

## **Semiotics for E-commerce: Shared Meanings and Generative Futures**

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### **Abstract**

E-commerce will become the de facto way that business is conducted, particularly so with the new generations of virtual enterprises. Our concern however, is that the thrust of present e-commerce 'solutions' is generally misguided. Like many previous IS/IT systems they are in danger of failing to deliver expected cost-effective returns to organisations. Despite the high level of interest and excitement in e-commerce to date, organisations are getting increasingly wary of backing yet another 'emergent' technology that promises, yet fails, to deliver competitive advantage. BIT students and industrial practitioners are well placed to exploit new, practical frameworks that can deliver this advantage. In achieving this, we believe that usability is a mission critical component in providing adaptable, exploitable (thus successful) e-commerce solutions. Put simply, a stakeholder's trust and confidence depends critically upon shared common meanings and metaphors with both their IT/IS systems and other stakeholders. Semiotics ('the science of signs and shared meanings') offers a sound theoretical basis from which BIT students and practitioners can manage, design and build adaptive and commercially exploitable e-commerce solutions. Since the BIT professional interfaces between management, ethical, legal and computing cultures, they are ideally placed to offer approaches with the necessary credibility to appeal to multidisciplinary interests. Accordingly, we present and explicate the unifying Shared Meanings Design Framework (SMDF) that transcends organisational and computer-technical knowledge. We also relate SMDF to the major research programmes such as the key UK and European initiatives in e-commerce, so as to contextualise fully our own semiotic vision of e-commerce.

## 1. Introduction

Any visit to resources like <http://www.commerce.net/> or <http://www.brainstorm.co.uk/> and meta-resources such as <http://www.cix.co.uk/~parkside/pocket/commerce.htm>, <http://www.ecompublishing.com/> or <http://www.allec.com/> confirms that electronic commerce ('e-commerce') is becoming the de facto way that business is conducted. The easy access that the Internet offers to e-commerce has fuelled the value of information as a global instantly tradable commodity in its own right. This in turn, as the influential Butler Group (<http://www.butlergroup.co.uk/>) continually reports, is leading to the rise of a new generation of wholly on-line, or virtual, organisations known as meta-intermediaries. These 'metamediaries', ranging from Deckchair.com (<http://www.deckchair.com/>), nearplanet.com (<http://www.nearplanet.com/>) to, indeed, <http://www.metamediaries.com/> are now in the business of information, not products.

Suppliers are increasingly at the mercy of customers. The customer, via the metamediaries' information portals, can choose her products from a vastly increased and timely database of product alternatives in an accessible environment that no traditional intermediary, such as the high street travel agent, can match. Likewise, the Internet has also opened up new distribution channels like MP3.com (<http://www.mp3.com/>) that customers can access directly; thus bypassing traditional distributors (O'Connell 1999). In short, the Internet's technological advances have empowered the customer who, having perceived this added benefit, will pay a premium. The metamediary must thereby win the confidence of its customers by offering increasingly *meaningful* information over and above its competitors.

Our concern however, is that the thrust of present e-commerce 'solutions' is generally misguided. Like so many Information Systems in the past they are in danger of failing to deliver expected cost-effective returns to organisations. Despite the high level of interest and excitement in e-commerce to date, organisations are getting wary of backing yet another 'emergent' technology that promises, yet fails, to deliver competitive advantage. Again, the technical and business expertise is divorced (if they were ever 'married') as we get embroiled in, say, complex technical security issues that the average intelligent human being cannot follow. For instance, a potential customer will quite happily give her credit card details over the telephone to a complete stranger, as this is a straightforward process with simple well-known problems and safeguards. Asking that more-than-capable customer to configure, let alone understand, her public and private keys, digital signatures and so on is simply too ambitious to gain her confidence. Such technological hurdles are not an option for the organisation wishing to pursue a generative future in the metamediary world of e-commerce.

Being at the crossroads of technology and commerce, Business Information Technology (BIT) students and industrial practitioners are well placed to exploit new, practical frameworks that ought to deliver this advantage. Just as we cannot expect customers to be security experts as in our illustration, the BIT professional cannot be both a technical and business expert. Similarly, the computer expert is not a business domain expert and vice versa.

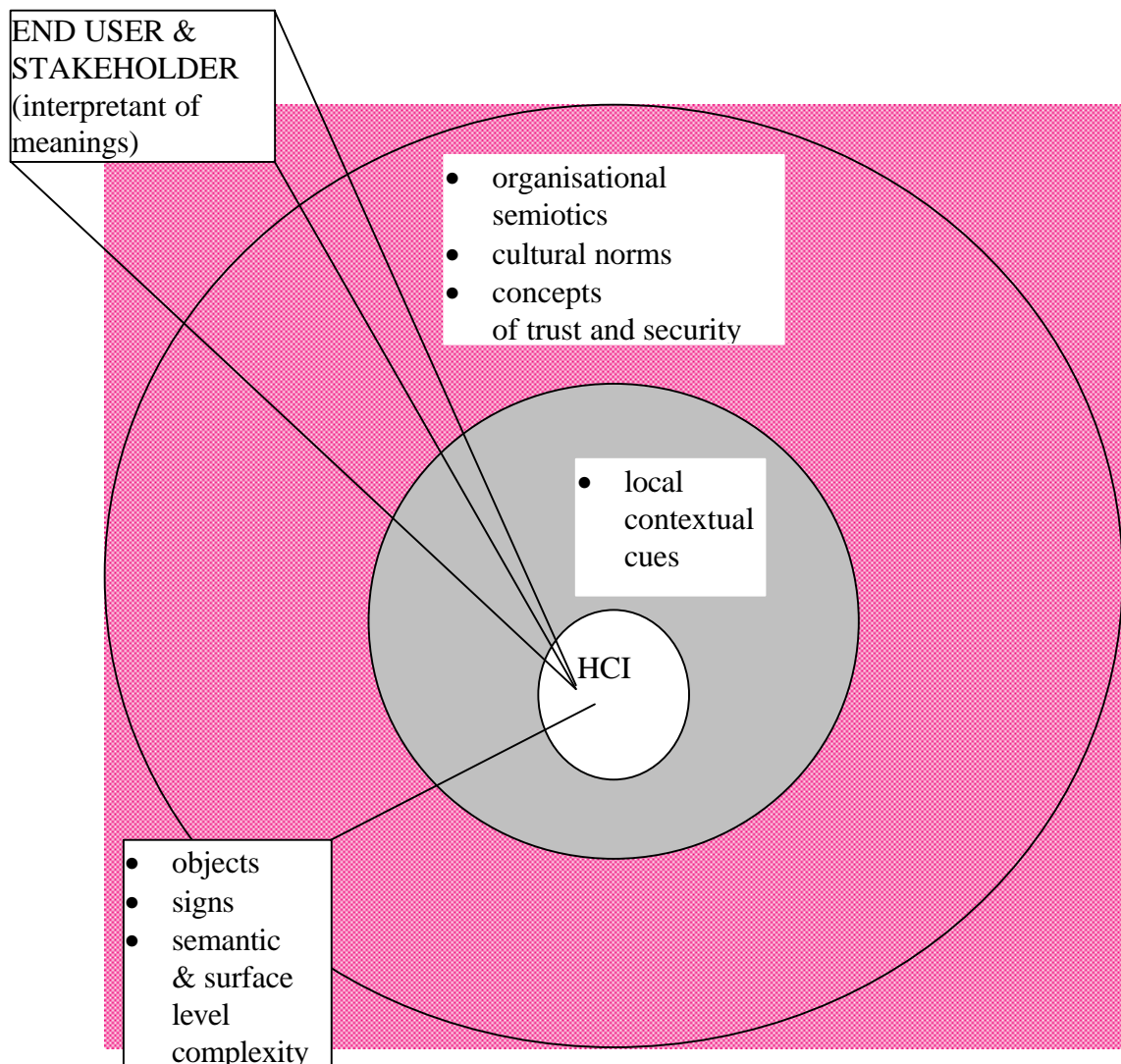
The BIT role is thus to advance an environment where these experts can usefully relate to each other and share their knowledge and issues in a common way so that they can understand each other. Remembering that business domain experts are, like customers, the end-users of computer systems, *usability* is a mission critical component in providing adaptable, exploitable (thus successful) e-commerce solutions. We therefore present what we have coined as the

*Shared Meanings Design Framework* (SMDF). The SMDF offers support to e-commerce developers throughout the IS development life cycle, particularly those who wish to confront fundamental issues of shared meanings. Our vision is that SMDF (derived explicitly from an underpinning semiotic paradigm as we explain shortly) can do much to mitigate such problems. We freely acknowledge that our ideas are still under development and we welcome responses from industrial and academic practitioners.

## 2. Semiotic (Shared Meanings) Design Framework

SMDF places considerable emphasis on the Human Computer Interface (HCI) as the crucial mission critical area, where issues of meaning, complexity and usability (see French, 1998) are central to the success or otherwise, of an e-commerce application. We believe that end user received meaning is dependent on a number of interrelated semiotic layers. These layers are shown in figure 1, and it is this vision which has led us to evolve SMDF to support the *semiotic enhanced* systems life cycle model shown in figure 2.

**Figure 1: Schematic showing end-user received meaning dependencies**



**Figure 2: SMDF, An Overview**

<b><u>SYSTEMS DEVELOPMENT PHASE</u></b>	<b><u>TYPICAL ACTIVITIES &amp; TECHNIQUES</u></b>
<ul style="list-style-type: none"><li>• <b>Elicitation phase</b></li></ul>	Apply semiotic analysis of stakeholders. Check status and validity of shared meanings. ( <i>Shared Meanings Elicitation</i> )
<ul style="list-style-type: none"><li>• <b>Human Computer Interface Design</b></li></ul>	Undertake detailed semiotic analysis of signs and sign systems employed. ( <i>Semiotics of HCI</i> )
<ul style="list-style-type: none"><li>• <b>Quantify surface level complexity</b></li></ul>	Use state notation to verify interface complexity in terms of user actions and system states. ( <i>State Notation</i> )
<ul style="list-style-type: none"><li>• <b>Identify Tools</b></li></ul>	Identify semiotic compatible development tools for prototyping/full implementation of the final system. ( <i>Semiotic Compatible Checklist</i> )
<ul style="list-style-type: none"><li>• <b>HCI Testing &amp; Pilot Site Testing</b></li></ul>	Carry out empirical validation of the interface. ( <i>Semiotic Enhanced Usability Metrics</i> )
<ul style="list-style-type: none"><li>• <b>Post-Implementation</b></li></ul>	Use a <i>Semiotic Review Checklist</i> to ensure that the system is potentially maintainable

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The proposed SMDF framework consists of a carefully sequenced application of various semiotic enhanced (or semiotically focussed) techniques; our aim being to underpin e-commerce development from initial requirements elicitation through to post-implementation and review.

The remainder of this paper seeks to explicate each of these stages in turn. Stages 1-3 are described in some detail. Stages 4, 5 and 6 are essentially described in outline form only, as these are still under development by the authors.

### 3. SMDF - Stage by stage

#### **SMDF Stage 1: Elicitation Phase (*Shared Meanings Elicitation*)**

Much work has been carried out in recent years with respect to formalising and supporting the crucial elicitation phase of IS (Information System) development when system requirements are drawn up. Many different techniques and approaches have been used over the years in order to extract and validate both the functional and non-functional requirements of Information Systems, see for example Kotonya and Somerville (1998).

However, many of the existing approaches do not appear to us to ask fundamental enough questions concerning, after Andersen (1998), the *semiosis* of the organisational setting. Rather, traditional elicitation techniques have often tended to concentrate too much upon process driven activities operating at the surface level of organisational behaviour.

We believe that before familiar elicitation techniques such as interviewing, record inspection, and observation *et al* are used, we should firstly examine the *signified* of an organisation. We believe that the adoption of the semiotic paradigm will help to maximise the ‘goodness of fit’ of an e-commerce system to any particular organisational culture. We can conveniently divide the *signified* into several *levels* as shown below in figure 3:

**Figure 3: The Signified**

<i>SIGNIFIED</i>	• SOCIAL WORLD	Beliefs, expectations, contracts law, cultural norms.
	• PRAGMATICS	Intentions, communications, conversations, negotiations, change.
	• SEMANTICS	Meanings, propositions, validity, truth.

Hybrid managers can relate these levels of the signified to the specifics of e-commerce systems, by applying a common sense checklist approach well before traditional system elicitation techniques are used. Indeed, the results of the checklist may well influence the optimal choice of elicitation method(s) themselves. A suggested checklist is shown in figure 4.

**Figure 4: Exemplar E-commerce *semiosis* Checklist**

<p>1. How can we best characterise the beliefs of the organisation as a whole? Are there cross-national implications involved?</p>	<p><b>SOCIAL</b></p>
<p>2a What expectations exist as to how these beliefs may (or may not) be supported by the proposed system?</p> <p>2b Who holds / does not share these beliefs?</p>	
<p>3a What legal barriers exist: internal SOP's (Standard Operating Procedures) or external. How do these impact on the proposed System?</p>	
<p>3b Who enforces these constraints?</p>	
<p>4 Are contractual obligations involved?</p> <p>Do these relate to &gt; trading issues?          &gt; contracts of employment?          &gt; other?</p>	
<p>5. How will the proposed system alter internal communication(s) within the organisation or externally (i.e. to customers). Have all those involved been consulted and how they might react to these changes?</p>	<p><b>PRAGMATICS</b></p>
<p>6. How is change generally handled? Are there established procedures for negotiation? Is the organisation strongly hierarchical or free ranging and flexible?</p>	
<p>7. What is the <i>de facto</i> means of both lateral and upward/downward or external communications handled within the organisation? How well do these method(s) work? Will these methods be influenced or replaced by the proposed system?</p>	
<p>8. Do all members of the organisation share the same understanding of terms such as: currency, cash, trust, secure transaction, exchange of goods etc.</p>	<p><b>SEMANTICS</b></p>

## **SMDF Stage 2: The semiotics of HCI**

Semiotics (the science of ‘signs’) provides us with a useful analytical framework within which notions about the cultural and social context of HCI systems can be approached (De Souza, 1993). From a semiotic viewpoint, an interface is essentially a self-referential symbolic sign system that is ultimately decoded (or rather interpreted) by a set of users. Semiotic analysis attempts for example, to separate out the following features of an interface:

- the intrinsic meanings inherently present within the symbolic system;
- the perceived meaning as decoded by a particular set of users;
- the meaning which a particular context may endow to an interface and a set of users.

We believe that semiotics offers the would be e-commerce interface developer *three* useful approaches:

- *contextual HCI semiotics*;
- *web interface semiotic guidelines*;
- *semiotic metaphor analysis*.

### **A) *Contextual HCI semiotics***

Semiotics can help us interpret the results of various studies that have revealed that an intimate link exists between an interface and its work-setting (so-called ‘socio-cultural’ studies). Two recent examples include Gobbin (1998), who explores notions of ‘cultural fit’ and Bourges-Waldeg (1998) who highlights the issue of *Meaning in Mediated Action* (MMA) in cross-cultural HCI design. Both studies concern themselves with an applications organisational and social ‘goodness of fit’ which is in turn, dependant on both the user’s cultural background as well as various *macro* and *micro* organisational factors.

Semiotics recognises that for meanings embedded in an interface to be fully shared, it is necessary that we firstly analyse the context within which the system is to be used in a systematic fashion. What semiotics offers here is simply a unifying coherent analytic standpoint in which users are seen to act as *interpretants*. What they are seeking to interpret is the *object* represented by the *sign*.

Thus, to take a simple example: “*Web pages are usually full of small images that act as user-friendly and aesthetically appealing ways of navigating through hypertext space. For this to work correctly, it is obviously necessary that the user can interpret each of these signs and correctly infer that each is actually an index object (a hypertext link to a physical or logical page)*” (Codognet, 1999).

We would argue strongly that in order to interpret computer-based signs successfully, users often draw their cues from the contextual features present in their local environment (Andersen, 1991). Thus, we should not neglect to analyse the values and beliefs of the organisational settings within which our interface will operate, since these features will directly influence the user’s expectations of interface signs and meanings. We call this *contextual HCI semiotics*.

We can seek to capture the following local semiotic contextual features by asking the following types of questions:

**a) Is the application likely to be particularly sensitive to cross-cultural factors?**

The following features have been identified by Bourges-Waldegg (*ibid.*) as being particularly sensitive to cross-cultural change:

- i. Character sets (e.g. the Latin Alphabet, Arabic and Hebrew systems) – including both visual scanning issues and encoding issues;
- ii. Collating sequences including indexing;
- iii. Numeric formats (e.g. decimal fraction notation);
- iv. Date currency and time formats;
- v. Telephone numbers.

We should also note here that generic cross-cultural factors influence the choice and interpretation of colour, meanings of icons, symbols and interpretation of so called ‘universally understood’ abbreviations.

**b) What is the local organisational context like?**

We use a modified version of the measures of *macro-organisational* belief and values as described by Pilskin et al. (1993) to tackle this issue:

- i. To what extent is the organisation innovative and reactive?
- ii. To what extent is the organisation used to handling risk?
- iii. Does the organisation encourage integration or competition amongst organisational sub-units?
- iv. What is the nature of support offered by senior management?
- v. To what extent are individuals held accountable for their performance?
- vi. What is the reward structure used in the organisation?

**c) Are there any special contextual features of the user’s workgroups?**

From a semiological viewpoint, a workgroup is best viewed as a set of *actors*. These actors use a number of *signs* including verbal, computer based, social cues, and day to day speech. Each of these are interpreted within a specific social context in order to mediate and perform their day to day activities.

The computer-based sign is thus viewed from this perspective, as merely one of a number of a ‘props’ that support the *performance* of the workgroup, see Stamper (1991). We should therefore, take particular care to capture the full richness (of the often informal social interaction) which exists within workgroups, if we are to be sure to achieve successful integration of an e-commerce solution within an existing workgroup setting. We suggest that the following types of questions are asked:

- i. What are informal social relations like (do members of the workgroup often assist each other informally) in order to carry out routine tasks?

- ii. Do workgroup members commonly use any specialised terminology of their own, or has the workgroup developed its own abbreviated language of utterances of its own (a so called *restricted code*, indeed 'jargon') for day to day communications?
- iii. Who are the leading players? Who organises and directs day to day workgroup activities? How are these activities co-ordinated?
- iv. How robust is the workgroup in response to differing loading conditions?
- v. To what extent are the workgroup already familiar with IT systems? Do the existing systems match workgroup members user needs in terms of motivation, user quality of life, or cognitive styles?

***B) Web Interface Semiotic Guidelines (Semiotics a meta-language for Web-site design?)<sup>1</sup>***

Semiotics deals with meanings associated to *signs*. These include all types of signs and signification including language, pictures, symbols, actions etc. Semiotics thus is about the means of communication, and the Web is the focus of e-commerce development. Particularly from the customer's perspective an e-commerce Website is clearly the sole basis upon which decisions about the status, authenticity, and trustworthiness of others is made.

Some generally agreed generic principles of semiotics include the following:

- Communication, meaning-making and culture are linked through a belief in a shared understanding of signs;
- Any semiotic element (sign or text) has at least two planes, an expression in the so called 'semiotic' plane and a content in the 'mimetic' plane;
- Each semiotic element may be read in any number ways other than that intended by the author;
- Texts and signs offer statements at a level of power and solidarity, and ideology;
- There are three main categories of sign Icon, Index, Symbol. Any sign may contain elements of all of these;
- Signs are not static, their meaning and their place in meaning making changes for individuals through time.

In e-commerce Web design we are interested in the message. It is possible of course to communicate a false message (either explicitly or implicitly). For example making an organisation look bigger than it is, or to pretend that it is able to offer various services and products that in fact it cannot market via the web. This obviously compounds the problem of trust: how do the users of that Website know how to trust the information? Unless users trust the site and have confidence in the organisation they will surely take their E-business elsewhere.

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<sup>1</sup> This section is a synopsis of the material that can be found at <http://www.sbu.ac.uk/~vileawa/semiotics/Semioticsofweb.htm>

## **E-commerce design guidelines**

1. *Engender trust.* Which site would you trust for information <http://www.ibm.com> or [www.demon.co.uk/~joebloggs](http://www.demon.co.uk/~joebloggs)? Make sure that the information the organisation gives is verifiable, accurate and trustworthy.
2. *Build in accessibility for all cultures and all browsers, and hearing and sight impaired users.* Meanings are culturally bound so look for *culturally neutral* signs. Additionally, make sure that content is expressed in a variety of ways, to account for sight and hearing impaired users. Even the placement of corporate logos, or the varieties of size in text, can have an impact on the social domain.
3. *Make the text as clear as possible.* This does not exclude the use of graphics, and it does not mean that the page need be dull. Rather, that it need take account of the fact that your site may be accessed by anyone from anywhere in the world.
4. *Use forms for feedback and act on it.*
5. *Make the Website inclusive.* The style of font or style of writing and language used may unwittingly exclude second language speakers. Websites may display a picture that some may interpret as being offensive, even if it is not intended to be so.
6. *Make sure that the Website is not giving off a message of authoritarianism or absolute power.* What does it mean to say that web-sites offer statements of solidarity and power? It may be that the site excludes certain groups, perhaps by being gender specific or culturally biased (unless the organisation wishes this!).
7. *Try to engender solidarity in the reader.* It is important to show the right balance of power and solidarity on the site. Readers should feel solidarity with the Website's messages, and feel 'at home'. If the Website, or part thereof, needs to express authority it should do so in a way that does not exclude the reader of that site or make them want to withdraw.
8. *Use icons and indexes liberally, but take care with symbols, by nature they are vague.* Icons should be used where illustration of ideas is necessary, use Indexes to point to a specific page or point (this includes hypertext links), and symbols only when the convention of their meaning is well understood. Remember that convention is culturally constructed. Indexes are obviously an essential part of navigation and of drawing attention to web sites.
9. *Always maintain and update the Website.* The meanings of signs change with time. Think of the word "card". A *card* is made of card, but not a credit card or a smart card. Initially the word card came from the material used to manufacture the item, now the name has changed through usage to refer also to the little bits of plastic so essential to users of e-commerce sites. Conceivably, words and pictures that are on the site may mean one thing this week and something very different next week.
10. *Choose a stable and consistent navigation metaphor.* Signs are time dependent, structure must not be. Thus, structure must be consistent. With a fruitful navigation

metaphor the organisation will be able to populate its web site with any data whilst customers will still know how and where to go. Navigation bars, control panels, frames all essentially perform the same function. Semiotically they give both structure and content. Consistently displayed, they give a sense of familiarity and location.

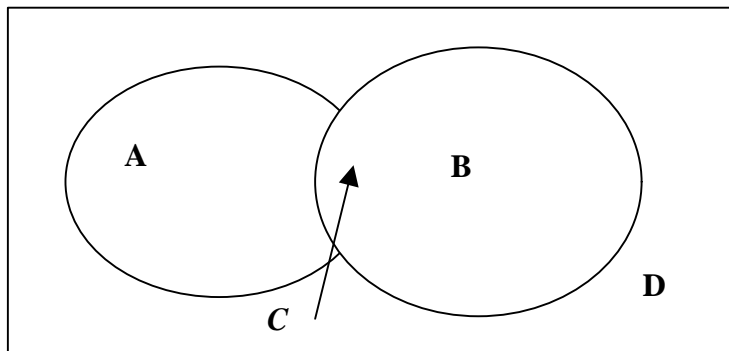
11. *Always give escape routes - back and out.* Web pages deliver content, Web sites provide structure. Of course, in reality the structure of a site is purely a metaphor manifested through its directory structure, which in turn is metaphorical as data is often stored in a fragmented way on disk. What is more important is the ease of which users can navigate through the site and then escape again. No one knows 'where they want to go today' unless the site informs them where they can go, and make it easy for them to get there. If the site wants to draw people in, make it self contained and make sure that everything that is needed while they are in the site is there. Lock users into the site by making everything that they need is readily available, so that they only leave when they want to, not because they have to.

### ***C) Semiotic metaphor analysis***

Semiotics is concerned with the internal consistency of sign systems and this prompts us to question the validity and consistency of the interface metaphors themselves (Nehaniy, 1998). We can, for example consider such matters as the choice of metaphor, examine the consistency of the metaphor(s) used, and look at how these might relate to the results derived from earlier SMDF stages.

We suggest the use of the following simple Venn diagram notation, primarily for its value as a *visualisation* tool. Essentially we suggest a highly simplified version of the functional mappings approach to metaphor analysis, as offered by Alty & Knott (1998) or less complex alternative to more rigorous algebraic-semiotic approaches is exemplified by the recent work of Goguen (1998). Our approach is simple enough to enable the end-user, software developer and BIT professional alike to view the interface from a refreshing perspective and to adopt what we may call a *fresh eyes* approach. A simple example is presented in figure 5:

**Figure 5: Venn diagram notation of interface metaphor**



COMMENTARY

*A = interface metaphor used e.g. cue-cards, windows, folders...*

- *a list of objects used and of their 'virtual' behaviours e.g. a 'window' opens and shuts but cannot be re-sized, a waste-bin can be full, partly full or empty...*

*B = interface system functionality*

- *a list of actual system objects used and their actual system behaviour(s) e.g. an interface window can be virtually re-sized by the user, opened or closed.*

*C = A ∩ B = list of exact matches between metaphor signs ('objects') and system objects ('sign') functionality*

- *e.g. a metaphor window (a real window) and interface window both can be opened and closed (but we cannot resize a real window!)*

*D = desirable (?) or unexpected (!) features not supported by either interface or metaphor*

- *e.g. a user catalogue requires a 'shopping basket' currently not easily supported by the window metaphor (or any system interface object/function?)*

**E (not shown) = note mismatches between interface and signs:**

- *e.g. metaphor window (sign object) cannot be re-sized but an interface window can (as we have already stated)*

**SMDF Stage 3: Quantifying and controlling surface level complexity**

*State-Notation*

It is perhaps useful at this juncture to remind ourselves of the relevant generic industrial drivers which appear to be currently operating in the e-commerce marketplace today:

### *Industrial drivers*

End-users have become increasingly demanding. They now require us to deliver secure and sophisticated e-commerce solutions on time with effective and efficient interfaces. This means that we may be involved in the following typical activities:

- Building internet/intranet based solutions;
- Building multi-modal interfaces (integrating sound, graphics, text & video);
- Re-engineering or establishing new connections to existing legacy systems.

### *Technological Drivers*

- Visual development tools have become popular and powerful. We can now design e-commerce applications of essentially arbitrary complexity. Thus, we need a means of managing and quantifying surface level complexity.
- Web interfaces typically involve a potentially heterogeneous set of highly geographically distributed set of users – this presents us with a new set of issues: there may be new cultural and shared meanings and usability barriers to overcome.

Our response to these *drivers* has been to develop our own *visual formalism*, which we believe, can help developers control and manage interface complexity within an increasingly demanding commercial and technological e-commerce environment (French, 1997). We have therefore, chosen to adopt our own based around the familiar notion of a *state transition diagram*.

We are aware of course, that others have chosen to adopt alternative approaches to the issue of modelling interface complexity. Formal methods approaches (as exemplified by the recent work of Johnson (1996) and Faconti (1996) for example) attempt to adopt rigorous notions of mathematical proof in order to predict interface behaviour. Advocates of Formal methods insist that the interface is modelled mathematically using a suitable formal language such as **VDM** or **Z** before being subjected to rigorous proof verification.

Since this approach has indeed gained some considerable favour (particularly perhaps amongst those from the academic community) it is perhaps useful at this point to briefly to justify our state based approach from a hybrid manager's perspective.

We feel that HCI semiotics and state modelling fit particularly well together, since they can be used together to model and control both surface level complexity and the semantic complexity of an interface. Formal methods have their own strengths, however we feel that our approach offers greater simplicity and easier readability potential for e-commerce developers, hybrid managers and their end users alike, to debate and negotiate interface development.

The crucial concept here is *negotiation*. Developers, end users (and those hybrid managers – BIT professionals? - given the often-unenviable role of mediating between the two) realise that interface development crucially involves the identification of shared meanings. This process

also necessitates active end-user participation (using visualisation techniques and user-friendly approaches) in negotiating both deep semantic- and surface-level interface complexities. Indeed, such negotiation may involve re-negotiating the very work context(s) within which the system will operate.

State modelling used within SMDF is a 'hybrid manager' friendly approach than, say, formal methods approaches to tackling interface complexity issues, since all the various system stakeholders can at least start this process of negotiation. To illustrate let us take a small example. A customer (simulated by one of the authors) attempts to visit [nearplanet.com](http://www.nearplanet.com)<sup>2</sup>, with the resulting 'Certificate Name Check' exceptional outcome:



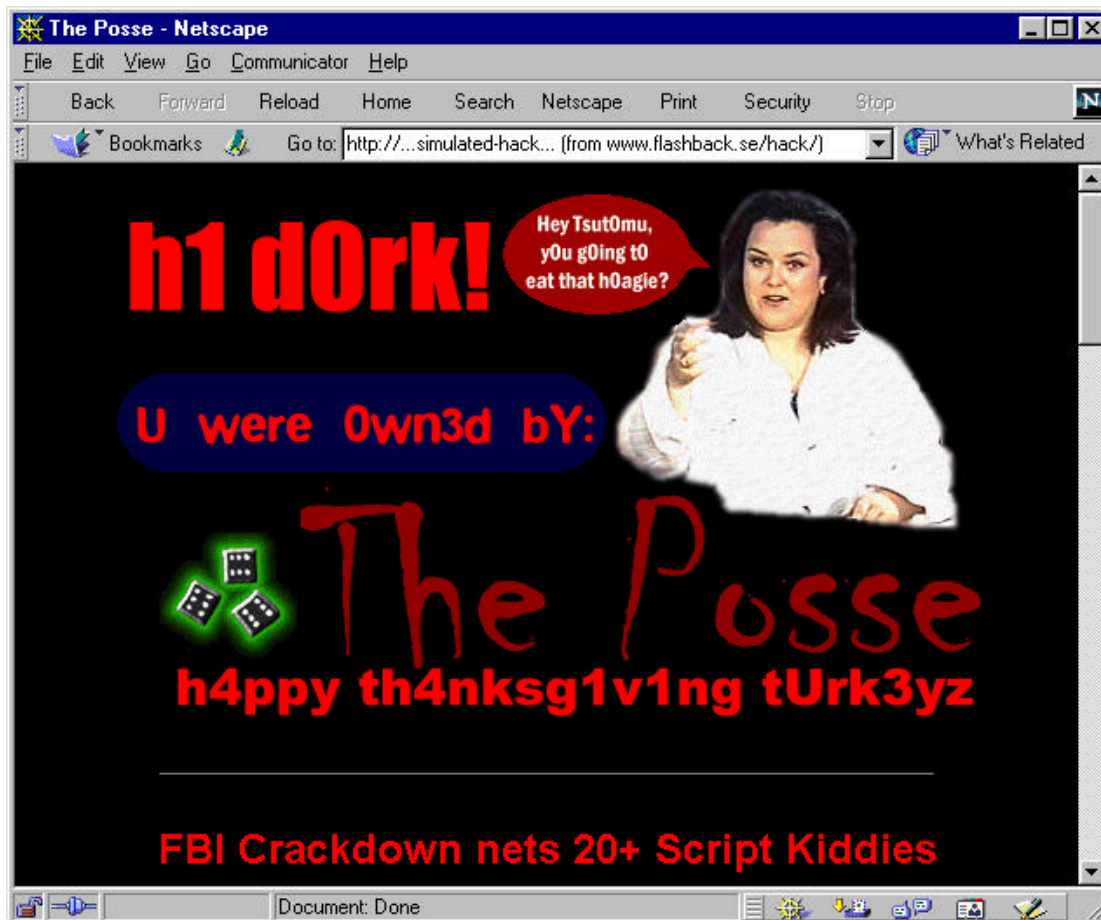
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<sup>2</sup> We hasten to add the example is merely a fictional simulation, and in no way reflects adversely on nearplanet.com, who have very kindly agreed to let us use them in our illustration, or the other organisations directly or indirectly referred to in the example.

The customer, concened by this exception, selects the 'More Info...' button and is greeted with:



All the customer, who how is really confused and worried, can now do is to press OK. He then goes back to the 'Certificate Name Check' window and decides to continue...

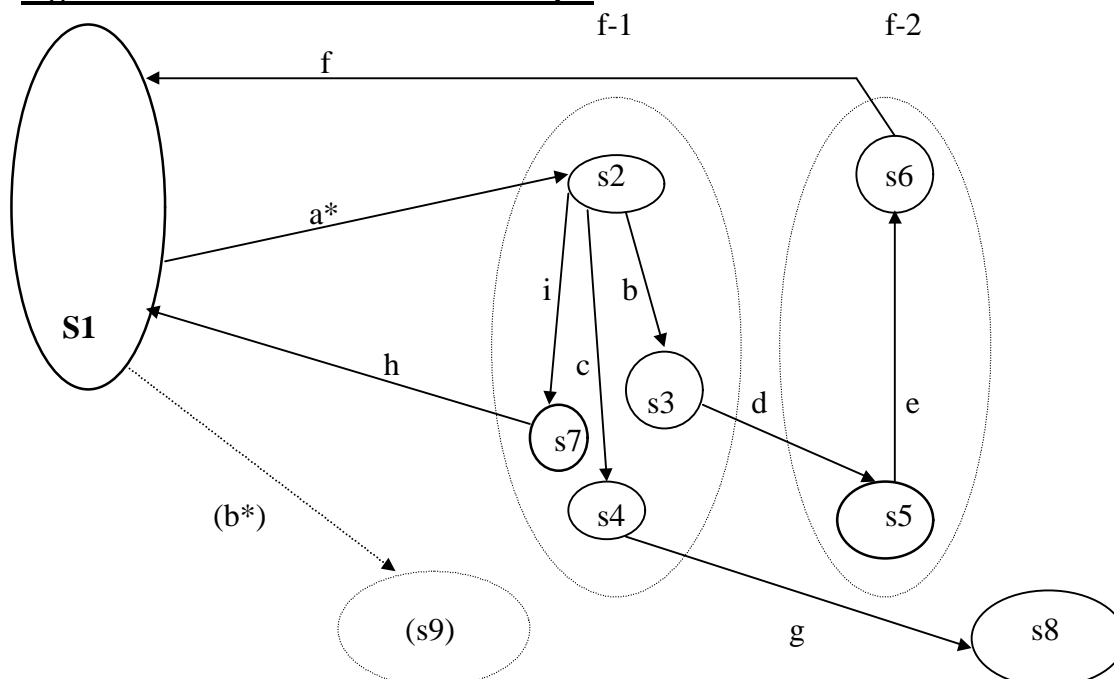


The customer had expected to go to:



Our graphic example rendered as a state diagram is given in figure 6.

**Figure 6: State notation for short example**



States and actions	Narrative description	{UA = user action, SA= system action, DA= dual user/system action, S= state, SS= sink state}
s1	Netscape home page mode	S
a*	user enters Web site address <i>www.nearplanet.com</i> and hits return button / system activates exception frame-1 (f-1)	DA
s2	default opening state of frame-1 (f-1)	S
b	user activates "More Info" button	UA
s3	activated "More Info" button	S
d	system activates and opens exception frame-2 (f-2) whilst closing frame-1	SA
s5	default state of exception frame-2 (f-2)	S
e	user activates "OK" button	UA
s6	activated "OK" button	S
f	system closes frame-2 and returns user to their home page	SA
c	user presses "Continue" button of frame-1	UA
s4	activated "Continue" button of frame-1	S
g	system activates link to new web site (also closes exception handling forms)	SA
s8	ALIEN site of web reached!	SS (!)
i	user presses "Cancel" button of frame f-1	UA
s7	activated "Cancel" button of frame-1	S
h	system closes exception frames and returns user to home page	S
(b*)	user enters web address <i>www.nearplanet.com</i> and hits return button / system activates desired site	SA
(s9)	desired web site destination <i>www.nearplanet.com</i> is reached and displayed	S

*Notes:*

- Normally a diagram starts with state-1 (the so called default or waiting state);
- States are represented by solid ovals, labelled with an arbitrary state number (e.g. a sequence of integers, internal to the diagram);
- Actions (user initiated or system initiated) are represented by directed arrows – two way arrows are not allowed;
- Forms behaviour is indicated by dotted oval – a form is always deemed to be 'opened' in its so called default state;
- Any additional material (as appropriate)

**SMDF Stage 4**

Currently we are evaluating software tools to determine those that might best promote SMDF. Although still in its early stages, we are getting encouraging results with FileMaker Pro (<http://www.filemaker.co.uk/>). This was originally a database management system that began life on the Apple Macintosh, known as 'the computer for the rest of us' (i.e. the non-technical expert). FileMaker Pro has since developed into a PC and Macintosh software development environment offering 'information management from the desktop to the Web'. This is a claim made by FileMaker, but from our work carried out to date we sense that semiotically their claim is justified. (We are unconnected with them other than having purchased their products.) We sense that the 'rest of us' philosophy has been retained in FileMaker Pro to its advantage in building e-commerce solutions using SMDF.

## **SMDF Stages 5 & 6**

We believe that existing methods of site and pilot testing, which typically involve the recording of various usability metrics and application of acceptance testing techniques (Shneiderman 1998), should be supplemented with various types of empirical semiotic analysis. The emphasis as far as the user is concerned should, we believe, be re-focused on shared meanings and interpretation rather than focus either upon mere speed considerations, or on crude error rate calculations. We hope to distinguish for example between errors caused by misinterpretation of meanings, from errors due to other causes.

## **Concluding Remarks**

Through sharing meanings between the business domain expert (culminating in the customer) and the computer technical expert and, by extension, all the stakeholders in e-commerce solutions, SMDF offers potential for the virtual organisation, thus the metamediary. Given that this is such a fundamental initiative, we are naturally looking for further support from academics and industrial partners to develop the ideas presented. Consequently, the BIT professional's role can be realised, and a generative future can be assured at last. We believe that SMDF actively supports the key UK, European, US and world-wide initiatives in e-commerce (<http://www.isi.gov.uk/isi/>, <http://www.cordis.lu/fp5/>, <http://www.qlinks.net>). The European Commission is anxious that e-commerce will transcend its diverse populations, both culturally and in ability, in that 'there's no such thing as the average user' (Placencia and Ballabio, 1998). In this spirit at least the future for SMDF and its derivatives is thus assured.

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