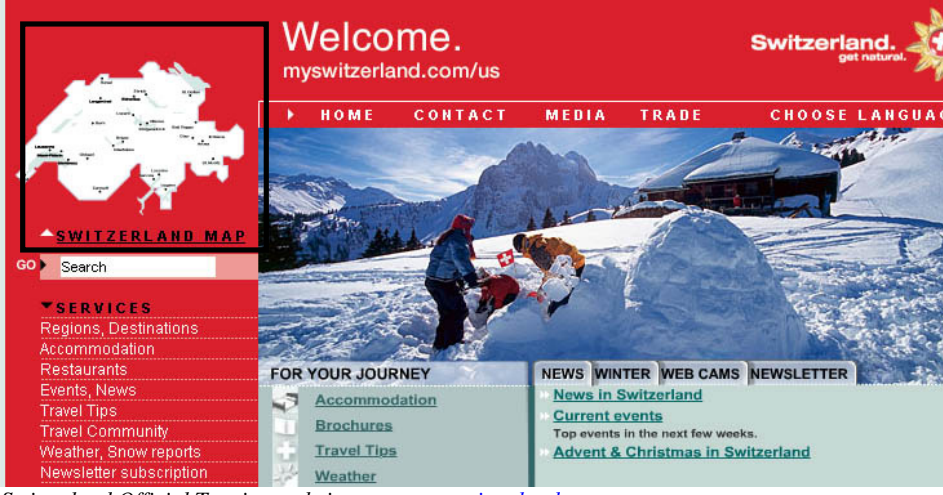
	<p>on the difference between the real world and how it has been modeled through the website. On the SFMoMA website it is not clear that the term “collections” refers to the collection online (i.e. website ontology), that is, a selection of the whole collection in the museum. Users think that if they do not find something on the website it means that the museum does not own it.</p>  <p>SFMoMA website – www.sfmoma.org</p>
Actions	<ul style="list-style-type: none"> - Consider a user profile; - Identify the semiotic units composing the page; - Vision the user profile and, for each semiotic unit, check all the potential ontologies it could refer to and verify potential conflicts;
Criteria	Conceptual Conflicts
Explanation	Even if the referred ontology is clear and familiar, the sign used could have different meanings within the referred ontology. In particular, this could be due to the fact that the sign used is <i>too general</i> or in <i>competition</i> with other semiotic units on the same page.
Example	<p><i>Too general</i></p> <p>In the example the semiotic unit “Info” is too general. Even if the user is able to related it to a particular ontology (i.e. interlocutor ontology) it is not clear what kind of information it provides.</p>

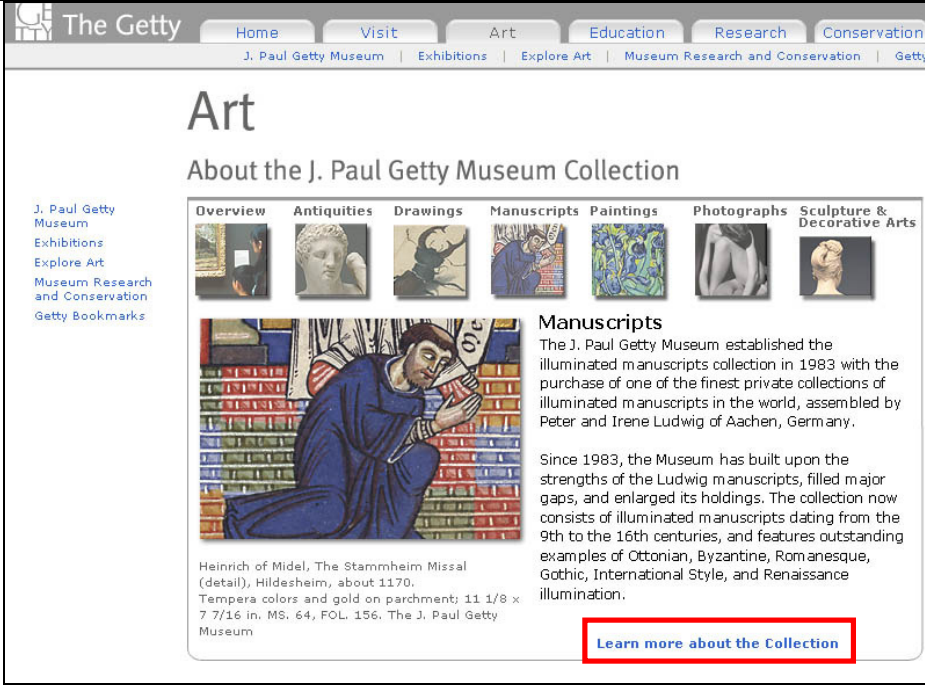
	 <p>SFMOMA website – www.sfmoma.org</p>
<p><i>Exampe 2</i></p>	<p>In the example the links labels of the Lamborghini website main menu are too generic and could mean everything: they refer to common sense ontology but are too vague and unclear.</p>  <p>Lamborghini home page – www.lamborghini.com</p>
<p><i>Example 3</i></p>	<p>Competitiveness</p> <p>In the example the logos “how to find us” and “visit us” are easily comprehensible if considered separately. However, they are in competition since the meanings seem to be very similar and the user is not sure which meaning give to which semiotic unit.</p>

	 <p>University of Southampton website - http://www.soton.ac.uk/</p>	
<p><i>Actions</i></p>	<ul style="list-style-type: none"> - For each semiotic unit verify that within the ontology it refers to it can not have different meanings. - For each semiotic unit verify that on the same page there are not other semiotic units having a similar meaning 	

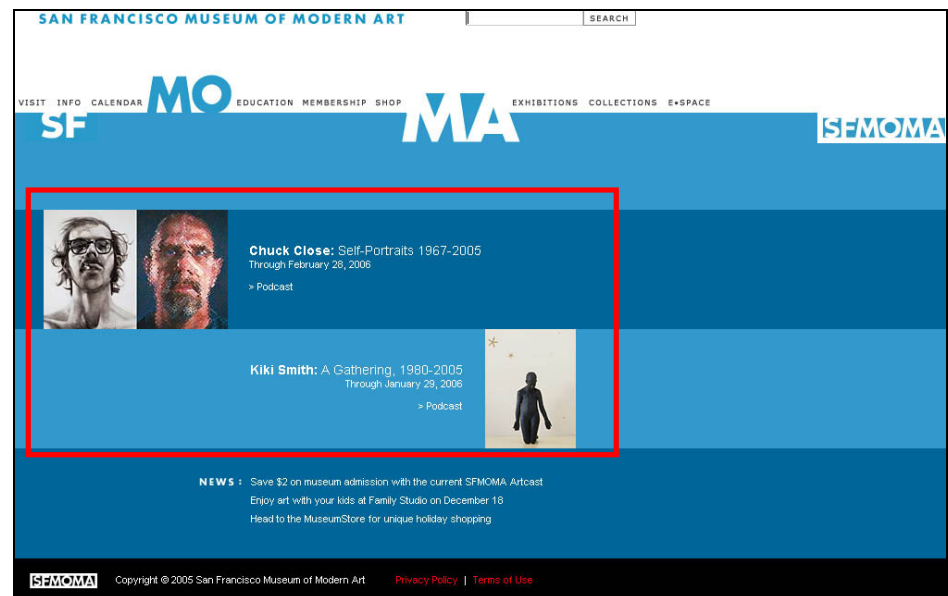
FUNCTIONAL SEMANTICS EVALUATION – USER PROFILE DEPENDANT	
KIND OF PAGE	
<i>Criteria</i>	Interactive Function Clarity
<i>Explanation</i>	The user should correctly interpret the interactive function of a sign - i.e. if it is a sign helping consultation (titles, headings), navigation (links, linked images, linked icons), orientation (labels, colors, images contextualizing the section of the website, the path taken by the user), operation or simply decorative sign (logos, decorative widgets).
<i>Example</i>	<p>In the example the SFMoMA logo is positioned in a misleading place: it seems to have just a decorative purpose, while it has a specific navigation purpose (link to the HP). With respect to the Internet Conventions, it should be positioned for example in the top-left corner of the screen.</p>  <p>The screenshot shows the SFMoMA website interface. At the top, there is an orange header with navigation links: 'TO COLLECTIONS MAIN' and 'COLLECTIONS ACCESS ONLINE'. Below the header, the SFMoMA logo is displayed in large white letters on an orange background. On the right side of the header, the SFMoMA logo is repeated in a smaller, black box with white text, which is highlighted by a red rectangular box. The main content area is titled 'Architecture + Design Selections' and shows a grid of art and design items, each with a small image and a title. The items include 'Saul Bass', 'Marco Brambilla', 'Frank O. Gehry', 'Greg Lynn', and 'Ingo Maurer'. On the left side, there is a sidebar with navigation links: 'VIEW', 'ARCHITECTURE + DESIGN', 'MEDIA ARTS', 'PAINTING + SCULPTURE', 'PHOTOGRAPHY', 'BROWSE BY ARTIST', 'SEARCH', 'BEGIN SEARCH', and 'EXPLORE'. Below the sidebar, there is a section titled 'Making Sense of Modern Art' with a link to 'See this and more interactive multimedia features in the Explore section of our site.'</p> <p>SFMOMA website – www.sfmoma.org</p>
<i>Example 2</i>	In the example the titles of the article are clickable, but their position and their color does not make the link explicit to the user. The user guess that they have just a consultative function (i.e. they are titles) while they also have a navigational function.

	 <p>Provincia di Potenza website - http://www.provincia.potenza.it/</p>
Actions	<ul style="list-style-type: none"> - Consider a user profile; - For each semiotic unit consider if, with respect to the Internet, web domain and website ontologies the user can correctly guess if its function is: <ul style="list-style-type: none"> - Towards navigation - Towards context - Towards content - Towards decoration - Towards operation - Towards interaction paradigm
Criteria	Dialogic Function Predictability
Explanation	The user should understand not only the interactive function but also the dialogic function of a navigational semiotic unit, that is, the kind of page that will be reached - i.e. a page providing more content (Additional Topic Content link), a page providing a list of topics (group of topics link), a page providing topics strictly related to the current one (Topic Switch link), etc.
Example	In the example the semiotic unit “Switzerland map” is a linked icon: it is quite clear that it has a navigational function but it is not clear at all what kind of content it provides, i.e. if it provides a bigger image of the map, if it takes to a group of topics page and provides info about each single region (this is the actual dialogic purpose of the link), etc.

	 <p>Switzerland Official Tourism website – www.myswitzerland.com</p>
<p><i>Example 2</i></p>	<p>In the example the overview page of the Manuscripts collection of the Getty Museum is shown. By clicking on “Learn more about the Collection” the user would expect to reach a page either giving more info about the collection or a list of its artworks. But the link takes the user to a search page, through which s/he can search for artworks related to Manuscripts. The label of the link is misleading and the user can be disappointed to find a search tool instead of real content.</p>

	 <p>Getty Museum – Manuscript collection page – www.getty.org</p>
Actions	<ul style="list-style-type: none"> - For each semiotic unit guess its dialogic purpose and in particular if it is: <ul style="list-style-type: none"> - a member topic link - a group of topics link - an additional content link - a topic switch link - a related group of topics link - a previous content link
Criteria	Designer's Deputy Clarity
Explanation	<p>Apart from the interactive and dialogic function, a semiotic unit could be unclear because the motivations of the designers are not clear. The user should be able to guess the designer's deputy of the website (i.e. why a particular sequence of topics in a guided tour, why some topics are related with each others, why some links are emphasized, etc.). In a dialogic perspective, some design choices could be unclear and the user could be unable to grasp the argumentation strategy staying behind it, thus causing misunderstandings.</p>
Example	<p>In the example it is not clear the purpose of some semiotic units within the dialogue with the user: on the SFMoMA Homepage there are the two current exhibitions at the museum, but it is not explicated to the user if they are the only two ones, if they are highlights and if so through which criteria they</p>

have been selected.



SFMOMA homepage – www.sfmoma.org

Example 2

The example shows an internal page of the MEDINA Portal prototype, a culture-oriented tourism website providing info about Mediterranean countries. The page proposes content about an interesting spot. The highlighted links provide other topics/spots related to the current one. Both the interactive and the dialogic function are quite clear, but what is not clear is the motivation staying behind the relation, that is, why the designer relates the current topic to the others. The user is not able to understand the real meaning and purpose of the link within the discourse.

	 <p><i>Tunisia National Website Prototype – MEDINA Project 2002-2006 (EUMEDIS Programme)</i></p>
<p><i>Actions</i></p>	<p>- For each semiotic unit guess the designer's purpose and, if it is not explicit, verify that it does not compromise the user's understanding of the dialogue with the application.</p>

Annex III

Teaching W-SIDE

Marco Speroni © February 2006

Abstract

W-SIDE has been taught in Bachelor and Master Courses at the Faculty of Communication Sciences of the University of Lugano. In particular, it has been taught within the TEC-CH Master (Technology Enhanced Communication for Cultural Heritage Master). Here is reported part of the material used for teaching W-SIDE Framework (i.e. a slides-based presentation of the method) and an example of W-SIDE analysis done by the students. The assignment consisted in choosing three kinds of pages from a website and analyze the semiotic units composing it, paying particular attention to the content semantics but also reporting samples of problems regarding functional semantics. W-SIDE has been simplified with respect to the course objectives, therefore the analysis done by students did not want to be exhaustive and complete but aimed at sensitize them on web semiotics and at stimulating discussion. In this work students also went beyond the assignment and proposed new and challenging research streams regarding the semiotic analysis of web interfaces.

W-SIDE – Web-Semiotic Interface Design Evaluation

Outline

- Seminar Objectives
- Introduction
- W-SIDE Framework
- Conclusions
- Assignment

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2

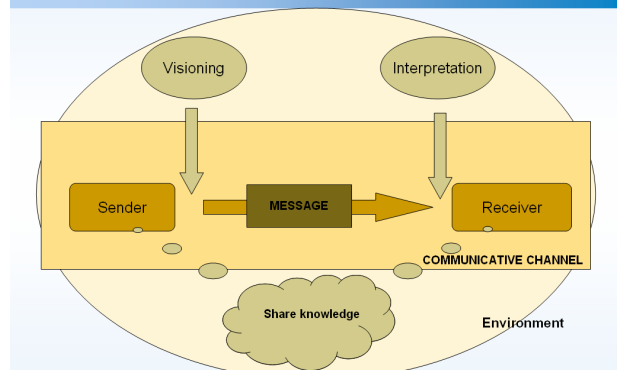
Pedagogical Objectives

- Why this seminar?
 - Usually, too scarce attention is paid to the signs used in the interfaces
- What do we want to achieve?
 - Make students aware of the problem
 - Convey the basic rules
- Method:
 - Theoretical background
 - Hands-on activity
 - Tutoring

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3

A communicative perspective 1/2



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4

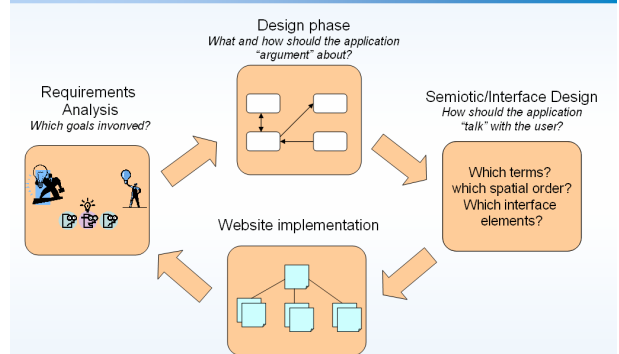
A communicative perspective 2/2

- A website is a set of many different messages that should be easily perceived, understood, memorised and recalled
- **THE PROBLEM**
- The website (and indirectly its designers) could use a **different language**, a **different knowledge** and a **different channel**

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5

Web Semiotic Design: Why?



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6

Web Semiotic Design: What is it?

- A research field coming from:
 - Human Computer Interaction
 - Semiotics/Linguistics
- Related to design
 - Translate in interface design what defined in the conceptual design;
 - Define the best compromise for making most of users understand and interact with the application
- Related to usability (bi-directional)
 - verify that the designer intentions are correctly communicated to the user
 - verify the user intentions are correctly supported and interpreted by the application

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7

Links & Information scent

SCENT OF INFORMATION

"Users are 'informavores' on the hunt for information" (*Palo Alto Research Center*)

- A link creates expectations on the user and it is a promise: "you will exactly reach the content you are looking for";
- A link and its information scent is designed considering different features:
 - link format (a text, an icon, an image, a symbol);
 - link position (where the links is positioned on the page);
 - link relation with other signs (how it is related to other signs);

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W-SIDE Framework

- Web Semiotic-Interface Design Evaluation;
- W-SIDE Model for analyzing the semiotic of a website;
- W-SIDE Technique for evaluating the users' understanding of the interface;
- The efficacy of the interface depends also on the *language* the web site speaks;

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W-SIDE: 5 Basic Ideas

1. Semiotic of the interface is different from semiotic of the content;
2. The sign in the interface:
 - Has a *content/conceptual* semantics
 - Has a *functional* semantics (i.e. it is interactive)
3. The semantics can be classified;
4. There are quality rules in the use of signs;
5. The effectiveness of the signs can be evaluated;

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W-SIDE: Idea 1

- Two different levels:
 - **semiotic of the content:** what "ontologies" are typical for a domain?
 - Ex. "oinokoe", in the archeology domain
 - **semiotic of the interface:** what signs should be used?
 - Ex. "vase for wine" (if a non-expert public is addressed)
- Two different expertise are required
 - i.e. the content's expert is not always the most suitable person for fixing the labels!

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W-SIDE: Idea 2

- A sign in the interface:
 - Has a **content/conceptual semantics**, i.e. the semantics it has in the real world (in the linguistic codex);
 - Has also a **functional semantics** (i.e. it leads somewhere else, it activates operations...);
- These two levels must be considered separately

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W-SIDE: Idea 3/1

- The signs' semantics can be classified;
- Web signs refer to different "ontologies", both as content and functional semantics;
- Ontologies are domains of knowledge;
 - when choosing signs, pay attention to what pre-supposed knowledge you are counting upon!

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W-SIDE: Idea 3/2

- For CH applications, web signs refers to the following ontologies:
 - Sender/institution (in itself and as belonging to a category) ;
 - Domain (at a generic and specific level) ;
 - Web/Informatics (Internet conventions) ;
 - Common Sense knowledge (Common background) ;
 - "This" website (terms and concepts shared within the website's boundaries) ;
 - ...

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W-SIDE: Idea 3/3

- Web signs can have the following interactive functions:
 - **Towards Content** (towards consultation, making the user look the content up - titles, keywords, headings) ;
 - **Towards Context** (towards orientation, making the user aware of where s/he is and what the website is talking about with respect to a generic context) ;
 - **Towards Navigation** (towards navigation, proposing new or already visited content) ;
 - **Towards Operation** (towards system modification, proposing the modification of the system or of the external world) ;
 - **Towards Decoration** (towards look&feel, not having a particular interactive function but stimulating engagement, conveying a corporate brand and the coherence between the virtual and the real world) ;
 - **Towards Interaction Paradigm** (hourglass, mouse-hand) ;

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W-SIDE: Idea 4/1

- On the sign's content meaning:
 - Is it understandable?
 - Is it adequate?
 - What kind of knowledge is presupposed?
- On the sign's functional meaning:
 - Is it understandable?
 - What kind of knowledge is presupposed?
- On the ontologies:
 - Are the selected ontologies the most adequate (to the target)?

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W-SIDE: Idea 4/2

- Based on the basic questions...rules for quality can be developed!
- Examples:
 - Do not mix signs belonging to different ontologies in the same list;
 - Do not use ambiguous signs (ex. "Map");
 - Do not use different signs for one meaning (or too similar meanings);
 - ...

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W-SIDE: Idea 5

- Evaluation can be done;
- User testing (different backgrounds) ;
- Experts' review:
 - Classification of the signs according to the ontologies;
 - Matching of the ontologies with the target users' background (will they understand this?) ;
 - Check with the quality rules;

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Conclusions

- While designing link labels:
 - Pay attention to your users and their language/knowledge;
 - Always keep in mind the scope of your link and make all the possible to explicitate it to the user;
 - Always keep in mind that the link has relations with other signs in the website and should be coherent with them

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Assignment: Goals

- Understand the ontologies;
- Classify signs;
- Distinguish the meaning of the sign in the ontology and its use in the site;

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Assignment: Steps/1

- Select 3 pages from a website
 - 1 concerning a topic (ex. A work of art description)
 - 1 concerning a list (ex. A list of works of art, of sections etc.)
 - 1: free choice!
- Classify all the signs according to the ontologies

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Assignment: Steps/2

- NB: the SEMIOTIC UNIT is the object of the analysis:
 - Semiotic Unit: a sign or group of signs related to a single message/function;
- Comment the relation between:
 - the sign and the ontology;
 - the ontology and the function;

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Homework Assignment

- Web Semiotic Analysis -

Students' names not reported

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Web signs analysis for Tate Online website	5
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1. Executive summary

We have analyzed the signs in three pages of the Tate collection, with the high-level goal of understanding and applying the *ontologies* for the CH applications introduced to us during the seminar *Semiotics of Interfaces*. The two low-level goals we had in mind were:

1. Understand what kind of knowledge is presupposed by the user (to this purpose we tried to understand and classify accordingly the meaning of the signs in the interface)
2. Analyze the relation between the meaning of the sign in the interface and its functional meaning.

The two goals we had implied conducting the analysis at two levels:

- read the signs in the interface and classify them (using as analysis tool the *ontologies* introduced in the seminar)
- seize the functional meaning of the sign and, most important, judge to what extent the sign's own meaning is consistent with the functional meaning.

For the second goal & level of analysis, we chose to focus on the inconsistencies between the sign's own meaning and the functional meaning. Therefore we critically analyzed only those signs that were misleading for the user.

Throughout our analysis we have run across some findings that we added under the last section of the document. We have covered issues such as: transparency of the interface; conciseness of web signs; evolution of the language of the interface, the continuous shifting of the web signs between ontologies.

Key terms: semiotics of interfaces, ontology, own meaning, functional meaning, reading in and out of context, glossomatics, 'tabula rasa', acquire new meaning, transparent interface.

2. User profile

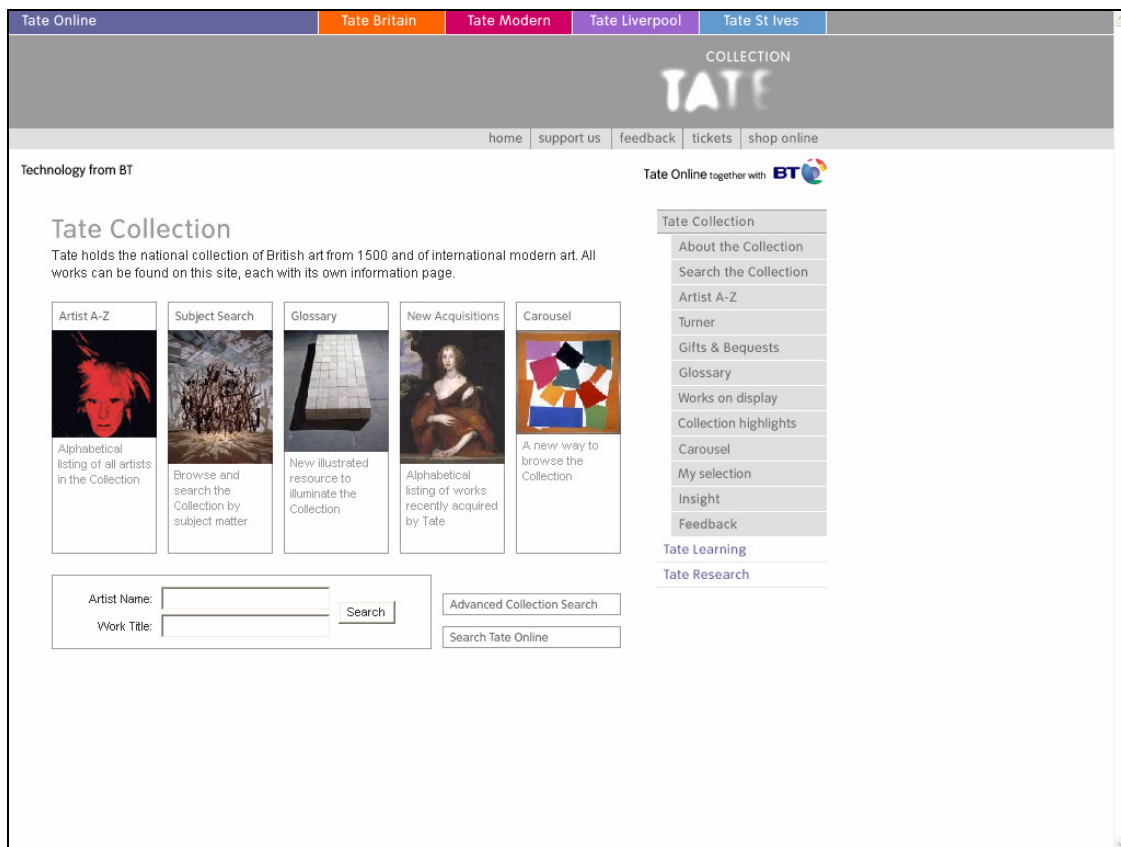
We have done the analysis employing one user profile, of moderate knowledge on art and Internet. The level of familiarity of the user with the museum's world, art domain, internet, informatics and common knowledge is detailed below:

Ontologies	Knowledge	Level of familiarity
Sender		
Generic	Museum's world	6
Specific	Tate online	3
Domain		
Generic	Art	6
Internet / Web		
	Internet conventions	6
Informatics		
	Informatics conventions	9
This website		
	Tate collection online	3
Common-knowledge	Industrial designer	9

However, in certain points of our analysis we felt the need to introduce and briefly sketch new user profiles, just to show in what way a certain piece of information would be easy or uneasy to grasp for different types of users. In these cases (usually in the tables below), we mentioned in what way users having different backgrounds would understand differently the same sign or what would be the difficulties given the absence of the required background.

3. Web signs analysis. Tate Collection

<http://www.tate.org.uk/servlet/BrowseGroup?cgroupid=999999956>



We have analyzed three pages of the Tate collection website, on two levels:

1. Own meaning of the signs. We have employed as analysis tool the *ontologies* introduced in the seminar *Semiotics of Interfaces*.
2. Functional meaning. We focused our analysis on the peculiar issues or inconsistencies regarding the relation between the own meaning and the functional meaning of the sign.

3.1. Signs classifications according to the *ontologies*

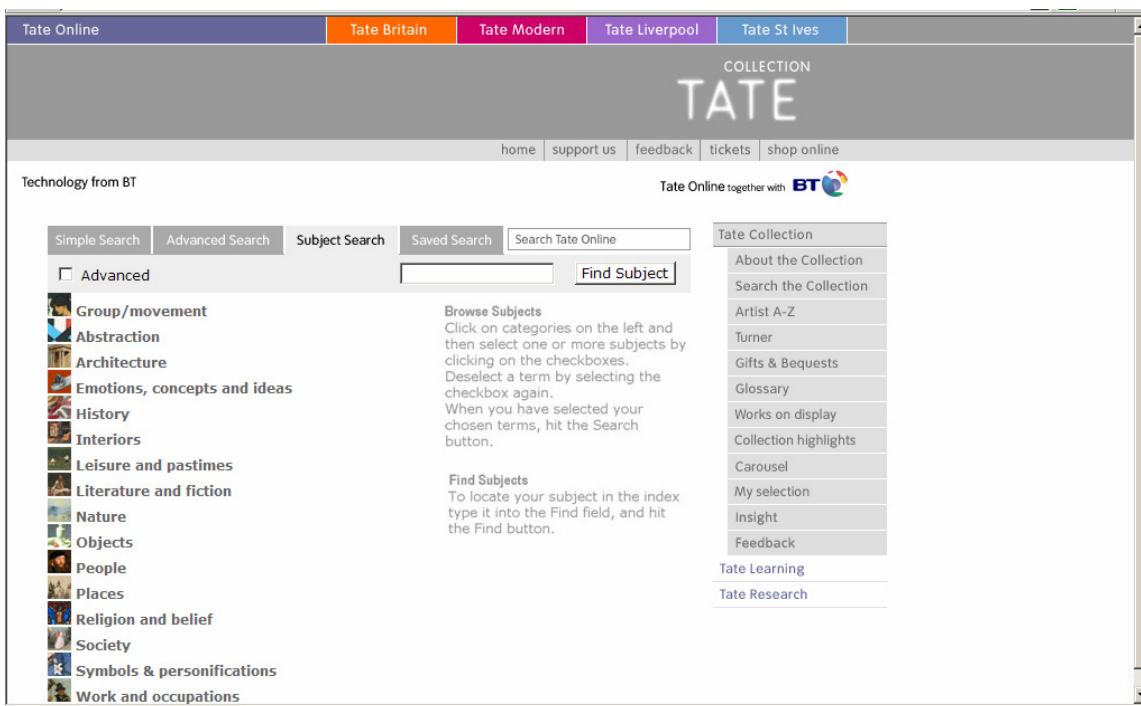
The *ontologies* or categories that we used as analysis tools refer to the presupposed knowledge of the user accessing CH applications and rank as follows:

- Sender knowledge
- Domain knowledge
- Web knowledge
- Informatics knowledge

- 'This website'
- Common knowledge

We have classified and commented accordingly the web signs on the three Tate's web pages in the tables below.




3.1.a. Signs classifications for page 1



Labels		Ontologies						Comments
		Sender	Domain	Internet	Informatics	This website	Common-knowledge	
Tate online								All the labels referring to the Tate Museums require knowledge on the Sender (the institution in itself).
Tate Modern								
Tate Britain								
Tate Liverpool								
Tate St Ives								
Simple Search								Both <i>Simple</i> and <i>Advanced Search</i> are terms that became accustomed through the Internet.
Advanced Search								
Subject search								
	Group/movement							The labels on the left, from <i>Group/movement</i> to <i>Work and Occupations</i> are search criteria and subordinated in context to the label <i>Subject search</i> . That is why we ranked all of these labels under domain knowledge. We mention also the roll-over show: when the user has the mouse on each of the subject search criteria, on the right
	Abstraction							
	Architecture							
	Emotions, concepts and ideas							
	History							
	Interiors							
	Leisure and pastimes							
	Literature and							

	fiction							one image and an explanation of the criterion appears. In this case, the possibility that the user is lost is reduced to a minimum.
	Nature							
	Objects							
	People							
	Places							
	Religion and belief							
	Society							
	Symbols and personifications							
	Work and occupations							
Saved search								Signs understanding require Web knowledge.
Search Tate Online								
Tate Collection								Sender knowledge.
	About the collection							Sign reading requires knowledge about museum's world.
	Search the Collection							On the one hand, the sign is typical of the web (<i>Search</i> has become a buzzword for web browsing); on the other hand,



							one user familiar with the museum's world on-site (and not on-line) could just as well grasp the correct meaning of the sign.
	Artist A-Z						Any user familiar at least with catalogue offline searching will think of a list and of search criteria when seeing the label. We left the label under <i>Domain</i> ontology and also under <i>Common-knowledge</i> . For the second case, certainly a user that has ever used any type of list / catalogue can easily infer that it is a list of artists.
	Turner			This sign will speak or not to the user depending on his art background and especially Anglo-Saxon art background. The sign would have been more specific if it were named 'Turner Collection', as it appears on roll-over.			
	Gifts & Bequests			Unclear label, especially for a non-native English speaker user (<i>bequests</i>). However, as it is under collection and is certainly refers to donations, we assume it is under sender knowledge, museum's world.			
	Glossary						Common-knowledge.
	Works on Display						Labels understanding requires knowledge on museum's world.
	Collection						

	Highlights							
	Carousel						<p>This sign stirs curiosity and it seems it has been meant to do this. Mind that it falls under Tate collection, therefore we touch in here an issue that we would call <u>reading in and out of context</u>: when reading in context, the user does realize that the label speaks about the collection, since it is subordinated to this label on the interface; secondly, does the user also infer a potential interpretation of the sign by giving a quick look at the signs above and below the sign itself? That is to say: if the user reads through the signs, from <i>Works on display</i> to <i>My selection</i>, all of them referring to the Tate collection, what does he infer about <i>Carousel</i>?</p>	
	My selection						<p>Average Internet surfers would immediately understand that when it is about My XXX (anything), they are about to click, choose and save or bookmark something. So we would say this is typical of the web. On the other hand, if Aunt Y, a typical 40 year old lady that has never used Internet more than twice in her</p>	

								life, runs across the term, she might as well realize that it is something that she may choose herself and being an art museum's website, she could easily infer that the selection involves artworks.
	Insight							This term is not clear enough; Reading it into context, under <i>My collection</i> , would entitle us/our average user to believe that the sign refers to extensive comment on several works of art. As to the ontology it should fall under, we opted for common knowledge, since no other type of knowledge is necessary to understand the term.
	Feedback							Does not require Internet knowledge to understood; yet for certain users the term is linked to the Internet.
Tate Learning								Typical of the museum world.
Tate								

Research								
Home								Internet knowledge.
Support us								Common knowledge. Issue: we notice an overlapping between this label and the label <i>Gifts & Bequests</i> ; both of them seem to refer to information for supporting Tate, financially or otherwise. Unless one of the signs is misleading, which we will discover in the next section, on the functional meaning.
Feedback								-
Tickets								Common knowledge.
Shop online								Internet knowledge.

Tables legend:

-  Belonging to a given ontology with a high probability
-  Belonging to a given ontology with a lower probability

3.1.b. Signs classifications for page 2

Address <http://www.tate.org.uk/onlineevents/live/> Go Links

Tate Online Tate Britain Tate Modern Tate Liverpool Tate St Ives

Online Events

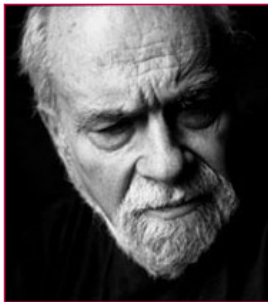
ONLINE TATE

home support us feedback tickets shop online

Technology from BT Search Site: Go [Tate Collection](#) [Advanced Search](#) Tate Online together with BT

Programme Talks Symposia Sound & Performance Help

Contested Territories: Arthur Danto, Thierry de Duve, Richard Shusterman



Event Time [GMT] * Local Time
2 February 2006 18.30 02 February 2006 18.30

Local Time Zone:

Online Event Duration: 1.5 hours
Venue: Tate Britain

Tate Britain Since the publication of his essay *The Artworld* (Journal of Philosophy, 1964), Arthur Danto's work has always affirmed a deep relationship between philosophy and art. He is best known for his contemporary version of GWF Hegel's 'end of art' thesis, first enunciated in 1984 and most recently developed in his book *After the End of Art* (Princeton University Press, 1997). On the occasion of his first visit to the UK in many years, Danto talks with historian and theorist of contemporary art Thierry de Duve, and philosopher Richard Shusterman. De Duve's work has long revolved around Marcel Duchamp's readymade and its implications for aesthetics. His publications include *Kant after Duchamp* (MIT Press, 1998) and *Look, 100 Years of Contemporary Art* (Ludion, 2001). Shusterman's areas of study range from high-brow topics to popular culture, integrating perspectives from European, American and East-Asian studies. He is the author of many books

Online Events
Programme
Live
Archive
Forums
Newsletter

[Tate Collection](#)
[Tate Learning](#)
[Tate Research](#)

Note: The signs already analyzed for the previous page are no longer considered in the table below.

Labels		Ontologies						Comments
		Sender	Domain	Internet	Informatics	This website	Common-knowledge	
Programme								Common knowledge.
Talks								
Symposia								While this sign seems to appeal to the user's common knowledge, there is also a possibility that the label is representing a special feature of the Tate Online. More on this under Functional meaning.
Sound and performance								Common knowledge.
Help								Informatics knowledge.
Local time zone : change								Common knowledge.
Online events								Sender knowledge, museum's world (events). Some level of familiarity with the web is

								required to grasp the full meaning of the sign.
	Programme							Common knowledge.
	Live							
	Archives							
	Forums							Web knowledge.
	Newsletter							
Next online event								Same as to <i>Online events</i> .
See full program timetable								Common knowledge.
Help								Informatics knowledge.

3.1.c. Signs classifications for page 3

<http://www.tate.org.uk/servlet/ViewWork?workid=1311&searchid=30646>

Address  <http://www.tate.org.uk/servlet/ViewWork?workid=1311&searchid=30646>  Go Links

TATE

[home](#) [support us](#) [feedback](#) [tickets](#) [shop online](#)

Technology from BT Tate Online together with 

Search ▶ Results ▶ Work

Work Images Subjects Texts ◀ 2 of 16 ▶

Pierre Bonnard 1867-1947

The Bath 1925
Baignoire (Le Bain)

Oil on canvas
support: 860 x 1206 mm frame: 1079 x 1438 x 116 mm
painting

Presented by Lord Ivor Spencer Churchill
through the Contemporary Art Society 1930

N04495

This is one of a series of paintings that Bonnard made of his wife Marthe in the bath. Though she was in her mid-fifties, the artist depicts her as a young woman. Marthe spent many hours in the bathroom: she may have had tuberculosis, for which water therapy was a popular treatment, or she may have had an obsessive neurosis. The bath, cut off at both ends, and the structure of the wall create a rigorously geometric composition. The effect is strangely lifeless, and almost tomb-like; as if the painting were a silent expression of sorrow for Marthe's plight. *(From the display caption August 2004)*



© ADAGP, Paris and DACS, London 2002

Tate Collection

- About the Collection
- Search the Collection
- Artist A-Z
- Turner
- Gifts & Bequests
- Glossary
- Works on display
- Collection highlights
- Carousel
- My selection
- Insight
- Feedback

Tate Learning

Tate Research

Note: The signs already analyzed for the previous pages are no longer considered in the table below.

Labels		Ontologies						Comments
		Sender	Domain	Internet	Informatics	This website	Common-knowledge	
Work								Meaning easy to grasp for a user familiar with the art domain. (We could argue that these signs could be grasped by a user just by appealing to common-knowledge.) To mention: roll-over helps user grasp the meaning: e.g. <i>View other images for this work.</i>
Images								
Subjects								
Texts								
>> 2 of 16 >>								Specific to Internet or/and Informatics: DB & lists.
Copyright ADAGP								Common knowledge.

Key issue:

For many of the web signs analyzed in the above tables, one of the key issues in deciding for one ontology over the other is what we call: reading in or out of context. We tend to believe that when the user goes through a webpage, he does not (even cannot) consider the signs separately, but a phenomenon of contagious construction of meaning happens, so that the context is created automatically by some terms with a heavy semantic charge with the result that this charge extends over other signs.

We have identified and we detail below some aspects of this issue that we ran across:

1. When the user quickly goes through one website page, does he consider the signs separately or does he consider them within context?
2. Secondly, if the user considers the signs within context, does he do this consciously or does he do it mechanically (therefore uncontrollable through conscious exercise)? Important issue because if the context for reading the signs is created automatically then with a high probability this process acquires different dimensions (different constructions of meaning) from user to user. In this case the designer has in fact a much lower degree of control over the interface than he thinks he has.
3. In what way the structure of the interface affects the reading within context? This issue refers to the control that the designer has over the interpretation of the signs, by the deliberate structuring of the page.
4. Misleading/false construction of meaning. When going through one list, an average user will have an unstated, presupposed idea of common features of the signs within the list. Reading through the list, the phenomenon of false construction of meaning can happen: features that apply to certain signs are extended to some other signs, in virtue of their having a common core (which entitles them to be on a list). This aspect could entitle in some rare case, positive turns, when the meaning is correct and it could explain, for example, why users tend to understand several signs that under a strict usability control seem difficult to grasp.

3.2. Functional meaning

Under this section we have covered the peculiar aspects of the relation between the own meaning of the sign and the functional meaning.

Issues:

1. Seemingly overlapping: *Support us* vs. *Gifts & Bequests*.

Support Us leads to a page containing information on how to support Tate, to donate or on the different foundations connected to the Tate's. On the other hand, *Gifts & Bequests* leads to a page that presents a number of groups of works that have been acquired by gift or bequest.

2. Unclear label for non-UK residents: *Turner*

As we have already mentioned, at roll-over appears Turner Collection, therefore the content of the page that it leads to becomes quite clear. Clicking on the label we are lead to an introductory page for the *Turner Collection*.

3. Mysterious label: *Carousel*

We clicked on the label *Carousel*, but the page keeps to its mystery. Only by clicking *About* we are given an explanation. It is an interactive game that allows the user to browse, select and put together several artworks from selected 2000 pieces from Tate collection. we point however to the fact that the label is, in our opinion, mysterious enough to attract users and make them click. One aspect to be criticized is that the page we are lead to by clicking is not explanatory.

4. Grasp difference between *Collection Highlights* and *Works on display*

By clicking *Works on display*, users are invited to choose one of the four Tate Galleries to obtain a list of the artists with works on display at that site.

By clicking, instead, the *Collection Highlights*, the user will find a selection of artworks from Tate's.

5. *Symposia*: Tate special or common meaning?

We were wondering whether the label *Symposia* has been chosen for a special online forum for discussions on Tate online. Instead, *Symposia* stands for events organized by Tate, so it falls rightfully under Common Knowledge ontology.

6. Unclear label: *Sounds & Performance*

Not only the label, but also the page the label leads to, is unclear. In fact the page refers to events related to sounds, electronic music and live art.

4. Findings and conclusions

This last part of the document is dedicated to some findings we ran across throughout our short analysis and that we thought to be relevant for the goals of the project.

4.1. How to meet the goal of a transparent interface?

An interface that best meets the needs of the users should be transparent; in other words, the signs of the interface should reflect the content, so that the user is driven directly towards the content that is interesting for him.

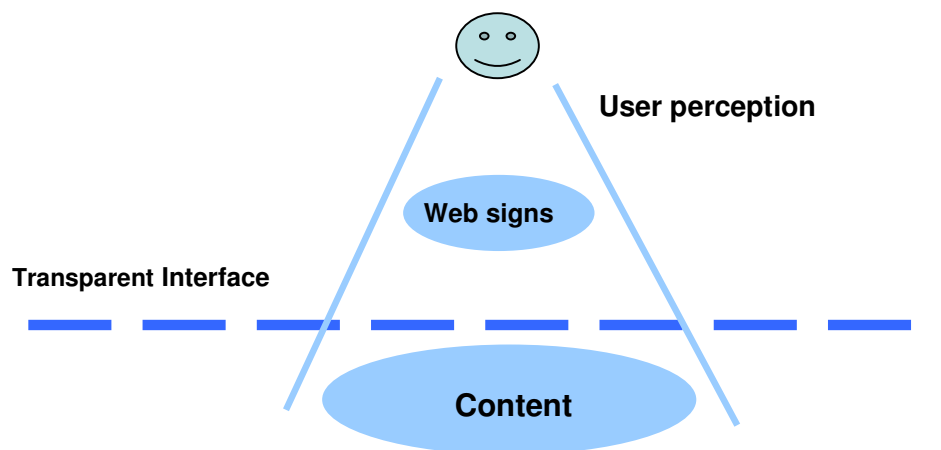


Fig. 1: The transparent interface

Fig. 1 represents the ideal situation for a website: the web signs should intermediate the dialogue between the user and the content without distortion of the message.

Many words vs. concise

In order to achieve the goal of having a transparent interface, the web signs should grasp the exact meaning meant to be transmitted. But can the web signs do this and still keep to their conciseness? If the web signs use enough words, they can be easily understandable. But if the web signs need to be concise, clarity is given up and the message is no longer reflected with no distortions.

We have found a good example of this situation by comparing a standard website (such as Tate Online) vs. a non-conformist website, such as American Visionary Art Museum (<http://www.avam.org/>) .



We have done the comparison in terms of the conciseness and the semantic charge of the signs and during this process we ran across some interesting points.

AVAM is one example of a website where the labels are built as if from the perspective of the user and allow space for little or no doubt. In one way, AVAM uses practically transparent labels, such as: *What's in the museum?* Conversely, a website such as Tate, would translate this message into a much smaller semiotic unit, trying meanwhile not to damage the initial meaning.

Let's see below how would the open, transparent signs of a website such as AVAM be translated into smaller semantic units:

What's in the museum? → Museum

Who is the visionary behind all? & What's visionary art? → About us

How can I give to the museum? → Support us

What's there for teachers and students? → Education

How can I become a member? → Membership

Websites such as Tate's aim for maximum of meaning into minimum of words, therefore towards effective conciseness.

4.2. An applied semiotic perspective: Glossematics

Glossematics is a formal method of analyzing texts, by cutting the text into smaller and smaller pieces in order to find invariant elements and the smallest meaningful units. Linguists have for the most part abandoned glossematics because they perceive it to be too formal and rather imprecise but Andersen, P. Bogh considers that these two disadvantages of this method constitute assets in the realm of computer semiotics.

To the greatest extent possible, glossematics seeks to take a "tabula rasa" approach constructing an internally consistent framework of axioms and principles with minimal reliance on external terms. In the case of the interfaces the "tabula rasa approach" will consist in using self generated semiotic, or by using terms that will bring to a conceptual consistency, functional consistency and eventually to a web session consistency (study case applied to interfaces of museum web-sites). The *tabula rasa* theory, first stated Thomas Aquinas in the 13th century, later developed by John Locke, states that the (human) mind is at birth a "blank slate" without rules for processing data, and that data is added and rules for processing are formed solely by one's sensory experiences.

Applied to computer semiotics, our examination takes place only regarding the impact of the technological development and in particular the human-computer-interaction.

The practical implications of the ‘*tabula rasa*’ theory applied to computer semiotics include two major aspects: one regards the new language that has been created and is in continuous evolution since the moment 0 = the birth of WWW. The other aspect is related to the user experience; both the language and the user experience are part of a process of perpetual evolution and deepening that impedes the creation of ultimate and permanent heuristics. Applied to our analysis, this process ultimately leads to permanent shifting between the ontologies of the web signs. The evolution of the terms in human-computer interaction (HCI) is continuous and the terms will shift in time from one ontology to another following the changes in the HCI (we have exemplified this in table no. 4 below).

Acquiring new meaning in the semiotics of interfaces

Certain terms that have been used in the Internet have acquired a different meaning for this specific context. Words such as Home, Profile, User, Browse have developed new connotations and dimensions. It would not be much to say that these new terms are a starting point (from *tabula rasa*) for a new language, the language of the interface.

Below, we have selected only a few terms that have acquired a new meaning by being used on the web. Certain users refer to this terms with their newly acquired meaning even in daily life. Which means that the language of the interfaces has become so powerful to invert the order of priorities set by historical timeline.

Definition	Term	Web-use definition
<p>A place where one lives; a residence. The physical structure within which one lives, such as a house or apartment.</p> <p>A dwelling place together with the family or social unit that occupies it; a household. An environment offering security and happiness. A valued place regarded as a refuge or place of origin. The place, such as a country or town, where one was born or has lived for a long period. The native habitat, as of a plant or animal. The place where something is discovered, founded, developed, or promoted; a source. A headquarters; a home base.</p>	HOME	The main page of a Web site. Typically, the home page serves as an index or table of contents to other documents stored at the site.
<p>Also, in line with. In conformity or agreement; within ordinary or proper limits. For example, The new policy was intended to keep prices in line with their competitors, <i>or</i> It's up to the supervisor to keep the nurses in line.</p> <p>Also, on line. Waiting behind others in a row or queue. For example, The children stood in line for their lunches, <i>or</i> There were at least 50 persons on line for opera tickets. Also in line for. Next in order for, as in He is next in line for the presidency. All of these terms employ <i>line</i> in the sense of "an orderly row or series of persons or objects," a usage dating from the 1500s.</p>	ON LINE	<p>Turned on and connected. For example, printers are online when they are ready to receive data from the computer. You can also turn a printer offline. While the printer is offline, you can perform certain tasks such as advancing the paper, but you cannot send data to it. Most printers have an online button you can press to turn the machine on- or offline.</p> <p>Users are considered online when they are connected to a <u>computer service</u> through a modem. That is, they are actually on the line.</p>

<p>A strip of material, as of ribbon or leather, or a metal clamp, that is placed between the pages of a book to mark the reader's place.</p>	<p>BOOK MARK</p>	<p>To mark a document or a specific place in a document for later retrieval. Nearly all Web browsers support a bookmarking feature that lets you save the address (URL) of a Web page so that you can easily re-visit the page at a later time.</p>
<p>A side view of an object or structure, especially of the human head. A representation of an object or structure seen from the side. See Synonyms at form. An outline of an object. See Synonyms at outline. Degree of exposure to public notice; visibility: preferred to keep a low profile. A biographical essay presenting the subject's most noteworthy characteristics and achievements. A formal summary or analysis of data, often in the form of a graph or table, representing distinctive features or characteristics: a psychological profile of a job applicant; a biochemical profile of blood. Geology. A vertical section of soil or rock showing the sequence of the various layers.</p>	<p>PROFILE</p>	<p>User- profile Made-up character used researches related to internet.</p>

<p>One that uses: a user of public transportation. Law. The exercise or enjoyment of a right or property. One who uses addictive drugs.</p>	<p>USER</p>	<p>An individual who uses a computer. This includes expert programmers as well as novices. An <i>end user</i> is any individual who runs an application program.</p>
<p>To inspect something leisurely and casually: <i>browsed through the map collection for items of interest.</i></p> <p>To read something superficially by selecting passages at random: <i>browsed through the report during lunch.</i></p> <p>To feed on leaves, young shoots, and other vegetation; graze.</p>	<p>BROWSE</p>	<p>In database systems, <i>browse</i> means to view data. Many database systems support a special <i>browse mode</i> , in which you can flip through fields and records quickly. Usually, you cannot modify data while you are in browse mode.</p> <p>(2) In object-oriented programming languages, <i>browse</i> means to examine data structures. (3)</p> <p>To view formatted documents. For example, you look at Web pages with a <i>Web browser</i>. <i>Browse</i> is often used to mean the same as <i>surf</i>.</p>

Annex IV

IDM and Website Modeling

Marco Speroni © February 2006

Abstract

The following images show a short example of IDM Technique at work. In the example the dialogic structure of the Edward Munch's Exhibition website (www.munchundberlin.org) has been modeled. The website provides content about Edward Munch, his life, his artistic influences and his prints shown in the Exhibition at the Staatliche Museum of Berlin.

The notation and the concepts shown here are a simplification of the ones composing IDM (see section 3.4.4.2 and 3.5.2). They have been adapted with respect to W-SIDE Framework and the objectives of this work. For a complete introduction to IDM please see Bolchini [Bolchini, 2005].

IDM – Legenda

IDM Conceptual Design Notation – Simplified version



Kind of topic (multiple topic)

Representative
Work

Default Page



Single topic



Topic Switch Page



Relevant Relation



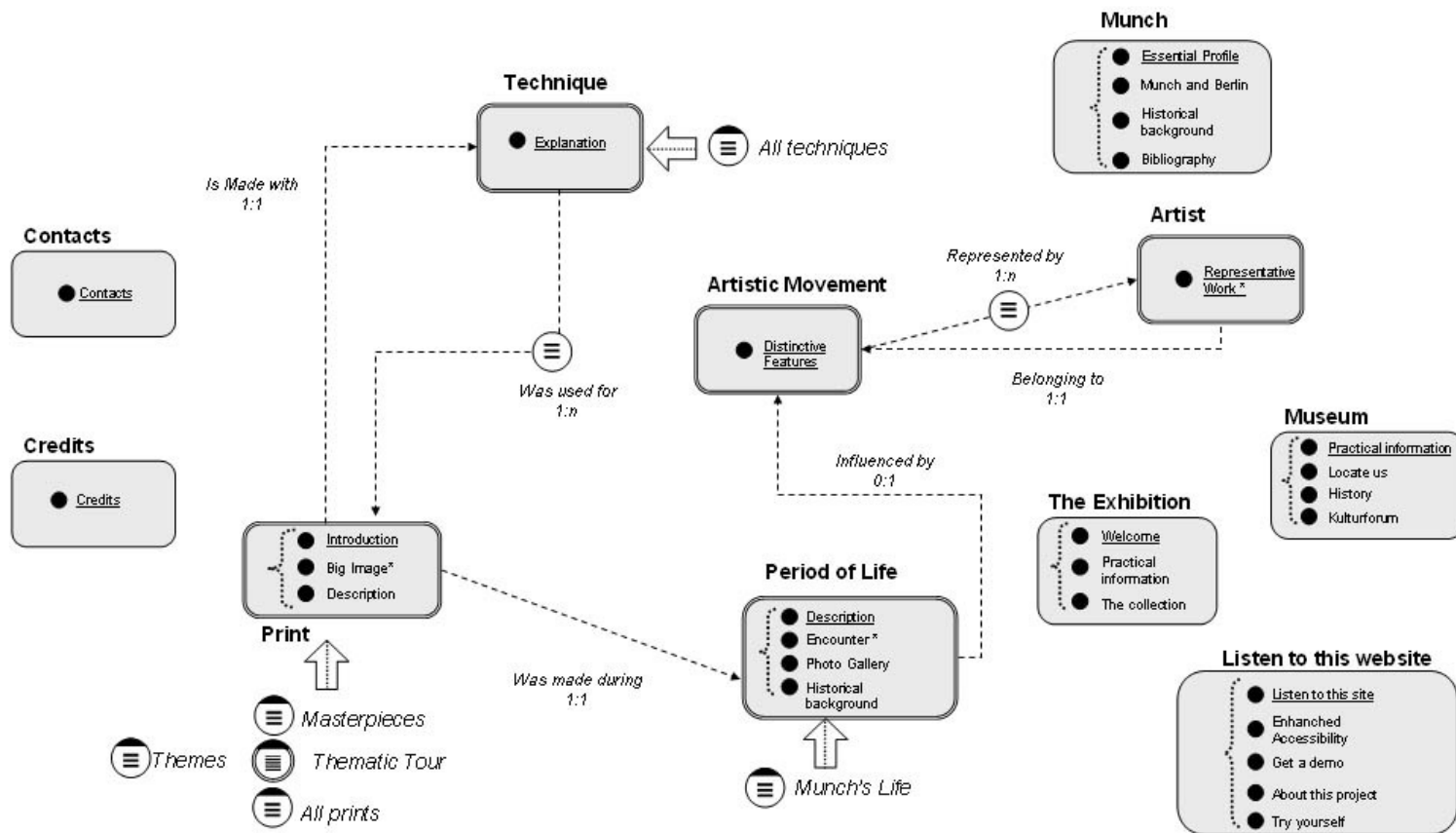
Group of topics page



Single Page

IDM dialogue map – channel (web version)

Munch und Berlin exhibition – www.munchundberlin.org



Annex V

W-SIDE Glossary

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Abstract

W-SIDE is a semiotic toolset that may be used by analysts and designers to model and evaluate the interface language of web applications. This document lists the main concepts of the W-SIDE Framework and gives a brief definition for each term. The scope of the glossary is to provide analysts, designers, and also students, scholars, and researchers a quick access to the explanation of the W-SIDE vocabulary.

The meaning of the terms hereby reported is intended to be restricted to their application to web semiotic analysis and, in particular, to the W-SIDE semiotic analysis model. Therefore, the description of the entries may not capture the significance the terms may assume in other contexts, in other models, or in other stages of the development cycle. In other words, they are not absolute statements, but definitions valid in the context of the W-SIDE Framework. Other concept definitions are instead borrowed, and therefore widely applicable to a variety of fields, such as hypermedia design, human-computer interaction, communication design and usability evaluation.

Common Sense Ontology

Common Sense Ontology (CSO for abbreviation) is the set of concepts belonging to the common background of users, and the signs used can count on this shared knowledge to trigger understanding. Common Sense Ontology refers to common daily-life terms that users should master in order to correctly interpret the sign.

Communication-Intensive Websites

Web applications mainly conceived by stakeholders who need to achieve communication goals, i.e. who wish to use the site to get across messages and establish a dialogue with a variety of users. Communication-intensive aspects may coexist with transaction-oriented aspects, typical of traditional information systems. E-commerce web sites are typical examples of this combination. Other examples of communication-intensive websites include cultural-heritage web sites, educational web sites, institutional web sites, promotional and corporate web applications.

Content Semantics Evaluation

Content Semantics Evaluation matches the knowledge of the real world presupposed by a semiotic unit and the one mastered by the user.

Context Ontology

Context Ontology (CO for abbreviation) is the knowledge not directly concerning the topics the website talks about but relevant for making the dialogue possible and comprehensible. In a museum website there could be semiotic units referring neither to the InterLocutor Ontology nor to the Topic Ontology but to contextual concepts helping the user better understand them.

Dialogic Function

The dialogic function refers to navigational semiotic unit and is the key-element for creating coherence within the website and within the dialogue with its user. A link can have different dialogic functions – i.e. proposing a member topic page, proposing a group of topics page, proposing already visited content, etc. – and the user should correctly interpret them.

Functional Semantics Evaluation

Functional semantics evaluation regards the functional meaning of a sign, that is, the purpose of the sign within the interactive paradigm of the website. A semiotic unit can have a specific *interactive function* and a specific *dialogic function*.

Group of Topics

In the dialogic structure of a website, topics are organized in relevant groups for allowing the user to choose/decide the topics of interest. A group of topics determines the entry points or access paths to the topics as possible subject of conversation; as an example, “Masterpieces” is a specific group of artworks, while “All artworks” is another, larger group. Obviously, more groups of topics create hierarchic structure, that is, families of group of topics.

Interactive Function

A Semiotic unit has always at least one interactive function on a webpage and the user should easily guess it. In particular a semiotic unit can have a consultation function, an orientation function, a navigation function, an operation function, a decoration function or an meta-language function.

InterLocutor/Institution Ontology

InterLocutor Ontology (ILO for abbreviation) is the set of concepts belonging to the real world of the partner who use the website as a meta tool for communicating something to the user. Very often it is the knowledge concerning the institution staying behind the website: in a museum website a link like “Exhibitions” refers to a concept belonging to the museum’s world.

Internet/Web Ontology

Internet Ontology (IO for abbreviation) is the knowledge of concepts, skills, conventions shared among typical web surfers or among people familiar with web browsing in general. When referring to this ontology, semiotic units are understandable only if the user is familiar with the “world” of the web and knows its concepts, rules and conventions.

Kind of Topic

In the dialogic structure of a website, a kind of topic is a generic category of topics of interest for the user. The kinds of topic identify the core content of the application. As an

example, in a museum website “artwork” is a kind of topic and each actual artwork with real content is an instance of “artwork” kind of topic.

Ontology

It is a particular set of concepts a sign refers to and that the user should master for understanding web semiotic units and what they want to communicate.

Referential Content

Referential content is the reference knowledge about the “world” the web site talks about, which is pointed by web signs and should be mastered by the user.

Relevant Relation

In the dialogic structure of a website, a relevant relation determines that the user can switch from a “topic” to another having a strict relation with it; as an example, “authorship” is a possible change of subject relating any “author” to its “paintings”.

Semiotic Heuristic

A semiotic heuristic is a criteria used in the Inspection Analysis and aimed at evaluating the user’s understanding of one or more semiotic units.

Semiotic Unit

A semiotic unit is a sign-vehicle or group of sign-vehicles composing a unique meaningful and functional message to the user.

Semiotic User Profile

Semiotic User profile regards the modeling of the user considering her/his level of familiarity with the set of ontologies presupposed by the website under analysis.

Topic

In the dialogic structure of a website, a topic is a token (i.e. instance, exemplar) of a kind of topic. Each kind of topic defines a number of actual topics.

Topic Ontology

Topic Ontology is the knowledge concerning the particular “domain” or “topic” the interlocutor talks about. In a museum of art website any semiotic unit referring to concepts

strictly related to art, artworks, techniques, artists, etc. are samples of signs referring to the topic ontology.

Towards Content Semiotic Unit

Semiotic units having a consultation function. They are titles, headings, keywords helping the user to understand and browse the content.

Towards Context Semiotic Unit

Semiotic units having an orientation function. Thanks to these semiotic units, the user can realize what the website is talking about, what the actual page is talking about with respect to the topics covered by the website or with respect to the navigational path followed to that point

Towards Decoration Semiotic Unit

Semiotic units having a decorative function. They do not have a functional or informative purpose, but aim at modifying the user perception, at instilling a mood or a feeling, at communicating the corporate identity of the website and at conveying its consistency with the real world.

Towards Interaction Paradigm Semiotic Unit

Semiotic units having a meta-language function. They help the user to understand the language of the medium and how interact with it. Examples are the hourglass while waiting for the page to load, the mouse-hand, the links changing state when passing over them, or the simple the blue links under-lined for making the user aware of the possibility to interact with an element on the page.

Towards Navigation Semiotic Unit

Semiotic units having a navigation function. They are links – menu labels, list of links, content maps, etc. - having the purpose to put forth pointers to new content or to already visited content. Semiotic units having a navigation function entails also a dialogic function.

Towards Operation Semiotic Unit

Semiotic units having an operation function. They let the user modify the state of the application or of the external world. For instance, a button for inserting an item in the shopping bag, a “submit” button for sending personal information, a button for subscribing to a newsletter, a button for “confirming an order”, etc.

Web Conceptual Design

The activity of conceiving and documenting the overall conceptual and interactional architecture of the website as it will influence the user experience.

Web Semiotic Evaluation

The activity by which the understanding of the website language is measured in terms of its capability to effectively communicate the content and functional semantics staying behind it.

Web Domain Ontology

Web Domain Ontology (WDO for abbreviation) is the knowledge shared among websites belonging to the same sector/domain. As an example, museum websites typically make use of similar signs for referring to the same informative objects – the term “Collections highlights” for referring to the possibility to browse the online version of artworks, or “Education” for referring to the online resources to be used in didactical environments.

Web Site Modeling

Experts/inspectors identify the kinds of pages that give shape to the structure of the website in order focus the semiotic analysis on these pages.

Web Site Ontology

Website Ontology (WO for abbreviation) is the knowledge regarding the website in itself. A website itself can become generator of knowledge or creator of conventions which are valid and shared only within the boundaries of that specific site.

W-SIDE Model

W-SIDE Model is a conceptual toolset aimed at analyzing the semantics – both conceptual and functional semantics - staying behind web interface elements.

W-SIDE Evaluation Technique

W-SIDE Evaluation Technique is the activity regarding the evaluation of the interface language and its understanding by critic users. The evaluation refers to W-SIDE Model and is composed by W-SIDE Inspection Method and W-Side User Testing Method.

W-SIDE Syntactic Inspection

Inspectors detect technical/grammar breakdowns causing user misunderstandings. Such problems are user-profile independent, since the problem is not related with the misalignment between the knowledge presupposed by semiotic units and the one owned by the user but rather on the clarity of their structure, of their relations and their overall consistency.

W-SIDE Semantic Inspection

Inspectors “put into the shoes” of critic user profiles and predict misunderstandings in the interpretation of interface semantics.

W-SIDE User Testing

W-SIDE User testing is used for double-checking results detected by inspectors that are doubtful or hardly interpretable and need further validation by observing real users while interacting with critic pages.