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An integrative semiotic methodology for IS research

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AN INTEGRATIVE SEMIOTIC METHODOLOGY FOR IS RESEARCH

Abstract

Semiotics studies the production, transmission and interpretation of meaning represented symbolically in signs and messages primarily, but not exclusively, in language. For information systems (IS) the domain of semiosis consists of human and non-human interactions based on technologically-mediated communication in the social, material and personal worlds. The paper argues that semiosis has immense bearing on processes of communication central to the advanced information and communications technologies studied by IS scholars. Its use separately, or in mixed methods approaches, enriches areas of central concern to the IS field, and is particularly apt when researching internet-based development and applications, for example virtual worlds and social media. This paper provides a four step structured methodology, informed by a central theoretical semiotic framework to provide practical guidelines for operationalizing semiotics in IS research. Thus, using illustrative examples, the paper provides a step-by-step semiotics approach to research based on distinctive semiotic concepts and their relationships – *producer, consumer, medium, code, message* and *content* - and how, at an integrating level, the personal, social and material worlds relate through sociation, embodiment and sociomateriality.

Keywords: Semiotics, research methods, sociation, embodiment, sociomateriality

AN INTEGRATIVE SEMIOTIC METHODOLOGY FOR IS RESEARCH

1. Introduction

Semiotics¹ is the study of how meaning is generated and interpreted through signs and symbols. A sign is something that stands for or represents something other than itself. Human language is the most well developed sign system {de Saussure, 1960 #18}, but almost anything that we interact with can become a sign and therefore represent a meaning. Moreover, the form of the representation is not neutral or transparent but itself has significant effects on the meaning - intended and unintended, recognized and not recognized.

Thus, semiotics seeks to look behind or underneath the manifest appearance of texts² (interpreted widely to include all cultural artifacts) to reveal the underlying social and cultural structures that generate them. In this sense it “denaturalizes” them, generating insight into the forms of representation that we tend to take for granted. The more obvious the text appears, the more difficult it may be to get beneath the surface and reveal its hidden features. Thus, with semiotics we are focusing attention on the form of representation itself, rather than the message content, and the effects that the representation has on both the production and interpretation of the content.

¹ The term “semiosis” refers to the actual process of sign usage. “Semiotics” refers to the study of sign systems especially in the Peircian tradition. “Semiology” refers to the study of signs particularly in language following de Saussure {Noth, 1990 #3505, p.14}. For introductions see: Cobley {, 2010 #4135}, Chandler {, 2002 #3506}, Hall {, 2013 #4134}, Barthes {, 1967 #3504}, Eco {, 1979 #3509}. For comprehensive reference works see: Sebeok {, 1994 #3521}, Noth {, 1990 #3505}, Krampen {, 1987 #3485}, Short {, 2009 #4103}.

² Within semiotics, the term “text” covers all forms of social signification and representation including writing, speech, technology, visual arts, advertising, dress and behavior

Within information systems (IS), the most obvious example is the appearance of the screen itself which is redolent with iconic and visual signs {O'Neill, 2008 #3478;de Souza, 2005 #3477}, but information systems more generally structure our experience of reality through their forms of representation {Kallinikos, 2011 #3717;Kallinikos, 2015 #4817}. Both Agerfalk {, 2010 #4874} and Grover and Lyytinen {, 2015 #4872} have recently suggested the importance of semiotics. Technology, particularly information and communications technologies (ICT), is triply involved here. First, the main focus of the paper is using semiotics to analyze and understand communication but, in the modern world, ICT is the main medium through which that communication occurs. Second, the medium is not neutral or transparent but has effects on the meaning and interpretation of the message. Finally, ICT can enable communication to occur in a more or less efficient and effective manner.³

In an earlier paper, Mingers and Willcocks {, 2014 #4104} developed a general framework for IS research (see Figure 1 below) . This framework provided the “what” and “why” of semiotic research but, because of its inevitable generality, could not provide the “how”. That is the purpose of the current paper - to provide detailed practical guidelines for carrying out research from a semiotic perspective. The step-by-step approach we suggest may be used by itself, but can also be part of a mixed-methods study {Venkatesh, 2013 #3792;Mingers, 2001 #1329}. We see this paper as following the genre of research guidelines for particular research approaches such as positivist {Dubé, 2003 #4862}, interpretive {Myers, 1997 #4136}, critical {Myers, 2011 #3788}, mixed method {Venkatesh, 2013 #3792} and critical realist {Wynn, 2012 #3785}. Our

³ In fact, technology is now going beyond merely transmitting already existing content to partially creating that content itself. For example, the app *musical.ly* contributes in the production of professional sounding music videos. This trend actually makes the role of semiotics even more important (thanks to an anonymous referee for this thought).

aim is to enable researchers, both those familiar with semiotics and those not, to conduct semiotic studies in a rigorous manner. An introduction to the basis of semiotics, that is the sign, can be found in Appendix A and a Table listing many of the semiotic concepts with empirical examples is in Appendix B.

2. Overall Semiotic Methodology

The field of semiotics essentially consists of many different concepts and ideas that have been developed and applied in varied situations. There are very few sources that provide a general purpose semiotic methodology that could be usable for IS research. Manning {, 1987 #4172}, in his sociological book, covers ethnographic fieldwork; most others are either general introductions to semiotics {Chandler, 2002 #3506;Van Leeuwen, 2005 #4174;Halliday, 1978 #4175}, contributions to the theory {Barthes, 1967 #3504;Eco, 1979 #3509;Kress, 1996 #4161}, or specific, often rather ad hoc, applications of particular analyses {Barley, 1983 #3462;Brannen, 2004 #3536}. Within the IS literature there are a variety of applications of semiotics which we shall examine below, but no significant text or research guide. There is also literature within disciplines such as management or marketing where semiotics is a more well-known and utilized approach {Oswald, 2006 #4248;Umiker-Sebeok, 1987 #4186;Barley, 1983 #3462;Brannen, 2004 #3536;Mick, 1986 #3464} but again no structured methodology.

We have therefore developed our own structured methodology that has two distinct components. The first is a step-by-step methodology, following the general retroductive methodology of critical realism, for undertaking a semiotic analysis of a problematic situation or research question. The second is a framework within which to organize the key semiotic concepts. This is based upon the general semiotic research framework developed by Mingers and Willcocks {,

2014 #4104} (see Figure 1) but augmented by Jakobson's {, 1960 #3471} model of semiosis (Table 1), the result being displayed in Figure 2.

2.1. Semiotics Research in IS: Taking a Step-By-Step Approach

Research approaches are not mutually exclusive such that a researcher needs to choose one rather than another. In practice, we see semiotics best used as part of a carefully designed mixed-methods study together with other qualitative and quantitative methods {Mingers, 2001 #1329} customized to the research problem at hand.

Mingers and Brocklesby {, 1997 #396} proposed a very general set of steps for research that could encompass a wide range of particular research methods (the 4As): *Appreciate* the current research situation; *Analyze* the structures generating and maintaining it; *Assess* alternatives to the current situation; *Act* to bring about change (see Table 1). Specific research methods or projects may only enact certain of these stages. For example, an ethnographic study may only intend to describe a particular situation (A_1); an exploratory statistical analysis may collect data and then look for underlying factors (A_1, A_2); the investigation of problems with an information system may also assess and recommend changes ($A_1 - A_3$); some action research may aim to actually bring about change ($A_1 - A_4$). Table 1 shows how the general critical realist applied research methodology {Bhaskar, 2013 #3913; Bhaskar, 2014 #4762} and Wynn and Williams' {, 2012 #3785} critical realist (CR) case approach fits into this framework. It also includes the semiotic methodology that will be developed.

4A's framework	Critical realist applied research	Wynn and Williams CR case study	Semiotic methodology
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Appreciate and describe the research situation as it is	Resolution of complex phenomena into components	Explication and description of the events to be explained	Identify problems and questions in the meaning or set of meanings attributable within the defined situation
	Redescription in an explanatory meaningful way	Description and explication of the relevant context and possible causal structures	Gather a collection of material both textual and verbal relevant to the explanations and carry out an overview using the integrative semiotics research framework
Analyze the causal structures that generate and maintain the situation	Retroduction of potential hypothetical explanatory mechanisms	Retroduction of mechanisms from the structure that might have generated the events	Collect and analyze in sufficient detail the semiotic materials relevant to the research questions, using semiotic concepts, in order to generate hypotheses or possible explanations
Assess alternatives to the current situation	Elimination of alternatives	Empirical corroboration of the putative causal mechanisms	Verify the rigor of the research process and establish the more likely explanations for the phenomena identified. Validate results, confirm or eliminate or extend hypotheses and explanations, develop possible semiotic worlds in which the communication problems identified would not occur.
	Identification of causally efficacious mechanism		
Act to bring about appropriate	Correction of earlier findings	Use of triangulation and mixed methods	Contribute new understandings, critiques and research proposals, and, where part of the research project

change			agenda, improve semiotic and communication processes.
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Table 1: 4A's Methodological Framework together with the Semiotic Research Framework

In Figure 1 we provide a high level view of the integrative semiotic methodology we have developed, disaggregated into twelve major steps. For the researcher wanting to operationalize the steps, we provide a more detailed 12-step version of the framework in Appendix C.

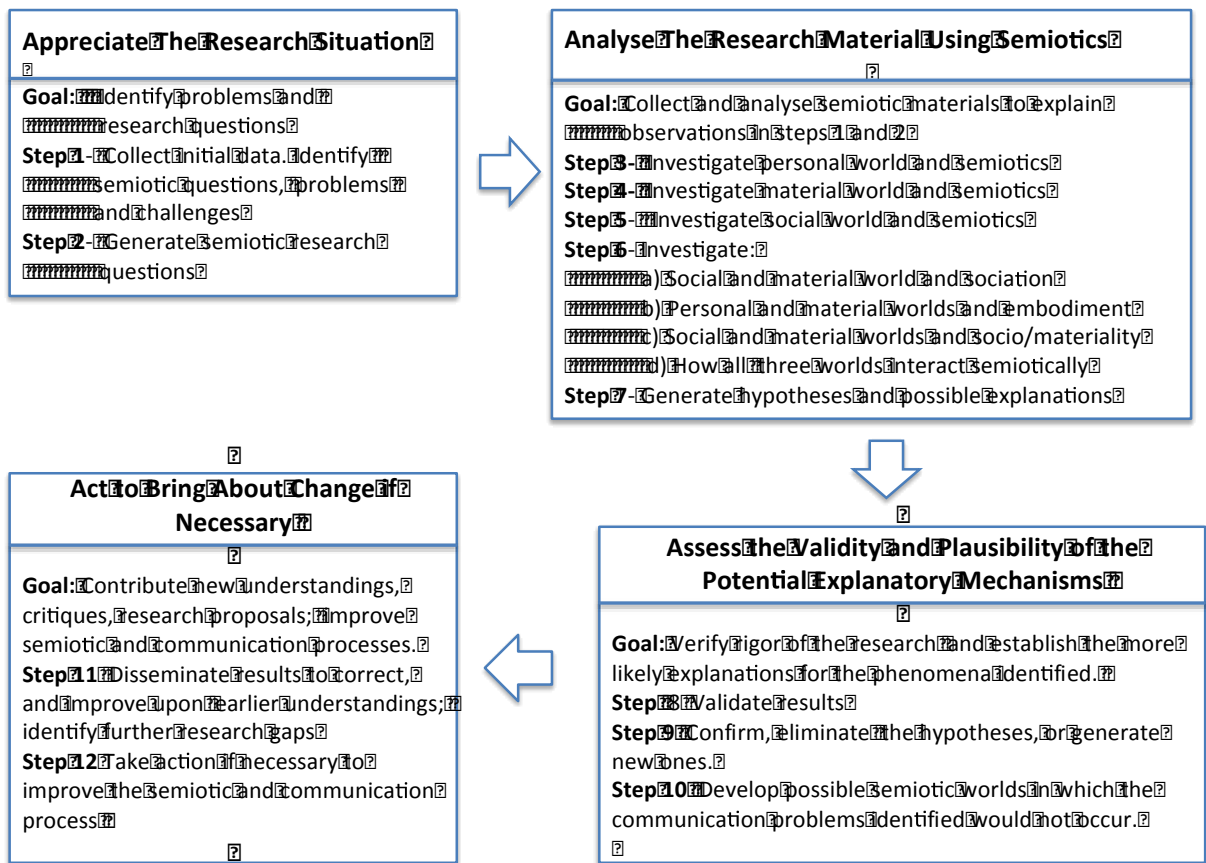


Figure 1 – An Integrative Semiotic Methodology: Mingers and Willcocks 12 Step Approach

If the overall steps will be familiar to IS researchers, this is because despite the methodological pluralism recorded in IS research (see: {Bernroider, 2013 #4249;Mingers, 2011 #4250}) there is also, as Lee {, 1991 #297;, 1989 #4254;, 2009 #4255} argues, an implicit shared logic of enquiry. While this could be the subject of a whole paper, we would comment only that Dewey's {, 2004 #4251;, 2004 #4252} work on pragmatic enquiry can here provide overarching shape, points, and direction. Knowledge as a model of how something works is provisional and contextual. A scientific enquiry will proceed through identifying a problem, challenge, lack of understanding that needs to be addressed to further meaning and/or practice. The search creates hypotheses, is experimental, collects evidence and searches with validating controls to discover a provisional, useable truth a warranted assertability, that 'fits' (corresponds as a key in a lock {de Waal, 2005 #4253}) with the evidence and works in practice.

The methodology described in Table 1 is generic in the sense that it could apply to many research approaches. The specifically semiotic aspects occur in step 1 and even more so in step 2 where a variety of semiotic concepts may be applied. To help structure the plethora of semiotic concepts that exist we will now introduce another component of our methodology - a general semiotic framework to fit within the chosen research approach.

2.2. The General Semiotic Framework

Mingers and Willcocks {, 2014 #4104} developed in detail a general framework for research in information systems that positioned semiotics at the center of three worlds – the Personal, the Social and the Material (see Figure 2) so we will only summarize it briefly here.

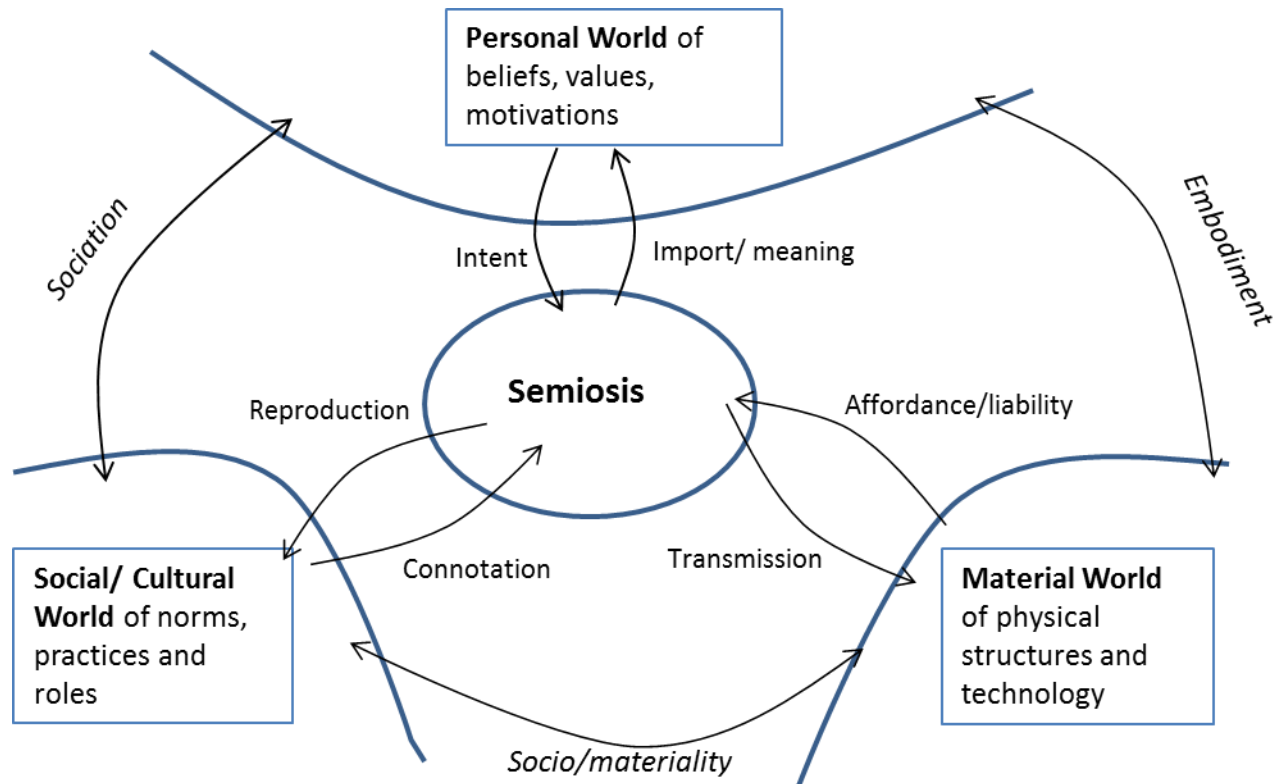


Figure 2 An Integrative Semiotic Framework - Relations Between Semiosis and the Three Worlds

(developed from Mingers and Willcocks {, 2014 #4104})

The semiotic process draws on the social world for the system of connotations underlying language and through use thereby reproduces and sometimes changes it. The material and technical world provides the medium through which communication occurs – through affordances and liabilities it enables the transmission of communications, although not in a purely neutral way. The personal world of individuals generates communications in line with

their conscious (and unconscious) intentions, and communications have meaning or import which they need to interpret. In Figure 1 we also show more general relations between the three worlds – that between the personal and social we call sociation, it being both the process of socialization and the enactment of the social world. Between the personal and material worlds there is a relation of embodiment {Mingers, 2001 #1485} – the mind is enacted within a physical body. And between the material and social there is a relation of sociomateriality but by this we do not mean strong sociomateriality {Orlikowski, 2008 #3470} but rather an interaction between two separable domains.

There are many useable semiotic constructs, and we wish to provide a structured framework for employing these. To do this we invoke the communicational model of Jakobson {, 1960 #3471} because it includes both a structure for communication and also the possible functions that each element within the system may perform. The model is updated in Table 1, particularly the terms he used⁴.

⁴ This is because his model generally assumed a direct communication between a sender and a receiver which is very different from today's networked communications often with multiple senders and receivers, and the receivers being active rather than merely passive.

- **PRODUCER** (addresser) the person(s) or system sending or initiating the message
- **CONSUMER** (addressee) the person(s) or system receiving and interpreting the message
- **CONTENT** (context) the meaning or information carried in the message within a particular context
- **MESSAGE**⁵ (message) the form within which the content is expressed or represented – a particular sequence of signs
- **CODE** the cultural system of meanings that underlies the message and allows the signs to convey the meaning that they do
- **MEDIUM** (contact) the physical mode of transmission of the message

Table 1 – A Development of Jacobson’s Six Communication Elements (his original terms are in brackets)

Each element of the model can be seen to fit into one of the three worlds in Figure 2. The resulting superimposition is shown in Figure 3, which provides an overall picture of the different aspects and concepts of semiotics. The researcher can use Figure 3 to help decide which concepts are most useful depending on the particular research question.

The heart of the framework in Figure 2 is the **content**, and the **message**. The content is the actual meaning, and any information that it carries {Mingers, 2013 #3849}, which the producer is aiming to provide for the consumer. The content could be expressed or represented in different

⁵ Within the semiotic literature the term “text” is often used instead of “message”. We prefer message as it is less tied to a written document to denote the whole of the representation in whatever form.

ways – what we will call here the message. Its interpretation depends on the context of the message as well as the mental readiesses of the consumer. The message is the set of signs, symbols and signifiers that is used to represent the content on a particular occasion. The message will have overt or intended meanings, but it will also carry with it latent and perhaps unintended connotations as well.

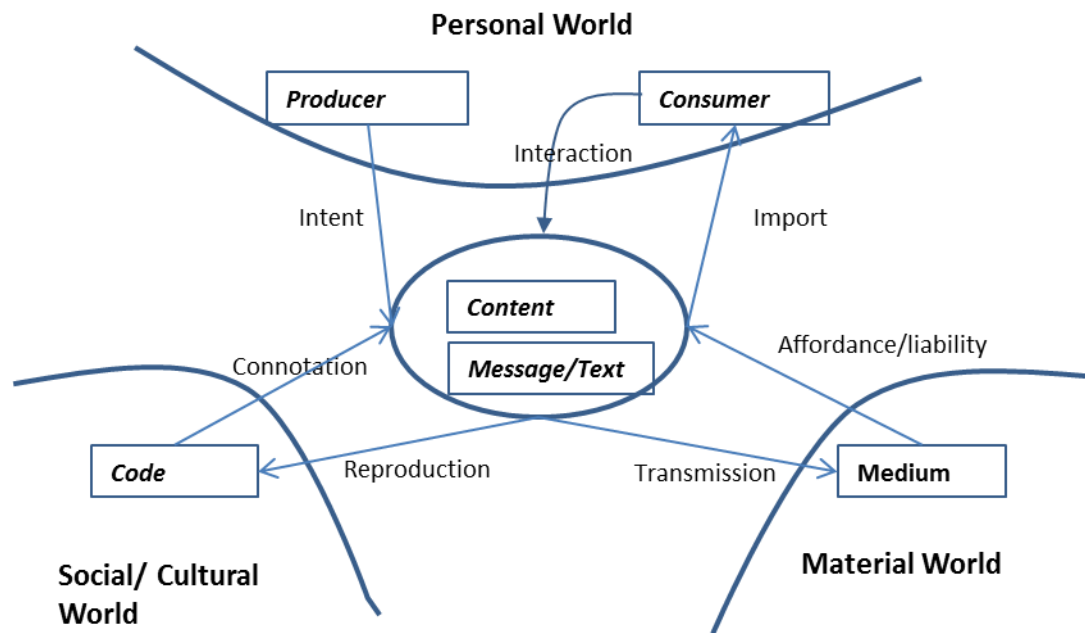


Figure 3: Semiotic Research Framework including Jakobson's model (The relations between worlds have been left out for clarity but are included in Figure 1. There are many other elements in the three worlds, the diagram only shows the *location* of the elements of the model)

The message has to be embodied physically in some way so that it can be transferred from producer to consumer – this is the **medium**. It could be audible, visual, tactile, face-to-face or

virtual, physical or electronic. The medium is not simply neutral, however, as its particular characteristics, in terms of affordances and liabilities {Volkoff, 2013 #4190}, has effects on the meaning and the codes that can be used.

The **code** is the system of social and cultural meanings or connotations that allow symbols to represent meaning. The code must to some extent be shared by the producer and consumer for any form of communication to occur. The code is intrinsically social {Wittgenstein, 1958 #1073}, there cannot be a private language. The employment of symbols, as in the use of a language, also reproduces and potentially changes the code through interaction.

Finally, we have the **producer**, who has some intent, and the **consumer**, for whom the message has some import⁶. Traditionally in semiotics, this was seen as two people in interaction – sender and receiver or addresser and addressee. Nowadays, with websites, news media, and social media, this is much more attenuated with both producers and consumers often being much more ill-defined groups. The producers of a communication are all those groups involved in generating a particular communication, and the consumers are those who receive it, intended or not, and then have to interpret and understand it. Receipt of a message is not as a passive acceptance but rather an active interpretation based on prior socialization and embodied cognition {Dourish, 2001 #3486;de Souza, 2005 #3477;Mingers, 2001 #1485}. A further complication is that many communicational media, especially websites, have become *interactive* in the sense that the consumer does not just “receive” the content but is active, through their choices, in controlling the content and indeed, in social media sites for example, actually

⁶ Many semioticians (e.g., Peirce) accept that signs exist in the natural world, e.g., smoke/fire, paw-print/animal, without there being a deliberate producer. We fully accept this in general but in this paper restrict ourselves to deliberately produced signification.

generating much of it {O'Neill, 2008 #3478}. This is represented in Figure 3 by the “interaction” arrow.

We have now established the structured methodology, and the conceptual framework that will guide the semiotics research. In the following four sections, we describe the various semiotic concepts that can be applied, and illustrate them with empirical examples from information systems and other management areas. The sections follow the model in Figure 3 – the personal world of producer and consumer (section 3); the semiotic world of message and text (section 4); the social world of semiotic code (section 5); and the material world which provides the medium of communication (section 6). How these can be integrated together is discussed in section 7.

3. Investigate the Personal World: Producer and Consumer

The key here is to identify the producer (s) and consumer(s), focusing in particular on the intention of the producer, the meaning to the consumer, and their interactions with message and content (Figure 3).

Communication depends upon already established congruencies between those involved. To be able to communicate at all, people must already belong to shared communities of meanings and conventions. In terms of our model, they must share, to some degree, both the code and the content. (Within philosophy, this is termed the *universe of discourse*). Communication is an active and creative process – the producer has to generate an appropriate text (*encoding*) and

then the consumer has to interpret and understand the text (*decoding*) - although what is decoded may not be the same as what is encoded.

In contrast to the traditional cognitivist, representationalist paradigm, we shall adopt the perspective of cognition as an active, embodied phenomenon. This develops from the phenomenology of Heidegger {, 1962 #241} and Merleau-Ponty {, 1962 #758;, 1963 #759}, autopoiesis {Maturana, 1980 #13;Mingers, 1995 #15;Varela, 1991 #689}, and work within ICT such as Winograd and Flores {, 1987 #708}, Dourish {, 2001 #3486}, O'Neill {, 2008 #3478}, Schultze {, 2010 #3659} and Schultze and Orlikowski {, 2010 #3646}. This is in opposition to the Cartesian split between mind and body that informs disciplines such as artificial intelligence, computing, information and cognitivist psychology.

This is also the position underpinned by the work of Johnson {, 1987 #800} and Lakoff and Johnson {, 1980 #3516}, including their emphasis on reason shaped by the body, a cognitive unconscious to which we have no direct access, and metaphorical thought of which we are largely unaware.ⁱ But we, as human beings, are “structurally coupled” with our immediate environment of people, signification systems and materials. Signs act as affordances and constraints – they lead to particular interpretations and constrain against others – but this is always relative to the knowledge and intentions of the receiver.

This makes it important, as a first step in any semiotic analysis, to identify who the producers and intended consumers are, and there may be multiple groups of each. As an example, example. Huang and Chuang {, 2009 #4132}, in their analysis of social tagging, identified three relevant groups – the system designers who produce a system that affords the possibility of tagging, the tag writers who attach tags to their own or others messages, and the user community who consume the tags but who consist of a diverse variety of different groups. The particular images

and connotations that signs or texts may conjure up will only occur if the consumers share those cultural references and this can be highly specific to certain groups dependent on many obvious factors – for example, age, nationality, gender, place, interests. There may also, particularly with public communications, be consumer groups who are *not* intended and therefore may not share the code. As well as the extent of the shared code, we need to consider other issues – the purpose and modes of the text.

Texts will have been produced for a purpose, although they may also have unintended effects as well. In recent years the range of ICT systems has expanded vastly and now covers most areas of human activity:

- **Task performance** (work and personal): Office applications (e.g., WP, SS), transaction processing, statistics packages, work-specific task systems (e.g., CAD), booking sites, shopping sites
- **Communication and networking**: email, Skype, LinkedIn, ResearchGate, wikis
- **Information provision**: databases, ERP, MIS, timetables, reference works (e.g., Wikipedia), maps, media (e.g., newspapers)
- **Leisure**: games, music, hobbies, creative software (e.g., PaintShop, Photoshop)
- **Self-expression and representation**: Facebook, Twitter, blogs

These varied purposes will affect the appearance and content – or modality - of the textⁱⁱ. Consumers have to make judgments – is it fact or fiction? Authoritative (e.g., encyclopedia) or biased (e.g., advertising)? Trustworthy (e.g., rigorous research) or mere opinion (e.g., blogs)? Such judgments have to be made by comparing the text with other similar texts (the ‘genre’ – see

below), prior knowledge, and what seems possible or plausible.⁷ We also have to recognize the existence of deliberate deceit – texts that simulate or pretend to be something they are not – scams and fake websites. French et al {, 2006 #4168} provide an interesting semiotic analysis of how trust can be built up through a series of interactions between text (website) and user within an E-service context.

Finally, although we generally assume that the producer is human, in fact now much content on websites is actually driven algorithmically by the technology itself, varying according to location and interests and other recently visited websites.

4. Investigate the Semiotic Domain: Message

The message (often called ‘text’ in semiotics) is the sensory representation of the content. It is often visual but can be based on sound, feel (a kiss), smell (new-mown grass) or taste (apple pie). It may be a single sign (e.g., a heart), a sentence, a behavior or a complex combination of icons, indexes and symbols as in a website or advert. In any event, the aim of this part of the analysis is to understand what cultural meanings the message embodies, both overt and intended, and latent and perhaps unintended.

The first step is to identify the specific message(s) to be analyzed and to be clear about:

- the reason for choosing this message;
- the producer of the message and their purposes;
- the intended - and actual - audience; and
- the general context in which the message is produced.

⁷ In some cases, Eco {, 1979 #3509} warns, the signifier can become so familiar that it appears to have more reality than the signified. For example, events in long-running TV soap operas are often covered in news programs as if they were real.

Next, it is important to collect related messages in order to understand how the symbols in the message are related to the wider culture. These could include examples of similar messages; examples of messages which are related but very different; and general information from the wider culture – images, stories, data – that portray the cultural landscape from which the message draws its symbolization. As well as purely textual material, this stage could include observation of behavior, for example users interacting with a website or information system, and interviews to see how the audience is interpreting the message.

The next step is to identify the various signs present in the message, and also the structure of the message, that is, the overall presentation and the relations of the various signs within it.

4.1. Identify Signs in the Message

As we have seen, signs may take many forms and be of many types. Within IS, the majority of signs will be primarily visual, at least in their presentation, as they will appear on a screen although sounds are an important feature of many computer interfaces. Even touch is now entering into the space with devices such as iPads and smartphones.

Peirce {, 1992 #4177}classifies signs in terms of three modes of representation - the index, the icon and the symbol. They differ primarily in the closeness of the relation to their signified. An index is a signifier that has a direct relation to its signified⁸. An icon is a signifier that resembles its signified in some way by looking or sounding like it, or sharing some of its characteristics. Examples are models (scale models and conceptual models), diagrams, pictures, sound effects and onomatopoeia. A symbol is a signifier that has no direct relation to its signified, rather its

⁸ This could be through *causality*, e.g., smoke/fire, thermometer/temperature, symptom/illness, ringing or knocking/person calling, signpost/direction; or *contiguity*, e.g., sail/ship, White House/President, suits/executives, eye/looking, bell/end of school

relation is a matter of habit or convention and has to be learnt or acquired. Virtually all language (except onomatopoeia) is symbolic, as are alphabets, Morse code, numerals, traffic lights and flags⁹.

Looking at the computer screen in front of me (which shows a Word document in a Window), one can see a whole array of signs, especially cons such as the small printer, disc, clipboard, scissors, window etc.; but also indexes such as the time and date, scroll bars and loud speaker slider; and symbols such as the words and letters themselves, or the links to other software such as Facebook. There are also signs that are a mixture, for example the style and formatting icons are symbolic but also iconic; the number of words is symbolic and indexical and the power meter showing CPU usage is iconic and indexical. The Google map in another window is indexical (pointing to things), iconic (modelling distances and heights) and symbolic (using conventional symbols).

As an example, French et al {, 2006 #4168} researched how users developed degrees of trust in a transactional website. It was found that a variety of signs in a website can promote either trust or lack of trust, for example brand identities, digital seals, credit card authorization, URL addresses, physical addresses and the general professional appearance of the site. It is important therefore that designers pay attention to the way in which particular appearances may well lead to unintentional negative trust reinforcement.

It should be noted that Peirce developed more complex typologies of signs, the most well-known having ten categories based on three dimensions – the representamen itself, its relation to the object and its

⁹ The relationship is said to be arbitrary although it may be better to say that prior to being established the relationship is arbitrary but once established it may be very strong.

relation to the interpretant {Peirce, 1992 1998 #4177;Short, 2009 #4103}. In one research example, Huang and Chuang {, 2009 #4132} used these ten sign classes as a framework to analyse social tagging. Tagging is currently a major development within social communication on platforms such as *del.ici.ous*, *Flickr*, *YouTube*, *Twitter* and *Google* maps. Studying this phenomenon is complex, partly because it has both technological and social dimensions. The ten different Peircean classes of sign proved very helpful in analysing a range of tagging issues.

The next, and very significant, part of the analysis is understanding the meaning of the signifiers and sometimes their multiple meanings (polysemy). The meaning of icons and indexes, to the extent they are effective, is usually fairly obvious, but if symbols are arbitrary how do they come to develop their meaning(s)? For semiotically informed research, we need to understand and apply four concepts – metaphor, metonymy, denotation and connotation.

Metaphor and Metonymy. The major way that new signifier/signified relations come into being is through relationships either between signifiers or between signifieds that already exist. The primary forms of relationship are metaphor and metonymy¹⁰. Metaphor concerns relationships of **resemblance and similarity** (like iconic signs) and metonymy concerns relationships of **cause and contiguity** (like indexical signs). These form two fundamental dimensions within linguistics. Indeed, it has been argued strongly, and with much evidence, by Lakoff and Johnson {, 1980 #3516; 1987 #781} that virtually all language is, at base, metaphorical (including in that metonymy)ⁱⁱⁱ.

Relationships can be formed through both the signifier and the signified. As an example, the word “mouse” used to refer only to a small grey animal. Then a computer pointing device was

¹⁰ These are known as “tropes” within linguistics and literature. There are in fact four tropes, the others being synecdoche and irony, but these latter two are subsidiary.

created resembling a mouse (metaphor) and so came to be called a mouse. Now the latter is so ubiquitous that “mouse” is more likely to be interpreted as referring to a computer mouse than a “real” one. Here, the relationship between signifieds led to a new meaning for a signifier.

Another example: the color purple {Lawes, 2002 #3535}. Purple was used extensively by Roman Emperors and so came to be associated with them (causality) and more generally with rich powerful people (contiguity). Rich people have high quality possessions (causality) so purple became associated with high quality. A modern company might use purple to package its biscuits hoping that they would therefore be seen as high quality (contiguity). Here the first relations (Emperor-rich-quality) are between signifieds then the second (purple-packet) is between signifiers^{iv}.

An example. Barley {, 1983 #3462}, in a semiotic analysis of the practice of funeral directing, particularly uses metaphor and metonymy as base concepts. The study shows how much of the process is concerned with presenting similarities between the dead body and a sleeping body; between the sick or death room and an ordinary, unoccupied room; and between the church and a living room.

Often, over time, the original connection may become lost so that the signifier represents the signified directly, without any intermediary object. For example, when growing up it was commonplace to say “I am going to spend a penny” as a euphemism for going to the washroom (which is a euphemism for going to the toilet). I just learnt that as a direct representation. It was only upon later reflection that I realized that many years before, going to a public toilet actually cost a penny, hence the expression^v.

Denotation and Connotation. These two terms refer to the relationship between a signifier and a signified. In particular, denotation means the main, standard, literal or primary meaning of a sign. Connotation means other ideas or feelings that go along with the sign. Thus the denotation of “home” is the building where you live; its connotations may include warmth, security and peace. The overall meaning of the sign includes both. The denotation of a word is that which a competent speaker {Habermas, 1970 #1307} of the language should understand from it; but the connotations are much more dependent on the audience.

Many factors can affect the connotations of a sign. Different signifiers with the same general meaning (denotation) may have very different connotations – “freedom-fighter” vs “terrorist”. The style or tone of voice may change the connotation completely, e.g., sarcasm or irony. Even a change in font may affect the interpretation of a text, for example connoting fun rather than business.

4.2. Examine the Structure of the Message – the Syntagm

Having identified and explored individual signs, it is then necessary to look at the whole structure of the message, that is, the structured set of relationships between signs which gives the whole its meaning. It may be sequential, as in language - a sentence, a paragraph, or a whole book, or spatial as in a website or picture. The meaning of the whole depends on two dimensions or axes – the syntagmatic and paradigmatic (essentially the same as metonymy and metaphor). The syntagmatic axis concerns positioning and combination. - essentially how the meaning of a sign depends on its relations to other signs that are present in the syntagm. Consider a simple sentence: “The man hit the ball”. The syntagmatic meaning comes from the placing of the words – if ball and man were swapped the sentence would be meaningful but mean something different.

The paradigmatic axis concerns selection and difference - how one sign has been chosen at the expense of others (which are therefore absent).

The Paradigmatic Dimension. The paradigmatic axis concerns the choices for each of the positions in the syntagm. “Hit” could have been “caught”, “threw” or “blew up”. We can consider that each position has a paradigm set of terms or signs that could occupy it^{vi}.

Thus signs gain their meaning, especially their connotations, in virtue of the set of absent differences, the signs they could have been but are not. The differences may be similarities but are often opposites or contrasts. With similar terms, there is the direct meaning of the term itself, but then also the meaning that can be gleaned from the terms that were not used. This is reflected in the sayings: “that goes without saying” and “that is conspicuous by its absence”. The first references the unstated assumptions of the discourse, what does not need to be said. The second saying points to situations where the term that would be normally used is not and its absence is thus meaningful.

Opposites and contrasts are extremely important {Jakobson, 1990 #4155; Kelly, 1955 #2408}. We can distinguish between:

- **Oppositions** (contradiction): mutually exclusive, binary terms such as, dead/alive, present/absent, heads/tails. “Not dead” means “alive”. One is the negation of the other.
- **Antonyms** (contrariety): terms that are graded on the same underlying scale such as, good/bad, hot/cold, clever/stupid. “Not good” does not necessarily mean “bad”.
- **Contrasts**: Terms that are alternatives to each other but not necessarily opposites such as hard-working/very able, as in: “He got a first through hard work” implying that it was not through great ability^{vii}.

Greimas {, 1987 (original 1970) #4170} developed these ideas more formally into the semiotic square¹¹ which displays patterns or modalities of opposition between concepts. For example, we might have beauty (S1) and ugliness (S2) as the top two corners. These are contraries, but not contradictions, since non-beauty is not necessarily ugliness. We then put the negations in the bottom opposite corners so that the diagonal relations are contradiction. Then the vertical relations are complementary – beauty is complementary to non-ugly, and ugly is complementary to non-beauty.

An IS example, Corea {, 2006 #4171} has used Greimas' semiotic square to study the effective use of IT in organizations. He considers three possibilities (modalities): modalities of performance, i.e., reaching a desired state or not; modalities of IT use, i.e., IT facilitating or inhibiting the organization's work; and modalities of action, i.e., having to act, causing to act, or wanting to act. Considering the first, we can begin with the concept (from a case study of the BBC) that the organization should be in a desired state – here, to take equal account of all audience members (S1). The contrary to this is to take selective account of audience members (S2). The contradictions are not to take selective account, and not to take equal account (Figure 4).

¹¹ Based ultimately on Aristotle's "square of opposition" which related in a similar way propositions in syllogistic logic.

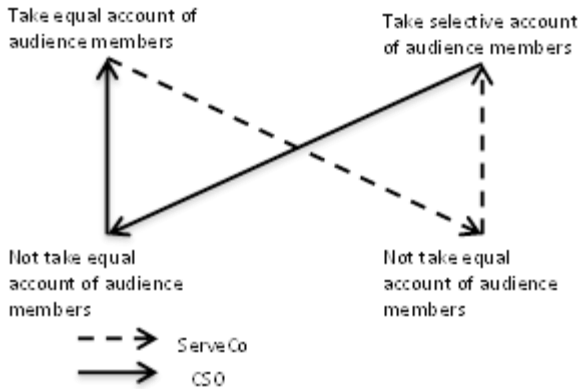


Figure 4 – The Greimas Semiotic Square and Call Center work (Source {Corea, 2006 #4183})

The Figure illustrates two competing directions of IT change. From the customer service operations department (CSO) focus the movement was from being selective in considering the audience to not being selective to being positively equal. But from the focus of ServeCo, the outsourced company that ran the main call center, it got better results and customer feedback if it was in fact selective, and took account of particular customer needs.

The Syntagmatic Dimension. In language, a syntagm is always directional, in time and also in space, as one word follows another. However, there are still possibilities for altering the meaning by changing the order of parts of a sentence or of paragraphs to emphasize on idea over another^{viii}. In non-linguistic texts, especially spatially ordered ones such as pictures, leaflets or websites, there are more possibilities. And apart from the relative position of elements, there are many ways of highlighting or emphasizing certain parts over others. For example, Kress and van Leeuwen {, 1996 #4161} identify three major dimensions in spatial texts – top/bottom, left/right and center/periphery and argue that the poles are not equivalent or neutral. In European cultures, reading is generally from left to right and so that is how we tend to “read” pictorial images. This

means that images to the left of center tend to be seen as the given or the past, and images to the right as new or the future. In the vertical axis, Lakoff and Johnson {, 1980 #3516} argue that up is seen as more or better, and down as less or worse, so placing one signifier above another gives it more value^{ix}.

As an illustrative example, Mancini and Buckingham Shum {, 2006 #3472} have used semiotics as a framework for modelling discourse in domains where there is debate and disagreement (e.g., scholarly debate). They have developed some test software (*ClaiMaker*) that represents discourse as a semiotic process based on the paradigmatic and syntagmatic combination and the connotation and denotation distinction discussed above. Making a claim in discourse is seen as creating a sign that refers to a referent such as a source or document in some respect. Other users could make different claims about the same source, i.e., that it says something else. These other signs can be seen as consistent with the first one, or inconsistent. At the same time, a similar claim could be made in terms of another referent, i.e., another paper that says the same thing. In this way the sign may have different referents, and the referent may have different signs pointing to it. Equally, a particular sign may have its primary, denotative meaning but also be associated with other signs that are connotative meanings. In further work, Uren et al {, 2006 #4169} have studied user behaviors in reviewing literature using this software.

5. Investigate the Social World: The Code

5.1. The Semiotic Ladder

This general semiotic framework was originally developed by Morris {, 1938 #719} as a trichotomy of the dimensions of semiosis – syntactics, semantics and pragmatics. Syntax covers the rules of the language or code – how the signs relate to each other; semantics the meaning of

signs – the relationship between signifier and signified; and pragmatics the use of signs - the intentions and effects that they have in practice. This categorization was later extended by Stamper {, 1991 #1941;, 1997 #802} to include the physical and empirical levels below syntax, and the social level above (Table 5)^x. This framework has been applied extensively, especially under the umbrella term of “organizational semiotics” {Stamper, 1997 #802;Stamper, 2001 #3481;Liu, 2002 #3520;Liu, 2002 #3538;Chong, 2002 #4873}.

Social (Is it right and trustworthy?): Social consequences, effects, conditioning
Pragmatic (Is it useful?): The uses and effects of signs
Semantic (Is it meaningful?): The meaning of signs; the relationship with what they represent
Syntactic (Is it understandable?): The rules and grammar relating signs
Empirical (Can it be transmitted?): The communication and transmission of signs
Physical (Does it exist?): The embodiment of a sign, “no it without bit”

Table 5 The Morris and Stamper Semiotic Ladder

An example. Price and Shanks {, 2005 #3547} used the framework to develop a comprehensive set of quality metrics. At the syntactic level the concern is with the conformance of the data to its metadata, i.e., data integrity. At the semantic level, the criteria concern the correspondence of the data to external reality – meaningful, complete, unambiguous, correct and non-redundant. At the pragmatic level, they concern the usability of the data – accessible, suitably and flexibly presented, understandable, secure, relevant and valuable.

A further example. Li et al {, 2010 #4167} have used semiotic concepts in helping to design IT systems for clinical path management. They begin at the semantic level, where they negotiate an understanding of domain-specific signs such as agents, concepts, relationships and behaviors. This is captured in an “ontology chart” which represents this information in terms of agent, role

and affordance. This provides the ontological structure of the clinical path which then needs to be complemented by an analysis of the activities that are necessary. These are specified in terms of norms – i.e., rules that govern the carrying out of activities, although it is recognized that agents are autonomous and may on occasions exercise their discretion. The resulting model is then used within an agent-based simulation to help improve the management of the pathway.

Burton-Jones et al {, 2005 #4180} also used the semiotic ladder, this time in developing a suite of metrics to assess the quality of an ontology. Metrics were developed at the syntactic level (lawfulness, richness), the semantic level (interpretability, consistency, clarity), the pragmatic level (comprehensiveness, accuracy, relevance) and the social level (authority, history). An automated ontology auditor was developed and this was applied to the DARPA Agent Markup Language library of domain ontologies. This showed that there was a wide variation in the quality of the ontologies in the library.

5.2.Examine the Code

We have so far looked from the perspective of the specific message, but much that we have discussed actually concerns the social and cultural context from which signs gain their meanings. In semiotics, this social level is generally termed the code, as distinct from the message, although it is much more sophisticated and complex than a code such as Morse code. Given that all social interaction is fundamentally semiotic, in looking at the social and cultural level we could be attempting to analyze the whole of society:

“The conventions of codes represent a social dimension in semiotics: a code is a set of practices familiar to users of the medium operating within a broad cultural framework. Indeed, as Stuart Hall puts is, ‘There is no intelligible discourse without the operation of a code’ {Hall, 1973 #4869`, p. 131}. Society itself depends on the existence of such signifying systems” {Chandler, 2002 #3506`, p. 148}

All forms of social activity, verbal and non-verbal, can be seen to be structured in terms of patterns of rules and meanings which can be seen as a code^{xi}. Codes are well organized systems of rules or conventions that can operate over a number of domains {Vannini, 2007 #4173}. They structure the relations between signifiers and signifieds (lexicon), and between the units within a syntagm (grammar) across a variety of different types of texts. A message is not therefore to be seen as an isolated unit, but gains its meanings from the code that underpins it. Codes are interpretive frameworks that are used by both producers and consumers of messages to afford the possibility of communication, much like the words and grammar of a language allow us to speak it. In responding to messages, we draw on the appropriate code to help us understand their meaning. Generally, the code that we need is obvious, but it may not be, especially if we are not the intended audience^{xii}. If we look across the cultural sphere we can distinguish three types of codes: social codes, textual codes and interpretive codes (see Table 6 - this section draws on Chandler {, 2002 #3506} p. 149).

Social Codes	<ul style="list-style-type: none"> • Bodily codes (body language): positioning, expressions, gestures, appearance • Behavioral codes: rituals, practices, games • Commodity codes: dress, cars, accessories, technologies
Textual Codes	<ul style="list-style-type: none"> • Verbal language: speech, writing, expression, rhetoric • Aesthetic codes: styles in art, drama, music etc. • Mass media codes: TV, film, newspapers (online and print), magazines • Social networking codes: Twitter, Facebook, Flickr, Tumblr etc
Interpretive codes	<ul style="list-style-type: none"> • Perceptual codes • Ideological codes

Table 6 Forms of social code

In practice, these different codes will work together. For example, a specific subcultural group will look, behave and dress in particular ways, use specific forms of language, possess (or not

possess – which can be just as much a sign as a possession) particular commodities, and relate to particular music and other art forms¹².

We can also analyze the code in a more hierarchical manner through the concepts of genre, myth and discourse.

5.3. Genre, Myth and Discourse

A *genre* is a particular combination of content and style that develops with respect to a type of text, communicational form or even general social activity {Berkenkotter, 1995 #4164; Bakhtin, 1986 #4165; Vannini, 2007 #4173}. Well-known examples of genres in novels and films are the Western, detective story or romance. Here, the genre will include plots, characterization, themes, settings and imagery. They provide a good deal of guidance in producing something within the genre and also a sense of familiarity to their audience. However, the idea of a genre is a very loose characterization – particular messages and texts may reference several genres; they may adhere to only part of it; genres themselves change and evolve over time; and sometime messages and texts within a genre may deliberately break the rules for effect.^{xiii}

As an IS example, Rosso {, 2008 #4162} used the genre concept to help categorize web pages in order to make searching for them more effective. Based on a selection of over 100 web pages, Rosso asked users to classify them into different genres of their own choosing. This resulted in 48 distinct types, examples being “About”, “Contact form” and “Diary or blog”. In the second stage, other users were given the same pages and asked if they could classify them into the 48

¹² As an excellent example, see Hebdige’s {, 1981 #4160} *Subculture: The Meaning of Style* for a semiotic analysis of the UK’s postwar working class, particularly punk, youth culture.

types. There was a reasonable degree of agreement (half or more of the participants agreeing on one genre in 60% of cases). In the final part of the study the 48 types (together with others suggested in the second round) were simplified to just sixteen and these were tested on a new set of pages with new participants. Again there was a reasonable degree of consensus. Also concerning the web, Warschauuer and Grimes {, 2007 #3543} have used semiotics and genre to analyze recent developments in Web 2.0, especially blogs and Wikis, in terms of audience, authorship and artifact.

A further example. Spinuzzi and Zachry {, 2000 #4166`, p. 172} developed the idea of “genre ecologies” to understand changing documentation processes^{xiv} For instance, in a police force the official, and complex, traffic incident reporting database was unofficially augmented with memos, Post-It notes and other unofficial genres which made it much more practically useful.

The concept of *myth*, as developed by Barthes {, 1972 #4181}, represents a much higher level, society wide, set of accepted ideas or beliefs that structures and informs lower level systems of denotation and connotation¹³. Myths are sets of ideas within a culture that are taken for granted, and therefore almost unseen. Myths have an ideological function – they serve to make particular worldviews (e.g., objectivism, masculinity, freedom, individualism) appear to be natural and therefore unchangeable{Barthes, 1972 #4181`, p.8}. Myths may be large-scale and deeply-rooted, sedimented in Giddens {, 1984 #7} structurational terms, or they may be local and short-lived. We can even see myths in play within particular organizations, e.g., “the bottom line is all that matters”.^{xv}

¹³ Myth has been called the “third order of signification” after denotation and connotation.

In his study of a health services call center, Corea {, 2006 #4183} used the concept of an organizational myth, combining it with Greimas's {, 1983 #3542} semiotic square (discussed above) to “deconstruct” the myth. The basic myth, which drove the whole IT call center operation, was that the service vision was to “surprise the customer” by exceeding their expectations. This was supported by a range of practices in terms of rewards for the staff (for exceptional performance) and for the customers. However, there were several problems with the operations, primarily because they were reactive rather than proactive. The semiotic square was used to explore this in terms of the negation of “surprise the customer” - “not to surprise the customer”, i.e, to be anticipated by the customer; and also a contrary such as “to be surprised by the customer”, i.e, to be unprepared for customer requests.

The most general level to discuss is that of *discourse*. Fairclough {, 2005 #4031} defined discourse as a particular way of representing certain parts or aspects of the world (physical, social, psychological). For instance, there are different political discourses (liberal, conservative, social-democratic) which represent social groups and relations between social groups in a society in different ways. Some forms of discourse analysis carry out various types of detailed linguistic analysis (e.g. analysis of grammar, semantics, vocabulary, metaphor, forms of argumentation or narrative, and so forth) and/or detailed analysis of other semiotic features of texts such as their visual aspects. There are analytical advantages in taking discourse analysis further. According to Foucault {, 1972 #3527}, discursive practices are the local socio-historical material conditions that enable and constrain disciplinary knowledge practices such as speaking, writing, thinking, calculating, measuring, filtering, and concentrating. Discursive practices produce, rather than merely describe, the “subjects” and “objects” of knowledge practices. On Foucault’s account

these “conditions” are immanent and historical rather than transcendental or phenomenological, that is, they are actual historically situated social conditions.

Foucault is interesting for moving from seeing discourse as a rule-governed, autonomous and self-referring system to discourse as embodying circuits and relations of power and creating meaning as power/knowledge {Foucault, 2003 #4260}. Such an approach allows the researcher to connect up the circuit of interactions between social, material and personal worlds, and to analyze power relations in the production, and use, of knowledge and meaning. In the context of IS, rich examples of such studies can be found in Davies and Mitchell {, 1994 #4257}, Doolin {, 1998 #4258} and Poster {, 1996 #4261}. They show how semiotic processes and the production of meaning support, are inherent in, both the communication and the control possibilities of ICTs {Willcocks, 2011 #4263}.

6. Investigate the Material World: The Medium

Once a message has been created and encoded, there comes the medium by which the producer makes it available for the consumer. The medium must have some form of physical embodiment (channel) which makes it accessible to the senses. Primarily, this will be auditory or visual, although it could involve smell, touch or taste. It could also be virtual in the sense of recent developments in augmented reality {Schultze, 2010 #3659;Schultze, 2010 #3646}. There must also be some form of transmission which could be physical (sounds or sights), electronic (telephone, radio) or through a computer^{xvi}.

The main issue is that the medium is not some neutral or transparent means of transmission that has no effects on the content or the appearance of the message; on the contrary, in many cases, as McLuhan {, 1964 #4189} said, “The medium is the message”. One way to see this is to say that

media can be characterized in terms of affordances and liabilities {Volkoff, 2013 #4190} – affordances being the things that media enable to happen or occur, and liabilities being the things they suppress or disallow. One of the most obvious semiotic examples is the development of emoticons as ways of transmitting emotion in SMS and emails which, as a medium, do not afford this possibility.

An illustrative example is information richness theory (IRT, sometimes called media richness theory) and email. Daft and Lengel {, 1986 #3924} proposed that different media could transmit more or less rich information, and were therefore suitable for different tasks. They only considered five media (in decreasing order of richness): face-to-face (F2F), telephone, personal written documents, impersonal written documents, and numeric documents, and proposed that managers would use the richer media for communications that were more equivocal and uncertain. The theory has been extended to include the newer, electronic media {Dennis, 2008 #4188} although empirical results have often not supported the theory. For example, Markus {, 1994 #1022; , 1994 #1313} found that email was used extensively by executives and not just for routine tasks but sometimes to avoid difficult or unwanted social interactions (the sacking or dumping by text approach!). Additionally, Ngwenyama and Lee {, 1997 #752} show, by analyzing a complex email interaction, how rich communication can emerge even through a medium that is seen as not especially rich. Similar results were found by Menchik and Tian {, 2008 #3473} who describe the “semiotic tactics” used to convey pragmatic information in email discussions.

Of particular importance to information systems is the HCI – the screen is the point of contact between producer and consumer and it is almost entirely a semiotic object {O'Neill, 2008 #3478; Scolari, 2009 #4266}, filled with signs and icons and based heavily on metaphor – e.g., “Windows” and the “desktop”. ^{xvii}Website design is still largely text based, reflecting the

traditions of the printed page, but it incorporates images, sounds and above all interactivity. The consumer can control the content that they see through the choices they make, and also in many cases, add their own content. In this way, the boundary between producer and consumer is breaking down.

In terms of graphics and symbols, the seminal work is by Bertin {, 1983 #4191} who developed systems for maximizing the amount of information abstract graphics could portray^{xviii}. Today this is particularly important in designing graphics for visualizing large amounts of “big data”. Going beyond individual icons, it is also important to consider icons in combination spatially on the screen. Moving images are also increasingly found on websites (see Kress and van Leeuwen {, 1996 #4161}; Metz {, 1986 #4192}).^{xix}

Going beyond simply analyzing the iconography of a screen, recent developments in HCI have been called semiotic engineering {de Souza, 2005 #3477}. The idea is to see an HCI as embodying or enabling a process of communication between the system designer and the user. In other words, they are designing signs that can trigger appropriate responses from the user’s perspective, not just from the designer’s. The designer is essentially saying, “this is what I know about you, this is what I think you want to do, and here is how to do it”. De Souza uses the same Jakobson communication framework as we do.

A further example is the work of Dourish {, 2001 #3486} and O’Neill {, 2008 #3478} on what they call embodied interaction. They are particularly interested in how interactive media can be studied and designed, taking into account the physical and social worlds in which they operate, and how media and technologies relate to the human beings interacting with them. They draw on phenomenology and {Heidegger, 1962 #241}, Merleau-Ponty’s {, 1964 #782} work on embodiment, and semiotics, and focus particularly on social and physical interactions:

“Tangible and social computing both capitalize upon our familiarity with the everyday world, a world of social and physical interactions. As physical beings, we are unavoidably enmeshed in a world of physical facts. ... So, the social and the physical are inescapable aspects of our everyday experiences.” {Dourish, 2001 #3486, p. 100}.

7. Investigate How the Material, Personal and Social Worlds Interact with Each Other

This part of the investigation will, first, explore the relationships of embodiment, sociation and socio/materiality (see Figure 1). Having gained insights from this exploration, the investigator will then turn attention to how these interactions and relationships illuminate the previous findings on how each of the personal, social and material worlds relate to semiosis. The objective here is to integrate the researcher’s understandings, in order to be able to address the research questions, challenges and problems in a comprehensive manner.

Embodiment and sociation analysis is usefully explored by an example. Schultze {, 2010 #3646} studied embodiment and presence in virtual worlds such as *EverQuest* and *Second Life*. Mingers and Willcocks {, 2014 #4104} describe how, through computer mediation, avatars re-embody the communicator who have a sense of presence in a virtual world and can engage in practices of the body (e.g. sit, move, speak, smile). As Schultze describes it, how the producer or consumer constructs and uses an avatar with regard to personality, appearance and behavior (embodiment) is embedded in a system of meaning (semiosis) informed by the social norms and conventions (sociation) shaped by both the actual world and virtual worlds (sociomateriality). Producers and consumers tend to choose a humanoid gendered avatar as having the most likeable and persuasive qualities necessary in ‘social’ settings. Here we see the personal and social worlds

interacting through sociation and semiosis mediated by technology. As Mingers and Willcocks {, 2014 #4104} put it:

“One of the key affordances is embodiment, in the sense of giving participants a virtual body that enables them to engage in practices of the body, and recapture the body’s non-discursive semiotic capabilities.”

The interactions are also performed to give experiences of presence. Schulze {, 2010 #3646} suggests six kinds of illusory presence - telepresence, social presence, co-presence, self-presence, hyper-presence and eternal presence - made possible through semiotic-personal-material and social interactions. Semiotic analysis would seem to be particularly proficient where non-material objects and virtuality are in play, as is increasingly the case with social media, mobile, cloud computing, the internet of things, and information analytics {Willcocks, 2014 #4265}.

Socio/material interactions have become highly researched in IS in recent years, including an MISQ special issue on the subject in 2014. Examples include Scott and Orlikowski {, 2014 #4262} who studied social media in the form of *Trip Advisor*, one of the largest on-line travel communities. Typically these are rich case studies but, without explicit semiotic tools, can downplay how socio/material interactions relate to semiosis, and the creation of meaning. At one point, for example, Scott and Orlikowski {, 2014 #4262, p. 876} state that: “*we see how anonymity is an entanglement of meanings and materialities produced through the ongoing material-discursive practices constituting the AA and TripAdvisor hotel evaluation schemes*”. However, with no explicit semiotic tools, their investigation of meaning is under-characterized, while their conceptualization of sociomateriality limits insight into how the social and material relate to the personal to generate meaning.

Jones {, 2014 #4264} studied the implementation of a computer-based clinical information system (CIS) in a 25-bed critical care unit (CCU) in a specialist cardiothoracic hospital in the United Kingdom. He provides a highly detailed description of the context, technologies, records, personal and social intentions, codes and the generation of meanings on which people act and work is performed. Though not using the same vocabulary, the rich case description and analysis by Kallinikos {, 2011 #3717} of a dairy production plant also manifests many issues that our semiotic integrative approach encompasses. However, we would argue that, with the tools developed in this paper, such studies can gain even further richness from additionally studying, more formally, embodiment, sociation, their relationships to each other, and to semiosis, and placing the communication processes and generation of meaning at the center of the analysis.

This is best demonstrated through an illustration, namely the instructive, partial, if remarkably prescient Zuboff {, 1988 #768} study of eight computerizing workplaces. In terms of research approach, she used case study, field intensive, longitudinal research, involving interviews with multiple stakeholders, participant observation over two years, and access to files, documentation and reports. Her commitment to understanding social phenomena was shaped fundamentally by phenomenology, and its application to sociology and psychology. The analytical method was inductive, and involved iteratively interacting with events, field notes and transcripts over time to refine an analysis, informed by the scholarly literature on history, cognitive psychology, social theory and the sociology of work. All this fits easily with our step-by-step approach detailed above.

In terms of a semiotically informed approach, Zuboff does not use the word semiotics in her study, but provides a seminal, highly nuanced contribution to understanding its central relevance in IS studies. Her studies uncover the potential of computer-based technology to automate or

informate, both involving a new relationship that computer-based information maintains with reality, whether within the workplace or wider society. For the world of cognition and the signs or symbol tokens by which it is mediated, ICTs have brought changes and promoted new cognitive forms, processes, and conventions. Zuboff demonstrates how, even within 1980s ICT developments, the physical and social constitution of the workplace increasingly gives way to a surrogate reality as a fluid, accruing, changing electronic text installs itself at the center of work life. Referential reality (whether physical or social) is increasingly accessed by means of software-based, decontextualized descriptions that become windows or screens into, but, as Kallinikos {, 2011 #3717} points out, also blindfolds of this reality at the same time. Work becomes literally a reading of digital marks and codes that may lack the coherence and narrative forms characteristic of traditional modes of human cognition and communication. Reading and making sense of the electronic text entails different skills – fundamentally abstract thinking, inference drawing and procedural reasoning. Meanwhile, lost relationships between sense and reference may also need crucial semiotic design assistance, as many of the studies we have referred to demonstrate. In all this, we would argue, semiotics becomes central. Zuboff, through a complex analytical perspective informed by Arendt, Foucault, Weber and others, presciently explores aspects of semiosis – especially signs, abstraction, text (she talks of the ‘electronic text’, the ‘social text’) and embodiment, within the working through at macro and micro levels in workplaces of the material, social and information (she deploys the notion of information panopticon) dimensions of a Foucauldian power perspective.

However, more recent developments in technologies require, and the adoption of philosophically grounded and integrated semiotics approach allows, a richer conceptualization and analysis of such computerized workplaces. At the level of concept, Zuboff nowhere mentions semiosis.

Despite her studying ICTs and their impacts, and the centrality of semiotics to communication, the design and use of ICT, and its usefulness for analyzing textual and non-textual systems, she nowhere systematically applies the rich and fruitful set of concepts available with semiotics – for example the six communication elements of producer, consumer, content, message, medium, code, and their interactions. The detailed vocabulary and concepts we have supplied here would have rendered her analytical framework much more operationalizable and rigorous than her dependence on grander, more elusive Foucauldian conceptualizations of discourse, power, panopticon and embodiment. Her analysis would also have been richer for articulating and applying systematically bridging, mid-level notions of sociomateriality, embodiment and sociation in relation to semiotic processes. As with Jones {, 2014 #4264} and Kallinikos {, 2011 #3717}, Zuboff {, 1988 #768} provides an admirable, highly nuanced analysis, that runs up against its conceptualizing limits precisely where semiotic conceptualization needed to be at its sharpest.

8. Conclusions

Semiotic analysis has been at the margins of information systems research despite the central focus of the field on information, digital technologies, communication processes and the creation of meaning. In this paper, building further on a previously developed philosophically and theoretically grounded model, we have sought to operationalize semiotics for IS researchers, by providing explanations of the main concepts, integrating these and previous studies into a usable step-by-step approach to semiotics research, and illustrating with multiple examples the components of semiotics and effective research processes.

As the research cases suggest, semiotic analysis and tools have become increasingly important to both IS research and IS practice as the power, applicability and pervasiveness of digital technologies has accelerated, and will accelerate further over the next decade. The paper's distinctive and innovative contribution is to provide, for IS researchers, a useable set of structured guidelines that can fit with a range of methodologies and predilections, and enrich the research questions that are asked, the process of research, and the relevance and practicality of the findings.

How can these guidelines be used? Clearly, the many concepts need a lot of work to understand, but we believe that, as seen in the many illustrative examples, when applied, these concepts provide a much richer set of findings. One limitation is that we do not provide a straightforward methodological technique that can be applied relatively unthinkingly. The researcher may choose to apply all the concepts in the four step approach we detail, or has discretion over whether to select only those that seem most relevant to investigating the research area and questions posed. Then again, the researcher may well choose to adopt a qualitative or quantitative or mixed methods study appropriate to the research task in question. They will then need to consider carefully how to design the research approach and may well draw quite selectively upon the concepts provided. This may well be a strength, however, in that it refocuses the emphasis on research design, and mitigates the rather blind manner in which published qualitative and quantitative methods, principles and guidelines (for example Dube and Pare, 2003; Klein and Myers, 1999; Myers and Klein, 2011) have often been applied in subsequent research submissions.

What are the application areas? Firstly we make the general point that we believe the guidelines make an important rebalancing feasible, and not just for IS. For if the IS field has been primarily

focused on the technology component of information and communication technologies, then, historically, the main semiotic theories have tended to focus on communication and information. Semiotics provides key tools for rebalancing and enriching IS studies in the vital areas of *information and communication*. But, for an increasingly ICT mediated world, the guidelines here provide a key resource also for enriching more general semiotic studies in the vital area of technology. But since semiotics is the basic mode of human communication, our guidelines are relevant to all studies researching communication interaction, and not just ICT or IS artifacts.

Secondly, within IS studies, the more mature applications have been in areas such as HCI, systems design, development and implementation, studies involving interactive media, information richness theory. In practice semiotics is so fundamental to IS, and our model so encompassing in terms of covering the personal, social and material worlds in relations of semiosis, and the six fold framework of producer, consumer, content, message, code and medium, that the applications are limitless wherever humans, information and technology are interacting. Contemporary and future technologies throw up the most interesting possibilities, however, as we are still wrestling with the means to study these, and older theories and perspectives are being tried, but are not necessarily the best fit. Semiotics seems especially timely and useful for exploring areas such as trust and websites, video games, knowledge work and systems, automation, robotics and work redesign, virtual reality, on-line behavior, social media, and areas where Zuboff's 'electronic texts' are increasingly pervasive, for example with surveillance technologies, big data and analytics, and areas of data privacy and security. Even such a short list reinforces the primary rationale and argument of this paper - that semiotics has been surprisingly under-used in IS involving IS or T artifacts, just at the point when its use seems more critical than ever.

Appendix A: Semiosis and the Sign

At the heart of semiotics are questions about the cultural meanings of symbols and objects {Beynon-Davies, 2010 #3755}. Humans are rather like King Midas in that everything they touch turns, not into gold, but into signs that then represent something other than themselves.

Semiotic analysis attempts to explain the genesis (production) and effectiveness (interpretation) of any meanings that social discourse attributes to particular phenomena. Within semiotics, culture is seen as the milieu within which communication and social action occur. Culture is seen to consist of institutions and rituals (social); artifacts and skills (material); and ideas, values and conventions (cognitive); as well as the means of their transmission from generation to generation (tradition) {Posner, 2003 #4863}.

Semiology has two lines of development, one stemming from Ferdinand de Saussure {, 1960 #18}, a Swiss linguist and primarily limited to language, and the other traceable to Charles Sanders Peirce {, 1907 #4114}, an American philosopher and scientist, who analyzed signs more widely. These are sometimes known as structural semiotics and social semiotics respectively {Vannini, 2007 #4173}. Structural semiotics, or structuralism more generally such as in Levi-Strauss {, 1963 #2055}, tends to focus on systems and structures over and above individual social actors who are merely “bearers” of the structure. Social semiotics, whilst recognizing the structural dimension, is much more concerned with the way skilled actors draw on and use semiotic resources and thereby, somewhat unconsciously, reproduce or transform the structure. We will be concerned primarily with social semiotics {Van Leeuwen, 2005 #4174; Halliday, 1978 #4175} as that is much more relevant to the organizational and social contexts of ICT.

De Saussure developed a dyadic concept of the sign as composed of two elements inextricably linked – the *signifier* and the *signified*. The signifier is the word, or word sound (phoneme), and the signified is the meaning of the word. Both were seen by de Saussure as essentially psychological entities, although later commentators have usually taken the signifier as including its physical representation. A sign must always have both components – there cannot be a meaningless signifier or a formless signified. What made de Saussure's conception radical was his belief that signs gained their meaning only by reference to other signs, not by any form of reference to the external world outside of language. Indeed, he argued that (linguistic) signs were essentially arbitrary in that there was no necessary relationship between the signifier and the signified – it was just a matter of convention. Some theorists heavily influenced by de Saussure include Levi-Strauss {, 1963 #2055} who developed a structuralist analysis of different cultures based on binary oppositions, as well as more recent semioticians such as Barthes {, 1967 #3504}, Eco {, 1979 #3509} and Derrida {, 1978 #2052}. His work also informed parts of Giddens {, 1984 #7} structuration theory which is one of the approaches commonly used in IS {Orlikowski, 2000 #3503; Jones, 2008 #3667}.

A practical example of the sign/signifier concept is Brannen's {, 2004 #3536} analysis of the Disney Corporations' experiences in internationalizing their theme parks to countries such as Japan and France. Taking various Disney products (e.g., Mickey Mouse or Cowboys) and practices (e.g., very directive personnel management) as signifiers, the analysis shows what these were taken to signify in the different cultures. The resulting "semantic fit" was close in Japan but divergent in France leading to many practical problems and conflicts.

For Peirce {, 1931-1958 #1949}¹⁴ however, a sign involves a triadic, as opposed to dyadic, relation. The signifier is called a *representamen* and the signified was split into an *interpretant* (meaning or sense) and an *object*, see Figure A.1.

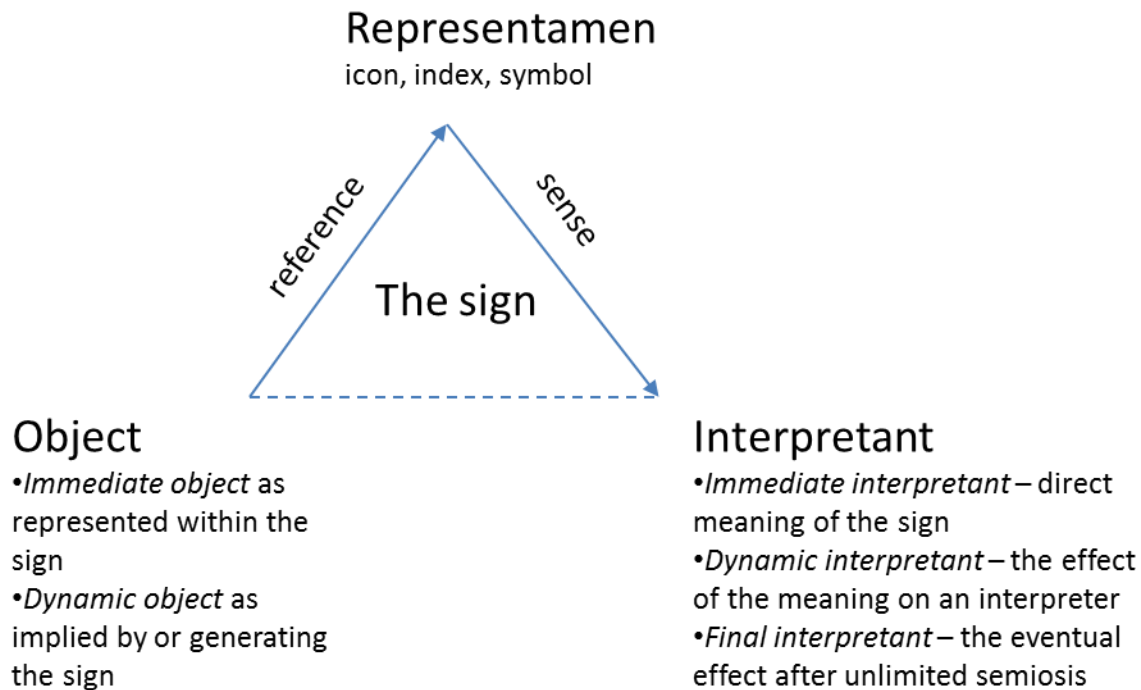


Figure A.1 Peirce's Semiotic Triangle

This makes Peirce's approach significantly different from, and preferable to, de Saussure's as it brings in an external dimension, outside of the sign system itself, of objects, structures, other

¹⁴ Peirce wrote extensively about semiosis over many years, often developing or changing his terminology. References to Peirce are to the volume and paragraph in the Collected Papers {Peirce, 1931-1958 #1949} or the Essential Peirce {, 1992 #4177}.

signs and people to which the sign refers¹⁵. Peirce developed several complex typologies of signs but there are two primary ones. First he split the object and the interpretant into two – the immediate and the dynamic. The immediate was the representation contained within the sign itself before it is actually interpreted; and the dynamic was the actual object implied by or generating the sign, and the effect of the sign on an interpreter respectively. The question as to how signs gain their intersubjective meanings will be dealt with later.

The second categorization was different types of signs, or rather different modes or ways that signifiers are related to their signifieds. Peirce distinguished three main modes although he also had more complex categorizations – index, icon and symbol. Any actual sign could be a combination of two or all three. These will be discussed in detail below.

¹⁵ We shall generally use the signifier/signified distinction in the paper except where the further subdivision is important.

Appendix B Summary of Main Semiotic Concepts with Empirical Examples

Concept	Explanation or Definition	Empirical example
Sign (Peircian)	“A sign ... [representamen] is something which stands to somebody for something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the <i>interpretant</i> of the first sign. The sign stands for something, its object. It stands for that <i>object</i> , not in all respects but in reference to a sort of idea, which I have sometimes called the ground of the representamen.” {Peirce, 1931-1958 #1949`, 2.228`, original emphasis}.	Huang and Chuang {, 2009 #4132} Friedman and Smiraglia {, 2013 #4871} Rosenkranz et al {, 2013 #3831}
Representamen (Peirce)	The particular form which a sign takes; its manifestation	
Interpretant (Peirce)	The sense made of the sign when it is interpreted. This was then split into three: <ul style="list-style-type: none"> • Immediate interpretant – the sense or meaning of the sign in itself, before it is interpreted • Dynamic interpretant – the meaning actually formed when a sign is interpreted • Final interpretant – the end result of the sign process which may be another sign 	
Object or referent (Peirce)	What the sign stands for (can be objects, ideas or events): <ul style="list-style-type: none"> • Immediate object – the object that is implicit in the sign (similar to the immediate interpretant) • Dynamic object – the actual object that has generated the sign in a particular instance 	
Signifier (de Saussure)	The physical form which a sign takes including spoken word	Friedman and Smiraglia {, 2013 #4871}
Signified (de Saussure)	The mental concept represented by the signifier – not a physical referent	{Brannen, 2004 #3536}
Types of sign (Peirce)	<ul style="list-style-type: none"> • Icon: A signifier that resembles or imitates its signified • Index: A signifier that is causally or contiguously 	French et al {, 2006 #4168} Friedman and

	<p>related to its signifier</p> <ul style="list-style-type: none"> • Symbol: A signifier that is only related to its signified by custom or habit 	Thellefsen {, 2011 #4178} Huang and Chuang {, 2009 #4132}
Universe of discourse	A frame of reference shared by a communicative community	
Text or message	Meant broadly to be any collection of signs that may be meaningfully interpreted – words, images, sounds, gestures including the outputs of information systems and websites	Beynon-Davies {, 2009 #3545}
Producer	The person or system who generates a message or text	Huang and Chuang {, 2009 #4132}
Consumer	The person or system who receives and interprets the text, whether or not they were the intended consumer	
Code	The social system of relations between signifiers and signifieds that allows them to have meaning	Beynon-Davies {, 2009 #3829}
Medium	The physical means of transmission of the text. This could be speech, writing, print or broadcasting; or it could be email, Skype or face-to-face. The medium is not neutral or transparent but has affordances and liabilities that can affect the meaning of the text.	Volkoff and Strong {, 2013 #4190} Daft and Lengel {, 1986 #3924} Menchik {, 1986 #3924} Scolari {, 2009 #4266} Andersen {, 1990 #3484}
Content	The actual meaning of the message within a particular context. There may be multiple contents of a message, for example, the meaning intended by the producer or the meaning(s) interpreted by the consumer(s)	
Modality	The reality status claimed by or accorded to a message as in whether it is factual or fiction; true or false; authoritative or merely opinion.	French et al {, 2006 #4168}
Polysemy	The fact that a single word or phrase or sign generally may have several meanings	
Metaphor/metonymy	<p>These are forms of relationship that generate new signifiers. They may be between signifiers or signifieds.</p> <p>Metaphor involves relations of resemblance or similarity and so applies particularly to iconic signs although it can also apply to symbolic ones.</p> <p>Metonymy involves relations of causality or contiguity and so applies particularly to indexical</p>	{Barley, 1983 #3462}

	signs.	
Denotation and connotation	Denotation refers to the primary, obvious or literal meaning or referent of a sign. Connotation refers to the associated meanings of a sign either socially or for an individual	
Syntagm and Paradigm	These are the orthogonal axes that generate meaning for a sign. Syntagm is the structured set of signs forming a text or message. Changes of ordering change the meaning of the text. Paradigm is a set of associated signifiers that are all members of a particular category. Any one from the set can be used in a particular position within the syntagm, thus changing the meaning.	Mancini and Buckingham Shum {, 2006 #3472} Uren et al {, 2006 #4169} Robichaud {, 2002 #3540}
Opposites and contrasts	<ul style="list-style-type: none"> • Oppositions (contradiction): mutually exclusive, binary terms such as, dead/alive, present/absent, heads/tails. “Not dead” means “alive”. One is the negation of the other. • Antonyms (contrariety): terms that are graded on the same underlying scale such as, good/bad, hot/cold, clever/stupid. “Not good” does not necessarily mean “bad”. • Contrasts: Terms that are alternatives to each other but not necessarily opposites such as hard-working/very able, as in: “He got a first through hard work” implying that it was not through great ability. 	Corea {, 2006 #4171}
Semiotic square { Greimas, 1983 #3542 }	A square of relations in a text in which the top corners are an antonym (e.g., good/bad) and the bottom corners are their negations (not good/not bad). The various relationships can then be explored	Corea {, 2006 #4171}
Semiotic ladder { Stamper, 1991 #1941 }	A hierarchical framework of dimensions of semiosis: <ul style="list-style-type: none"> • Physical • Empirical • Syntactical • Semantic • Pragmatic • Social 	Chong {, 2002 #4873} Price and Shanks {, 2005 #3547} Burton-Jones et al {, 2005 #4180} Li et al {, 2010 #4167} Putnik {, 2010 #4875}
Genre	A <i>genre</i> is a particular combination of content and style that develops with respect to a type of text, communicational form or even general social activity. In IS, for example, there could be the genre of transactional websites or personal assistants.	Yetim {, 2006 #3194} Warschauer and Grimes {, 2007 #3543} Spinuzzi {, 2000

		#4166}
Myth	A <i>myth</i> , as developed by Barthes {, 1972 #4181}, is a high level set of accepted ideas or beliefs that structures and informs lower level systems of denotation and connotation. Myths are sets of ideas within a culture that are taken for granted, and therefore almost unseen.	Corea {, 2006 #4183}
Discourse	Fairclough {, 2005 #4031} defined discourse as a particular way of representing certain parts or aspects of the world (physical, social, psychological) world. For instance, there are different political discourses (liberal, conservative, social-democratic) which represent social groups and relations between social groups in a society in different ways.	Davies and Mitchell {, 1994 #4257} Doolin {, 1998 #4258} Poster {, 1996 #4261} Willcocks and Lioliou {, 2011 #4263}

Table A1 - Main Semiotic Concepts with Empirical Examples

Appendix C

Appreciate the research situation	
<p>Objective: Identify problems and research questions in the meaning or set of meanings attributable within the defined situation.</p> <p>Actions: Carry out an overview, using the integrative semiotics research framework and initial data, to define the research site, its components, and the major questions arising. Examples include contradictions between different meanings, differences between intended and unintended meanings, lack of effectiveness in terms of desired outcomes as a result of communication.</p>	<p>Step 1 Collect initial data and identify questions, problems and challenges that arise in the relationships between the personal, social and material worlds. Examine producer, consumer, medium, message/text, content and code.</p> <p>Step 2 Generate research questions, and detailed sub-sets of research questions, to cover the three worlds and the interactions of the six components</p>
Analyze the Research Material Using Semiotic Concepts	
<p>Objective: Collect and analyze in sufficient detail the semiotic materials relevant to the research questions in order to understand and explain the observations in steps 1 and 2.</p> <p>Actions: Gather a collection of material both textual and verbal relevant to the problems. Analyze the materials using semiotic tools in order to generate hypotheses or possible explanations (in critical realist terms we would call these semiotic generative mechanisms) for the problems. This step involves abduction (Peirce 1931-1958, 5.171) or retroduction (Bhaskar 1978).</p>	<p>Step 3 For the personal world - Establish and interrogate producer, consumer, message/text, content, and their interactions. Examine especially the intent of the producer, and the import (meaning) to the consumer</p> <p>Step 4 For the material world - Establish and interrogate the medium (physical embodiment of signs, physical media) and the relevant affordances and liabilities and transmission processes relating to content and message/text</p> <p>Step 5 For the social world - Establish and interrogate the code, message/text and content and their relationships. Examine especially the connotative (the public meaning) and reproductive (how meaning is reproduced) aspects of the sign system, and the pre-existing social meanings of particular signs.</p> <p>Step 6 Carry out a higher level analysis of how:</p> <ol style="list-style-type: none"> The personal and social worlds relate through sociation - the relationship between social structure and action, between structures, practices and conventions and individual understandings and activity. the personal and material worlds relate through embodiment – i.e. embodied cognition and how the material (technology)

	<p>enables and constrains human action and understanding</p> <p>c) The social and material worlds relate through sociomateriality ¹⁶—i.e. through independent but mutually interacting and shaping processes.</p> <p>d) Investigate how the three worlds interact semiotically.</p> <p>Step 7 Use the analyses from Steps 3-6 to generate hypotheses and possible explanations</p>
Assess the Validity and Plausibility of the Potential Explanatory Mechanisms	
<p>Objective: To verify the rigor of the research process and establish the more likely explanations for the phenomena identified.</p> <p>Actions: Validate results, confirm or eliminate or extend hypotheses and explanations, develop possible semiotic worlds in which the communication problems identified would not occur.</p>	<p>Step 8 Validate results</p> <p>Step 9 Confirm, eliminate the hypotheses, or generate new ones.</p> <p>Step 10 Develop possible semiotic worlds in which the communication problems identified would not occur.</p>
Act to Bring About Change if Necessary	
<p>Objective: To contribute new understandings, critiques and research proposals, and, where part of the research project agenda, improve semiotic and communication processes.</p> <p>Actions: Disseminate research findings and proposals, intervene for semiotic and communication process change</p>	<p>Step 11 Disseminate results to correct and improve upon earlier understandings; identify further research gaps</p> <p>Step 12 Take action if necessary to improve the semiotic and communication process.</p>

Table A2 - Integrative Semiotic Methodology: Mingers and Willcocks 12 Step Approach

References

¹⁶ We are using the term “sociomateriality” differently from the usual sense as discussed in (Mingers and Willcocks 2014). We conceptualise the social and the material as intimately related but ultimately separable systems.

ⁱ This is in line with Merleau-Ponty:

“There is not thought and language ... Expressive operations take place between thinking language and speaking thought; ... It is not because they are parallel that we speak; it is because we speak that they are parallel ... I do not speak of my thoughts; I speak them and what is between them.”{Merleau-Ponty, 1964 #782`, p. 18`, orig. emphasis}

This is not to say that the meaning triggered by signs and symbols is completely arbitrary or subject-dependent. The very fact that they can trigger anything in the nervous system reflects the way in which we are socialized to the wider social system within which connotative systems exist. We, as human beings, are “structurally coupled” with our immediate environment of people, signification systems and materials. We can say that signs act as affordances and constraints – they tend or afford to lead to particular interpretations and constrain against others – but this is always relative to the knowledge and intentions of the receiver.

ⁱⁱ In semiotics *modality* is defined as the “reality status accorded to or claimed by a sign, text or genre” {Chandler, 2002 #3506`, p. 65}.

ⁱⁱⁱ These have been given a variety of names, as shown in this Table :

Saussure and Jakobson	Aristotle	Wilden	Freud	Peirce	Figure of speech (trope)	Types of relationship
Syntagm: combination and context	Contiguity: touching or containing	Diachronic	Displacement	Indexical	Metonymy	Direct: Causal Cultural Spatial Temporal Physical Conceptual
Paradigm: selection and substitution	Similarity and contrast	Synchronic	Condensation	Iconic	Metaphor	Resemblance: Sight Sound Touch Taste Feel

Table : Two Primary Dimensions Underlying Meaning – Metaphor and Metonymy

^{iv} Another very common way for signs to emerge is when part of an activity comes to stand for the whole (metonymy), particularly nouns becoming verbs (“verbing”, an example of itself!). This is very common with technological developments. For example, everyone now says “Google it”. Google was just the name (noun) for a search engine but has now become the generic word for an internet search. An older example - to Hoover is derived from a Hoover.

^v We can also see from these examples that the codes for signifiers change over time. At any point there may be lapsed or residual codes on their way out, dominant codes, and emergent codes on their way in. Clothing fashion {Barthes, 1967 #3504} perhaps best exemplifies this dynamism in that this year's fashion is almost defined by its contrasts with previous year's colors and styles. Codes are often specific to particular sub-groups but may then spread out into the main culture – this is particularly true of youth culture and popular culture.

^{vi} De Saussure considered that terms gained their meaning only from the *differences* from other terms within the set rather than having a positive meaning of their own. Moreover, each language generates its own, unique set of differences which cannot be directly translated one to another. For example, the paradigmatic set of words for “chair” in English do not correspond to the set for “chaise” in French. Each language divides up the world differently. This can be seen very clearly in cases such as the Eskimos who have a large number of words for different types of snow^{vi}. Originally observed by Boas, this claim has been contentious but recent research seems to confirm it {Robson, 2012 #4151}. but the claim is equally true within a language – for example, experts will have many more distinctions available than novices.

^{vii} The two poles of a contrast are not usually equally weighted or expected. One is the norm, or the most valued, at the expense of the other – one is said to be *unmarked* and the other *marked* {Jakobson, 1990 #4153}. The unmarked pole is the standard and the marked one is a derivative form, for example “unknown”, “tireless”, “woman”, “non-verbal communication”. Present, active tenses and singular nouns are usually unmarked (although perhaps not within academic texts!). These distinctions point to very deep-seated assumptions within a culture, which are often not explicitly recognized, and are part of wider genres and myths that are discussed in this article

^{viii} De Saussure was primarily concerned with language and there are, of course, rules governing what is possible syntagmatically – in this case English grammar. But other, more general, systems can also be analyzed in this way - Barthes {, 1967 #3504} studied both fashion and food. Websites are good examples. A website needs to have a certain set of components and these govern both its look and its feel. For example, all sites tend to have an overall graphic layout, logo, images, text, navigation mechanisms and then a selection of others depending on purpose such as a shopping cart, search, contact forms, chat rooms or security.

^{ix} As a further example, in the center/periphery dimension, the center is seen as more important and integrative while the periphery is seen as secondary or ancillary. This is related to the perceptual distinction between figure and ground – we tend to focus attention on the center and put the rest in the background.

^x In more detail, the empirical level concerns the transmission of signals as theorized by Shannon and Weaver {, 1949 #1944} in terms of the mathematical theory of information, and the physical level concerns the actual physical embodiment of signs. The social level concerns the effects of semiotics, and the knowledge it generates, on the social world, and the way the social world shapes semiotics.

^{xi} Here is an example from “The Big Short”, a description of financial traders during the crash, which gives a sense of the ubiquity of semiotic symbols.

"Their clothes told you a lot, too. The guys who ran money dressed as if they were going to a Yankees game. Their financial performance was supposed to be all that mattered about them, and

so it caused suspicion if they dressed too well. If you saw a buy-side guy in a suit, it usually meant that he was in trouble, or scheduled to meet with someone who had given him money, or both. Beyond that, it was hard to tell much about a buy-side person from what he was wearing. The sell side, on the other hand, might as well have been wearing their business cards: The guy in the blazer and khakis was a broker at a second-tier firm; the guy in the three-thousand-dollar suit and the hair just so was an investment banker at J.P. Morgan or someplace like that." {Lewis, 2010 #4159}

^{xii} Consider, for example, a sign one author saw in a public convenience recently. It read "Could we respectfully ask our clients to refrain from standing on the toilet seats as it damages them". Who this is aimed at, and its meaning, are far from clear.

^{xiii} Although most well known in the domain of literature, there can also be genres of fashion (casual, smart, sporty, formal) {Barthes, 1967 #3504}, music (rock, pop, folk, R&B), organizational communication (memo, email, meeting) {Yates, 1992 #4163} or behavior (work, parenting, having fun). For IS, Yetim {, 2006 #3194} applies Habermas's discourse ethics as a way of legitimating genres within information systems.

^{xiv} On page 172 they state that:

"A genre ecology includes an interrelated group of genres (artifact types and the interpretive habits that have developed around them) used to jointly mediate the activities that allow people to accomplish complex tasks. ... multiple genres co-exist in a lively interplay as people grapple with information technologies" .

^{xv} Hayward {, 1996 #4182} neatly illustrates the relations between denotation, connotation and myth in analyzing a picture of Marilyn Monroe. Denotatively, the photo refers to the person, Marilyn. Connotatively, this is associated with her qualities, both good – sexuality, beauty, glamour, and bad – depression, drugs, suicide. Mythically, it evokes the myth of Hollywood – the dream factory churning out stars, but then also destroying them.

^{xvi} When semiotics was first developing there were only a small number of possibilities – talking, writing, printing, and film – but with the development of modern technology this has grown enormously.

^{xvii} Andersen {, 1990 #3484}, who coined the term "computer semiotics", was one of the first to make a major study, adapting the semiotic theories from both structural linguistics such as Barthes {, 1967 #3504} and Eco {, 1979 #3509} and the phenomenological approach of Winograd and Flores {, 1987 #708}.

^{xviii} In *The Semiology of Graphics* his major distinction was between figurative or representational images (icons in Peirce's terms) and symbolic, abstract graphics. He argued that iconic representations were inevitably ambiguous, with the consumer being able to make a variety of interpretations, but graphics could be made much more precise by always fixing their meaning using legends or keys.

^{xix} Kress and van Leeuwen {, 1996 #4161} have developed a form of visual grammar in their book *Reading Images*. On website moving images, Metz {, 1986 #4192} has developed a semiotic theory of types of film shot – and details eight different syntagms that can be chosen in the making of a film.