

# Semiotics as a Theoretical Foundation of Information Design

Jason H. Sharp  
jsharp@tarleton.edu  
Computer Information Systems, Tarleton State University  
Stephenville, TX 76401, USA

## Abstract

This paper sets forth semiotics as a viable theoretical foundation of information design. In addition to presenting a brief history of the development of semiotics it also gives three examples of how semiotic principles are applied to specific fields of study. These areas include information systems engineering, organizational decision support systems, information intensive web interfaces, and agent-based e-commerce systems. Although some have criticized semiotics for being arbitrarily applied, the literature presented in this paper supports it as an effective theory of information design which provides many practical applications.

**Keywords:** semiotics, information design, theoretical foundation, application of semiotics

## 1. INTRODUCTION

Information design as a discipline is concerned with the effective communication of messages through the use of words and symbols. Horn (1999) defines information design as "the art and science of preparing information so that it can be used by human beings with efficiency and effectiveness" (p. 15). Similarly, Passini (1999) states, "information design means communication by words, pictures, charts, graphs, maps, pictograms, and cartoons, whether by conventional or electronic means" (p. 84). In his anthology *Information Design*, Robert Jacobson includes several articles that introduce approaches that serve as theoretical foundations of information design. These approaches include sense-making, human-centered design, and wayfinding. The purpose of this paper is to set forth semiotics as another possible theoretical foundation of information design.

## 2. HISTORICAL DEVELOPMENT OF SEMIOTICS

Simply put, semiotics is the study of signs. However, the term sign must not be limited to common understanding such as a street sign,

billboard, astrologically sign, or bumper sticker. Eco (1976), a well-known semiotician writes, "semiotics is concerned with everything that can be taken as a sign. A sign is everything which can be taken as significantly substituting for something else" (p. 7). In contemporary society, the use of signs range from the classic pick-up line, "hey, baby, what's your sign?" to comedian Bill Engvall's now infamous "here's your sign" routine which encourages people to hold up a sign to indicate what otherwise should be obvious. In relation to semiotics, Chandler (1999) states, "signs take the form of words, images, sounds, odours, flavours, acts or objects, but such things have no intrinsic meaning and become signs only when we invest them with meaning" (Introduction section, ¶15). The basis of semiotics is found in this definition of a sign, in that, the sign does not have intrinsic meaning, it only has meaning that is assigned to it.

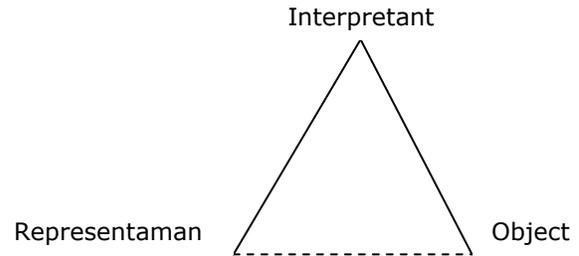
Thus, when an instructor informs the departmental secretary that there is no chalk in the classroom, the only reason the secretary immediately creates a mental picture of a small, white, cylinder-shaped writing tool, is because someone, somewhere along the way ascribed

that meaning to it. In theory chalk could have been named something completely different but still have the same meaning given to it. The same could be said for stop signs, restroom signs, and a multitude of other signs which signify a particular meaning. Chandler (1999) asserts, "we interpret things as signs largely unconsciously by relating them to familiar systems of conventions. It is this meaningful use of signs which is at the heart of the concerns of semiotics" (Signs section, ¶1). In order to lay a theoretical foundation based on semiotics, it is beneficial first to briefly summarize its historical development.

Ferdinand de Saussure and Charles Saunders Peirce, are considered pioneers in the development of semiotics. In Saussure's approach a sign is made up of the signifier, the form which the sign takes, and the signified, the concept which the sign represents. The relationship between the signifier and the signified is called signification. Saussure's work dealt primarily with linguistic signs, but the principles can to a large degree be applied to visual signs as well.

One principle Saussure establishes is the arbitrary nature of a sign (1976). The arbitrariness of a sign can be illustrated through the use of what is commonly referred to as the peace sign. The peace sign is formed by shaping the forefinger and middle finger into the shape of a V. However, this same sign can also be interpreted as the symbol of victory. For example, American soldiers in Iraq were shown giving the thumbs up sign which to Americans represents that everything is okay. Unfortunately, that same sign can be interpreted as a derogatory gesture within Iraqi culture. This principle of arbitrariness then has significant ramifications for information design in that the words, symbols, and icons that are used to communicate a message must carefully chosen based on the intended audience.

Charles Sanders Peirce, who was developing his theory of semiotics at the same time as Saussure, considered a sign to be made up of the representamen, the form which the sign takes, the interpretant, the sense made of the sign, and the object, that to which the sign refers. The interpretation between the representamen, interpretant, and the object is referred to as semiosis. The three components can then be represented by the semiotic triangle shown below:



The dotted-line represents the fact that there is not an observable or direct relationship between the representamen and the object (Chandler, 1999). According to Peirce's model of a sign then "the traffic light sign for 'stop' would consist of: a red light facing traffic at an intersection (the representamen); vehicles halting (the object) and the idea that a red light indicates that vehicles must stop (the interpretant)" (Chandler, 1999, Signs section, ¶24). Peirce also develops the concepts of specific terms that are now routinely used in computing technology and particularly in multimedia and web-based applications. The two most common are symbols and icons. According to Peirce a symbol is "a sign which refers to the object that it denotes by virtue of a law, usually an association of general ideas, which operates to cause the symbol to be interpreted as referring to that object" (as cited in Chandler, Signs section, ¶31). Symbols then are interpreted "according to 'a rule' or 'a habitual connection'" (as cited in Chandler, Signs section, ¶31).

In reference to icons, the relationship between the sign and its object is "mainly by its similarity" (as cited in Chandler, Signs section, ¶32). "A sign is an icon 'insofar as it is like that thing and used as a sign of it'" (as cited in Chandler, Signs section, ¶32). To simplify the terms, a symbol does not resemble the object, but must be in some way specifically taught to the audience before the relationship is made. One example is language in general. An icon on the other hand, actually resembles or imitates the actual object, e.g., a portrait or scale-model (Chandler).

This differentiation can clearly be seen in the use of icons in modern computing environments. With the advent of graphical user interfaces such as the Windows Operating System, users have become familiar with signs that represent or imitate the intended object. A simple example is the use of a picture of a printer to represent the

act of printing a document. Although some icons are not quite as representative, most can be deduced from a logical standpoint. The picture of a floppy disk to indicate the action of saving a file to disk, whether it is actually a floppy, the hard disk, or some other form of secondary storage. A symbol on the other hand does not necessarily carry with it an intrinsic meaning as an icon often does. This can be illustrated by the standard flowcharting symbols used in planning the logic for programming projects. For example, the symbol for input/output is the parallelogram. However, if a person has not been taught that this symbol represents input/output it would have no meaning or a possibly a different meaning to that person. Outside of the context of logical planning, a parallelogram could represent anything. Therefore, in order for a flowchart to be understood, the functionality of the various symbols that are utilized must be explained.

The final figure to be introduced in this historical development of semiotics is Charles Morris. Morris (1964) states that "semiotic has for its goal a general theory of signs in all their forms and manifestations, whether in animals or men, whether normal or pathological, whether linguistic or nonlinguistic, whether personal or social" (p. 1). Morris is credited with creating the framework of semiotics which includes semantics, syntactics, and pragmatics. Semantics is concerned with the comprehension of the intended meaning of the sign, syntactics is concerned with the recognition of the sign, and pragmatics is concerned with interpretation of the sign in terms of relevance (Chandler, 1999).

### 3. THE APPLICATION OF SEMIOTICS

Over the centuries, the semiotics has been applied to various fields including literature, music, poetry, film, and advertising. In current research, semiotics has been used as a theoretical base of information design in the areas of information systems engineering, organizational decision support systems, and the development of agent-based e-commerce systems.

#### Systems Engineering

In the area of information systems engineering, Peirce's classic semiotic model of representamen, interpretant, and object is applied as the theoretical foundation for understanding the nature of requirements (Chong, Liao, & Kecheng, 2002). The relationship between semiotics and

requirements engineering is the fact that "an effective method for requirements engineering for building computer supported systems rest heavily on the understanding of signs and nature of information that users, designers, and software engineers create, process, store, and use" (Chong et al., 2002, p. 2). In this semiotic model for requirements engineering, "the development of a software system can be seen as a series of transformations between requirements and solutions at different levels, which we call semiotic transformations" (Chong et al., p. 3).

#### Organizational Decision Support System

A second area where semiotics has been applied is in the development of an organizational decision support system (ODSS). In this case, rather than using the semiotic triangle presented above, Morris's semiotic framework of semantics, syntactics, and pragmatics is used to show "how the semiotic approach can be beneficially used to identify and refine organizational level problems that are suitable for ODSS support" (Harindranath & Liebenau, 2002, p. 390). The method presented is to conceptually break the information system down into four levels based on semiotic theory and then relate those levels to four concepts of organizational processes. Within this particular context, semantics deals with the problem of meaning, syntactics is concerned with the use of formalism, and pragmatics deals with the actual context of activity.

The term empiric is introduced to refer to the physical characteristics of codes and signals (Harindranath et al., 2002). The four organizational processes that are drawn out of the semiotic approach are prioritization which identifies organizational level problems, contextualization which attempts to understand why perceptions of organizational level problems differ, formalization, modeling of divergent organizational perceptions, and functionality. These correspond with pragmatics, semantics, syntactics, and empirics respectively. The challenge then, "is to use the semiotic technique in organizational analysis to satisfy the requirements of prioritization (of organizational level decision problems), contextualization, formalization, and functionality" (Harindranath et al., p. 394). Consequently, the semiotic technique "could go some way towards providing a clearer conceptualization of organizational decision problems, and therefore, what an ODSS should actually be" (Harindranath et al., p. 394). In conclusion, "the semiotic tool addresses the fundamental problem of reconcil-

ing differing perceptions within the organization to assist in overcoming the inherent problems of heterogeneity" (Harindranth et al., p. 397).

### **Information Intensive Web Interfaces**

A third area to which semiotics has been applied is in the design of information intensive web interfaces. Suffice it to say with the growth of the Internet and the World Wide Web the concepts surrounding semiotics such as symbols, icons, words, and more recently interactive widgets the establishment of a "fruitful dialogue between the user and the web site" is made possible; accordingly, Islam, Ali, Al-Mamun, and Islam (2010) postulate that "web signs, like signs in general, make use of a complex sign system composed not only of words and grammar from natural language but also by other languages and grammars that must be understood in order to correctly interpret the interface" (p. 46). In this day and age web interface design is big business and the difference between an effective and an ineffective design can be the difference between success and failure regardless of the particular purpose of the web site. For example, a less desirable product or service may actually succeed over a more quality product or service simply due to the usability, ease of use, and user-friendliness of its web design.

In an effort to illustrate the benefit of applying semiotics to web interface design Islam et al. (2010) conducted a study of information intensive web sites related to the cultural heritage sector (e.g., The British Museum, National Gallery of Canada, Metropolitan Museum of Art). The study involved the statistical analysis of 2346 interface signs from 200 pages selected from 34 museums ranging in size from large to small. Specifically the authors were interested in two primary issues: (1) user presupposed knowledge (ontologies) to interpret the web sign and (2) complexity experienced by the user and reasons why the users encountered difficulties in interpreting the meaning of the sign properly. As such the authors considered two ontologies based on Speroni's Web-Semiotics Interface Design Evaluation. These were Website Ontology and Common Sense Ontology. Website ontology encompasses those concepts which may or may not belong to the external world, but belong to the website itself. Common Sense Ontology refers to those concepts related to the common background of the users. Not surprisingly, the authors found that users felt high complexity related to Website ontological signs and little or

no complexity related to Common Sense ontological signs. Also expected was that larger websites averaged more complexity related to web signs than smaller websites. It can be deduced therefore that web signs based on the prior knowledge of the user contribute to user satisfaction and usability. However, this adds to the effort that must be put behind the design in terms of having a clear understanding of the website users. Consequently, the authors recommend avoiding the "use of website ontological signs by using the other appropriate signs [i.e., Common Sense ontological signs] in replace of these signs could reduce the sign complexity as well as increase the user's satisfaction" (p. 53). Ultimately, "from an interpretation perspective, the semiotic approach is useful because it provides a framework in which to reconcile the perspectives of the websites held by both designer and user" (p. 52).

### **Agent-Based E-Commerce Systems**

A final area to which semiotics has been applied is in the development of agent-based e-commerce systems. An agent-based e-commerce system consists of a process between supplier and customer and the exchange of electronic transactions between the two (Barjis, Chong, Dietz, and Kecheng, 2002). The broad semiotic application it to analyze "how meanings and intentions can be conveyed through language (signs) and what aspects of language need to be captured so that through the representation of data, the agent-based e-commerce can function as an effective substitute for human communication" (Barjis et al., 2002, p. 492-493).

It is due to this interpretation of signs and the growing complexity of developing these systems that the semiotic approach is recommended as a viable methodology (Barjis et al.). The basic structure of a sign in this context consists of the recipient, sender, meaning, and intention. The process then is to first identify how human agents use signs to communicate intent and meaning and then apply these findings to the agent-based system (Barjis et al.). A significant portion of this application of semiotics to agent-based e-commerce systems draws heavily on the work of Tim and Vile who identified three phases based on semiotics (as cited in Barjis, et al.). The first phase, contextual HCI semiotics analysis, indicates that "an interface is a sign system that is repeatedly interpreted by a group of human agents" (Barjis et al., p. 499). If this

is correct, the "human agents' culture and context will influence the way in which they interpret signs from the interface" (Barjis et al., p. 499). Of course, this is a core principle of semiotics. Barjis et al. (1999) goes on to say that "from a computing perspective, the semantic model is useful because it provides a framework that reconciles the perspective of the system held by both the designer and the user" (p. 500). In the second phase, web interface semiotic analysis, "the analysts are primarily concerned with how to represent the meaning of a term on a computer in the most effective way" (Baris et al., p. 500).

Baris et. al. state that "in order to understand the representation of term using signs, interest is in the means of communication and all types of signs and signification including languages, symbols, icons, pictures, etc" (p. 501). Finally, in the third phase, semiotic metaphor analysis, "the analysts are interested in choosing a right metaphor for representing the sign, whether the sign is to be shown as icon, symbol, or index" (Barjis et al., p. 504). The findings show that the semiotic approach provides a framework for "identifying the responsible human agents, software agents, and their potential actions and the behavioral norms which brings about the realization of the potential actions" (Barjis et al, p. 509). In summary, Baris et al. assert, "these features make it a valuable asset in understanding the design requirements of the agent-based e-commerce system" (Barjis et al., p. 509).

#### 4. CONCLUSION

Despite the positive results of semiotics illustrated above, it is important to note that it is not without its critics. Some argue that it is not yet a "full-fledged analytical method or theory" (Chandler, 1999, Criticisms of Semiotic Analysis section, ¶1). Others consider semiotics a general-purpose tool which should not be arbitrarily applied to any given field. This argument stems from the fact that some semioticians consider it applicable to almost every discipline when in fact, it "is just one of many techniques which may be used to explore sign practices" (Chandler, Criticisms of Semiotic Analysis section, ¶2). However, it appears that the positives outweigh the negatives. Chandler (1999) points out that the strength of semiotics its ability to "help us to realise that whatever assertions seem to us to be 'obvious', 'natural', universal, *given*, permanent and incontrovertible are generated by the ways in which sign systems operate in our dis-

course communities" (Strengths of Semiotic Analysis section, ¶3).

Semiotics can help "make us aware of what we take for granted in representing the world, reminding us that we are always dealing with signs, not with an unmediated objective reality, and that sign systems are involved in the construction of meaning" (Chandler, Strengths of Semiotic Analysis section, ¶5). Based upon the wide use of the semiotic approach in various fields and its specific application to the areas discussed above it appears that with conscientious application semiotics can serve as an effective theoretical foundation for information design.

#### 5. REFERENCES

- Barjis, R., Chong, S., Dietz, J. L. G., & Kecheng, L. (2002). Development of agent-based e-commerce systems using semiotic approach and DEMO transaction concept. *International Journal of Information Technology & Decision Making*, 1(3), 491-510.
- Chandler, D. (1999). Semiotics for Beginners. <http://www.aber.ac.uk/media/Documents/S4B/semiotic.html>
- Chong, S., Liao, S.Y., Kecheng, L. (2002, July 15). Semiotics for Information Systems Engineering. Paper presented at the 2002 International Symposium on Communication Systems, Networking, and Digital Signal Processing, <http://www.scit.wlv.ac.uk/~in8189/CSNDSP2002/Papers/A1/A1.1.pdf>
- Eco, U. (1976). *A Theory of Semiotics*. Indiana University Press, Bloomington, IA.
- Harindranath, G., & Liebenau, J. (2002). Organizational reconciliation and its implications for organizational decision support systems: a semiotic approach. *Decision Support Systems*, 33, 389-398.
- Horn, R. (1999). Information Design: Emergence of a New Profession. In R. Jacobson (Ed.), *Information Design*, The MIT Press, Cambridge, MA.
- Islam, M., Ali, M., Al-Mamun, A., & Islam, M. (2010). Semiotics explorations on designing the information intensive web interfaces.

*The International Arab Journal of Information Technology*, 7(1), 45-54.

Morris, C. (1964). *Signification and Significance: A Study of the Relations of Signs and Values*. The MIT Press, Cambridge, MA.

Passini, R. (1999). Sign-Posting Information Design. In R. Jacobson (Ed.), *Information Design*, The MIT Press, Cambridge, MA.

Saussure, F. (1959). *Course in General Linguistics*. Philosophical Library, New York.