Perceptions of the Internet: what people think when they search the Internet for information

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Abstract

The study described in this article aimed to gather insights into what people think when they search the Internet for information. The premise is that people relate to information services and systems metaphorically. In other words, they identify the system or service as analogous to something perhaps more mundane or commonplace. These are known as wild metaphors. They help to explain the unknown or unfamiliar and help us to learn new things. They arise from our individual beliefs and backgrounds but they are also inevitably influenced by our collective experience of contemporary media characterisations of the Internet. This study relates the analogies that academics in Australia report for the Internet with the satisfaction that they derive from information seeking on the network. It provides some insight into how academics in Australia perceive the Internet when they use it to search for information.

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Introduction

In recent years, the technologies and protocols of Internet working have been embraced by a public access agenda that has transformed this one-time, middle-up infrastructure into a widely used public utility. This trend has been accompanied by, and in some ways generated by, a rhetoric for popularising and promoting the Internet. We see the network referred to as an information infrastructure (Cerf, 1994; Dempsey, 1993; Kahin, 1995), an infobahn (Michell, 1995), an information superhighway (Koelsch, 1995) or more recently a communication superhighway (Hearn *et al.*, 1998). To date, this sort of rhetoric has been used successfully to promote public policy (Information Infrastructure Taskforce, 1993; National Research Council, 1994) and to justify the establishment of expensive infrastructures, particularly in the education sector (McClure and Lopata, 1996). But, it also gives us pause to consider if this same hype is having any effect on what people think when they use the Internet to look for information?

At first glance, this seems an odd question to ask and a difficult one to answer. Information scientists, however, have long been interested in what people do and also what they think when they search for information (Bates, 1979). Indeed, the cognitive viewpoint, which is the most contemporary of the research paradigms of this discipline, is fundamentally concerned with achieving deeper insight into information behaviour by understanding the source of an individual's knowledge structures and the effect these have on information behaviour and information processing (Belkin, 1990). Knowledge structures are determined by the social/collective experiences of the individual. They comprise a schema of categories or concepts which the individual uses for information processing (Ingwersen, 1992). Saracevic *et al.* (1988) call this schema, the internal knowledge state of the information seeker. The internal knowledge state focuses attention on a number of the user's cognitive processes and structures such as how knowledge is stored, how it is organised, associated, retrieved and changed in the individual user's mind. We often see terms like cognitive models, mental models, mental representations,

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schemata and knowledge structures used interchangeably with internal knowledge state.

Interest in the internal knowledge state of the user has underpinned research not only into the models that information users have of systems and programs but also research which has focused on the models that systems have of users. For example, there has been research aimed at developing information systems that accommodate representations or models of user knowledge (Belkin *et al.*, 1982; Borgman *et al.*, 1989; Myaeng and Korfhage, 1990; Newby, 1989). The main problem with a number of these prototype systems is that they simply incorporate a selection of stereotypes, which are then selected as most appropriate by a user to match his/her own level of knowledge. With this in mind, Gilbert (1987) suggests that, rather than implanting stereotypes of users into systems, a more appropriate strategy would be to allow the system to tell the user about itself. The user could then adapt to the system rather than the system adapting to the user.

This is not as far-fetched as it may seem. Studies have, in fact, revealed that people do adapt to the information systems that they use. They do this by casting the system or service and its use as a more familiar entity or practise. Borgman's (1986) research, for example, has found that people structure their system knowledge metaphorically and she emphasises how important it is for people to develop a consistent metaphor for expressing their knowledge about an information system. These metaphors or analogies are also thought to have a role in the learning of systems by users. Carroll and Thomas (1982) have suggested that mental models in the form of metaphor or analogy can substantially affect how users learn about the systems they are searching. Bruner (1986, p. 46), described these as "wild metaphors" or crutches that "help us get up the abstract mountain".

Returning to our earlier discussion, it is clear that these social constructions, mental representations and expectations appear in the "wild metaphors" that have been used to characterise and popularise the Internet. These metaphors are, in fact, part of the collective experience of Internet users. How this collective experience is translated into the personal mental constructions that people contrive as they use the Internet is an intriguing question. At the very least, personal metaphorical constructions for the Internet provide us with a context for observing what people think and expect when they use the network.

Research

This article is based on a research project that has, in part, been reported elsewhere (Bruce, 1998). The research as a whole was focused on factors that affect satisfaction with information seeking on the Internet. In this article, I would like to focus on a part of this larger research project, as yet unreported. The article looks specifically on how a user's mental representation for the Internet (as analogy) might predict the satisfaction derived from information seeking on the Internet. It reports the findings of two research questions:

(1) Are there categories of end-user analogy for the Internet?
(2) Do particular analogies for the Internet predict the amount of satisfaction that a user will derive from information seeking on the network?

Before doing so, the reader will need some background to the larger study; in particular, the technique that was used to measure satisfaction with information seeking. This technique is called magnitude estimation. It is a method that was first developed by the discipline of psychophysics for measuring human perception of physical sensory stimuli (see Lodge, 1981 for a discussion of the techniques for the collection and analysis of magnitude data) but it has since been adapted and used on numerous occasions to measure responses to social psychological stimuli. Information scientists, for example, have used the technique (Bruce, 1994, 1998; Eisenberg, 1986; Janes, 1991) to gather reliable and valid data on variables like relevance and satisfaction.

The collection and analysis of magnitude data has an elegant simplicity. The researcher asks the subject(s) to provide a response to a particular stimulus so that the intensity of the response matches the subjective judgment of the intensity of the stimulus. The subject is asked to do this using two or more modes of response. For example he/she may be asked to provide a

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number, large or small, that matches the intensity of the stimulus. He/she may be also asked to squeeze a hand dynamometer with a force that matches the intensity of the stimulus.

A group of magnitude responses is validated for a particular variable by comparing the relationship between two response modalities for a calibration exercise with the relationship between responses when data are gathered for the variable in question. For this research, the calibration exercise involved subjects responding to the length of a number of lines that were shown to them one at a time. The researcher then had each subject tell the story of two incidents when he/she searched the Internet for information. For each incident, the subject was asked to provide a number that matched the satisfaction that he/she derived from information searching using the network. The subject then squeezed a hand dynamometer with a force that for him/her matched the level of satisfaction that was derived from the information seeking incident. The data were validated (this is discussed at length in Bruce, 1998) using techniques established by the discipline of psychophysics.

The measure of central tendency for a set of magnitude responses is called the geomean. The geomean is calculated by firstly converting magnitude estimates into logarithms. The arithmetic mean of the set of logarithmic scores is then calculated. The antilog of this arithmetic mean is called the geomean. The geomean can be used to compare magnitude estimates for a group based on the value for a particular variable. In Bruce (1998), for example, the geomean for satisfaction with information seeking for a group of academics who frequently use the Internet to search for information was compared with the geomean for satisfaction with information seeking for a group of academics who only infrequently use the Internet in this way. This comparison of geomeans allowed some initial judgement about whether or not frequency of use can influence the level of satisfaction that a person derives from information seeking on the Internet. With two or more geomeans to compare, a researcher can look for the significance of noted differences using a T-test or an F-test for analysis of variance (again see Bruce, 1998 for a full discussion of these techniques).

Sample

The information searchers who were studied in this research were academics. The sample was randomly selected using a sampling frame that was constructed from a consolidated list of the e-mail addresses of academics working at five universities in New South Wales (The University of Technology, Sydney, the University of Sydney, the University of NSW, Newcastle University and Charles Sturt University). The universities themselves were selected to represent the various types of universities in the Australian academic sector. The Australian academic sector comprises older, long-established metropolitan universities (the University of Sydney, the University of NSW), universities in regional cities (Newcastle University), amalgamated universities in large metropolitan areas (The University of Technology, Sydney) and regional centres (Charles Sturt University). Thirty-seven academics from across these universities were interviewed for this research.

Data collection

Data were collected from academics in the sample using a structured interview. This was conducted in the office of each academic and involved a calibration exercise and the description of two information seeking incidents. The first incident described by each subject was the last time he/she had used the Internet for information seeking. The subject was then asked to choose and describe a second incident where the Internet had been used for this purpose.

There are, of course, limitations to data that are based on recalled information behaviour. The first limitation is accuracy of recall. To address this, subjects were asked to retell each incident of information seeking as a memory prompt. The retelling was structured to enhance the subject's recall of the information seeking process overall. The subject was asked to identify the problem that he/she was attempting to resolve and the Internet information resource(s) that were used. The subject was also required to describe the search strategy that was used and its outcomes.

The second limitation with data that are collected by asking subjects to recall an information seeking incident is the possibility of a

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bias towards recalling only incidents where information seeking was a successful or positive experience. The likelihood of overstating satisfaction with data collected from self selected incidents is acknowledged, so where these data are associated with conceptualisation of the Internet in the form of an analogy (reported in the results section of this article), the associations are based on data for Incident 1 only. The reader will recall that the first incident described by each subject was the last time they searched the Internet for information. In other words, for Incident 1, the subject did not have the option of describing his/her most successful search for information using the Internet.

Each subject was also asked about how frequently he/she used the Internet to search for information, whether he/she had attended an Internet training session and the extent to which he/she expected his/her information searching to be successful.

Of specific interest to this article, each academic in the sample was finally asked to articulate his/her conceptualisation of the Internet in the form of an analogy by completing the sentence "Internet is like a …" The researcher noted no hesitation among the academics in the sample when they responded to this question. Indeed, this particular component of the interview schedule had been comprehensively piloted by the researcher in another project in which subjects exhibited a similar ease with articulating a conceptualisation of the Internet in the form of an analogy (Bruce, 1996).

Data analysis

The first step to analysing the data for conceptualisation of the Internet involved an examination of the transcripts which reported the analogy for the Internet that had been obtained from each subject. Data analysis was aimed at identifying the common themes and images that appeared in these analogies. A coding system was developed to keep track of this. Strauss and Corbin (1990) describe this process as open coding:

> The process of breaking down, examining, comparing, conceptualising, and categorising data (Strauss and Corbin, 1990, p.61).

The researcher categorised the analogies for the Internet on the basis of common themes and images that emerged from this process of open coding.

The data were then examined by 80 graduate students from the School of Information, Library and Archive Studies at the University of New South Wales. This second level of analysis was intended to achieve interjudge reliability for the categories of analogy that had been derived by the researcher. The student coders were divided into ten small groups. Each group was instructed to examine the analogies collected from the academics in the sample and to look for common themes or repeated images in the transcripts. When this process was complete the ten groups were collapsed into five larger groups (16 students per group). These larger groups were instructed to examine the coding achieved by the smaller groups. They were asked to look for overlap and to come to some agreement as a larger group on how the analogies might be categorised. The researcher then collected the categorisations achieved by the student coders.

At this point, the categories of analogy that were created by the student coders were overlapped with those categories created by the researcher. To ensure reliability, each analogy was assigned to a category only where the student coding and researcher coding agreed. One of the five groups of students did not manage to complete the coding task. This group had been looking for analogies to fall into the categories of information regarded as process and information regarded as thing. They were unsuccessful in this task. There was some similarity in the coding of categories of analogy by the other four groups of students, however. Assignment of an analogy to a category was considered reliable where three out of the five coding parties (four students and one researcher) agreed.

Results

Initial coding by the researcher identified three categories of analogy. These appear in Table I. The category labels are at the top of each column and under each of these labels the analogies obtained from the academics in the sample are listed.

The researcher could not find any common theme appearing in the seven analogies for the Internet that remained uncoded. These analogies included views of the Internet being like a

Table I Categories of analogy for the Internet

Web/grid/road system: analogies that stressed connectivity and structure	**Information store/library: analogies that stressed information aspects of Internet**	**Brain/large organism: analogies that assign the characteristics of a living organism to the Internet**
Subject 6: I see the Internet as a grid where the intersections of the lines in the grid are the nodes	*Subject 1*: I see it as a Web of information – as a means to information	*Subject 5*: I use Internet as a way of augmenting my human brain
Subject 11: A large marble with a lot of different coloured threads in it and what you have to do is try and pick up on a thread of one colour and try to trace it through	*Subject 2*: I regard Internet as a source of information. Just like a databank	*Subject 7*: It is like a large organism in that it is self sustaining. Chop off bits of it and they will continue
Subject 19: It is like the freeway system in California	*Subject 3*: I see it as analogous to a library…	*Subject 8*: Like seeking information from a living encyclopedia. It is alive and constantly changing
Subject 22: I see it as a connection of roads and towns where the computers are like towns and villages	*Subject 4*: I see Internet as a library – as a store of books that I can draw on	*Subject 13*: It is like the human nervous system without a brain because there is no centre, it is just all of the nerve endings connecting with one another
Subject 23: The notion of highways and of connecting sites that are distant in terms of geography	*Subject 9*: Its like access to this huge library that has all different things in it but it is not just restricted to one particular university or one city library	*Subject 31*: Like a very large brain that has a lot of inputs from many different people
Subject 26: The Internet is a road system that you are unfamiliar with and you don't have a map for. I guess it is a road system that changes	*Subject 10*: Like an extremely large and poorly catalogued library	
Subject 29: I see Internet as like a net or web – a series of node points	*Subject 14*: It gives you the feeling of being in a much bigger environment – a much bigger university where you can contact lots of different people with lots of different interests and get expert answers to questions very simply and easily	
Subject 36: It is like a cobweb	*Subject 15*: It is like academic conversation	
	Subject 18: It is like a time consuming puzzle. It is positive and daunting at the same time. It opens up a world of information to me, however, it appears at times to make my task a lot harder	
	Subject 20: My vision is that of a library. I am looking at the area where all the journals are	
	Subject 21: It is like a world catalogue	
	Subject 27: It is like a fairly enormous library	
	Subject 28: It is like a big library where you can find information	
	Subject 30: It is a library without a librarian. Its the biggest CD-ROM driver in the world	
	Subject 31: It is a bit like Pandora's box. A kaleidescope of unexpected, interesting, encyclopedic amounts of information	
	Subject 33: It is analogous to a huge library which has lots and lots of information	
	Subject 37: It is a big store or something where information is gathered and organised	

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fruit shop; a sort of infinite depth of bubbles; short wave radio; learning to drive a car; or another form of Windows.

The researcher's coding of analogies for the Internet was then confirmed by interjudge reliability testing using a group of student coders as described above. At the point when the student categories of analogy were collected, two themes dominated:

(1) Networks/interconnected/connectivity: analogies that stressed connectivity.
(2) Organised/information base/library: analogies that stressed information store.

The student categories were then compared with the three categories of analogy derived by the researcher. The student coders had not achieved a category for analogies that ascribed the characteristics of living organisms to the Internet. The analogies that were assigned to the category that the student coders called networks/interconnected/connectivity were compared with the analogies grouped under the heading Web/grid/road system by the researcher. The analogies that the student coders called organised/information base/library were compared with the analogies in the category that the researcher called information store/library. The interjudge reliability data are presented in Table II.

Assignment of an analogy to a category was considered reliable where three out of the five coding parties (four students and one researcher) agreed. In this way, interjudge reliability testing resolved two categories of analogy. The category of analogy for the Internet as a brain or large organism was left out. The remaining two categories were assigned the labels given to them by the student coders. There is 100 percent overlap between the researcher category of Web/grid/road system and the student category called networks/interconnected/connectivity. Two of the analogies assigned to the category information store/library did not survive interjudge reliability testing. The analogy for subject 15 and subject 18, therefore, does not appear in the category organised/information base/library. The categorisation of analogies for Internet that resulted from interjudge reliability testing appears in Table III.

The data in Table II indicate that there were two broad categories of analogy for the Internet that were obtained from the academics in the sample. It must be noted that interjudge reliability testing meant that only 23 of the 37 analogies for Internet were assigned to a category. In other words, there was no agreement among the five coding parties for 14 of the 37 analogies for Internet provided by academics in the sample. I will come back to this issue in a moment but, to answer the broad question appearing in the introduction to this article, there do appear to be categories of end-user analogy for the

Table III Analogies for Internet assigned to categories

Analogy	Subject
Networks/interconnected/connectivity	6, 11, 19, 22, 23, 26, 29, 36
Organised/information base/library	1, 2, 3, 4, 9, 10, 14, 20, 21, 27, 28, 30, 32, 33, 37

Table II Interjudge reliability coding of analogies for Internet

	Student 1	Student 2	Student 3	Student 4	Researcher
Analogies allocated to networks/ interconnected/connectivity by student coders	1, 5, 6, 11, 12, 13, 19, 22, 23, 26, 29, 31, 36	1, 6, 11, 12, 13, 17, 19, 22, 23, 26	16, 19, 22, 23, 28, 29, 35, 36, 37	2, 6, 36, 35, 31, 29, 11, 22 23, 26, 17, 19	6, 11, 9, 22, 23, 26, 29, 36
Analogies allocated to Web/grid/ road system by the researcher					
Analogies allocated to organised/ information base/library by student coders	2, 3, 4, 5, 8, 9, 14, 20, 21, 30, 32, 33, 37	2, 3, 4, 5, 9, 10, 16, 14, 20, 21, 25, 27, 28, 30, 33, 37	1, 2, 3, 4, 8, 10, 20, 21, 27	1, 2, 3, 4, 5, 9, 10, 16, 20, 21, 23, 27, 28, 30, 32, 33, 37	1, 2, 3, 4, 9, 10, 14, 15, 18, 20, 21, 27, 28, 30, 32, 33, 37
Analogies allocated to information store/library by the researcher					

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Internet. In fact, the data from this research study reveal two broad categories of analogy for the Internet. On the one hand, analogies that emphasis the information aspects of the Internet and, on the other hand, those analogies which emphasis connectivity and structure. Analogies that emphasise information aspects of the Internet were the more common.

Discussion

It should be noted that these results may have been affected by a bias in the data collection schedule predisposing academics towards reporting the Internet as analogous to an information store or library. Academics in the sample were, after all, asked to focus on their use of the Internet in a context of information seeking. The interview schedule required the retelling of two incidents of information seeking on the Internet. It is possible, therefore, that when asked to express their analogy for the Internet, the image of information store or accessing information, sprang most immediately to mind. Such a bias in the data is acknowledged.

With this reservation stated, however, the data nonetheless reveal two common ways of conceptualising the Internet among the academics in the sample. For one conceptualisation there is an emphasis on information, information store and access to information. The other conceptualisation emphasises connectivity, structure and networking. Both provide some acknowledgment of the Internet as an information environment. The latter is basically a structural perception, implying that connectivity between information users and information resources is the primary objective. At the point of connection, it appears, the Internet has achieved what it is supposed to. It could be assumed that users who conceptualise the Internet in this way will be satisfied with the Internet as long as connectivity occurs. This was apparent in the explanations for this type of analogy that were provided by some of the academics in the sample. For example:

- Subject 6. I see the nodes as being geographically based. I can well understand that most people would not. I definitely see it as something located on something like a geographical map. If I am communicating with the UK I see the node as being located on the other side of the world on a globe or a map or something. A map of the world cut by grid lines.
- *Subject 22*. I see it as a connection of roads and towns where the computers are like towns and villages.
- *Subject 29*. If I am a node point on the web, I am connected to every other node point in the world. I have to zig zag through a series of node points in order to get to the far side of the net but I know I can get there because it is connected in that fashion. No matter where I am placed on the net, I am a node. I do not care. It does not matter where I am at; as long as I am familiar with the node points where I want to go I know I will get there.

Conceptualisation of the Internet as an information store is more complex. It suggests that users expect the Internet to provide something in addition to connectivity. Indeed, it is interesting to note that this view of the Internet in fact draws attention to flaws or weakness in the network when it is used for searching out information. For example, some academics in the sample made comments such as:

- *Subject 3*. I see it as analogous to a library but a very badly catalogued library which has grown enormously in the last few months and librarians are almost totally overwhelmed by the mass of information that has poured in in all sorts of shapes and forms and are not keeping up at all.
- *Subject 10*. Like an extremely large and poorly catalogued library.
- *Subject 27*. It is like a fairly enormous library but with a fairly poor index system with one major index but which does not find everything when you've got to go to subindexes to find things. Sometimes you just have to go to a section and start searching. So a poorly indexed library.
- *Subject 28*. It is like going into a library and there is no catalogue or index.

These data suggest that a conceptualisation of the Internet that emphasises connectivity would more logically arouse higher levels of satisfaction with the Internet than a conceptualisation of the Internet as an information store or library. After all, connectivity is a more likely outcome of Internet use than is information access

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(Dillon, 1993). Further analysis of the data, therefore, focused on this issue.

As previously noted, when the analogies for the Internet were subjected to interjudge reliability testing, 14 of the analogies provided by academics in the sample were not allocated to a group. Because of this, the initial categorisation achieved by the researcher, which incorporated more of the sample, was examined and then this was followed by an analysis of the categorisation that was achieved by interjudge reliability testing.

The first stage of analysis, therefore, used the data which appear in Tables IV, V and VI. The categories of analogy are Web/grid/road system; information store/library; brain/large organism. The data in the tables indicate the level of satisfaction that the academics in the sample assigned to each category had with information seeking on the Internet for Incident 1. Incident 1 level of satisfaction is presented as a category rating (1 Not satisfied to 6 Satisfied) and as a magnitude estimate. The magnitude data relate to the numeric estimate provided to describe the level of satisfaction derived from the first information searching incident described by each subject. The numeric estimates are expressed as logarithms.

The data in Tables IV, V and VI were first analysed by comparing the geomeans which represent the measure of central tendency for the magnitude estimates of satisfaction in each category of analogy. These data indicate a difference in satisfaction with information seeking between the three categories. The geomean for satisfaction with information seeking for academics who conceptualise the Internet in terms of connectivity and structure is 4.4463 (see Table IV). For academics who conceptualise the Internet as an information store or library, the geomean for satisfaction with information seeking is 15.8489 (see Table V).

Table IV Analogy for Internet (Web/grid/road system)

Subject	Satisfaction with information seeking (CR)	Satisfaction with information seeking (ME)	
6	2	1.5441	
11	2	0.1761	
19	2	0.4771	
22	4	0.9031	
23	3	0.6021	
26	3	–0.4771	
29	5	0.6990	
36	5	0.9031	
			n = 8
	3.5560	0.6480	Mean
	1.5090	0.5680	StDev
		4.4463	Geomean

Table V Analogy for Internet (information store/library)

Subject	Satisfaction with information seeking (CR)	Satisfaction with information seeking (ME)	
1	2	1.3010	
2	6	1.3010	
3	2	0.3010	
4	1	0.3010	
9	5	1.9542	
10	3	0.4771	
14	6	1.9542	
15	5	1.9031	
18	3	1.0000	
20	6	1.0000	
21	5	0.9542	
27	6	2.0000	
28	6	0.9777	
30	5	1.9542	
32	3	1.6990	
33	3	0.6990	
37	6	1.0000	
			n = 17
	4.2940	1.2220	Mean
	1.7240	0.5980	StDev
		15.8489	Geomean

Table VI Analogy for Internet (brain/large organism)

Subject	Satisfaction with information seeking (CR)	Satisfaction with information seeking (ME)	
5	4	0.7782	
7	4	–0.2218	
8	5	0.8451	
13	4	0.8451	
31	5	1.1761	
			n = 8
	4.4000	0.6850	Mean
	0.5480	0.5300	StDev
		4.8417	Geomean

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Where the analogy for the Internet stresses the characteristics of a living organism, the geomean for satisfaction with information seeking on the Internet is 4.8417 (see Table VI).

On their own, these data do not indicate if the difference in satisfaction between categories of analogy is significant, however. The difference in the distribution of the magnitude estimates$_{log}$ for satisfaction with information seeking across the three categories was, therefore, analysed using an F-test for one way analysis of variance (see Figure 1).

As the data in Figure 1 indicate, the F_{obt} was 3.60. This gave a P-value of 0.041. Because the alpha was set at 0.05, the null hypothesis appearing in Figure 1 was rejected. In other words, the difference in satisfaction with information seeking between the three categories of analogy for Internet (Web/grid/road system; information store/library; brain/large organism) is statistically significant.

This analysis was followed up using the categories of analogy that resulted from inter-judge reliability testing. As previously stated, the student coders found two broad categories of analogy. These categories overlapped with two of the three categories that emerged from coding by the researcher. The category called Web/grid/road system identified by the researcher, stressed connectivity and structure in the analogy for the Internet. So too, did the category which student coders called networks/interconnectedness/connectivity. An overlap also occurred between the category for analogies that stressed information. The researcher called this category information store/library. The student coders, on the other hand, called this set of analogies organised/information base/library. The key to reliability testing was that each analogy was assigned to a category only where three or more of the five coding parties agreed. The data that appear in Tables VI and VII include only those subjects where this was the case. All the analogies categorised by the researcher as Web/grid/road system appear in the category networks/interconnected/connectivity. Subject 15 and subject 18, who were assigned to the researcher's category of information store/library, were not included in the category organised/information base/library following reliability testing. As previously stated, the student coders did not develop a category for analogies that may ascribe characteristics of a living organism to the Internet. The data that appear in Table V were, therefore, not included in this second phase of analysis.

The data for this second stage of analysis appear in Tables VII and VIII. Once again, the data in these tables indicate the level of satisfaction that those academics assigned to each

Figure 1 Hypothesis testing (F-test)

H_0: Satisfaction with information seeking on the Internet is the same regardless of analogy for the Internet

H_0: $\mu_1 = \mu_2 = \mu_3$

Analysis of variance

SOURCE	DF	SS	MS	F	P
FACTOR	2	2.424	1.212	3.60	0.041
ERROR	28	9.425	0.337		
TOTAL	30	11.849			

Individual 95 percent CI for mean based on the pooled standard deviation

	N	MEAN	STDEV	-------+---------+---------+------
WebME	9	0.6475	0.5678	(---------*---------)
InfME	17	1.2222	0.5980	(-------*-----)
BrainME	5	0.6845	0.5300	(-----------*-----------)
				-------+-------+-------+-------
POOLED STDEV = 0.5802				0.40 0.80 1.20

Table VII Analogy for Internet (networks/interconnected/connectivity)

Subject	Satisfaction with information seeking (CR)	Satisfaction with information seeking (ME)	
6	2	1.5441	
11	2	0.1761	
19	2	0.4771	
22	4	0.9031	
23	3	0.6021	
26	3	–0.4771	
29	5	0.6990	
36	5	0.9031	
			n = 8
	3.5560	0.6480	Mean
	1.5090	0.5680	StDev
		4.4463	Geomean

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Table VIII Analogy for Internet (organised/information base/library)

Subject	Satisfaction with information seeking (CR)	Satisfaction with information seeking (ME)	
1	2	1.3010	
2	6	1.3010	
3	2	0.3010	
4	1	0.3010	
9	5	1.9542	
10	3	0.4771	
14	6	1.9542	
20	6	1.0000	
21	5	0.9542	
27	6	2.0000	
28	6	0.9777	
30	5	1.9542	
32	3	1.6990	
33	3	0.6990	
37	6	1.0000	
			n = 15
	4.3330	1.1720	Mean
	1.7990	0.6100	StDev
		14.8594	Geomean

Figure 2 Hypothesis testing (T-test)

H_0: Satisfaction with information seeking on the Internet is the same regardless of analogy for the Internet

H_0: $\mu_1 = \mu_2$

T = –2.17
DF = 14
P = 0.048
95 percent CI for $\mu_1 - \mu_2$ = –1.13, –0.01

category had with information seeking on the Internet for Incident 1. Level of satisfaction is presented as a category rating (1 Not satisfied to 6 Satisfied) and as a magnitude estimate. The magnitude data is the numeric $\text{estimate}_{\log}$ for level of satisfaction that was provided by each subject for Incident 1.

The data in Tables VII and VIII indicate a difference in satisfaction with information seeking between academics who stressed connectivity and structure in their analogy for the Internet (geomean = 4.4463; see Table VI) and academics who stressed information access (geomean = 14.8594; see Table VII).

The significance of the difference between the geomeans was tested by comparing the distribution of the magnitude $\text{estimates}_{\log}$ of satisfaction with information seeking across the two groups. In this case, because two distributions were compared, a two sample T-test was used (see Figure 2).

The T_{obt} from this test was – 2.17 and the P-value was 0.048. The P-value was less than the alpha of 0.05 so the null hypothesis that appears in Figure 2 was rejected. Once again, this means that the difference in satisfaction with information seeking between the two categories of analogy for the Internet that arose from interjudge reliability testing (see Tables VII and VIII), was found to be statistically significant.

Both stages of data analysis, therefore, find a statistically significant association between analogy for the Internet and satisfaction with information seeking on the Internet. As discussed earlier, this analysis promotes initial speculation that the relationship would logically be characterised by higher levels of satisfaction on the part of academics who conceptualise the Internet in terms of connectivity or connectedness. Surprisingly, the data analysis indicates the opposite to be the case. Academics who conceptualise the Internet as an information store or library have higher levels of satisfaction than academics who conceptualise the Internet as a structure of connectivity and interconnectedness.

This does not tell us anything about the strength of this association. The correlation between analogy for the Internet and satisfaction with information seeking was, therefore, calculated. The two categories for analogy achieved by interjudge reliability testing were used (see Table IX).

Although analogy is represented by nominal data, the variable in this case is dichotomous. This means that the choice of an appropriate coefficient can be made on the basis that magnitude estimates of satisfaction with information seeking are regarded as interval data (Lodge, 1981). The appropriate correlation coefficient for interval data is Pearson's (see Figure 3).

The coefficient is moderate in strength. These data indicate that, where an academic conceptualises the Internet as an information store or library, there is a modest likelihood that satisfaction with information seeking will be higher than for an academic who conceptualises Internet in terms of connectivity.

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Table IX Analogies for Internet related to satisfaction with information seeking

Subject	Analogy; 1 = networks/ interconnected/connectivity 2 = organised/information base/library	Satisfaction with information seeking (ME)
6	1	1.5441
11	1	0.1761
19	1	0.4771
22	1	0.9031
23	1	0.6021
26	1	–0.4771
29	1	0.6990
36	1	0.9031
1	2	1.3010
2	2	1.3010
3	2	0.3010
4	2	0.3010
9	2	1.9542
10	2	0.4771
14	2	1.9542
20	2	1.0000
21	2	0.9542
27	2	2.0000
28	2	0.9777
30	2	1.9542
32	2	1.6990
33	2	0.6990
37	2	1.0000

Figure 3 Satisfaction correlated with analogy for Internet – Pearson's r

Correlation coefficient for analogy for Internet and satisfaction with information seeking on the Internet

Pearson's r = 0.44

Conclusions and recommendations

Apart from reporting some interesting data, this study highlights a number of factors, which are important, as we develop our understanding of the phenomena of Internet use. The first of these is the apparent influence that the rhetoric used for characterising the Internet is having as part of the collective experience of the media consumer and Internet user. The second factor that emerges is the influence that an accommodation of a specific mental representation for the Internet might have on the satisfaction that a person will derive from using the network. And the third factor to emerge from the data reported here, is the way context or type of use can influence the way a person thinks about or mentally constructs models of the system or service her/she uses. The recommendations for further research and development emerge from all three factors.

First, it is easy to see the connection between the analogies for the Internet that the academics in this study reported and the media hype or rhetoric used to promote and characterise the network. We can see the influence of this collective experience in the characterisations of information superhighway, information infrastructure, web and so on that are repeated in the data from the study. The phenomenon of the Internet is, in fact, a rather unique expression of how the wild metaphors used by the media to explain unfamiliar or emerging entities can be accommodated by the public and ultimately influence what people expect, how they identify with, use, learn about and derive satisfaction from, new technologies.

This, of course, leads us to ask – why are satisfaction and mental representation for the Internet related? And second, why would a particular type of mental representation relate to higher levels of satisfaction than another? Our earlier discussion indicated that theory building in information science has promoted the view that people need to create a mental representation of a system or service in order to effectively utilise it. This mental representation is a reflection of past experiences, knowledge structures, belief systems, expectations and so on. In other words, the person who is using a system or service like the Internet is seeking some context for identifying this perhaps-unfamiliar entity with something that is more commonplace or more easily assimilated with, existing cognitive structures. When it comes to the activity of information seeking, it seems that the most commonplace context, at least in the minds of the academics in this study, is a library. Where the academics in the study found this familiar context as a means for expressing their way of thinking about the Internet, they were more relaxed with the practice of information seeking and therefore reported higher levels of satisfaction. The academics who reported the Internet as analogous to a web or grid or network on the other hand, drew up a mental

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image that is less consistent with the activity that they were engaged in. Do we normally use webs or grids or road systems to find information? This could explain the fact that the academics who reported this form of analogy for the Internet also reported lower levels of satisfaction with their information seeking on the Internet.

What does this suggest for the designer and developer of information services for the Internet? In this age of digital information environments, users are looking for reality anchors based on non-digital models. When they search for information, they want to "feel" like they are engaged in the familiar "down to Earth" practice of visiting a library, looking for references in an index, selecting a resource from a shelf, evaluating the service that is provided, communicating with a human intermediary or librarian, browsing shelves and so on. There is a tension between the virtual and the real and at a point in time, people need to re-establish a connection to the tangible when selecting and evaluating information that they access through the Internet. Witness the common practice of printing off documents at the point of selection so that these documents can be perused to determine relevance or usefulness. Witness also the popularity of ask a "…" services on the Internet where users have access to an expert. They can ask a question of a person. They have some control over individualising their information need in the way they would if they entered a library and asked a reference librarian.

Designers and developers should consider how they represent their services to the user. Perhaps an information service should look like a library. When the user comes to the web page it should look like he or she has approached an information or reference desk in a library. When he or she makes an enquiry or does a search, it should have the feel of interrogating an online public access catalogue. If the user has difficulties, he or she should be able to turn to a reference librarian. When the user has selected the resources he or she should be able to browse a simulation of books on a shelf for materials related to the topic in the way he or she might in a library. Digitising information has distanced us from the physical or tangible anchors that we use for common information behaviours like choosing, browsing, searching, selecting, determining relevance and using. We are in transition. Most of us remember when we had to use a pencil and paper to think. We are now thinking directly onto computer keyboards and no longer need the tangible anchors. Eventually this will be true for the use of digital information. In the meantime, the data from this research suggest that developers and designer need to simulate the metaphors that assist information seekers are using to help make this transition.

Of course, context or type of use is a powerful factor affecting how a person thinks about services and systems. The data from this study also reveal that an academic's conceptualisation of the Internet is related to the context in which he or she is using the Internet. There is, in fact, a source of bias in the data collected for this study. The bias arises from the interview schedule where each academic in the sample was asked to describe in detail two incidents of information seeking on the Internet. It is possible that this may have influenced academics in the sample to report the Internet as analogous to an information store or library. It makes sense, therefore, to recommend that further research should determine whether particular categories of analogy for the Internet appear for different use contexts. For example, when the Internet is used to communicate with colleagues, when it is used for publishing, when it is used for teaching or disseminating information, when it is used for recreation and so on. Does a person think differently about the Internet in these different contexts and will this influence how satisfied he or she is when using the Internet in this way?

The Internet is so much more than an information environment. It is a social technology, an advanced communication medium, a new publishing paradigm, a recreational and commercial entity. It is gradually being translated into a public utility with the potential to transform everyday information and communication behaviour. The research agenda is replete. There are many questions still to answer, but the methods used, and the data collected by the study described here, provide us with at least some exploratory insight into what people think when they search the Internet for information.

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