USERS' METAPHORIC INTERACTION WITH THE INTERNET

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A thesis submitted for the degree of Doctor of Philosophy
University of Bath
Department of Psychology
March 2008

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ACKNOWLEDGMENTS

Whilst a Ph.D. is undoubtedly an independent and personal journey, I could never have completed this work without the support of the following people. I appreciate the supervision of Professor Helen Haste and Dr. Jeff Gavin. I am grateful for the input of Professor Steven Brown and other members of ISSSS who provided clarification on all matters concerning Q Methodology. Thanks also to Professor William Gosling for his insightful comments on issues relating to Wittgenstein and definitions. I am very grateful to the psychology staff at the University of Bath and to my research participants, both of which kindly gave their time to make this research possible. Heartfelt thanks are extended to my fellow postgraduate friends for keeping me sane during the Ph.D. crusade. I also thank my family for their support and understanding, with special thanks to my mum Laura for the pep talks when they were most required. Finally, I am forever indebted to my husband Rick for his love, endless patience and encouragement. This project would never have been completed without him.

To

Rick, Beegee, Gizmo,

Shrimp, T-Rex and Arriba

ABSTRACT

Metaphors are a necessary component in users' perception, interpretation and interaction with the Internet. Users make sense of the Internet by describing the unfamiliar in terms of the familiar, and in doing so, the technology becomes understandable. A significant amount of research examines designers' metaphors of the Internet via their implementation into user interfaces. However, there is a paucity of research on how *users* metaphorically understand the Internet. This thesis sought to examine the textual and visual metaphors employed by Internet users in order to make the technology more understandable. It also explored whether different groups of Internet users employ different kinds of Internet metaphors. To address these goals, Q Methodology was used in conjunction with questionnaire data: the Q sorts generated metaphoric conceptions and the questionnaire data indicated the demographic variables to be examined in relation to metaphor use. The data from 244 participants show that users employ a diverse array of conceptual representations of the Internet. Third-order factor analysis indicated that two types of metaphors dominate users' conceptions of the Internet. The first metaphor is concerned with dynamic, chaotic interlinking; the second depicts the Internet in terms of centralised, ordered and structured connections. A second bipolar metaphoric dimension is embedded in the factors: one view emphasises the structural components of the Internet, the other is focuses on the *process* of accessing the information. These two dominant bi-dimensional metaphors emerge in both visual and textual format. Furthermore, a relationship exists between users' perceived level of Internet skill and their use of metaphors; expert users prefer to employ the centralised/ordered metaphor of the Internet, whereas users with intermediate skills prefer to invoke a chaotic metaphoric representation of the Internet. This research is one step towards identifying how users' metaphors mediate Internet use and understanding. Improved understanding of users' metaphorical interaction with the Internet has many practical applications. Understanding the metaphors that shape many different users' perceptions of the Internet will facilitate the creation of technologies that are accessible to a wide range of people with a wide range of characteristics and skills.

Structure of The Thesis

Chapter 1: Introduction to the Research

This first chapter gives a four page overview of the research. It outlines why it is important to study users' metaphors for the Internet, both in textual and visual form. It introduces the notion that different groups of users can invoke different metaphors and that this warrants examination. Q Methodology is briefly introduced as a method for studying users' subjective conceptualisations. The second section of this chapter provides a brief history of the Internet at around the time of data collection (2003/2004). This serves to contextualise the research in the appropriate technological timeframe, thus elucidating the core research questions.

Chapter 2: Usability, Models and Metaphors

This chapter introduces the core endeavour in human-computer interaction: usability. Many approaches have been adopted in Human-Computer Interaction (HCI) to measure usability: this chapter focuses on the most salient approach to the current research – conceptual models. A definition of conceptual models is followed by the argument that these models are usually metaphorically based. The next section proceeds to define metaphor and outline its importance for conceptualisation, comprehension and communication. The chapter concludes by examining the function of metaphor in HCI.

Chapter 3: Common Internet Metaphors and their Origins

This chapter exemplifies some of the most common Internet metaphors and their origins. Based on an extension of the framework proposed by Norman (1988), the chapter examines popular cultural metaphors, designer-led metaphors as implemented into the interface and general system metaphors of the Internet.

Chapter 4: Cultural and Interface Metaphors

This chapter evaluates studies that have examined cultural metaphors of the Internet. Next, the user-centred design literature on interface metaphors is critically reviewed, culminating in a discussion of the numerous critiques aimed at the use of interface metaphors. Next, the chapter discusses how designers' metaphors as implemented in the user interface may not necessarily be synonymous with users' metaphors. Lastly, the chapter critiques the user-centred design literature for its technological focus, and calls for the need to examine users' metaphors of the Internet.

Chapter 5: Users and their Internet Metaphors

This chapter reviews literature which examines users' metaphoric perceptions of the Internet, highlighting how metaphors are utilised by different groups of users. Next, it discusses some of the salient demographic characteristics of Internet users and their core uses during the time period contemporaneous to the current research (2001-2004). By including material on current 2008-2009 demographics, the chapter reflects on how user characteristics have changed since the data collection.

Chapter 6: Methodological and Epistemological Issues

This chapter discusses why Q Methodology was employed in the current study. It introduces some of the common methods used in usability testing, usability inspection and usability inquiry. It justifies the use of Q Methodology as a participatory design technique that examines users' subjective understandings of a given topic. It addresses combining Q Methodology with questionnaire data in order to examine the relationship between types of metaphors and specific groups of Internet users.

Chapter 7: Research Goals and Rationale

This chapter provides the rationale for the two core research questions for this thesis. What are the metaphors employed by users to conceptualise the Internet? Within this, what are the types of textual and visual metaphors being utilised by users? Do the same kinds of metaphors arise in different modes of presentation? The second core research question asks if there is any variation in the kinds of metaphors being employed by different groups of Internet users.

Chapter 8: Q Sort: Methodology

This chapter outlines the basic procedural details involved in conducting a Q study both offline and online. The issue of augmenting Q Methodology data with R Methodological data is addressed.

Chapter 9: Q Study Preparation: Pilot Studies

The purpose of this chapter is to outline the preparation work needed for the research. It highlights how each of these exploratory studies played a pivotal role in the design and development of the main study. The first pilot study provided the concourse for the current research. The second pilot study refined the concourse. There were three vital developments that emerged from the third pilot study; the finalisation of the Q sample, the development of the research website and online Q sorting interface, and testing and modifying the accompanying Characteristic Profile Questionnaire (CPQ).

Chapter 10: Method and Procedure

This chapter describes the method used to collect data for the study. It outlines how participants were recruited and the exact procedural details they followed to complete two tasks: 1) a Q sort using either images or textual descriptions of the Internet and 2) a 22 multi-item Characteristics Profile Questionnaire (CPQ) incorporating closed- and open-ended responses. The response rate for the study is examined, followed by a discussion of some technical decisions regarding Q factor analysis that will impact analysis and interpretation.

Chapter 11: Envisioning the Internet: Image Q Sort Results

The purpose of this chapter is to describe the results of the Image Q sort analyses. Firstly, the most salient Characteristics Profile Questionnaire (CPQ) characteristics are summarised for all the Image Q sorters. This is followed by the analysis and interpretation of the Image factors and accompanying CPQ data.

Chapter 12: Describing the Internet: Text Q Sort Results

This chapter describes the results of the Text Q sort analyses. The first section summarises the most relevant CPQ characteristics for the Text Q sorters. This is followed by the analysis and interpretation of the Text factors and accompanying CPQ data.

Chapter 13: Integrating the Internet: Dual Participants' Q Sort Results

This chapter outlines the analysis and interpretation of the data from the 'Dual' participants; those who completed both Image and Text Q sorts. A summary of the most relevant CPQ characteristics for the Dual Q sorters is followed by the analysis of the Image Q sort data, then the Text Q sort data. The next section examines the nature of the relationship between the Image and Text factors, and then *all* the emergent Image, Text and Dual factors.

Chapter 14: Discussion: Implications and Applications

The purpose of this final chapter is to discuss the main findings of the research. By doing so, this chapter highlights the contribution to both theory and application represented by this thesis. The chapter begins with a clear summary of the four most important findings that emerged from the research. Next, the findings are broken down by research question and examined in detail in relation to previous literature. The following section discusses the implications to metaphor theory and implications for HCI research, followed by applications for interface design. Lastly, suggestions for the scope of future research are examined.

DEFINITIONS

The interdisciplinary nature of this thesis means that an assortment of technical, methodological and philosophical concepts will be encountered. Some of these terms are relatively straight forward to define, whereas others require more considered discussion. Terminology is a problem in many fields of study. The same concept may have a continuum of meanings; each meaning dependent on a multitude of contexts. If knowledge is always context-dependent, there can never be an absolute definition provided for any concept. As Wittgenstein (1973) notes, "meaning just *is* use". In other words, the meaning of a word is its use in the language. If language is in a constant state of change, definitions are subject to unceasing evolution and cannot be pinned down.

In recognising the fact that definitions are always context-dependent, where possible, this thesis provides considered discussion on the various historical and contextual influences on a particular definition. Contemplating the sorts of approaches being used to construct concepts calls for broader understanding beyond the limits of absolute definitions. This concern is what keeps particular definitions from being naturalised and excluding other conceptualisations. However, it is also necessary to adopt a pragmatic approach. It is possible to provide a reasonable and adequate approximation for the multiplicity of definitions; that is, the most considered interpretation in given circumstances according to the best of our knowledge. During the thesis, one particular approach to a concept may be adopted. This is because useful insights may occur if it is known precisely what is being talked about. However, readers should note that this is a pragmatic convenience rather than a statement of an 'absolute truth'. In other words, in adopting one approach in order to facilitate understanding, it is simultaneously recognised that the particular definition chosen is relative, constructed and evolving.

Some definitions of terminology are discussed during the course of individual chapters. The approaches taken to other important concepts are outlined below; definitions of technical terms are provided in the *Glossary* in Appendix 15.

The Internet

In formal usage, Internet is traditionally written with a capital first letter. Several dominant Internet-related organisations use this convention in their publications (see W3C, ISOC). In other sources, the first letter can be written in lowercase (internet). In this instance, it refers to any interconnected local area networks. The Internet (with a capital i) is the specific name of the largest internet on Earth. Thus, referring to the Internet as a proper noun will be the convention followed in this thesis. Note that although the term 'Internet' is singular in form, it does not necessarily mean that the Internet is uniform entity. The Internet does not mean the same thing for everybody. In this circumstance, it might be more accurate to refer to 'Internets'. However, for the sake of clarity, I will follow the convention of using 'Internet' in singular, proper noun form, whilst simultaneously accentuating the fact that the Internet does not necessarily constitute one homogenous, universal entity.

Mental Images

As part of the Q sorting process, participants are asked to sort images or textual statements according to 'how like they are in relation to their own mental image of the Internet'. It is acknowledged that considerable controversy surrounds the nature of mental images and representations (see Pylyshyn, 2002; Kosslyn, 2006). Despite the complex and fractious debates amongst philosophers, psychologists, and cognitive scientists concerning the precise definition of mental imagery, it is not the aim of thesis to explicate this discussion further. The focus of this research is to examine how everyday Internet users understand and represent the Internet in their 'mind's eye'.

In order to carry out this research, a number of simplifying assumptions were made. Firstly, it was assumed that the Internet users under investigation have mental representations of the Internet. Mental imagery is a familiar aspect of most people's everyday experience (Brewer & Schommer-Aikins, 2006). The English language supplies quite a range of idiomatic ways of referring to visual mental imagery: ‘visualising,’ ‘seeing in the mind's eye,’ ‘having a picture in one's head,’ ‘picturing,’ ‘having/seeing a mental image/picture,’ and so forth. As the focus of the research is the Internet user (rather than academics or philosophers), it was necessary to employ terms that would be meaningful to the everyday person. Thus, the phrase ‘mental representation’ was employed to convey the idea of a visualisation in the mind’s eye; these representations may be in either visual or textual format. As is evident from the wealth of data gathered, this approach proved successful; such terms were familiar enough to be useful in eliciting responses that conveyed the complexity, vividness, and abstractness of one or more metaphoric representations.

CHAPTER 1. INTRODUCTION TO THE RESEARCH

"Is the Internet a place with a sense of location, or a tangible thing with a physical manifestation, an abstract topology, virtual city, parallel universe, a lattice, virtual universe or a global brain? Perhaps it is an Indra state of independent but associated mutual self-reflecting metaphysical pearls? A library, shopping mall of competing stores, an ever changing morphogenic field, a deity-like entity with infinite information or a simple but prolific seed-bearing flower?

The Internet is simultaneously all of the above and none of the above."

Figure 1.1. Ratzan (1998, p.14) on conceptualising the Internet

11 OVERVIEW

The Internet is having an irrevocable impact on our lives. As online directories replace the Yellow Pages, search engines augment traditional research and news sites supplant newsprint, we are in an age where we have come to rely tremendously on the Internet. The Internet is a complex, multi-faceted technology; our experience interacting with it is both nascent yet broadening every day with increasing dependency. Since its inception, the Internet has transformed at an astounding pace. From its genesis to the dotcom boom, from the dotcom bust to the 'social web', the Internet has evolved from a multimedia information repository to a dynamic infrastructure enabling interconnectivity and interactivity of web-delivered content. People use the Internet in ways that are increasingly more complicated than anything before.

Given the rapid evolution of the Internet, any attempt to measure and model the Internet will always be time sensitive. It has been said that an Internet year is like a dog year, changing approximately seven times faster than normal human time: "When we started in the early 70s, we were running the Internet at the speed of 50 KB per second. Thanks to the technological advances today we have a speed of 10 GB per second -- almost 1000 times better" (Cerf, 1999). Current technology enables transfer of data at speeds up to 40 GB per second (Microsoft Projects, 2009). The number of Internet users has more than doubled in the past five years alone, going from 700 million users in 2003 to 1.7 billion users in March, 2009[1] (see Figure 1.2).

[1] http://www.internetworldstats.com

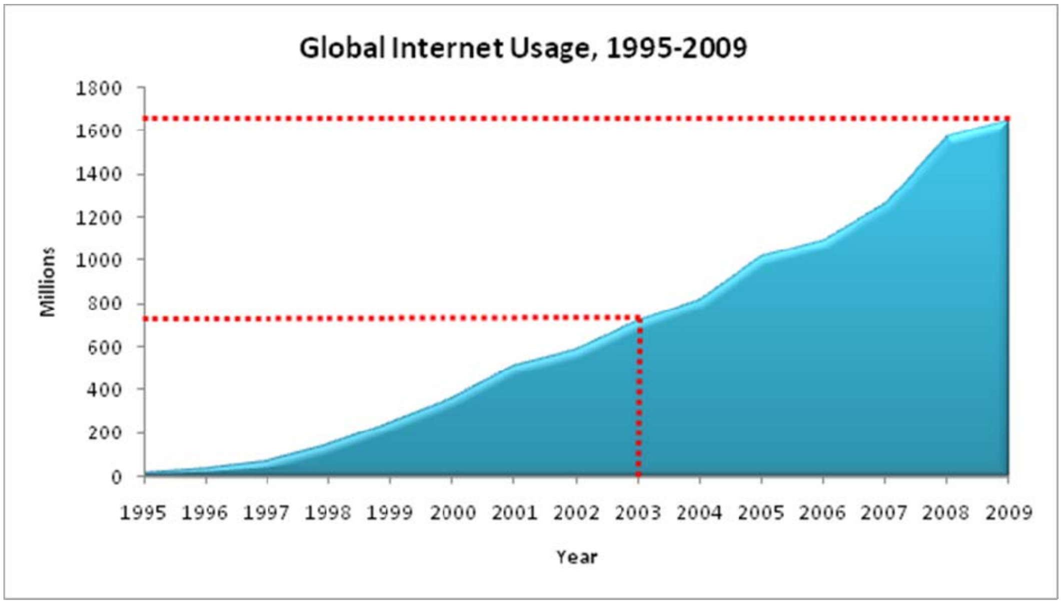

Figure 1.2. Global Internet usage from 1995 - 2009

The empirical material for this research was gathered online between December 2003 and March 2004. This thesis therefore provides a snapshot of the Internet and its users during this specific timeframe. This research examines users' understanding of the Internet as a technological system, via their use of metaphors. There are two complementary and intertwined components to addressing "understanding".

- How do people understand the Internet?
- How do people draw upon their understanding to use the Internet?

This thesis examines the first research question. It is a matter of exploring users' conceptual understanding about the Internet as a whole. The second research question is a matter of exploring the relationship between conceptual understanding and *use of* the Internet. This second component is not addressed in the current research. Both research questions are important for the study of users' interaction with the Internet. However, it is argued that it is first necessary to obtain an understanding of the kinds of metaphors being employed by users of the Internet before exploring the relationship with use of those metaphors, Research examining the relationship between metaphors and use of the Internet is beyond the scope of this research.

This thesis seeks to explore two core research questions. The first question asks what are the metaphors employed by users to conceptualise the Internet? Within this, what are the types of textual and visual metaphors being utilised by users? Do the same kinds of metaphors arise in different modes of presentation? The second core research question asks is there any variation in the kinds of metaphors being employed by different groups of Internet users?

Despite the permeation of the Internet into our lives, people have difficulties conceptualising and interacting with the Internet. The Internet is a relatively new and rapidly evolving technology. Many people, with varying abilities, all must understand how to use this complex technology to achieve results important to them. One of the common ways that people seek to intuitively understand computers, and new technology in general, is through metaphor. In particularly complex, ambiguous or novel situations, overtly metaphorical language is likely to be in evidence. It is important to understand the role that metaphors play in facilitating the communication between humans and the Internet.

Metaphors reflect users' understanding of the Internet and impact their interactions with it (Zhang, 2008). By conceptualising abstract, hard to imagine, and difficult to articulate Internet-based concepts and interactions in more concrete and familiar terms, the technology is made more usable. Since its inception, the Internet has been associated with a plethora of metaphors. Metaphors can be generated in popular culture (e.g. "information superhighway"), by designers who implement metaphors into the interface in order to make it useable (e.g. "desktop"), and by users of the Internet. There are an enormous number of metaphors potentially available, simply because metaphors can be developed from almost every noun in the language. It has been likened to a book, a web, a digital library, and an electronic market, to name just a few of the most oft-cited metaphors for the Internet.

The metaphors are not only a way of describing the Internet (e.g. information superhighway) or describing specific operations (e.g. cut and paste commands for deleting and copying objects). They are also a framework for explaining how the technology operates. Metaphors are pivotal for conceptualising the type of interaction with the technology and as part of the conceptual model instantiated at the interface.

Metaphors are routinely implemented into Internet interfaces. However, the process of designers implementing and evaluating interface metaphors offers just one perspective on the artefact; from the viewpoint of the designers and for the benefit of their practical concerns. Not only are the metaphors designer-led, but they are often applied on an ad hoc and idiosyncratic basis, without much validation whether users actually conceive the Internet in this way. Embedding a metaphorical model into an interface is not necessarily synonymous with what the user actually perceives whilst interacting with the technology. Indeed, users frequently and understand and utilise the technology in quite different ways from those that designers intended.

The ways in which users metaphorically concretise the Internet will vary widely. The Internet is a unique cultural technology (Swiss & Herman, 2000): it is the result of the negotiation between different interest groups who potentially understand and metaphorically represent the technology in a myriad of ways. Studies examining specific user groups indicate that users of varying demographic backgrounds will have a striking diversity of conceptual representations for the Internet. There is some evidence to suggest that perceived level of Internet expertise (self-efficacy) and gender have an impact upon metaphorical understandings of the Internet (Ratzan, 2000; Palmquist, 2001).

Users may use a combination of both images and text to conceptualise and interact with the Internet. However, most research is verbocentric, in that it relies on methodological techniques which are textually based. By focussing on language-based metaphors, many previous studies have limited participants' responses; in other words, participants can give us only what we give them the opportunity to provide. This research enables participants to present their mental representation in a visual format. This is beneficial for two reasons. Firstly, not all metaphors are linguistic or can be iterated in linguistic form. Secondly, due to the hypertextuality of the Internet, it is a space that is hard to comprehend. A powerful way to understand and conceptualise the Internet is to visualise it through graphical representation. Moreover, these visualisations convey meaning. In this way, participants are able to represent their idea of the Internet that otherwise might be hard to describe.

To explore these questions, a methodology is needed that will systematically examines users' *subjective* metaphors, enable users to provide their metaphoric representation of the Internet in either *textual* or *graphical* format and enable analysis of subjective perceptions in terms of *individual variations.* It is difficult to systematically measure user conceptualisations due their highly subjective nature (Nicolajsen, et al., 2007). Since understanding users' conceptual models is a subjective and 'open-ended' matter (Drogseth, 2005), then a methodology that systematically examines subjective issues is necessary.

Q Methodology is a research method used to examine how people subjectively think about a topic. Participants are asked to rank sort a sample of items (typically statements) into a subjectively meaningful pattern – this forms the 'Q sort'. For example, in a study about people's attitudes towards the Internet, a participant might be given statements such as 'The Internet is dehumanising" and "The Internet makes me work more efficiently", and asked to sort them from "most like my view of the Internet" to "least like my view of the Internet". The resultant Q sorts are factor analysed in order to reduce the many individual viewpoints down to a few "factors". The emergent factors represent shared ways of thinking about the topic.

Q Methodology enables users to configure both textual and visual metaphors of the Internet. It can also be triangulated with traditional questionnaire data, which will provide information on the relevant intrinsic and extrinsic variables. By comparing the subjective data from the Q sorts with demographic data from questionnaires, this research develops an innovative approach to investigating the relationship between metaphor use and groups of users. Additionally, this approach combines the strengths of both qualitative and quantitative research traditions and can be considered to be a good launching pad for exploratory research.

The Internet has evolved since 2004, and it is feasible to assume that Internet metaphors of users have similarly transformed. Where possible, the thesis

contextualises the research, both in the contemporary 2003/2004 timeframe when the data was collected, and in relation to current research and findings.
To assist in identifying which approaches, studies and results are considered historical context, contemporary to the current research or subsequent recent research, the thesis adopts the following nomenclature (Table 1.1):

2000 and before	*Early*	Popularisation and commercialisation of the Internet begins with the advent of the WWW. Studies of the Internet are in their infancy.
2001-2004	*Contemporary*	Studies are contemporary to data collection for this research.
2005 and after	*Recent*	Studies completed subsequent to current research. Focussing on Web 2.0 technologies, such as social networking.

Table 1.1 Terminology to depict research periods in relation to current study

As the Internet continues its exponential growth, it is likely that the metaphors used to describe it will also grow in both scale and complexity. Metaphorical references vary over time, especially with changes in technology or cultural/aesthetic shifts, and users eventually may not understand or appreciate older metaphorical references. Indeed, although the Internet has evolved since the data collection, the findings still have practical implications and applications to today's researchers studying the Internet. Metaphors are integral to users' conceptualisations of technology. As the Internet continues to change to incorporate ubiquitous computing and the Semantic Web, it is imperative to continue to examine how users fundamentally understand the technology.

1.2 THE INTERNET

There have been many attempts to define the Internet (see Appendix 1.1). However, the diversity and rapid evolution of the Internet ensures that any attempts to pinpoint its characteristics are immediately challenged as new trends emerge. It is perhaps more useful to specify just what is interesting and significant about the Internet.

According to Lievrouw and Livingstone (2002), there are four key features of the Internet that demarcates its significance. Firstly, the Internet is *recombinant* in that it both shapes and is shaped by society. Secondly, the Internet is *ubiquitous* in the sense that it affects everyone in the societies in which it is employed. Thirdly, the Internet enables *interactivity*; users have the means to "generate, seek and share content selectively, and to interact with other individuals and groups, on a scale that was impractical with traditional mass media" (ibid., p. 9). Lastly, the 'network' has become accepted as the archetypal form of contemporary social and technical organisation. As Castells (2002, p. 1) notes, while networks are not inherently new to history, "they have taken on a new life in our time by becoming information networks, powered by the Internet".

Studying the Internet is challenging because of its continuous and rapid evolution. Just a few decades ago the Internet was a relatively obscure network of large computers used only by a small community of researchers. Today, the Internet is far from obscure, having become a global cultural phenomenon. The Internet began as a military research network, rapidly growing in scope to incorporate universities and research organisations. Early popularisation of the Internet began with the introduction of email in 1972, followed by Usenet and bulletin board services in the late 1970's. Public interest in the Internet only began to increase exponentially with the advent of the World Wide Web in the early 1990's. By 1996, the Internet was a household term, marking the dawn of the Internet age. Today, social networking sites that enable users to interactively create, communicate and publish content dominate the Internet (see Figure 1.3).

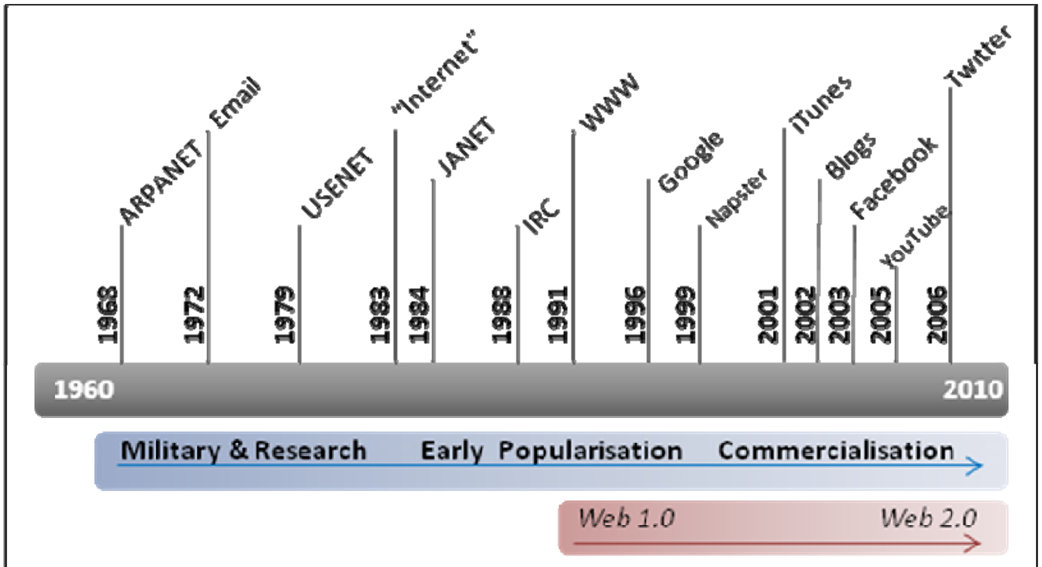

Figure 1.3. Internet timeline: Brief snapshot

Considering the historical development of the Internet is important for contextualising the current research[2]. Data collection for the current study was conducted in 2003. Taking a snapshot of the Internet and its users during this timeframe (and highlighting how the Internet has evolved since then), provides a clear explanation for the types of research questions that were addressed in this study.

1.2.1 The contemporary Internet: 2001-2004[3]

The year 2003 marked almost a quarter century since the birth of the Internet and ten years since the inception of the Web browser[4]. By 2003, the Internet had over seven hundred million active users[5] (see Figure 1.2). In 2003, 76% of Americans had used the Internet, and 65% had home access (USC, 2004). In the UK, 58% of UK adults had used the Internet by February 2004, with 49% of UK households having Internet access in December 2003 (Office for National Statistics, 2004). The vast majority of

[2] See Appendix 1.2 for more detailed history of the early developments of the Internet.
[3] As Table 1.1 describes, 'contemporary' reflects the 2001-2004 time period in which the study data was collected. This is in contrast to 'early' (pre-2000) and 'recent' (post-2005) studies.
[4] See Appendix 15 for Glossary of Technical Terms.
[5] http://www.internetworldstats.com

online users logged in from home using dial-up access (Madden, 2003; Meeker, Pitz, & Fitzgerald, 2004).

During this period, email was the ‘killer application’ of the Internet, followed by information seeking activities. With more than 40% of online users having been online for more than three years, the Internet had become a mainstream information tool. Google had just begun its meteoric rise to search engine domination. In January 2004, Google searches accounted for 39% of all searches, compared to the 64% of searches in December 2008 (Nielsen/NetRatings). The popularity and dependability of using the Internet as an information resource had raised users’ expectations about the information and services available online.

Digital information on the Internet had increased exponentially. It is estimated that one exabyte of data (one billion gigabytes) is the equivalent information to all the printed material in the world. In 2000, 12 exabytes of data were created, stored and transferred across the Internet (Enriquez, 2003), increasing to an estimated 17.3 exabytes in 2003 (Lyman & Varian, 2003). This information surfeit was accompanied by several challenges. Firstly, users were sceptical on the credibility of information available online (Flanagin & Metzger, 2000). Secondly, so much data could be overwhelming to some users who become confused as to the content and structure of the information available. Thus, users had to deal with the considerable uncertainty, complexity and difficulties involved in making sense of the many different technologies available, the lack of any clear choices, and the huge amount of knowledge that was needed even to approach them, let alone use them (Stewart, 2003). Furthermore, users were worried about privacy concerns resulting in a one-way flow of information, through websites which contained 'read-only' material (Hinchcliffe, 2006).

In 2003, keyword searches would provide a plethora of links to digitised print information on mainly static web pages. In 2006, the same search term would also drive traffic to online video sites, social encyclopaedias and social networking sites. As Figure 1.4 shows, the static display of information on a web page circa 2003 is dramatically different to the interactive, participatory web page circa 2009.

Figure 1.4. Comparison of TechCrunch website, circa 2003 and 2009

In just a few short years, this important shift marked the transition from the world of static display to consumer generated media and social networks. The advent of user-generated content meant users went from merely retrieving information to actively creating and publishing content. The evolution of the Internet since 2003 can be characterised as the difference between Web 1.0 and Web 2.0.

1.2.2 The current Internet: 2005 - 2009

At the end of 2006, Time magazine's Person of the Year was 'You'. On the cover of the magazine was a picture of a PC with a mirror in place of the screen, reflecting the general feeling that 2006 was the year the Web entered a new, more social and participatory phase.

Web 2.0 is a term introduced in 2005 (O'Reilly, 2005) to refer to a perceived second generation of web development and design that emphasises content creation over content consumption. With Web 2.0, also known as the 'social web' or the 'participative web', greater levels of participation, agency and democracy are possible, thus enabling users to more easily create, assemble, organise (tag), locate and share content. The past few years have seen an explosion of user-generated content, across blogs, social networks, social media sites and user reviews. In 2008, social networking leaders Facebook and MySpace added 145 million unique visitors between them over the course of the year. Twitter, a social networking and micro-blogging service launched in 2006, hit 1 billion 'tweets' in 2008 (Schonfeld, 2008). Thus, Web 2.0 technologies facilitate communication, encourage information sharing and collaboration. They have led to the development and evolution of web-based communities, social networking sites, video-sharing sites, wikis, blogs and folksonomies[6]. Abram (2005) has claimed that the social Web is about conversations, interpersonal networking, personalisation and individualism. It is the 'people-centric Web' (Robinson, 2005).

The Web 2.0 concept is a popular yet controversial term. The boundary between what defines the early World Wide Web (assigned the retronym 'Web 1.0') and Web 2.0 is unclear. A precise definition of what constitutes a Web 2.0 application remains elusive and many sites are hard to categorise with the binary label Web 1.0 or Web 2.0. Overall, the term Web 2.0 is generally used to signify the features of 'social software' technologies, such as participation, user-generated content and social networking. Although the term suggests a new version of the World Wide Web, it does not refer to an update of any technical specifications, but rather to changes in the ways the Web is being utilised. From this perspective, Web 2.0 has not supplanted Web 1.0, but rather is a consequence of a more fully implemented Web (Anderson, 2007).

1.2.3 The future of the Internet

Although the Internet has already gone through an immense evolution, it should not be assumed that the Internet has finished changing. The Internet is currently evolving to incorporate ubiquitous and wireless connectivity via PDA's, mobile phones, wearable computing and other networked devices. Videoblogging, enhanced interactivity via customisable gadgets, increasingly complex portable

[6] See Appendix 15 for Glossary of Technical Terms.

communication devices will continue to enable mobile socialisation. The Semantic Web (Web 3.0) will enable users to find, share and integrate information more easily; a critical endeavour given that an estimated 986 exabytes of information will be available online by 2010 (Gantz et al., 2007). Berners-Lee (2001; 2006) envisions the future of the web as an environment in which semantic content is made both accessible and understandable by computers. This way, the technology can enhance user experience by facilitating the completion of sophisticated tasks (such as opening a calendar and seeing meetings, travel arrangements, photographs, and financial transactions all appropriately placed on a time line). Beyond this immediate future, it is hard to foretell the future of the Internet and how the technology will change.

1.3 CONTEXTUALISING THE RESEARCH

During 2001 to 2004, the Internet became part of our everyday lives. This period of four years represents a unique situation for conducting research into users understanding of the Internet. The Internet was domesticated, technology became affordable and Internet users matured. Internet penetration increased rapidly; physical access to computer hardware became widely available in schools, public libraries, and the home. It therefore no longer was a question of technical access or connectivity. Research on the Internet conducted at the end of the twentieth century evolved from studying *who* had access to the technology, to examining *how* users effectively understood and accessed the technology. Assessments of inequality of use came to be attributed more to autonomy of use and skill level than to access to technology (Dewan & Riggins, 2005).

Despite the permeation of the Internet into their lives, during this timeframe users reported having difficulties conceptualising and interacting with the Internet. The Internet was still a relatively new technology. It was not always evident how the technology operated or what its functions were. Users had difficulty finding and organising information on mainly static information-based pages dominated; this is in stark contrast to today's content creation and social networking focus. At the time the research was conducted, social networking applications were either not widely practised yet, or had not even come onto the market.

Accordingly, the focus of this research is to examine how users understand the Internet as a technological system as a whole, via their use of textual and visual metaphors. It also explores a range of salient variables in relation to those Internet metaphors.

CHAPTER 2. USABILITY, MODELS AND METAPHORS

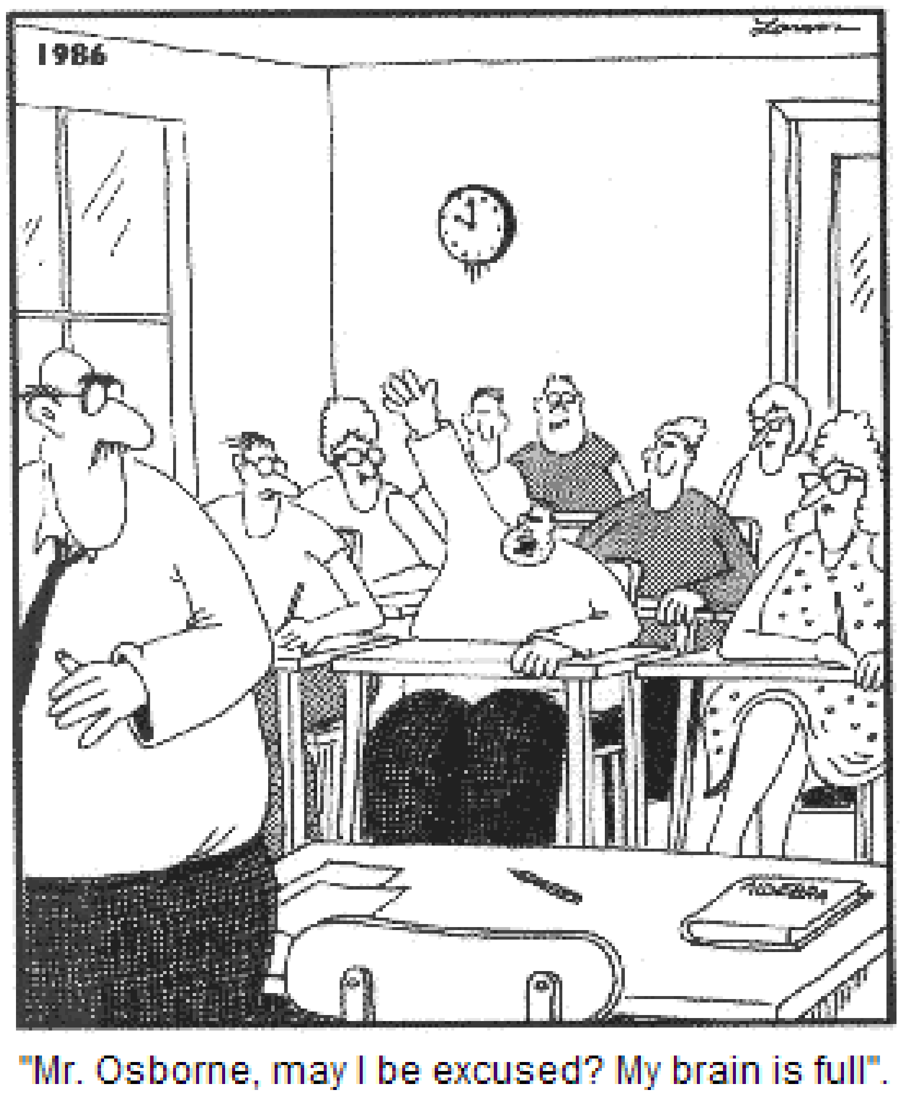

Figure 2.1. 'Mind as container' metaphor. © *Gary Larson and FarWorks, Inc*

2.1 INTRODUCTION

Many approaches have been adopted in Human-Computer Interaction (HCI) to measure usability: this chapter focuses on the most salient approach to the current research – conceptual models. A definition of conceptual models is followed by the argument that these models are usually metaphorically based. The next section proceeds to define metaphor and outline its importance for conceptualisation, comprehension and communication. The chapter concludes by examining the function of metaphor in HCI.

2.2 MODELS IN HUMAN-COMPUTER INTERACTION

Human-computer interaction (HCI) has emerged relatively recently as an area of research that analyses and designs specific user interface technologies in order to enable optimal interactivity for users (Still, 2007). It is a multidisciplinary field in which psychologists, sociologists, anthropologists, computer scientists, human factor engineers and software developers collaborate with the goal of making computing systems that are both useful and usable.

Usability is a core endeavour in human-computer interaction (Diaper & Sanger, 2006). Among the various efforts to explain what the term means, usability refers to how well users can learn and use a product to achieve their goals and how satisfied they are with that process. Numerous approaches and methodologies have been developed within the HCI domain to measure usability. One of the approaches most salient to the current thesis is the study of conceptual models. Conceptual models have provided one of the most popular tools for researchers to develop models of human-computer interaction. It has been widely acknowledged that the operation of any technology is learned more readily (and solutions to problems offered quicker and easier) if the user has a good mental model.

Early research in the HCI field suggested that mental models enable people to interact with complex devices, such as computer systems (Gentner & Stevens, 1983). In this conception, mental models refer to the concepts and frameworks people construct about specialised, delimited aspects of the environment, and how these affect their thinking and behaviour in that particular domain. This approach to defining mental models should not be confused with an alternative approach proffered by Johnson-Laird (1983), who developed a theory of mental models as cognitive architecture. Both approaches have made major contributions to cognitive psychology. For the purposes of this thesis, Gentner's approach of defining conceptual models as frameworks to understand particular domains will be adopted.

A conceptual model is a high level description of how a system is organised and operates (Johnson & Henderson, 2002). It explains what users can do with it and the concepts they need to understand how to interact with it. More specifically, the conceptual model specifies and describes the major design metaphors employed in the design. These metaphoric conceptualisations are key. Via metaphor, core system concepts are exposed to users, providing an explanatory framework for understanding and use of the system. The explanatory power of a conceptual model is that it must be something familiar to the user, because it is the user who must ultimately understand and interact with the system.

Metaphor is commonly used to explain a concept not previously well understood in terms of something that is already understood; metaphor bridges the unfamiliar and the familiar. Dependent on the metaphoric model chosen, users will think of things differently, the objects will be different, the operations users can perform on them will be different, and how users work will be different (Johnson & Henderson, 2002). An inefficacious metaphor model will afford a confused understanding of the system and confused direction on how to think about their work.

Models are frameworks for the user to facilitate their interaction with and understanding of the technology. Conceptual models of the system are largely based on metaphor. Before we examine the use (and study) of conceptual models in human-computer interaction, it is first necessary to understand the definition and functions of metaphor.

2.3 METAPHOR

The significance of metaphor in conceptualisation, comprehension and communication has long been recognised (Haste, 1994). Despite having a large and notable literature, there is no simple, widely-accepted definition of metaphor. Furthermore, it is not always easy to distinguish metaphor from some of its semantic cousins, including simile, analogy, synecdoche, catachresis, and metonymy (see Appendix 2.1 for brief definitions). It is not the aim of this thesis to enter into a full etymological discussion on the distinctions between these elements. It is sufficient to acknowledge that these tropes exist. Outside of linguistic and philosophical debates, there is a tendency to use the word ‘metaphor’ as a generic term and for simplicity, this convention will be followed in this research. Nevertheless, a brief summary of various definitions of metaphor is necessary.

2.3.1 Defining metaphor

Defining metaphor is not simple. The range of definitions for metaphor are so great that Soskice (1985, p. 15) once remarked that “anyone who has grappled with the problem of metaphor will appreciate the pragmatism of those who proceed to discuss it without giving any definition at all. One scholar claims to have found 125 different definitions, surely only a small fraction of those which have been put forward”.

The classical Aristotelian approach defined metaphor as a literary device; an expressive or poetic departure from literal, concrete, everyday language to define one thing as though it were something else. Aristotelian approaches to metaphor remained largely unchallenged until the mid-twentieth century. Black (1962) critiqued both Aristotle's notion of metaphor as an ornamental use of language and the assumption that metaphor involves the mere substitution of one term for another. Black challenged this *comparison* model of metaphor, proposing an alternative *interaction* model which relies on a complex interaction of thoughts, rather than a process of linguistic substitutions. In this way, metaphor acts as a ‘filter’ in which two or more subjects interact according to a ‘system of associated commonplaces’ (a shared set of cultural responses) to produce new meanings for the entire phrase or sentence. In the metaphor ‘the Internet is an encyclopaedia’, not only is the Internet viewed in terms of associations of encyclopaedias as containing massive amounts of information, but ‘encyclopaedia’ is also reinterpreted through its juxtaposition with the Internet. This creative process of interpretation provides opportunities for new insight, in circumstances such as scientific discovery.

Both the *comparison* and *interaction* models were challenged by Lakoff and Johnson’s (1980) *conceptual metaphor* theory, in which they claimed that metaphor is “pervasive in everyday life, not just in language but in thought and action” and that our “ordinary conceptual system is fundamentally metaphorical in nature” (ibid., p. 3). Metaphors are systematic thought structures that link two conceptual domains. The ‘source’ domain (a set of *literal* entities, attributes, processes and relationships) is pivotal in structuring the ‘target’ domain (*abstract* entities, processes and relationships) through the metaphorical link, or ‘conceptual metaphor’. Unlike Black’s (1962) interaction view of metaphor, Lakoff and Johnson assert there is an interaction of schemas or concepts, rather than an interaction of two words.

Lakoff and Johnson’s conceptual view of metaphor has largely dominated the field since the 1980s. There have been a number of divergent theories proffered since then; these theories differ in which aspects of metaphor they emphasis and in their proposals for how metaphor works (see Fauconnier & Turner, 2002; Evans & Zinken, 2009; Cameron & Deignan, 2005). Despite the disparate foci, they have all attempted to broaden traditional conceptions of metaphor as a special use of language, offering an understanding of metaphor as a fundamental cognitive process or structure.

2.3.2 Visual metaphors

Along with the rejection of metaphor being understood as mere poetic device came the understanding that metaphor can be represented in other modes besides the verbal. Lakoff and Johnson (1980) proposed that metaphors are primarily a phenomenon of thought, not only of language. Thus, the mechanisms underlying metaphor may exist in the mind independently of language. Visual metaphors play an important role in human reasoning, thinking and understanding processes; our mental images are a powerful tool for understanding abstract ideas that cannot easily be expressed through words. The pervasiveness of spatial and physical metaphors in our vocabulary reveals the relationship between metaphor and imagery.

Until recently, metaphors have been studied almost exclusively via verbal expressions. There is growing interest in the nature of pictorial metaphor (Forceville, 2005; Cupchik, 2003). There is still little agreement among researchers even over basic terms and definitions. Early attempts to define visual metaphors described them as a form of visual fusion in which two separate areas are combined into one spatially bounded entity. More recently, visual metaphors are being examined in terms of underlying concepts, instead of surface characteristics (El Refaie, 2003). This view challenges the representational view of visual metaphor, which implies that the visual can be seen simply as expressing the same meanings as language, albeit in a more imprecise form. In fact, visual communication can and often does refer to meanings that have no verbal translation at all.

2.3.3 This thesis' approach to defining metaphor

This thesis adopts as a pragmatic convenience the following slightly modified definition of metaphor. Metaphor consists of giving to one thing a name or description that belongs by convention to something else, on the grounds of some (perceived or actual) similarity between the two. In this conception, metaphor is a fundamental way of learning and structuring conceptual systems, a part of everyday discourse. Furthermore, metaphors are not solely linguistic in form and can also be conveyed pictorially. Metaphors do not merely reflect a fundamentally objective and literal mode of representation. Rather, metaphors have multiple dynamic dimensions that are contextually based. Metaphor usage and meaning needs to be considered in this full context of use, acknowledging that, although we may choose as researchers or theorists to focus on a particular dimension of metaphor, the others are still there, influencing what people do and say. Metaphor, from this perspective, has multiple interconnected dimensions: linguistic, pictorial, cognitive, affective and contextual.

2.4 THE FUNCTION OF METAPHOR

Whilst definitions of metaphor remain unresolved, the function of metaphor is clear: metaphor enables us to comprehend partially understood concepts in terms of ones that are better understood (Lakoff & Johnson, 1980; Ortony, 1993; Haste, 1994).

2.4.1 Metaphors enable comprehension

Metaphor enables comprehension of highly abstract concepts and processes that would normally be unattainable without it (Haste, 1994). According to Pylyshyn (1993), the role of a metaphor is not to fully explain all aspects of a complex environment but to provide a framework on which to reference new, vague, and disconnected ideas about that environment, phenomenon, or concept. Carroll and Mack (1999) assert that when one is learning, the knowledge structures that are accessed cannot be totally relevant; by definition, the structures that are fully appropriate have not been acquired yet. Hence, related knowledge is accessed instead; this related knowledge becomes a metaphor for the material being acquired. In this way, people develop new cognitive structures by metaphorically extending old ones. The process of building these linkages between the known and the abstract is what they believe makes a metaphor effective as a model (Palmquist, 2001). To appropriate an image from Wittgenstein (1961), metaphor is a ladder of cognitive ascent, which can be kicked away after the vista it has exposed is revealed. Metaphors play a vital role in helping us to make sense of unfamiliar situations; unfamiliar concepts are is structured and categorised usefully, and the metaphor provides a framework for understanding and exploring a novel situation (Grey, 2000). In this way, metaphors are constitutive, in that they shape the way novel phenomena are apprehended, and even how they develop concretely and materially (Ratto & Beaulieu, 2003). Metaphors not only enable the understanding of complex topics, they also affect further perception and interpretation of experiences (Gentner & Gentner, 1983).

2.4.2 Metaphors provide insight

Metaphor is the vehicle of insight. It initiates and extends understanding through the formation of new conceptual connections (Encycl. of World Problems & Human Potential, 1994). In this way metaphor creates rather than reflects similarity (Dowling, 1996). “Many of our activities are metaphorical in nature ... [these] metaphorical concepts structure our present reality…New metaphors have the power to create a new reality” (Lissack, 1997, p. 294). Indeed, the importance of metaphor in relationship to creativity, whether in the arts or the sciences, has been frequently noted. Metaphor enables us to generate new meanings from old. Metaphorical extension forges and reshapes concepts and thereby modifies language so that it comes to embrace an ever wider and more complicated repertoire of referents and activities (Moser, 2000). Metaphor, then, is not an alternative way of expressing common sense but a common way of achieving new sense.

2.4.3 Metaphors facilitate communication

Metaphors embody shared assumptions and beliefs, thus enabling us to communicate about complex topics or convey novel ideas (Haste, 1993b). They are an essential part of communication. Metaphors are effective tools of communication in providing common ground for discourses. They are the tools by which people conceptualise and communicate abstract concepts in a manner that is more useful and comprehensible. Once a concept has been formulated, it usually has to be communicated to people and groups who are unfamiliar with the specialised jargon in which it is embodied. In such a situation, metaphor can be called upon to convey the essentials of the concept. In order to be effective as mechanisms of communication, metaphors must be robust in order to convey shared meanings across different contexts, but concurrently be flexible to allow for different formulations in different contexts. This characteristic makes metaphors important tools of communication between various discourses, both over time and across various topics (Hellsten, 2003).

2.4.4 Metaphors aid technological comprehension

Metaphors enable us to understand technologies. We tend to use metaphor to make the technology meaningful by representing it in recognisable ways. For example, by thinking about the Internet as analogous to an older, most established concept, such as encyclopaedia or a card index, the properties of the technology are made more concrete and more understandable. Metaphors can be powerful tools that provide a way of comprehending a space that is too large and too complex to be seen directly. Metaphors exploit the extraordinary human ability to organise objects in space (Dieberger, 1998; Dieberger & Frank, 1998). For example, metaphors enable users to navigate the Internet by providing cognitive maps of cyberspace. Cognitive maps are metaphorical constructs that utilise the spatial and tactical knowledge we have about navigating in the real world and applying this knowledge to way-finding on the Internet. The function of this is twofold: metaphors create a 'sense of place' by re-establishing a connection to the tangible physical world that we all know and function in (Dodge & Kitchin, 2000). More importantly, they are a strong influence in the development of an information infrastructure. Thus, metaphors help users to formulate configurational knowledge; that is, knowledge of the associations between and relative locations of places (Kitchin & Dodge, 2007). This is very important for Internet users; with a structured layout, users can orient themselves in cyberspace and more effectively find the information they require.

2.5 THE FUNCTION OF METAPHORS IN HCI

Metaphors are core components in human–computer interaction (HCI) as a means of facilitating the usability of a technological system. Early HCI textbooks advocated the use of metaphors: “Designers of systems should, where possible, use metaphors that the user will be familiar with” (Faulkner 1998, p. 89); “Metaphors make it easy to learn about unfamiliar objects” (Hill 1995, p. 22); “Very few will debate the value of a good metaphor for increasing the initial familiarity between user and computer application” (Dix et al. 1998, p. 149).

As technology gets ever more complex, it becomes essential for designers to provide a user-centred design that focuses upon the needs and abilities of the user.

Metaphors can be a powerful tool for designers, in the process of designing, in the process of communicating the design and the process of helping users understand and use the technology. Since the inception and huge success of the desktop metaphor, many popular design guides, tutorials, and textbooks have described metaphor as a central principal of interface design.

Metaphors enable users to draw upon their knowledge about a familiar situation in order to reason about the workings of the new system. Since people often employ metaphors when first learning an unfamiliar task or domain, “designers of [computer] systems should anticipate and support likely metaphorical constructions to increase the ease of learning and using the system” (Carroll & Thomas, 1982, p. 108). Metaphor is beneficial for inspiration and creativity, communication and familiarisation.

It is not an exaggeration to say that the process of creating products, especially digital products, is riddled with metaphor. The programming languages are all highly metaphoric: “hard drives” are “written to”, images are “loaded”, “files” are “saved” or “moved” to “folders”, and so forth. As part of the creative process, ‘invention metaphors’ help designers to develop innovative and creative conceptualisations and break away from more conventional approaches. Many of these initial invention metaphors might be inappropriate and thus discarded; others will be useful and brings a new perspective to the technology.

Once design ideas have been generated, an important step in the design process is communicating a cogent model of the technology to the user; that is, a conceptual model of how the technology works. The metaphors used within the user interface serve as bridges to the user’s mental model of the system. Familiarising metaphors make a product or interface easier to understand by creating correspondences with a more familiar domain. The desktop metaphor, for example, leverages users’ experiences with paper files and folders to familiarise the mechanism of organising documents. These metaphors unify or generalise, collecting individual experiences into one conceptual framework, and allowing that conceptual framework to form the basis for new experiences (Heckel, 1991). Once learned, the metaphor becomes a tool users can apply to new interfaces and interactions.

CHAPTER 3. COMMON INTERNET METAPHORS AND THEIR ORIGINS

Figure 3.1. Google as library metaphor. © Grosse Pointe News 2007

3.1 INTRODUCTION

Since its inception, the Internet has been associated with a wide variety of metaphorical expressions. Somehow users have come to ‘surf’ the ‘Web’, follow their ‘bookmarks’ to ‘sites’ where they browse ‘pages’, registering ‘hits’ with the ‘host’ computer. This chapter discusses some of the most common Internet metaphors and their origins. Based on an extension of the framework proposed by Norman (1988), the chapter examines popular cultural metaphors, designer-led metaphors as implemented into the interface and general system metaphors of the Internet.

3.2 POPULAR METAPHORS OF THE INTERNET

There have been many popular metaphors of the Internet. In the literary world, Gibson first coined the term ‘cyberspace’ his novel ‘*Neuromancer’* (1984). Gibson metaphorically depicts the Internet as “*a graphic representation of data abstracted from banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data. Like city lights, receding*” (p. 69). His concept of cyberspace describes the “sense of a social setting that exists purely within a space of representation and communication . . . it exists entirely within a computer space, distributed across increasingly complex and fluid networks” (Slater, 2002, p. 355).

Key metaphoric representations of the Internet have also been proffered in cinematic cyberspace; most notably *TRON* (1982), *Johnny Mnemonic* (1995), *Hackers* (1995) and *The Matrix* trilogy (1999; 2003). *TRON* provided influential representations of virtual space within a computer. The computer space was made tangible by anthropomorphising the computer mainframe (programs and data were made analogous to their human creators). In *Hackers*, computer code is metaphorically represented as an urban landscape of text, with city skyscrapers depicting code and circuit board connections as the roads between buildings (see Figure 3.2a). The *Matrix* trilogy took the metaphorical approach one step further than its predecessors. The plot revolves around the presupposition that the 'real' world humans experience is simply an illusion generated by digital code. Thus, key representation of cyberspace is reality underpinned by eerie green flowing computer code, such as the AI agents in the 'corridor of code' in Figure 3.2b.

Figure 3.2a. 'City of Text' Dataspace, from Hackers (1995)

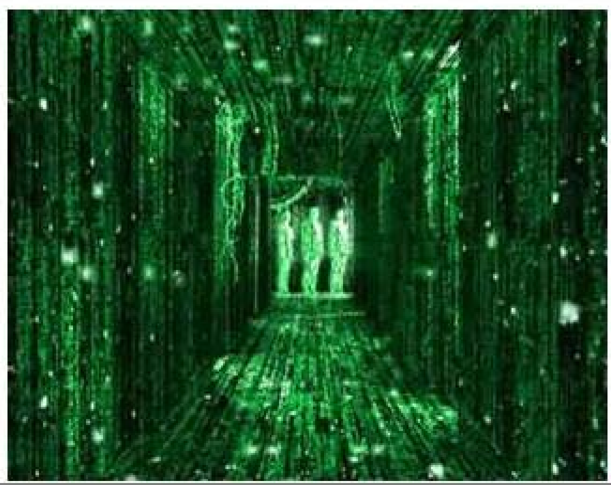

Figure 3.2b. 'Corridor of Code', from The Matrix (1999)

Another well-known and oft-cited metaphor is the notion of the Internet as an information super-highway. In January 1994, former Vice President Al Gore gave a landmark speech at UCLA about the 'information superhighway', in which the infrastructure of the Internet was compared to the U.S. interstate highway system.

The comparison between the highway system and routes for speedy transfer of information have spawned many metaphorical extensions; for example, broadband Internet access has been described as a way to avoid ‘traffic jams’ on the ‘onramp’ to the ‘superhighway’.

3.2.1 Metaphors shape and are shaped by technologies

It is evident that metaphors of technology are powerful elements of popular culture. They are important creative and rhetorical tools that not only facilitate apprehension of new technologies such as the Internet, but they also reshape our understanding of it (Postman, 1992). For example, how we have come to understand the human mind has greatly changed in the last 3000 years according to the dominant prevailing technology.

At various times in the history of science, the development of new ideas has depended on a shift in the model of how things work. Such models are often metaphors based on experience with familiar contemporary technology (Haste, 1993). Dramatic changes in technology over the past few centuries have been associated with equally dramatic shifts in the way we think about the human mind. We can trace the course of technological metaphors for the mind from Plato’s aviary, to Descartes’ clocks, through the steam engine, and on up to computerised networks. Furthermore, we can be assured that the leading metaphor for mind will move on with the next technological advance.

‘Defining technologies’ of each era become central metaphors through which the theology, philosophy, literature and science of that society understand reality. Bolter (1984) describes three epochs, each having its own defining technology which permeates the culture of the period and opens up new intellectual perspectives: the classical era, the modern period and the computer era.

The “classical period” (c. 500 BC - 500 AD) was defined by manual crafts such as weaving and pottery. Accordingly, under the influence of this technology, the philosophers of the period tended to think about the mind as a container. Although technology has evolved immensely since then, Plato’s aviary still remains a popular notion of mind as a physical entity that contains other entities in space (Fernyhough, 2006). The Modern period was characterised as a time of rapid growth in technology and mechanisation. The defining technology of the seventeenth century was the mechanical clock. Descartes envisioned the human body as being controlled by clockwork mechanisms. Although Cartesian philosophy exempted the mind from mechanist reduction, the message became mistaken and the mind was also conceptualised as a machine. In *L'Homme machine* La Mettrie (1748, in Wozniak, 1992) argued that mind and body were equally mechanical.

The metaphors based on the mechanical defining technologies of the era were useful tools for understanding physiological phenomena. However, mechanical metaphors worked much less well when applied to the mind because it was difficult to imagine mechanisms complex and versatile enough to approximate mental activities. Until well into the twentieth century, those who believed that the brain functioned mechanically had great difficulty describing just how these mental mechanisms worked. Nor could anyone come close to building a machine that could perform operations even vaguely analogous to the human mind (Babbage's steam-powered 'Analytical Engine' was the closest approximation). All of this changed with the coming of the computer.

The defining technology of twentieth century is the computer. Computers, unlike the crude calculating machines of the past, seemed fast, complex, and supple enough to approximate real thought. It was during this period that mechanical equipment started to be replaced by electronic equivalents; in parallel, mechanical metaphors for the mind were replaced by the computer metaphor (Figure 3.3).

Figure 3.3. Computer metaphor © Jan Loof

We need little persuading of the influence of the computer metaphor, which sees the components of our cognitive system as analogous to the central processor, storage devices and peripherals of a desktop computer. The notion of the brain as a computer is entrenched in cognitive psychology. Cognitive scientists seek evidence for the modularity of psychological processes, which reflect metaphors of mind as a multipurpose computing tool with information-processing modules that have evolved independently for different cognitive tasks.

The evolution of the computer metaphor of mind illustrates how a metaphor can cut both ways: first computers were modelled after minds, and later minds were modelled after computers (Gigerenzer, 1991). At the beginning of the Cognitive Revolution, the mind became a metaphor for the computer. Von Neumann (1958) and others explicitly suggested the analogy between the neuronal connections in the brain and the serial computer. As the computer became entrenched in everyday routine, a broad acceptance of the metaphor of the mind as a computer followed (Gigerenzer, 1991). Contemporary debates surrounding the computer metaphor can be divided into ‘strong’ and ‘weak’ accounts of the mind-computer relationship. The ‘strong’ version (as exemplified by Daniel Dennett) seeks to define a sequential set of rules through which the computer can actually duplicate the workings of the mind. This perspective maintains that “the computer is not merely a tool in the study of the mind; rather, the appropriately programmed computer really *is* a mind” (Searle, 1980, p. 417). In contrast, the ‘weak’ account of philosophy of mind (as exemplified by John Searle) is content with seeing computers as models or metaphors for certain kinds of mental activities. Thus, the computer is a valuable tool for helping us to understand the mind, but the two entities are not homologous. Searle's persuasive counterarguments against strong AI challenged the computational view of mind and opened the path for new ways to conceptualise the mind. The emergent networks of mass communication technologies, such as the Internet, have become the next model of cognitive organisation. The complex interconnected networks of the Internet have become a new metaphor for the complex mesh of nerve interconnections in the brain, where sets of incoming signals are integrated and processed.

It is widely acknowledged that our interaction with technological tools entrenched in everyday practice generate new theoretical metaphors and concepts (Gigerenzer, 2000; Basalla, 1988). As technology becomes a part of our lives, it becomes a part of our metaphorical substrate (Lienhard, 1996). It is futile to separate technologies from the metaphorical language through which technological objects are conceived and used (Lévy, 2001). Not only do we witness a change in the dominant technology, but also in ideas, concepts, values, language that redefine our whole worldview.

The power of technology to inspire new metaphors derives from not only from the emergence of new tools, but more importantly from the community of tools users. It is the users of technology which affect the pragmatic use of a tool, which in turn leaves its mark on the new theories of mind. The entrenchment of the technology in the social community is an important precondition for its final acceptance as a model of mind. Finally, new social organisations can inspire the creation of the technology in the first place. Humans and technology are forever bound to engage in this iterative, dynamic process, whereby technology both shapes society and is shaped by it. Technologies generate new concepts and ideas, new ways of thinking about the old. But these new metaphors in turn affect how we conceive of the technology.

It is therefore evident that the defining technologies of each age are instrumental in shaping how we think about processes beyond the original scope of the technology. Interestingly, there is a double aspect to these 'defining technologies'; they are part of the content of discourse but also the medium of discourse. In other words, they are what we openly talk about and the means by which we communicate.

3.3 METAPHORICAL MODELS OF THE INTERNET

As outlined in Chapter 2, people form mental models of technologies that have predictive and explanatory powers for understanding the interaction. Norman (1988) identifies three core components in the interaction between technology and users: the designer, the user and the technology interface. From these components emerge three types of conceptual model: the Design Model, the User Model and the System Image (see Figure 3.4).

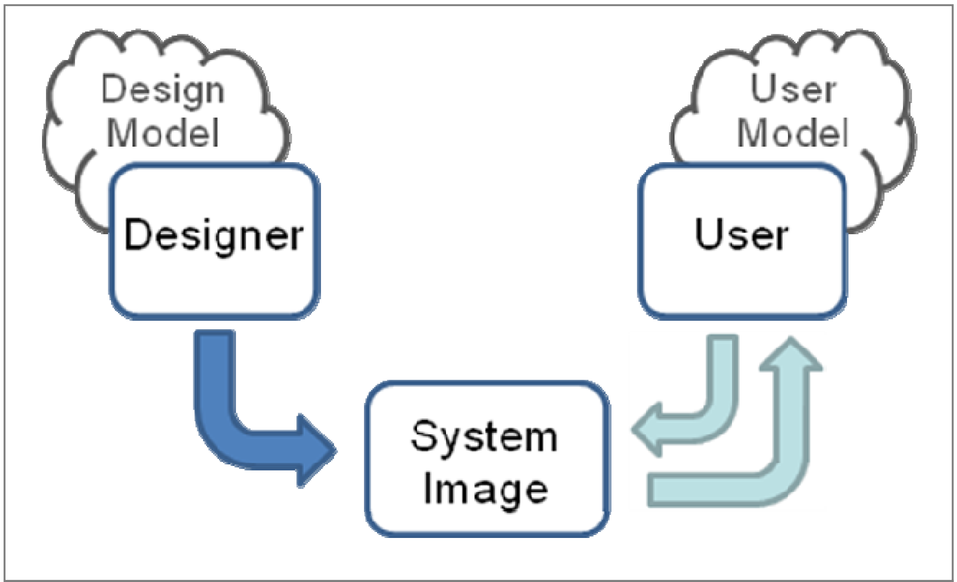

Figure 3.4. Norman's (1988) framework depicting the relationship between designer, user and system

The Design Model is the conceptualisation the designer has in mind of how the system works. The System Image is as an appropriate representation of the technological system. It is a manifestation of the designer's model as implemented at the point where the user and system interact. It is an *idealised* view of the how the system works, the *ontological structure* of the system (the objects, their relationships, and control structures) and the *mechanism* by which users accomplish the tasks the system is intended to support. The designer must ensure that everything about the System Image is consistent with and exemplifies the operation of the

Design Model. The User Model is what the user develops to explain the operation of the system. Users develop their mental models through their interaction with the target system (Norman, 1983). Thus, according to this framework, the designer starts with their own conceptual model of the system. It is implemented into the system via interface metaphors. The System Image metaphor should effectively communicate the Design Model to the user. Through experiencing the system (via the interface), the user develops their own mental model of the target system.

Norman's approach remains an influential framework within the HCI domain for characterising at least three core components involved in human-computer interaction. Furthermore, it is possible to utilise this framework to identify sources for common metaphors of the Internet: System Image or 'interface' metaphors (as manifestations of the Design Model) and users' metaphors of the Internet. As an extension to Norman's framework, this thesis proposes that there are at least two other important sources for Internet metaphors that are not explicitly referred to in Norman's approach: cultural and system metaphors of the Internet. As the previous section discussed, metaphoric models of the Internet are used so they can be comprehended, interpreted and communicated within a certain community of users. Figure 3.5 depicts a modified version of Norman's framework to incorporate common cultural metaphors of the Internet.

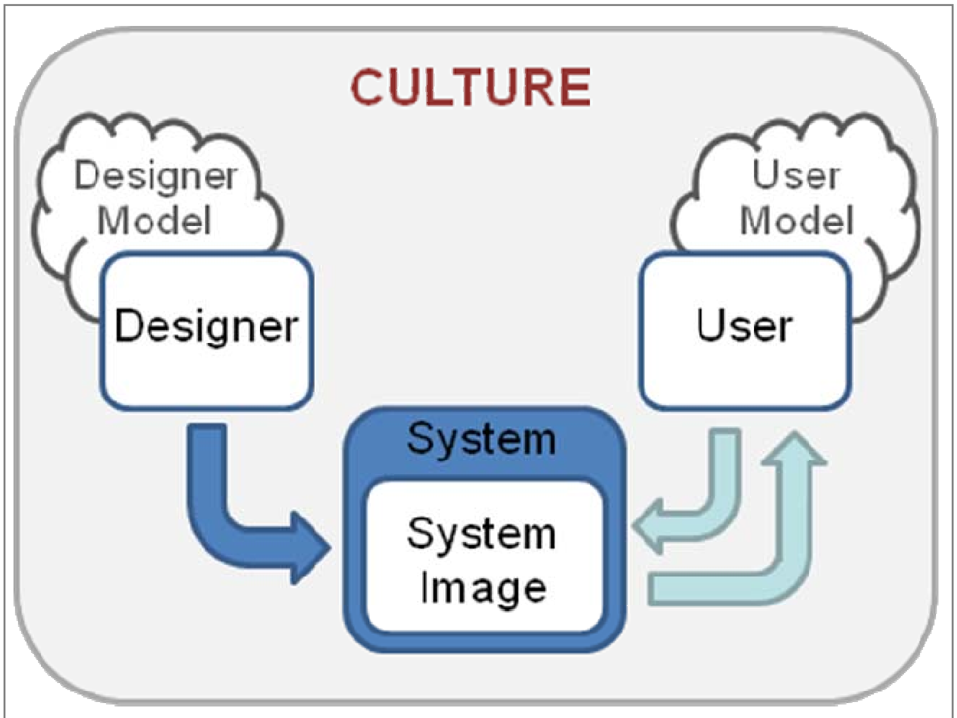

Figure 3.5. Extension of Norman's (1988) framework to include system and cultural models

The second modification to Norman's framework is the addition of a system metaphor. If the System Image metaphor is how the system *presents itself* to users, the System metaphor refers to the model users construct in their minds about how the system as a whole works. Thus, a conceptual model of a system is *not the user interface;* it is not about how the software looks or how it feels (Johnson & Henderson, 2002). The System Image and System metaphors are closely related, but the difference is important. Asking how users understand a technological system is a qualitatively different question to asking users if they understand a specific interface. To further explicate, asking users 'what do you think of when using the *Internet*?' is different to asking 'what do you think of when using the *Web*? or *ftp*?[7] or any other of the interfaces for specific applications that run on the Internet. Interface metaphors are not necessarily synonymous with system metaphors and thus warrant their own examination.

[7] See Appendix 15 for Glossary of Technical Terms.

The following section proceeds to examine some of the most common metaphors as generated by designers as interface metaphors, and some common system metaphors. Users' metaphors of the Internet are discussed in detail in the following chapter.

3.4 INTERFACE METAPHORS

Designers have implemented a wide array of metaphors in the interface. Metaphors aid designers as a source of organisation and a decision guide about how to represent information. Thus, the form and structure of the point at which users interface with the Internet is not generated automatically, rather it has to be invented and designed. There has been a rapid expansion in computing metaphors as the Internet has grown and changed. Indeed, the impact of computer-based metaphors has been extensive (Rohrer, 1997; Cerf & Stefik, 1997).

Early designer metaphors for the Internet interface included rooms and houses (Henderson & Card, 1986; Microsoft, 1995). Contemporary metaphors for e-commerce web sites have introduced virtual shopping malls as a context for browsing and purchasing products. Collaborative learning websites have adopted 3D virtual worlds (e.g. Borner, et al, 2003), whilst some social networking sites have developed 3D environments, such as landscapes (Second Life) or hotels (Hotel Habbo). Most recent examples include galaxies (Wakita & Matsumoto, 2004), geological maps (Viegas, Perry, & Howe, 2004), ant colonies (Sobecki, 2008), mountains (Altom, et al., 2004) and portals (Kalyanaraman & Sundar, 2008).

3.4.1 Desktop metaphor

User interfaces created by designers are commonly based on metaphors of real world objects they are already familiar with. For example, Apple's graphical user interface, with its trash can and file folders, has been widely emulated. Another commonly-known example is the desktop metaphor, now widely used on personal computer systems. The monitor of a computer represents the user's desktop upon which documents and folders of documents can be placed. A document can be opened into a 'window', which represents a paper copy of the document placed on the desktop. The desktop metaphor has been modified and extended with various implementations; for example, desktop calculators, trash cans, 'filing cabinets' of network volumes and so forth. Typically, the features and usability of the system are often deemed more important than maintaining the 'purity' of the metaphor, hence there are features such as menu and task bars that have no counterpart on a real-world desktop.

Recently, Agarawala and Balakrishnan (2006) have updated the desktop metaphor in order to make the computer desktop more synonymous with an offline desktop. The authors have developed a programme, called BumpTop[8], which discards the old notion of organising computer files into tidy folders-within-folders, substituting a 3-D environment in which document-like icons representing electronic files can be scattered, stacked, spun, stuck to walls, and even smashed into one another (see Figure 3.6).

Figure 3.6. BumpTop interface: a 3-D version of the desktop metaphor

This version of the desktop breaks free from the rigid and mechanical style of standard point-and-click desktops. It facilitates real-world interaction by enabling users to push, pull and pile documents. Users can make important documents bigger; once it is bigger, it is also heavier, so it pushes other icons out of the way. Users can even crease and fold icons, or crumple them up and toss them into a corner of the

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[8] http://bumptop.com/

screen. This programme is a good example of making computer interfaces conform to real world principles, rather than having users conform to computer principles.

3.4.2 Iconic metaphors

Iconic metaphors are commonly designed into Internet browsers in order to assist the user. For example, the user is transported to the default or 'home' page by clicking on an iconic representation of a 'house'. Users can stop a page loading by clicking a red coloured icon (Netscape utilises an octagonal sign, resembling the internationally recognised traffic stop sign; Internet Explorer and Mozilla Firefox use a red cross). Browsers also use iconic metaphors for finding things on the page; binoculars for Netscape and a magnifying glass for Explorer/Firefox. Other well-known iconic metaphors include the 'hour glass' (to signify processing time) and the omnipresent 'trash can' (to signify deleted items).

Figure 3.7. Common visual interface metaphors

Figure 3.7 indicates other common visual metaphors used in the computer interface; a quick glance at the metaphorical icon provides the user with a rapid understanding of the system functionality (for example, a calendar, a calculator, post-it notes, etc.). This use of metaphoric signs is a well established technique in browser software.

3.4.3 Document metaphors

Document metaphors are axiomatic in interface design and in the language utilised to describe online activities; ‘pages’ are ‘bookmarked’ and ‘browsed’, the home page of a site is traditionally called index.html, and it is intended to list all the other pages available there. The conception of the Internet as a document collection does vary. The Internet can be thought of as a rather disorganised mess of pages, with only a few links holding them together. Alternatively, others might attempt to impose order by organising the documents into hierarchical topical categories, much like it is done with book records in a library catalogue. Lastly, with the continued popularity of search engines, such as Google, some might view the Internet as a database of documents in which unique documents are searched for by submitting queries (Tomaszewski, 2002).

3.5 SYSTEM METAPHORS

The Internet, as a technological system, has been explicitly compared to a number of metaphorical objects. It has been likened to a highway, a book, a web, a digital library, and an electronic market, to name just a few of the most oft-cited metaphors for the Internet. There are an enormous number of metaphors potentially available, simply because metaphors can be developed from almost every noun in the language (e.g. ocean, road, cloud, etc.) and complex metaphors can be developed from associated pairs (e.g. information superhighway).

Perhaps the most widely-known is metaphor of a web (and thus the most common source of confusion between the WWW and the Internet). As Table 3.1 indicates, system metaphors of the Internet are abundant; each metaphor varies according to the user and the context in which they are being employed.

Metaphor	**Examples**
Highway / road	highway, map, path, routes, traffic
Web / network	The ‘Web’, the ‘Net’
Library / information archive	catalogue, index, directory
Market place / shopping mall	e-commerce, e-marketing, e-shopping
Building / place	access, address, firewall, gateway, portals, sign in/log in, sign out/logout, site, visit, wallpaper
Book / encyclopaedia	bookmark, browse, browser, pages, publish
Ocean / sea / waves	navigate, pirates, surfing
Layers / hierarchy	Levels, page up / page down

Table 3.1. Common system metaphors and examples

System metaphors highlight salient features for attention from what would otherwise be an overwhelmingly complex reality. For example, describing the Internet as a set of technological tools will afford different understanding than defining it as a complex network of social relations, a language system or a cultural milieu, and so on.

3.5.1 Spatial Metaphors

The Internet is often conceptualised in terms of being a physical, social and information *space*. The spatial metaphor is the source of many of our terms related to Internet use; for example, users navigate or explore the space, following links from one place to another. They get ‘lost’, ‘wander’, and try to go straight ‘there’, by typing ‘addresses’ or ‘locations ’into their browsers. The basic premise of the spatial metaphor is that locating information in cyberspace has similar psychological features to navigating in physical space. Spatial metaphors exploit the extraordinary human ability to organise objects in space, to recall and reason about their locations and many other space-related cognitive abilities. The spatial metaphor arose out of a need for a common language to discuss hypertext issues and a framework within which to develop usable interfaces (Boechler, 2001). Mental representations of spatial layouts of information can be an effective framework for accessing information on the Internet.

3.5.2 Container Metaphors

Metaphor has been used to define spaces and boundaries where there really are none (Lakoff and Johnson, 1980). The digital world (itself a metaphor), due to its intangible nature, has been particularly ripe for this sort of metaphoric usage. A number of container metaphors are in use when referring to the Internet. The Internet has been analogised as an ocean (surfing the Web), a library (browsing a site), a book (web pages), and of course, the Internet as a web. Without these structuring metaphors, users would quickly become confused when interacting with the system.

3.5.3 Orientation Metaphors

Related to the creation of metaphoric boundaries is the ability to navigate through space (and time) via metaphor. Once a space is defined, there typically needs to be some method for users to orient themselves and progress through the system interface. In many Western cultures, the metaphors LEFT IS BACKWARD and RIGHT IS FORWARD are commonly used in technological design, as evidenced by the omnipresent "back button" on browsers to return to the previous web site. This sort of orientation via metaphor is crucial for users to be able to explore the product space and discover the features and functionality therein.

3.5.4 Personification Metaphors

Metaphor can also be used to portray complex, non-human activities as simpler, human ones via personification. By endowing technology with human characteristics, it makes them more approachable and usable. From a technical viewpoint, computers do not "write" data to disk. By using metaphor to personify these actions, users can better understand what the technology is doing.

3.6 MAPPING THE INTERNET

In the last decade, researchers have begun to create maps of the Internet. Orientational, spatial, navigational and container metaphors are embedded in these

Internet 'maps'. These visualisations make the Internet's structure explicit, to give a rapid overview, to support navigation or support organisation.   Some of the representations appear familiar, using the metaphoric conventions of real-world maps or the nodal structures of network maps. However, many of the maps are much more abstract representations, turning to nature, the cosmos or neuroscience for analogical models.

These maps tend to depict either the physical structure and information traffic patterns of global networks (Figure 3.8a), or the content and social spaces of the electronic world (Figure 3.8b).

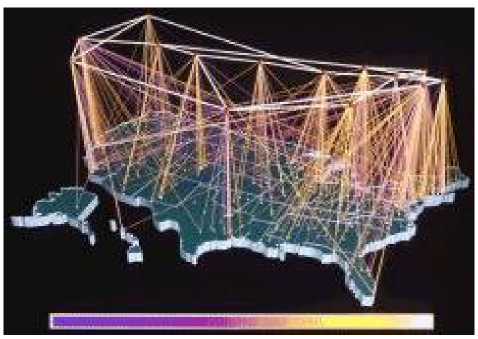

Figure 3.8a. Example of Structure map. Visualisation of NSFNET, Donna Cox & Robert Patterson

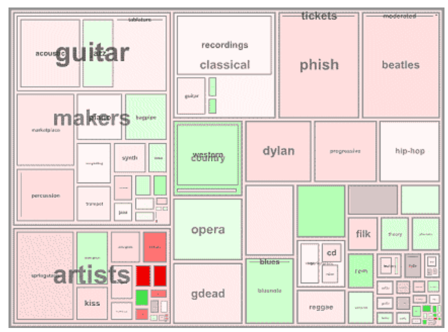

Figure 3.8b. Example of Content map. Treemap Tool, Andrew Fiore & Marc Smith

Accurately rendering structural maps has become increasingly difficult, because there is no central source of information about the Internet's backbone networks and traffic. Nevertheless, these kinds of maps are useful for providing a general structural overview of the Internet as a whole. In contrast to mapping the underlying infrastructure of the Internet, content maps focus upon how information is organised via web sites. These maps are most useful in helping users navigate the new information landscapes, by providing a route through which access can most readily be accessed.

Until recently, cyberspace mapping was restricted to a few companies and research institutes that had access to the expensive required hardware and software. However, nowadays there are a number of freely available mapping technologies on the Internet that allow users to generate and publish web maps. For example, on web sites that utilise folksonomic tagging (such as *Flickr.com*[9]), hundreds of thousands of website maps have been produced and posted online (see Figure 3.9).

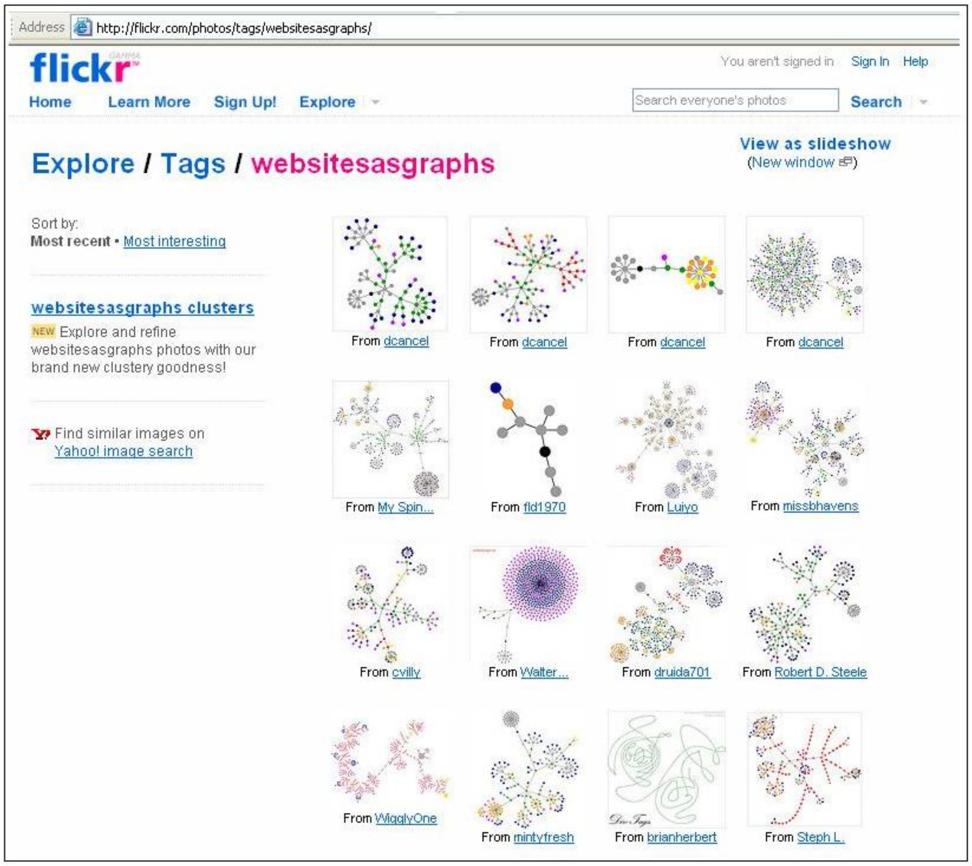

Figure 3.9. Web maps posted on Flickr.com, circa 2005

Despite the pervasiveness and apparent ease with which these web maps can be created, it should not be assumed that the maps are objective reflections of an underlying physical reality[10]. The metaphor of a map is so persuasive that we are tempted to believe that there is no metaphor. Cyberspace maps are not objective artefacts; they reflect a process of creating as much as revealing knowledge. Despite being able to take on any form desirable, the Internet is often conceptualised as having three dimensions. The principles of real space do not exist on the Internet unless they are designed and implemented in the form of these cybermaps.

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[9] See Appendix 15 for Glossary of Technical Terms.
[10] Note: maps of websites do not depict the topology of the Internet, which is physically real.

Furthermore, geographical metaphors spatialise web sites as places implying territories defined by borderlines, separating spaces into semantic categories. Whilst these divisions may be functional to the Internet user, they are not an inherent property of the Internet. Thus, although new technologies seem to “offer the possibilities for recreating the world afresh” (Robins, 1995, p. 153); a realm of ‘it-can-be-so’ over ‘it-should-be-so’ (Novak, 1992, p. 226), many adopt standard metaphors despite being able to have any form desired. Cyber-maps are never merely descriptive; they are heuristic and metaphoric devices that seek to communicate particular messages (MacEachren, 1995).

CHAPTER 4. CULTURAL AND INTERFACE METAPHORS

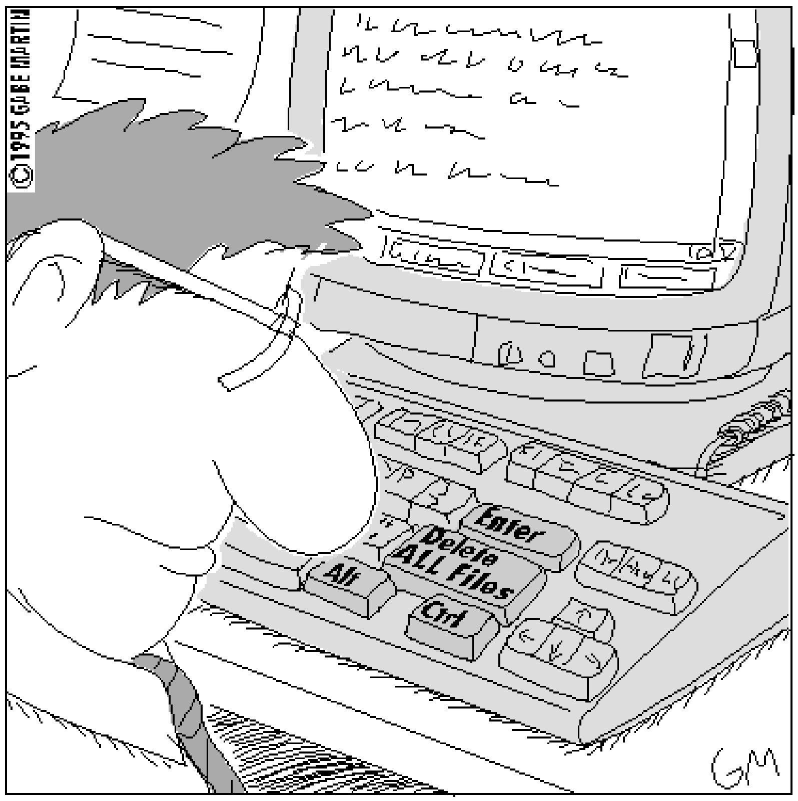

Figure 4.1. Ineffective design. © Gabe Martin, 1995.

4.1 INTRODUCTION

The purpose of this chapter is to review the literature surrounding Internet metaphors. First, it evaluates studies that have examined cultural metaphors of the Internet. Next, the user-centred design literature on interface metaphors is critically discussed, culminating in a discussion of the numerous critiques aimed at the use of interface metaphors. Next, the chapter discusses how designers' metaphors as implemented in the user interface may not necessarily be synonymous with users' metaphors. Lastly, the chapter critiques the user-centred design literature for its technological focus, and calls for the need to examine users' metaphors of the Internet.

4.2 CULTURAL METAPHORS

In an early study, Palmquist (1996) derived a list of common Internet metaphors by indexing the titles of published professional journals. She found that metaphors were used in 70% of Computer Database articles, 65% of the Magazine Index articles and 55% of the Information Science Abstracts (ISA) articles. Palmquist categorised the metaphors into major 'families': travel, buildings/politics, anthropomorphic, commerce, space, frontier, fire/water and animals. As Table 4.1 indicates, travel metaphors occurred most frequently; fire/water and animal metaphors occurred the least.

Metaphor Family	**Frequency**	**Examples**
Travel	20%	Map, travel, road, ramps
Buildings / Politics	15%	Town hall, village
Anthropomorphic	15%	Dreams, wet feet
Commerce	14%	Marketplace, shopping mall
Space	12%	Cyberspace, robots
Frontier	12%	Hunt, explore
Fire/Water	6%	Ocean, surf, flaming, hot
Animals	6%	Spider, worm, virus

Table 4.1. Palmquist's (1996) metaphor categories

Palmquist found that the articles indexed by various databases vary in their use of metaphors. Those regarding travel were used in 44% of ISA articles but only 15% of other databases. Metaphors regarding commerce, politics and place were used 29% of ISA articles but only 16% and 2% of Computer Database and Magazine Index respectively. Interestingly, Palmquist asserts that a surprisingly large proportion of the metaphorical references in titles could easily be characterised as Anthropomorphic. A noteworthy 43% of Computer Database articles and 23% of Magazine Index articles fell under the Anthropomorphic category.

By utilising a similar indexing technique, Lakonder (2000) identified a number of common Internet metaphors across several issues of *Wired* magazine, (see Table 4.2).

Classification	**Description**	**Examples**
Living organism	The technology experienced as living entities	"The Internet matures"
Communities	The interaction between people	"Virtual communities"
Highway	The exchange and transfer of information	"Rush hour on the superhighway"
Instrument	How the Internet can help us to find information	"a machine for thought"
Network	The connection between different computers	"Surf the Net / Web"
Sea / Water	The search for information	"Surf / navigate the Internet"
Container / space	The storage of information	"Cyberspace is a few clicks away"
World	Describing and *experiencing* the Internet as a world	"Visit homepages and sites"

Table 4.2. Lakonder's (2000) metaphor categories

These categories were similar to Palmquist's metaphor families. Whilst this research provides some support for Palmquist, Lakonder's findings were only loosely based on empirical research. Interestingly however, Lakonder's research focused on two additional important issues. Firstly, Lakonder analysed the metaphor categories in terms of productivity. She argued that all of the above metaphors produced a wealth of related metaphors, except the sea/water category. The only parts of this metaphor family that map across from the source to the target Internet domain were the acts of *surfing* and *navigating*. Whilst these instantiations are frequently used, there are no instances of surfing boards, waves, or beaches on the Internet, just as there are no ships, captains or sailors. Thus, less productive metaphors, also known as idiosyncratic metaphorical expressions (Lakoff & Johnson, 1980), were not used systematically.

Finally, Lakonder raised an important usage issue concerning the metaphor categories. Whilst surveying the magazine articles, she noticed that metaphors were rarely used in isolation; several metaphors were used in conjunction in order to highlight different aspects of the Internet. Lakonder conjectured that the only way for users to comprehend all aspects of the Internet is to blend several metaphors (e.g. *surf* the *net*, *navigate* the *web*). In other words, single metaphors are not as effective at describing the complexity and multi-functionality of the Internet. User together multiple metaphors help us understand several aspects of the technology.

Palmquist's (1996) and Lakonder's (2000) studies are useful because they indicate which metaphor families were actively used in the communication of information about the Internet at that time. However, the main disadvantage is that they capture metaphors of the authors, not that of the readers. Furthermore, titles of articles are generally short and hence there is little opportunity for textual elaboration. The titles only summarise content, so the context of the metaphor is limited. Finally, in Palmquist's (1996), 25% of the identified metaphors defied classification and were assigned to the inevitable 'Other' category. This indicates a significant proportion of metaphors did not fall nicely into the prescribed metaphor classification.

4.3 INTERFACE METAPHORS

In early research, metaphor use was routinely recommended in interface design (Carroll, Mack & Kellogg, 1988; Coyne, 1995; Rohrer, 1995; Gold, 1997; Mandel, 1997; Stefik, 1997; Stone, et al., 2005). Some researchers asserted that user interface metaphors should closely match the way a user thinks of a specific task (Nielsen, 1993) and that interfaces should reflect users' metaphors (Hollan, Hutchin & Wetzman, 1984). Other researchers believed that familiar, everyday metaphors, such as desktops and indexes, should be the starting point for interface design, since users can interpret the interface based on their prior knowledge of the source of the metaphor (Carroll, Mack & Kellogg, 1988).

The majority of early work on Internet metaphors is more practically oriented; researchers discuss the characteristics that make Internet metaphors useful or productive. Carroll and Thomas (1982) provided eight recommendations for producing 'good' metaphors. The first recommendation is that metaphors be formulated on a case-by-case basis, taking into account the specific system to be metaphorically represented, as well as the given user population expected to use the system. Metaphors should be chosen that are most congruent with the system, and must be conducive to the emotional attitude of the user. When it is necessary to use multiple metaphors to represent a system, the fourth recommendation is that the metaphors need to be "similar enough, but not too similar" (Carroll & Thomas, 1982, p. 113). Designers need to consider the consequences of using particular metaphors, and to explicitly point out to the user that the metaphor is not a perfect representation of the underlying system. They should also provide users with exciting metaphors for routine work, and multiple metaphors which present different views of the system.

Madsen (1994) developed a set of usefulness criteria that require a good deal of evaluation by users, but his characteristics seemed insightful. A good metaphor is one that has richness of structure, applicability of structure, suitability and a well understood literal meaning. Richness of structure requires that the metaphor provides a variety of associations to meaningful other ideas or concepts. Applicability of structure requires that the metaphor provides a structure of associations that is not misleading to the user. Finally, the metaphor needs to be applicable and to have a well understood literal meaning to an intended audience. Norman (1988) describes 'good' metaphors as those that successfully transfer the designer's model of the system to the user. However, the mappings need to be coherent. That is, constraints and affordances of the metaphorical model need to accurately portray how the system really works.

Metaphors were also measured on how productive they are. For example, for some metaphors (e.g. highway metaphor) several aspects from the source domain can be mapped across to the Internet domain. Other metaphors are much less productive, whereby only a couple of instances are mapped across frequently. Rohrer (1997) discussed the many elements that map between the highway and the Internet (see Table 4.3).

Highway (Source)	**Internet (Target)**
Highway	Transmission pathways, cables
Vehicles	Computers, telephones
Goods transported	Information
Fuel	Electricity
Drivers	Users
Destinations	Information supply sites
Journey	Downloading (or uploading) information
Marketplace	Commercial information suppliers

Table 4.3. Rohrer's (1997) mapping of the Internet as highway metaphor

Research conducted contemporaneously to the current study focused on identifying the types of Internet metaphors. Based upon Lakoff and Johnson (1980) well-known classification scheme for metaphors, Barr, Biddle and Noble (2002) sought to provide a classification of commonly used interface metaphors. They identified five categories of metaphor: orientational, ontological, structural, process/element and novel/conventional (see Table 4.4).

Classification		Example
Novel / Conventional	*Orientational*	Progress is to the right
	Ontological	Files and documents
	Structural	Filing system
	~ *Process / Element*	Filing documents / icons

Table 4.4. Barr, Biddle and Noble's (2002) metaphor categories

Orientational metaphors involve explaining a concept in terms of space. These types of metaphors are used often in user-interfaces, particularly for quantification and navigation. Ontological metaphors explain concepts in terms of very basic categories such as objects and substances. They serve many purposes, such as referring, quantification, identification of aspects, identification of causes, and helping to set goals and motivate actions. Structural metaphors involve characterising the structure of one concept by comparing it to the structure of some other concept. These types of metaphors deal more directly with our experience of everyday life and are thus a more specific version of the ontological metaphor. Process and element metaphors are more specific forms of structural metaphor; they are used to explain how some aspect of system functionality works. An element metaphor however, is a perceivable aspect of the user-interface which is designed to aid the user in understanding what process metaphors are applicable. The *filing system* metaphor is also an example of a process metaphor; it enables users to work with the file-system by using a similar process used in their real life, thus transferring their knowledge of filing to the computer. Element metaphors act as perceptible cues (e.g. icons of folders) and can consist of graphics, sounds and text. The last category identified by Barr, et al., (2002) can be applied to the types already outlined. Simply put, conventional metaphors are those which are already used by the target audience without thinking (for example, complex structural metaphors, such as *the data is a document*). Conversely, novel metaphors will be consciously perceived because structure of the metaphor needs to be established instead of assumed.

Barr, et al.'s (2002) taxonomy highlights the presence of orientational metaphors. However, orientational metaphors are strongly based in our physical and cultural experiences of the world. The orientational metaphor of progress moving to the right comes from our experience of reading text. This experience therefore is highly cultural as not all cultures read from left to right. Similarly, Barr, et al.'s classification of novel/conventional metaphors are specific to a particular user group. Some metaphors which are conventional to one group may be novel to another. Further research is needed to understand which metaphors prospective users will take as being conventional, and which they will see as being novel.

By providing generalised taxonomies of common metaphors, researchers aim to facilitate the design of more effective interfaces and devices better adapted to users and user groups (Still, 2007). These initial studies suggested the existence of general topical categories from which more refined studies might be derived. However, the key to designing information navigation interfaces lies in discovering how *users* naturally conceive of information spaces. The vast majority of the research cited above is designer- or researcher-led speculation, rather than user-generated understandings of Internet metaphors. If users think metaphorically about the Internet, then it is imperative to understand what the user thinks of the system. Theoretical and philosophical meanderings of designers and researchers, whilst informative, do not help us to get to the crux of the issue: the only way to investigate how users understand, experience and utilise Internet metaphors is to study users themselves.

4.3.1 Problems with Interface metaphors

The idea of metaphor in user interface design has a troubled history and an uncertain status today (Blackwell, 2006). An enthusiastic initial adoption was replaced by the recognition of the drawbacks of metaphor mismatches. At the end of the twentieth century, metaphor became the target of regular complaints from researchers about the generality of the concept, its theoretical accuracy, and its applicability (McGrenere & Ho, 2002; Bærentsen & Trettvik, 2002; Torenvliet, 2003). User interface guidelines and handbooks backed off, afraid to support or spurn metaphor use in HCI. The silence is most stunning in the *Handbook of Human Computer Interaction*, a 1,582 page volume in which only two of the sixty-two chapters even mention metaphors (Helander, et al., 1998). By the year 2000, investigations into the efficacy of metaphors found that metaphors are a mixed bag; unavoidable, useful, yet problematic (Wolfe, 2001).

Metaphors introduce a fundamental trade-off between the generation of novel insights and the possibility of dangerous or even deadly misappropriation (Ratto, 2006). Perhaps the most widely-known example of how metaphorical elements can cause misunderstanding was Macintosh's use of the trash can to eject a disk. Usually, when a user wishes to delete a file, they simply drag it to the trash can icon and the file is deleted automatically. Thus, associating the function of the non-metaphorical 'trash can' with the function expressed by the metaphorical icon is clear to the user. However, the problem arises for Macintosh users in that to eject a disk from the computer, then the icon symbolising the disk has to be grabbed, and dropped into the trash can. Many users experience confusion and then anxiety when dropping disks full of data into the trash can, for fear that they are irretrievably erasing important information instead of simply removing the disk. Nearly every user has already been in the unpleasant situation when they have accidentally erased files which they wanted to keep. Thus, if a situation occurs when files which are intended to be kept are somehow associated with an operation (the throwing into the trash can) which has something to do with destroying, this evokes confusion and tension. Rohrer (1995) suggests that metaphors are most intuitive to users when they are fairly literal, as in deleting a document by tossing it in the trash can. But metaphors can also be confusing when they are extended in important ways which do not precisely mimic their analogues. If the metaphor contains misleading attributes, it can lead users to utilise the interface incorrectly because they assume it can do things that the source object can. You cannot, for instance, clear your virtual desktop with one swipe as you could with your analog one. If applied inefficaciously, metaphors can be misleading and allow for false affordances (Mohnkern, 1997).

Additionally, problems arise through the application of spatial (and often linear) metaphorical representations. Hypertext navigation is rarely linear in practice; as

McLuhan (1967, p. 63) astutely noted[11] “our electrically-configured world has forced us to move from the habit of data classification to the mode of pattern recognition. We can no longer build serially, block-by-block, step-by-step, because …all factors of the environment co-exist in a state of active interplay”. However, users often apply metaphors of the physical environment, such as employing stepwise path following, which enables users to retrace their path one page at a time. Furthermore, there is evidence to suggest that representing the Internet in spider diagram fashion is not most efficient way of thinking about and navigating this online space (Chen & Stanney, 1999).

Linear models of navigation highlight the power of metaphors to conceal rather than illuminate all the functions of a new technology. For example, if users think of the Internet as a ‘cyberspace’, it may mask the Internet’s potential to serve as a surveillance mechanism. Similarly, if the Internet is conceptualised a waterscape or ocean to be ‘surfed’, it could possibly interfere with the understanding that each node on the Internet is a networked connection with a set of clearly defined paths and protocols.

Some interface metaphors do not scale well. The basic desktop metaphor is well suited for managing and organising several hundred documents. However, it reached its limits with file systems that contain tens of thousands of files, which is a typical number for most personal computer systems today. For even bigger systems, like the Internet a desktop metaphor is totally inadequate (Dieberger, 1998). Nardi and Zarmer (1993) argued that metaphors are inadequate in interfaces for information intensive applications, such as the Internet, because they cannot convey the complex applications semantics with any precision. Thus, the utility of metaphor is limited to the learner’s first encounter, and the problems of understanding the deeper complexity of the system remain.

Lastly, the Internet is too complex a phenomenon to be fully contained by any one metaphor. As the user must traverse a more hyperlinked and distributed environment, the complexity of that reality is particularly difficult to capture in a

[11] McLuhan’s insights were revolutionary at the time, prophesising the social effects of the Internet decades before it became a reality.

single metaphor. For example, the use of the 'library' metaphor considers only what is possible with specific types of technology, and then restricts the meaning of the metaphorical referent to that narrow conception. That is, we do not see the technology as restricted because we redefine the social phenomenon to include only what is technically possible. Maintaining a consistent extension of a single metaphor may blind us to aspects of the Internet that are ignored or hidden by that metaphor (Lakoff & Johnson, 2003). This means that it may be more beneficial to conceptualise alternative metaphors even at the expense of completeness and consistency. Also, users need to be aware of their metaphors, to be concerned with what they hide, and to be open to alternative metaphors even if they are inconsistent with the current favourites.

4.4 DESIGNERS' METAPHORS VERSUS USERS' METAPHORS

Metaphors aid designers as a source of organisation and a decision guide about how to represent information. Designers are starting to implement metaphors that move beyond the two-dimensional desktop into more immersive digital environments. For example, building upon users' inherent abilities to navigate in space, Altom, et al. (2004) developed an interface for three-dimensional file navigation. MountainView is a fully 3D environment with rendered mountains and simple terrain. Users can 'fly' around one or more mountains, which contain thumbnails of memos, documents, spreadsheets, databases, or other files (Figure 4.2).

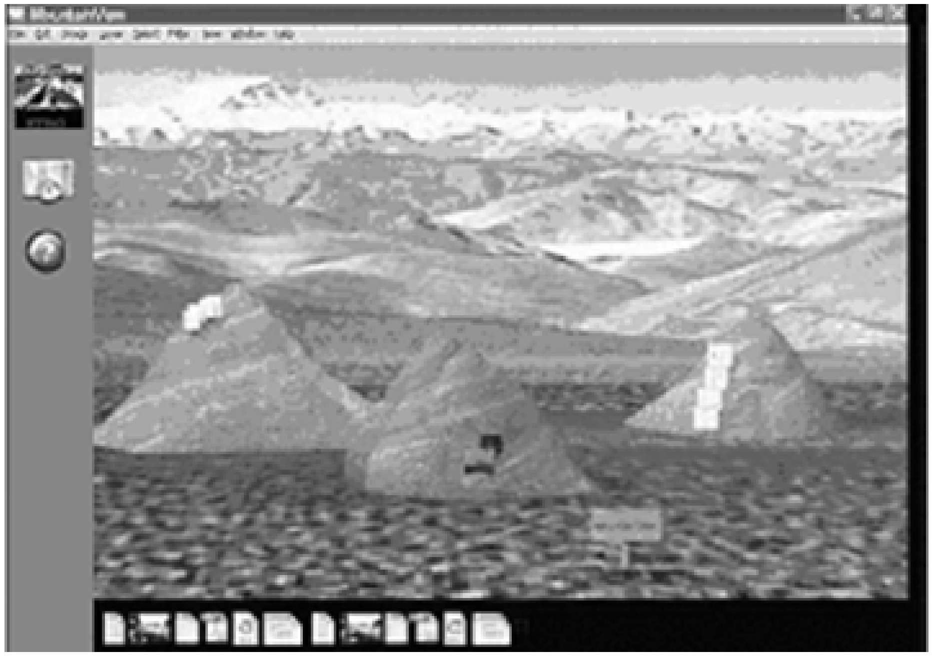

Figure 4.2. Screen capture of MountainView interface

Initial testing of the interface indicated that users reported that the metaphor was intuitive for navigating between the 'mountains' of files. As a navigational tool, the MountainView interface assisted users with identifying current position and orientation, demonstrating the surrounding and guiding navigation. However, beyond the navigational affordances, the metaphor was ineffective. Users reported having trouble locating and managing files (a core function for any file management system). The aesthetic appeal of the MountainView interface actually undermined its usability; the visual 'noise' was distracting and meaningless, rather than functional. Research has shown that simple graphics are more effective than detailed images, because they only show information that is relevant to the task at hand, thereby reducing the time and cognitive resources required to process the information (Clark & Lyons, 2004). Furthermore, interface metaphors that tend to leverage solely the visual modality, still often render users 'lost' within the computer world (Sellen & Nicol, 1990). This disorientation can occur due to inadequate design (e.g. missing cues, poor organisational structure) or user shortcomings (e.g. low spatial ability) (Stanney & Salvendy 1994; 1995).

In the case of the MountainView interface, the inefficacy of the metaphor was in large part caused by the dissonance experienced by users from associating mountains and files. Advanced navigational metaphoric concepts should minimise cognitive leaps between the metaphor and the function it conveys. Thus, whilst the 3D mountain environment afforded navigation through space, users were not able to understand how the mountain metaphor could enable them to manage their files.

The MountainView interface is a prime example of designers implementing a metaphor without investigating whether users would find it efficacious to represent their interaction with the Internet in this way. Although usability testing was conducted, it was based designers' assessment of users' expectations. However, people frequently behave in ways that appear counter-intuitive to the designer (Smith, 1997).

In referring to Norman's (1988) design model (Figure 3.4) Johnson and Henderson (2002) assert that the Design Model is most crucial for the success by which users are able to use a technology. They argue that the designer should first craft an explicit conceptual model and then implement that design into the user interface. The user therefore can interact with the technology and work out the conceptual model that the designers intended. The resulting product or service will be simpler, more coherent, and easier to learn. However, problems arise if the user's mental model does not correspond to the designer's model. The designer only communicates with the user via the System Image, which is open to interpretation by the user.

Users can potentially understand and metaphorically represent the technology in a myriad of ways. As Wyatt (1998, p. 1) notes, "highways, railroads, webs, tidal waves, matrices, libraries, shopping malls, village squares and town halls all appear in discussions of the Internet". It is imperative therefore to understand the users' model for how the system functions. Users will frequently bring their own metaphors to bear on the domain. Users are in principle free to understand the technology in quite different ways from those that designers intended (Hine, 2000).

The exact use of a device may be hard to foresee. Once the technology enters the 'information ecology' (Nardi & O'Day, 1999), uses become unpredictable, since nobody can foretell the vast variety of settings in which a technological product will be eventually used. Furthermore, it is difficult to integrate a new technology into the existing system of people, practices and technologies, because information ecologies are diverse, continually evolving, and "marked by strong interrelationships and dependencies among its different parts" (Nardi & O'Day, 1999, p. 51). For this reason, before releasing a technical artefact in the market and sometimes even periodically throughout its life, it is highly recommended to test the users' interpretations (Gamberini & Valentini, 2001). However, in the case of interface metaphors, this recommendation is still overlooked.

4.5 PROBLEMS WITH THE USER-CENTRED DESIGN LITERATURE

Researchers routinely advocate building user-centred systems which enable people to reach their goals, take account of natural human limitations, and generally are intuitive, efficient and pleasurable to use (Preece, Rogers & Sharp, 2002). However, most research is driven by technological motives rather than user-centred principles (Kjeldskov & Graham, 2003).

HCI seeks to support human beings interacting with and through technology. Much of the structure of this interaction derives from the technology, and many of the interventions must be made through the design of technology (Carroll, 1997). Thus, an underlying, albeit false, presumption among technology-driven researchers is that the main problem in research is a technological one. In the provocative book, *The Sciences of the Artificial*, Simon (1969) discusses the apparently complex path of an ant traversing a beach, observing that the structure of the ant's behaviour derives chiefly from the beach; the ant pursues a relatively simple goal and accommodates to whatever the beach presents. In this analogy, the beach represents technology; it is assumed that technology should be expected to play a powerful role in structuring human behaviour and experience. In other words, humans should adapt to the terrain of technology, rather than vice versa. The emphasis therefore is on the technology, rather than the human user. Although the book entirely predates HCI, and many of its specific characterisations and claims are no longer authoritative, Simon's analogy echoes through the history of HCI and still provides guidance in charting its continuing development (Carroll, 1997).

Furthermore, the technical focus is not restricted to the objective measures of usability. Hornbæk (2006) states that the vast majority subjective satisfaction measures are conducted after users used the interface. According to Mulder and Steen (2005, p. 1), “many projects aim to put end-users central … but very often this ambition is not completely realised. More often than not a technological perspective is leading. For example: end-users may be invited to react to prototypes only after they are finished”. Users are often not embedded in a continuous user-centric process. In most cases, they are only involved in one single stage (e.g. usability testing) or only in the final stages of the process (e.g. evaluating) (Haddon et al., 2006). For research to be truly user-centric, users should be involved in setting design goals and planning prototypes, instead of becoming involved only after initial prototypes exist (Carroll, 1997). Users should be involved throughout the whole development process (not only in the evaluation phases), and insight in the user’s expectations and requirements should even serve as a starting point for the development of a new product or application.

CHAPTER 5. USERS AND THEIR INTERNET METAPHORS

Figure 5.1. The interaction between computer and user. © Randy Glasbergen

5.1 INTRODUCTION

Studies of the Internet are, by its nature, studies of the end user. In order to understand Internet users, it is necessary to examine their conceptualisations of the technology. Furthermore, users must be anticipated in all their diversity (Livingstone, 2007). It is important to garner the salient individual characteristics of the Internet user population. Without understanding these basic user characteristics, researchers are "target shooting in a darkened room" (Johnson, 2007). The following chapter examines users' metaphoric perceptions of the Internet. It highlights how metaphors are utilised by different groups of users. Next, it discusses some of the salient demographic characteristics of Internet users during the time period contemporaneous to the current research (2001-2004). Where possible, it discusses how these demographic characteristics have changed to the current day.

5.2 USERS' METAPHORS OF THE INTERNET

There is a paucity of research that examines users' metaphors of the Internet. Matlock and Maglio (1996) found that users often refer to the Internet as a multi-dimensional landscape. Obtaining information was expressed as traversing interconnected paths towards locations that contain information objects. Some of the objects were referred to as two dimensional (e.g. "*at* AltaVista" indicating a point on a 2-D plane), whereas others are three dimensional (e.g. "*in* Yahoo!", suggesting a 3-D container). In later research, Maglio and Matlock (1998) focused on how users metaphorically refer to the active process of accessing information on the Internet. Maglio and Matlock identified seven types of metaphor, which represent distinct information seeking actions (see Table 5.1).

Classification	**Example Actions**
Outside	Click, press, type, scroll
Trajectory	Go, come, bring, follow
~ *User agent*	Go, follow
~ *Web agent*	Bring, come up
Container	Have, contain
Information Action	Look for, lookup, search
Miscellaneous	See

Table 5.1. Maglio and Matlock's (1998) metaphor categories

Responses referring to typing on the keyboard, clicking the mouse and so forth, constituted 'outside actions'. Expressions conveying information movement were coded as 'Trajectory' actions; these responses were further split into actions in which the users is the agent (e.g. *I went*…) and those in which the web is the agent (e.g. it *took me to…*). The fifth type of metaphor referred to website as containers; the sixth refers to information actions (e.g. I looked up information). The final category collected other metaphors not included in the previous classifications.

Bruce (1999) aimed to gather insights into what people think when they search the Internet for information. Data were collected from 37 academics via a structured interview. Two dominant metaphorical themes emerged: (1) organised/information base/library and (2) networks/interconnected/connectivity. The first category of metaphors emphasise the information aspects of the Internet; the second category emphasises connectivity and structure. Analogies that emphasise information aspects of the Internet were the more common. Both themes provide some acknowledgment of the Internet as an information environment. However, whereas one conceptualisation emphasises information, the other is a structural perception, implying that connectivity between information users and information resources is the primary objective.

Contemporary research conducted by Ratzan (1998; 2000) examined how Internet users metaphorically think about the Internet. Three hundred and fifty Internet users completed an Internet-based questionnaire, asking about level and extent of use, age, gender and skill level. In addition to this basic demographic data, Ratzan asked participants to provide open-ended descriptions of the Internet. Based on their own descriptions, participants were then asked to categorise their own metaphors into one of five categories provided by Ratzan (derived from his classification of metaphors in an offline pilot study). Table 5.2 describes Ratzan's categories and provides examples of each. Finally, using a 7-point Likert scale, Ratzan asked participants to rate how likely they would think of the Internet in terms of Palmquist's (1996) metaphor categories.

Category	**Description**	**Examples**
Open Place	A location; having no confining boundaries, extending	Ocean, road, highway
Closed Place	A location; having distinct borders or shape, contained	Library, building
Animate Object	Living thing, animal, plant or person	Spider, worm, army
Inanimate Object	Non-living thing or object	Tool, object, container
Other	None of the above	

Table 5.2. Ratzan's (1998; 2000) metaphor categories

In terms of users' own descriptions of the Internet, Ratzan found that the theme of 'Information' dominated user perceptions of the Internet. Interestingly, those who used this metaphor tended to describe it more often as an *information source* rather than as an *information conduit* (as in highway). The second and third most common themes were that of Library and Network. The phrase 'information superhighway', which appears often in the mass media, did not occur frequently.

Palmquist (2001) examined users' metaphors of the Web. Users were asked to choose a preferred Web metaphor from a list derived from Palmquist's earlier research (which identified eight metaphor families used in popular magazine articles). Users were also able to provide their own metaphorical description, including providing an explaining for the reasons why certain metaphors were preferable or appropriate. Palmquist found that the choice of ‘highway’ and ‘frontier’ were the preferred metaphors for 60% of the respondents.

5.2.1 User variation in Internet metaphors

Maglio and Matlock (1998) investigated how users of varying levels of expertise metaphorically talk about the information seeking on the Web. Maglio and Matlock categorised their results (see Table 5.1) according to two levels of expertise (novice vs. expert users). They found significant differences in the types of metaphors evoked according to skill level. Experts tended to use the trajectory metaphors more often than novices. Additionally, experts viewed themselves as the agent (i.e. moving through the information space), rather than the web as agent (i.e. information moves through the web). Novices more often viewed web sites as containers than experts. Accordingly, for novices the web passively contains information, whereas for experts the web actively provides information.
Overall, web users (novice and experienced alike) talked about using the web as if they had been moving from place to place. This indicates the primacy of motion metaphors when talking about information seeking on the Internet. The results also indicate a striking difference between experienced and novice users in how they perceive information access on the Internet.

Ratzan (2000) explored how differently skilled Internet users metaphorically understand the Internet. Ratzan categorised his results (see Table 5.2) according to varying levels of expertise, and gender. His results indicate a decreasing relationship between the use of place metaphors from novices to experts. It might suggest that the user cognitive images of the Internet as a location in space changes or evolves as the level of skill increases. Conversely however, the frequency of describing the Internet as an object (tangible or intangible) seemed to steadily increase as skill level increased. Furthermore, he found that novices tended to use finite and tangible metaphors while experts tended to use more metaphysical, intangible metaphors. Ratzan suggests that this may indicate the lack of comfort level of the low user to conceptualise something amorphously vast and the significant ability of experts to do so.

Men and women appeared to project different self-perceptions of themselves as Internet users. Men tended to consider themselves as higher skilled users while women tended to perceive themselves as lesser skilled on-line users. Females were more likely to use highway and frontier metaphors than did males and this held true over all age categories. Ratzan concluded that metaphors appear to manifest only a few dominant themes and may function as subtle markers. He speculates that Internet metaphors may have potential as a basis for assessing Internet users' skill and other parameters.

Palmquist (2001) investigated whether metaphor use is related to the users' gender and level of database search experience. In addition to obtaining information about users' preferred metaphor of the Internet, users completed a short demographic questionnaire (which collected information on their gender, level of computer experience, level of Web search experience, and commercial database search experience). Palmquist found that there was a significant gender divide in preferred metaphors: female participants strongly preferred the 'highway' metaphor, while male participants were more drawn to the 'frontier' metaphor.

Maglio, et al. (1998), Ratzan's (1998; 2000) and Palmquist's (2001) research is certainly one step closer towards achieving understanding of users' metaphors of the Internet. Whilst these studies are empirically based (rather than theoretically derived), they have important limitations. Whilst the studies provided a forum for users to provide their own Internet descriptions, during the analysis they still imposed preconceived, researcher-led categories onto the data. Indeed, although Palmquist (2001) can be credited for obtaining further empirical support of her (1996) classification scheme, it is important to remember that the metaphor taxonomy is derived from the researcher, not the user. Palmquist's subsequent research therefore seeks to confirm her own predetermined classification system of metaphor families. The metaphors themselves are not directly derived from the Internet users, rather authors of Internet articles. This is an important observation because it can introduce researcher bias and not be representative of the actual user population. In this way, there still is a tendency to privilege knowledge *about* end-users over knowledge *of* end-users.

5.3 USERS OF THE INTERNET

The Internet is a multifaceted tool that can be described, utilised and understood in a myriad of ways, each unique to the perspective of its user. There is a healthy interest in understanding children (Bilal, 2002; Tsai, 2004; Yan, 2006; Livingstone, 2006; Livingstone & Bober, 2007; Heim, et al., 2007), people with disabilities (Tak & Hong, 2005), the aging population (Selwyn, 2004; Adams, et al., 2005) and specialised target user groups (e.g. teachers: Levin, et al., 1999; Bruce, 1999).

These studies indicate that users of varying demographic backgrounds have a striking diversity of conceptual representations for the Internet. Internet adoption has grown rapidly since the mid 1990s. In 2003, 63% of Americans and 59% of Britons use the Internet; in 2008, 74% and 67% were online respectively (Jones & Fox, 2009; Dutton & Helsper, 2007). Demographic and expertise variables are all shown to play a role in accounting for variations in the breadth and depth of Internet use (Livingstone, 2003; Livingstone & Helsper, 2007).

Gender differences in Internet use have diminished since 1995, when almost 95% of Internet users were male (GVU Surveys, 1999). In both the USA and UK, almost equal proportions of males and females use the Internet[12]. Age differences in Internet use indicate that older people use the Internet less than younger people, although age differences do not clearly emerge until mid-life. Contemporary literature shows that seniors going online in larger numbers and are becoming increasingly comfortable with Internet technology (Harwood, 2004; Fox, 2006). Education is also strongly related to Internet use. Approximately half of those with basic education (up to secondary school) use the Internet while most (90%) of those with further education use the Internet.

Internet experience emerges as an important factor in determining the overall presence of users. Numerous studies cite the importance of Internet experience and skill as a primary predictor for the activities that are pursued on the Internet (Howard et al., 2002; Quan-Haase, Wellman, & Haythornthwaite, 2002; Rainie &

[12] USA data: Pew Internet and American Life Project, (2007a; 2007b). UK data: Dutton & Helsper, (2007)

Bell, 2004). According to Horrigan and Rainie (2002), the number of years a person has been online is “a strong predictor of the amount of time they spend online, the frequency with which they log on, and the scope and frequency with which they engage” (p. 138). Buente and Robbin (2008) found that there has been a sharp increase in the experience level of Internet users since 2002. In the UK, in 2005 only a quarter (25%) had used the Internet for more than 5 years; in 2007 it increased to 41% (Dutton and Helsper, 2007). The proportion of US users that have five or more years of experience is significantly higher (70%).

5.3.1 Internet self-efficacy

In addition to exploring years of experience using the technology, it is also useful to examine the extent to which users perceive themselves to be skilled using the technology. Computer self-efficacy is an individual's judgment of their ability to perform a computer related task (Compeau & Higgins, 1995). It has received substantial empirical support as an antecedent to technology use. Recent studies show that self-efficacy is related to computer anxiety (Beckers & Schmidt, 2001), training (Chou, 2001), and task performance (Nahl 1996; 1997; Ren, 2000; Jawahar & Elango, 2001; Thompson, Meriac, & Cope, 2002). Compeau and Higgins (1999) report that self-efficacy will not only predict technology use over a period of time, but will influence choices about what technologies to adopt and how each will be used.

Internet self-efficacy indicates users’ self-perceived confidence and expectations of using the Internet (Eastin & LaRose, 2000). Arguably, using the Internet requires skills additional to traditional computer use (e.g., users must learn how to establish and maintain an Internet connection, learn effective searching strategies, as well as be able to use the multitude of applications it offers) and thus the concept warrants its own research. Recent studies show that users with high levels of efficacy may display better performance in Web-based learning tasks (Tsai & Tsai, 2003). Research indicates that females may have lower levels of Internet self-efficacy than males (Durndell & Haag, 2002).

Studies have found a relationship between positive attitudes and high self efficacy, which in turn are important factors in determining frequency and types of Internet usage (Sam, Othman & Nordin, 2005; Ying-Tien & Tsai, 2006). Ren (1999) found a positive correlation between perceptions of self-efficacy and levels of Internet use. Whitty and McLaughlin (2007) found a relationship between self efficacy and types of Internet use; undergraduates with higher levels of Internet self-efficacy were more likely to use the Internet for computer-based entertainment and to facilitate offline entertainment.

It is evident that self efficacy plays an important explanatory role in determining if an individual is going to utilise the resources available online (Whitty & McLaughlin, 2007). However, the concept of self efficacy does not go without criticism. Firstly, the delineation between self efficacy and other related variables is not always clear. Whereas some researchers argue that computer self-confidence, computer attitudes and computer anxiety are so closely related that they are actually part of the same construct (Colley, Gale, & Harris, 1994; Levine & Donitsa-Schmidt, 1998), others have identified computer use and acceptance as important separate determinants (Hong, Thong, Wong, & Tam, 2002; Venkatesh & Davis, 1996).

An additional complicating factor is the questionable accuracy of the self-evaluation of Internet skills. Research indicates that users often have preconceived notions of their skill which can lead them to estimate their actual performance inaccurately (Ehrlinger & Dunning, 2003). In fact, Dunning, Johnson, Ehrlinger, and Kruger (2003) report that user's perception of their skills tend to be opposite of their actual skill. Thus, contrary to the majority of research that reports a correlation between high self efficacy and increased performance, recent studies indicate that overconfidence can lead to a negative relationship between self-efficacy and performance over time (Moores & Chang, 2009). Indeed, a final criticism of the self efficacy construct centres around that issue that self-efficacy ratings are not stable over time (Mitchell, Hopper, Daniels, George-Falvy, & James, 1994; Stajkovic & Luthans, 1998) and can be easily manipulated via increased experience and exposure to computers (e.g. Hasan, 2003). Self efficacy scales may therefore be best used in conjunction with other scales (such as computer anxiety and attitudes) for a more complete understanding of computer usage (Fazio & Petty, 2008).

5.3.2 Attitudes

Attitudes toward the Internet are related to Internet self efficacy. Users' attitudes may also influence their motivation and interests toward learning to use the Internet (Coffin & MacIntyre, 1999). Many attitudinal predictors of technological expertise are affective: subjective feelings of comfort and competence with computers or the Internet, computer phobias, attitudes towards new technology, and the perceived importance of computers (Morahan-Martin & Schumacher, 2007).

At the time of the data collection for this study, Jackson, et al., (2003) reported that users have very positive attitudes about the Internet, and more so if they use it more. This trend appears to have continued to the current day. In a recent survey of British people's attitudes towards the Internet, Dutton and Helsper (2007) found that users are generally positive about the Internet and technologies. They think it is an efficient means of gaining information, that it makes life easier and disagree that it is frustrating to work with. Internet users tend to have positive attitudes towards the social impact the Internet has had on their lives.

However, perceptions of the Internet are not uniformly rosy. Negative attitudes towards the Internet usually surround issues of privacy, information reliability and potential harm to children from using the Internet (UCLA Internet Report, 2001). Recently, Dutton and Helsper (2007) found that 88% worry about credit card information being abused online. Interestingly, non-users are more worried about threats to personal privacy by technology than users of the Internet. The majority of those surveyed also agree that the Internet can be addictive. Furthermore, just over 50% agreed that there is too much immoral material online and that the Internet is complex to use (ibid.).

Jackson, et al. (2003) found that both positive and negative attitudes predict use, even after controlling for demographic variables (such as gender, race, and age). As expected, some negative attitudes predicted less use (for example, believing that children can be harmed by using the Internet). However, some negative attitudes predicted more Internet use (for example, believing there is no privacy on the Internet). Jackson, et al. (2003) explain these unusual results in terms of informed attitudes. Less trusting attitudes can be constructed as more informed attitudes towards the Internet, which in turns predicts greater Internet use.

Lee and Anderson (2001) used Q methodology to classify Internet users according to their attitudes towards the Internet. ‘Assimilators’ look forward to further developments in Internet technology and agree that technological change would be beneficial rather than harmful to society and its culture. ‘Convenience Users’ wish to have better search engines in order to speed up Internet use, and lament the sheer amount of information available on the Internet. ‘Reluctant Users’ prefer face-to-face interaction with other people and have a fear that the seductive power of the Internet might change their lifestyle. Interestingly, respondents’ gender and level of perceived Internet skill seemed to be factor predictors. Assimilators included more females than males; Reluctant Users were equally divided between males and females, but were characterised by the highest percentage of purported inexperienced users. This study indicates the interplay between Internet attitudes, perceived skill and Internet use.

5.4 USING THE INTERNET

As Chapter 10 outlines, data was collected for the current study during 2003/2004. As such, it is useful to identify how the Internet was used and who was more likely to engage in these activities during this critical time period. There are a multitude of different purposes for which people use the Internet. Uses include connecting with other people through e-mail, gathering general or topic-related news (political, financial, medical, job-related and hobby-related information) , doing research, surfing just for fun, online shopping, and buying and selling financial instruments (Pew Internet and American Life Project, 2006). They can be broadly broken down into four predominant usage needs: communication, information, entertainment and commerce (Shah, Kwak & Holbert, 2001; Johnson & Kaye, 2003; Stafford, Stafford, and Schkade, 2004; Buente & Robbin, 2008). The following section highlights that certain user groups have an increased propensity to embark on certain online activities.

5.4.1 Communication

Communication was the principle use of the Internet, even as new services and applications became available and easier to accomplish (Madden, 2003). Over 90% of Internet users sent emails, and almost two-thirds (60%) used instant messaging. Although chat rooms had existed for some time, their popularity remained muted in both the UK and US. Research remains inconclusive whether a gender divide existed regards communication activities on the Internet. Typically, women used the Internet more often to communicate with others, whereas men used it for entertainment (Jackson, Erving, Gardner & Schmitt, 2001; Morahan-Martin, 1998).

Recent research by Joiner, et al., (2005) found no gender difference in communication activities. Dutton and Helsper (2007) found that, contrary to common assumptions, men undertake more communicative activities on average than do women. Since 2003/2004, newer ways of communicating online, such as making and receiving phone calls, have been becoming increasingly popular; a fifth of Britons utilise the Internet to make a phone call (Dutton & Helsper, 2007). Although the vast majority of Internet users use email, the rise in popularity of social networking sites has enhanced existing possibilities for communicating and interacting with others, such as emailing, chatting and blogging[13]. Approximately one fifth of British Internet users have created a profile on a social networking site. Although men are more likely than women to have created an online profile, the largest difference in the use of social networking sites is based on age. Students are three times as likely (42%) as employed users (15%) to have a profile and almost no retired users (2%) have such a profile (Dutton & Helsper, 2007).

[13] See Appendix 15 for Glossary of Technical Terms.

5.4.2. Information gathering

In 2003, the gathering of task-related information was a core aspect of information use behaviour. When facing a vast collection of information, users usually have one of three possible information seeking strategies: searching for specific information, browsing for general information, or exploring just for fun (Catledge & Pitkow, 1995). The vast majority of Americans reported using search engines to find specific information, although almost two-thirds indicated that they explore the Internet (Madden, 2003). By December 2002, those seeking health information online grew by 59%, those seeking religious information online doubled, whilst those searching for political news and information online grew by 57% (ibid.).

Recent studies indicate that users are more likely to use both search engines and specific bookmarked pages to look for information (Dutton & Helsper, 2007). In Britain, the most popular types of information are those associated with leisure activities such as travel plans and finding out about local events. Americans are also interested in locating travel information, but the predominant category searched for concerns health-related information. Fox (2006) found that 80% of American Internet users have searched for information on at least one of seventeen health topics. Alarmingly, over three-quarters of health seekers rarely check the source credibility, which translates to about 85 million Americans gathering health advice online without consistently examining the quality indicators of the information they find (ibid.). In addition to travel, news and health information, approximately half of those surveyed in the UK and USA use the Internet to find sports, humorous and job-related information.

5.4.3 Entertainment and Commerce

The Internet is much more than simply a mechanism for communication and information dissemination. Another important reason users cited for the Internet improving various aspects of their life is that it enhanced their ability to pursue hobbies and interests (Howard, Rainie & Jones, 2001; Madden, 2003). Internet-ready game consoles, increasing bandwidth, and computers primed for multimedia, have made gaming an increasingly popular form of entertainment. Approximately a third of American adults and almost one half of British users played online games; however, this proportion increases significantly in younger uses (Jones, 2003).

Since 2003/2004, the growing adoption of broadband has helped increase the numbers of users that download music and videos. Over half of American users have used the Internet to watch or download video; only a third of Britons have downloaded videos, but are much more likely than Americans to use the Internet to download music (Pew Internet and American Life Project, 2007c; Dutton & Helsper, 2007). Furthermore, there appears to be a gender difference regards entertainment activities online. Men engage in entertainment and leisure activities online more frequently than do women. They spend more time surfing the web, playing games, downloading music and videos, listening to the radio and looking at adult sites with sexual content (Dutton & Helsper, 2007).

E-commerce is also a growing area of activity. In 2003, the most popular online commercial activity was getting information about a product online; this was followed by buying products and services and making travel reservations (Madden, 2003). Ever increasing numbers of users began using the Internet to conduct important financial transactions (ibid.). Recently, Fox and Beier (2005) found that although online banking is holding steady as a mainstream Internet activity, its growth is not accelerating as have some other forms of online activities. This can perhaps be explained by what analysts dub the ‘trust gap’; trust is a big factor in choosing to banking online in spite of news headlines about identity theft and phishing[14].

[14] See Appendix 15 for Glossary of Technical Terms.

CHAPTER 6. METHODOLOGICAL AND EPISTEMOLOGICAL ISSUES

"No sane person should believe that something is 'subjective' merely because it cannot be settled beyond controversy"

Figure 6.1. Hilary Putnam, The Many Faces of Realism, (1987, p. 71).

6.1 INTRODUCTION

The purpose of this chapter is to discuss the rationale for selecting Q Methodology as a method to study users' metaphors of the Internet. Firstly, it introduces some of the common methods used in usability testing, usability inspection and usability inquiry. It justifies the use of Q Methodology as a participatory design technique that examines users' subjective understandings of a given topic. It addresses combining Q Methodology with questionnaire data in order to examine the relationship between types of metaphors and specific groups of Internet users.

6.2 METHODOLOGICAL APPROACHES IN HCI

Given the relatively recent emergence of the HCI field, approaches to studying the Internet are by no means settled as an intellectual endeavour. Its disciplinary roots are diverse and its methods barely formed (Livingstone, 2005). As Chapter 2 discussed, one of the core domains of HCI research is the concept of usability, which refers to how well users can learn and use a product to achieve their goals and how satisfied they are with that process. An evaluation of the usability of a system involves the implementation of a variety of methods that examine how users interact with the system and assess whether the system's performance is acceptable.

Usability measures can be broadly broken down into three evaluation methods: testing, inspection and inquiry (Hom, 1998). Usability testing uses a variety of techniques (see Table 6.1) to evaluate a product by testing it on users. It is an invaluable practice since it gives direct input on how real users use the system. Designers will typically conduct a number of usability tests, in which users are observed interacting with the technology. Traditional usability testing typically occurs in a laboratory-like setting. Participants are brought into the test environment, a tester provides tasks to the participants, and the participants are instructed to think aloud by verbalising their thoughts as they perform the tasks. Usability testing requires some form of design or product to test. Since this thesis examines how users' conceptualise the Internet via their use of metaphor (and not their use of a particular metaphorical interface), usability testing techniques are not considered as methods for this research.

With the usability inspection approach, experts use different methods to evaluate a user interface without involving users (Table 6.1). It is widely acknowledged that to make a useful product, designers must consider the needs of the future users of the product to be designed. Users and designers often have differing knowledge of the product, which makes it very difficult for designers to consider users' needs (Norman, 1986). Usability inspection methods only involve the evaluation of a product by expert commentators; this thesis is concerned with *users'* understanding of the Internet and as such, these methods are not appropriate for this research.

Usability Testing	**Usability Inspection**	**Usability Inquiry**
Coaching Method Performance Measurement Question-asking Protocol Remote Testing Retrospective Testing Shadowing Method Teaching Method Thinking Aloud Protocol	Cognitive Walkthroughs Feature Inspection Heuristic Evaluation Pluralistic Walkthrough Perspective-based Inspection	Contextual Design ~ Field Observation ~ Focus Groups ~ Interviews ~ Questionnaires Participatory Design

Table 6.1. Common methods used in usability testing inspection and inquiry

6.3 BEYOND USABILITY TESTING

The usability inquiry approach is concerned with obtaining information about users' likes, dislikes, needs and understanding of the system by talking to them, observing them using the system in real work (not for the purpose of usability testing), or letting them answer questions verbally or in written form (Jacko & Stephanidis, 2003).

A variety of approaches and techniques for increasing user participation have been developed. Contextual design (Beyer & Holzblatt, 1997) enables researchers and designers to observe people doing tasks in their natural context. By using a variety of methods (field observation, focus groups and interviews), researchers get an understanding of the user in the contexts in which they use the system. These methods typically involve users at the beginning of the development process and at the end to test prototypes.

A significant advantage of contextual design is that the method is more a discovery process than an evaluative process; users become more of a partner in the design process. However, there still is a tendency to privilege knowledge *about* end-users over knowledge *of* end-users (Steen, et al., 2007). Designers risk inscribing their own views of the user, their activities and priorities. These are often 'the wrong values', based on an inadequate or misleading view of the user and their requirements (Stewart & Williams, 2005). Furthermore, whilst user involvement is increasingly common in the later phases of product development, it is less common to involve end-users in the early phases, for example, to participate in the problem definition at the start of a project. The 'fuzzy front end of innovation' (Koen et al., 2002) occurs at the early stages of a project, in which problems and opportunities, ideas and concepts are explored and articulated (Steen, et al., 2007). Thus, whilst focus groups, interviews and questionnaires can be beneficial for obtaining in-depth data about users, designer or researcher evaluations can be still privileged over users.

Participatory design techniques advocate active user participation throughout the design and research process. In participatory design, end-users are treated as experts as their knowledge (and skills) is brought into the development process. With participatory design methods, users' knowledge is privileged (Steen, et al., 2007). Participatory design acknowledges that there is no single best practice that could be used in all situations and offers thus a wide variety of different methods for designing. In fact, its fluidity and ambiguity has been regarded as one of its strengths (Elovaara, et al., 2006).

Although the centrality of user participation is gaining more momentum, there still remain a lot of difficulties concerning the actual process and role of involving the users. Whilst there are a number of well established methods to measure usability, it is substantially more difficult to systematically measure users' subjective knowledge and experience (Nicolajsen, et al., 2007). Researching users' conceptual models faces some serious challenges. It is concerned with people's generally implicit, yet complex and subtle understanding of the Internet, and these are difficult to ask about directly (Livingstone, Van Couvering, & Thumim, 2005). Operationalising user's understanding is difficult because of its highly subjective nature. Limonard and de Koning (2006, p. 176) refer to this as the "dilemma of user involvement": users cannot always articulate their expectations or predict what they expect to do with certain devices or applications. Measuring the subjective dimensions is often skipped or neglected because of the shorter product life cycles, time pressure, budgetary reasons, or simply because of ignorance (McNamara & Kirakowski, 2005). Measuring user subjective understandings thus calls for other methodologies than traditional usability measures. Such considerations are still rather limited in the field (Nicolajsen, et al., 2007). If understanding users' experience is a subjective and 'open-ended' matter (Drogseth, 2005), then a methodology that systematically examines subjective issues is necessary.

6.4 MEASURING SUBJECTIVITY

Subjectivity is ubiquitous and always somewhat at issue whenever human beings are involved. However, it is a complex phenomenon that has either eluded or been largely ignored by social scientists for some time. R Methodologists[15] (those operating in the established positivistic paradigm) are accustomed to thinking of subjectivity as 'noise' or 'psychometric slop'. Subjectivity is but idiosyncrasy, random error, an accident; it is what remains of an individual's objective test performance after all sources of variance have been partialled out. It is thought as unreliable and uncorrelated with anything else and therefore is not an appropriate subject matter for scientific scrutiny.

Other researches not operating within the traditional positivistic framework see subjectivity as an inherent part of human research. A variety of methods have been developed to study subjectivity. Researchers which utilise Q Methodology regard subjectivity as being a person's own point of view, made objective through formal

[15] The letter 'R' signifies a generalisation of Pearson's *r*, most often used in the behavioural study of relationships among analytically distinct traits, abilities and so on (McKeown & Thomas, 1988).

representation in a Q sort (Stephenson, 1953). Therefore, subjective response is not what is left over after the factoring process; the subjectivities themselves are the categories of response (Brown, 1972). Furthermore, these subjective expressions can often be found to operate in a lawful fashion. For example, one individual's appreciation of a musical piece may be correlated, in some broad way, with that of another individual, and this can be demonstrated and held steady for inspection (ibid.).

6.4.1 Using Q Methodology to measure subjective understanding

Developed by William Stephenson (1902-1989), Q Methodology is a research method used to examine how people subjectively think about a topic. Participants are asked to rank sort a sample of items (typically statements) into a subjectively meaningful pattern – this forms the 'Q sort'. The resultant Q sorts are factor analysed in order to reduce the many individual viewpoints down to a few "factors". The emergent factors represent shared ways of thinking about the topic.

Epistemologically, Q Methodology ruptures the boundaries between the positivistic and constructivist frameworks (Goldman, 1999). In studying subjectivity, Stephenson was not advocating a retreat "from the scientific standards of behaviour psychology back to the era of introspection in private worlds" (Cattell, 1951, p. 206, as cited in Brown, 1972). Subjectivity, for Stephenson, was no mysterious or romantic notion. Although subjectivity is anchored in self-reference, it does not mean that it is inaccessible to rigorous examination. In developing Q, Stephenson created a technique which allowed for the systematic measure of subjectivity. The operation for a subjective viewpoint can be translated into the ranking of stimulus objects, and it is this operation that provides the raw data for analysis. Through the ranking, the person's own viewpoint is made public, and without recourse to invoking the spirits: "one has not asked [the respondent] to introspect or to turn on his stream of consciousness; instead he has expressed his subjectivity operantly, modelling it in some manner as a Q sort. It remains his view point" (Stephenson, 1968, p. 501, as cited in Brown, 1972).

Therein lies the innovation that is Q Methodology; “[it] brings almost all that has been regarded hitherto as ‘subjective’ … into the domain of singular testable propositions” (Stephenson, 1952, p. 206 as cited in Brown, 1972). Stephenson accomplished the unthinkable and developed a methodology for the scientific study of human subjectivity.

The Q sorting process is wholly subjective in the sense that it represents ‘my point of view’. The factors which subsequently emerge represent functional categories of the subjectivities at issue, i.e., categories of ‘operant subjectivity’ (Stephenson, 1977). These sortings can be analysed objectively without entirely sacrificing the richness of the subjective data. As a small sample technique, Q provides depth rather than generalisability. It combines the strengths of both qualitative and quantitative research traditions and is considered to be a good launching pad for exploratory research (Sell & Brown, 1984).

Participants actively configure their own subjective representation of a topic, by modelling their viewpoint in the form of a Q sort. Meaning is not a categorical construct in Q; rather, it is thoroughly contextual, discursive and social. It is formative, emergent and contingent, an empirical abstraction which must be elaborated and understood, rather than reduced (Goldman, 1999). This approach is a significant advantage over other qualitative analysis techniques. Typically, once texts have been gathered, the task becomes one of organisation, analysis, and presentation, and in most instances the researcher superimposes categories on the data. Q methodology likewise involves the artificial categorising of statements (via factor analysis), but ultimately this artificiality is replaced by categories that are meaningful to the sorter. Thus, it is users’ own meanings that are used to categorise the data, not research-led categories that are ascribed *a priori.*

Stephenson’s ideas represented a radical philosophical and statistical shift in thinking. For many years, his ideas were shunned by a long list of eminent researchers (including the likes of Burt, Banks, Cattell, Eysenck and others). As R proponents outnumbered Q proponents, the controversy gradually subsided and Q came to be relegated to a rather minor position. However, in recent years, Q methodology has been successfully applied to many diverse topics; for example, chronic pain (Risdon, Eccleston, Crombez & McCracken, 2003), environmental issues (Addams & Proops, 2000; Capdevila & Stainton Rogers, 2000), family roles (Chusid & Cochran, 1989), gender conformity (Brownlie, 2006), health and illness (Van Exel, de Graaf & Brouwer, 2006), jealousy (Stenner & Stainton Rogers, 1998), love (Stenner & Watts, 1998; Watts & Stenner, 2005b), national identity (Robyn, 2000), pathological identities (Stowell-Smith, 1997), personality (Rhoads, 2001a; 2001b), quantum theory (Watts & Stenner, 2003), sexual relations (Stenner, et al., 2006), stereotypes (Robinson, et al., 2008), terrorism (Sezkin, 2007) and violence (Chappell, 1997-1998). The proliferation of studies has served to clarify Q Methodology's presuppositions and to demonstrate its applicability in virtually every corner of human endeavour. Furthermore, they have demonstrated its 'sense-making' capacity and ability to find qualitative 'order' even in domains where variability and disparity seem initially to have prevailed (Watts & Stenner, 2005a).

6.4.2 Q as a mixed method

Rather than being led by particular theories or disciplines, best practice in research methods currently seeks to integrate useful and effective methods from diverse sources into a multi-method research design (Livingstone, Van Couvering, & Thumim, 2005). The broad trend in media research is towards the triangulation of qualitative and quantitative methods (Bertrand & Hughes, 2005; Schroder, Drotner, Kline, & Murray, 2003). The aim is to overcome, or compensate for, the disadvantages of certain methods over others. Q combines the interpretative component of qualitative analysis with the statistical rigour of quantitative analysis. It explores patterns of subjective views held by people and uses the statistical technique factor analysis to systematically examine the range of discourses held.

For this thesis, a research methodology is needed that will 1) systematically examines *users'* subjective metaphors, 2) enable users' to a provide their metaphoric representation of the Internet in either textual or graphical format and 3) interpret these subjective perceptions in conjunction with various intrinsic and extrinsic variables. The first two components can be achieved by using Q Methodology. The third is accomplished by triangulating Q methodology with questionnaire data.

It is evident that Q is superlative in eliciting subjectivities. However, in order to examine the relationship between emergent metaphors with various intrinsic and extrinsic variables, an additional methodology must be used in conjunction with the Q sort. It is possible to combine Q Methodology with traditional questionnaire-based data. A relatively straight-forward open- and closed- ended multi-item questionnaire can provide crucial information on users' demographics, their uses of the Internet, their attitudes towards the Internet and how they understand and define the technology. By combining questionnaire data with Q, it can suggest whether groups of users utilise different types of metaphors of the Internet. By examining the characteristics associated with each factor, it is possible to explore whether certain viewpoints 'belong' exclusively to specific groups. In sum, new metaphorical meanings will emerge as a result of synthesis of items in the Q grid configurations. The accompanying demographic data will be helpful in factor clarification, for it provides contextual clues for interpretation (McKeown, 1990).

CHAPTER 7. RESEARCH GOALS AND RATIONALE

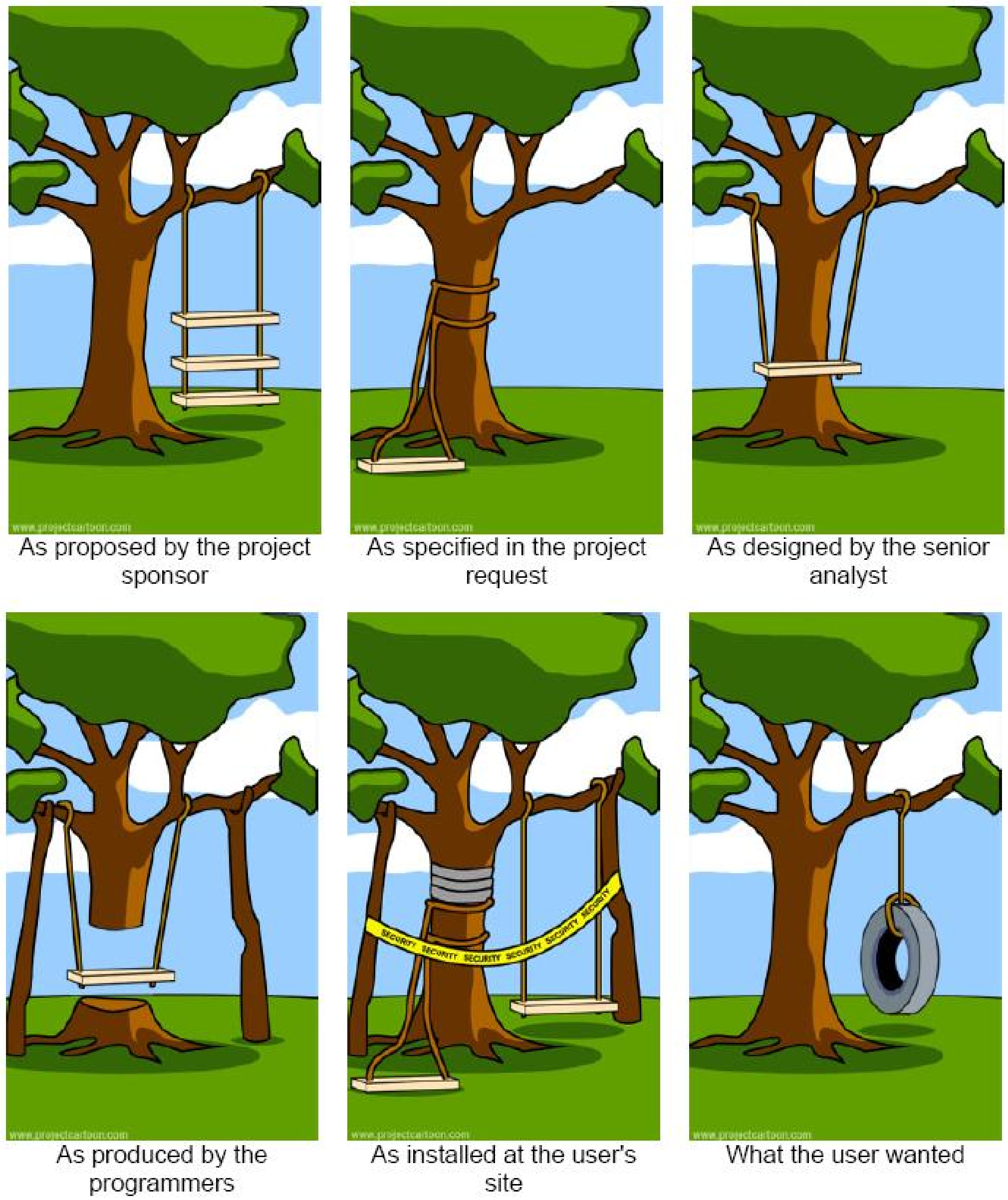

Figure 7.1. Tyre swing cartoon. Unknown author.

7.1 INTRODUCTION

The literature review in the preceding two chapters has identified some key gaps in the literature. Metaphors are an integral part of the interaction between technology and users. Although there has been considerable research on designer's metaphors as implemented into the user interface, there is a paucity of research that examines how users' conceptualise the Internet. Research that has been conducted on users' Internet metaphors can be criticised for privileging researcher knowledge *of* users, and for only providing users with the opportunity to discuss their metaphors in textual form. This thesis seeks to advance our knowledge of users' conceptualisation of the Internet via the use of metaphors. It enables them to provide their metaphors in either visual or textual form, with minimal intrusion from the researcher. It extends previous research that examines the relationship between metaphors and different groups of users. The purpose of this chapter is to examine the research goals and their rationale in detail.

7.2 RESEARCH QUESTIONS AND GOALS

This thesis seeks to explore two core research questions. The first research question asks:

- **What are the metaphors employed by users to conceptualise the Internet?**
  - Within this, what are the types of textual and visual metaphors being utilised by users?
  - Do the same kinds of metaphors arise in different modes of presentation?

The second core research question asks:

- **Is there any variation in the kinds of metaphors being employed by different groups of Internet users?**

From these research questions, the following research goals are developed:

1. To sample Internet metaphors being utilised by users to conceptualise the Internet in 2003/2004.
    a. Examine users' visual metaphors of the Internet
    b. Examine users' textual metaphors of the Internet
    c. Explore whether a relationship exists between the visual and textual metaphors
2. Explore whether individual differences among users exist, in terms of extrinsic demographic variables (age, sex, experience) and intrinsic variables (self efficacy) in the use of visual and textual Internet metaphors.

7.2.1 Users' metaphors of the Internet

As the Internet continues to evolve in complexity, designers will continue to incorporate many metaphoric concepts into user interfaces. Metaphors aid designers as a source of organisation and a decision guide about how to represent information. However, the process of designers implementing and evaluating interface metaphors offers just one perspective on the artefact; from the viewpoint of the designers and for the benefit of their practical concerns. Innovation, development, and evaluation of design ideas cannot be based only on the designer's intuitions but must be grounded in users' actual needs, perceptions and behaviours (Oulasvirta, 2004).

The Internet is an intrinsically interactive tool. Internet users are not passive recipients to which the Internet uniformly does something to. Internet users are active in their interaction with the technology and active in the reconfiguration of the Internet. Indeed, the crucial thing missing from the traditional taxonomies of Interface metaphors, or those that attempt to visually map the Internet, is the failure to appreciate how the Internet is *conceived* by people as opposed to simply *perceived* by people. The Internet is not simply some physical structure to which humans must adapt. People play a role in producing the space, through their activities and practice. An analysis of the Internet should recognise that is a subjectively defined concept which is communicated, negotiated and understood between people.

Embedding a metaphorical model into an interface is not necessarily synonymous with what the user actually perceives whilst interacting with the technology. Indeed, users are likely to understand the technology in quite different ways from those that designers intended. Figure 7.1 illustrates the witty cartoon of a tyre swing pictured in various states of dysfunctionality to represent the 'customer experience gap' between what is designed and what is actually needed. These gaps are usually caused by a lack of insight in the totality of dimensions of a user's experience. Interface developers aim to increase the usability of the system, but all too often fail to actually understand how users conceptualise the technology.

In order to anticipate what the user expects and experiences, users should be involved in the development process. However, users are often not imbedded in a continuous user-centric process. In most cases, they are only involved in one single stage (e.g. reacting to prototypes only after they are finished). For research to be truly user-centric, users should be involved throughout the whole development process (not only in the evaluation phases), and insight in the user's expectations and requirements should even serve as a starting point for the development of a new product or application. It points to the need for designers to embed users' metaphorical notions into their design in order communicate a cogent model of the Internet to the user.

As technologies have become increasingly more complex, it has become imperative to pay more attention to users' interaction with the technology. Indeed, to take full advantage of the opportunities offered by the Internet, we need to comprehend clearly how users metaphorically interact with the technology. Metaphors are an integral part of users' computing experience. However, there is a surprising lack of research into users' metaphors of the Internet. A good deal of research has been done to demonstrate the pros and cons of metaphors as interface design mechanisms, but the metaphorical thinking of *users* has been little studied. Data from previous studies on Internet metaphors have been static because they have been derived from titles of journal articles or philosophical perspectives and not from users. This research is truly user-centric, examining users' subjective perspectives and metaphors of the Internet.

Improved understanding of users' metaphorical interaction with the Internet has many practical applications. Understanding the metaphors that shape many different users' perceptions of the Internet will facilitate the creation of technologies that are accessible to a wide range of people with a wide range of characteristics and skills. This knowledge can be informative (providing useful research findings), predictive (providing tools to model user behaviour), or prescriptive (providing advice regarding how to design or evaluate) (Rogers, 2004). Advances in this knowledge will help people from all walks of life and interests to access, search and use the information distributed across Internet resources. If metaphors can function as possible mental models for users' experience with the Internet, they may provide an important tool with which to design instruction.

Research Goal $_1$: To sample Internet metaphors being utilised by users to conceptualise the Internet in 2003/2004.

Whilst the centrality of understanding users' metaphors has been established, it is necessary to break this broad research goal down into more specific components.

7.2.2 Textual and visual metaphors

The metaphors users generate to represent the Internet can be textual or graphical in nature. The power of language relies on the fact that with only one word we can evoke images, sensations or complete experiences lived previously. However, cognitive scientists emphasise that humans think in images as well as words (Kosslyn, 2005). Visual representations play an important role in human reasoning, thinking and understanding processes; our mental images are a powerful tool for understanding abstract ideas that cannot easily be expressed through words.

The fact that one metaphorical concept can be expressed in many different ways does not necessarily mean that there are no differences at the level of representation (El Refaie, 2003).Whereas language is perhaps more precise in expressing some areas of meaning, other concepts may be shown more easily and more effectively in images. The sequential/temporal characteristic of language may lend itself to the representation of action, procedural information or abstract concepts. However, spatial display of visual images may better show structural relations; for example, links between entities and groups of entities. Images are also better at providing detail and appearance (Kress, 2000; Ware, 2000). The differences regarding what verbal and visual metaphors can express most effectively indicates the need to investigate both modes of metaphoric representation and the impact they have on Internet comprehension and use.

According to the Columbia Encyclopaedia (2007), the basic description of the platypus occupies 145 words. Without an image, it would be very difficult to clarify what type of animal this is. Nevertheless, for a person that has already seen or knows what a platypus is, the mention of the word is enough to link a complete set of experiences related with this animal. Describing and visualising a platypus is analogous to the processes of understanding the Internet. For inexperienced users, a description of the various facets of the Internet may not afford a Gestalt understanding of what the technology actually is. An image may be created as a symbol of the Internet, and so an interpretation exists at the outset to aid interaction with the tool. However, for experienced users, the mere mention of the word 'Internet' can evoke a multitude of experiences and understanding that cannot necessarily be encapsulated by an image.

The Internet is a complex hybridisation of structural and procedural information, and so users will necessarily use a combination of both images and text to understand the Internet. However, previous research on users Internet metaphors has been verbocentric, in that it relies on methodological techniques which are dialectically based. By focussing on language-based metaphors, previous studies have limited participants' responses; in other words, participants can give us only what we give them the opportunity to provide. This research enables participants to present their mental representation in a visual format. This is beneficial for two reasons. Firstly, not all metaphors are linguistic or can be iterated in linguistic form. Secondly, due to the hypertextuality of the Internet, it is a space that is hard to comprehend. A powerful way to understand and conceptualise the Internet is to visualise it through graphical representation. In this way, participants are able to represent their idea of the Internet that otherwise might be hard to describe.

This research enables Internet users to provide their metaphoric representation of the Internet in either textual or graphical format. Thus, this research aims to examine both the visual and textual metaphors generated by Internet users. It also explores whether the same kinds of metaphors arise in the different modes of presentation.

Research Goal $_{1A}$: Examine users' *visual* metaphors of the Internet
Research Goal $_{1B}$: Examine users' *textual* metaphors of the Internet
Research Goal $_{1C}$: Explore whether a relationship exists between the visual and textual metaphors

7.2.3. User variation in metaphor use

It is widely acknowledged that in order to build an effective and useable system that the significant characteristics of its users must be taken into account. General characteristics of users are typically built into some kind of 'user model'. However traditionally, the model that is built is a model of a canonical (or typical) user. Designers and developers cannot assume that users will represent a homogenous group; Internet users vary so much that a model of a canonical user is insufficient. The Internet can be described, utilised and understood in a myriad of ways, each unique to the perspective of its user. The ways in which users metaphorically concretise the Internet will vary widely. The Internet is a unique cultural technology: it is the result of the negotiation between different interest groups who potentially understand and metaphorically represent the technology in a myriad of ways. The Internet possesses 'interpretative flexibility', in that not only do relevant social groups view the technology differently, but the technology could be said actually to be a different thing for each (Hine, 2000).

There is evidence to suggest the existence of different metaphorical images on the part of differently skilled users. Depending on the age, gender, perceived skill, years of experience or attitudes held, representations of the Internet could be changed in various ways. This has important implications about how we should analyse and study the Internet. If the Internet experience is a process of negotiation between different interest groups who potentially understand and represent the technology in differing ways, then the only way to understand it is analysing the groups of users interacting with it. If variations across users groups are related to the types of metaphors employed, research is needed to investigate the relationship between the metaphors employed by different users.

Very few studies have examined the relationship between different groups of users and metaphor use. Studies examining specific user groups indicate that users of varying demographic backgrounds will have a striking diversity of conceptual representations for the Internet. Demographic, usage and expertise variables are all shown to play a role in accounting for variations in the breadth and depth of Internet use. Additionally, there is some initial evidence to suggest that perceived level of Internet expertise and gender has an impact upon users' metaphorical understandings of the Internet (Ratzan, 2000; Palmquist, 2001). This research adopts an exploratory approach, seeking to identify whether a relationship exists between the types of metaphors employed and users' demographic characteristics.

Research Goal $_2$: Explore whether individual differences among users exist, in terms of extrinsic demographic variables (age, sex, experience) and intrinsic variables (self efficacy) in the use of visual and textual Internet metaphors.

In sum, as more of our time, leisure and business activities are conducted in virtual space, the understanding of user perceptions of the Internet is a particularly significant area of research. Our conceptualisations of the Internet are powerful in framing our conception of the new virtual worlds beyond our computer screens. The representations we adopt to describe the Internet will determine how it develops, who has access to it in the future, what kind of information it will carry and what its primary purpose will be. The beliefs we hold about technology will have important consequences for ways in which we relate to, interact with and understand it. Our understanding of Internet representations will help users, designers and service providers comprehend the various spaces of online information, providing understanding and aiding navigation.

CHAPTER 8. Q SORT: METHODOLOGY

Figure 8.1. William Stephenson, Founder of Q Methodology

8.1 INTRODUCTION

Q Methodology was used in this study in order to reveal the subjective patterns of metaphors which are employed by users of the Internet. This chapter examines Q methodology in detail. Q Methodology has been established for over seventy years and has been used extensively by researchers whose epistemological stance diverges from the more traditional positivist paradigm. The focus of this chapter is to outline the basic procedural details involved in conducting a Q study both offline and online. The issue of augmenting Q Methodology with R Methodological data is also addressed.

8.2 CONDUCTING A Q STUDY

The basic steps of the Q sorting procedure are as follows. A heterogeneous set of items (called a Q sample) is drawn from the concourse (the sample of statements participants sort). A group of respondents (P set) is instructed to rank-order (Q sort) the Q sample along a standardised continuum according to a specified condition of instruction. Participants do this according to their own perception in relation to an appropriate criteria (e.g. like/dislike, similar/different). Items of great "psychological significance" (Burt & Stephenson, 1939) are "ranked or scored highly, whilst those of little relative significance ... [are] ranked or scored lowly" (Stephenson, 1936). The resulting Q sorts are submitted to correlation and factor analysis. Interpreted results are factors of '*operant subjectivity'* (Stephenson, 1977). Breaking this down a little further, conducting a Q study involves following six fundamental steps (see Table 8.1).

1.	Concourse generation
2.	Q Sample selection
3.	P Set selection
4.	Q Sorting procedure
5.	Q Factor Analysis
6.	Interpretation

Table 8.1. Six steps to running a Q study

8.2.1 Concourse generation

As discussed in Section 6.4, Q methodology's central tenet is to study subjectivity. Thus, the phenomena it examines consists of the ordinary conversation, commentary and discourse of everyday life; for example, the kind that proliferates when discussion turns to such things as the Iraq War, the next '*Britain's Got Talent*' winner, impressions of the movie *The Matrix*, and so forth. In Q, this flow of communicability surrounding any topic is referred to as a concourse. Concourses occur in all realms of human experience. Indeed, "there is a concourse for every concept, every declarative statement, every wish, every object in nature when viewed subjectively, in physics, philosophy, history, sociology, psychology, law, art" (Stephenson, 1986, p. 44). Simply put, a concourse is a 'universe of statements' for any context or situation and it is the task of Q methodology to empirically examine the subjective realities of people engaged in a discussion (McKeown, 1990). The concourse is ordinarily comprised of a set of statements about a particular subject matter, although pictures, objects, and even musical selections might also be employed. For example, Grosswiler (1990) created a multimedia Q sort comprised of writings, picture, and snippets from videos and records; Kinsey (1991) utilised a selection of Gary Larson cartoons. Concourse items can be elicited from any number of sources: by extensive reference to the academic literature, from both literary and popular texts, from formal interviews, informal discussions and often via pilot studies.

8.2.2 Q Sample selection

It is impossible to administer an entire concourse, which might consist of several hundreds of statements containing opinions about the issue under investigation. A subset of items, called a 'Q sample', is drawn from the larger concourse, and it is this set of items which is eventually presented to participants in the form of a Q sort. The main goal in selecting a Q sample is to provide a miniature which, in major respects, contains the comprehensiveness of the larger process being modelled. The selection of potential items may or may not be theoretically driven; unstructured sample do not rely on experimental principles to guide selection whereas structured samples do.

8.2.2.1 Structured Q samples

Guided by Fischer's (1960) experimental design principles, structured Q samples are more systematically composed than unstructured samples. Firstly, the parent concourse is organised into overarching categories of response. The Q sample items are conceptualised theoretically and organised into a factorial framework. Once the main theoretical issues have been identified, a set of statements that cover each of the issues are selected to make it representative of the parent concourse. Such an experimental design procedure provides a reasonable way of selecting the Q sample theoretically. However, not all Q samples can be theoretically conceived *a priori* to the commencement of the study. Some studies are necessarily explorative in nature and so categories of response cannot be deduced in advance. In these circumstances, unstructured Q samples are utilised.

8.2.2.2 Unstructured Q samples

Unstructured samples include items presumed to be relevant to the issue under investigation without excessive effort made to ensure coverage of all possible sub issues. Items are selected that are broadly representative of the issues in the parent concourse. Thus, care is still taken to make sure the concourse is an accurate reflection of the all positions in the larger concourse (but just not as comprehensively and systematically as the structured sample). With unstructured samples, it is possible that some topical aspects might be over- or under-represented, hence a 'skew' could unintentionally be incorporated into the final Q sample (McKeown & Thomas, 1988).

Regardless of whether the selection of the Q Sample is structured or not, the process still involves a great deal of careful consideration. As Curt (1994, pp. 128-129) suggests, this is "one place where Q-method is noticeably a craft", whereby the Q methodologist must carry out this task skilfully, patiently and with an appropriate application of rigour. As a result, the generation of the final Q sample can often take up the bulk of the time and the effort involved (Watts & Stenner, 2005a).

8.2.2.3 Q samples, representativeness and emergent meaning

It is apparent therefore that not all Q samples need to be structured; in fact, some of the best Q studies have used unstructured samples (Stephenson, 1953). Furthermore, the exact nature of the sampling task is of little consequence provided that the final Q sample can justifiably claim to be 'broadly representative' of the relevant opinion domain (Watts & Stenner, 2005a). Indeed, the Q sample need not contain anything and everything that could potentially be said about a given situation. The concern that a Q sample can never really be complete as there is always something else that might potentially be said is actually of little importance. The Q sample itself is not the main concern; rather it is the active engagement with and configuration of the Q sample items by participants which causes new meanings and understandings to emerge.

For example, in the first exploratory pilot study undertaken for this research (see Chapter 9), a Q sample statement which stated that 'the Internet is like a book' was used. Whilst many inherently understand and utilise this metaphor, it says little about what it actually means to Internet users, nor does it tell us how or where this notion fits into people's wider expectations and understandings of the Internet. In the pilot study, participants generally considered this 'book' statement to be a very good descriptor of the Internet (such that it was frequently 'ranked highly'). However, it was ranked highly for a variety of quite different reasons: (a) to refer to a fixed, structured entity in which the information is static, (b) to refer to the Internet as an information resource and (c) to refer to the complex interlinking nature of information on the Internet.

It is evident therefore that the meaning of the statement unfolded and was expressed in very different ways as the participant group engaged with the presented items. This unfolding of meaning can be observed across every statement of the Q sample. It is not the main concern to represent every available opinion, for the qualitative detail proliferates as a Q study proceeds. Even a less than ideal Q sort may still produce useful results "because it invites active configuration by participants" (Stainton Rogers, 1995, p. 183). Thus, if a Q sample is at least broadly representative of its subject matter, the engagement of participants with that Q sample (and the resultant configurations) will afford a general overview of relevant viewpoints on the subject (Watts & Stenner, 2005a).

8.2.2.4 Q sample size

The exact size of the final Q sample will, to a great extent, be dictated by the goal to obtain a broad representation of items. As a general rule-of-thumb however, a Q sample of somewhere between 40 and 80 statements is considered satisfactory (Curt, 1994; Stainton Rogers, 1995). Any less than this and issues of adequate coverage may be a problem. Anymore and the sorting process can become unnecessarily unwieldy. It is always best, however, to initially generate an overly large number of statements, which can then be refined and reduced through processes of piloting.

8.2.2.5 Preparing the Q sample

Once the Q sample has been finalised, the items need to be prepared for the Q sorting process. Similar to well-written questionnaires, the Q sample items need to be made sufficiently clear, precise and unambiguous, and only describe one pertinent issue. Each Q sample item should be presented on an individual card, in preparation for participants to sort. The response format must also be chosen; if the researcher decides upon 'agreement' as the subjective area of interest, participants would be asked to rank items using a continuum of most disagree to most agree (other subjective dimensions for sorting can be how 'pleasing', how 'relevant' or how 'interesting' the Q sample items are).Lastly, the researcher must decide upon the specific layout of the sorting grid. The grid is conventionally set up as an inverted quasi-normal distribution (see Figure 8.2).

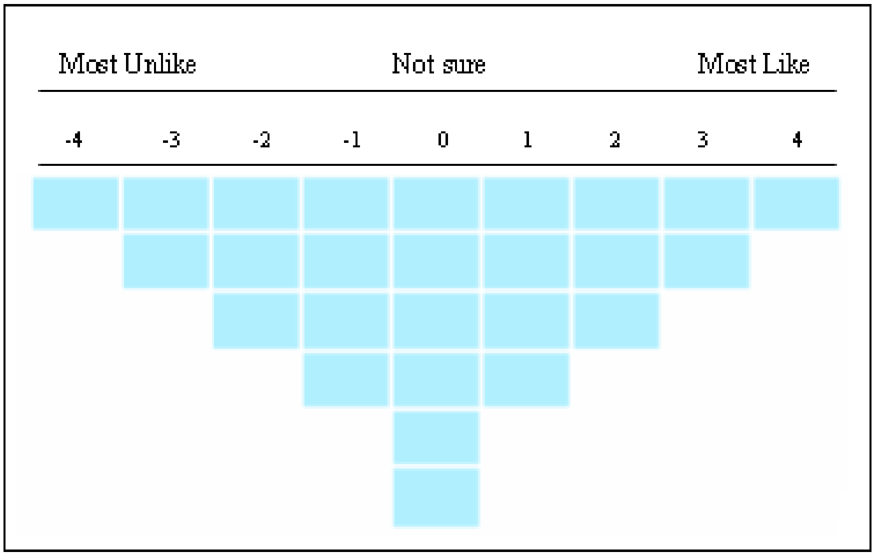

Figure 8.2. Sample inverted quasi-normal distribution

This convention follows from the understanding that in most cases there are fewer issues people feel most strongly about (pro or con); therefore, a greater number fall between the extremes. The exact configuration of the Q grid will vary according to the research of each researcher. In any case, the actual shape and structure of the distribution curve arguably matters very little since the factors of subjectivity tend to be robust enough to be reproduced under a variety of configurations (Brown, 1971; McKeown, 1990). In other words, whether the distribution is +5/-5 or +3/-3, it has little effect on the final results.

It is this distribution, however, that enables subjectivity to be measured by allowing comparisons of Q sorts between people. The standardised distribution means that the rankings can be converted into numbers which can be statistically analysed. Each Q sort distribution has a mean value of 0 and a standard deviation value of 1, meaning that the "scores given to the [items] by different individuals are comparable - the zero on all scales is the same absolute value for everyone" (Stephenson, 1967). The centre point of a Q sort distribution ("0") therefore indicates lack of psychological significance; items placed there hold little or no meaning for the individual. Meaningful statements are those to the right and left of the central neutral point. In this fashion, there is "a basis for measurement of feelings, attitudes, opinions, thinking, fantasy, and all else of subjective nature" (ibid., p. 11).

It is important to note that this statistical element should not be taken as a reductionist technique. The aim is not to test in an objective manner any items of the concourse. The act of sorting Q statements is *not* to verify them as inherently true or false. Rather, the sorting is a statistical tool to elicit the patterns of meaning by examining the relationships of the different configurations of the items in the concourse. Q Methodology is concerned with the configurations and syntheses of items of a concourse and therefore with understanding and meaning making, not explanations or predictability (Stephenson, 1978).

8.2.3 P Set selection

The next step is to select participants to sort the Q sample in their preferred order of importance. The P set is a structured sample of respondents who are theoretically relevant to the problem under consideration. Participants are strategically sampled in order to ensure that particularly interesting or pivotal viewpoints are represented. Large numbers of participants are not required for a Q methodological study. Q methodology aims to reveal and to explicate some of the main viewpoints that are favoured by a particular group of participants. It probably does this most effectively when the participant group contains between 40 and 60 individuals (Stainton Rogers, 1995). This is only a ‘rule of- thumb’ however, as highly effective Q studies can be carried out with far fewer participants.

8.2.4 Q Sorting procedure

The Q sample is administered to participants in the form of a Q sort. The Q sort is a tool used to assist participants in manifesting a point of view in a systematic way (Brown, 1980). The Q sample items are traditionally offered in the form of a pack of randomly numbered cards (one statement/picture to a card). Q sorts are performed according to a condition of instruction which directs the respondents to rank-order the Q sample statements according to the purpose of the study. The ‘condition of instruction’ is what the researcher tells participants to do, think or remember whilst conducting a Q sort. The instructions are designed to establish a mental context within which the person will make decisions while ranking stimuli.

Participants are asked to read through all the Q sample items first so as to get an impression of the range of opinion at issue and to permit the mind to settle into the situation. At the same time, the person is also instructed to begin the sorting process by initially dividing the statements into three piles: those statements experienced as agreeable in one pile, those disagreeable in a second pile, and the remainder in a third pile. The rating scale is spread across a flat surface, such as a desk. Participants begin by placing the Q sample items under the appropriate rating markers. For example, a participant could select four items from the 'most agree' pile and place them vertically under the +4 and +3 columns, to indicate the strength of their agreement. Once the participants had sorted the most agreed upon items, the researcher would direct them to do the same with the 'most disagree' items. Participants would continue to switch between the extreme ends of the Q sort grid, slowly working towards the middle. The statements under the middle marker (0) are often the Q sample items left over after the positive and negative slots have been filled. The reason that participants are directed to work back and forth between the positive and negative poles is to help them reflect on the significance of each item in relation to the others. Once all the Q sample items have been sorted into the grid, participants may review and modify their configuration until they are satisfied that their Q sort accurately portrays their personal point of view.

8.2.4.1 Post Q sort

Following the Q sort procedure, the next task involves the gathering of supporting information from the participant in the form of open-ended comments. This can be done via a brief post-sorting interview in which the following issues should be investigated: (a) how the participant has interpreted the items given especially high or low rankings in their Q sort, and what implications those items have in the context of their overall viewpoint; (b) if there are any additional items they might have included in their own Q sample (what they are, why they are important, and so on); and (c) if there are any further items about which the participant would like to pass comment, which they have not understood, or which they simply found confusing (Watts & Stenner, 2005a). Such open-ended comments are a vital part of the Q methodological procedure, for they will aid the later interpretation of the sorting configurations (and viewpoints) captured by each of the emergent factors.

8.2.5 Factor Analysis

The analysis of the Q sorts relies upon factor analysis and is therefore sometimes referred to as the scientific base of Q. Factor analysis is a statistical technique that simplifies complicated data into overarching patterns. By reducing a larger number of variables into a smaller number of 'factors'[16], it uncovers the latent structure of a dataset. Note that Q factor analysis deviates slightly from the method used in R Methodological studies. In Q factor analysis, correlations between persons as opposed to variables are factored. It determines whether a set of people cluster together (rather than a set of variables).

8.2.5.1 Extraction and rotation of factors

Firstly, the correlation matrix of all Q sorts is calculated. This represents the relationship of each Q sort configuration with every other Q sort configuration (not the relationship of each item with every other item). Next, this correlation matrix is subject to factor analysis, with the objective to identify how many basically different Q sorts are in evidence (Brown, 1980; 1993). Q sorts which are highly correlated with one another may be considered to have a family resemblance; these define a factor. A factor indicates different conceptions about the topic at hand, with those persons sharing a common conception defining the same factor but differently from those loading on the other factors. Thus, factors can be thought of as model Q sorts summarising the subjective similarities among those who associate significantly with them (McKeown, 1990).

The number of factors extracted largely depends upon the type of factor analysis and rotation chosen. The more recently developed Principal Components Analysis (PCA) is preferred in R Methodology, as it is widely regarded to be more objective due to the determinacy of its solutions (based on maximum variance). However, Centroid factor analysis, the very oldest of the factor techniques, is preferred in Q circles. Stephenson (1953) preferred Centroid due to its indeterminacy (no mathematically correct solution), since it parallels the indeterminant character of

[16] See Appendix 15 for Glossary of Technical Terms.

subjectivity. In Centroid factor analysis, there is no single 'correct solution' available; instead it offers a potentially infinite number of solutions. It is this openness which leaves researchers free to consider any data set from a variety of perspectives, before selecting the solution which they consider to be the most appropriate and theoretically informative (Watts & Stenner, 2005a).

A similar principle is in play when deciding on which rotation method to use. Modern factor rotation techniques, such as Varimax, supposedly reveal only the most mathematically (not necessarily the most theoretically) informative solution. Q practitioners emphasise the importance of theoretical discretion in choosing factor solutions, and thus retain Stephenson's preference for theoretical (judgmental or 'manual') rotation. Indeed, proponents of theoretical rotation often argue that it is futile to let a computer decide which point of view to adopt when an infinite number are possible.

It can be noted that factor rotation, judgemental or otherwise, has very little impact on the factors insofar as the amount of variance is concerned. Rotation does not affect the configuration of meaning throughout individual Q sorts or the relationships between Q sorts; rather, it shifts the perspective from which they are observed (Van Exel & de Graaf, 2005). The advantage of judgmental rotation is that it endeavours to find a factor structure that has theoretical meaning (Thompson, 1962).

8.2.5.2 Factor loadings

Following factor extraction, a column of numbers is generated, one for each individual Q sort. Each column represents the loadings of the Q sorts onto each factor. These loadings represent the extent to which each Q sort is associated with each factor (i.e. the loadings are correlation coefficients between each Q sort and factor). Q sorts that load significantly[17] onto a factor are usually deemed to be defining sorts for the factor. For example, in Figure 8.3, Q sorts 2, 4, 5 and 6 define Factor 1. Participants whose Q sorts do not load onto any factor have points of view

[17] See Chapter 10 for the formula used to determine how large a loading must be before it is considered significant.

that are idiosyncratic and cannot be included in under any theme depicted in the Q Factor Analysis results (Schmolck, 1998).

```
PQMethod2.11                    TEXT ANALYSIS
Path and Project Name: C:\PQMETHOD\PROJECTS/text


Factor Matrix with an X Indicating a Defining Sort
                    Loadings
 QSORT               factor1   factor2   factor3

  1 text1            0.1226    0.7159X  -0.1914
  2 text2            0.6415X  -0.0936   -0.0282
  3 text3            0.0576    0.8305X  -0.0688
  4 text4            0.5931X   0.1760   -0.1469
  5 text5            0.7033X  -0.0424    0.1700
  6 text6            0.6151X  -0.3091    0.2102
  7 text7            0.2403    0.2376    0.6325X
  8 text8            0.1274    0.2309    0.4584X
  9 text9            0.0084   -0.0284    0.7046X
 10 text10           0.1670   -0.7711X  -0.2053


 % expl.Var.          45        20         11
```

Figure 8.3. Factor matrix indicating defining sorts

8.2.6 Interpretation

Interpretation begins with examining the idealised factor array generated for each factor. To fully interpret each factor, it is essential to calculate and examine the factor scores for each Q sample item. Factor scores point out the salient items that deserve special attention in describing and interpreting that factor.

8.2.6.1 Bipolar loadings

Occasionally, bipolar loadings occur; this is when participants load on opposite 'ends' of a single factor, expressing opposite perspectives. The polar loadings do not simply represent a transposed mirror image of the same viewpoint; rather they constitute two separate and distinct perspectives of a factor and must be interpreted separately (Mattson, et al., 2006). In order to generate a separate factor array for positive and negative loadings, the factor is duplicated, the loadings inversed and the factor interpreted separately.

8.2.6.2 Distinguishing and consensus items

'Distinguishing items' are the Q sort items that distinguish between any pair of factors. These items help to differentiate factors from one another by identifying which items in the configuration are most salient to examine. For example, an item would be considered 'distinguishing' if it was rated highly (ranked in the +4 position) in one factor, but rated lower on another factor (in the -3 position). These different placements indicate that different perspectives are in evidence. 'Consensus items' are the Q sample items in which there is no significant difference between any factors. It therefore fails to distinguish one factor from another because all the factors may rank the item similarly.

It is important to note however that the purpose is not to isolate one or two particular items and use them as the crux of the overall analysis. As Brown (1997) notes, just because a statement is singled out as distinguished or consensual by statistical criteria, it does not mean that we are obliged to accept this as having special theoretical or substantive importance. Rather, the factor array represents a gestalt configuration of items and thus the positioning of particular items must be evaluated in relation to the placement of the other items.

8.2.6.3 Interpretation and context

There is no set strategy for interpreting factor arrays, because it largely depends on how participants interact with the Q sorting task. Q engages the social sphere from the perspective of the experiencing respondent (Goldman, 1990). This suggests that interpretation and understanding is contextual. Parts are understood in light of the whole; the whole is understood as an interaction of the parts. Thus, understanding is dependent upon the situation of its expression. The meaning of an expression in one instance may change in another (McKeown, 1990). "Each statement may mean something different to everyone, and something different to the same person in different circumstances.... statements in concourse shift their meanings with their company – they may have different meanings in different factors" (Stephenson, 1983, pp. 75, 82). In other words, understanding the meanings is dependent upon the people who experience it.

8.2.6.4 Synthesising Q and R data

New meanings emerge as a result of synthesis of items in the Q grid configurations. However, it is often the accompanying demographic data that can be helpful in factor clarification, for it provides contextual clues for interpretation (McKeown, 1990). When factors structures have been identified, relevant demographic data (such as age, gender, etc) can aid the investigator to interpret the structure of subjectivity (Brown, 1992). The augmentation of Q data with R data is controversial because the two approaches are viewed as being fundamentally incommensurate. However, it is important to note that Stephenson's orientation toward the subjective was not in the opposition to the study of objective attributes, for he regarded Q as applicable to both (Brown, 1972). In this instance, the inclusion of R data should not be mistaken for the misapplication of reductionist techniques. Observing the patterns of subjectivity in relation to their demographic component opens the door to clarity in understanding through the detection of connections which unaided perception might pass over. It must be noted that there is no necessary relationship between the objective and the subjective (and therefore between R and Q). For example, there is no reason to suspect that someone's ability to find information on the Internet is related to whether they like using the Internet. However, the possibility of such a relationship is not precluded. Nevertheless, it is maintained that a full, synthetic, interpretative overview of the data can only be obtained with a subtle blend of the objective and generalisable with the subjective and context bound (Ford, 1999).

8.3 ONLINE Q SORTING

Q Methodology studies have traditionally been conducted through a manual, offline process involving participant's sorting of cards. The advent of technologies, such as the computer, Internet and more recently the WWW, means that the Q sorting process can now be conducted online in a more cost and time efficient manner. The Internet, as in so many other applications, provides an alternative, more effective means of accomplishing what was traditionally performed with a manual process.

A number of programmes have been developed that make use of the Internet to collect data for Q studies. One of the most well known (and established) interfaces is called 'Web-Q'[18], developed by Peter Schmolck. Web-Q is a free-ware programme in which participants rate items by selecting radio buttons along a given scale (see Figure 8.4). As items are rated, the program tracks the number of items assigned to each rating score. For each rating score a status is displayed providing the user with a visual cue as to many how many items are assigned to the rating, how many more items are necessary or must be removed. Whilst this programme can be credited for pioneering the movement towards computerised Q sorting, it has a number of limitations. Visually and tactically, this interface is not synonymous with the offline mode of Q sorting (Figure 8.4).

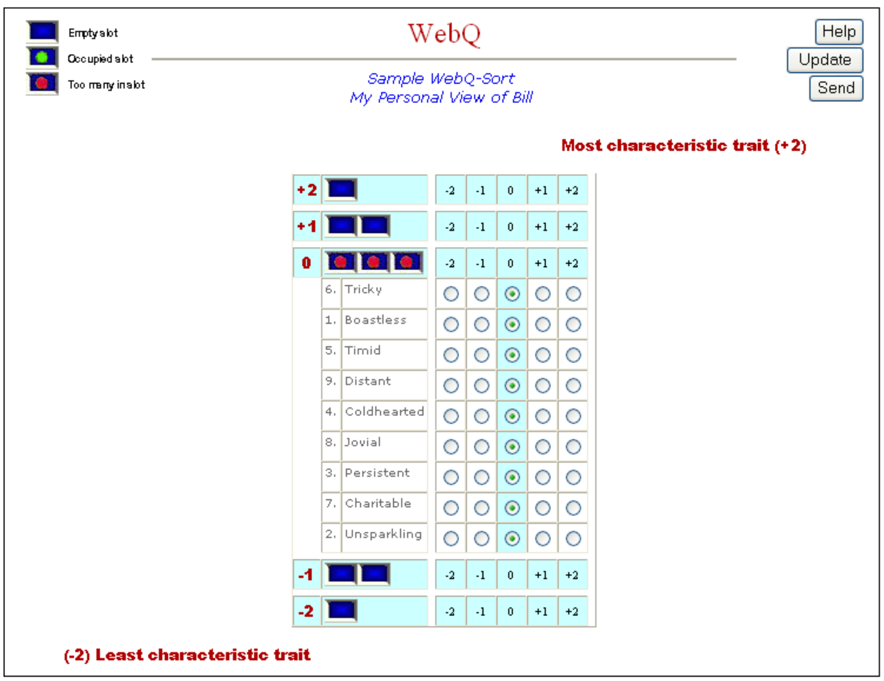

Figure 8.4. Screen shot of Web-Q interface

Getting participants to rank order statements via ticking radio buttons is arguably not a true simulation of the Q sorting task. Nonetheless, a number of other researchers have adapted this interface for their own research needs[19]. In attempt to more fully

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18 http://www.lrz-muenchen.de/~schmolck/qmethod/webq/index.html
19 Christopher Correa, http://q.sortserve.com; Joy Coogan http://homepages.uel.ac.uk/J.Coogan/study1wq.htm; Stan Kaufmann http://www.epimetrics.com/demos/

simulate the traditional Q sorting task in online media, a new type of online Q sort interface was developed specifically for this study (see Chapter 9). The following chapter outlines how this Q interface was built for the current research; one that arguably better simulates the actual process of Q sorting.

CHAPTER 9. Q STUDY PREPARATION: PILOT STUDIES

> If at first you don't succeed,
> call it version 1.0

Figure 9.1. Quote, unknown author

9.1 INTRODUCTION

Chapter 8 dealt with the methodological concerns of conducting a Q study in general. The reader will have quickly realised that there is a great deal of preparation needed in order to run an effective Q study. The purpose of this chapter is to outline the preparation work needed for the current research. This chapter outlines the three pilot studies which were conducted prior to the main research. It highlights how each of these exploratory studies played a pivotal role in the design and development of the main study.

9.2 PILOT STUDIES

Between January 2002 and July 2003, a series of in-depth exploratory pilot studies was conducted (see Table 9.1). The first pilot study, conducted as part of my undergraduate dissertation, provided the concourse for the current research. The second pilot study was run in order to refine the concourse. There were three vital developments that emerged from the third pilot study; the finalisation of the Q sample, the development of the research website and online Q sorting interface, and testing and modifying the accompanying Characteristic Profile Questionnaire (CPQ).

<table>
<tr><th>Function</th><th>Pilot No.</th><th>Research Activity</th></tr>
<tr><td>Concourse Generation</td><td>1.</td><td>Undergraduate dissertation</td></tr>
<tr><td rowspan="2">Q sample selection</td><td>2.</td><td>Mixed mode Q sorts</td></tr>
<tr><td rowspan="3">3.</td><td>Quasi Q sorting task</td></tr>
<tr><td rowspan="2">Methodology Refinement</td><td>Testing feasibility of online Q sorting</td></tr>
<tr><td>Trial run of the CPQ</td></tr>
</table>

Table 9.1. Pilot studies and method development

The following sections outline these exploratory studies in detail, indicating how each contributed to the development of the current research methodology.

9.3 PILOT 1: CONCOURSE GENERATION

This piece of research formed the basis of my undergraduate dissertation, '*Metaphors of the World Wide Web'* (Hogan, 2002). It was from this research that the current Q sample was generated.

9.3.1 Aims

The aims of this exploratory qualitative study were threefold:

1. Establish the metaphors people use to represent the World Wide Web
2. Investigate if these metaphors vary according to different levels of experience.
3. Discuss whether the metaphors we use constrain or enhance our understanding of the Web.

9.3.2 Participants

Nine participants were obtained through opportunity and snowball sampling. The sample size was purposely small; it was deemed better to get detailed representations of a small number of participants, rather than a superficial understanding of a much larger number of Web users. The nine participants were carefully selected to represent three varying levels of Internet experience: low users, average users and expert users. User categories were defined through a combination of their experience and average use of the Web. Low users were defined as having less than 1 year of experience and only 1 hour a week of use; average users had approximately 3 years experience and used the Web between 3-4 hours a day; expert users had over 5 years experience, used the Web for 8-10 hours day, plus held a job in Web design/development or related field.

9.3.3 Method

Structured, qualitative interviews were employed to elicit the metaphorical descriptions of Web users. Prior to the interview, participants were required to draw a picture of their own mental representation of the Web. As part of an in-depth interview (lasting anywhere between 25-55 minutes), participants discussed their own drawings, and were also asked to discuss how other people might imagine the Web. Six digital representations of the Web were taken from the ‘Atlas of Cyberspace’ (Dodge & Kitchin, 2001) for this purpose. Six images were selected from this source on the basis that they represented a broad cross section of the available depictions. Table 9.2 depicts the six images in minimised form; note that in the proper interviews, the images were blown up to A4 size to ensure sufficient detail could be viewed for discussion.

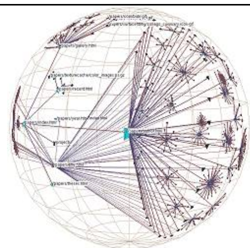
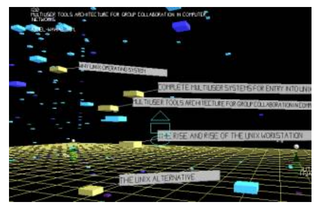
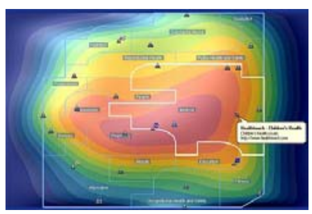
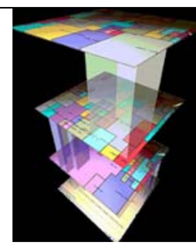
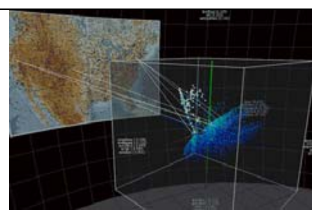
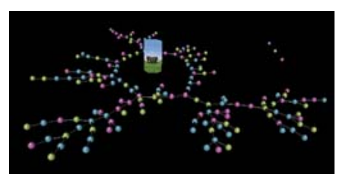
1		2	
3		4	
5		6	

Table 9.2. Six Web representations

Once participants were given sufficient time to look over these representations, they were asked to discuss how each picture was similar or dissimilar to their own picture(s) which they had drawn. Participants usually quickly identified pictures that were similar and dissimilar to their own idea and were encouraged to fully explain how and why they were so. They were also asked to reflect on whether there were any themes (similar/dissimilar components/ideas) across the pictures.

In addition to the discussion of the drawings, the purpose of the interview was to elicit rich qualitative responses to a number of questions on the following general themes:

- Searching the Web
- Mental Representations of the Web
- Linking/Structuring Web pages

Following some general introductory questions (which functioned to identify their skill level), participants were asked how they search for information and other uses for the Web. Participants were then asked about their representations of the Web, leading to a discussion of the pictures they had drawn. Next, participants were asked about how they think Web pages are linked and structured. Experienced users were asked additional questions of how metaphorical representation is entrenched in the Web design process. At the end of the interview, participants were asked to complete two summary statements:

> 'When I think of the Web, I think of...'
> 'The Web is like a...'

These final questions were included to elicit metaphorical statements. They also served as a useful tool to concretise the ideas developed through the course of the interview. At the end of the interview, participants were given the chance to add, modify or discuss any further points. Participants were thanked for their time and effort and were fully debriefed.

9.3.4 Outcomes

The results from this research indicated that metaphor is used extensively to describe the Web. There is evidence to suggest that the range of metaphors used varies according to level of Web experience. Expert users tended to use fewer metaphors than the other user groups and were more likely to explicitly use analogies to explain their ideas. Thus, experts were more likely to use metaphors as communication aids.

In contrast, average users and low users were more likely to use metaphors as conceptual tools to aid their understanding of the Web.

9.3.4.1 Internet vs. World Wide Web

It is important to note that this previous research investigated metaphors of the World Wide Web, whereas the current research examines metaphors of the Internet. There is a significant difference between the Web and the Internet (see Appendix 1.2 for more information). Whereas the Internet is a global network of physically linked computers, the spatial geometries and forms of the Web are entirely produced. This is an important distinction that should not to be overlooked. However, one of the most notable results of my research into this topic has been how often users' misunderstand the distinction. For many Internet users, the Web and the Internet are synonymous; they are merely different words used to refer to the same entity. The terms are used interchangeably to refer to the same concept.

> "I think they are the same, the Internet and World Wide Web. I think the words kind of means the same thing, web and net" [LU2]

Therefore, whilst the delineation between the Internet and the Web is both accurate and undeniable, it is of little importance to the everyday Internet user. This distinction therefore becomes one of academic debate, rather than a functional category of meaning for the user. As the most fundamental aspect of the current research is to examine users' understanding of this technology, there seems little justification for keeping the divide. The interview data can therefore safely be used as a concourse for the current research, despite the slightly different research focus.

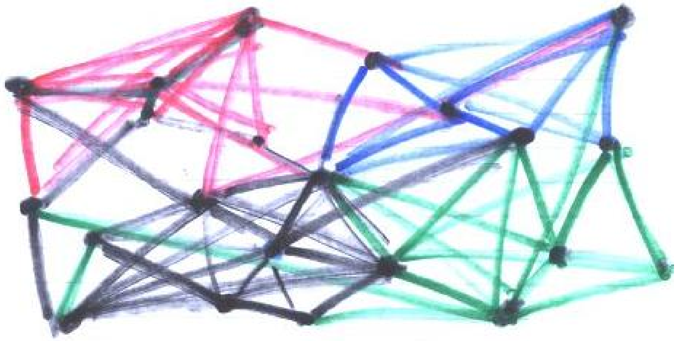
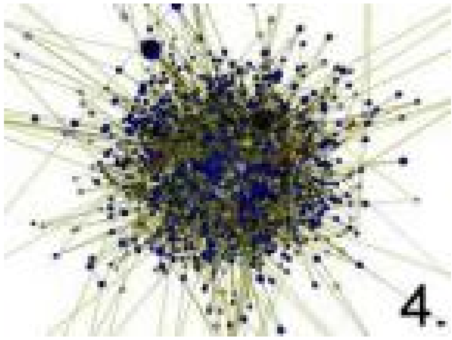
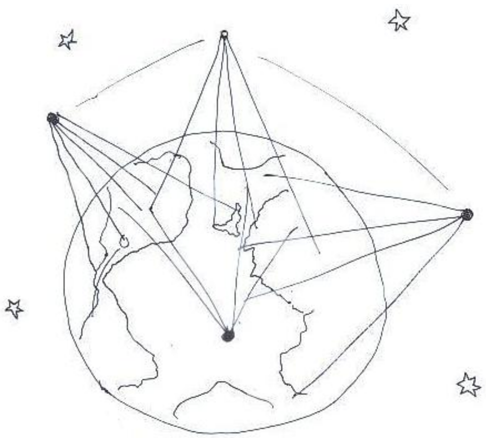
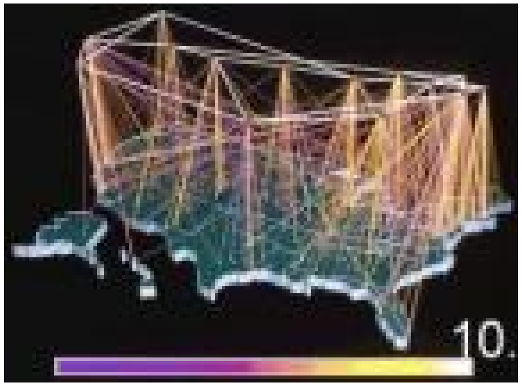
9.3.4.2 Concourse generation

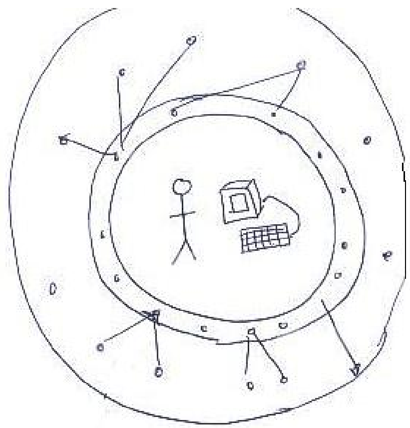
The nine interviews generated a great deal of rich, qualitative data, which formed the basis for the text concourse. After removing obvious duplications, the interview transcripts generated thirty six elaborated descriptions of the Internet. The initial image concourse emerged from a combination of the participants' drawings and the six web representations they discussed as part of the interview. The drawings produced by each of the participants prior to the interview can be found in Table 9.3. As these depictions played a pivotal role in the development of the interview discussion, it was important that they play an equally significant role in the concourse of the current study. As the drawings would be combined with other more professional images in the final Q sample, it was necessary to find a digital image that duplicated the essence of the drawing. Using the 'Atlas of Cyberspace' and other online resources, every attempt was made to find an image that was professionally rendered, yet was a true replication of the drawn image. Table 9.3 indicates the original drawn image and its duplicate digitally rendered version.

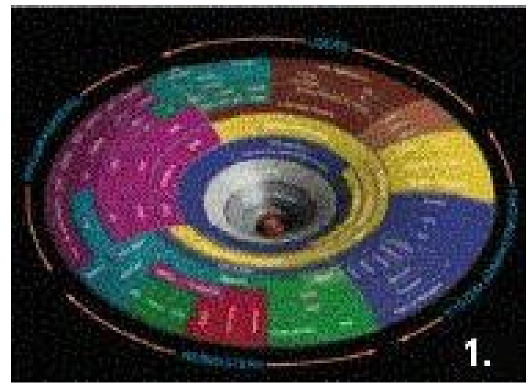
For some images, it was not always possible to find an exact replica (for example, the last two images in the table below). In these instances, the participants' interview transcripts were re-examined, in order to understand what each participant was attempting to convey with their image. This explication then led the search to find a representative image. For example, in the last image, the participant was actually trying to represent the Internet as floating bubbles of information in the air:

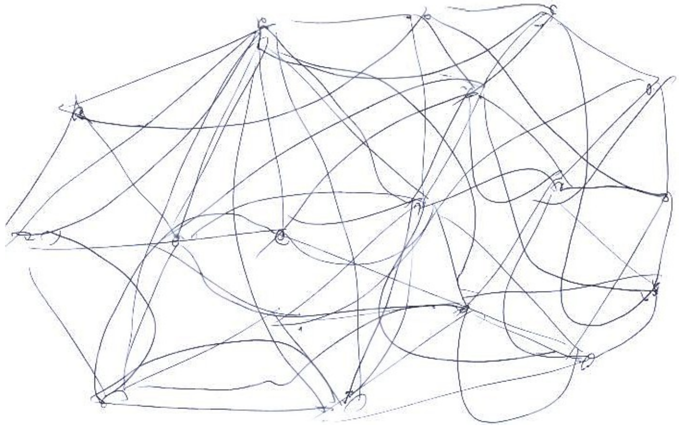
> "The Internet is like all these little bits of information, kind of floating in the air and then if you call them up on your computer screen then they're all pieced together in the right order and they appear magically on your screen" [LU2]

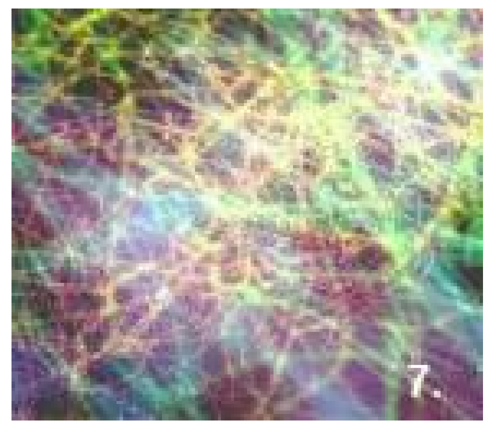
Therefore, whilst at first it appears that the selected digital image does not duplicate her drawing, it does accurately reflect her explanation of the drawing.

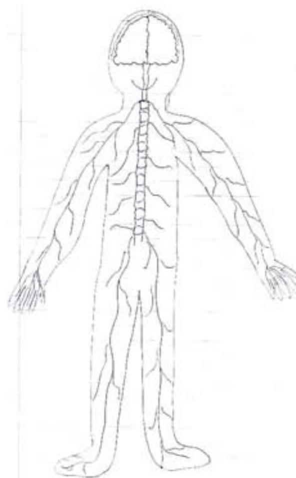
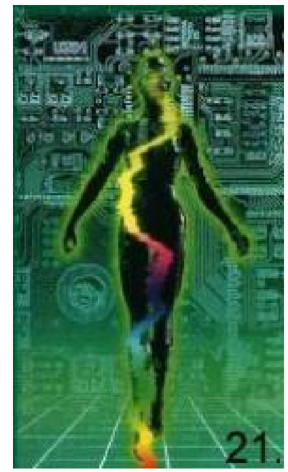
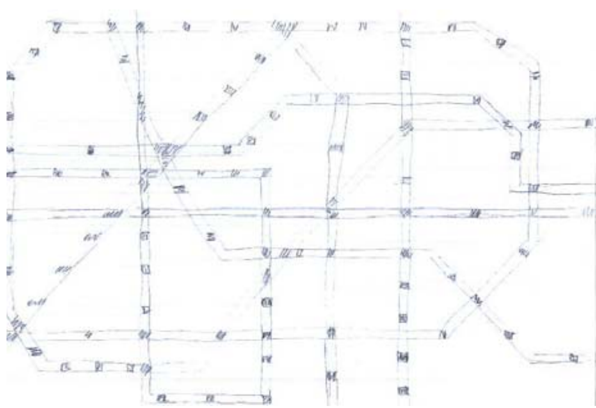
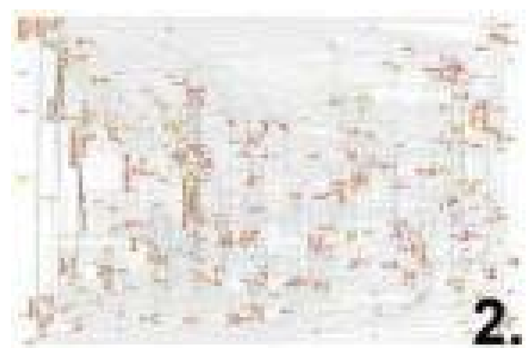
Drawn Image	Current Q sample
	
	




1.

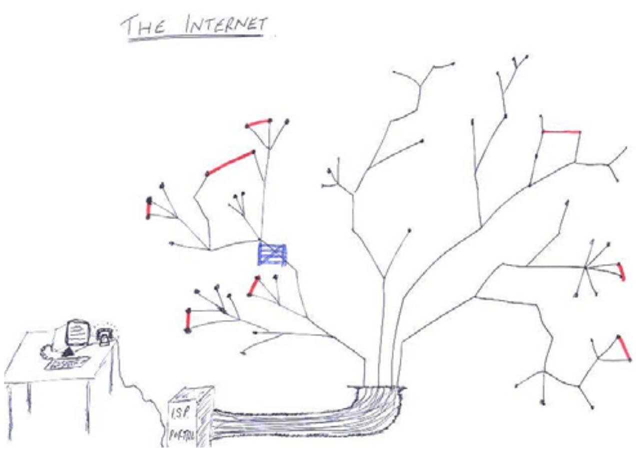


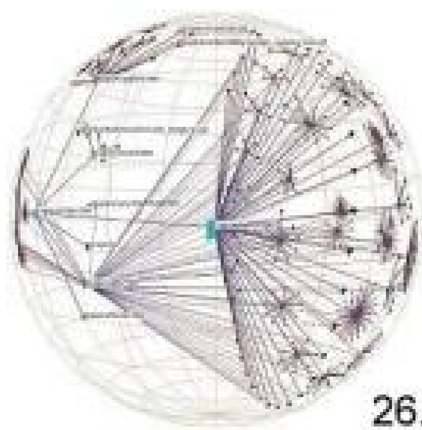

7.


MUSIC
GAMES
SHOPS


guitar
makers
artists
22.


THE INTERNET
ISP


26.

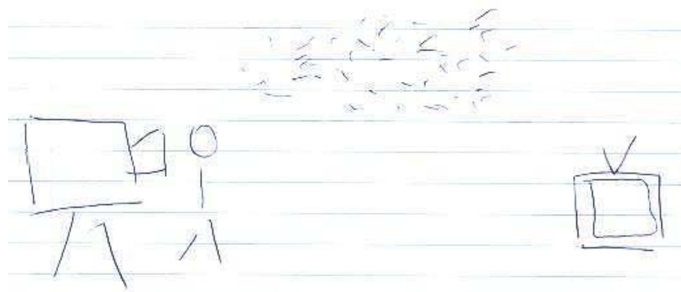
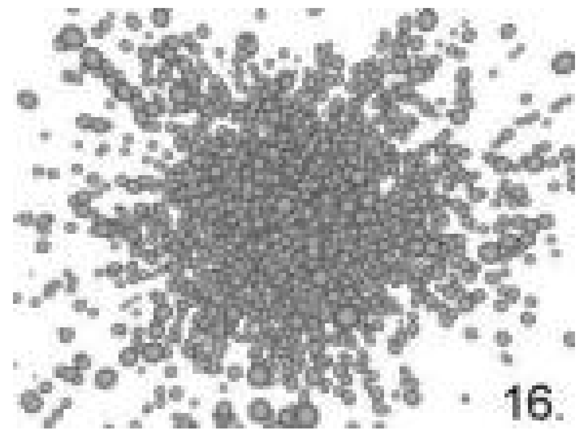
	

Table 9.3. Comparison of drawn images and their facsimile in the current Q sample.

In terms of the Web representations, the interview transcripts highlighted that four of the six images consistently produced strong reactions (both positive and negative). Participants almost immediately liked or disliked images 1-4 and rated them as similar/dissimilar (respectively) to their own mental representation. Accordingly, these four images were included in the concourse (see Table 9.4).

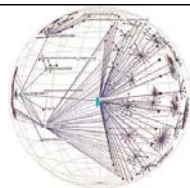
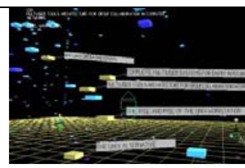
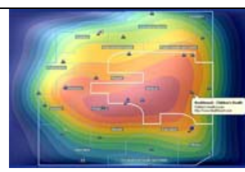
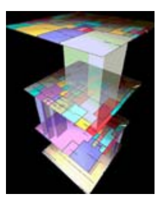
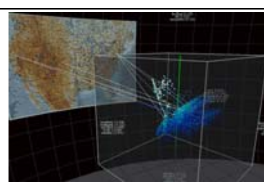
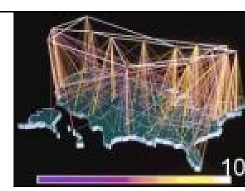
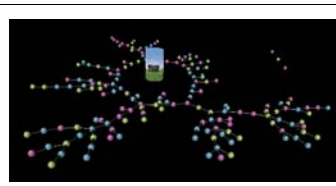
	Web Representation	**Included?**	**Equivalent concourse item**
1		✓	--
2		✓	--
3		✓	--
4		✓	--
5		✗	
6		✗	"Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it"

Table 9.4. Inclusion of equivalent concourse items

In contrast however, images 5 and 6 seemed to be either too abstract or confusing:

> "What is image 5? [laughs] I don't get it … I see a map but I don't get how it's meant to be the Internet… I'm just going to ignore that one" [AU1]

> "6 looks like a bunch of marbles, no an atom. It looks like one of those models you make in science class. And what's that thing in the middle supposed to be?" [EU3]

Given the level of confusion over these two images, it was deemed necessary to exclude them from the concourse. The essence of each image was not completely eradicated however; the geographical element of image 5 was reflected in another image included in the concourse (image 10). Similarly, the atomic nature of image 6 was already included in one of the text concourse statements (see Table 9.4).

In sum, the first pilot generated 36 statements to be used as the text concourse for the current study. It also generated 9 drawn images and 4 digital representations, thus forming part of the image concourse. Given that the text concourse was substantially larger than the image concourse, it was necessary to locate additional images of the Internet. Consequently, another twenty three images of the Internet were obtained from various online sources, although most notably from the Atlas of Cyberspace. Whilst this was a largely unstructured Q sample (see section 8.2.2.2), the images chosen represented a broad cross section of the representations available on these resources. Thus, a total of thirty six textual statements and thirty six images formed the concourse for the current study.

9.4 PILOT 2: Q SAMPLE SELECTION

Whereas the first exploratory study generated the concourse for the current study, the next pilot study was concerned with refining and defining the Q sample. As Chapter 4 outlined, the main goal in selecting a Q sample is to provide a miniature which, in major respects, contains the comprehensiveness of the larger process being modelled. In more established research topics, there is usually a theoretical basis guiding the selection of Q sample items. However, in this case, there is little or no previous research to aid the Q sample selection process. As Q methodology is based on the premise that meanings are not ascribed *a priori*, it was important that the Q sample would not be unduly influenced by a categorisation of the items according to my own personal (informal or formal) hypotheses. Therefore, a demographically similar set of respondents engaged in another small-scale exploratory study to decide how items were to be included in the Q sample.

9.4.1 Aims

The aim of the second pilot study was to:

1. Investigate whether the thirty six image and text concourse items were an optimal number for the Q sorting process.
2. Explore whether it was feasible to combine image and text concourse items into one mixed media Q sample.

9.4.2 Participants

An opportunity and convenience sample of 17 students completed the Q sorting task. The students were demographically similar to the respondents in the previous research from which the concourse was drawn, and so were likely to hold similar subjectivities regarding the concourse items (see Table 9.5).

Sex	*8 males, 9 females*
Age	Age range: 21–41; mean age 25.71 years
Hours per week	11-15 hours per week using the Internet
Years Experience	6.41 years experience using the Internet

Table 9.5. Demographic breakdown of respondents in Pilot 2

9.4.3 Method

Given that the data collection was conducted in a classroom setting, the session began with an introductory lecture about the research area and Q Methodology. The class was divided into three equal groups, by sequentially numbering neighbouring students. Participants were informed that they would be each completing three Q sorts:

1. Images only (Q sample = 36 images)
2. Text only (Q sample = 36 statements)
3. Mixture of both images and text (a representative selection of 18 images and 18 statements were chosen to form the mixed concourse)

Although the medium of the Q sort was varied, the condition of instruction remained the same: How like /unlike is each item in relation to your own mental image of the Internet? Each group of participants was given the appropriate concourse items and were instructed to begin the Q sorting task. Approximately 5-10 minutes was spent with each group, helping them to understand how to complete the Q sort. This extra time explaining the process of the Q sort was necessary for a number of reasons. Primarily, this was a novel methodology for the students and it took a little extra time to understand what was required of them. Secondly, in typical Q sorting exercises, each respondent should have a set of Q sample items per person, which will enable them to physically sort the stimuli on a table and into the grid formation. However, with so many students completing three Q sorts in such a short space of time, space restrictions did not permit this. Instead students only had one concourse set per group, and had to write the corresponding number from each image/textual statement into the provided blank grid.

Participants were given approximately 30 minutes to complete the first Q sort. After this time, they swapped concourse sets and completed the Q sort task once again for the next medium. Once again, after approximately 30 minutes, they swapped concourse sets and completed the final Q sort for the remaining medium. In this way, the students each completed 3 Q sorts using images only, text only and a mixture of both.

Following this intensive activity session, participants were then given a 30-minute break. They were invited to fill out the brief demographic questionnaire and feedback form in the break. When they returned, they were given a 50-minute lecture on the importance of investigating Internet representations and how Q Methodology can be used to achieve this. Participants were also asked to give feedback on what they thought about the methodology and research and how it could be improved.

9.4.4 Outcomes

9.4.4.1 Number of Q sample items

The feedback from the participants indicated that the thirty six statements and images were too many items to sort properly. Although almost all the participants (88%) rated the duration of the task as ‘ok’ or ‘not bad’, several of them remarked during the Q sorting procedure that there were simply too many items to choose from. Indeed, it is inherent in the nature of the Q sorting process that respondents are required to make many decisions about the salience, meaning and relationship of each item to the others. In this study, this potential cognitive overload is exacerbated by the fact that the items are rich in detail, colour and texture and in some cases, overly abstract. To maximise the probability of participants completing the Q sorts in the main study, it was deemed necessary to reduce the number of items. The assessment of how many items to omit was decided in the next exploratory study.

9.4.4.2 Combining Q sort mediums

Another outcome of this exploratory study was the differing responses to the image, text and mixed Q sample items. Participants had intuitive, acute responses to a particular medium, often either loving or hating the image or text based Q sorts. Just over half of the participants (59%) preferred the images based Q sort. Many participants remarked that they enjoyed completing the visual alternative to the textual statements:

> “The images are more stimulating … and thought provoking”.

Almost a third (29%) preferred the text based Q sort, saying that the text was:

> “Less ambiguous and more descriptive”.

> “The meaning was clearer”.
>
> “ [The statements] were easier to classify”.

Interestingly, most of the participants generally disliked the mixed Q sample; only 2 participants (12%) preferred the mixed stimuli:

> “The combination was more understandable”.
>
> “It gave me a more complete and deeper understanding”.

However, when probed further, these participants admitted that that they found it more difficult to shift back and forth between media within one Q sort. Accordingly, the mixed Q sample was abandoned in the main study. Participants would be given the choice of whether they wished to complete an image or text based Q sort, but with only one mode of representation available per Q sort.

9.5 PILOT 3: Q SAMPLE REFINEMENT

The preceding pilot study indicated the need to reduce the Q sample into a comprehensive, more manageable number of items. Additionally, a number of other methodological issues were also tested in this pilot study; for example, the possibility of conducting the Q sorting process online and testing the effectiveness of the Characteristic Profile Questionnaire. Retrospectively, it emerged that this pilot study was pivotal in determining the methodology used in the current study.

9.5.1 Aims

The aims of this exploratory study were to:

1. Condense the thirty six images and textual statements into a more manageable Q sample.
2. Investigate the possibility of running an online Q sort.
3. Trial run the Characteristics Profile Questionnaire.

9.5.2 Participants

An opportunity and convenience sample of 30 Ph.D. Psychology students and 14 staff members at the University of Bath were canvassed to participate in an online ‘quasi-Q sort’ and questionnaire. A total of 13 participants formed a self-selecting sample (see Table 9.6 for the demographic breakdown).

Sex	*4 males, 9 females*
Age	Age range: 21–55; mean age 28.38 years
Hours per week	11-15 hours per week using the Internet
Years Experience	6.58 years experience using the Internet

Table 9.6. Demographic breakdown of respondents in Pilot 3

9.5.3 Method

Given the focus of this research, it was deemed appropriate to actually utilise the Internet to study users whilst they were interacting with the technology. Accordingly, prior to this pilot study, a research website was set up which would enable respondents to complete this exploratory study online. In a closed-web page design (Bradley, 2003), respondents were invited to visit the research site to complete the quasi-Q sort and questionnaire. This was achieved via an e-mail request in which the research site’s URL[5] was embedded in the message. The respondent simply clicked on this hypertext link, which then evoked their web browser, presenting the reader with the web-based survey. The email message included a brief introduction about the researcher and why they were being invited to complete the survey. It outlined what participation would involve and the time span of involvement. Once they clicked on the embedded URL, participants were taken to a visually stimulating home page including some images and textual descriptions of the Internet. This was the precursor to the main study’s research website; it was designed in the hopes that the images would entice them to participate in the study. From the home page, participants could click a number of links to begin participating. They were given the choice to complete as many or as

[5] See Appendix 15 for Glossary of Technical Terms.

few of three tasks: an image quasi-Q sort, a text quasi-Q sort and a demographic questionnaire.

The typical Q sorting process, as outlined in chapter 8, was deviated from slightly, hence the completion of 'quasi' Q sorts. Participants were asked to sort the thirty six images/textual statements according to how like/unlike they were in relation to their own mental image of the Internet. However, instead of sorting them into a Q grid, they were only asked to sort them into three piles: those LIKE, those UNLIKE and a NOT SURE pile. They were then asked to consider and discuss which items they preferred and which were most similar and dissimilar to each other and why. This procedure, subjective clustering of stimuli followed by free response labelling, has previously proved useful for obtaining similarities judgements (Green, et al., 2000).

The full instructions for the image based task were as follows:

RANK THE IMAGES!
Sort these images according to how like/unlike they are in relation to your own mental image of the Internet.

1. Below are 36 images of the Internet. Click and hold each thumbnail image to move them around the page. Double click to enlarge them, click once to shrink.

2. Sort the images into **3** piles: those LIKE, those UNLIKE and a NOT SURE pile

Participants could move and enlarge small icons around the page by clicking on them. They moved each of the icons into three large, brightly coloured boxes labelled 'UNLIKE my mental image, NOT SURE, LIKE my mental image' respectively. They then scrolled down slightly for the next set of instructions, which were as follows:

Each picture is numbered in the bottom right hand corner. Using the form below, note down:

A. Which pictures are

   Most like your own mental image. Why?

   Not at all like your own mental image. Why?

   Neither like/unlike your own mental image. Why?

B. Which pictures are

   Similar to each other. Why?

   Dissimilar to each other. Why?

You may form as many groupings as you desire - but do not feel the need to fill all the response boxes! Please be as descriptive as you can when explaining why you have grouped certain images together. Your answers for section A might not necessarily be the same for Section B.

Following these instructions, participants filled in a form that asked for the above information. Participants could form as many groupings as they desired and were encouraged to be as descriptive as possible. Once they had filled out the online form, they were thanked and directed to press the 'submit' button. Their responses were emailed to the researcher for analysis. They were then directed to another page which encouraged them to complete the demographic questionnaire, and if they had time the remaining image/text tasks. If not, they clicked on a link to return to the homepage.

If they chose to complete the brief demographic questionnaire, participants were directed towards a second page, which had a multi-item questionnaire that asked about their Internet use and their attitudes towards the Internet. This questionnaire was the precursor to the modified questionnaire used in the main study. Responses were in the format of check boxes and Likert scales, so participants could click the drop down menu provided for each question and select the most appropriate answer. For some questions, the response was open-ended. Participants typed in their response in the given box (there was no limit on how much they could write). Once they had completed the questionnaire, they were once again thanked and directed to press the 'submit' button.

This was the end of respondent participation. Each response was submitted electronically and anonymously via email to the researcher. The only identifying characteristic was the IP address[6], which was necessary for the multiple responses to be matched up for each participant.

9.5.4 Outcomes

Thematic analysis of participants' responses enabled a more refined yet comprehensive Q sample to be selected for the current study. The thirty six image and textual statements were reduced to twenty six items which form the main Q sample. The following section describes this process in detail.

9.5.4.1 Image Q sample selection

In order to refine the original 36 concourse items into a more manageable number, a structured approach was employed. Thematic analysis for the groupings participants rated as similar and dissimilar yielded eight distinct themes (see Table 9.7).

Spherical (3D)	*2D Networks*
Circular (2D)	Recurring squares
Maps	Card Index
Sci-Fi	Chaotic

Table 9.7. Eight emergent themes from Image sample

Two images were selected from those identified as being characteristic of this group. However, this only created 16 stimuli (8x2), arguably too small a Q sample to adequately cover other potential representations.

[6] See Appendix 15 for Glossary of Technical Terms.

To augment this small Q sample, further analysis of the quasi Q sorts was conducted. The data were entered into PQMethod, as if the participants had completed the full Q sort process. As part of the extensive analysis report, a table of ‘consensus and disagreement’ of the items is generated. This contains important information, for it indicates which items are rated positively, negatively and more interestingly, which items generate bipolar responses. Each of the bipolar images were selected for inclusion in the Q sample, along with one or two images that were consistently rated positively and one or two images that were consistently ranked negatively. Appendix 9.1 displays the final Q sample of twenty six images [7].

It can be noted that some studies suggest that Q samples should normally be between 40-80 items (Watts & Stenner, 2005a). However, the abstract and novel nature of this study requires a much smaller Q sample than is usually deemed necessary. The selection procedure ensured that the Q sample maintained comprehensiveness, despite its smaller size.

9.5.4.2 Text Q sample selection

Using a structured Q sample approach, thematic analysis for the groupings participants rated as similar and dissimilar yielded five distinct themes (see Table 9.8).

Linking and connectivity	*Chaotic*
Tree diagrams	City/map
Electrical impulses	

Table 9.8. Five emergent themes from Text sample

The method of selecting textual Q sample items was identical to the process for the image selection; two or three statements identified as being characteristic of the five emergent themes were selected and augmented by the bipolar, consistently positive and consistently negative ranked items in the quasi-Q sort analysis. Appendix 9.2 displays the final Q sample of twenty six textual statements.

[7] Appendix 9.1 also provides information on source location and Copyright for each image.

9.5.4.3 Development of online Q sorting interface

A second very important outcome of this pilot study was the affirmation that the Q sorting process could be conducted online. Respondents commented that they liked the efficiency of participating online. Consequently, a more elaborate research website was constructed that fully simulated the Q sorting process. The research website (see Figure 9.2) was constructed using a combination of Notepad and Macromedia Dreamweaver MX®. Javascript® language augmented the HTML[8] code.

Figure 9.2. Home page of the research website

9.5.4.3.1 Features of the online interface

In the past decade, there have been a small number of online Q sort interfaces developed. These online applications can be credited as being early pioneers into the field of online Q sorting. However, they can be criticised on the basis that they do not fully simulate the original, manual Q sorting process. To overcome these limitations, an online interface was designed whereby participants used a drag-and-drop method to simulate the sorting process traditionally used in Q studies (see Figure 9.3)

[8] See Appendix 15 for Glossary of Technical Terms.

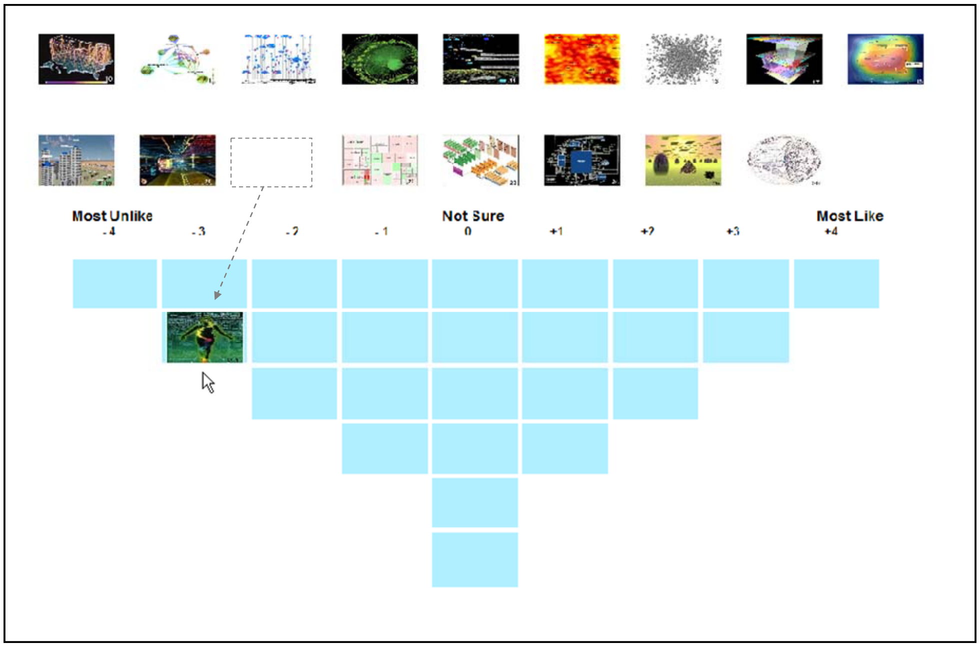


Figure 9.3. Drag-and-drop feature of the research website

Unlike previous online Q sorting programmes, this interface is analogous to the offline Q sorting process. Participants can perform a full Q sort by dragging items, first to one of the appropriate intermediate holding areas (for negative, neutral or positive ratings), and then to the final placeholders on the rating scale. This most closely simulates the 'feel' of doing an offline sort, making this interface unique in design.

In order for all the Q items to be displayed concurrently, each image had to be displayed in icon form, at least initially. This is especially useful, as it not only enables all the items to be displayed, but also that they can be easily manipulated and moved around the page. However, in icon format, it is not easy to see the contents of each item. Therefore two methods were employed to increase visibility: the ability to enlarge the icons, and the provision of 'alt text'[9].

The JavaScript code written into the HTML code of the website enabled the picture icons to be enlarged by double clicking on them. This means that the contents of

[9] See Appendix 15 for Glossary of Technical Terms.

each could be viewed in detail. Figure 9.4 illustrates that each item was numbered in the bottom right-hand corner, enabling participants to keep track of which items had been sorted. Each icon could be double-clicked again to reduce them in size. This was helpful for moving the icons around the screen and not obliterating other Q item icons.

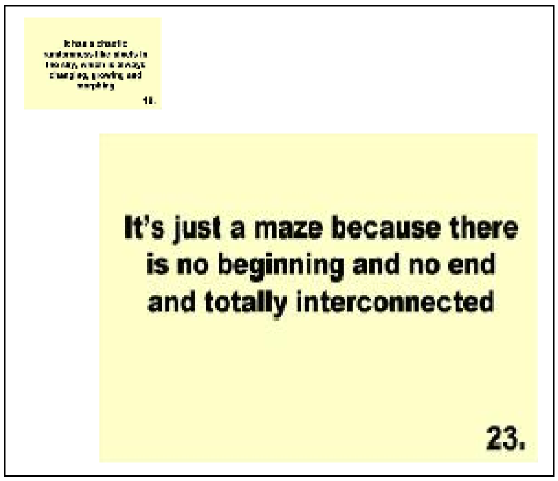


Figure 9.4. Double-clicking to enlarge icon

Furthermore, if participants preferred not to enlarge the icons, the content of each item could be displayed simply by hovering the mouse over the item (See Figure 9.5). The alt text described the content of the image, even if it was not fully sized and therefore could be viewed properly. Thus, the alt text enabled more detail to be viewed, without enlarging each image on the screen.

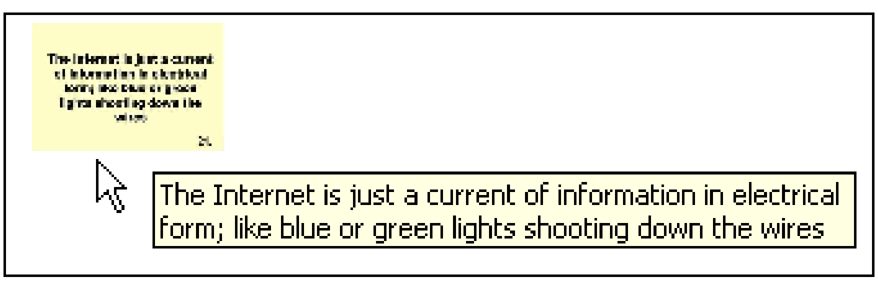


Figure 9.5. Alt text displayed when mouse hovers over image icon

In sum therefore, a number of design elements were incorporated into the website design, as to make the online Q sorting process fully simulate the traditional offline mode. It was hoped that this would afford a more authentic Q sorting experience.

9.5.4.4 Testing the Characteristics Profile Questionnaire

A final important outcome of the third exploratory pilot was the testing and subsequent modification of the Characteristic Profile Questionnaire. All 13 participants proffered feedback about the efficacy of the questionnaire (for example, wording, order and/or redundancy of some questionnaire items). This feedback was instrumental in the subsequent modifications. But in order to understand how the questionnaire was adapted, it is necessary to describe how it was initially set up.

9.5.4.4.1 ORIGINAL QUESTIONNAIRE SETUP

Inclusion of a questionnaire was deemed to be a vital augmentation of the Q sort data. In addition to providing contextual clues for interpretation, it will suggest whether demographic demarcations inherently exist in the data. By examining the characteristics associated with each factor, it is possible to ascertain whether certain viewpoints 'belong' exclusively to specific groups. Initial findings by Ratzan (2000) and Maglio and Matlock (1998) indicate that users' perceived level of skill and gender may be related to metaphor use. Beyond these two studies, there is a lack of empirical guidance for the inclusion of salient variables to examine. Thus, the questionnaire was developed as an exploratory tool, to investigate a range of characteristics that could emerge as salient in relation to metaphor use. Items from the following interesting and relevant questionnaire sets were therefore incorporated:

- Internet Use (Pilot 1; GVU WWW User Survey, 1998)
- Internet Attitudes Scale (Nickell & Pinto, 1986)[10]
- Internet Self-efficacy (Eastin & LaRose, 2000)
- Vividness of Visual Imagery Questionnaire (Marks, 1973).

[10] The Internet Attitude Scale (IAS) was modified from the Computer Attitude Scale, developed and validated by Nickell and Pinto (1986). The original scale remains the same; the IAS merely replaces the word 'computer' with 'Internet'.

It is acknowledged that there are many other questionnaire sets which could have been included in the design. It is not claimed that the questionnaire design is in any way representative of *all* the possible variables. There is little theoretical background to guide the selection of the most pertinent questions. Instead, the most commonsensical questionnaire sets were included in this exploratory investigation. For example, items in the Web Attitudes Scale (Liaw, 2001) had some degree of overlap with the Internet Attitudes Scale and Internet Self-efficacy (Eastin & LaRose, 2000). Thus, to avoid obvious duplications and keep the questionnaire streamlined, the Web Attitudes Scale was not included.

The original version included questions covering the following areas:

- Basic demographics
- Internet usage
- Perceived Internet problems
- Perceived Internet efficacy
- Attitudes towards the Internet
- Defining and understanding the Internet
- Visualising the Internet

The questionnaire began with a general demographic section, which asked participants for their age, gender, highest level of education, the number of years of Internet experience and finally the approximate number hours per day and per week the Internet is used.

To survey how the Internet is used, elements from Pilot 1 research and the 'Web and Internet Use' questionnaire set from GVU Tenth WWW User surveys (1998) were modified and extended. The questions covered topics such as primary use and frequency of use of certain Internet tasks, the penetration of the Internet (what activities the Internet has replaced, the extent to which the Internet has become a part of everyday life), perceived Internet problems and perceived level of skill. This section was augmented by a set of new questions added in for the purpose of this study. These questions asked about the types of information searched for, the style of information search and perceived ease of use of the Internet. The majority of these items were closed, Likert type responses, although the scales differed according to the type of question.

The items used to measure attitudes towards the Internet were adapted from Nickell and Pinto (1986) Computer Attitudes Scale. Individuals were asked to indicate their agreement or disagreement with several statements using a five-point Likert scale ranging from (1) “strongly agree” to (5) “strongly disagree”. Similarly, the items used to measure how capable someone feels using the Internet were taken from Eastin and LaRose (2000) Internet Self-Efficacy Scale. Since previous research demonstrates that there may be a relationship between level of skill and internet usage (see Chapter 5), it follows that variables which have an impact on perceived skill and Internet usage could also be related to metaphorical usage. It was therefore pertinent to include these items in the current demographic questionnaire. These Internet self-efficacy items were not included in a separate section, but rather were dispersed throughout the questionnaire and often were synthesised with other questions. For example, Question 4 not only asks which tasks participants have completed in the past, but also rate how capable they felt whilst doing them. This synthesis was employed to reduce duplication of items in the questionnaire.

The last section of the demographic questionnaire modified items taken from the Vividness of Visual Imagery Questionnaire (VVIQ) (Marks, 1973). The VVIQ requires a set of verbal reports in the form of ratings along a 5-point scale of the vividness of a series of visual images of people, scenes and activities (Marks, 1973). The rating scale remained the same (a five-point scale ranging from (1) “perfectly clear and vivid”, to (5) “no image at all”). However, the scenarios Marks (1973) uses were modified to include more Internet related depictions. For example, instead of asking participants to mentally visualise a person or the sun (as in the original research), they were asked to think about searching the Internet for information. Related to this, the final few questions asked participants which mode of thought they used when thinking about these scenarios. This is because it is acknowledged that not all mental ‘imagery’ is pictorial in nature.

A number of open-ended responses were dispersed throughout the questionnaire.

Taken from Pilot 1, participants were required to describe their definition of the Internet, and how they search, browse and explore the Internet for information. They were also required to answer the summary statements included in Pilot 1 interviews (*'When I think of the Internet I think of...'* and *'The Internet is like a...'*). These questions worked very well in the previous research at eliciting rich metaphorical descriptions. They have also proved to be exceptionally beneficial in the analysis of the data, because these responses are instrumental in contextualising participants' Q sorts.

9.5.4.4.2 MODIFICATIONS TO THE QUESTIONNAIRE

Participants indicated several areas in which wording and content could be improved on the Internet Attitude Scale (Nickell & Pinto, 1986). Questions with ambiguous interpretation and overlapping meaning were excluded from the final questionnaire (see Appendix 9.3). Additionally, a number of items from the GVU Tenth WWW User survey (1998) were modified, deleted or extended (see Appendix 9.3). Participants failed to respond to the more technical questions concerning Internet software settings, and so were omitted from the questionnaire. Similarly, participants complained that the some of the Internet problems were too technical, that some of the items overlapped or were just too vague. Accordingly, the list was modified to include 13 potential problem areas (an equal distribution of technical- and user- related problems). Lastly, the list of Internet tasks were extended to include more recent applications, such as streaming audio and video conferencing over the Internet. Overall, participants reported that they found the questionnaire easy to complete. The modified version of the questionnaire was retained for the current study (see Appendix 10.4 for full questionnaire). It has been labelled the 'Characteristic Profile Questionnaire' (CPQ) in order to reflect the extensive qualitative and quantitative measures that examine Internet user's characteristics.

CHAPTER 10. METHOD AND PROCEDURE

Figure 10.1. On Internet surveys. © Peter Steiner, The New Yorker, July 5, 1993 issue.

10.1 INTRODUCTION

This chapter describes the method used to collect data for the current study. Participants completed two tasks: 1) a Q sort using either images or textual descriptions of the Internet and 2) a 22 multi-item Characteristics Profile Questionnaire (CPQ) incorporating closed- and open-ended responses.

Chapter 8 outlined the six fundamental steps involved in running a Q study (see Table 10.1). Chapter 9 described in detail the generation of the concourse and how the Q sample was selected (steps 1 and 2). Following on, the focus of this chapter is how the ‘P set’ (or participants) was obtained[11], and the exact procedural details they followed whilst participating in the study (steps 3 and 4). How the data were analysed and interpreted is the subject of Chapters 11-13.

1.	CONCOURSE GENERATION
2.	Q SAMPLE SELECTION
3.	P SET SELECTION
4.	Q SORTING PROCEDURE
5.	Q FACTOR ANALYSIS
6.	INTERPRETATION

Table 10.1. Six steps to running a Q study

10.2 P SET SELECTION

In order to maximise the volume and diversity of users participating in the study, participants were obtained through a variety of methods. It was a self-regulating system in the sense that the types of users already participating were continually monitored (garnered from their CPQ data), and then sought alternative methods to specifically target and obtain demographically different participants. In total, respondents were recruited in five ways:

[11] All participants were treated in accordance with the ethical standards of the British Psychological Society. See Appendix 10.1 for the ethical considerations taken in to account during the implementation of this research.

1. Website indexing (self-selection)
2. Newsgroup postings
3. Chat room postings
4. Emailing to selected and random bulk-email lists
5. Cohort group sample

10.2.1 Website indexing (self-selection)

In an 'open-web page' design (Bradley, 2003), the research web site was 'open' to any visitor who might come across the site whilst surfing the Internet (thus, there was no control over who visited the site). To generate visitors, the site needed to be advertised to prospective participants. To do this, the research website was submitted to an 'indexing service', so that when users' conducted a web search for 'cyberviz' (the domain name selected for the research website) or other related terms (such as Internet, metaphor, visualisation), the site would be displayed alongside other relevant hits. The indexing service was provided with a number of keywords which related to the site. This registered the research site on the 'hit' lists of the top ten search engines (Table 10.2):

Altavista	Infoseek
Aol Netfind	Lycos
Excite	Northern Light
Google	WebCrawler
Hotbot	WhatUseek

Table 10.2. Top ten search engines, in alphabetical order

When the exact term 'cyberviz' was entered into the main search engines, the research site URL (http://www.cyberviz.co.uk) is the top 'hit'. However, under less specific search terms , the research site does not enter the first few thousand hits. It is very unlikely therefore that much traffic was generated from this method, unless the user happened to type the exact keyword 'cyberviz' into the search engine.

10.2.2 Newsgroup postings

A number of Google newsgroups were randomly chosen and messages concerning the research were posted (see Appendix 10.2). Using a random number generator, four groups from each of the ten meta-groups was selected (see Figure 10.2).

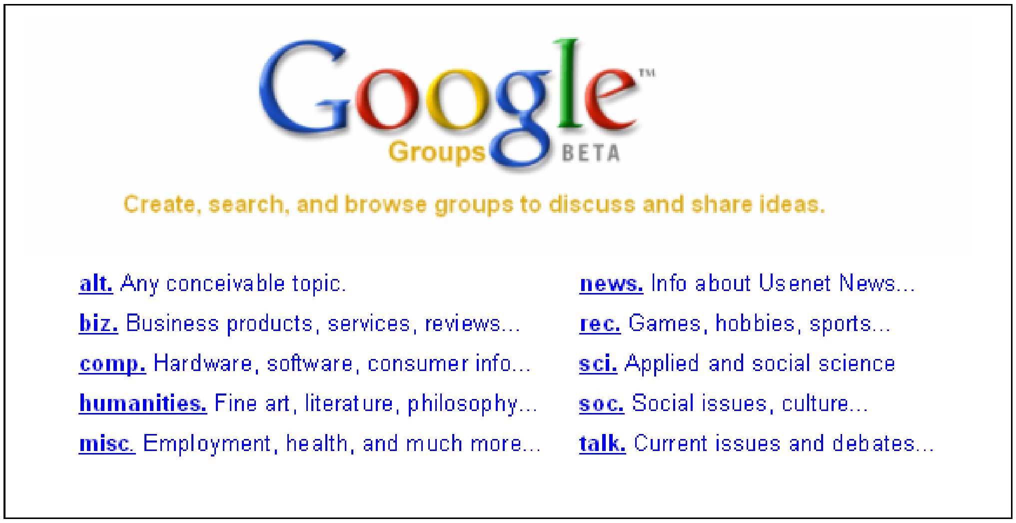


Figure 10.2. List of Google newsgroups

Whereas some newsgroups engage in open participation (any Internet user can post a message on any topic), many newsgroups have closed membership (only certain group members can post to the group on specific, related topics). Therefore, in addition to the forty randomly selected newsgroups, an additional two groups were selected from each of the ten meta-groups, by looking at the newsgroup path name and judging whether they would be likely to accept the research message posting (for example, newsgroup paths that contained the terms internet or computer, e.g. *alt.internet*). It was hoped that this judgement sample would augment the randomly selected newsgroups and thus increase the likelihood of my message being posted. Approximately two thirds of the sixty message postings were rejected due to each newsgroup's spamming[12] policies. The twenty newsgroups which accepted the message postings are shown in Table 10.3.

[12] See Appendix 15 for Glossary of Technical Terms.

Meta-Group	News Group	N	%
.alt	alt.anybody	4	20%
	alt.anything		
	alt.computer		
	alt.internet		
.biz	biz.comp	1	5%
.comp	comp.databases	6	30%
	comp.graphics		
	comp.human-factors		
	comp.internet		
	comp.networks		
	comp.text		
.humanities	humanities.design.misc	1	5%
.misc	misc.creativity	1	5%
.rec	rec.games.computer	2	10%
	rec.puzzles		
.sci	sci.cognitive	3	15%
	sci.image.processing		
	sci.virtual-worlds.apps		
.soc	soc.net-people	1	5%
.talk	talk.bizarre	1	5%

Table 10.3. Newsgroups which accepted the message postings

Just under a third of all the message postings were accepted from the *.comp* groups – those that deal with anything computer related. It is not surprising therefore that the newsgroups which discuss similar and related topics to this research were more willing to accept such messages. The only meta-group which rejected all the postings was *.news*, which specifically deals in news about Usenet.

Even though two thirds of the postings were rejected, twenty newsgroups have sufficient potential to generate a substantial number of visitors to the research website. Indeed, in two of the newsgroups, my message post became rather controversial, generating a lengthy and often contentious discussion threads. For example, 34 messages were posted at *sci.image.processing*, and 47 at *rec.puzzles*. In the *talk.bizarre* newsgroup, my discussion thread was rated number one in the 'Top Ten, Threads' in December 2003, garnering almost 5% of the thread total (out of 153 distinct threads).

10.2.3 Chat room postings

'Chat rooms'[13] were created in two well known Internet portals, MSN and Yahoo! (cyberviz@groups.msn.com and cyberviz@chat.yahoo.com respectively). There was no expectation that visitors would participate in an online chat about my research. Rather, the chat rooms were created to further advertise the research and encourage visitors to the research website. Similar to the website indexing method, the chat rooms were 'open' to any visitor who might come across them whilst browsing the Internet for similar information (for example, someone who was interested in chatting to others about general Internet issues). There was no control over who visited these chat rooms, making it a self-selecting sample. A welcome message introducing the purpose of the chat room, including a link directing them to the research website, was displayed prominently on the opening page (see Figure 10.3).

[13] See Appendix 15 for Glossary of Technical Terms.

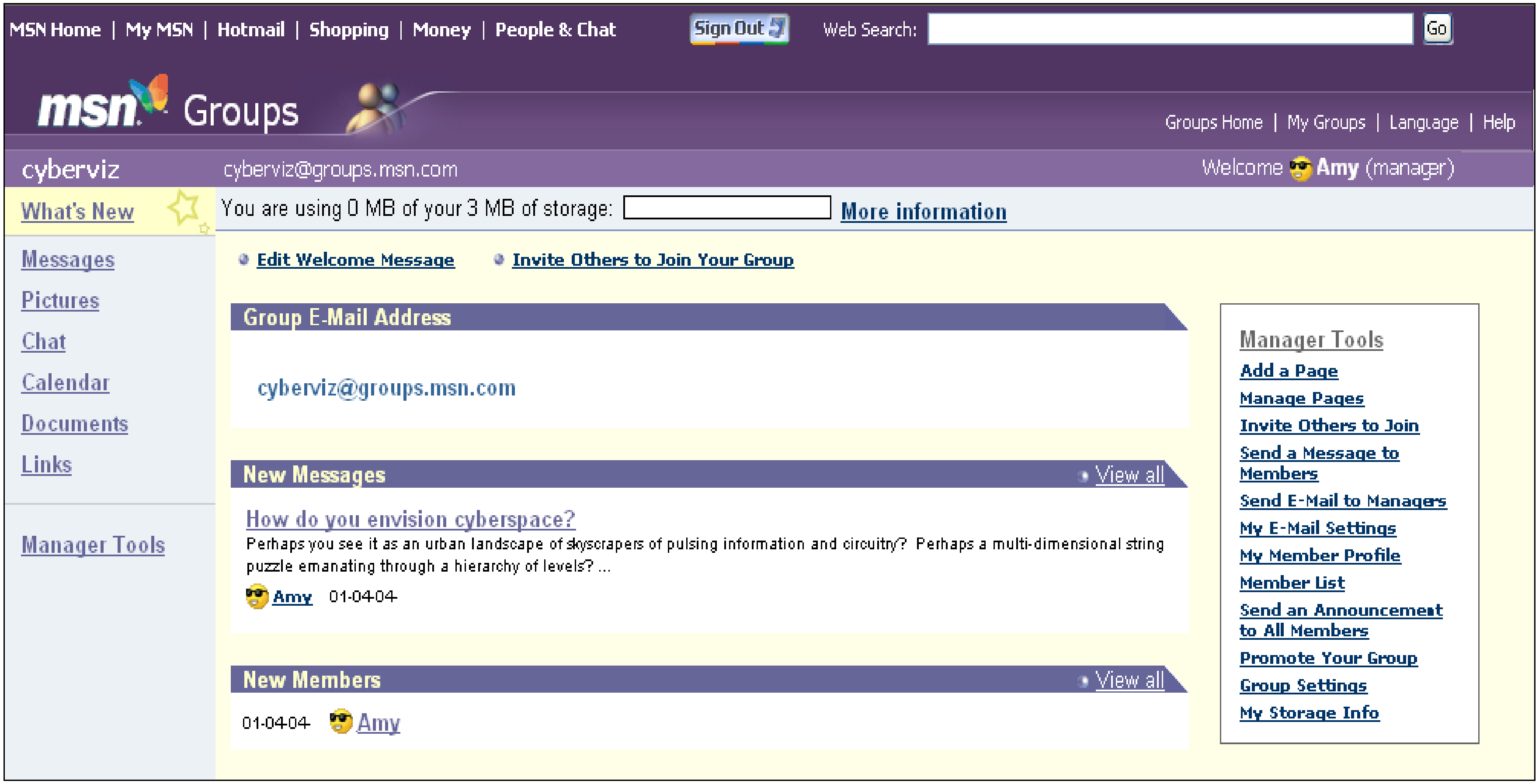


Figure 10.3. Chat room created in MSN groups

To increase the traffic visiting the chat room, the 'Membership Policy' settings were set so that anyone could view the chat and become a member of the chat group without the permission of the group administrator. The content was moderated however, so that full control was maintained over any messages which were posted (in order to reduce the likelihood of spamming). The chat rooms were indexed in both MSN's and Yahoo!'s directory listings and search engines under the 'Computers and Internet' category (Internet sub-category).

Although it is impossible to quantify exactly how many participants were directed to the research website from the chat rooms, as of the end of the data collection period, no messages were left in the chat forums. Therefore, it is unlikely that many of the participants were generated from this method.

10.2.4 Emailing to selected and random bulk-emailing lists

In a 'closed-web page' design (Bradley, 2003) respondents were invited to visit the research website. An email request was sent out to both random and selected bulk-email lists (see Table 10.4). The email message included a brief introduction about the researcher, a few paragraphs detailing the purpose of the study, and outlined what participation would involve including the time span of involvement. The research site's URL was embedded in the message. The respondent could simply click on this hypertext link, or type the URL into the address bar, bringing them to the research website's homepage.

The selected email lists were those to which I have subscribed to during the course of my Ph.D. study, thus forming a judgment sample. People that subscribe to these specific email lists are most likely to be experts in the areas of Q Methodology, human-computer interaction, computers and the Internet. To counteract this domain expertise, typical Internet users were solicited via the randomly selected bulk-email lists. Using a random number generator, fifteen email lists were chosen from a Listserv provider. I subscribed to each list and posted the email message.

To increase the reception of the email messages by each list, the content of the email message was modified slightly. Experts in the field were sent a more academic version whereas the random email lists were sent a more colloquial, enticing version (see Appendix 10.3). Surprisingly few of the emails were rejected due to the list's spamming policies, so it is likely that the majority of participants were generated via this method.

Selected email lists	WEBEXPERIMENTS@YAHOOGROUPS.COM
	CYBERSOCIOLOGY@YAHOOGROUPS.COM
	AH@LISTSERVER.TUE.NL
	UM@DI.UNITO.IT
	GK-MEMBERS@BATH.AC.UK
	CHI-WEB@ACM.ORG
	NETPSY@MAELSTROM.STJOHNS.EDU
	MAPPING-CYBERSPACE@JISCMAIL.AC.UK
	Q-METHOD@LISTSERV.KENT.EDU
Random email lists	IND-DIFFS@JISCMAIL.AC.UK
	AHC-UK@JISCMAIL.AC.UK
	ACCESS-LANG@JISCMAIL.AC.UK
	WRITING-DEV-ART-AND-DESIGN@JISCMAIL.AC.UK
	ART-TECHNOLOGY@JISCMAIL.AC.UK
	ADMIN-TECHTRANS@JISCMAIL.AC.UK
	DCS-PUZZLENEWS@LISTS.DISCOVERY.COM
	GENERAL@TSAWEB.ORG
	ARTNET-ALL@JISCMAIL.AC.UK
	YOUTH-STUDY@JISCMAIL.AC.UK
	ACEWEB@JISCMAIL.AC.UK
	GENDER-HCI@JISCMAIL.AC.UK
	AHP@JISCMAIL.AC.UK
	ART-VISUAL@JISCMAIL.AC.UK
	TSA@WATSA.ORG

Table 10.4. Selected and random email lists

10.2.5 Cohort group sample

Not surprisingly, the above online sampling methods inevitably led to a skew in the sample towards those who have an increased inclination to use the Internet. To counteract this, an offline mode of sampling was employed, specifically targeting novice and infrequent users of the Internet.

Sixty two first year psychology undergraduates were obtained in a convenience, self-selecting sample. This cohort group[14] was chosen based on their likely characteristics that they were novice and/or infrequent Internet users. The basis of this assumption was that a similar research group obtained the previous year had these desired characteristics (Joiner, et al., 2005).

A two-hour lecture and activity session was given to the participants. In the first hour, participants were given a lecture introducing Q Methodology and also about the importance of studying the Internet. In the second hour, participants were given the choice of whether they wished to complete the online survey; it was not a requirement, yet it was made clear that it was desirable. As the data were submitted electronically and therefore anonymously via email, it is not possible to know how many of the participants completed the study. Therefore, it is not possible to calculate the mean distributions of age, gender and Internet experience for this cohort group.

10.3 Q SORTING PROCEDURE

The Q sorting procedure was conducted between December 1, 2003 and April 20, 2004. Participants were required to complete two online tasks;

1. Online Q sort
2. Characteristic Profile Questionnaire

[14] See Appendix 15 for Glossary of Technical Terms.

10.3.1 Q Sort task

Participants were obtained in the ways outlined in the preceding section. They were invited to participate in the online Q study and were given information about what was involved and how long it would take. Interested participants either clicked on the link embedded in the message, or typed the URL into their address bar. Participants were taken to the research website.

The purpose of the research website was to establish a trusting relationship with the prospective respondent and encourage them to proceed with the research. To do this, there was text to (1) establish the authority and credibility of the researcher by providing relevant supporting links, (2) explain the survey purpose, (3) explain benefits of the results to online communities to address the salience issues of the survey, (4) establish respondent confidentiality and privacy and (5) provide open access to researchers through email address links to answer questions before starting the survey (Cho & LaRose, 1999). Additionally, to further entice participation, select images and descriptions of the Internet were displayed on the homepage.

Once respondents had clicked the appropriate link to begin participation, they were firstly given the choice to complete either a text or image Q sort. Depending on their choice, the respective Q sample icons were displayed on the next webpage (see Figure 10.4).

Figure 10.4. Task 1 instructions for the Q sorting process

Regardless of the type of Q sort chosen, the instructions presented to participants were identical and were as follows. Participants were asked to sort the Q sample according to a specific condition of instruction: how like or unlike they are in relation to their own mental image of the Internet.

TASK 1: RANK THE IMAGES!

Sort these images according to how un/like they are in relation to your own mental image of the Internet.

1. Below are 26 images of the Internet. Click and hold each thumbnail to move them around the page. Click to enlarge them, double click to shrink. You can also hover your mouse over each thumbnail for the full description.

2. Sort the images into **3** piles: those UNLIKE, those LIKE and a NOT SURE pile

Participants were instructed to move and enlarge small image icons into three large brightly coloured boxes labelled ‘UNLIKE my mental image, NOT SURE, LIKE my mental image’ respectively (see Figure 10.5).

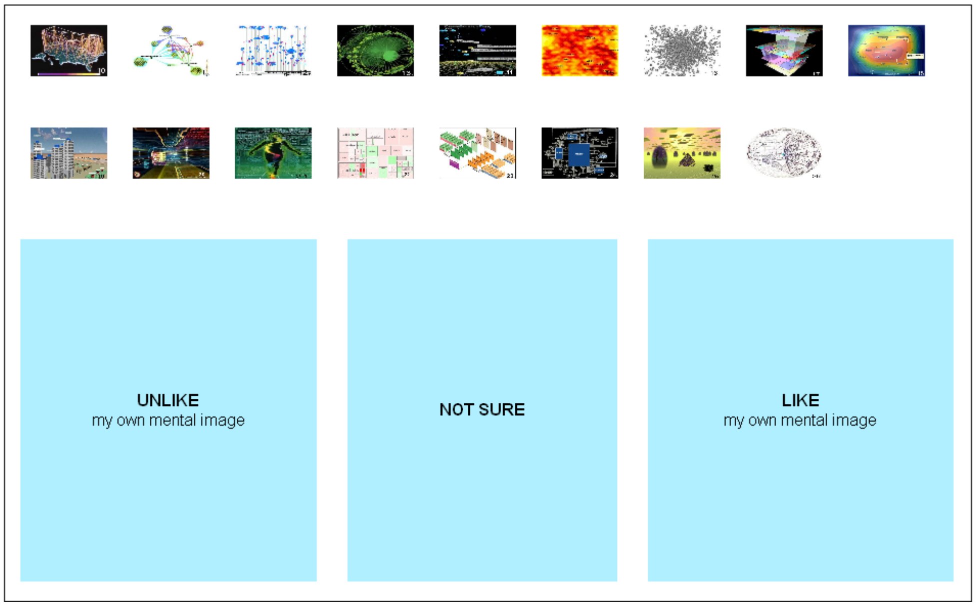


Figure 10.5. Preliminary sort into 3 piles

Participants then scrolled down slightly for the next set of instructions:

> **TASK 2:**
> Below is a grid that helps you to sort your images in a little more detail. There are 26 slots for each of the images to be placed into. The left hand side of the grid is for the images MOST UNLIKE your own mental image, the right hand side is for those MOST LIKE your own mental image.
>
> **1.** Sort the images from your **'UNLIKE'** pile above into the **left** hand side of the grid. Remember to put the one you MOST dislike at the very far left (The -4 slot).
> **2**. Sort the images from your **'LIKE'** pile above into the **right** hand side of the grid. Remember to put the one you MOST like at the very far right (The +4 slot).
> **3.** Finally, sort the images from your **'NOT SURE'** pile above into the **middle** of the grid.
> **4**. Alter the placement of the statements until you feel that the distribution represents your views.

Thus, in the second step, participants moved the icons into the Q grid. A nine point scale was employed, whereby participants could rank items from -4 (most unlike my mental image of the Internet), through 'zero', to +4 (most like my mental image of the Internet). Figure 10.6 illustrates the distribution and also dictates the number of items that could be assigned to each ranking position. Notice that respondents could only choose one item that they *most* agreed or disagreed with, forcing them to carefully consider how they ranked each item.

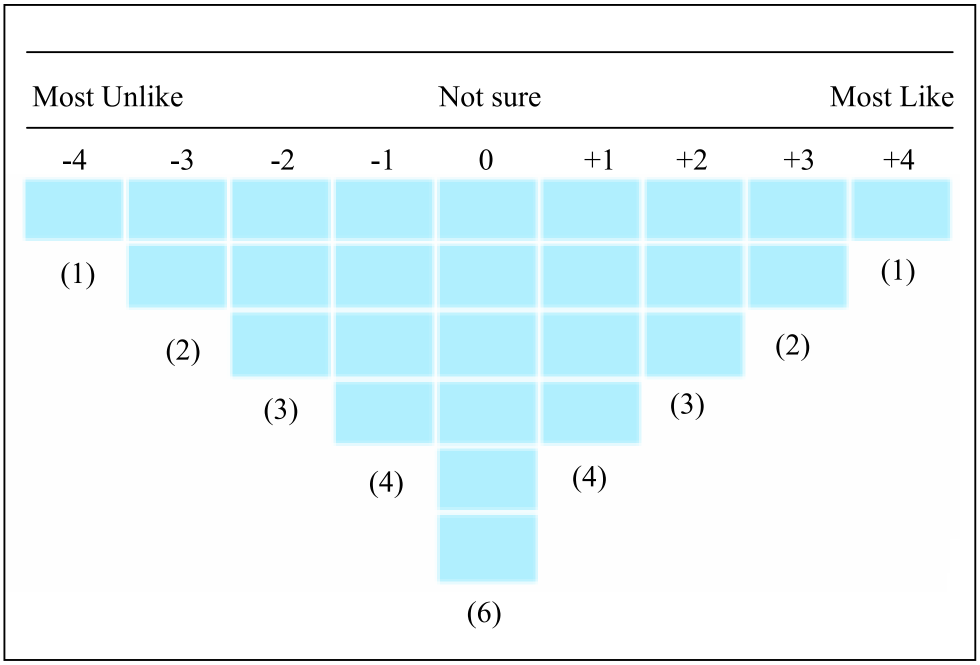


Figure 10.6. Inverted quasi-normal distribution from -4 to +4

In the third and final step, participants were given the following instructions:

TASK 3: This is the easy bit!
In this final section, put each image number in the corresponding grid slot below.

1. Each image has a number in the bottom right hand corner. Click the image above to enlarge it and view its number.
2. In its corresponding grid slot below, select the image number from the pull down menu.
3. Complete step 2 for **ALL** the images and then press submit

Participants were required to transfer each image's corresponding number to an identical grid with pull-down menus (Figure 10.7). Note that this step does not usually form part of a traditional Q study; it is an artefact of the computerised Q sort process (it was necessary for the data to be sent via email to the researcher).

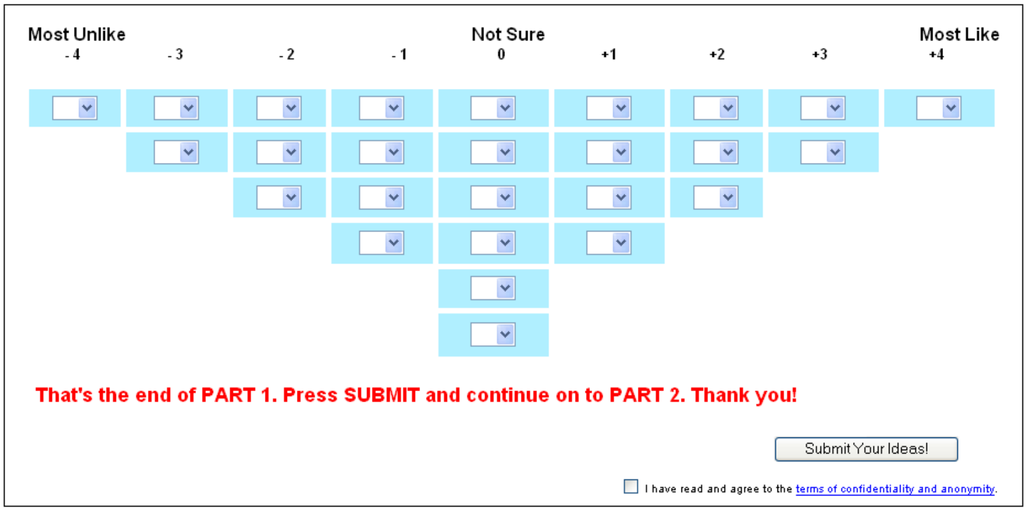


Figure 10.7. Transferring Q sample number into pull-down menus

Once participants had completed this final step, they were thanked and directed to press the 'submit' button and continue on to Part 2; completing the Characteristic Profile Questionnaire. Note that the research website was configured so that participants had to agree to specific terms of confidentiality and anonymity before they could submit any data (see Appendix 10.1).

10.3.2 Characteristic Profile Questionnaire

Participants were directed towards a second page (Figure 10.8), where it was requested they complete a 22 multi-item questionnaire incorporating closed and open-ended responses (see Appendix 10.4 for full questionnaire). The majority of responses where in the format of check boxes and Likert scales, so participants clicked the drop down menu provided for each question and selected the most appropriate answer. For some questions, the response was open-ended. Participants typed in their response in the given box (there was no limit on how much they could write).

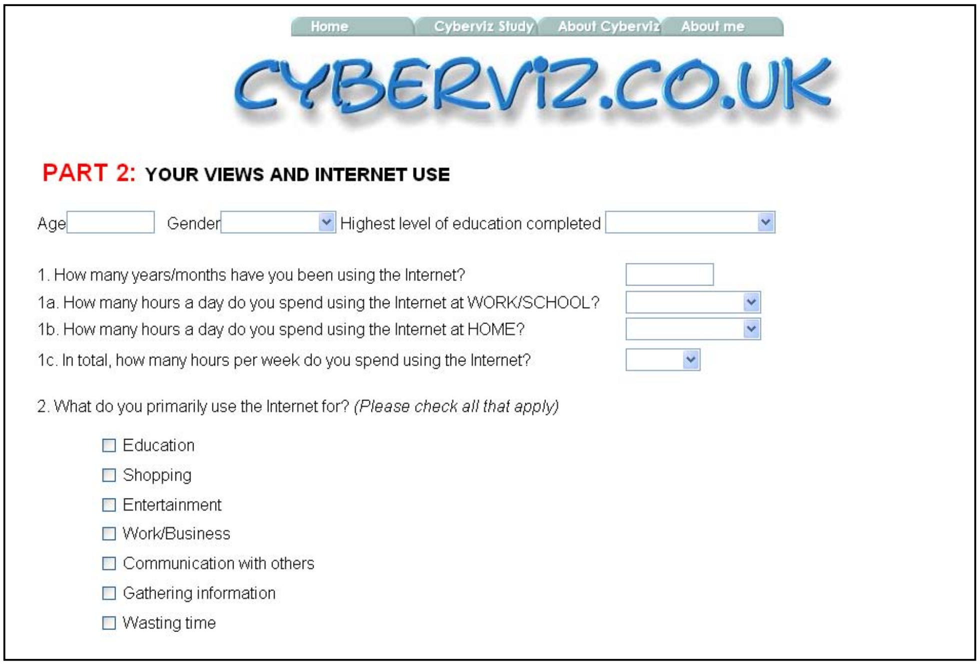


Figure 10.8. Screen shot of the Characteristic Profile Questionnaire

Once participants had completed the questionnaire, they were once again thanked and directed to press the 'submit' button. Following completion of both parts of the study, participants saw one last web page that thanked them for their participation. They then could choose to click the link that took them back to the home page, or had the opportunity to complete the other type of Q sort. If they chose to do this, they followed the Q sort instructions as outlined previously, but did not need to resubmit a response for the Characteristic Profile Questionnaire.

This was the end of respondent participation. Each response was submitted anonymously via email to the researcher. The only identifying characteristic was the IP address, which enabled participant responses to be matched up. On April 20^{th} 2004, the data collection was terminated. The links on the website were changed as to prevent access to the questionnaire and Q sorts. The home page was modified announcing that data collection was complete. This was the standardised procedure (see Appendix 10.5 for small modifications made to the procedure during the data collection period).

10.4 RESPONSE RATE

450 participants (227 women, 215 men) from 28 countries submitted a response to the online survey. The responses were screened for missing data, multiple submissions and any indications of frivolous responding. A total of 206 participants submitted incomplete responses (Table 10.5). Deletion of these incomplete responses resulted in 244 participants being retained for final analysis.

Incomplete Responses	**N**
Blank response	67
CPQ only	110
Image Q sort only	13
Text Q sort only	16
Total	**206**
Complete Responses	**N**
Image Q sort and CPQ	114
Text Q sort and CPQ	106
Image Q sort, Text Q sort and CPQ	24
Total	**244**

Table 10.5 Frequency of incomplete and complete responses

Of the 244 retained participants, 114 completed an Image Q sort and questionnaire, 106 a Text Q sort and questionnaire, and 24 people chose to complete both the Image and Text Q sorts and the questionnaire.

In order to calculate the response rate, it is necessary to know the approximate size of the population that was canvassed to take part in the study. However, it is impossible to quantify how many Internet users viewed my various communications regarding the research. Neither is it possible to estimate how many participants were gained through either sampling method[15]. Therefore, it is not feasible to calculate a response rate, based on the ratio between those who viewed my

[15] Retrospectively, the Characteristics Profile Questionnaire should have included a question which asked from which source participants were referred.

communications and those who completed the study. However, a proxy for response rate can be used; the ratio between the number of website 'hits' (those who accessed the home page) and those who actually submitted a complete response. Table 10.6 indicates that 244 participants proffered 512 responses. Each completed section contributed a 'hit' on the website counter.

Complete Responses	**N**	**No. of Responses**	**Weighted Frequency**[16]
Image Q sort and CPQ	114	2	228
Text Q sort and CPQ	106	2	212
Image Q sort, Text Q sort and CPQ	24	3	72
Total	**244**	**--**	**512**

Table 10.6. Frequency and weighted frequency of complete responses

At the end of the data collection period, there were 1617 'hits' registered on the website (the counter did not distinguish between unique and repeat visitors to the site). This total hit count includes the non-responsive visitors (those who visited the research website but did not submit any response), the incomplete and complete responses (Table 10.7).

	Frequency	***%***
Complete responses	512	32%
Incomplete responses	206	13%
Non-response	899	55%
Total	**1617**	

Table 10.7. Sample proportion (in %) for complete, incomplete and non-responses

It can therefore be estimated that this online study generated a response rate of 32%. This rate is reasonable for an online survey and comparable to response rates for similar surveys[17].

[16] Weighted frequency is calculated by multiplying the frequency by the number of responses. Weighted frequency is synonymous with the number of 'hits' on the website counter

[17] There is a lack of consensus as to Internet survey response rates. Response rates for Internet-administered questionnaires tend to range from 15%-72% (Ilieva, Baron & Healey, 2002) with an average participation rate of 37% (Sheehan, 2001).

10.5 Q FACTOR ANALYSIS

Before we proceed to analyse and interpret the findings from the Image Q sorts, it is first necessary to explain some of the technical decisions that will impact the analysis.

10.5.1 Factor extraction

The software, PQ Method[18] version 2.11, was used for analysing the Q data. PQ Method provides two options for the type of Factor Analysis; Centroid or Principal Components. In this study, Centroid factor analysis was used, as this is the preferred technique of Q Methodologists (see section 8.2.5.1). The next step was to decide how many factors are to be extracted for analysis. The process of selecting the number of factors is a protracted, complex task of finding the 'best fit' of the data by trying a number of different factor solutions, factor analysis and rotation methods. For each of the factor analyses outlined in Chapter 11-13, a range of factor solutions were tried before settling on the most appropriate arrangement. This was decided by determining the solution that yielded the least number of confounding sorts, the least number of participants which did not load on any factor and maximising the number of highly significant loadings onto each factor.

10.5.2 Factor rotation

PQ Method supports two approaches to factor rotation; a mathematical procedure called *Varimax* and theoretically based process referred to as *theoretical* or *judgemental* rotation. For the current factor analyses, theoretical rotation was used as this is the preferred technique of Q Methodologists (see section 8.2.5.1). Note that, in some circumstances, it is pertinent to have no rotation, for the rotation process can cause a high degree of confounding[19] across all factors. This usually indicates that there are just one or two main factors – the rotation process usually spreads the variance out across a larger number of factors.

[18] See Appendix 15 for Glossary of Technical Terms.
[19] See Appendix 15 for Glossary of Technical Terms.

10.5.3 Factor loadings

Once the factors were satisfactorily extracted and rotated, items that 'load' significantly onto each factor were flagged. Factor loadings are in effect correlation coefficients; they indicate the extent to which each Q sort is similar or dissimilar to the composite factor array (McKeown & Thomas, 1988). Those significantly loading sorts are usually deemed to be defining sorts for the factor. To determine how large a loading must be before it is considered significant, the following calculation, based on the number of items in the Q sample, is used:

Standard Error (SE) x $1/\sqrt{N}$, where N is the number of Q set items.

In this study, 26 Q sort items were used, so $1/\sqrt{26} = 0.196$. Loadings in excess of 2.58 (SE) are statistically significant at the .01 level. Thus, in this study, factor loadings in excess of $2.58(0.196) = 0.51$ (irrespective of sign) were considered statistically significant.

10.5.3.1 Utilising the statistical criterion

It is important to note that not all loadings that meet this statistical criterion are flagged; some loadings are purposefully omitted in order to reduce confounding. Indeed, the statistical flagging algorithm of PQ Method is not a limit placed on the researcher; it is just a tool to aid the researcher in identifying significance. The researcher's judgment often supersedes the flagging algorithm; ultimately, it is the researcher's task to identify and flag significant Q sorts. The main purpose of identifying defining sorts is to "maximise the purity of saturation of as many Q sorts as possible" (ibid. p. 52); that is, to obtain a clear-cut view of persons who represents one particular viewpoint. It is sometimes pertinent to include Q sorts which have low and pure (but not necessarily statistically significant) loadings on one factor as long as they have minimal loadings on another factor. Thus, although the statistical criterion is helpful in identifying significant loadings, it is the researcher's task to maximise the number of pure loading sorts and minimise confounds.

10.6 INTERPRETATION

The following three chapters present the analysis and interpretation of the Q sort and CPQ results. The majority of participants completed only one Q sort (either image or text) and a CPQ. It is therefore necessary to analyse the visual and text Q sort data independently. Chapter 11 examines the visual metaphors of the Internet by analysing the results from the image Q sorts. The data from the accompanying CPQ are interpreted in conjunction with the Q sorts, thus indicating if individual differences arise in the use of certain metaphors. Similarly, Chapter 12 examines the textual metaphors via analysing the text Q sorts in conjunction with the CPQ data. Unusually, a small fraction of participants chose to complete *both* an image and text Q sort, plus the accompanying CPQ. Therefore, Chapter 13 proceeds to examine the textual and visual metaphors generated by this group, plus investigate the relationship between two.

CHAPTER 11. ENVISIONING THE INTERNET: IMAGE Q SORT RESULTS

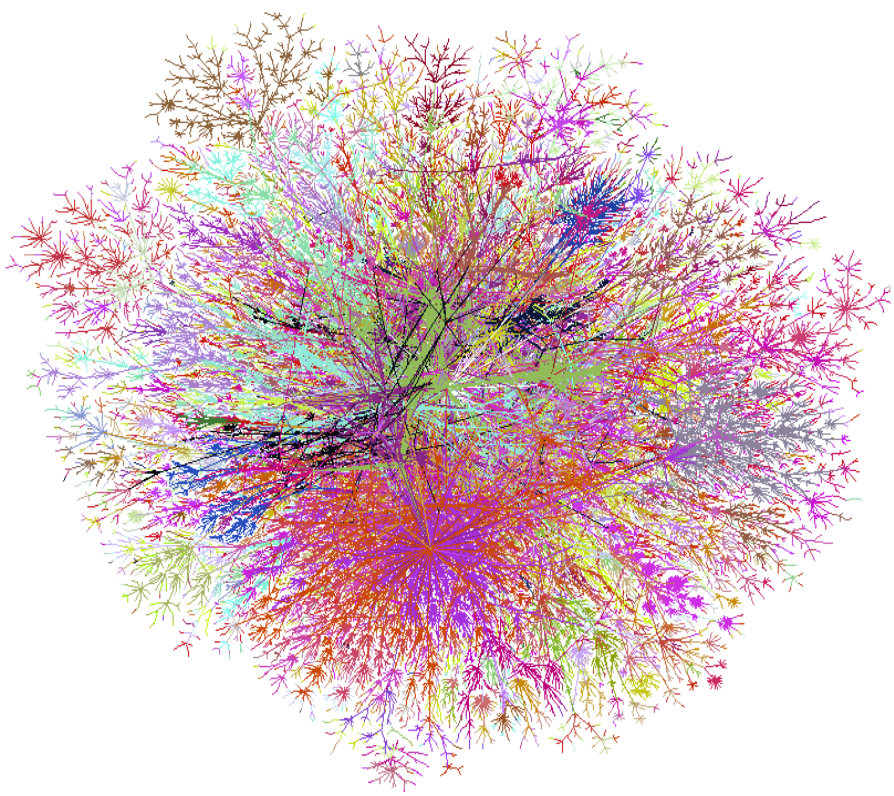


Figure 11.1. First map of the Internet, appeared in Wired Magazine, December 1998. © Bill Cheswick & Lumeta Corporation

11.1 INTRODUCTION

The purpose of this chapter is to describe the results of the Image Q sort analyses. Firstly, the most salient Characteristics Profile Questionnaire (CPQ) characteristics are summarised for all the Image Q sorters. This is followed by the analysis and interpretation of the Image factors and accompanying CPQ data. The final section summarises the significance of the findings for each factor.

11.2. PARTICIPANTS

As Table 11.1 indicates, 114 participants completed an Image Q sort and Characteristics Profile Questionnaire (CPQ), constituting just under half (47%) of the complete submitted responses.

Complete Responses	**N**	**%**
Image Q sort and CPQ	114	47%
Text Q sort and CPQ	106	43%
Image Q sort, Text Q sort and CPQ	24	10%
Total	**244**	**100%**

Table 11.1. Frequency of Image Q sorters

11.2.1 Descriptive statistics: Summary of CPQ patterns

The 114 participants that completed an image Q sort are predominantly young (<24) and have between 5 to 8 years experience using the Internet. They perceive themselves to be advanced users of the Internet. Primary usage centres around communication via email and chat applications, gathering information and for educational purposes. Just over half use the Internet to entertain themselves but not to work. Types of information specifically searched for include reference materials and commercial products/services. They report having problems finding information, dealing with sites that require payment or registration for access, plus encountering broken links. There is a generally positive outlook towards the Internet, with the majority agreeing that the Internet is an efficient way of getting information and can alleviate tedium. There are some however, that feel that the Internet is frustrating to use. Whilst the overall shape and size of the Internet are unclear, the process of accessing linked information is clear (see Appendix 11.1 for detailed descriptive statistics summary of Image Q sorters).

11.3 Q FACTOR ANALYSIS

As discussed in section 8.2.2.4, the optimal number of participants in any Q study is usually between 40 and 80. It is apparent therefore that 114 Image Q sorters is a much larger sample than is typically preferred (very large numbers of participants can easily negate many of the subtle nuances, complexities, and hence many of the essential qualities contained in the data). The most logical solution would be to divide the sample into smaller subsets and analyse each individually. However, when dealing with operant subjectivities, participants may not divide obviously along lines prescribed by demographic characteristics. Therefore, it is better to avoid too many assumptions *a priori*, particularly where these assumptions are based on preconceived demographic notions. A technique is needed therefore that will allow individuals to categorise themselves on the basis of the item configurations they produce (and hence via the viewpoints they express).

In order to let the data speak for itself, with minimal intrusion from the researcher, a Super-order factor analytic solution was proposed. This is a two stage process; firstly, a larger set of initial factors are extracted and then, the factors themselves are factor analysed to create a smaller set of 'Super-factors'. The primary function of the Super-order factor analysis is to explore the data. It reduces the likelihood of the researcher's *a priori* assumptions being imposed upon the data. This procedure also allows the subjectivities contained within a larger sample to emerge without losing the subtle nuances and complexities of the data.

11.3.1 Super-order Factor Analysis

The 114 Q sorts were randomly divided into four smaller sub-samples. The first three groups were factor analysed using the Centroid method with orthogonal theoretical rotation. Group 4 was analysed using Centroid factor analysis with no rotation. A total of 8 factors (9 perspectives) emerged from the 4 groups (see Appendix 11.2 for the first-level factor analyses). Table 11.2 indicates that Factor 5 (in Group 3) is bipolar; it has both positive and negative loadings.

Random groups	Factors		
Group 1	1	2	
Group 2	3	4	
Group 3	5+	5-	6
Group 4	7	8	

Table 11.2. Nine composite perspectives, Image Super-Factor Analysis

Each of the 9 perspectives produced a composite factor array. These 9 factor arrays were then submitted to the same factor analytic procedure. Using Centroid factor analysis with theoretical rotation, the 9 perspectives condensed around two operant Super-factors. The factor matrix for the two Super-factors is presented in Table 11.3 and in graphical form in Appendix 11.3. Super-factor I was defined by 5 of the 9 Q sorts; Super-factor II was defined by 4 of the 9 Q sorts. The two Super-factors accounted for 72% of the variance; Super-factor I for 39% and Super-factor II for 33%.

Original Factor		**I**	**II**
Group 1	1	**0.82X**	-0.35
	2	0.39	**0.72X**
Group 2	3	**0.87X**	-0.24
	4	0.07	**0.83X**
Group 3	5+	**0.87X**	-0.24
	5-	**0.52X**	-0.26
	6	0.12	**0.72X**
Group 4	7	**0.91X**	0.27
	8	-0.19	**0.81X**

Table 11.3. Defining sorts for Image Super-Factor Analysis

Table 11.3 indicates the significantly loading sorts which are defining sorts for the factor. All 9 sorts loaded above the 0.51 level of statistical significance.

11.4 INTERPRETATION

The 26 separate perspectives on the Internet, rendered from images drawn from a naturally occurring discourse, have condensed around two operant factors. Both of these factors constitute distinct ways of thinking about the Internet. Each factor has generated a composite factor array, which will be interpreted in conjunction with the responses from the Characteristic Profile Questionnaire (CPQ) data. The following section focuses on interpreting these factors.

The two Super-factors are identified as[20]:

- Super-factor I:
    - Chaotic Communication Networks
    - Functional Concretised Communication
- Super-factor II: Contained Organisation

11.4.1 Super-factor I: Chaotic Communication Networks and Functional Concretised Communication

Super-factor I is characterised by images that convey the complex interlinking nature of the Internet. The images rated as 'most like my mental representation of the Internet' are those that depict highly connected, chaotic interlinking within a global structure. Images 4 and 7, the most highly rated, convey complex, nodal connections which are randomly and chaotically structured. Images 26, 10 and 13 also depict complex nodal connections, but within a geographical boundary. The full factor array for Super-factor I is provided in Figure 11.2.

[20] Note that the titles given are suggestive rather than definitive of the content of each factor.

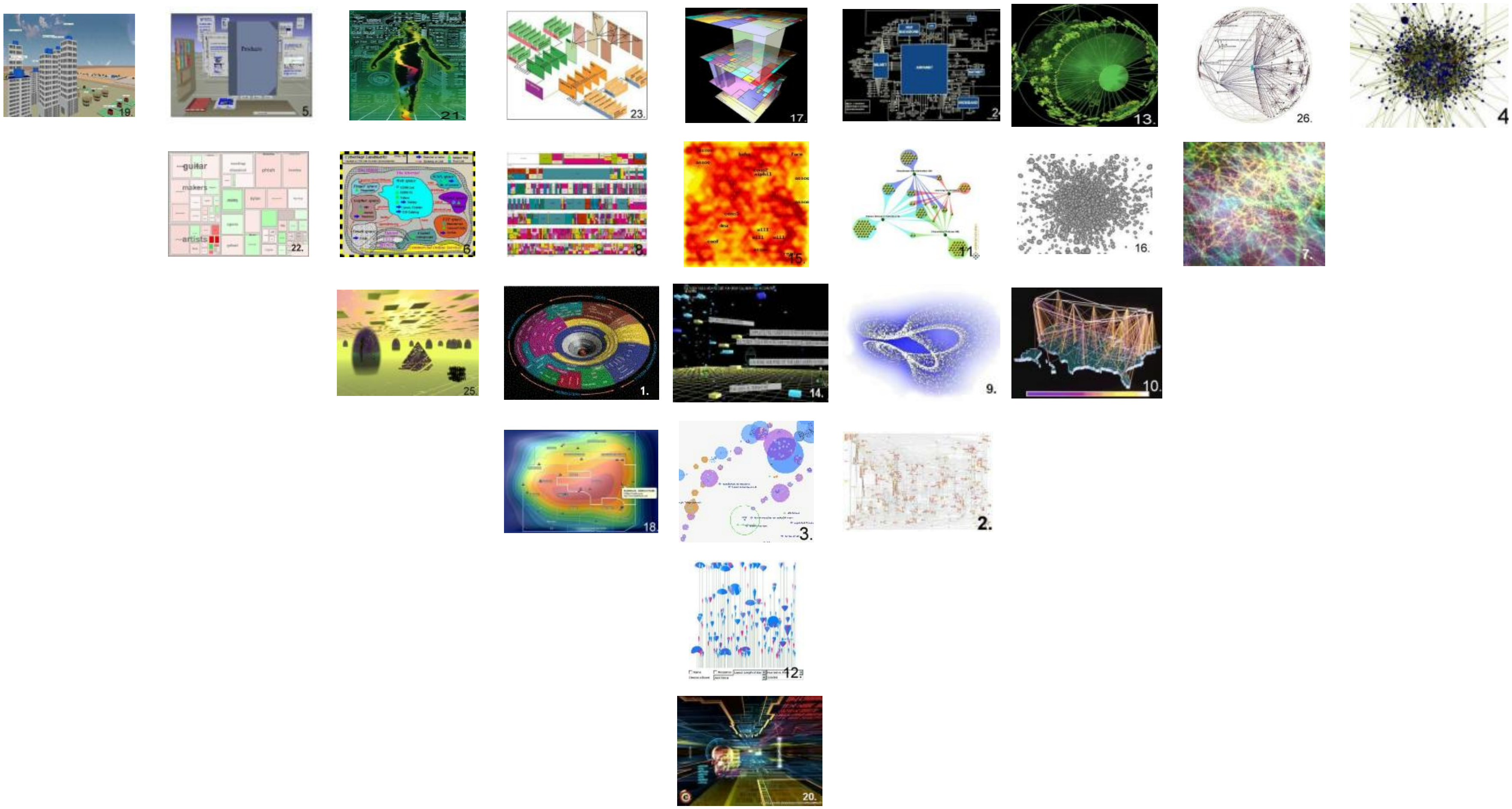


Figure 11.2. Factor array, Image Super-factor I

Table 11.4 examines a subset of the factor array in more detail. It focuses on the six images selected to be most representative of participants' mental image of the Internet. Data listed includes the array position, z-score, item number and Q sort item.

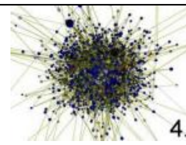
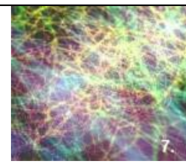
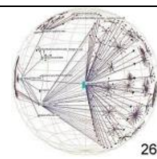
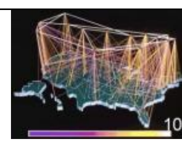
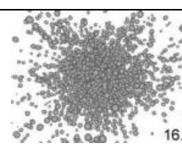
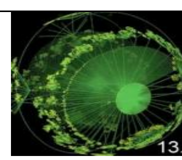
Array Position	Z Score	Item number	Image
(+4)	1.664	4**	
(+3)	1.592	7**	
(+3)	1.307	26**	
(+2)	1.132	10	
(+2)	1.117	16**	
(+2)	1.057	13**	

Table 11.4. Six highest ranked Q items, Image Super-factor I [21]

11.4.1.1 One factor; Two perspectives

In typical Q studies, it is generally expected that one main interpretation will emerge from each idealised factor array. It is therefore unusual that this Super-factor is

[21] Based on normalised (z) scores. Double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

characterised by two distinct interpretations of the same factor array. The dual interpretation is based on an inherent demographic divide. When analysing these two factions separately, it has emerged that these groups actually interpret the factor array in distinct ways.

The group seems to be divided between the older, more educated participants and the younger female participants (see Table 11.5). The youngest participants have achieved A-level qualifications, whereas those aged between 30-34 have achieved Master's or Doctoral degrees ($\chi^2(35, N = 46) = 70.65$, $p \leq 0.000$). Interestingly, participants with A-Level qualifications perceive themselves to be more novice/intermediate users than those with higher degrees ($\chi^2(15, N = 46) = 28.9$, $p \leq 0.017$). Novice users tend to utilise the Internet between 11-15 hours per week, whereas as advanced users utilise it between 21-25 hours ($\chi^2(21, N = 46) = 32.37$, $p \leq 0.05$). Not surprisingly, younger participants are also more likely to use the Internet to waste time ($\chi^2(5, N = 46) = 11.46$, $p \leq 0.043$).

Age	30-34	18-20
Gender	--	Female
Highest Qualification	Master's/Doctorate	A-Level
Perceived Skill	Advanced	Novice/Intermediate
Hours of use per week	21-25 hours	11-15 hours
Primary use	--	Waste time
Factor Interpretation	Chaotic Communication Networks	Functional Concretised Communication

Table 11.5. Demographic divide of Super-Factor I

Note that this demographic divide naturally emerged in the data; there was no statistical manipulation that 'forced' the data to fall into these distinct categories. Given this inherent divide, it was necessary to analyse how the two demographically discrete groups understood the Q sample images.

11.4.1.1.1 CHAOTIC COMMUNICATION NETWORKS

The salient characteristics for this sub-group are presented in Table 11.6 [22].

Basic Demographics	Age	30-34
	Highest Qualification	Master's (33%) Doctorate (67%)
	Perceived Skill	Advanced (67%) Expert (33%)
Usage	Primary Uses	Work (89%) Information search (89%) Communication (78%)
	Frequency of Use	Newsgroups (never 33%, very often 44%) Banking (very often 55%)
	Tasks Accomplished	11-15 tasks (56%), 16-20 tasks (44%)
Information Retrieval	Types of Information	Reference (100%) Commercial (67%)
	Information Search Patterns	Mostly search (78%)
Problems	Perceived Problems – User	Organising Information (33%) Returning to Web pages (33%)
Internet Attitudes	Responsible for good things we enjoy	Disagree (67%)
	Helps me to create new ideas	Agree (44%) Disagree (56%)
Internet Visualisation	Overall shape/size of the Internet	Unclear (100%)
	Accessing information	Clear (55%) Unclear (44%)
	Continuing the search for information	Clear (44%) Unclear (55%)

Table 11.6. Most salient profile characteristics of the older sub-group

[22] The Characteristic Profile Questionnaire covered many areas and only the most salient characteristics are presented in the summary table.

This is an older group who has achieved a high level of education. They have completed most of the main Internet tasks and accordingly perceive themselves to be advanced or expert users. It is not surprising therefore that this group seems to have an advanced level of understanding about what constitutes the Internet:

> "An interlinked network of computers connected using the TCP-IP protocols providing the underlying frame work for a large number of services such as the web, email etc" [Pic 32].

> "Basically, computers networked together for the purpose of sharing data. It's the means of sharing and the type of data that define the various subtypes of Internet interaction (WWW vs. SSH vs. IRC...)" [Pic 16].

There certainly seems to be a level of expert knowledge here, as demonstrated by the awareness of different Internet applications, such as the WWW or email. For this group, the Internet is not one single entity; rather it is a collection of tools:

> "The Internet is not really a single 'thing'. It's a collection of computers that speak to one another" [Pic 116].

They are also knowledgeable of the various Internet protocols, such as TCP/IP and SSH[23]. Specifically, this group seems to be aware of how these protocols enable the connection, communication, and data transfer between two computing endpoints. The focus here is on how the protocols govern a network of communication:

> *(I think of)* "Communication" [Pic 56].

> "This communications network is an even more innumerable collection of pathways, criss-crossing, with multiple intersections and nodes" [Pic 43].

This is not surprising given that almost 80% primarily use the Internet for communication purposes. Furthermore, this communication network is enabled by a

[23] See Appendix 15 for Glossary of Technical Terms.

universal computer language, which the Internet uses to communicate. For this group of users, the Internet can be thought of as a common worldwide computer language. It is this universal Internet language which enables this group to search for specific commercial and reference information; an activity in which 90% of this group partakes.

> "The Internet is a universal language that people can use to connect and explore disparate information" [Pic 16].

The focus seems to be on network structures of communication. This evidenced by the choice of image 4 and 26 to be most like their mental representation of the Internet. These images convey a complex interconnection of links and nodes. Specifically, the focus is on a web-like network of connections:

> "A giant network of webs" [Pic 75].

> "A large web of computers" [Pic 32].

> *(I think of)* "A spider's web" [Pic 22].

It seems therefore that this group chose images that conveyed a networked structure which enables them to communicate and search for specific information. However, it should not be assumed that the network structure is rigid or static. Indeed, this group refers to the chaotic, ever-changing nature of the Internet:

> "An even more innumerable collection of pathways, criss crossing, with multiple intersections and nodes … the network appears highly disorganized, repetitive, and inefficient" [Pic 43].

> "Allows users to access information in a decentralised way" [Pic 52].

For this group of users, the Internet is decentralised and chaotic. The links between pages of information are randomly structured and core technological components are not viewed as being centralised. Rather they view the Internet as a multitude of chaotic paths that can lead to the information.

> "A maze – there are many ways to come to a specific thing" [Pic 108].

Indeed, as Table 11.7 indicates, the images which were rated most unlike their own mental image of the Internet were those that depict very structured, rigid and static conceptions of the Internet. They negatively rated the virtual library (image 5); a conception that invokes traditional offline modes of searching for information in books. They also rejected images that conveyed overly categorised, ordered information (images 22 and 6) in which information can be neatly ordered into discrete categories. Interestingly, the overtly science fiction type representations (images 21 and 25) were also rejected, perhaps because they were devoid of any linking structures. Whilst these images were successful at conveying the notion of space, they did not depict the paths to access information (a key component for this group whose focus is networks of communication).

Array Position	Z Score	Item number	Image
(-4)	-2.167	19**	
(-3)	-1.375	5**	
(-3)	-1.248	22**	
(-2)	-1.060	21	

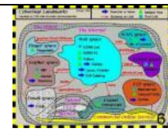
(-2)	-1.057	6	
(-2)	-1.022	25**	

Table 11.7. Six lowest ranked Q items, Image Super-factor I[24]

Given the emphasis on chaotic interconnections, it is understandable that this group report having difficulties organising the information they gather and also returning to specific web pages. Furthermore, this group has difficulty representing the overall structure and shape of the Internet. Approximately half also have problems visualising how information is accessed and continuing the search for information. Interestingly, despite their reported problems, the chaos is not perceived to be a negative attribute. Rather, it is viewed as an inherent strength of the Internet;

> "This jumbled network … is the real strength of the entire Internet system" [Pic 43].

In sum, this older, highly educated group of expert users perceived the Internet in terms of chaotic networks of communication. They tended to prefer images that depicted complex, nodal interconnections and rejected images that were devoid of linking structure and those that conveyed rigidity.

11.4.1.1.2 FUNCTIONAL CONCRETISED COMMUNICATION

The most salient and distinguishing characteristics for this sub-group are presented in Table 11.8.

[24] Based on normalised (z) scores. Double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

Basic Demographics	Age	18-20
	Gender	Female (88%)
	Highest Qualification	A-Level (77%) Diploma (23%)
	Perceived Skill	Novice (24%), Intermediate (29%)
Usage	Primary Uses	Communication (100%) Education (82%) Waste time (71%) Instead of work (45%) Entertainment (71%)
	Frequency of Use	Chat (very often 65%) Music (often 47%) Games (sometimes 41%)
	Tasks Accomplished	6-10 tasks (47%) 11-15 tasks (35%)
Information Retrieval	Types of Information	Reference (94%) Commercial (82%) Other (59%)
	Information Search Patterns	Mostly search (71%) Mostly explore (71%)
Problems	Perceived Problems – User	Finding Information (53%)
	Perceived Problems – Technical	Broken links (82%)
Internet Attitudes	Responsible for good things we enjoy	Agree (45%) Neutral (47%)
	Is frustrating	Agree (47%) Disagree (53%)
	Enhances standard of living	Agree (47%) Neutral (47%)
	Helps me to create new ideas	Agree (41%) Neutral (41%)
	Helps to put new ideas into action	Agree (47%) Neutral (35%)

Table 11.8. Most salient profile characteristics of the younger sub-group

This predominantly young, female group selected images of the Internet that depict complex nodal connections within a geographical boundary. This group uses familiar cartographic conventions to conceptually map the Internet. Images 10, 13 and 26 (chosen to be most like their own mental representation of the Internet) illustrate how complex connections are contained within a global structure. Specifically, the focus is on how these global connections across the world enable them to communicate with friends in different countries.

> "I think the Internet is a useful and available means of … communicating with others worldwide" [Pic 27].

> "Reaching out to all over the world making communication much easier" [Pic 80].

> "The Internet is a huge communication network linking people all over the world" [Pic 91].

The focus on communication is key, with over 63% of qualitative responses referring to communication aspects of the Internet. Indeed, the focus on communication with globally dispersed friends is not surprising given that their primary use of the Internet is to communicate via email and chat applications.

This group understands that this type of communication would only be possible with the advent of this new technology. They refer to the Internet in terms of access; only those with the relevant technology can access the online world of information.

> "The Internet is the electronic connection between all capable computer systems" [Pic 30]

> "A vast resource of information that enables communication between anyone with access to it " [Pic 37]

> (*I think of*) "Infinite amounts of information accessible to anyone with the hardware" [Pic 26].

However, although they recognise that the technology is a necessary component, it is not the focus.

> “A mass of information. I mainly only think of the websites I visit though, not the technology behind them” [Pic 88].

For this group, the emphasis is on what the Internet enables them to do. This group therefore has a functional view of the Internet. The Internet is a resource to be used to facilitate activities. The Internet is merely a means to an end.

> *(I think of)* “Computers, email, friends abroad” [Pic 27].

> *(I think of)* “Email” [Pic 41].

> *(I think of)* “Communication” [Pic 89, Pic 91].

> “The Internet is a tool for people to communicate with others across the world, to find information which could otherwise not be found, to buy things which would otherwise take long periods to buy” [Pic 100].

This group is most likely to spend time online wasting time and entertaining themselves by downloading music and playing online games. Interestingly, despite the focus on what the Internet enables them to do, there is a degree of ambivalence towards the Internet. They appear to be uncertain whether the Internet has a positive impact on their lives. Furthermore, equal proportions agree/disagree that the Internet is frustrating. This is understandable given that they only perceive themselves to be novice/intermediate users of the Internet. It is possible that the frustration may arise because of the incongruence between what they want to do with the Internet and what their technical knowledge allows them to do.

Indeed, this group report that their primary goal in using the Internet (besides communication) is searching and exploring the Internet for reference and commercial information.

“I think the Internet is a useful and available means of gathering information, finding things out and sharing information” [Pic 27].

“A resource for gathering information” [Pic 80].

However, over half the group report having difficulties actually finding information and encountering broken links. These problems could be due to the fact that they view the information online as invisible:

(Is like) “An invisible book that needs a computer to read it” [Pic 18].

(Is like) “An invisible web of information” [Pic 107].

Finally, in contrast to the more chaotic communication networks of the older group, the representation of this younger, female group is less chaotic. This group tends to invoke more traditional methods of offline searching, such as libraries and encyclopaedias.

“Every computer linking to a giant library” [Pic 98].

(Is like a) “Giant electronic encyclopedia” [Pic 98].

(Is like a) “Library” [Pic 80].

These conceptions refer to fixed, structured entities in which the information is static. Indeed, they view information as being stored somewhere online in a vast reservoir of data:

“A vast bank of information” [Pic 98].

“A very large database of information” [Pic 107].

“A reservoir of information” [Pic 37].

Interestingly, their choice of images in the Q sort factor array also conveys this notion of contained information. Images 13 and 26 (chosen as most like their mental image of the Internet) illustrate how the connections are contained within a global structure. This suggests how the networks are concretised by being constrained by earthbound connections. Image 10 shows a complex interlinked network hovering over a map of the United States of America[25]. This is literal mapping of the physical infrastructure of the Internet, constraining it to the cables that carry data between geographically remote endpoints. For this group, the Internet is not an ethereal, chaotic entity; rather, it is much more structured and contained. However, the emphasis is still on complex communication networks, as shown by the rejection of images that are devoid of nodal interlinking (see Table 11.8 above).

In sum, this younger, female group of novice users perceived the Internet in terms of contained networks of communication. Whilst the technology is a necessary component, the focus is on what the Internet enables them to do. For this group, the Internet is functional, not technical.

11.4.1.2 Communalities and specificities[26]

Super-factor I was unusual in that is was characterised by two distinct interpretations of the same factor array. Based on an inherent demographic divide, two sub-groups actually interpreted the factor array in distinct ways, despite sorting the Q sample items into a similar configuration. It is therefore expected that there will be a significant degree of communality between the two interpretations. Both factors referred to the Internet in terms of communication. Both also liked images that depicted complex nodal network connections and rejected those devoid of any linking structures.

An interesting similarity between the two sub-groups is that some participants seemed to be acutely aware that they were invoking metaphors to describe the

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[25] This is especially interesting seeing as 75% of participants on this factor were located in the United Kingdom (see Appendix 11.4 for the geographical breakdown of all factors)

[26] Whilst these terms can be used to refer to statistical attributes of data, they are used here merely to refer to the extent to which the interpretations share common and distinct dimensions.

Internet. One participant from the older group explicitly used an analogy to describe the Internet:

> "The Internet is LIKE temporal connection between neurons and LIKE a collective conscience" [Pic 16] *(formatting is original)*

Similarly, a participant from the younger female group described the Internet as a 'metaphorical book':

> "The Internet is a metaphorical book which you have to learn to navigate to find the pages that interest you" [Pic 18].

These examples show that some participants in both groups were consciously aware of drawing similarities between the Internet and other familiar entities.

Beyond these similarities, the two interpretations have a significant amount of specificity. Whilst the focus for the older group was on the technical aspect of the Internet (in accordance with their perceived expertise), for the younger female group the Internet is more functional. Similarly, the older group emphasised structures of communication whereas the younger female group focussed on global connections with friends. A final distinction is that the older group viewed the complex connections as chaotic (and believed this to be the inherent strength of the Internet); in contrast, the younger female group saw the Internet as much more contained.

11.4.1.3 Summary of Super-factor I

This Super-factor was characterised by two distinct interpretations of the same factor array; an older, highly educated group of expert users perceived the Internet in terms chaotic networks of communication and a younger, female group perceived the Internet in terms of functional, concretised communication. The following section proceeds to interpret the second factor that emerged from the Image Q sort analysis.

11.4.2 Super-factor II: Contained Organisation

Super-factor II is characterised by images that emphasise how to organise and cohesively structure the Internet. Interestingly, rather than select images that depict an image of the Internet as a whole, these participants prefer to focus on ways to organise the Internet. Interestingly, Super-factor II is characterised by the omission of the nodal, vastly interconnected image. The typical densely clustered network images were relegated to the neutral columns, indicating that these types of images were not an important attribute for this factor. The full factor array for Super-factor II is provided in Figure 11.3.

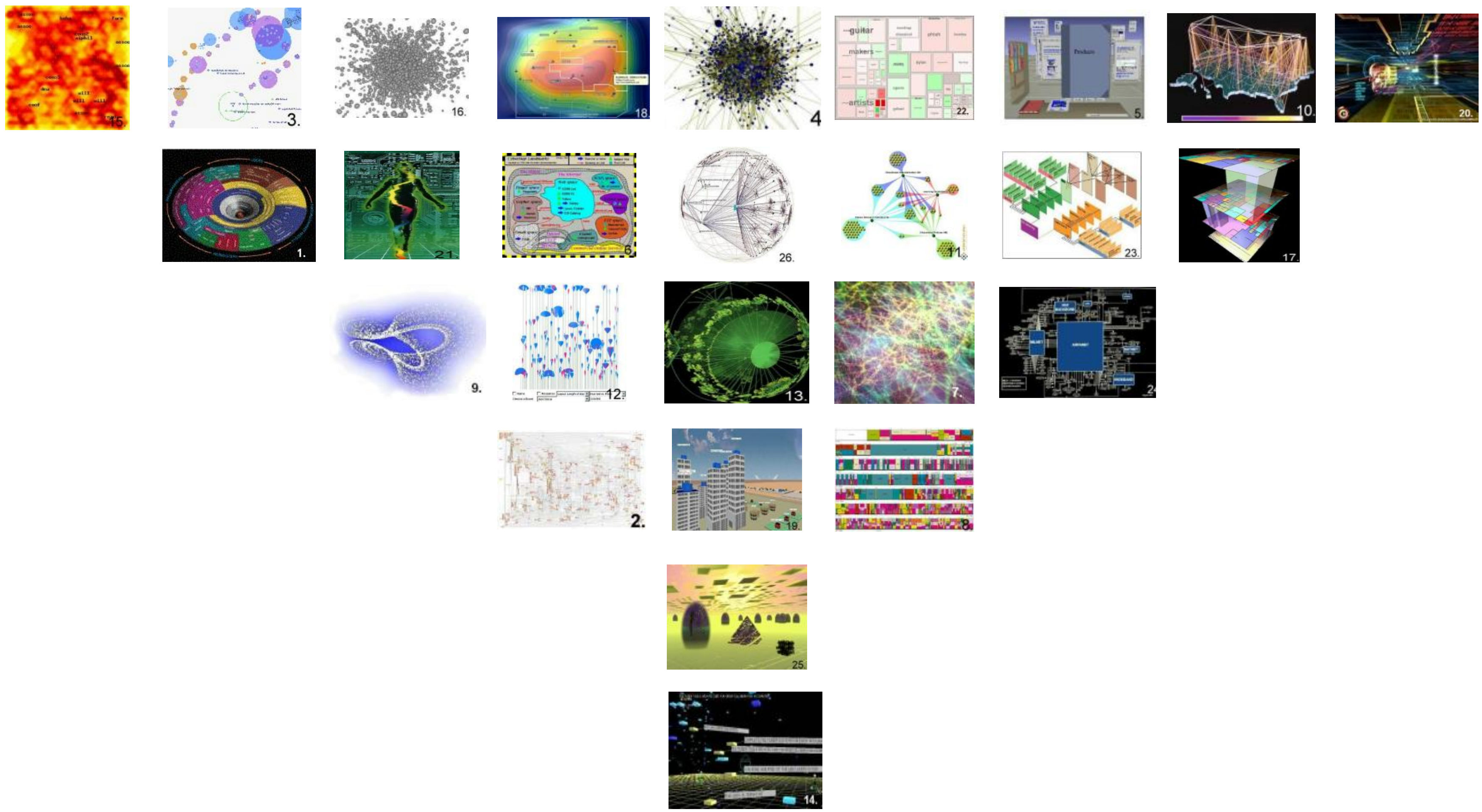


Figure 11.3. Factor array, Image Super-factor II

Table 11.9 indicates that the images rated as 'most like their mental representation of the Internet' are those that convey how information is contained and ordered. Image 17 depicts hierarchical ordering and suggests the ways in which general information is successively filtered down into smaller, more specific units. Images 23 and 24 depict a central point from which websites and links emanate. Image 5, another distinguishing image for this factor, refers to information contained a virtual library space. Thus, the emphasis for this Super-factor is how information is contained in order to impose organisation.

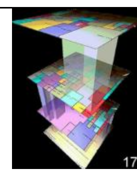
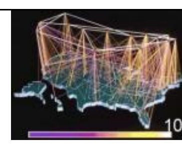
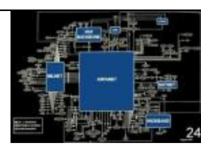
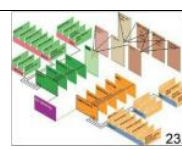
Array Position	Z Score	Item number	Image
(+4)	1.862	20**	
(+3)	1.607	17**	
(+3)	1.572	10	
(+2)	1.318	24**	
(+2)	1.128	23**	
(+2)	0.836	5**	

Table 11.9. Six highest ranked Q items, Image Super-factor II[27]

[27] Based on normalised (z) scores. Double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

The salient profile characteristics for this group are presented in Table 11.10.

Basic Demographics	Age	15-20
	Gender	Female (65%)
	Highest Qualification	A-Level (81%)
	Internet use at Work	30 minutes – 1 hour (32%)
	Internet use at Home	1 – 3 hours (39%)
	Perceived Skill	Intermediate (32%), Novice (26%)
Usage	Primary Uses	Communication (94%) Education (81%) Working (29%), Waste time (32%)
	Frequency of Use	Chat (very often 61%)
	Tasks Accomplished	6-10 tasks (39%)
Information Retrieval	Types of Information	Reference (90%) Commercial (74%)
	Information Search Patterns	Mostly search (58%)
Problems	Perceived Problems – User	Finding Information (68%) Organising Information (19%)
	Perceived Problems – Technical	Registering (81%)
Internet Attitudes	Is dehumanising	Disagree (32%) Neutral (45%)
	Unlimited possibilities	Agree (32%) Neutral (26%) Disagree (32%)
Internet Visualisation	Overall shape/size of the Internet	Unclear (88%)
	Internet Structure	Unclear (78%)
	Internet Linkage	Unclear (70%)
	Information Retrieval	Moderately clear (52%)

Table 11.10. Most salient profile characteristics for Super-factor II participants

This is a predominantly young group which has between 5 to 6 years experience using the Internet. They characterise themselves as novice/intermediate users of the Internet, having only completed 6-10 of the most common Internet activities. Most of the participants only use the Internet at work up to one hour a day, although their usage increases at home. They do not use the Internet for work purposes, nor to waste time. This group's primary uses of the Internet are to communicate via email and chat, and search for reference material.

> "Email and chat rooms and searching for journal articles" [Pic 19].

> *(I think of)* "MSN and online journals" [Pic 90].

Accordingly, this group has a positive attitude towards the Internet in terms of its impact on work; most agree that the Internet is an efficient way of getting information and can alleviate tedious work.

> "I think of how amazing the Internet is, that it hasn't always been around, and that it has become so integrated into everyday life and made, for example, research so much more efficient for students" [Pic 83].

However, they tend towards having ambivalent/negative attitudes when it comes to other areas of their lives; almost a third of the group believes that the Internet is limited in the possibilities it offers its users.

> *(I think of)* "A massive resource of information for anyone to access but also anyone to destroy and infiltrate, but also for anyone to contribute to" [Pic 83].

Almost half of the group is not sure whether the Internet enhances our standard of living. There also seems to be a concern about the extent to which the Internet dehumanises its users (only one-third believes the Internet is not dehumanising!)

> "It is a very useful resource not to replace humans but to work alongside them in an efficient way" [Pic 79].

Thus, although the Internet has enabled them to work more efficiently, it seems as though that is the limit of its impact.

> *(Is like)* "Life before the Internet, only faster" [Pic 63].

Interestingly, despite the perceived positive impact of the Internet on their work lives, over three-quarters of the group report having problems finding information on the Internet. Furthermore, this group seems to have a lot of difficulty mentally visualising the overall shape, size and structure of the Internet. Interestingly however, although the overall structural elements are unclear, the process of retrieving information is moderately clear. Accordingly, less than 20% report having difficulties efficiently organising the information they gather.

Indeed, it seems as though the core concept for participants loading onto this factor is the issue of organisation. For this group, the information contained within the Internet is in disarray.

> "Internet connections extend in to a vast number of locations providing a huge, but poorly organised source of information and communication" [Pic 77].

> "Massive, loosely organised network" [Pic 77].

> "Tangled web of information" [Pic 84].

> *(Is like a)* "Disorganized bunch of information" [Pic 5].

In conjunction with the disorganisation, this group reports that the information available on the Internet sometimes lack relevance.

> "The Internet is a system of organization of information that covers every area of knowledge, the useful and the useless" [Pic 23].

> “Linked sites that contains loads of (sometime totally pointless) information accessed via a computer” [Pic 19].

> “A network of information (and sometimes misinformation) stored on computers all over the world” [Pic 49].

It is not surprising that this group mention finding irrelevant information, given that their predominant activity is to search the Internet for specific reference and commercial information. Indeed, this is reflected in their selection of image 5, a virtual library, as one of the images most like their own representation of the Internet. Indeed, this group commonly referred to the Internet in terms of more traditional offline modes of finding information, such as reference books or libraries:

> *(Is like an)* “Encyclopedia” [Pic 14].

> *(Is like a)* “Massive reference book” [Pic 19].

> *(Is like a)* “Never ending book of information” [Pic 99].

> “A huge library with no control or organizers” [Pic 20].

For this group, the Internet is a space that lacks organisation; the chaos is not a valued characteristic[28]. Rather, they prefer to impose structure and organisation by thinking about the Internet in terms of contained entities of information.

> *(Is like a)* “Database” [Pic 6].

> *(Is like a)* “Huge database that holds mostly everything” [Pic 69].

> “Interconnection between many servers holding a vast amount of information” [Pic 103].

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[28] Contrast this to the older sub-group in Super-factor I who view the chaotic nature of the Internet as an important and valuable quality.

Information is understood as being stored on the Internet. The Internet therefore is successfully organised by becoming a container of information. This is further demonstrated by the images selected to be least like their own mental representation of the Internet. Table 11.11 indicates the items rated most negatively. They tended to reject images that are overly abstract and convey neither how information is contained nor how it is organised.

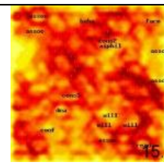
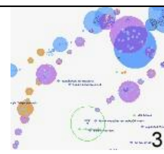
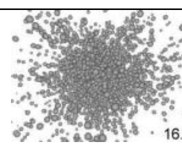
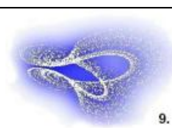
Array Position	Z Score	Item number	Image
(-4)	-2.155	15**	
(-3)	-1.296	3**	
(-3)	-1.169	1*	
(-2)	-0.967	16**	
(-2)	-0.919	21	
(-2)	-0.835	9**	

Table 11.11. Six lowest ranked Q items, Image Super-factor II[29]

[29] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing item for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

These images are devoid of structures that organise the information. As previously illustrated, the emphasis for this group is visualising ways in which the information contained in the Internet can be re-organised into meaningful segments:

> "A super highway of information all linked together in a big 'map' which is grouped into topics and subjects and areas of similarity" [Pic 83].

> "A computer mediated virtual space, containing unlimited amounts of information, organised through websites and links" [Pic 7].

Indeed, it is possible that this group do not visualise the Internet as a whole, but rather think about it only in terms of organising information:

> "I don't really visualise anything in particular when I think of the Internet, I merely interact with whatever is on my screen" [Pic 106].

> "I really don't know, all I know is that it can help me find a lot of information quickly" [Pic 12].

> "Not something you can grasp" [Pic 5].

11.4.2.1 Summary of Super-factor II

In sum, Super-factor II was characterised by the omission of the nodal, vastly interconnected image. Rather, this predominantly younger group of users understands the Internet in terms of how to organise and cohesively structure the information it contains. They tended to prefer images that depicted ways to contain and organise information and rejected images that were devoid of these core elements.

11.4.3 Communalities and specificities

There were only a few similarities between the two Super-factors. These can be most effectively illustrated by examining the 'consensus items' (Table 11.12).

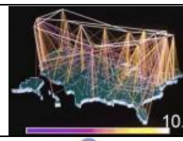
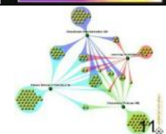
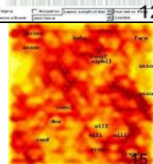
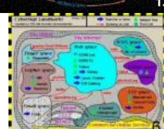
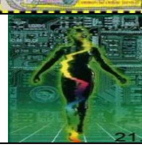
		I	II
10*		2	3
11*		1	1
14*		0	0
12**		0	-1
15*		-1	-1
1**		-1	-3
6*		-2	-1
21*		-2	-2

Table 11.12. Consensus Q items, two Image Super-factors [30]

The two Super-factors (three perspectives) consistently selected images 10 as being similar to their own mental representation of the Internet. Similarly, they all tended to reject overtly abstract images such as image 21, 6 and 1, and had neutral views of images 12 and 14. Note that these items indicate a consensus in ranking, but should not be mistaken for a consensus of meaning. For example, in Super-factor I, image 10 was positively rated to convey the geographical boundaries of the Internet. In

[30] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing item for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

Super-factor II however, it was selected to convey the hierarchical ordering of the Internet.

Beyond these limited similarities, the viewpoints embedded in the two Super-factors were highly distinct. In Super-factor I, the older subgroup perceived the Internet in terms chaotic networks of communication whereas the younger, female sub-group perceived the Internet in terms of functional concretised communication. Super-factor II was characterised by the omission of the nodal, vastly interconnected image. Rather, this predominantly younger group of preferred images that depicted ways to contain and organise information.

11.5 CONCLUSIONS

The 26 separate images of the Internet condensed around two operant factors (three perspectives). This indicates that there are at least two dominant visual metaphors used to describe the Internet. The first visual metaphor is of a highly connected, chaotic interlinking network within a global structure. Interestingly, the second metaphor is characterised by the omission of the typical vastly interconnected network, and instead emphasises how information is stored, contained and structured.

Furthermore, there is evidence to suggest that the emergence of these visual metaphors relate to specific user groups (see Table 11.13). In fact, the first factor had two distinct interpretations of the same factor array, based on an inherent demographic divide. An older, more educated and skilled group focussed on the technical aspects of the Internet. They reported mostly use the Internet for work purposes and accordingly, emphasised structures of communication. They also believe that the inherent strength of the Internet lies in its dynamic, chaotic connections (and accordingly, it is difficult to perceive the overall structure of the Internet). Given these demographic characteristics, it is perhaps not surprising that this group conceive the Internet in terms of complex, nodal interconnections (rejecting images that were devoid of linking structure and those that conveyed rigidity).

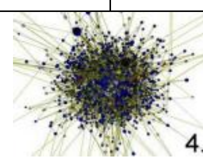
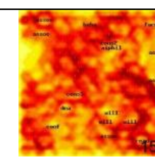
Salient Characteristics	Image Super-factor I		Image Super-factor II
	Old	***Young***	
Age & Gender	Male, 30-34	Female, 19 and under	Female, 20 and under
Perceived Skill	Advanced / Expert	Novice / Intermediate	Novice / Intermediate
Primary Use	Work	Entertainment / Wasting time	Education (not work or waste time)
Perceived Problems	Organising information / Returning to web pages	Finding information	Organising information / Finding information
Visualisation	Overall shape – unclear	--	Information Retrieval - clear
Attitudes	Not responsible for good things in life	Is Frustrating	Dehumanising, Limited possibilities
Item rated most positively:			
Item rated most negatively:			
Factor Interpretation:	**Chaotic Communication Networks**	**Functional Concretised Communication**	**Contained Organisation**

Table 11.13. Comparison of the two Image Super-factors

In contrast, a younger, female group with less skill and experience conceived the in terms of global networks of communication. The focus was more functional than technical, emphasising global communication with friends (with the connections being more structured and contained). They were more likely to use the Internet to waste time, yet found the technology frustrating.

The second factor was also characterised by a younger, lesser skilled group of users. However, this group of users were much more likely to use the Internet for education purposes (not to work or waste time). Given this group's primary use of the Internet is search for information, it is not surprising that they conceive of the Internet in terms of a structured and organised information depository.

The following chapter now proceeds to analyse the Text Q sorts and accompanying Characteristics Profile Questionnaire data.

CHAPTER 12. DESCRIBING THE INTERNET: TEXT Q SORT RESULTS

> "What we need is a nationwide network of information superhighways, linking scientists, business people, educators and students by fiber-optic cable.
> This network would encourage a second information revolution."

Figure 12.1 Al Gore on the future of the Internet. The Futurist, January 1991

12.1 INTRODUCTION

The purpose of this chapter is to describe the results of the Text Q sort analyses. The first section summarises the most relevant CPQ characteristics for the Text Q sorters. This is followed by the analysis and interpretation of the Text factors and accompanying CPQ data. The final section summarises the significance of the findings for each factor.

12.2. PARTICIPANTS

As Table 12.1 indicates, 106 participants selected to complete a Text Q sort and Characteristics Profile Questionnaire (CPQ), constituting 43% of the submitted responses.

Complete Responses	**N**	**%**
Image Q sort and CPQ	114	47%
Text Q sort and CPQ	106	43%
Image Q sort, Text Q sort and CPQ	24	10%
Total	**244**	**100%**

Table 12.1. Frequency of Text Q sorters

12.2.1 Descriptive statistics: Summary of CPQ patterns

The 106 participants that completed a Text Q sort are an older group (30-50 years old) and have between 5 to 10 years experience using the Internet. They perceive themselves to be advanced users of the Internet. Primary usage centres around communication via email, and gathering reference and commercial information for educational and work purposes. They report having only a few user-based and technically-based problems; the problems they do encounter concern finding and organising information and dealing with sites that require registration or those with broken links. There is a very positive outlook towards the Internet, with the majority agreeing that the Internet is an efficient way of getting information and can alleviate tedium. There are some however, that feel that the Internet is frustrating to use.

Whilst the overall shape, structure and size of the Internet are unclear, the process of accessing linked information is clear (see Appendix 12.1 for detailed descriptive statistics summary of Text Q sorters).

12.3 Q FACTOR ANALYSIS

In order to overcome another large sample size, the same Super-order factor analytic procedure as described in the preceding chapter was applied to the Text Q sort data.

12.3.1 Super-Order Factor Analysis

The 106 Q sorts were randomly divided into four smaller sub-samples. All four groups were factor analysed using the Centroid method with orthogonal theoretical rotation (see Appendix 12.2 for the first-level factor analyses). A total of 10 factors and 13 perspectives emerged from the 4 groups (See Table 12.2). Factors 4 and 5 had both positive and negative components, indicating two distinct perspectives for each factor. The composite factor arrays for each of the 13 perspectives were then submitted to the same factor analytic procedure.

Random groups	**Factors**				
Group 1	1	2			
Group 2	3	4+	4-	5+	5-
Group 3	6	7	8		
Group 4	9	10+	10-		

Table 12.2. Thirteen composite factors, Text Super-Factor Analysis

Using Centroid factor analysis with theoretical rotation, the 13 perspectives condensed around two operant Super-factors. Larger factor solutions were considered but each failed to offer the fidelity and clarity of the more parsimonious two factor solution. The factor matrix for the two Super-factors is presented in Table 12.3 and in graphical form in Appendix 12.3. Super-factor I was defined by 3 of the 13 Q sorts; Super-factor II was defined by 5 of the 13 Q sorts. The two

Super-factors accounted for 58% of the variance; Super-factor I for 28%, and Super-factor II for 30%.

Original Factor		I	II
Group 1	1	0.53	-0.54
	2	0.62	0.69
Group 2	3	**0.89X**	-0.04
	4+	0.55	-0.46
	4-	0.03	**0.56X**
	5+	0.08	**0.57X**
	5-	0.17	0.22
Group 3	6	**0.88X**	-0.19
	7	0.15	**0.65X**
	8	0.28	0.03
Group 4	9	**0.97X**	0.11
	10+	0.01	**0.70X**
	10-	0.13	**0.72X**

Table 12.3. Defining sorts for Text Super-Factor Analysis

Table 12.3 indicates the significantly loading sorts which were deemed to be defining sorts for the factor. Eight sorts loaded above 0.51 (irrespective of sign) at the .01 level of significance on one of the two Super-factors. Three sorts were confounded and two sorts did not load onto any factor. Each of these Super-factors constitutes distinct ways of thinking about the Internet. The following section proceeds to interpret these factors.

12.4 INTERPRETATION

The 26 separate perspectives on the Internet, rendered from statements drawn from a naturally occurring discourse, have condensed around two operant factors. The two Super-factors are described below and are identified as:

- Super-factor I: Triune Networks
- Super-factor II: Dynamic Complexity

12.4.1 Super-factor I: Triune Networks

Super-factor I is characterised by statements that convey the Internet in terms of complex interlinking networks. The statements rated as ‘most like my mental representation of the Internet’ are those that depict massively interlinked network structures; statement 8 refers to a network of networks and statements 5 and 16 refer to highly complex interlinked entities. The full factor array can be found in Appendix 12.4a. A subset of this data is listed in Table 12.4.

Array Position	Z Score	Item number	Text
(+4)	2.039	8	The Internet is a massive interlinked thing; it is a web of webs.
(+3)	1.607	5*	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
(+3)	1.249	10**	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or the pages being grouped according to content.
(+2)	1.245	25**	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
(+2)	0.981	16	It is just unique; a complex, interlinking entity.
(+2)	0.973	23	It’s just a maze because there is no beginning and no end and it’s totally interconnected.

Table 12.4. Six highest ranked Q items, Text Super-factor I [31]

[31] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.

This focus on network structures is paralleled in the qualitative responses on the Characteristics Profile Questionnaire. A significant proportion of participants consistently referred to the Internet in terms of it being a network, or densely interconnected web:

> *(I think of)* “A complex network” [Text 39].
>
> “Network” [Text 18’ Text 30].
>
> “A network of computers” [Text 52].
>
> *(Is like a)* “Web” [Text 16; Text 85; Text 86].
>
> *(Is like a)* “Net” [Text 35].
>
> *(Is like a)* “A giant interconnected web” [Text 17].

Furthermore, these networks are not moderate in size; rather they are depicted as being immense:

> “A vast complex network of knowledge and technology” [Text 4].
>
> “A vast cluster of connected hardware” [Text 6].
>
> “A connection of a huge number of servers” [Text 35].

It is important to note that although the focus is on network *structures*, it should not be mistaken for an equivalence in meaning. Rather, this factor is characterised by the fact that these networks actually symbolise one of three things; the human user, the computer component or the data/information exchange between the two.

> “A loosely-coupled adaptive network of computing devices, humans and their knowledge” [Text 4].

> “A combination of the community of human contributors/users … data …and the electronic aether that relates the environment for interaction thereof” [Text 8].

In this way, the network metaphor is a triune. For this group, the Internet consists of three sub-networks, each of which constitutes the bigger Internet network. The three sub-networks are interdependent and the Internet can only be meaningful if its three components are considered. Indeed, statement 25, rated as like their mental representation, refers to the Internet as several sub-structures: “*The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing”*. In this conceptualisation, the Internet is made up of several smaller sub-networks rather than one large overarching network.

The triadic nature of the network is reflected in the qualitative responses. Participants refer to all three components (user, computer, information exchange) when conceptualising the Internet. Firstly, this group refers to the Internet as networks of people. In this conceptualisation, the Internet is actually constituted by its users:

> “The human element is comprised of the individuals that develop and share information/applications across the Internet and the users that share and consume the information/applications” [Text 4].

> “The Internet is made out of people; it is a network built out of computing and communication technologies that connect those people; it is the social connections and the created information and the written code of those people” [Text 22].

The second focus is on networks being multiple connections between computers and servers. These physical connections make up the infrastructure of the Internet:

> “Ostensibly the Web is formed via the communication's infrastructures worldwide from cable to satellite etc. and any countless numbers of servers

> with addresses on various domains, hierarchies, search engines all interlinked via addresses and protocols ...” [Text 105].

This level of conceptualisation indicates that these participants have a high degree of expert knowledge. This is also by their awareness of the various Internet protocols.

> “A network of networks that uses multiple protocols to exchange data” [Text 15].

It is not surprising that this group seems to have an advanced level of understanding of the Internet’s technological elements. As Table 12.5 indicates, this is an older male group, who have achieved a high level of education. They have between 7-8 years of experience using the Internet and perceive themselves to be advanced or expert users.

Primary uses of the Internet include communication (via email), gathering information and for work and educational purposes. They are most likely to search the Internet for specific reference information, but will also sometimes browse and explore for commercial, health, job/home and other types of information.

> *(I think of)* “Work” [Text 6].

> *(I think of)* “Information” [Text 51; Text 80; Text 85].

> *(I think of)* “Learning random things” [Text 87].

Basic Demographics	Age	30-39 (36%), 40-54 (30%)
	Gender	Male (66%)
	Highest Qualification	Master's (25%), Doctorate (25%)
	Years Experience	7-8 years (38%)
	Hours of use per week	6-10 hours (25%), 26-30 hours (19%)
	Perceived Skill	Advanced (34%), Expert (31%)
Usage	Primary Uses	Communication (85%), Gathering information (69%), Work (66%), Education (63%)
Information Retrieval	Types of Information	Reference (91%), Commercial (66%), Other (53%), Health (50%) Job / Home listings (44%)
	Information Search Patterns	Mostly search (59%) Sometimes browse (50%) Seldom explore (38%)
Impact	Internet used instead of	TV (66%), Phone (66%), Reading (48%)
Problems	Perceived Problems – Technical	Registration (69%) Broken Links (66%) Payment for Access (56%)
Internet Attitudes	Is frustrating	Agree (38%)
	Enhances standard of living	Agree (53%), Neither (38%)
Internet Visualisation	Overall shape/size of the Internet	Clear (57%)
	Internet Structure	Clear (63%)
	Internet Linkage	Clear (75%)
	Information Retrieval	Clear (75%)

Table 12.5. Most salient profile characteristics for Super-factor I participants

It is not surprising therefore that this group emphasises the advantages of using the Internet. They view the technology as a resource or tool which enables them to accomplish an array of tasks that would otherwise be impossible or impeded.

> "An easy and useful tool for both our life and job!" [Text 25].

> "A very good tool to find anything about in subject anywhere in the world" [Text 72].

> *(I think of)* "Chatting to my friends, easy access to almost anything" [Text 84].

> "Lets you carry out a lot of things in your daily life without ever leaving your house so I guess it's very convenient too!" [Text 86].

Despite this positive emphasis, almost half are ambivalent when it comes to seeing the Internet as a tool that enhances their quality of life. Furthermore, this group believes that the Internet is frustrating to use. This is perhaps because the quality and relevance of information to be found on the Internet varies:

> "Lots of information, not always reliable" [Text 80].

> "Still lacks perfection" [Text 56].

The focus on the misinformation found on the Internet relates to the third and final conceptualisation of the network. These participants refer to the network to convey how information is exchanged between computing endpoints. The focus here is on how information is shared across the network:

> "A vast network of computers and servers that share information in the form of Web pages, files, applications, and other forms" [Text 17].

> "A big database which allows people to share information … both good and bad" [Text 86].

Interestingly, this data exchange is what actually structures the Internet. Although this group has an appreciation of the underlying physical infrastructure, they also conceptualise the Internet in terms of intangible communication networks:

> "The Internet is structured with and is held together by open communication protocols" [Text 22].

> *(I think of)* "Communications infrastructures" [Text 105].

Given this group's ability to visualise the Internet in tangible and intangible ways, it is not surprising that they have a clear mental representations of *both* the structural and procedural elements of the Internet. Unlike most participants, this group has a clear idea of the overall shape and size of the Internet, as well as how it is structured and linked. Indeed, the predominant means this group uses to structure the Internet is by conceptualising the data to be stored.

> "A shared repository for human knowledge" [Text 4].

The data on the Internet can be contained at specific locations or by technical procedures:

> "It's basically a network of interlinked computers housing their own filing cabinets of information" [Text 89].

> "The connection of 'crates' of information, based on a necessary formalization of procedures for the sharing of those informations" [Text 56].

This particular participant refers to 'crates' of information as a way to group or contain data. It is possible that they were referring to the technically-known term 'packets' of information. Packets are formatted blocks of information carried over computer networks. By condensing the data into smaller storage units, the network can transmit longer messages more efficiently and reliably. For this group therefore, the Internet is made more useful by conceptualising the information as being grouped into related chunks:

"A massive web of links divided into groups depending on there content" [Text 85, *sic*].

"A series of unique … documents and images that relate to each other only by arms length reference" [Text 6].

This is corroborated by their positive ranking of statement 10, which refers to pages being grouped according to content. Thus, for this group, information is stored and semantically organised within the network structures. This is also conveyed in their rejection of statements that convey the Internet as being ethereal and abstract (see Table 12.6). Statements 3 and 18 lack ways that order and contain information. Similarly, statement 6 refers to information flying around; this is rejected in favour of the more concretised depiction in which information is enclosed.

Array Position	Z Score	Item number	Text
(-4)	-1.682	15**	It's a mass of coloured lines, like a ball of string.
(-3)	-1.607	3**	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
(-3)	-1.335	24**	The Internet is just a current of information in electrical form; like lights shooting down the wires.
(-2)	-1.245	18**	I imagine it as a more ethereal abstract thing that plucks bits of information out of the atmosphere.
(-2)	-0.805	6	Like a molecule, which has a central starting point, a ring which surrounds it and has stuff flying out from it.
(-2)	-0.794	13	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.

Table 12.6. Six lowest ranked Q items, Text Super-factor I [32]

[32] Based on normalised (z) scores. Double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.

12.4.1.1 Summary of Super-factor I

In sum, this older, male group of expert users perceived the Internet in terms of massively complex interlinking networks. For this group, the Internet consists of three sub-networks: the human user, the computer component or the data / information exchange between the two. Each of these sub-networks constitutes the bigger Internet network and the specific conceptualisation brought to mind is largely dependent on the context of use.

12.4.2 Super-factor II: Dynamic Complexity

Super-factor II is characterised by statements that convey the dynamic, interlinking, constantly changing nature of the Internet. The statements rated as 'most like my mental representation' are those that depict the Internet as a tangled maze of connections. The full factor array can be found in Appendix 12.4b. The six statements rated as most like their mental representation of the Internet are listed in Table 12.7.

Array Position	Z Score	Item number	Text
(+4)	1.864	11**	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
(+3)	1.475	23	It's just a maze because there is no beginning and no end and it's totally interconnected.
(+3)	1.429	8	The Internet is a massive interlinked thing; it is a web of webs.
(+2)	1.257	4*	I can't imagine the Internet. It is such a complex thing that has no parallel to anything else. The Internet just is.
(+2)	1.007	16	It is just unique; a complex, interlinking entity.
(+2)	0.971	24	The Internet is just a current of information in electrical form; like blue or green lights shooting down the wires.

Table 12.7. Six highest ranked Q items, Text Super-factor II [33]

Although this predominantly female group has an age divide (20-24 and 50+)[34], there is no statistical relationship between age, gender, education and hours of use. Unlike Image Super-factor I therefore, this factor is not characterised by two interpretations based on an inherent demographic divide. Users loading onto this factor all report having between 5-6 years experience and perceive themselves to be intermediate to advanced users of the Internet. They mostly search for specific reference and health information materials and accordingly think of the Internet in terms of accessing information:

> *(I think of)* "Vast amounts of information" [Text 3].

> *(I think of)* "Access to information" [Text 7].

---

[33] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.
[34]

Basic Demographics	Age	20-24 (46%), 50 and upwards (36%)
	Gender	Female (73%)
	Highest Qualification	A-Level (36%) Master's (36%)
	Years Experience	5-6 years (36%)
	Hours of use per week	1-10 hours (46%), 26-40 hours (36%)
	Perceived Skill	Intermediate (36%), Advanced (36%)
Usage	Primary Uses	Communication (91%) Gathering information (91%) Education (82%) Shopping (64%, sometimes)
Information Retrieval	Types of Information	Reference (100%) Health (82%) Job / Home listings (73%) Commercial (64%)
	Information Search Patterns	Mostly search (64%) Sometimes browse (55%) Sometimes / Seldom explore (36%)
Problems	Perceived Problems – User	Organising Information (63%) Finding information (55%)
	Perceived Problems – Technical	Registration (91%) Broken Links (73%)
Internet Attitudes	Is frustrating	Disagree (36%) Neither (46%)
	Is responsible for good things	Neither (46%)
	Unlimited possibilities	Agree (36%) Neither (27%) Disagree (27%)
	Enhances standard of living	Neither (64%)

Table 12.8. Most salient profile characteristics for Super-factor II participants

This group also report having problems with locating and organising information (Table 12.8). This is not surprising given that they conceptualise the Internet as constantly changing. Statement 11, chosen as most like their mental image, portrays the Internet as amorphous; in this conception, there is no logical linearity in to which its constituent parts are structured.

> "The Internet is a network of networks. No central brain, per se, but more like the billions of neurons that make up the brain. But non-linear, more clustered" [Text 44].

> *(Is like a)* "Non-linear, loosely structured, glob" [Text 34].

In this way, the Internet is conceptualised as chaotic; it has a very loose structure and is dynamic.

> "Nodes, connected by links; changing in a more and more extended way, and 'limited' by very few structure limits" [Text 79].

Furthermore, these chaotic connections are randomly structured and are decentralised. Thus, the Internet can be viewed as a multitude of chaotic paths that can lead to the information.

> "A maze – there are many ways to come to a specific thing" [Text 96].

The focus on chaotic interlinking is emphasised by the rejection of certain statements. Table 12.9 indicates the statements that were rated as most unlike their own mental image of the Internet. They tended to reject statements which portray the Internet as centrally structured (statement 6) and controlled (statements 17 and 22). Indeed, they seem to negatively rate the items that suggest any form of structure (statements 25 and 26).

Array Position	Z Score	Item number	Text
(-4)	-1.574	6	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.
(-3)	-1.355	26	It would be like a tree diagram; the bottom of the trunk would be your home page and then it would spark off to different websites, or different pages within a website. It would keep branching out as far as it could.
(-3)	-1.215	25	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
(-2)	-1.163	21	I see it as a number of layers; your top layers feed into or distribute to lower levels. It's like a complex tree diagram breaking down from the top.
(-2)	-1.049	17**	The Internet is like a nervous system. It has a central spinal cord where all the information is controlled and where it comes from. Then, the information is sent like nerve signals back and forth in all different directions.
(-2)	-0.982	22**	It's a train network where you can see all the routes and the stations; the station is where you pick up the information, the rail tracks form branches where you can go along each track and search for information.

Table 12.9. Six lowest ranked Q items, Text Super-factor II[35]

Instead, this group contends that the Internet is so complex that it evades definition (as demonstrated by the positive ranking of statement 4). By understanding the Internet as an intangible entity, it evades formal definition and is not easily organised. By making the Internet analogous to a ghost or half-lit highway, these participants are portraying the Internet as ethereal, invisible and intangible:

35 Based on normalised (z) scores. Double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.

(Is like a) “Ghost of the world” [Text 20].

“A half lit highway through dark space, spattered with lights like stars that represent the information that can be gathered” [Text 81].

If the routes to information are not clear, it is not surprising that this group is not sure whether they find the Internet to be frustrating. This may also be because they encounter a significant amount of misleading information whilst searching the Internet for information.

(Is like a) “Red herring” [Text 63].

The phrase ‘red herring’ has a number of specific metaphorical meanings, all sharing a general concept: something being a diversion or distraction from the original objective. In reference to the Internet, it most likely alludes to the misinformation users come across when searching for specific facts. It is understandable therefore that this group have a rather ambivalent attitude towards the Internet; the majority are not sure whether the Internet is responsible for the good things in life and whether it actually enhances our standard of living.

12.4.2.1 Summary of Super-factor II

In sum, this younger, female group of users characterise the Internet in terms of dynamic, chaotic interlinking. The Internet has a decentralised structure that is constantly changing and evades formal definition.

12.4.3 Communalities and specificities

There were not many statements that were universally rated as most like or most unlike across the two factors (see Table 12.10). The only statement that was consistently ranked neutrally was statement 12, which conveys the Internet in terms of information travelling down the wires. The concept of electronic connections does not seem to play a significant role in both of these factors. It makes sense that both factors rated statement 16 positively, as they both dealt with complex interlinking representations of the Internet.

		I	II
12*	I see it as structured lines, like the information travelling down the wires.	0	0
16*	It is just unique; a complex, interlinking entity.	2	2

Table 12.10. Consensus Q items across the two Text Super-factors [36]

This lack of consensus indicates that the two Super-factors have a high degree of specificity. Super-factor I depicts the Internet in terms of massively complex interlinking and interdependent sub-networks. In contrast, Super-factor II is more concerned with the chaotic, dynamic nature of the Internet.

12.5 CONCLUSIONS

The 26 separate perspectives of the Internet condensed around two operant factors. This indicates that there are at least two dominant textual metaphors used to describe the Internet. The first metaphor is of massively complex, interlinking system of at least three sub-networks (the human user, the computer component or the data/information exchange between the two). The second metaphor emphasises the dynamic, chaotic, decentralised nature of the Internet.

Again, there is evidence to suggest that the emergence of these metaphors vary according to specific user groups (see Table 12.11). An older, male, more educated and skilled group of users conceive of the Internet as complex interlinking networks. Given their expert level of understanding and experience, these users view the Internet as having at least three interdependent components. They are able to conceptualise the Internet both in terms of its underlying structure, but also in terms of data exchange.

[36] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement for this factor at significance of $p \leq 0.05$.

Salient Characteristics	Text Super-factor I	Text Super-factor II
Age	30+	20-24, 50+
Gender	Male	Female
Perceived Skill	Advanced - Expert	Intermediate - Advanced
Perceived Problems	--	Organising Information Finding Information
Visualisation	All clear	--
Attitudes	Is frustrating	Ambivalence
Item rated most positively:	The Internet is a massive interlinked thing; it is a web of webs.	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
Item rated most negatively:	It's a mass of coloured lines, like a ball of string.	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.
Factor Interpretation:	**Triune Networks**	**Dynamic Complexity**

Table 12.11. Comparison of the two Text Super-factors

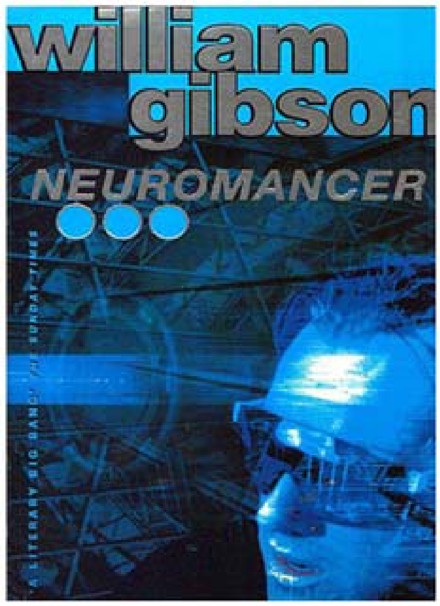
Accordingly, these users report have little trouble mentally visualising the overall structure of the Internet and the processes of accessing information. Interestingly, although these users are able to represent the Internet in both tangible and intangible ways, they do not think of the Internet in ethereal or abstract terms. Rather, the sub-networks are semantically organised and structured.

This contrasts with the younger, female group of users characterise the Internet in terms of dynamic, chaotic interlinking. These users are primarily concerned with how the Internet enables them to *access* information and accordingly see the Internet as multitude of chaotic paths that lead to information. Given that they conceive the Internet as constantly changing, it is not surprising that they report having problems with locating and organising information.

It is worth noting that the first factor indicates that the same metaphor can be used to convey different levels of meaning. The ‘complex network’ metaphor is utilised by users to refer to several different things; networks of users, networks of computers and networks of information exchange. These findings indicate that metaphors are used to represent multiple layers of meaning and thus it is often obsolete to merely categorise metaphors into superficial ‘themes’.

The following chapter now proceeds to analyse the data from the participants that completed both an Image and Text Q sort.

CHAPTER 13. INTEGRATING THE INTERNET: DUAL PARTICIPANTS' Q SORT RESULTS



> "Cyberspace: A consensual hallucination experienced daily by billions of legitimate operators, in every nation … A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data."

Figure 13.1. From William Gibson's Neuromancer (1984).
© William Gibson & HarperCollins Publishers Ltd

13.1 INTRODUCTION

This chapter outlines the analysis and interpretation of the data from the 'Dual' participants; those who completed both Image and Text Q sorts. A summary of the most relevant CPQ characteristics for the Dual Q sorters is followed by the analysis of the Image Q sort data, then the Text Q sort data. The next section summarises the significance of the findings for each factor, followed by an examination of the relationship between the Image and Text factors. The final section of this chapter compares the relationship between *all* the emergent Image, Text and Dual factors.

13.2. PARTICIPANTS

As Table 13.1 indicates, 24 participants selected to complete both an Image and Text Q sort along with the Characteristics Profile Questionnaire (CPQ), constituting 10% of the submitted responses.

Complete Responses	**N**	**%**
Image Q sort and CPQ	114	47%
Text Q sort and CPQ	106	43%
Image Q sort, Text Q sort and CPQ	24	10%
Total	**244**	**100%**

Table 13.1. Frequency of Dual Q sorters

13.2.1 Descriptive statistics: Summary of CPQ patterns

The 24 participants that completed an image Q sort are mostly young (<24) and have between 9 to 10 years experience using the Internet. They perceive themselves to be advanced users of the Internet. Primary usage centres around communication via email, gathering reference information and for educational/work purposes. They report having problems finding specific web pages and organising the information they gather, plus dealing with sites that require payment or registration for access. There is a generally positive outlook towards the Internet, with the majority agreeing that the Internet is an efficient way of getting information and can alleviate tedium.

There are some however, that feel that the Internet is frustrating to use. Whilst the overall shape, structure and size are unclear, the process of accessing linked information is clear (see Appendix 13.1 for detailed descriptive statistics summary of Dual Participant Q sorters).

13.3 Q FACTOR ANALYSIS - IMAGES

This section deals with the analysis and interpretation of the Image Q sorts submitted by the Dual participants. The 24 image Q sorts were subjected to Centroid factor analysis with orthogonal theoretical rotation. The factor analysis yielded two operant factors. Other solutions were considered but each failed to offer the clarity of the more parsimonious two factor solution. The factor matrix for the two factors is presented in Table 13.2 and in graphical form in Appendix 13.2. Table 13.2 indicates the significantly loading sorts which were deemed to be defining sorts for the factor; the first factor was defined by 10 of the 24 Q sorts and the second by 8 of the 24 Q sorts. Four sorts were confounded; two sorts did not load onto any factor.

Respondent ID[37]	**Factor 1**	**Factor 2**
Dual 1	0.27	-0.04
Dual 2	0.01	**0.66X**
Dual 3	0.01	**0.79X**
Dual 4	**0.73X**	0.08
Dual 6	**0.73X**	-0.17
Dual 7	0.26	**0.67X**
Dual 8	-0.07	**0.53X**
Dual 9	**0.65X**	-0.12
Dual 10	0.35	**0.69X**
Dual 11	0.38	-0.57
Dual 12	0.45	0.32
Dual 13	0.53	0.61

[37] An inadvertent mistake in the coding process meant that the label 'Dual 5' was accidentally omitted. Thus, the missing 'Dual 5' does not indicate omission of participant data; rather it reflects a simple coding error.

Dual 14	**0.78X**	0.10
Dual 15	0.10	**0.48X**
Dual 16	**0.87X**	0.11
Dual 17	0.17	-0.22
Dual 18	**0.55X**	-0.07
Dual 19	-0.07	**0.39X**
Dual 20	**0.61X**	-0.31
Dual 21	**0.52X**	0.07
Dual 22	**0.39X**	-0.18
Dual 23	0.29	-0.47
Dual 24	**0.50X**	-0.18
Dual 25	0.18	**0.46X**

Table 13.2. Defining sorts for Dual participants, Image Factor Analysis

It can be noted that the loadings for Dual 15, Dual 19, Dual 22, Dual 24, and Dual 25 are actually below the level considered statistically significant at the .01 level (loadings in excess of 0.51 irrespective of sign) yet have been flagged as defining sorts. However, these Q sorts still represent a clear cut view of a particular viewpoint, and thus were included as defining sorts. The two factors accounted for 59% of the variance; factor 1 for 32%, and factor 2 for 27%. Both of these factors constitute distinct ways of thinking about the Internet. The following section proceeds to interpret these factors.

13.3.1 Interpreting the Image factors

The 26 separate images on the Internet have condensed around two operant factors. The two factors are identified as:

- Factor 1: Centralised Nodal Structures
- Factor 2: Dynamic Abstract Clusters

13.3.1.1 Factor 1: Centralised Nodal Structures

This factor is characterised by images that convey nodal, structured connections. Images 26, 11 and 14 illustrate how complex connections emanate from a centralised source; similarly, image 2 conveys an Internet ‘backbone’ from which the nodal connections derive. The images chosen as least like their mental image are those that that do not depict complex, nodal connections which are centrally structured. The full factor array for Dual Image factor 1 is provided in Figure 13.2.

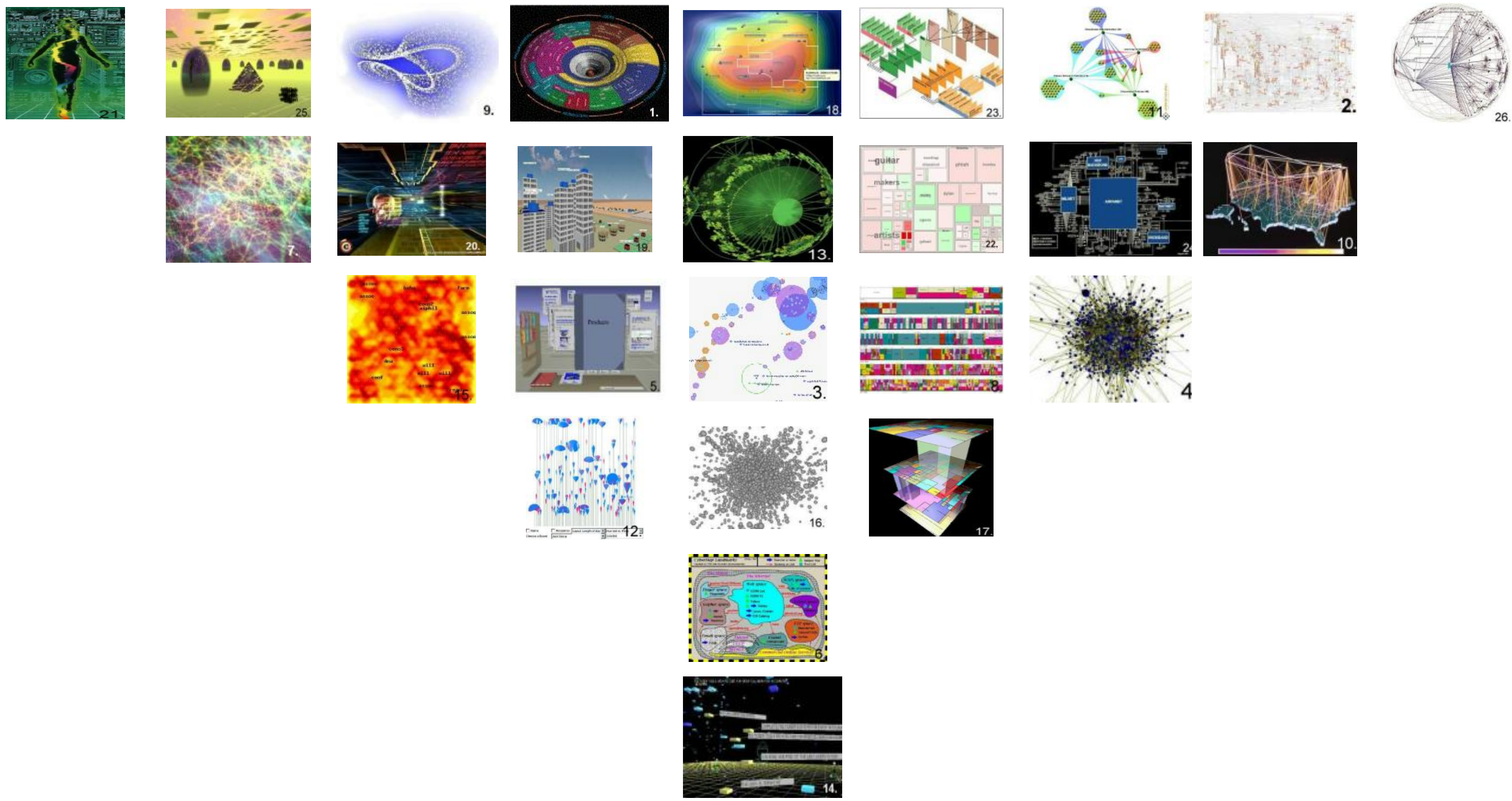


Figure 13.2. Factor array, Image Factor 1 (Dual participants)

Table 13.3 indicates the salient profile characteristics for this group.

Basic Demographics	Age	20-24 (20%) 35-39 (20%) 55-59 (20%)
	Gender	Male (70%)
	Highest Qualification	Diploma (30%) Doctorate (30%)
	Years Experience	10 years (40%)
	Perceived Skill	Advanced (60%), Expert (40%)
Usage	Primary Uses	Communication (90%) Work (90%) Gathering information (80%) Entertainment (70%)
	Tasks Accomplished	16-20 tasks (60%)
Information Retrieval	Types of Information	Reference (100%) Commercial (70%) Other (70%)
	Information Search Patterns	Mostly search (70%) Sometimes browse (50%) Sometimes explore (50%)
Problems	Perceived Problems – User	Finding Information (40%)
	Perceived Problems – Technical	Registration (90%) Payment for access (90%)
Internet Visualisation	Overall shape/size of the Internet	Unclear (70%)
	Internet Structure	Clear (80%)
	Internet Linkage	Clear (80%)
	Information Retrieval	Clear (80%)

Table 13.3. Most salient profile characteristics Dual participants, Image Factor 1

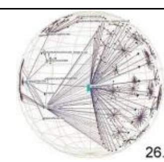
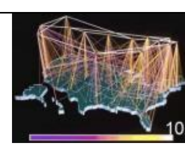
This is a predominantly male group with 10 years of experience using the Internet. They have completed the majority of the main Internet tasks and 100% perceive themselves to be advanced or expert users. They use the Internet mostly at work for communication (via email), work and entertainment purposes. They specifically search the Internet for reference and commercial information.

> *(I think of)* “Email, communication, and information searching” [Dual 24].

> *(I think of)* “A browsable information exchange” [Dual 21].

Given their predominant use of the Internet is to search for reference and commercial information, they report having trouble finding and accessing specific information. Specifically, this group reports having problems accessing information, particularly with sites that require registration or payment for access. Interestingly however, in terms of mentally visualising the Internet, they have a perfectly clear idea of the process of accessing information. They also have a clear idea how the Internet is structured, linked and how information is retrieved and shared. The only problem they have is visualising the overall structure of the Internet.

Table 13.4 highlights the types of images this group prefers to utilise when thinking about the structure of the Internet.

Array Position	Z Score	Item number	Image
(+4)	1.728	26 **	
(+3)	1.316	2 **	
(+3)	1.264	10	

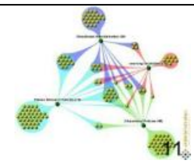
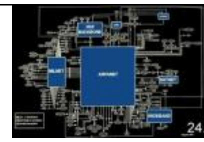
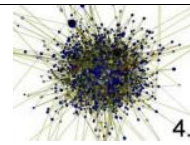
(+2)	1.258	11	
(+2)	1.186	24	
(+2)	1.005	4	

Table 13.4. Six highest ranked Q items, Dual Participants, Image factor 1 [38]

Images 26 and 2 are distinguishing for this factor; they convey the notion of a complex interlinking network structured by a centralised interweaving of nodes and lines. Nodes can be viewed as individual points and the lines represent the relationships between them. All of the images chosen as most like their own mental representation of the Internet depict the complex linking between the nodes.

> "An immense grid of linked lines that connect computers all over the world" [Dual 24].

> "The Internet is a huge network of interlinked computers and servers. It includes the Web, email, video conferences, etc..." [Dual 6].

The nodes can represent a number of different entities and therefore different layers of meaning are evident in this factor. Each individual node can be conceived as a number of devices connected to a network, such as an individual computer, a server, an Internet site (or a particular web page), the location of data files or it could even signify the geographic location of the network device. It is impossible to know for sure which, or any, of these conceptualisations were being referred to when participants selected these images as most like their own mental representation of the Internet. However, by studying the configuration of Q sort items and the qualitative responses, it is feasible to infer that participants were at least in part

[38] Based on normalised (z) scores. Double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

referring to a geographical element. Image 10 shows an interlinked network over a map of the USA[39], indicating a preference for a more concrete, geographically based conceptualisation of the Internet. This is paralleled in image 26 in which the complex interlinking is bounded by a sphere, or globe, which could possibly represent the world:

> "A giant web of information and communication stretching between people and countries" [Dual 4].

> "An electric grid connecting several cities together" [Dual 6].

These statements infer a geographical element – that is, connections that spread between cities and countries. They do not symbolise a map, for the images which are map-based are actually ranked neutrally in the middle of the Q configuration.

In addition to the geographical element, the group also refers to the nodes in terms of server based connections.

> "The Internet is nothing more than a large number of server computers all communicating with each other. We communicate with different machines through a dizzying maze of electronic connections between various host computers" [Dual 4].

Indeed, although the interlinking is complex, there is not an even distribution of connectivity. A fewer number of network nodes (servers or 'hubs') are far more connected than other nodes (e.g. images 26, 11 and 4). This means that there is a degree of centralisation to the structure; it is not random, chaotic interconnectivity.

> "It is a bowtie shape of 30% heavily linked resources, some 75% barely to not linked resources which have several distinct patterns or regions" [Dual 18].

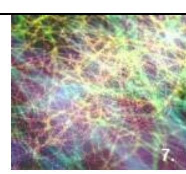
[39] Given that 42% of the overall Dual sample and 60% from this specific factor are from the USA (See Appendix 11.4), it is of little surprise that there is a USA geographic focus.

This is further illustrated in the rejection of image 7, which conveys a chaotic number of electrical signals running all over the place, having no structure or order. Interestingly however, although they prefer images which convey a centralised nodal structure, they do not necessarily infer centralised source of control. They seem to believe that Internet users themselves have the power to define the Internet, more so than traditional media. So, the nodal connections refer more to the structure, rather than issues of power or control.

> "Open-access, self-publishing, unmoderated, uncontrolled - only for some, but for more than were allowed to participate in traditional publishing/information-sharing" [Dual 14].

> *(Is like a)* "Place where anyone can make a difference" [Dual 14].

Table 13.5 indicates the images selected as least like this group's mental image of the Internet. Images that illustrate very abstract (image 15) or science fiction based representations (images 21, 25 and 20) tended to be rejected. The one thing in common is that they do not afford the nodal, connecting structure that is preferred on this factor.

Array Position	Z Score	Item number	Image
(-4)	-2.263	21 **	
(-3)	-1.654	25 **	
(-3)	-1.260	7 **	

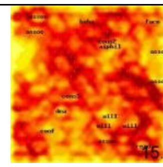
(-2)	-1.157	9 **	
(-2)	-1.155	20 **	
(-2)	-0.709	15 **	

Table 13.5. Six lowest ranked Q items, Dual Participants, Image factor 1 [40]

Furthermore, the rejection of image 9 indicates a dislike to chaotic, non-linear complexity. They tend to prefer linear, structured representations in which links are thought of as mainly one way.

> "A unidirectional graph with the rare bidirectional link" [Dual 9].

Up to this point, the nodal connection have portrayed geographically based, centrally structured sever connections. However, the nodes not only can represent concrete entities (such as computers or servers geographically dispersed across the world), but also abstract relations (such as communication protocols). Given the proclivity to use the Internet to communicate, it is not surprising that participants understand the nodal connections to be a part of a communication network.

> "A massive network of computers that communicate using a shared set of standard communication protocols" [Dual 16].

Furthermore, the nodes, and the connections between them, are the technical specifications or protocols that describe how to exchange data over the network. In other words, nodes use the network as a means of communication. This level of description is understandable given that this group perceive themselves to be

[40] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing item for this factor at significance of p ≤ 0.05; double asterisks (**) indicate a distinguishing item for this factor at significance of p ≤ 0.01.

advanced to expert users. Indeed, when asked to describe the Internet, the majority of responses were very technical in form, as opposed to descriptions that highlight types of use and/or the implications of the Internet.

> "Which OSI layer should I start with? The Internet, in terms of the actual IP protocol, is just a means of addressing computers and computer networks. There are many, many useful tools built upon this platform; www, ftp, p2p networks, voice networks, various forms of secure communication, etc" [Dual 9].

For this group therefore, it seems as though the nodal connections have several layers of symbolism; they can be used to refer to centrally based servers, to geographically remote locations and to communication protocols. What this indicates is that this group is adept at representing the Internet in a variety of different ways. Furthermore, these representations change as a function of what the Internet is being used for:

> "The Internet can be viewed in different ways depending on what you are looking for. To me it can be a network of networks interconnected with routers, communicating with TCP/IP and giving access to a lot of services. I can also look at it as a web of information with no hierarchic structure which interacts and gives access to different perspectives on the information I am looking for" [Dual 20].

The Internet is not a single pre-defined entity; rather it becomes whatever the user needs it to be for particular Internet activities.

> "Recall the poem about the elephant and the blind man, there are many useful truths. It is a pyramid of access points to prioritised layers of information; it is a bowtie shape of 30% heavily linked resources, some 75% barely to not linked resources which have several distinct patterns or regions; it is a visible visceral model of the human brain; it is cultural memory, often short term, not often enough secure long term memory; it is a 'baby' in its design and use and has many transformations ahead of it" [Dual 18].

Astoundingly, although they have an ever-changing view of the Internet, the VVIQ items in the Characteristics Profile Questionnaire indicate that they have very clear mental images when thinking about the Internet. Unlike all of the other factors, this factor is characterised by participants having a perfectly clear mental visualisation of both the structural and procedural elements of the Internet. The only problem they have visualising the Internet is conceptualising its overall shape and size. Given that its form changes according to the activity, it is not surprising that this group does not have a definite view of the Internet's shape.

13.3.1.1.1 Summary of Image Factor 1

In sum, this group of expert users perceived the Internet in terms of centralised nodal structures, in which the nodes could communication protocols, centrally based server hubs or even the geographic location of the network device. They tended to prefer images that conveyed complex connections emanating from a centralised source. They also thought about the Internet in terms of a multitude of representations which change as a function of the current Internet activity.

13.3.1.2 Factor 2: Dynamic Abstract Clusters

This factor is characterised by images that convey the clustering of semantically similar information. Image 16 illustrates densely clustered bubbles of information; Image 4 depicts the clustering of nodes and image 11 portrays semantically similar information being grouped together into units. The full factor array for factor 2 is provided in Figure 13.3.

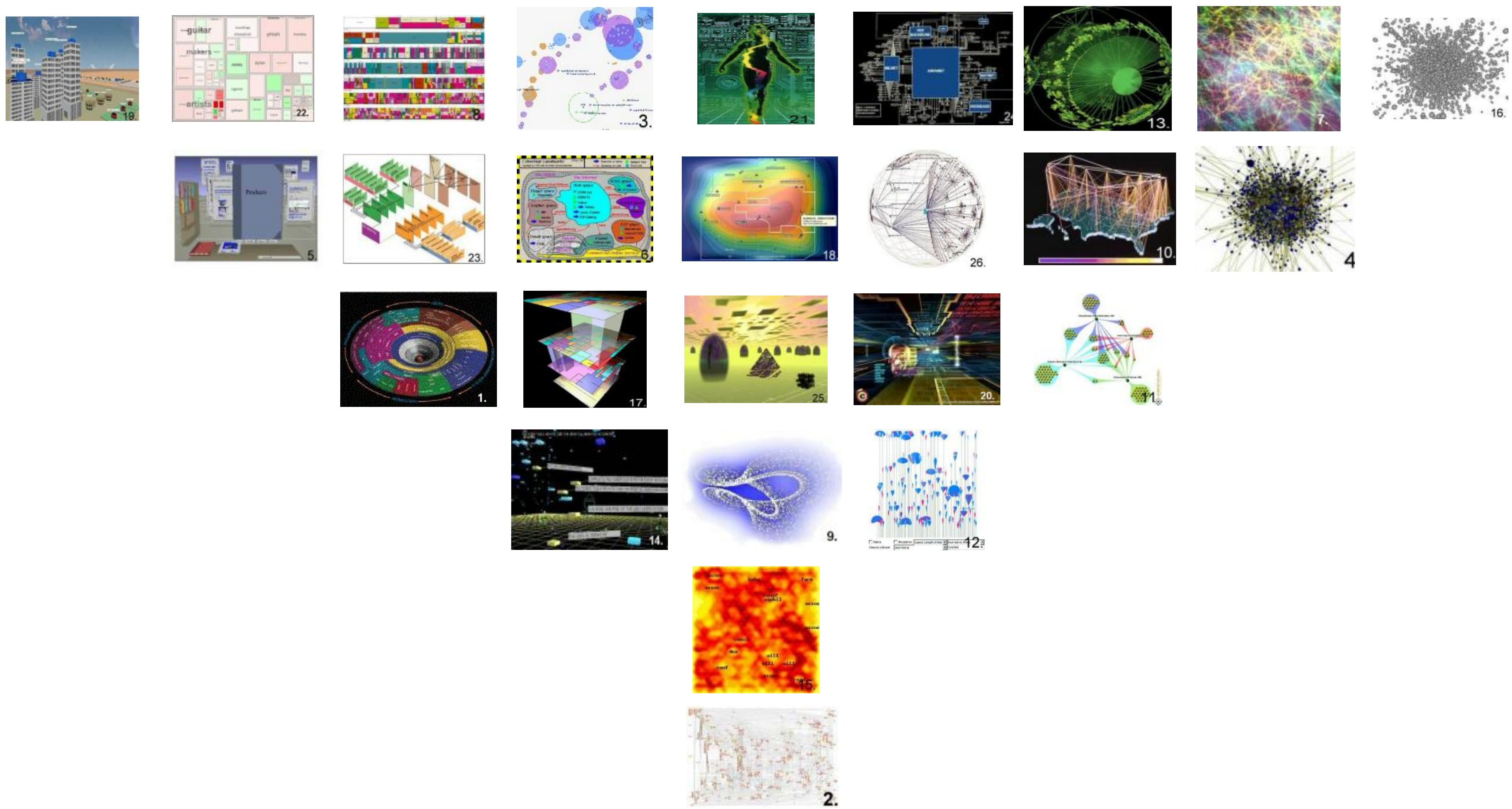


Figure 13.3. Factor array, Image factor 2 (Dual participants)

Table 13.6 indicates the salient profile characteristics for this group.

Basic Demographics	Age	20-24 (38%) 19 and under (25%) 40-44 (25%)
	Highest Qualification	A-Level (38%), Bachelors (38%)
	Perceived Skill	Advanced (50%), Intermediate (25%)
Usage	Primary Uses	Gathering information (100%) Education (88%) Waste time (75%) download music (often 38%) Communication (75%)
	Tasks Accomplished	11-15 tasks (63%)
Information Retrieval	Types of Information	Reference (100%) Commercial (100%)
	Information Search Patterns	Mostly search (75%) Mostly explore (50%) Sometimes browse (38%)
Problems	Perceived Problems – User	Organising Information (63%) Finding web pages (37%)
	Perceived Problems – Technical	Registration (75%) Payment for access (75%) Broken links (63%) Useless graphics (50%) Downloading pages (37%)
Internet Attitudes	Is frustrating	Agree (75%)
	Helps me create new ideas	Disagree (50%)
	Helps put new ideas into action	Agree (50%)

Table 13.6. Most salient profile characteristics Dual participants, Image Factor 2

This factor is defined by those who are fairly young (73% aged 24 and under), although a more mature faction also loads onto this factor. The majority report having between 5-7 years experience using the Internet and accordingly perceive themselves to have intermediate to advanced skills. Interestingly, whilst communication is still an important activity, it appears that it is not the central reason for using the Internet. The predominant use of the Internet is to gather information, for educational purposes and to waste time (by downloading music). They are most likely to search the Internet for reference, commercial and health information. Although they have little problems returning to pages they once visited, they seem to have problems finding specific web pages. The majority also report having problems organising the information they gather. They also report having a number of technically-based problems, specifically with sites that take too long to download, have broken links and/or useless graphics. Whilst this group agrees that the Internet reduces tedium and is more efficient at gathering information, the majority find it frustrating to use. Interestingly, whilst half believe that the Internet does not help them create new ideas, the same portion feels the Internet helps put their ideas into action.

Indeed, it is the creative aptitude of this group that exemplifies this factor. Unusually, the accompanying qualitative descriptions which are used to contextualise the Q sort data are often fantastical in nature. This group refers to the Internet in terms of conceptual and figurative language that is highly descriptive and metaphorical:

> "A prosthetic for the mind, for dreaming" [Dual 10].

> "A jewelled net of information" [Dual 19].

For this group of users, the conception of the Internet is neither static nor rigid. In this way, the Internet is a dynamic entity that is constantly changing.

> "A rhizome-like amorphous entity with ever-changing connectivity" [Dual 10].

In addition to having these rather fantastical, abstract and figurative conceptualisations, they also have representations that are anchored in reality. They therefore have this very dynamic view of the Internet: it can concurrently be intangible and ethereal whilst being concretised by its functionality. For example, when completing the statement, *'When I think of the Internet, I think of...'*, their answers were very matter-of-fact:

> *(I think of)* "Sitting in front of a computer screen" [Dual 3].
>
> *(I think of)* "Computers" [Dual 2].
>
> *(I think of)* "A tool" [Dual 8].

These qualitative responses indicate that this group actually *experiences* the Internet in a concrete, literal way. This is in sharp contrast to the conceptual ways in which they *think* about the Internet.

It seems therefore that this group has dynamic representations of the Internet that can be alternated according to whether they are actually interacting with the technology, or just thinking about it. Indeed, do not be fooled that this group of users do not really seem to have a concrete grasp of what they think the Internet is; they have purposely chosen fantastical images (see Table 13.7) to portray their abstract conceptualisation of this technology.

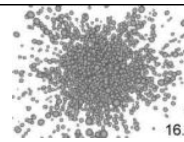
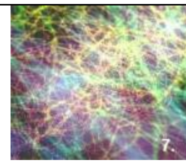
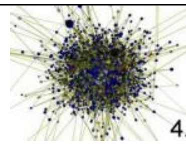
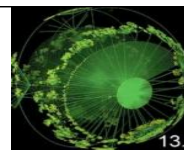
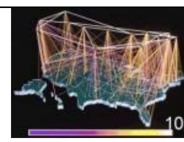
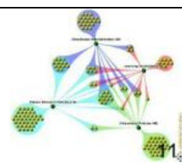
Array Position	Z Score	Item number	Image
(+4)	1.650	16 **	
(+3)	1.644	7 **	
(+3)	1.384	4	
(+2)	1.019	13 **	
(+2)	0.921	10	
(+2)	0.776	11 *	

Table 13.7. Six highest ranked Q items, Dual Participants, Image factor 2 [41]

Table 13.7 indicates that the images chosen as most like their mental image are those that depict how information is linked or clustered. It is possible that the densely clustered units in Images 16, 4, 13 and 11 may portray interlinked computers:

> "A global network of interlinked computers" [Dual 15].

> "Distributed data and computing resources which may be geographically remote but connected and accessible via standard communication protocols" [Dual 7].

[41] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing item for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

It is also equally feasible that those images convey the notion of interlinked data:

> "A vast interconnecting network of data" [Dual 2].

> "A network of information from around the world" [Dual 25].

Indeed, it seems as though a core component of this factor is the emphasis on clusters of information:

> "A vast interconnecting network of clustered data" [Dual 2].

Furthermore, these clusters contain 'sign posts' which help them to gather the information, which may or may not always be relevant.

> "Clusters of information with sign posts leading you around. The quality of these sign posts differs with every site" [Dual 8].

> *(Is like)* "A mass of irrelevant information" [Dual 3].

This perhaps explains why they report having little difficulties finding information, but do have trouble organising information. Interestingly, despite having problems with organisation, this group tended to reject images that portray highly categorised and ordered information (images 22, 8, 23 and 1). Table 13.8 indicates the items that are most unlike their own mental image. They tended to dislike static, overly ordered and bounded packets of information. Furthermore, they tend to dislike the 'virtual library' image and the card index metaphor, both of which are associated with more traditional modes of gathering information. This is not surprising given that this factor is characterised by a younger generation; i.e. those who perhaps recognise the need for new ways of gathering information.

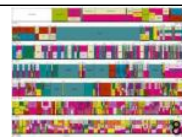
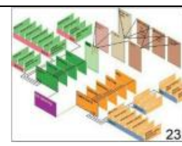
Array Position	Z Score	Item number	Image
(-4)	-2.141	19 **	
(-3)	-1.595	22 **	
(-3)	-1.369	5 **	
(-2)	-1.205	8 **	
(-2)	-0.981	23 **	
(-2)	-0.961	1	

Table 13.8. Six lowest ranked Q items, Dual Participants, Image factor 2 [42]

13.3.1.2.1 Summary of Image Factor 2

In sum, this factor is characterised by dynamic representations that vary according to whether the participants are actually interacting with the technology, or just thinking about it. When thinking about the Internet, rather abstract and figurative representations are used; when experiencing the Internet, they refer to it as clusters of interlinked information.

[42] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing item for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

13.3.1.3 Communalities and specificities

By examining the consensus items, we can begin to examine the degree of similarity between these two image factors (see Table 13.9). Participants on both factors tended to rate images 11 and 24 positively; these are images that illustrate densely structured connections. For Factor 1 this could portray the centralisation of nodal connections; for Factor 2 this could be the clustering of information. They both tended to reject image 1 and those in the neutral columns (images 6 and 18) which portrayed highly categorical information which are devoid of any links.

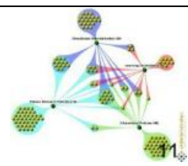
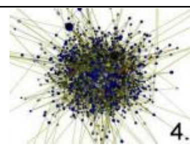
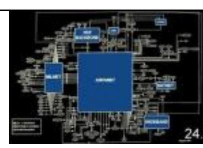
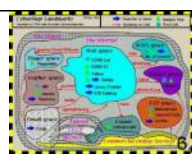
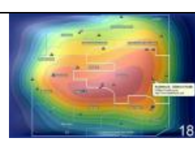
		1	**2**
11 **		2	2
4 *		2	3
24 **		2	1
6 *		0	-1
18 *		0	0
1 *		-1	-2

Table 13.9. Consensus Q items across the two image factors [43]

[43] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing item for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing item for this factor at significance of $p \leq 0.01$.

Furthermore, both factors deal with dynamic representations. In factor 1, the nodal connections had several layers of meaning; in factor 2, the representations changed according to whether the Internet was being thought about or interacted with. These dynamic representations suggest that Dual participants have an array of different conceptualisations of the Internet which vary according to what they are doing and/or thinking at the time.

Beyond these similarities, the two factors embodied distinct conceptualisations. Participants who loaded onto Factor 1 are concerned with the nodal, structured connections which portray a geographical, server based, centrally structured communications network, affording easy access to information. The participants who loaded onto Factor 2 envision the Internet as clusters of semantically related information whilst experiencing the Internet, but in more conceptual terms when just thinking about the technology.

13.3.2 Summary of Image Factors

The 26 images of the Internet condensed around two operant factors. Once again, this indicates that there are at least two dominant visual metaphors used to describe the Internet. The first metaphor is concerned with centralised nodal structures; that is, complex connections emanating from a centralised source. The second metaphor emphasises the clustering of semantically similar information.

There is no clear cut relationship between metaphors and specific user groups. What is evident however, is the fact that for both factors, the metaphors are used to symbolise several meanings. In factor 1, the nodal connections are used to refer to centrally based servers, to geographically remote locations to communication protocols. The metaphors evoked in Factor 2 simultaneously have ethereal yet functional qualities; these represent the dynamic representations users have which vary according to whether they are actually interacting with the technology, or just thinking about it. Both these metaphors indicate that these users groups are adept at representing the Internet in a variety of different ways. Furthermore, these representations change as a function of what the Internet is being used for. Thus, the Internet is not a single pre-defined entity; rather it becomes whatever the user needs it to be for particular Internet activities. The following section now proceeds to analyse the Text Q sort data.

13.4 Q FACTOR ANALYSIS - TEXT

The 24 text Q sorts were subjected to Centroid factor analysis with orthogonal theoretical rotation. The factor analysis yielded two operant factors; again, this was decided by determining the solution that generated the least number of confounding sorts and maximising the number of highly significant loadings onto each factor. The factor matrix for the two text factors is presented in Table 13.10 and in graphical form in Appendix 13.3.

Respondent ID	Factor 1	Factor 2
Dual 1	**0.49X**	-0.14
Dual 2	0.24	**0.83X**
Dual 3	**0.65X**	-0.05
Dual 4	0.06	**0.84X**
Dual 6	0.24	**0.53X**
Dual 7	**0.60X**	0.13
Dual 8	**0.44X**	0.04
Dual 9	0.21	**0.67X**
Dual 10	0.47	-0.39
Dual 11	**0.57X**	0.32
Dual 12	**0.71X**	-0.03
Dual 13	**0.51X**	0.15
Dual 14	**0.59X**	0.31
Dual 15	0.26	**0.58X**
Dual 16	0.36	**0.77X**
Dual 17	0.40	0.51
Dual 18	-0.13	**0.76X**
Dual 19	**0.51X**	0.27
Dual 20	0.21	**0.59X**

Dual 21	**0.40X**	0.20
Dual 22	-0.09	0.24
Dual 23	0.12	**0.38X**
Dual 24	0.30	0.21
Dual 25	0.49	0.64

Table 13.10. Defining sorts for Dual participants, Text Factor Analysis [44]

The first factor was defined by 10 of the 24 Q sorts; the second by 9 of the 24 Q sorts. Three sorts were confounded; two did not load onto any factor. The two factors accounted for 61% of the variance; factor 1 for 28%, and factor 2 for 33%.

13.4.1 Interpreting the Text factors

The 26 separate descriptions of the Internet have condensed around two operant factors. The two factors are identified as:

- Factor 1: Chaotic Interlinking
- Factor 2: Linkage Layers

13.4.1.1 Factor 1: Chaotic Interlinking

This factor is characterised by statements that convey highly connected, chaotic interlinking of the Internet. The statements chosen as most like their mental image are those that portray massive amounts of complex interlinking (statements 8, 5 and 16). Furthermore, the connections are ever-changing and chaotic (statements 11 and 23). The full factor array can be found in Appendix 13.4a. A subset of this data, specifically the six statements rated as most like their mental representation of the Internet is listed in Table 13.11.

[44] Dual 1, Dual 8, Dual 13, Dual 19, Dual 21 and Dual 23 were flagged as defining sorts as they still represent a clear-cut view of one particular perspective.

Array Position	Z Score	Item number	Text
(+4)	1.843	8	The Internet is a massive interlinked thing; it is a web of webs.
(+3)	1.633	16 **	It is just unique; a complex, interlinking entity.
(+3)	1.147	7 **	I imagine it as a map; regions on the map are like major categories. If you click on a region, you see hundreds of thousands of subject categories and millions of websites.
(+2)	1.116	5 *	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
(+2)	1.038	11 **	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
(+2)	0.935	23 **	It's just a maze because there is no beginning and no end and it's totally interconnected.

Table 13.11. Six highest ranked Q items, Dual Participants, Text factor 1 [45]

It is evident from Table 13.10 that this factor is concerned with the highly interlinked nature of the Internet. Indeed, one respondent referred to the Internet as:

> "A jewelled net of information" [Dual 19].

The jewelled net is a metaphor of how every point of the net contains information regarding all other points. It is a concept originating in Hinduism; it refers to "a network of jewels that not only reflect the images in every other jewel, but also the multiple images in the other" (Cayley, n.d.). Each node reflects the qualities of all other nodes. The fact that all nodes are simply reflections indicates that there is no particular single source point from where it all arises. By referring to the Internet as

[45] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.

a jewelled net, this participant is portraying the Internet as an interdependent and complex interlinking network.

In addition to the complex interlinking, this group envisions the Internet as amorphous, dynamic and constantly changing. They view a multitude of chaotic paths that can lead to information:

> "A mass of irrelevant information" [Dual 3].

> "A lot of electronic signals running around all over the place" [Dual 13].

Furthermore, there is no centralised source of control that moderates the Internet; rather, they view the Internet as unmoderated and uncontrolled.

> "Superficially covering every element of human experience - but with no real editorial control" [Dual 7].

> "Open-access, self-publishing, unmoderated, uncontrolled" [Dual 14].

Given that they envision the Internet as chaotic and disorderly, it is not surprising therefore that they report having problems locating specific pages and not being able to efficiently organise the information they gather (see Table 9.19 below). Indeed, for this group, the chaos is almost entertaining. They refer to the Internet as a maze or lucky dip:

> "A maze of information" [Dual 12].

> *(Is like a)* "Lucky dip" [Dual 1].

Mazes are puzzles that are to be solved; a fun way to entertain themselves. This conception is not surprising given that their primary use of the Internet is for entertainment (see Table 13.12).

Basic Demographics	Age	20-24 (50%) 30-34 (20%) 40-59 (30%)
	Highest Qualification	A-Level (30%) Doctorate (30%)
	Years Experience	5-6 years (40%) 9-10 years (50%)
	Perceived Skill	Advanced (60%)
Usage	Primary Uses	Gathering information (100%) Shopping (90%, sometimes - often) Wasting time (80%) Instead of working (60%) Entertainment (80%)
Information Retrieval	Types of Information	Reference (100%) Commercial (90%) Job / Home listings (60%)
	Information Search Patterns	Mostly search (60%) Always browse (60%) Mostly explore (40%)
Problems	Perceived Problems – User	Organising Information (60%) Finding web pages (40%)
	Perceived Problems – Technical	Registration (90%)
Internet Attitudes	Is frustrating	Disagree (40%)
	Is responsible for good things	Neither (70%)

Table 13.12. Most salient profile characteristics Dual participants, Text Factor 1 [46]

This group is characterised by using the Internet to waste time and for entertainment purposes. Almost all the group shop online frequently, and is used daily instead of working. The view the Internet as a source of entertainment:

> "It is a very useful resource and entertainment provider" [Dual 11].

[46] Whilst the participants display a wide range of basic user characteristics, a demographic divide does not exist. Unlike the Image Super-factor I therefore, this factor is not characterised by two interpretations based on an inherent demographic divide.

They tend to enjoy spending the time searching the Internet for information and wasting time by shopping and completing other activities.

> *(I think of)* "Shopping and hours spent searching for relevant information" [Dual 1].

> *(Is like a)* "Glossy magazine" [Dual 7].

Given their proclivity to use the Internet as a form of entertainment, it is not surprising that this group has a generally positive outlook of the Internet. The majority believe that the Internet is not frustrating to work with. Interestingly however, despite being entertained by the Internet, the majority are unsure whether it is responsible for the good things we enjoy in life.

Nevertheless, this group views the computer as a portal to their entertainment. The computer is the mediating interface between the user and the entertainment:

> *(I think of)* "Sitting in front of a computer screen" [Dual 3].

> "The computer is a window my the world of entertainment and pleasure" [Dual 19].

Even though the computer is conceptualised as the point at which the Internet is experienced, it is interesting that they rated statement 13 as least like their mental representation of the Internet (see Table 13.13). On closer inspection however, it is likely that this conception was rejected as it conveys a very structured portrayal of the Internet, rather than the chaotic depiction they seem to prefer.

Array Position	Z Score	Item number	Text
(-4)	-1.499	2 **	I imagine the Internet as a big city; individual websites are grouped together in grids of city blocks. Important sites that are linked to many other sites are skyscrapers whereas houses represent sites that have the least importance.
(-3)	-1.424	3	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
(-3)	-1.397	15 *	It's a mass of coloured lines, like a ball of string.
(-2)	-1.285	9 **	It is an urban landscape of skyscrapers of pulsing information and computer circuitry.
(-2)	-1.124	6	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.
(-2)	-0.879	13	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.

Table 13.13. Six lowest ranked Q items, Dual Participants, Text factor 1 [47]

Statement 6 was similarly rated negatively as it conveys the Internet as having a central starting point. Statement 2, rated as being least like their mental image, refers to information being grouped together into units. Both of these statements do not fit in with the chaotic, decentralised interlinked representation they prefer. As Table 13.12 indicates that the statements which depict very structured, rigid, static conceptions of the Internet tended to be rejected.

13.4.1.1.1 SUMMARY OF TEXT FACTOR 1

In sum, this factor is concerned with the chaotic interlinking nature of the Internet. This group of users predominantly uses the Internet as an entertainment source.

[47] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.

They prefer statements that depict the Internet in terms of complex interlinking; the connections are ever-changing and chaotic.

13.4.1.2 Factor 2: Linkage Layers

This factor is characterised by statements that portray the Internet in terms of the linkages between points. The statements chosen as most like their mental image are those that refer to massively interlinked structures which are hierarchically organised and layered. The full factor array can be found in Appendix 13.4b. A subset of this data, specifically the six statements rated as most like their mental representation of the Internet is listed in Table 13.14.

Array Position	Z Score	Item number	Text
(+4)	1.595	5 *	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
(+3)	1.496	8	The Internet is a massive interlinked thing; it is a web of webs.
(+3)	1.482	25 **	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
(+2)	1.279	17 **	The Internet is like a nervous system. It has a central spinal cord where all the information is controlled and where it comes from. Then, the information is sent like nerve signals back and forth in all different directions.
(+2)	0.916	21 **	I see it as a number of layers; your top layers feed into or distribute to lower levels. It's like a complex tree diagram breaking down from the top.
(+2)	0.846	10 *	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or pages being grouped according to content.

Table 13.14. Six highest ranked Q items, Dual Participants, Text factor 2 [48]

[48] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing statement at significance of $p \leq 0.01$.

Table 13.15 indicates the salient profile characteristics for this group.

Basic Demographics	Age	20-24 (33%) 35-39 (22%)
	Highest Qualification	Bachelors (22%) Doctorate (22%)
	Years Experience	10 years (33%)
	Perceived Skill	Advanced (33%), Expert (33%)
Usage	Primary Uses	Gathering information (100%) Communication (88%) via Email (100%) Work (77%) (Never, instead of working, 44%)
	Tasks Accomplished	16-20 tasks (55%)
Information Retrieval	Types of Information	Reference (100%) Commercial (77%) Health (66%)
	Information Search Patterns	Mostly search (99%)
Problems	Perceived Problems – User	None
	Perceived Problems – Technical	Registration (88%) Payment for access (77%)
Internet Attitudes	Is frustrating	Agree (33%)
	Can eliminate tedium	Disagree (66%)
Internet Visualisation	Overall shape/size of the Internet	Unclear (77%)
	Internet Structure	Clear (66%)
	Internet Linkage	Clear (77%)
	Information Retrieval	Clear (100%)

Table 13.15. Most salient profile characteristics Dual participants, Text Factor 2

Participants in this factor have 10 years experience and accordingly perceive themselves to be advanced to expert users of the Internet. Their primary usage is to gather information, communicate and for work purposes. They do not use the

Internet to entertain themselves nor waste time. This group exclusively searches for reference, commercial and health-related information.

> *(I think of)* "Easy access to information and communicating with my family" [Dual 23].

This group only report having technologically based problems which are concerned with sites that require payment or registration. This group has a generally negative outlook of the Internet, feeling that the Internet does not relieve tedium and is frustrating to work with. This factor is characterised by participants having a perfectly clear mental visualisation of both the structural and procedural elements of the Internet. The only problem they have visualising the Internet is conceptualising its overall shape and size.

This group envision the Internet as a massive, interlinked network of computers and information:

> "A global network of interlinked computers" [Dual 15].

> "A vast interconnecting network of data" [Dual 2].

Interestingly, the linkage can be either structural or conceptual, indicating that there is a dual layer of symbolism. The links can be conceived in terms of the structural components of the network (servers, computers, routers and cables) or in terms of conceptual linkage such as links between websites or the communication process between two endpoints.

Conceptually, this group use links to refer to the communication process between computers and also between end users.

> "A massive network of computers that communicate using a shared set of standard communication protocols" [Dual 16].

> 'A vast web of communication links … stretching between people" [Dual 4].

> “We communicate with each other through a dizzying maze of electronic links between various host computers” [Dual 4].

Given that communications is one of the main activities this group report doing, the focus on communication is not surprising. This group also refers to the linkages in terms of electronic connections. In these representations, the linkage is conceptual inasmuch that the connections are intangible; it is how data and website are connected to one another.

> *(I think of)* “An electric grid connecting websites together” [Dual].

> “A mass of electronic data” [Dual 17].

Interestingly, whilst they conceptualise links between information as being intangible, this is not a quality which they revere in the Internet as a whole. Table 13.16 illustrates that they tended to reject statements that portrayed the Internet as ethereal, abstract, intangible or magical. Indeed, statement 4, rated as least like their mental image, suggests that the Internet is hard to be imagined. It is evident therefore that this group dislikes the idea that the Internet can evade definition. It is interesting then that these participants do not have a clear mental visualisation of the overall shape and size of the Internet. Nevertheless, they have a good idea of how it is structured, linked and the process of accessing information, which ties into their primary uses of the Internet. Perhaps for this group, it is not important to have an overall representation of the Internet, just as long as their concrete, grounded conceptualisations help them search for and access the information they require.

Array Position	Z Score	Item number	Text
(-4)	-2.101	18 **	I imagine it as a more ethereal abstract thing that plucks bits of information out of the atmosphere.
(-3)	-1.636	3	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
(-3)	-1.598	4 **	I can't imagine the Internet. It is such a complex thing that has no parallel to anything else. The Internet just is.
(-2)	-1.015	19 **	It has a chaotic randomness like pixels in the sky, which is always changing, growing and morphing.
(-2)	-0.964	11 **	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
(-2)	-0.896	15 *	It's a mass of coloured lines, like a ball of string.

Table 13.16. Six lowest ranked Q items, Dual Participants, Text factor 2 [49]

In contrast to the conceptual representations of linkage, these participants also refer to links in terms of the physical connections of the Internet:

> "The Internet is a huge network of interlinked computers and servers" [Dual 6].

> "It is a connection of worldwide group of computers consisting of LANS, WANS, hardware and software" [Dual 23].

The links therefore represent concrete, physical entities such as computers or servers which in turn form extensive networks. These structural connections are not randomly connected; rather they emanate from a central control point. This is depicted in statement 17 in which the metaphor of the nervous system has a central

[49] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.

controller. Interestingly however, the connections travel both ways, back and forth to the controller. In other words, this group feels that they interact with the Internet:

> "I can also look at it as a web of information … that interacts and gives access to different perspectives on the information I am looking for" [Dual 20].

Indeed, this group envisions the Internet in terms of a network of networks, ordered by a hierarchical structure (statements 21 and 10).

> "It is a pyramid of access points to prioritized layers of information" [Dual 18].

The hierarchy enables them to interact and give access to the information they are searching for. The notion of layers is actually explicitly referred to by one participant:

> "Which OSI layer should I start with? The Internet in terms of the actual IP protocol is just a means of addressing computers and computer networks. there are many, many useful tools built upon this platform www, ftp, p2p networks, voice networks, various forms of secure communication, etc" [Dual 9].

It is evident that this group is very technologically savvy and thus has the technical expertise to focus on the structural elements of the Internet. Given that they have completed almost all of the main Internet tasks and perceive themselves to be expert level users, it is not surprising that they have a very technical understanding of the Internet.

> "A massive network of computers that communicate using a shared set of standard communication protocols" [Dual 16].

> "It is a connection of worldwide group of computers consisting of LANS, WANS, hardware and software" [Dual 23].

For this group therefore, referring to linkages has several layers of symbolism; they can be conceptual links (such as communication or electronic connections) or structural links (the physical backbone of the Internet which is hierarchically structured). This indicates is that this group is adept at representing the Internet in a variety of different ways. Furthermore, these representations change as a function of what the Internet is being used for:

> "The Internet can be viewed in different ways depending on what you are looking for. To me it can be a network of networks interconnected with routers, communicating with TCP/IP and giving access to a lot of services. I can also look at it as a web of information with no hierarchic structure which interacts and gives access to different perspectives on the information I am looking for" [Dual 20].

This dual conceptualisation is extremely similar to the participants loading onto Image Factor 1. Both of these groups only have problems visualising the overall shape and size of the Internet. However, this is not surprising given that there are several layers of conceptualisation available to these users.

13.4.1.2.1 SUMMARY OF TEXT FACTOR 2

In sum, this group of expert users perceived the Internet in terms of linkage layers. They tended to prefer statements that conveyed massively interlinked structures which are hierarchically organised; the linkage could be either conceptual or structural depending on the activity at hand.

13.4.1.3 Communalities and specificities

Table 13.17 indicates the items which are rated similarly across the two factors. Both factors rejected fantastical and abstract statements (statements 3, 15 and 13), preferring more grounded ways of accessing the Internet. Both factors rated the 'web of webs' depiction most positively; Factor 1 to convey chaotic interconnections, factor 2 to portray how the Internet is linked.

		1	2
8 **	The Internet is a massive interlinked thing; it is a web of webs.	4	3
5 *	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.	2	4
20 *	It's like leafing through a filing cabinet. You look for the information and pull out the file, look through it and if it's got what you want you photocopy it. If not, put it back and try another drawer.	1	0
10 *	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or the pages being grouped according to content.	0	2
12 **	I see it as structured lines, like the information travelling down the wires.	0	1
24 *	The Internet is just a current of information in electrical form; like blue or green lights shooting down the wires.	-1	0
6 **	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.	-2	-1
13 **	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.	-2	-1
15 *	It's a mass of coloured lines, like a ball of string.	-3	-2
3 **	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen	-3	-3

Table 13.17. Consensus Q items across the two Text factors [50]

Superficially, both factors tend to like statements that convey the interlinking nature of the Internet. Closer inspection reveals that participants defined by Factor 1 use the interlinking to convey the chaotic interconnectedness of the Internet. Conversely, Factor 2 members reject the chaotic randomness and uses the interlinking to refer to the conceptual and structural components of the Internet.

[50] Based on normalised (z) scores. A single asterisk (*) indicates a distinguishing statement for this factor at significance of $p \leq 0.05$; double asterisks (**) indicate a distinguishing statement for this factor at significance of $p \leq 0.01$.

In sum, factor 1 depicts the Internet as an interlinking, chaotic, highly interconnected entity. The computer serves as a portal from which they experience the Internet and access entertainment. Factor 2 is concerned with conceptual and structural linkage.

13.4.2 Summary of Text Factors

The 26 descriptions of the Internet condensed around two operant factors. Once again, this indicates that there are at least two dominant textual metaphors used to describe the Internet. The first metaphor is concerned with dynamic, chaotic and unmoderated interlinking. The second metaphor also depicts massively interlinked structures, but the emphasis is on hierarchical organisation and structural layers.

There are key differences in the groups of users employing these contrasting metaphors. Interestingly, both factors are characterised by groups of users displaying a wide range of ages, educational achievement and experience using the Internet; both groups of users perceive themselves to have advanced / expert skills. The key differences between the groups boil down to their reported primary use and the attitudes held towards the Internet. Participants who conceive of the Internet in terms of dynamic, chaotic interlinking report using the Internet as a source of entertainment. Accordingly, they have a very positive view of the Internet and the majority do not find the technology frustrating to use. In contrast, those which perceive the Internet to be hierarchically organised predominantly use the Internet to search for information and have a very negative outlook of the technology (the majority disagree that the Internet can alleviate tedium). There is also further support for the idea that metaphors are used to symbolise several meanings. For those who conceive of the Internet in terms of linkage layers, the links can symbolise the structural components of the network (servers, computers, routers and cables) or as conceptual links between websites.

13.5 COMPARISON BETWEEN IMAGE AND TEXT FACTORS

As each participant completed both types of Q sort, it is interesting to see if the emergent factors were analogous to one another, despite the different Q sort medium[51]. Table 13.18 shows the participants which loaded onto the image and text factors. For comparison purposes, Table 13.18 only shows the participants that purely loaded onto both an image and text factors. The participants that have been omitted may have had low or confounding loadings on the remaining factor and as such cannot be used for comparison purposes.

Respondent ID	**Image**		**Text**	
	Factor 1	Factor 2	Factor 1	Factor 2
Dual 4	*			*
Dual 6	*			*
Dual 9	*			*
Dual 16	*			*
Dual 18	*			*
Dual 20	*			*
Dual 14	*		*	
Dual 21	*		*	
Dual 3		*	*	
Dual 7		*	*	
Dual 8		*	*	
Dual 19		*	*	
Dual 2		*		*
Dual 15		*		*

Table 13.18. Participants' loadings onto Image and Text factors

There seems to be a general loading pattern across the image and text factors. As Figure 13.4 indicates, 43% of participants who loaded onto Image factor 1 also loaded onto Text factor 2. It makes sense that the 'Centralised Nodal Structures' and 'Linkage Layers' would be similarly characterised. They are both concerned with complex interlinked networks that are centrally ordered. They both have a tendency to reject more ethereal, abstract portrayals and also chaotic, non-linear conceptualisations. They also both deal with several layers of meaning, with the nodes / links symbolising structural and conceptual elements. Despite these

[51] See Appendix 10.6 for analysis of whether the order of completion of the text and image Q sorts had an effect on the resultant factors.

similarities, it should not be automatically assumed that these factors portray identical meanings. Each factor separately contributes additional meaning that is not found in the corresponding factor. For example, part of the emphasis in Image factor 1 is on how nodes are geographically bounded – this is a missing element from Text factor 2. Likewise, Text factor 2 refers to the Internet in terms of hierarchical structures – this conceptualisation is absent in Image factor 1.

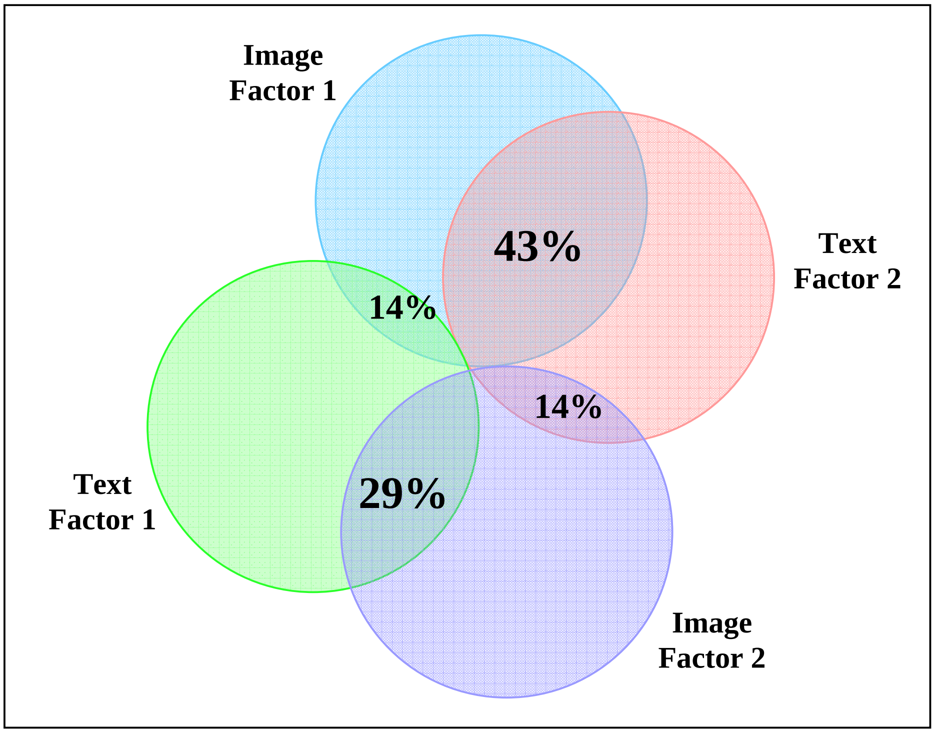


Figure 13.4. Visual comparison between Image and Text factors

Figure 13.4 also indicates that 29% of participants who loaded onto Image Factor 2 tended to load onto Text Factor 1. Again, it follows that the 'Dynamic Abstract Clusters' and 'Chaotic Interlinking' would be similarly characterised. Both conceptualise the Internet as a complex, massively interlinked entity which is constantly changing. They also both reject items that convey the Internet as being rigid and overly-categorised. However, beyond these initial similarities, each factor proffers additional interpretation. Image factor 2 portrays the Internet in terms of densely clustered bubbles of information. Furthermore, participants seem to have a dual layer of understanding according to whether they are thinking about the Internet or experiencing it. This level of understanding is absent in Text Factor 1. Similarly, participants loading onto Text Factor 1 perceive the computer as a portal to their world of entertainment.

In summary, it appears that there is a high degree of similarity between participants loading onto Image Factor 1 & Text Factor 2, and Image Factor 2 & Text Factor 1. Whilst each factor individually and separately contributes additional meaning not found in its corresponding factor, very similar metaphors emerged from the textual and image Q sorts. Thus, regardless of the medium of the Q sort, participants configured very similar representations of the Internet. This is an important finding, given the non-equivalency of items in the text and image Q sorts[52]. It therefore appears that the text and image factors represent slightly modified perspectives of the same two metaphors: he first emphasises the highly chaotic, decentralised nature of the Internet, whereas the second concerns centralised, hierarchically organised structures.

[52] For example, item 21 in the image Q sample depicts a body in cyberspace, whereas item 21 in the Text Q sample describes a tree diagram with hierarchical layers.

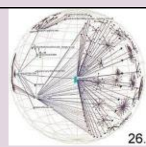
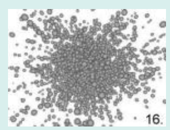
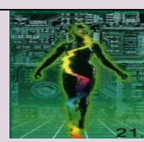
Salient Characteristics	**Dual – Image Q sorts**		**Dual – Text Q sorts**	
	Factor 1	***Factor 2***	***Factor 1***	***Factor 2***
Age & Gender	Male	Under 24	--	--
Years experience	10 years	5-7 years	5-6 years / 9-10 years	10 years
Primary Use	Work	Education / Wasting time	Shopping / Wasting time / Entertainment	Work
Perceived Problems	Finding information	Organising information / Finding web pages	Organising information / Finding web pages	None
Visualisation	Overall shape - unclear	--	--	Overall shape - unclear
Attitudes	--	Is Frustrating / Does not help create ideas	Not frustrating	Is Frustrating / Does not eliminate tedium
Item rated most positively:			The Internet is a massive interlinked thing; it is a web of webs.	Pages are points or nodes that are linked by edges and lines
Item rated most negatively:			I imagine the Internet as a big city	I imagine it as a more ethereal abstract thing
FACTOR INTERPRETATION:	**CENTRALISED NODAL STRUCTURES**	**DYNAMIC ABSTRACT CLUSTERS**	**CHAOTIC INTERLINKING**	**LINKAGE LAYERS**

Table 13.19. Comparison of the Dual Image and Dual Text Factors

13.6 THE RELATIONSHIP BETWEEN ALL EMERGENT FACTORS

The analysis of the Dual participants' image and text Q sort data has revealed two overarching metaphors. This final section examines if a similar pattern emerges across all of the factors.

13.6.1 Third-order analysis - Images

A total of four factors emerged from the Image Q sorts; two Super-factors from participants completing an Image Q sort only and two factors from participants completing an image and text Q sort (Table 13.20).

Image Q sort only	I	Chaotic Communication Networks Functional Concretised Communication
	II	Contained Organisation
Dual participants' Image Q sorts	1	Centralised Nodal Structures
	2	Dynamic Abstract Clusters

Table 13.20. Summary of Image and Dual-Image factors

Each perspective produced a composite factor array; these four factor arrays were then factor analysed using Centroid factor analysis with theoretical rotation. The four perspectives condensed around two third-order factors (Table 13.21), accounting for 70% of the variance; factor A for 26% and factor B for 44%.

		A	B	Factor Interpretation	
Image Q sort only	I	0.19	**0.94X**		Chaotic Communication Networks / Functional Concretised Communication
	II	**0.69X**	-0.08	Contained Organisation	
Dual - Image Q sorts	1	**0.72X**	0.19	Centralised Nodal Structures	
	2	-0.06	**0.91X**		Dynamic Abstract Clusters

Table 13.21. Defining sorts for Image third-order Factor Analysis

This indicates that participants that viewed the Internet in terms of 'contained organisation' (Super-factor II) have a similar idea to those who view it in terms of 'centralised nodal structures' (Dual Image factor 1). Similarly, participants that conceive the Internet in terms of 'chaotic communication / functional communication' (Super-factor I) have a strikingly similar conception to those who perceive the Internet in terms of 'dynamic abstract clusters' (Dual Image factor 2).

13.6.2 Third-order analysis - Text

Four factors also emerged from the Text Q sorts; two Super-factors from participants completing a Text Q sort only and two factors from participants completing both an image and text Q sort (Table 13.22).

Text Q sort only	I	Triune Networks
	II	Dynamic Complexity
Dual participants' Text Q sorts	1	Chaotic Interlinking
	2	Linkage Layers

Table 13.22. Summary of Text and Dual-Text factors

The composite factor arrays were factor analysed using Centroid factor analysis with theoretical rotation. The four perspectives condensed around two third-order factors (Table 13.23), accounting for 82% of the variance; factor A for 45% and factor B for 37%.

		A	B	Factor Interpretation	
Text Q sort only	I	**0.87X**	0.41	Triune Networks	
	II	-0.28	**0.77X**		Dynamic Complexity
Dual - Text Q sorts	1	0.45	**0.83X**		Chaotic Interlinking
	2	**0.86X**	-0.11	Linkage Layers	

Table 13.23. Defining sorts for Text third-order Factor Analysis

This indicates that participants that viewed the Internet in terms of 'triune networks' (Super-factor I) have a similar conception to those conceiving the Internet in terms of ‘linkage layers’ (Dual Text factor 2). Likewise, participants who view the Internet in terms of ‘dynamic complexity’ (Super-factor II) have a similar idea to those who view it in terms of ‘chaotic interlinking’ (Dual Text factor 1).

13.6.3 Third-order analysis - Dual Participants

It is not possible to combine the image and text Q sample items into one factor analysis, simply because there is no equivalency in the Q sample items across the mediums. Despite the inability to statistically analyse the factor relationship, it is possible to eye-ball the patterns. As Section 13.5 outlined, 43% of participants who loaded onto Image factor 1 also loaded onto Text factor 2; similarly, 29% of participants who loaded onto Image Factor 2 also tended to load onto Text Factor 1.

Figure 13.5 is helpful in terms of visualising the overall patterns between the Image only, Text only and Dual factors.

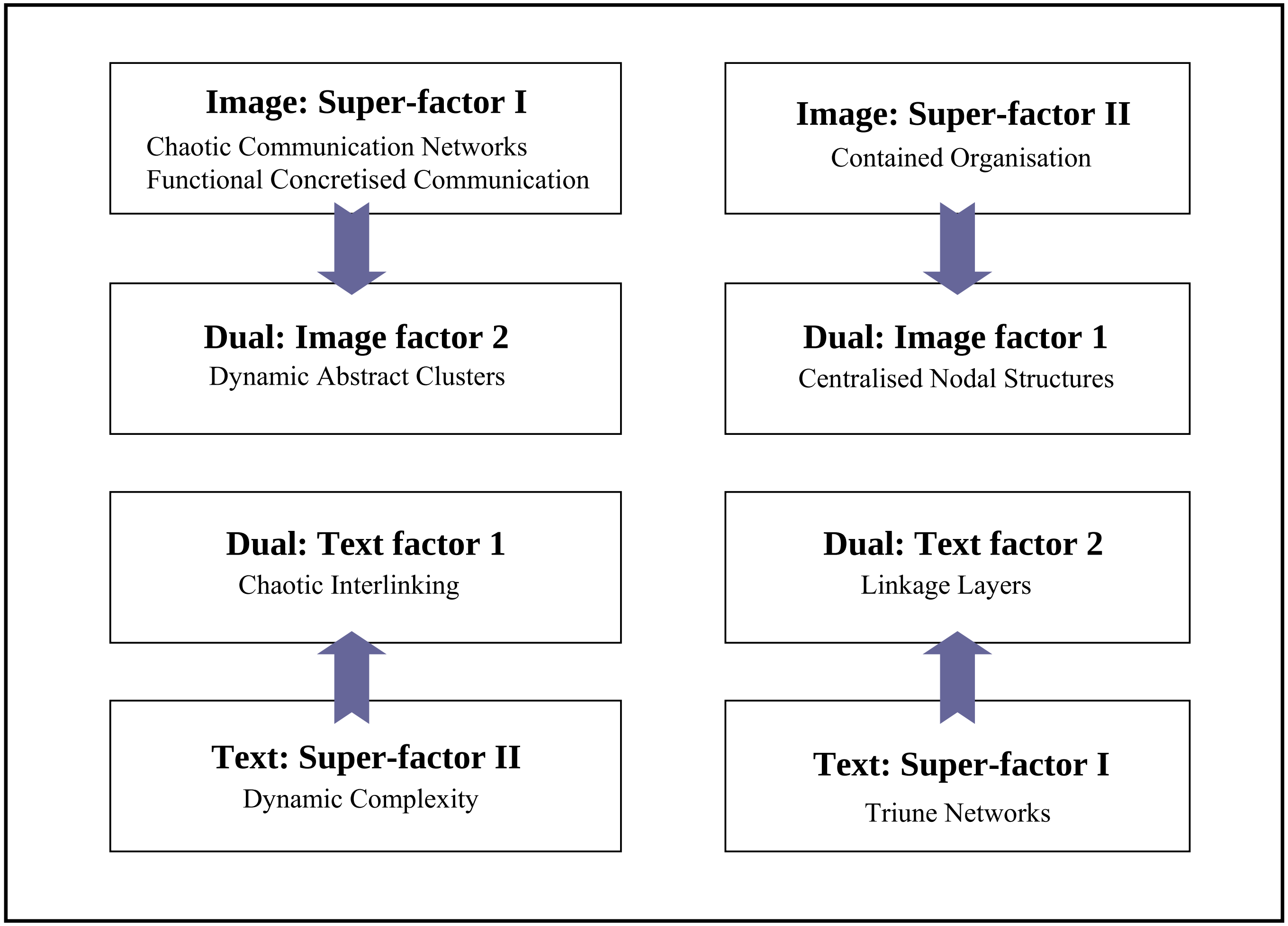


Figure 13.5. Associations between all factors

13.6.4 Two dominant metaphors: Chaos vs. Order

Across all of the emergent factors, it appears that two metaphors dominate Internet users' conceptions of the Internet. Furthermore, these metaphors emerge in both visual and textual mediums.

The first overarching metaphor depicts the Internet as having chaotic, complex interlinking; the structure is decentralised and is constantly changing. All four factors in the first cluster refer to these elements: Image Super-factor I emphasises highly connected, chaotic interlinking within a global structure; Dual Image factor 2 refers to dynamic clustering of semantically similar information; Dual Text factor 1 portrays massive amounts of complex connections that are ever-changing and chaotic; and Text Super-factor II depicts the Internet as having loosely structured, dynamic and decentralised paths leading to information.

In contrast, the second overarching metaphor represents the Internet in terms of centralised, ordered and structured connections. Again, all four factors in the second cluster consistently refer to these elements: Image Super-factor II focuses on how to organise and cohesively structure the Internet; Dual Image factor 1 emphasises centralised nodal structures; Dual Text factor 2 portrays massively interlinked structures which are hierarchically organised and layered; and Text Super-factor I is concerned with how information is stored and semantically organised within network structures.

Interestingly, in this second cluster, three of the four factors have generated metaphors that represent several layers of meaning. Participants that view the Internet in terms of centralised nodal structures (Dual Image Factor 1) utilise the nodes to represent centrally based servers, geographically remote locations or communication protocols. Similarly, for participants characterised by the linkage layers metaphor (Dual Text Factor 2), the links can represent either/both the structural components of the network (servers, computers, routers and cables) or the conceptual linkage between websites / data points. Finally, for users that think of the Internet in terms of the 'triune networks' metaphor (Text Super-factor I), the complex interlinking networks can represent the human user, the computer component or the data/information exchange between the two. What this indicates is that these users are adept at representing the Internet in a variety of different ways. The results also suggest that a relationship exists between groups and users and their metaphor use (see Appendix 13.5 for detailed comparison). Participants conceiving the Internet in terms of the 'chaotic & dynamic' cluster of metaphors generally perceive themselves only to have intermediate – advanced levels of skills using the Internet. In addition to the typical primary uses of communication and information searching, these users also predominantly use the Internet for education and entertainment purposes. Given their conception of the Internet as decentralised and randomly structured, it is not surprising that they report having problems organising and finding information. In contrast, participants viewing the Internet in terms of the 'centralised & ordered' cluster of metaphors perceive themselves to be advanced – expert users of the Internet. In addition to communication and information searching, they primarily use the Internet for work purposes. These users typically do not report having problems using the Internet; users from only two of the four factors say that they have issues finding information.

13.6.5 Second dimension: Structure vs. Process

The results suggest the existence of at least one bipolar metaphoric dimension: chaos vs. order. However, a second, more subtle dimension is also embedded in the factors. For some factors, the emphasis is on the structural components of the Internet. For example, the older, male faction of Image Super-factor I refer to network *structures* of communication; the younger, female faction of the same factor utilise the global metaphor to map the physical infrastructure of the Internet. Similarly, for Text Super-factor I, the focus is on network *structures,* whereby the Internet is made up of several smaller sub-networks rather than one large overarching network. Thus, in this conception, users have developed a representation of the overall structural make-up of the Internet. In contrast, the alternative perspective is on the *process* of accessing the information. For example, Text Super-factor II emphasises a multitude of chaotic paths *leading* to the information; Image Super-factor II depicts hierarchical ordering in which information is successively filtered down into smaller, more specific units. Thus, rather than developing an overall image of the Internet, these users think about the specific procedures of accessing and retrieving information from the Internet.

Figure 13.6 is helpful in terms of visualising the intersection between the two metaphor dimensions. Each of the main Image and Text metaphors represent a combination of the chaos/order and structure/process dimensions. Interestingly, the metaphors generated by the Dual participants (those completing both an image and text Q sort) generally referred to both structural and process elements. This is not surprising given that not only did these users choose to depict their representation of the Internet in textual and visual format, but the metaphors that emerged often symbolised several layers of meaning.

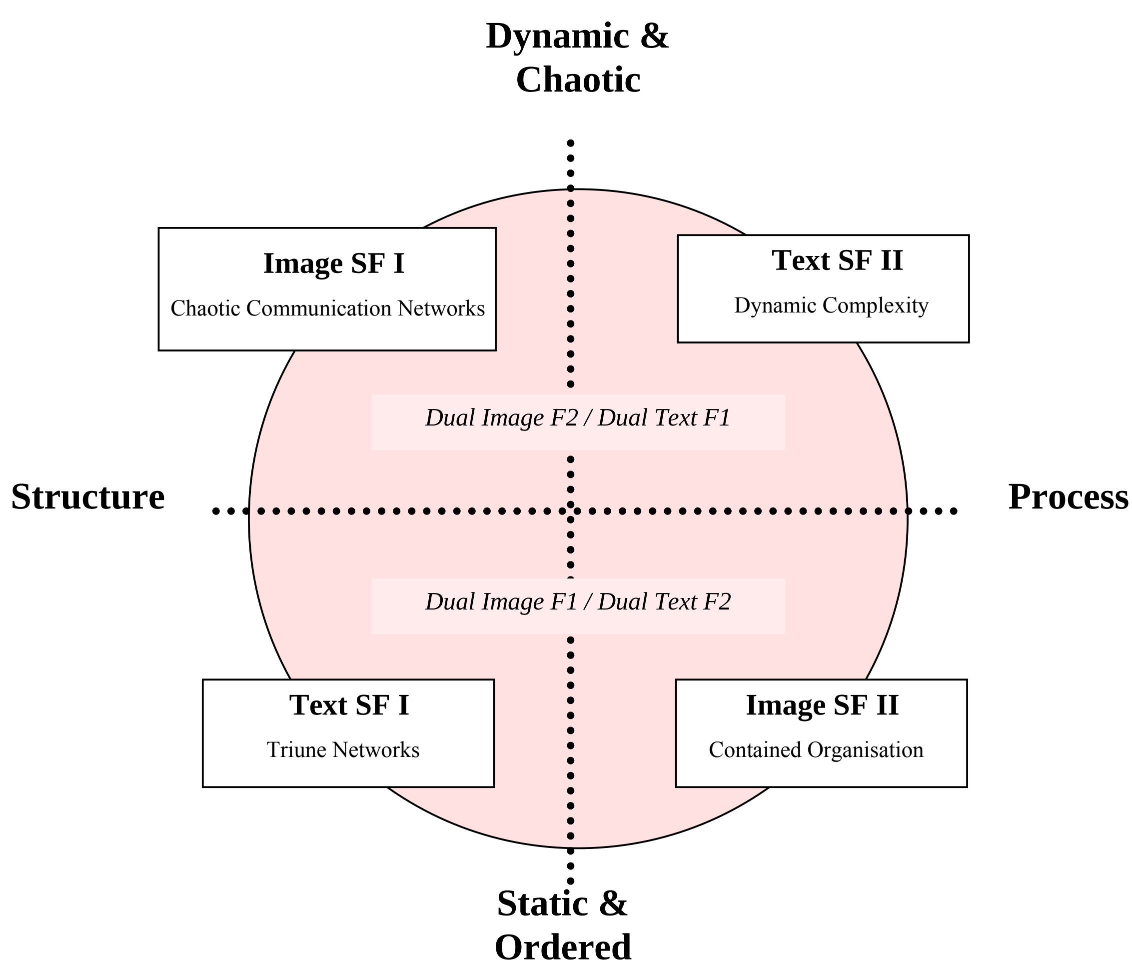


Figure 13.6. Dual metaphor dimensions

CHAPTER 14. DISCUSSION: IMPLICATIONS AND APPLICATIONS

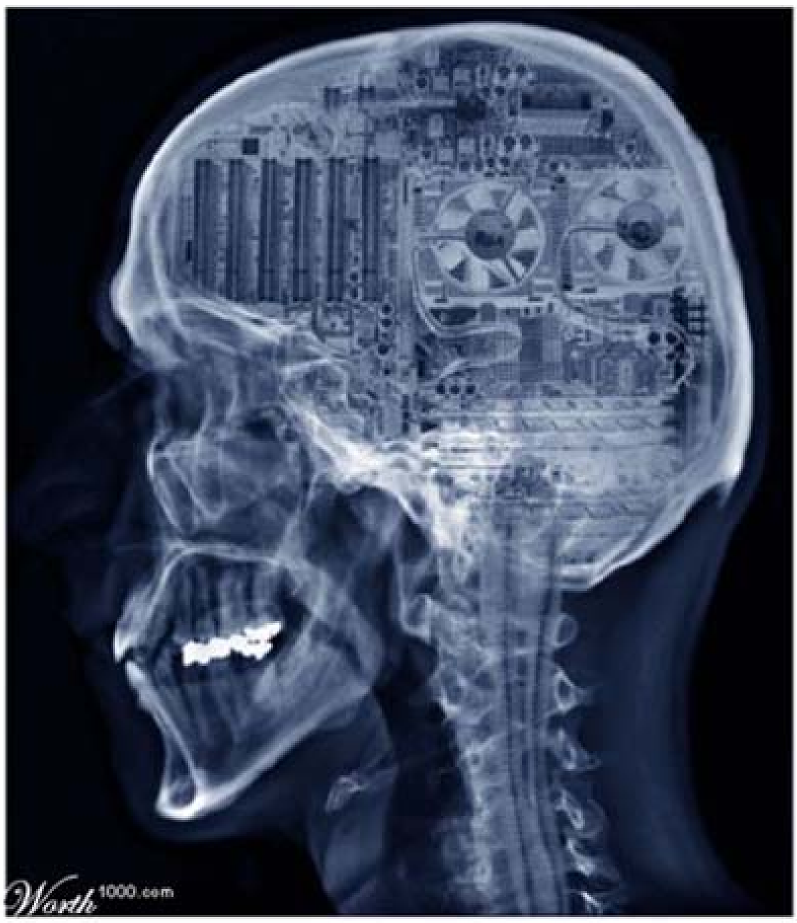


Figure 14.1. Brain as Computer Circuit. © Worth1000.com

14.1 INTRODUCTION

The purpose of this final chapter is to discuss the main findings of the research. By doing so, this chapter highlights the contribution to both theory and application represented by this thesis. The chapter begins with a clear summary of the four most important findings that emerged from the research. Next, the findings are broken down by research question and examined in detail in relation to previous literature. The following section discusses the implications to metaphor theory and implications for HCI research, followed by applications for interface design. Lastly, suggestions for the scope of future research are examined.

14.2 SUMMARY OF IMPORTANT RESEARCH FINDINGS

This thesis sought to examine the metaphors utilised by Internet users in order to make the technology more understandable. Four main findings have emerged from the analysis of 244 Q sorts and accompanying Characteristics Profile Questionnaire (CPQ) data.

1. Users employ a diverse array of conceptual representations of the Internet
2. Two types of metaphor dominate users' conceptualisation of the Internet
    a. Chaotic, complex, dynamic interlinking structure
    b. Centralised, ordered and structured connections
3. These two dominant metaphors are multi-modal, multi-representational and multi-dimensional
    a. Emerge in both visual and textual format
    b. Metaphors have multiple and dynamic meanings.
    c. A Structure vs. Process dimension is embedded in the two main metaphors
4. These metaphors vary according to users' perceived level of skill (self-efficacy).

14.3 RESEARCH QUESTION 1: What are the metaphors employed by users to conceptualise the Internet?

The primary research goal of this thesis was to investigate the metaphors employed by users of the Internet to describe, understand and conceptualise the technology. Users employ a diverse array of metaphors to conceptualise and understand the Internet. The metaphors range from the mundane to the elaborate: from a tangible network structure to a double-helixed slinky; from a vastly hyperlinked encyclopaedia to a non-linear, loosely structured, glob; from a database of information to a prosthetic for the mind. Furthermore, the consistency of certain metaphors over time indicates that some conceptualisations are more 'durable' than others. The disappearance of early popular metaphors indicates that metaphoric conceptions of the Internet change over time. The appearance of novel metaphors suggest that, as the Internet continues its exponential growth, the metaphors used to describe it will also grow in both scale and complexity. Thus, as the Internet continues to evolve in complexity, metaphorical references will change more rapidly, requiring frequent updating of users' assumptions.

Table 14.1 summarises the most common metaphors that were generated by all participants (in response to the question, *'The Internet is like a…'*). The most common representation of the Internet was a web. A fifth of users referred to the Internet in terms of a three-dimensional web-like network connecting computers, files or people situated in different points of the globe. An additional 13% utilised the similar metaphor of a network, in which the Internet can be conceived as a multi-dimensional space containing interconnecting and complex nodal structures. In this research, the network metaphor was the most prominent way in which users metaphorically conceive of the Internet, with a third of users representing the Internet as either a web or network.

Metaphor	%
Web	20%
Network	13%
Source of Information	11%
Library	9%
Book	8%
Tool	5%
Community	4%
Telephone line	4%
Database	3%
Directory	3%
Highway	3%
City	2%
Map	2%
Maze	2%
Window	2%

Table 14.1. Common metaphors

Other commonly employed metaphors included the Internet as an information source (11%) and a general repository of information (9%). The library metaphor was often referred to, perhaps because it is a familiar concept for dealing with vast amounts of information. The conception of the Internet as a book was a common way to impose order by organising the documents into hierarchical topical categories, much like it is done with book records in a library catalogue. A further six percent of users viewed the Internet as a database or directory of information. Smaller proportions of Internet users generated other metaphors, such as the Internet as a city, a map, a maze and a window/portal to services and information.

Contemporary[53] studies of users' Internet metaphors, conducted by Ratzan (2000) and Palmquist (2001), also found a diverse array of metaphors invoked by users in order to conceptualise the Internet. Palmquist (2001) grouped the range of metaphors generated by Internet users into eight categories: space , highway, frontier, waterscape, political space, marketplace, social place, living creature, others. With the exception of frontier and creature metaphors, all of Palmquist's metaphorical 'themes' were present in the current research. Ratzan (2000) found that users' generate a wide array of metaphors and grouped his analysis of metaphorical themes into four categories: open spaces, closed spaces, animate and inanimate objects. The most densely populated category was open spaces; over two thirds (67%) of metaphors were classified as being places that have no confining boundaries. This finding is corroborated by the current research, which found the predominance of chaotic, interlinking, amorphpous metaphors of the Internet.

[53] As Section 1.1 describes, 'contemporary' reflects the 2001-2004 time period in which the study data was collected. This is in contrast to 'early' (pre-2000) and 'recent' (post-2005) studies.

The metaphors in Table 14.1 provide examples of explicitly stated metaphors (i.e. *The Internet is a…*). Examples of instantational metaphors exist for almost all of the metaphor categories outlined in Table 14.1. By far the most common lexicalised metaphors were those pertaining to navigation and orientation in 'space'. Many users employed notions of location and movement in describing the process of browsing through an information space. The travelling metaphor implied destinations, landmarks and paths. The information foraging metaphor was apt in describing the active process of finding or searching for a piece of information. The permeation of orientation and space metaphors supports early research into users' Internet metaphors (Matlock & Maglio, 1996; Maglio & Matlock, 1998). These results also provide some support for studies that have examined the Internet metaphors generated by designers and researchers (Barr, Biddle & Noble, 2002; Palmquist, 1996; Lakonder, 2000).

14.3.1 Consistent metaphors over time

These findings indicate that some metaphors have been consistently in use at least for the past decade. There are several reasons for intransience of certain metaphors. Firstly, spatial metaphors make locating information in cyberspace analogous to navigating in physical space. Thus, familiar, experienced metaphors enable users to easily understand the technology based on their prior knowledge of the source of the metaphor. Secondly, metaphors that remain consistent over time can be thought of as 'productive'; if several aspects from the source domain can be mapped across to the Internet domain, it enables the metaphor to be flexible and to evolve. Similarly, these metaphors can be 'useful', in the sense that they have richness of structure, applicability of structure, suitability and a well understood literal meaning (Madsen, 1994). Richness of structure requires that the metaphor provide a variety of associations to meaningful other ideas or concepts. Applicability of structure requires that the metaphor provide a structure of associations that is not misleading to the user. Finally, the metaphor needs to be applicable and to have a well understood literal meaning to its intended community of users.

14.3.2 The disappearance of dominant metaphors

The consistency of certain metaphors indicates that some representations are more durable than others. It is plausible that, as the Internet continues its exponential growth, users eventually may not utilise older metaphorical references. This is supported by the notion that three previously dominant metaphors of the Internet are conspicuously absent from the current research findings: the ‘cyberspace’ metaphor, the ‘frontier’ metaphor and the ‘information superhighway’ metaphor.

During the early evolution of the Internet, perhaps the most prominent metaphor has been the imagination of the Internet as a separate, physical place known as ‘cyberspace’. The ‘age of cyberspace’ began approximately in the early 1990s, fuelled by the development of the World Wide Web. Despite its fictional origins, the term ‘cyberspace’ has been reified and has become a trope in popular usage. The cyberspace metaphor was influential because it rested upon a notion that popular culture had adopted, idealised and disseminated.

The ‘frontier’ metaphor was both powerful and persistent, particularly in the United States at the end of the twentieth century (Yen, 2002). The comparison between America’s western frontier and the Internet was apparent: the Internet was perceived as an unexplored place of abundant land, freedom, and opportunity, devoid of legal and social constraints. Thus, the Internet had become the electronic frontier from which freedom and prosperity could emerge. There are several reasons for the early dominance of this metaphor. In the early 1990s when the Internet entered popular culture, it was still quite a forbidding place for the uninitiated. Only computer-savvy settlers really knew how to survive there: “in its present condition, cyberspace is a frontier region, populated by the few hardy technologists who can tolerate the austerity of its savage computer interfaces, incompatible communications protocols, proprietary barricades, cultural and legal ambiguities, and general lack of useful maps or metaphors” (Kapor & Barlow, 1990, p.1). Secondly, the frontier metaphor arose among those who had a relatively large amount of influence over the Internet’s development. Given that the Internet originally developed under the auspices of the US government’s DARPA, the frontier metaphor provides a particularly Americanised (and predominantly male) perspective of the Internet. In the early

1990s, some researchers argued that “the culture of the Internet was predominantly American at that point in time” (Biegel, 2001, p.125). By contrast, those who came later to the Internet did not necessarily share the same perspective. It is feasible that perceptions of the Internet would be very different if other countries with alternative dominant metaphors had been primarily responsible for its development.

Another early metaphor is the notion of the Internet as an information super-highway. Popularised by Al Gore in the mid 1990s, the ‘information superhighway’ compared the infrastructure of the Internet to the U.S. interstate highway system. At the end of the twentieth century, the highway metaphor remained entrenched in thinking and writing about the Internet. In a study of metaphors in the computer domain, Grevy (1999) found that one sixth of those collected were *highway* metaphors. However, as Table 14.1 indicates, just 3% of the metaphors generated by users in the current study referred to the Internet as a highway system.

As users have become more familiar and experienced with the technology, it is perhaps no longer necessary to represent in terms of a fictional realm of ‘cyberspace’, nor a ‘frontier’ to be conquered or a highway to be travelled. Furthermore, the popularity explosion of the mid 1990s democratised, commercialised and globalised the Internet, making it distinctly less dominated by American perceptions. The combination of these two factors could account for the reason why these metaphors have fallen out of grace with Internet users. It appears that the cyberspace, frontier and highway metaphors have been dislodged from their prominence, making way for alternate perspectives on the Internet.

14.3.3The appearance of new metaphors

The current research has identified a wealth of novel metaphors not identified in previous research. Examples of novel metaphors include depicting the Internet as a collective conscience, a lucky dip, an out-of-body experience, a prosthetic for the mind, to name just a few. These metaphors are highly idiosyncratic, each having being generated by just one or two participants. However, when accumulated, these highly individual conceptions of the Internet make up almost 20% of the metaphors generated by participants.

It is important to note that it is entirely possible that these metaphors were present in previous studies. Palmquist (1996; 2001), Ratzan (2000) and Maglio and Matlock (1998) all included the omnipresent ‘miscellaneous’ category into their taxonomies. Although used as a catch-all for metaphors that did not fit neatly into their pre-designated classification schemes, it is possible that the ‘other’ category contained rare occurrences of these novel metaphors.

In addition to these idiosyncratic representations, a single novel metaphor actually appeared to dominate in the current research. As Table 14.1 indicates, in the current research, the most common metaphor users employed to conceptualise the Internet was as a network. However, from the previous studies, only Lakonder (2000) identified the presence of the network metaphor. This finding indicates that the network metaphor was not dominant in early studies of Internet metaphors. Its appearance in contemporary studies of users’ Internet metaphors suggests that the network metaphor emerged as common representation for the Internet at the beginning of the twenty-first century.

14.4 RESEARCH QUESTION 1A-C: What are the types of textual and visual metaphors being employed by users? Do the same kinds of metaphors arise in different modes of presentation?

The primary focus of this research was to examine users’ metaphors of the Internet. Within this goal, the research examined the types of textual and visual metaphors employed by users when describing the Internet. It also sought to explore whether the same kinds of metaphors arose across these two different modes of presentation.

14.4.1 Internet users’ visual metaphors

The 26 images of the Internet condensed around two operant factors, indicating that there are at least two dominant visual metaphors used to describe the Internet. Unusually, the first factor was characterised by two distinct interpretations of the same factor array. The two factors (three perspectives) were interpreted as follows:

- Super-factor I:
  - Chaotic Communication Networks
  - Functional Concretised Communication
- Super-factor II: Contained Organisation

14.4.1.1 Chaotic Communication Networks

These users conceived the Internet in terms of chaotic, dynamic and decentralised network structures of communication. The emphasis was on a web-like interconnection of links and nodes; the links between pages of information being randomly structured and core technological components decentralised. These users rejected images that depicted the Internet as structured, rigid and static. They negatively rated the virtual library image; a conception that invokes traditional offline modes of searching for information in books. They also rejected images that conveyed overly categorised, ordered information, in which information can be neatly ordered into discrete categories. In sum, this faction of users preferred metaphorical images that depicted complex, nodal interconnections and rejected images that were devoid of linking structure and those that conveyed rigidity.

14.4.1.2 Functional Concretised Communication

The section faction of the first factor also represented the Internet as having complex nodal connections, but within a geographical boundary. In contrast to the more chaotic communication networks of the previous group, this metaphorical representation was more fixed and structured. The networks were contained within a global structure, suggesting how the networks are concretised by being constrained by earthbound connections. Thus, whilst the emphasis was still on interlinking communication networks, it was conceived as being much more structured and contained. Accordingly, this group tended to invoke more traditional methods of offline searching, such as libraries and encyclopaedias.

14.4.1.3 Contained Organisation

The second factor generated metaphors that emphasised how to organise and cohesively structure the Internet. This factor was characterised by the omission of the nodal, vastly interconnected image. It focused on hierarchical ordering and the ways in which general information is successively filtered down into smaller, more specific units. These users felt the information on the Internet lacks organisation and relevance, and accordingly preferred to impose structure and organisation by thinking about the Internet in terms of contained entities of information.

14.4.1.4 Summary of visual metaphors

In terms of communalities and specificities between the factors, all users consistently selected the global connections image as being similar to their own mental representation of the Internet. Similarly, they all tended to reject overtly abstract images, such as the body-in-cyberspace metaphor. Beyond these limited similarities, the viewpoints embedded in the two factors were highly distinct. The first factor was characterised by the typical vastly interconnected network metaphor, whereas the second factor was characterised by its omission. Due to the highly novel and explorative nature of this study, it is difficult to discuss these results in relation to previous literature.

14.4.2 Internet users' textual metaphors

The 26 descriptions of the Internet condensed around two operant factors, indicating that there are at least two dominant metaphors used to metaphorically describe the Internet. The two factors were interpreted as follows:

- Super-factor I: Triune Networks
- Super-factor II: Dynamic Complexity

14.4.2. 1 Triune Networks

The first factor was characterised by statements that conveyed the Internet in terms of complex interlinking networks. The networks were not represented as being chaotic and random; rather, information is stored and semantically organised within the network structures. This was also highlighted in their rejection of statements that convey the Internet as being ethereal and abstract. Furthermore, these users utilised the massively interlinked network metaphor to symbolise one of three things; the human user, the computer component or the data/information exchange between the two. Thus, for this group, the Internet consists of at least three sub-networks, each of which constitutes the bigger Internet network. The three sub-networks are interdependent and the Internet can only be meaningful if its three components are considered.

14.4.2.2 Dynamic Complexity

The second factor was characterised by statements that conveyed the dynamic, interlinking, constantly changing nature of the Internet. The statements rated as 'most like my mental representation' were those that depicted the Internet as a tangled maze of connections; the chaotic connections are randomly structured and decentralised. In fact, this group contended that the Internet is so complex that it evades definition. By making the Internet analogous to a 'ghost' or 'half-lit highway', these participants portrayed the Internet as ethereal, invisible and intangible.

14.4.2.3 Summary of textual metaphors

These results suggest a bipolar characterisation of the network metaphor that seemingly dominates users' perceptions of the Internet. The first metaphor was of massively complex yet structured interdependent sub-networks. The second factor depicted the entropic and nebulous nature of the Internet. As discussed in section 14.3.3, only Lakonder's (2000) metaphor taxonomy identified the presence of the network metaphor. Given the predominance of the network metaphor in the current research, it is surprising that this theme did not emerge more frequently in previous research.

14.4.3 The relationship between textual and visual metaphors

A further goal of this research was to examine whether the same kinds of Internet metaphors emerge in different modes of presentation. Twenty four participants decided to complete both an image and text Q sort, enabling the comparison of metaphors across modes. The image and text Q sort data from the 24 participants each generated two factors (see Table 14.2).

Image Q sorts	**Text Q sorts**
Factor 1: Centralised Nodal Structures	*Factor 1: Chaotic Interlinking*
Factor 2: Dynamic Abstract Clusters	Factor 2: Linkage Layers

Table 14.2. Summary of relationship between Dual participants' factors

14.4.3. 1 Dual – Image Factors

Participants characterised by the first image factor perceived the Internet in terms of centralised nodal structures. These users tended to prefer images that conveyed complex connections emanating from a centralised source. Similar to the Triune Network metaphor, the nodes could represent communication protocols, centrally based server hubs or even the geographic location of the network device. Thus, this group of users thought about the Internet in terms of a multitude of representations which change as a function of the current Internet activity. The second image factor, Dynamic Abstract Clusters, revealed at least two ways these users metaphorically conceived the Internet. The first was the more concrete representation of clusters of semantically similar information; in contrast, they also had fantastical, abstract and figurative conceptualisations. They therefore had a very dynamic view of the Internet: it could concurrently be intangible and ethereal whilst being concretised by its functionality. Furthermore, these users are able to switch between multiple representations depending on whether they are actually interacting with the technology, or just thinking about it. When thinking about the Internet, abstract and figurative representations are used; when experiencing the Internet, they referred to it as clusters of interlinked information.

14.4.3. 2 Dual – Text Factors

The first text factor, Chaotic Interlinking, depicted the Internet in terms of complex interlinking connections which are ever-changing and chaotic. They perceived the Internet to have no centralised source of control; instead preferring to conceive the Internet as a multitude of maze-like paths leading to information. Descriptions that depicted very structured, rigid, static conceptions of the Internet tended to be rejected. The second text metaphor emphasised massively interlinked structures which are hierarchically organised and layered. They tended to reject statements that portrayed the Internet as ethereal, abstract, intangible or magical. Once again, the linking metaphor had at least dual layers of symbolism. The linkage could represent the structural components of the network (servers, computers, routers and cables) or the conceptual links between websites or information. Users varied these representations according to what the Internet was being used for.

14.4.3. 3 The relationship between Dual Factors

Analysis of the four Dual factors indicates that a relationship exists between the types of visual and textual metaphors employed by users. Participants who characterised the Internet visually in terms of 'chaotic interlinking' were more likely to textually represent the Internet in terms of 'dynamic abstract clusters'. The metaphors embedded in these two factors were extremely similar: Both conceptualised the Internet as a complex, massively interlinked entity which is constantly changing. They also both rejected items that conveyed the Internet as being rigid and overly-categorised. Similarly, participants who conceptualised the Internet visually in terms of 'centralised nodal structures' were more likely to textually represent the Internet in terms of 'linkage layers'. The metaphors that emerged were concerned with complex interlinked networks that are centrally ordered. They both had a tendency to reject more ethereal, abstract portrayals and also chaotic, non-linear conceptualisations

14.5 TWO DOMINANT METAPHORS OF THE INTERNET

It is apparent that two metaphors dominate users' perceptions of the Internet. The first metaphor depicts the Internet as having chaotic, complex, decentralised and dynamic interlinking structure. The second metaphor represents the Internet in terms of centralised, ordered and structured connections. Furthermore, these two dominant metaphors appear to be multi-modal, multi-dimensional and multi-representational.

Third-order factor analysis of all eight factors (2 Image, 2 Text, 2 Dual- Image, 2 Dual-Text) corroborates the existence of these two overarching metaphors across both modes of presentation. Whilst each factor individually and separately contributed additional meaning not found in other factors, it appears as though very similar metaphors emerged from the textual and image Q sorts. Regardless of whether the metaphor was constituted visually or textually, participants configured very similar representations of the Internet. This is an important finding, given the non-equivalency of items in the text and image Q sorts.

For some of the visual and textual factors, participants employed certain metaphors that explicitly had multiple and dynamic meanings. For example, the network metaphor was utilised to refer to several concomitant aspects of the Internet (e.g., the computer, the user or the data exchange between the two). This is an important finding for it highlights the functional nature of metaphor: particular metaphors are used to convey a particular meaning that is context dependent (Ortony, 1993).

These results suggest the existence of at least one bipolar metaphoric dimension: dynamic & chaotic vs. static & ordered. An additional, more subtle dimension is also embedded in the factors. Whereas some factors emphasised the *structural* components of the Internet, others focused on the *process* of accessing the information. For example, Image Super-factor I referred to network *structures* of communication; Text Super-factor I focussed on network *structures,* whereby the Internet is made up of several smaller sub-networks rather than one large overarching network. In contrast, Text Super-factor II emphasised a multitude of chaotic paths *leading* to the information; Image Super-factor II depicted hierarchical ordering in which information is successively filtered down into smaller, more specific units. Each of the main Image and Text metaphors represent a combination of the chaos/order and structure/process dimensions.

This structural / procedural dimension is corroborated in previous research on mental representations. Tversky (2004) asserted that representations of environmental spaces can be viewed in any of three different ways: survey, gaze and route perspective. With survey perspective, the observer can look at and describe the entire space as though they were at a stationary point far above it, able to see everything at once. Gaze perspective is when the observer is within the space, looking at and describing the space from a single unchanging point of view. Both of these mental representations equate to the structural perspective above, with the further nuance that with survey perspective the observer is outside of the space, whereas the observer is within the space with gaze perspective. In contrast to these structural representations, route perspective is when the observer is moving along inside the space and are able to see and describe it from your changing point of view. The structural/procedural differentiation is also demonstrated in cyberspace maps, which overtly fall into two categories: those depicting the physical structure of global networks and those addressing the content and social spaces of the electronic world (see section 3.6).

Early research examining users' Internet metaphors revealed a structural/procedural dimension when people think of searching the Internet for information. Bruce (1999) found a category of metaphors that emphasised the information aspects of the Internet; the second category emphasised connectivity and structure. Both metaphors portrayed the Internet as an information environment; however, whereas one conceptualisation focused on information, the other was a structural perception, implying that connectivity between information users and information resources was the primary objective.

14.6 RESEARCH QUESTION 2: Is there any variation in the kinds of metaphors being employed by different groups of Internet users?

A second core goal of this research was to explore whether individual differences among users exist, in terms of extrinsic demographic variables (such as age, sex, and years of experience using the Internet) and intrinsic variables (such as self-efficacy) in the use of visual and textual Internet metaphors. Examination of the variation in user characteristics for each of the Q sort factors suggest that age, gender and reported Internet activities are associated with metaphor use. However, these findings are tentative at best. However, the relationship between users' self-efficacy and the use of specific metaphors is more clear-cut.

Participants conceiving the Internet in terms of the 'chaotic & dynamic' cluster of metaphors generally perceive themselves only to have intermediate – advanced levels of skills using the Internet. In addition to the typical primary uses of communication and information searching, these users also predominantly use the Internet for education and entertainment purposes. Given their conception of the Internet as decentralised and randomly structured, it is not surprising that they report having problems organising and finding information.

In contrast, participants viewing the Internet in terms of the 'centralised & ordered' cluster of metaphors are predominantly male and perceive themselves to be advanced – expert users of the Internet. In addition to communication and information searching, they primarily use the Internet for work purposes. These users typically do not report having problems using the Internet; users from only two of the four factors say that they have issues finding information.

Self-efficacy appears to be most consistently related to the types of metaphors employed by users. Previous research has corroborated that perceived level of Internet expertise has an impact upon metaphorical understandings of the Internet. However, interestingly the results obtained in the current study are the exact opposite of what has been found previously. Ratzan (2000) found that novices tended to use finite and tangible metaphors, while experts tended to use more metaphysical, intangible metaphors. Hogan (2002) also found a general trend for low users to use more fixed, static representations of the Web. This trend decreases with level of expertise, culminating in expert users using more abstract representations to convey the hypertextual structure of the Web. In contrast, this research found that slightly lesser-skilled users conceived the Internet as chaotic and intangible, whereas more skilled users concretised the Internet with contained and structured metaphors. This research suggests that the users' metaphors of the Internet as a fixed entity changes or evolves as the level of skill changes; however, further research is needed to determine the nature of this relationship.

What is interesting however is the relationship between perceived level of expertise and the ability to hold multiple representations of the Internet. Hypothetically speaking, a diversity of representations from inexperienced users would be expected, since they do not have much previous experience on which to form a representation. Additionally, it would be understandable if this diversity decreased following substantial Internet use. In this way, less useful conceptual representations would be discarded as experience increased. However, although a few previously dominant metaphors seem to have disappeared from the concourse, these have been replaced by a multitude of novel representations. Interestingly, this suggests that the diversity of conceptual representations of the Internet has *increased* with continued experience of using the Internet. Levin, Stuve, and Jacobson (1999) found that experienced users' conceptual representations of the Internet are more elaborate and detailed than novices. Furthermore, experienced users were found to flexibly use a variety of conceptual representations, whereas novices tend to use a single conceptual representation.

Generally, users who perceived themselves to have advanced to expert skills tended to generate metaphors which embodied multiple and dynamic meanings. For example, for the 'triune networks' and 'centralised nodal structure' factors, the networks/nodes could represent one of three elements. These multiple, dynamic representations suggest that these experienced users have an array of different conceptualisations of the Internet which vary according to what they are doing and/or thinking at the time. Indeed, one participant remarked that:

"When I think of the Internet, it's always context-based for me" [Text 15].

For these experienced users therefore, the concept of the Internet can mean different things at one time, but also different things at different times. Levin, Stuve, and Jacobson (1999) found that experts have a greater variety of complex representations to use according to the specific context, whereas novice users tend to have a uni-dimensional representation. This finding is corroborated in a variety of research domains (e.g. physics (Larkin, et al., 1980; Chi, et al., 1981), chemistry (Kozma, et al, 2000) mathematics and biology (diSessa, 1991; Kindfield, 1994).

14.7 IMPLICATIONS FOR METAPHOR THEORY

Internet users are adept at juggling multiple representations. Lakoff and Johnson (1981) note the way ordinary people deal with understanding something complex is by having many metaphors for comprehending different aspects of the same concept. Metaphors are rarely used in isolation; several metaphors are used in conjunction in order to highlight different aspects of the Internet (Lakonder, 2000). The only way to comprehend the totality of the Internet, both conceptual and tangible aspects, is to use several different metaphors. As Lakoff and Johnson (1980) argue, each different metaphor highlights certain aspect of the Internet, downplays others and hides still others. It takes many different (and sometimes inconsistent) metaphorical perspectives to comprehend each abstract concept (Lakoff & Johnson, 1980b). Thus, the use of several metaphors does not seem to be a mere coincidence, but appears to be crucial for our understanding of all the different aspects of the Internet. There do not seem to be many restrictions as to which metaphors can be used together in this way; it rather seems as if any metaphors can be mixed, depending on what needs to be communicated and achieved.

This research reveals two opposing but complimentary conceptual representations of the Internet, which can be employed in different ways and for different purposes. Whilst conceiving of the overall structure of the Internet, it is plausible to think about a decentralised and interconnected structure. However, when thinking about the processes of accessing information on the Internet, it is efficacious to make the representation more concrete. It is feasible for users to simultaneously hold these differing representations and differentiate between the two according to specific purposes or tasks.

Furthermore, the metaphors that have emerged during this research have been shown to have multiple and dynamic meanings. In image factor 1, the nodal connections had several layers of representation; in image factor 2, the representations changed according to whether the Internet was being thought about or interacted with; in text factor 2 the links could be either structural or conceptual. These dynamic representations suggest that Dual participants have an array of different conceptualisations of the Internet which vary according to what they are doing and/or thinking at the time. This finding highlights that it is insufficient to merely analyse superficial metaphorical themes, because each metaphor embodies several layers of meaning. It suggests that we use metaphors in different ways in order to convey different things. In this conceptualisation, metaphor is performative and action-orientated: metaphors are used to achieve particular goals rather than merely reflecting themes. This research suggests that a full synthetic understanding of Internet metaphors can only be achieved only through the analysis of the contexts in which metaphor use occurs.

The only way for users to comprehend all aspects of the Internet is to blend several metaphors. Fauconnier (1997) refers to 'conceptual blending' in metaphors, in which the synthesis of at least two metaphors yield a third place (a blend).   Thus, the blending of structural and procedural representation yields a Gestalt understanding of the Internet. In isolation, each of the metaphoric dimensions are not as effective at describing the complexity and multi-functionality of the Internet; used together they help users understand multiple components of the technology.

The multiple metaphoric representations users generate about the Internet can be conceived as a 'metaphorical toolkit'. The conceptual representation of an inexperienced user can be thought of as a beginning tool. This initial uni-dimensional representation is not necessarily something to be taken away, to be replaced by the 'right' representation, but rather the first tool of many that the user will add to their 'metaphorical toolkit'. As the user becomes more experienced, they will learn multiple ways to think about the Internet and to learn which representation is most efficacious in order to accomplish certain tasks. Thus, as each metaphorical representation is added, the user needs to know not only how and when to use the metaphor, but how to switch from one representational to another as the nature of the task changes. This view of expertise encourages users to build up a diverse set of conceptual representations that novices start with, rather than ignoring or actively quashing them. By building on the naturally occurring diversity of novice conceptual tools, users can be aided in developing expertise with a rich set of representational tools that they can use to meet the challenges of the increasingly dynamic and complex online world.

Users should have many ways to think about the Internet and develop meta-cognitive strategies to choose which representation to use for a given task. Each metaphoric representation is effective for accomplishing some tasks and less effective for others. A user who runs into a problem can switch representations, thus enabling them to work around the cognitive block. This finding suggests that the first key element of a metaphorical toolkit is acquiring multiple representations. A second key is learning to coordinate these multiple representations and to switch from one to another as needed. Finally, a third key is to learn which representations are good for which purposes (and vice versa) so that one can select a sequence of representations that accomplishes the task at hand and allows the user to overcome any problems encountered along the way.

14.8 IMPLICATIONS FOR HCI RESEARCH

Metaphors are an integral component of users' perception, interpretation and interaction with the Internet. It is imperative to comprehend how users metaphorically conceive of the Internet, and how these conceptions relate to Internet use and understanding. This research goes beyond previous studies that examine common cultural metaphors of the Internet, or the metaphors conceived by designers and implemented into the interface. This research extends our knowledge by examining users' understanding of the technology via their utilisation of metaphor. Indeed, this research reveals how users' metaphors can be drastically different to those embedded into the technology by designers. Thus, to better support users, it is imperative to engage them in a more critical exploration of these technologies that will have a lasting impact on their personal understanding of it.

Understanding users is best accomplished by working with them as collaborators in the process of development, rather than only evaluators of the product. Users should be treated as experts, albeit in a different domain of knowledge than software designers and engineers. Users understand their goals, their motivations and so forth, and should collaborate in the design process. As Johnson (2007, p. 11) notes, "software should be designed neither *for* users nor *by* them, but rather *with* them" [emphasis original]. Furthermore, the collaboration process should enable and support users in formulating multiple conceptual representations. The goal of technology training for users should be to help them to develop multiple coordinated conceptual representations that they can use at appropriate times to help them achieve their goals for using the Internet (Levin, Stuve, & Jacobson, 1999).

Q methodology has the potential to become a useful tool in the participatory design process. Participatory Design advocates active user participation throughout the design process. The goal is to let end-users and designers jointly create a tool with which the end-user can do their work better. By utilising Q sorts as a communication tool between users and designers, Q becomes a reconstructive tool that can contribute to a programme of 'discursive democratisation' (Dryzek, 1990). This can provide a wealth of opportunities for Internet users to freely communicate about their experiences and express them in a meaningful way to developers. Q Methodology deconstructs the academically constituted concept of the Internet, elucidating the understanding of those who actually use the technology. Thus, Q methodology provides an avenue for meaningful exchange between developers and users. By exploring the intersection of practices and subjective understanding, Q might rigorously operationalise the difficult-to-grasp notions of user experience of the Internet.

Interaction with computers used to be limited to a desk environment. These interactions were typically solitary and focused; computing was an activity segregated from the rest of life. Today, computing is expanding beyond the desktop. The proliferation of portable or embedded computing devices available means that the future of computing is likely to include novel ways of interaction. This implies that the model of user interface in which a person sits in front of a computer is no longer the only model (Jaimes & Sebe, 2007). In the immediate future, it will be necessary to develop an understanding of the interaction between computers and humans as involving multiple interfaces, multiple users and multiple activities in a social context. Metaphors will continue to play a key role in the next transformation of the technology and our social practices surrounding the use of that technology.

14.9 APPLICATIONS FOR INTERFACE DESIGN

The ability of the Internet to support a diversity of metaphorical representations can be to a considerable extent the basis of the ‘ease of use’ that people report. However, if designers continue to implement a limited number of interface metaphors, we could see the unexpected result that these applications become easier to use for some people (those who hold and use conceptual representations in confluence with the designer’s implementation), but actually harder for many others to use. In order to recognise diversity, the designer must take into account the type of user frequenting the environment, ranging from novice user, knowledgeable but intermittent user and expert frequent user. For instance, each type of user expects the screen layout to accommodate their experience, their desires; novices needing extensive help, experts wanting to get where they want to go as quickly as possible (Dinet, et al., 2003).

Outcomes from identifying and representing users’ mental models basically fall into two areas: teaching to shape or alter mental models, and designing systems that better take them into account. Teaching implies scaffolding novices to emulate experts. In the case of mental models of using Internet search engines, it is useful to identify a series of learning objectives novice users should be able to accomplish. Learning could be constructed in the form of online tutorials or traditional instruction (Brandt & Uden, 2003). However, it is a fallacy to think mental models can be shaped simply by transferring conceptual knowledge of a system from experts to novices. There is increasing evidence that not only do individuals seek, access, and use information in very different ways, but those different biases can map onto different levels of effectiveness (Ford, 2001). The practical utility of such knowledge is twofold. First, it can help in our attempts to build adaptive information systems capable of compensating for individuals’ stylistic information processing biases (Ford, 2000). Second, it can assist in the process of designing more effective programs whereby individuals can develop meta-cognitive (“learning to learn”) skills in relation to information seeking (Ford, 2004; Ford, Miller & Moss, 2005).

User-centric approaches place users at the heart of design. Users of the system should be able to communicate his or her needs to the system. If the system does not have the capacity to understand the request, then the user and the system should be empowered to select mutually agreeable simple metaphors for communicating. More intuitive interfaces could be built to recognise common metaphors and then assist users by anticipating their actions and prompting them with cues. For example, users that have a ‘chaotic’ mental representation and suffer from disorganisation could be provided with more structured, hierarchical lists, tools for collecting data from web browsers, and so forth. Alternatively, users that prefer to examine large, abstract elements of a problem can benefit from an interface metaphor that lets them build in the detail as their understanding grows.

Simply providing metaphors does not necessarily endow users with the instant strength needed to effectively utilise the technology. The metaphorical interface serves better as a scaffolding tool than as a navigational aid. A facilitative design could provide novice users (either to the system or the specific application) with a framework to scaffold learning, by providing guidance that recognises weaknesses in basic mental models. A third might enable the computer to take the inexperienced user’s weaknesses into account and walk these users through sub-procedures. For example, novices could be presented with a search window that asks them to make choices and complete a form asking how much time they have; how deep they want to go; related search terms, and so forth (Brandt, 2003). A similar solution could focus on designing interfaces to be more intuitive to novices. By providing a diversity of interfaces and easier ways to switch among those different interfaces, the metaphoric interface tries to link directly to their current mental models. In this way, multiple conceptual representations in the ‘metaphorical toolkit’ framework can be useful to the developers of Internet interfaces (Levin, Stuve, & Jacobson, 1999).

Application of the structure / process metaphoric dimension could reflect the difference between a *presentation* metaphor and an *interaction* metaphor. The presentation metaphor emphasises the overall structure of the technology (its appearance, affordance, spatial layout and so on) and allows for the initial activation of the metaphor in the user’s mind. However, the maintenance of the metaphor in the mind of the user is dependent on the *interaction* properties of the metaphor. Thus, the interaction metaphor focuses on the processes of the technology (dialogue between computer and user, the set of user operations or functions and so on). There are two applications of these findings: firstly, it would be useful for Internet interfaces to be customisable to provide the option of interacting with a variety of metaphorical representations. Alternatively, designers need to implement metaphors that encapsulate both structural and procedural elements, or both a presentation and interaction metaphor. The London Underground map is one such example of a metaphorical map combining structural and procedural elements. In order to give travellers an overview of the whole system, the overall structure of the underground is provided (note, that the spatial layout of stations is not identical to the actual geographical locations above). At the same time however, the map enables travellers to plot their path step-by-step through the system, enabling people to derive both procedural and structural information. However, given the difficulty of constructing such a huge, complex, and dynamic map with an (virtually) unlimited number of nodes and edges, it is possible that such a map cannot be produced for the Internet.

14.10 EVALUATION OF THE METHODOLOGY

In the past decade, concern has been expressed about whether data collection via the Internet can produce the same quality of results as more traditional methods. Early studies of Internet users' demographics suggested that Internet samples may not have been demographically diverse: predominately young males from households with fairly high incomes (Sheehan & Hoy, 1999). Trends in Internet demographics contemporaneous with the current study however, suggest the digital divide is receding, at least in respect to gender, age and socio-economic status (Gosling, et al., 2004; Fallows, 2005; Couper, et al., 2007). Furthermore, contemporary research comparing electronic versus postal surveys confirmed no difference in content quality, yet indicate that Web-based surveys are superior to paper surveys in many aspects (Andrews, Nonnecke & Preece, 2003; Mathieu & St-Laurent, 2004; Yun & Trumbo, 2000).

Contemporary evaluations of Internet studies indicate that coverage error (the mismatch between the general offline population and the sampling frame) was the biggest threat to inference from Internet-based surveys to general populations (Couper, 2000). However, given that the target population for the current study was Internet users, it is arguably not too detrimental if the online sample is not representative of the general offline population. Yet, even when studying online users, it remains unclear whether online samples reflect the population of Internet users. Contemporary studies show that those who participate in online surveys may be more experienced, more intense Internet users, have stronger Internet skill sets (Zhang, 2000). Furthermore, invitations to participate posted on discussion groups may get higher response rates from technical discussion groups because they are more interested in any type of online interaction (Andrews, Nonnecke & Preece, 2003). This indicates that different groups may have dramatically different response rates based on survey salience. Thus, inevitably online samples tend to be skewed towards people who have an interest in and a propensity towards using the Internet. Indeed, it is difficult to survey non-users or infrequent users of the Internet if they do not have access to or the inclination to access the Internet, much less complete an online survey.

Despite these criticisms, the results of this study indicate that the range of user demographics accurately reflect those found in the general online population (as outlined in section 5.3). Couper et al, (2007) found that, given appropriate access to the Internet, those who complete Internet surveys resemble those who use the Internet. Internet questionnaires also have the benefit of drawing from self-selected samples. Pettit (2002) found that self-selected samples provide clearer, more accurate responses than non self-selected volunteers, such as undergraduate psychology students. There is also evidence that participants engage in less socially desirable responding when completing Internet questionnaires than a paper-and-pencil questionnaire or a telephone interview (Chang & Krosnick, 2003).

These findings indicate that the concern with Internet samples should be on choosing the method best suited for the target population (Gosling et al., 2004). In other words, research data should be obtained in samples representative of the population to which the findings are to be generalised. Although an offline technique could have been used in the current study, it was appropriate for this research to utilise an online technique to survey online groups of participants. Additionally, an

Internet approach provides added value by enabling certain groups Internet users (those who might understand, interact with, experience and use the Internet differently) to be specifically targeted. Thus, it is sensible that in order to understand users of the Internet, we must obtain data in the specific environment in which they operate.

When studying samples of online users, issues of non-response (an unwillingness to participate in online research given access) are pertinent. Participants certainly could have been dissuaded from participating in this research due to the novelty of the Q sort process in addition to the complexity of the questionnaire. Dillman (2000) found that complex Web-based surveys encourage novice users to discontinue the survey process. Therein lies the quagmire with online research; the target population must be technologically savvy enough to use it. Indeed, through careful monitoring of the types of participants responding, it became evident that infrequent users of the Internet were not participating in the research. Consequently, it was necessary to obtain an offline cohort sample in order to obtain this demographic of users.

To minimise survey complexity and thus respondent attrition, survey piloting is crucial. The extensive pre-testing conducted via the pilot studies (see Chapter 9) served to minimise attrition rates by checking for response completeness, relevancy and format inaccuracies. In retrospect, there was one potential inaccuracy that potentially could have affected response completion. Pilot testing indicated that the CPQ took approximately 10-15 minutes to complete. Accordingly, this estimated completion time was advertised on the research website and in the various communications soliciting participation. However, during the data collection phase, some participants indicated that it took longer than 10-15 minutes to complete the survey. Contemporary studies showed that inaccurate motivational techniques, such as estimated completion time, may create distrust and subsequently increase abandonment (Crawford, Couper & Lamias, 2001).

Furthermore, Rosenblum (2001) suggests that online questionnaires should consist of approximately 20 questions in order to minimise participant attrition. It follows that longer questionnaires will obtain lower response rates as they demand more input from the participant. Although the Characteristic Profile Questionnaire only contained 22 items, almost every question had a multi-part answer. In fact, the questionnaire required over 100 responses, clearly contravening Rosenblum's golden rule. It is arguable therefore that a proportion of participants were dissuaded from completing the research because of the lengthy questionnaire. However, whilst length of questionnaire in mail surveys has been repeatedly investigated, it is not clear what constitutes 'long' in the online environment. Furthermore, the difference between response rate and response quality should not be confused. Deutskens, et al. (2004) found that longer questionnaires yield acceptable response rates and response quality.

To overcome these issues, techniques were implemented to enabled potential participants to make informed judgments prior to participation based on the content, length, design of the questionnaire. This CPQ was designed as a 'single-form' approach; participants scrolled down the entire survey in one long HTML page. One important advantage of this approach is that it enabled participants to quickly ascertain the length of the questionnaire. In fact, the single-form approach is generally found to be more effective than alternative techniques (Dillman, 2000; Couper, Traugott & Lamias, 2001).

Researchers also worry about the potential for multiple submissions in online studies because of the lack of experimental control. Multiple submissions are potentially problematic for this research, it has been suggested that it tends to be more of a problem for studies with some novel activity (Reips, 2002). Although IP addresses were used to detect multiple submissions, there are some problems with this. IP addresses can be temporarily assigned to a given computer. Several computers can share one IP address and an IP address can change multiple times during the same connection. Therefore, relying on IP addresses is not a reliable technique to detect multiple submissions.

Other disadvantages of online research include a still rather broad and unpredictable range of technological resources. These varied configurations of hardware and software have important ramifications on the success to which users can access and complete the online survey. Browser and screen configurations, Internet connection methods and speeds can affect how respondents see the survey. Such design characteristics could lead respondents to either abandon the survey altogether or send incomplete information.

The use of online surveys are a double edged sword. On the one hand, the power of online surveys is that researchers have access to a multitude of respondents at dramatically lower costs than traditional methods. Persuasive arguments for using online research methods include cost reduction (Ilieva, Baron & Healey, 2002), efficiency (Andrews, Nonnecke, & Preece, 2003), facilitative interaction between researchers and participants (Wright, 2005), reduced geographic boundaries (Haythornthwaite, 2005), access to inaccessible user-groups (Koch & Emrey, 2002) and better response quality (Thompson, et al., 2003). Online surveys provide many more options for the researcher, far exceeding the relatively limited design feature of traditional offline surveys. The interactive, graphical and multi-media capabilities of Web-based questionnaires can be used as powerful tools to motivate, guide and enhance participation (Couper, 2000). Conversely, those same design features can also dissuade, confuse and hinder potential participants, increasing survey abandonment.

With the proliferation of such online surveys, it has become increasingly difficult to distinguish the well designed high-quality surveys from the bad. In the age of 'info-glut' and pervasive e-mail spamming, an aura of suspicion often surrounds any stranger-to-stranger communication, even when the declared topic is of mutual interest. The true extent of the age of suspicion remains to be seen and its impact on research measured. Perhaps the most critical problem with Internet-based research is the practical impossibility of obtaining random or representative sampling, and thus researchers can tentatively generalise their results to a very specific population, if at all. It is worth noting however, that although Internet samples may not be random nor representative, neither are the 'convenience' samples used in the typical laboratory study (constituted predominantly by volunteer undergraduate students). Benefits of using the Internet to recruit samples include obtaining a wider range of age, education, and occupation than is found in the undergraduate psychology participant pool (Birnbaum, 2004).

Indeed, many of the problems critics point to are not unique to the Internet. The new technology offers a spate of new problems layered over the old. Good survey fundamentals always need to be applied, regardless of how the survey is administered. Internet surveys are subject to the same sources of error as all others, including measurement, coverage, and sampling. It is imperative that researchers use design features judiciously in order to maximise quality of responses and minimise participant attrition. In the challenging milieu of Internet research, the researcher must be technologically savvy as well as methodologically informed.

14.10.1 Evaluation of Q Methodology

Researchers increasingly acknowledge that methods used to elicit the experiences of participants often ignore or are blind to these points of view, dissolving them in the categories and concerns of the researcher (Robbins & Krueger, 2000). For this thesis, a research methodology was needed that could systematically examines users' subjective metaphors (in both textual or visual format). Q Methodology is superlative in eliciting subjectivities. It is user-centric in that it "relies on the axiom that researchers should acknowledge and present the reality constructions of [participants] … without insisting on the superior ('objective') status of the researcher's own construction of reality" (Kitzinger, 1986, p.153). Statements are drawn from the respondents and organised by the respondent themselves. The researcher appears to have their hands off the process and to interpret only the subjective facts of the respondent's sort.

Given the emic nature of the methodology, concerns are expressed about the subjective nature of theoretical rotation. Q Methodologists typically eschew strictly mathematical criteria in favour of the theoretical, judgmental rotation of factors. A researcher may have specific goals in mind and therefore may have reasons for rotating the loadings and allegedly 'forcing' the data to conform to their own predetermined theory. However, Brown (1980, p. 229) states that this criticism is unfounded because "only those structures can emerge that the data will tolerate". When factors are rotated, the variability is redistributed. This is not changing the underlying structure (not forcing the data into a particular form), rather it changes the vantage point from which the data is viewed (McKeown & Thomas, 1988). By shifting the frame of reference, the researcher gets a different perspective, but it does not alter the reality of the data. Moreover, all rotation possibilities are equal in terms of representing the reality of the factor distribution (ibid.). Furthermore, since interpretation depends on context, "it seems unwise to let an automatic algorithm determine the questions we do and do not ask about our data" (Judd & McClelland, 1989). The data analyst knows more than the computer and failure to use that knowledge produces inadequate data analysis.

Another concern surrounds issues of interpretation. Robbins and Krueger (2000) assert that any interrogation of someone else's subjectivity and its comparison to others must ultimately be theory-laden. However, unlike R Methodology, Q's explanations are not anchored in *a priori* definitions imposed by the investigator. Instead, Q asks its participants to decide what is 'meaningful', that is, what has value and significance from their perspective. Brown (1980, p. 30) states that "[respondents] have their own operational definitions and models of the world, and the social scientist must avoid becoming so intrigued with his own constructions that he becomes insensitive to those of others". In doing so, Q methodology avoids many of the problems inherent to the more widely used research strategies; it allows the researcher to understand and interpret the subjective text of his or her respondents without confounding them with external categories of theoretical reflection (McKeown, 1990).

Lastly, concerns are expressed regarding the provision of a pre-designed Q sample. Indeed, there are always a finite number of items in the Q sample and in the end it is the researcher who has the final decision on which items to include (albeit on the basis of careful sampling processes). These objections culminate in the belief that 'you can only ever get back what you put in'. However, these types of arguments completely misunderstand of the premise of the methodology (Watts & Stenner, 2005). Firstly, the arguments rely on the tenet that Q sample items must only have a single, predefined meaning and hence that it could only ever be interpreted in a single way. The results of this study have shown that the singular 'putting in' of a particular image or statement does not prevent our 'getting back' multiple and qualitatively diverse responses. In contrast, R Methodological procedures necessitate meaning to be 'built into' the measurement instrument itself; each question or scale is assigned an exact predefined meaning and is considered to represent a partial measure of the construct that the scale sets out to measure. Qualitative researchers rightly chastise these methods for they fail to consider that participants can vary in the meaning and interpretation of these scales (Potter & Wetherell, 1987). Therefore, this essentially R methodological criticism is not relevant to Q methodology. Secondly, these objections fail to notice that it is overall item configurations which represent the research target of Q methodology. Q methodology pursues overall item configurations and its procedure renders a colossal number of such configurations available to its participants. For example, in the current study, a Q sample of 26 statements sorted by 244 participants along a +4 to -4 ranking distribution amounts to over 87, 000 comparative judgments[54]. It is difficult to see how this might sensibly be construed as restrictive.

It is evident that during the Q sorting process, respondents are required to make many decisions about the salience, meaning and relationship of each item to the others. An objection has been raised that the magnitude of the sorting task is beyond the cognitive ability of most people to perform adequately (Bolland, 1985). The forced distribution of the Q sample is also controversial. The Q sort is forced so that a certain number of items are prescribed for each rank. Furthermore, the practice of using an inverted quasi-normal distribution is believed to violate the principles of operant subjectivity (McKeown & Thomas, 1988). However, within the forced distribution format, the respondent is free to place an item anywhere within the distribution. This is an important point, especially when compared to conventional ranking methods in which items are scored serially and contextual definition is therefore constrained. Although the number of items permitted is predetermined, the respondent determines the meaning of the continuum, therefore controlling the contextual significance of each item. The prescribed distribution is not an index of meaning (as a scale), but merely statistical so that means and standard deviations can be calculated (ibid.). Furthermore, studies have shown that the shape of a Q sort distribution is methodologically and statistically inconsequential (Brown, 1971; Cottle & McKeown, 1980). Thus, the recommended

[54] Each participant at least implicitly considers each of the N = 26 Q sort items in relation to the others, leading to ½ $N(N$-1) = 325 comparative judgments per person. Multiplied by 114 image respondents, the 106 text respondents and 24 Dual participants, it amounts to 37,050, 34,450 and 15,600 respective judgments (totaling 87, 1000) in all.

distribution is merely a device for participants to consider items more systematically than they otherwise might.

14.10.2 Evaluation of online Q sorting

An online Q sorting process does have its advantages compared to the traditional, manual method of performing Q sorts. The main advantage of an online Q sorting process is that a greater volume and diversity of participants can be obtained in a more cost effective manner. Furthermore, Web-based interfaces for data gathering minimises data collection errors via the computerised process. With manual sorts a researcher must transcribe ratings and enter the data into the appropriate software application for analysis. While this process is relatively simple, the possibility exists for transcription errors, data entry errors, or simply losing the data. Using a Web-based tool, participants can complete their sort and submit the information back through the application. By lessening the possibility of manual error, greater data integrity and better data management can be obtained. Reber, Kaufman and Cropp (2000, in Van Exel, 2005) performed two validation studies comparing computer- and interview-based Q sorts and concluded that there is no apparent difference in the reliability or validity of these two methods of administration.

However, there are two fundamental issues that can reduce the effectiveness of a Web-based implementation: 1) the lack of direct communication during the sort between the administrator and participant and 2) the restrictions of the visual space given for a Q sort. Q studies have traditionally been conducted through a manual process involving participants sorting of cards. While the cards are being sorted, participants may also interact with the researcher; this one-on-one interaction allows the researcher to gain additional insight into participants' sorting process and rationale. The online interface used in the current study reduced this type of interaction. Furthermore, in traditional offline Q sort studies, a post-sort interview is typically conducted in order to gather supporting information from the participant in the form of open-ended comments. When the research website was developed, it was not possible at that time to incorporate this element into the design. However, it can be noted that the CPQ integrated several open-ended responses which serve to explicate and contextualise the meaning of each participant's Q sort. Future research utilising an online Q sort interface could incorporate the ability for the researcher to communicate with participants online using a chat interface. The Internet does offer several tools for conducting asynchronous and synchronous[55] conversations, thereby taking the place of the face-to-face questioning by the researcher. Another problem with the online Q sort interface is the amount of visual space required for sorts with large numbers of items. While such a situation would be an ideal application for large computer screens, such as white boards which often are several feet in length, most common computer monitors will prove too small for such complex sorts. Although steps can be taken to reduce these problems (see section 5.5.4.3.1), the lack of visual workspace nevertheless may have caused some confusion and participant attrition.

14.11 FUTURE RESEARCH

There is a great deal of scope to extend and modify the research conducted thus far. Due to the exploratory nature of this thesis, the research has raised more questions than it has answered. Based on the findings of this research, it would be interesting to further examine users' employment of metaphors over time. In fact, given the increasing prominence of ubiquitous and wireless technologies, now is the perfect time to examine how metaphors of the Internet change as the technology evolves. As new applications are developed and implemented, future research can study 'novice' users to specific applications and see how metaphors adapt with increasing experience. The application of this research can be two fold. Firstly, researchers can examine the ways in which users metaphoric representations changed with their increased interaction with the technology. Future analyses of metaphorical change can lead us to understand the relationship between an initial representation and its maintenance, adaptation, or elimination over time. Secondly, future research can examine the range of innovative metaphor techniques that will be implemented, which capitalise on unique characteristics of advancing interactive systems and move away from the WIMP paradigm (Windows, Icons, Menus, and Pointing devices, as exemplified by the desktop metaphor)(Stanney, et al., 2003). The more

[55] See Appendix 15 for Glossary of Technical Terms.

pertinent research question may not be 'whether' metaphors change, but rather 'how' metaphors will change.

This research has demonstrated that there is an important distinction between thinking about 'tools' (*structure*) and thinking about 'how we use tools' (*process*). Future research could examine if users' perceptions of the Internet actually vary according to whether they are thinking about it, or actually experiencing it. Indeed, metaphor use is intimately bound up with the transaction between users and their current goals. Internet use is a purposeful activity in the sense that it is functional, or directed toward the fulfilment of a particular need (Weiser, 2001). Depending on what the Internet is primarily used for (email, accessing information, making purchases online, cultivating relationships through online communities, playing games), the Internet can be described as a set of technological tools, a complex network of social relations, a language system, a cultural milieu, and so on. Thus, the way one metaphorically represents the Internet depends on the actions performed with it (Carroll, et al., 1994; Mantovani, 1996; Mantovani & Spagnolli, 2001). To appropriate an analogy; the properties of a car will differ substantially depending on whether one wants to mend it, advertise it, buy it or park it. Future research needs to examine how users employ their metaphorical understandings at the point at which they interface with the technology.

Users' metaphoric mental models are complex and difficult to emulate. One way to identify and characterise them is to capture the knowledge as they are being applied or put to use. Thus, an adequate analysis of Internet metaphors needs to rest on an empirical task analysis of what users actually do, not an abstract normative analysis of what they might do (Carroll, et al., 1998; Boechler, 2001). Surveys have often been criticised as tools for collecting data as they require participants to recall past behaviour (Schwarz, 1999), and the recollection of past behaviour is not always accurate. Furthermore, they are criticised for their separation from the user's task. In other words, they report on the user's perceived, rather than actual, interaction (Cockburn & McKenzie, 2001). The methodology used in the current study could be refined as to include a task element, thus operationalising users' interaction with the Internet as an embodied, practical phenomenon, instead of a mental, abstract one. This way, future research could examine the relationship between what users metaphorically think and what users actually do. This perspective is reflected in the 'situated' and the action-oriented frameworks (Vygotsky, 1978; Suchman,1987; Lave & Wenger, 1991). These approaches use the notion of *activity* as the central point in the way they analyse the context in looking at human behavior. The diverse facets of users understanding and experiences of the technology are interdependent and co-evolve with technology. This modification would in turn facilitate a more active definition of metaphor. The typical view of Internet metaphors stress its passive role as repository of knowledge, while the active search, thinking and problem-solving is done by the user, following a path through the maze of associations. To implement a more action-oriented perspective, another conceptual term may be needed. Forsythe (1986) argues that the notion of metaphor is commonly understood to mean the *description* of one thing in terms of another. In contrast, the 'isophor' is *experiencing* one thing in terms of another. As Maturana (1988) states, "[the] isophor suggests it is the dynamic constructing ability that involves conception and perception, unfolding and enfolding, that this gives rise to the coordination of actions in recursion which we know as language".

The function of this study was exploratory; it is acknowledged that if the study was replicated that different metaphors may emerge. Indeed, the metaphors that emerged from the Q sorts in no way reflect the totality of the participant's point of view. An individual's subjectivity may not be fully describable and its multiple qualities may be conditional and contextual. The Q sorting reflects the immediate and momentary embodiment of a deeper and complex subjectivity and thus different configurations, rotations and records are admittedly possible.

As extensively discussed throughout this thesis, Q Methodology is a user-centric technique: it is based on the premise that the self is central to all else (Stephenson, 1961 in Brown, 1972). This characteristic however is simultaneously its strength and its weakness. By focussing solely on the individual, the methodology does not explicitly take into account social and contextual forces on the individual and their emergent subjectivities. By examining the relation between the Internet and the individual user, the approach does not take into account the interaction and coordination between users, nor does it explicitly consider how metaphors are generated as part of the social and cultural milieu. By extracting metaphors from the social context in which they emerged only serves to naturalise their origin, as though they are timeless features of technology than highly specific cultural constructions. In fact, metaphors are highly culturally specific. For example, as discussed in section 14.3.2, the ‘frontier’ metaphor is a very powerful and influential way of thinking in the United States. The metaphors which are conventional to one group may be novel to another. This indicates that metaphors are used within “a shared category of meaning” (McLaughlin, 1990, p. 83). Certain metaphors are used so they can be comprehended, interpreted and communicated within a certain linguistic community. They are constrained by the available cultural repertoire; that is, the metaphors used will be dependent on resources of linguistic pool. In this way, specific metaphors are used to “interpret, express, and negotiate meaning within specific contexts” (Kern, 2000, p. 54).

Similarly, the Q sort approach needs to be adapted to examine the contextual and social factors that drive Internet understanding and behaviour. From this perspective, Internet use is not seen as an activity, which is isolated from social and cultural structures and phenomena. Rather, the individual is driven to seek information not solely because of a cognitive need, but also because of the necessity to satisfy affective needs, created by living and working in social settings. Given this conceptualisation of the research, Q Methodology needs to be implemented in the context of user practices, much like the approaches adopted with contextual design techniques.

The highly innovative and exploratory nature of this research meant that only a limited range of extrinsic and intrinsic demographic variables were examined in relation to metaphor use. Future research could examine in detail a broader range of user groups; for example, investigating the perceptions of the digitally excluded. Indeed, it is imperative that future interface designs which rely on metaphors should taking into account cultural diversity of targeted users (Marcus & West-Gould, 2000). Interfaces need to reflect “the values, ethics, and morals of the target users” (Ford & Gelderblom, 2003, p.220). Future research needs to explore further culturally diverse metaphors, their impact on communication, means of evaluating their effectiveness, and the process of designing them. To achieve successful communication simple, clear, consistent solutions will continue to benefit increasingly diverse information products for increasingly diverse international users.

Future research needs to further examine the relationship between expertise and metaphor use. Typically, users' experience is conceptualised as varying on a linear continuum from 'novice' to 'expert'. People who have never used a computer are considered novices; professional engineers and developers are considered expert users. Operating under this assumption, figuring out who users are for a particular technology is largely a matter of determining where they fall on the continuum. However, Johnson (2007) contends that it is a fundamental fallacy to think of users on this continuum. He proposes a more realistic and useful view that users can be places along three independent knowledge dimensions: g*eneral computer savvy* (how much they know about computers in general), *task knowledge* (how facile they are at performing a specific target task) and *knowledge of the system* (how well they know the specific application e.g. email, USENET). Knowledge in one of these dimensions does not imply knowledge in another. Users can be high or low on any of these dimensions independently. For example, an experienced Linux system administrator might struggle with shopping online. Future research examining the relationship between intrinsic demographic variables, such as self-efficacy, and the use of Internet metaphors should therefore encapsulate this more complex, multidimensional definition of expertise.

14.12 CONCLUDING THOUGHTS

Internet users employ a striking diversity of metaphors of the Internet. Metaphors work because they enable familiarity and understanding. Contemporary metaphors of the Internet are a clear indication of a lexicon that is influenced by our culture, our technology, and our experience in time and place. The consistency of certain metaphors over time indicates that some representations are more 'durable' than others. However, as the Internet continues to evolve in complexity, metaphorical references will change more rapidly, requiring frequent updating of users' assumptions.

Furthermore, the adoption of a single Internet metaphor necessarily omits insights offered by other perspectives. If single metaphors necessarily miss valuable insights, an effective way to overcome uni-dimensional representations is the deployment of multiple metaphors with complementary insights. The multiple metaphoric representations users generate about the Internet can be conceived as a 'metaphorical toolkit'. Inexperienced users should be encouraged to develop their initial metaphors into multiple representations and develop meta-cognitive strategies to choose which representation to use for a given task.

Internet interfaces can be customised to provide the option of interacting with a variety of metaphorical representations. Additionally, designers need to implement metaphors that encapsulate both structural and procedural elements, or both a presentation and interaction metaphor. The existence of these multiple dimensions of metaphor indicate that metaphors are used to convey a particular meaning that is context dependent. This research suggests that a full synthetic understanding of Internet metaphors can only be achieved through the analysis of the contexts in which metaphor use occurs.

Metaphors have multiple dynamic dimensions that are culturally and contextually based. Metaphor usage and meaning needs to be considered in this full context of use, acknowledging that, although we may choose as researchers or theorists to focus on a particular dimension of metaphor, the others are still there, influencing what people do and say. Additionally, both visual and textual metaphors need to be considered and implemented into interfaces. Currently, the only way to access information on the Internet is primarily through textual means. The possibility of developing graphical indexing is of great significance for user behaviour because images play such an important role in assisting human reasoning, thinking and understanding. Furthermore, providing users with a local and global view of the information space will enhance perception and understanding of the structure of hyperspace. By enabling users to comprehend the various spaces of online information, it will inevitably aid navigation.

Despite the difficult issues surrounding eliciting, measuring and implementing users' metaphors of the Internet, this research holds that the importance of metaphor cannot be underestimated. A person's expectations and assumptions about how an online system works and what it can (and cannot) do come largely from their metaphors (McAdams, 1995). As Hunt and Doherty (1995, p.13) note: "we are throttling forward into 'how should we name this tool?' when nobody has really bothered to answer 'why should we?' ". It is hoped that the current research illustrates that it is good that we are throttling forward, wondering about how we should make sense of virtual space and contemplating what sorts of metaphors we should use to construct them. This concern is what keeps the metaphors from being naturalised and excluding other conceptualisations. It keeps the map from becoming the territory. It matters because metaphors control how we conceptualise cyberspace. They control and hide; they legitimate certain cultural experiences while excluding others. In this way we can draw a multitude of maps, each that give multiple ways of thinking about the Internet.

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APPENDICES

APPENDIX 1.1: DEFINITIONS OF THE INTERNET

In an attempt to provide a clear definition of the Internet, the Federal Networking Council (FNC, 1995) unanimously passed the following resolution:

> "Internet refers to the global information system that
>
> - is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons;
> - is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols;
> - provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein".

This primarily technical definition simply describes the Internet as a collection of networks that link computers and servers together. The Internet is solely defined in terms of computers sending and receiving data. However, this definition has very quickly become outdated; the Internet can now be accessed virtually anywhere by numerous means. Technologies not necessarily thought of as 'computers' (such as mobile phones) allow users to connect to the Internet from anywhere there is a network supporting that device's technology.

With Internet developing at breathtaking speed, attempts to define the technology become redundant as soon as they are published. Nevertheless, a number of different theorists have attempted to identify the characteristics of the Internet. As Table A1.1.1 indicates, definitions of the Internet can be technical, social, functional, geographical, structural, historical, or any combination thereof. The categories listed below are certainly not exhaustive, nor mutually exclusive. Rather, they illustrate just a few of the vast array of possible representations.

Focus	**Definition**
Historical	The global network of computers used widely by researchers. ARPANET was the first incarnation ... and it refined the vision and pioneered techniques used on the Internet (Press, 1992).
Technical	The Internet uses a connectionless protocol that routes data through interconnected networks and acts as an intermediary between the higher protocol layers and the physical network (Farrel, 2004).
Structural	The Internet is the largest Internet in the world. It is a three level hierarchy composed of backbone networks (e.g. NSFNet, MILNET), mid-level networks, and stub networks (Keyes, 2000).
Geographical	The global network of regional and local computer networks (Delozier, 1997).
Functional	The Internet is system of linked computer networks that facilitates data communication services such as remote login, file transfer, electronic mail and newsgroups (Mann & Stewart, 2000).
Social	The Internet is a techno-social system consisting of a technological structure storing and distributing knowledge and social systems of cognition, communication, and co-operation. The two systems are structurally coupled (Fuchs, 2005).
Statistical	The Internet is growing rapidly at an unprecedented rate. The current estimate is 201 million users worldwide … [with a] projected 717 million users by 2005 (Press, 1999).
Metaphorical	The Internet is becoming the town square for the global village of tomorrow (Gates, 2003).

Table A1.1.1 Definitions of the Internet

While there are many different kinds of terminology used to describe the Internet, it is clear that many of them have overlapping descriptions. Yet, each singular definition fails to provide a clear overview of *all* the fundamental features of the Internet. Definitions of the Internet highlight specific features of the Internet, whilst concealing others. In this way, definitions are contextual and will vary according to the perspectives and interests of those who wish to define it.

APPENDIX 1.2: A BRIEF HISTORY OF THE INTERNET

THE EARLY INTERNET: 1958-2000

ARPANET

At the beginning of the Cold war, the Internet in its most primitive form was conceived. On October 4, 1957, the Soviet Union launched Sputnik, beating America in the race to launch the first Earth-orbiting satellite. As a direct consequence, the American government created the Advanced Research Projects Agency (ARPA). ARPA's aim was to apply state-of-the-art technology to US defense and to prevent technological surprise from adversaries. With the omnipresent threat of nuclear war, ARPA became concerned with preserving its communication networks in the advent of nuclear warfare. Licklider, head of the Information Processing Techniques Office at ARPA, formulated a solution; a decentralised global network that would function even if several parts were severely damaged.

Date	Event
1958	ARPA was established
1962	"Galactic Network" concept proposed
1964	Packet-switching networks proposed
1968	ARPANET set up, predecessor of today's Internet
1969	4-node ARPANET
1972	37-node ARPANET
1972	Email introduced ARRA renamed DARPA
1973	First international connections to the ARPANET (UCL)
1974	TCP/IP introduced
1975	First ARPANET mailing list created
1979	USENET established
1981	BITNET started

Table A1.2.1. Internet timeline: ARPANET

In a series of memos, Licklider (1962) outlined his revolutionary 'Galactic Network' in which networked computers would enable users to quickly access data and programs from any site. At about the same time, Kleinrock (1961) and Baran (1964) were developing ideas for sending information by breaking messages up into ‘packets’. Each packet would wind its way through the network via randomly chosen routes. This plan for a computer network system was eventually called ARPANET and became the predecessor of today’s Internet. Interestingly, teams at MIT, the National Physics Laboratory (UK) and the RAND Corporation had been concomitantly and independently working on the feasibility of wide area networks. Although the National Physical Laboratory had set up the first test network in 1968, ARPA decided to fund the networking of high-speed supercomputers at military bases and research universities across the USA.

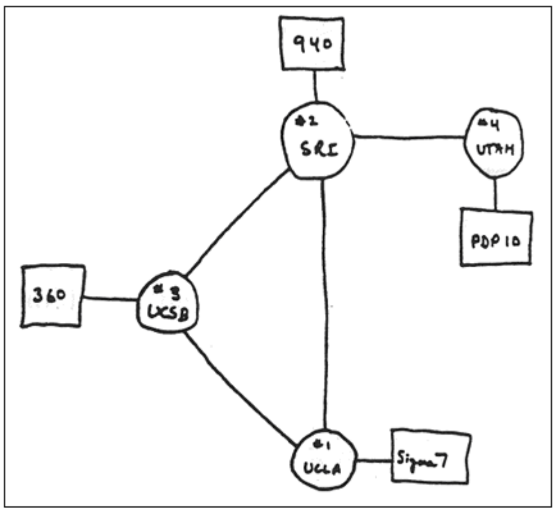

Figure A1.2.1. 4-node ARPANET diagram

By December 1969, ARPANET comprised four node computers; UCLA, Stanford, Santa Barbara and Utah (see Figure A1.2.1). Nodal implementation increased quickly and dramatically; in 1971 there were fifteen nodes in ARPANET; by 1972, thirty-seven nodes (Leiner, et al., 2003).

From ARPANET to Internet

In October 1972, ARPANET entered the public domain at the International Computer Communication Conference (ICCC). This marked the first demonstration of this new network technology to the public, along with unveiling the ‘hottest’ technology of the day: ‘electronic mail’. From this point, email quickly took off as the largest network application. Although ARPANET was intended to facilitate long-distance computing, researchers were using the network to collaborate on projects, to trade work notes and to swap personal messages. This person-to-person communication quickly became very popular and it was not long before the invention of the mailing-list, an ARPANET broadcasting technique in which an identical message could be sent automatically to large numbers of network subscribers. This was a forerunner to the 'people-to-people' activity that now dominates the Internet.

Date	Event
1983	Birth of the "Internet": ARPANET moniker retired. MILNET becomes separate military network
1984	JANET implemented to serve UK universities
1985	First registered domains (.com/.edu/.uk). NSFNet established and creates new backbone
1987	10,000 Internet hosts
1988	Internet Relay Chat (IRC) developed
1989	100,000 Internet hosts

Table A1.2.2. Internet timeline: The Early Internet

DARPA[56] turned its focus towards developing a communication protocol that would allow computers of differing (and often incompatible) hardware and software to share resources across the network. As long as individual machines could speak the packet-switching lingua franca of the new, anarchic network, their technical specifications, content and ownership were irrelevant. ARPA's original standard for communication, known as the 'Network Control Protocol' (Crocker, 1970), was superseded by a higher-level, more sophisticated standard known as Transmission Control Protocol/Internet Protocol (TCP/IP)[57] (Cerf & Kahn, 1974). TCP/IP enabled multiple independent networks of arbitrary design to interface with each other. The TCP/IP protocol is the foundation of internetworking design and to date is the most widely used network protocol in the world (Kozierok, 2005). Although 1974 marked the beginning of TCP/IP, it would take several years of modification and redesign before it was completed and universally implemented. The year that TCP/IP was officially adopted was considered to mark the birth of the Internet. This is because TCP/IP enabled the ARPANET to be linked to other networks into a network of networks, i.e. the Internet. In 1980, TCP/IP became the standard of the US Department of Defense (Information Sciences Institute, 1980). In 1983, ARPANET

[56] In 1972, the word "Defense" was prefixed to ARPA and the agency became known as DARPA.
[57] See Appendix 15 for Glossary of Technical Terms.

officially adopted TCP/IP. The ARPANET moniker was retired and the ‘Internet’ was officially born.

By the middle of the 1980's, the Internet was truly global in scope, constituting a multitude of networks across North America, Europe, Australia, Canada and Japan. In 1983, as the ARPANET transformed itself into the Internet, its military segment broke off and became MILNET. At the same time, governments decided to encourage the use of the Internet throughout the higher educational system; in 1984, JANET (Joint Academic Network) was implemented to serve British universities, and the following year, the US National Science Foundation established NSFNet for the same purpose. Other US government agencies jumped on the Internet bandwagon; most notably, NASA (SPAN) and the Department of Energy (MFENet), along with commercial facilities such as AT&T (USENET) (see Figure A1.2.2).

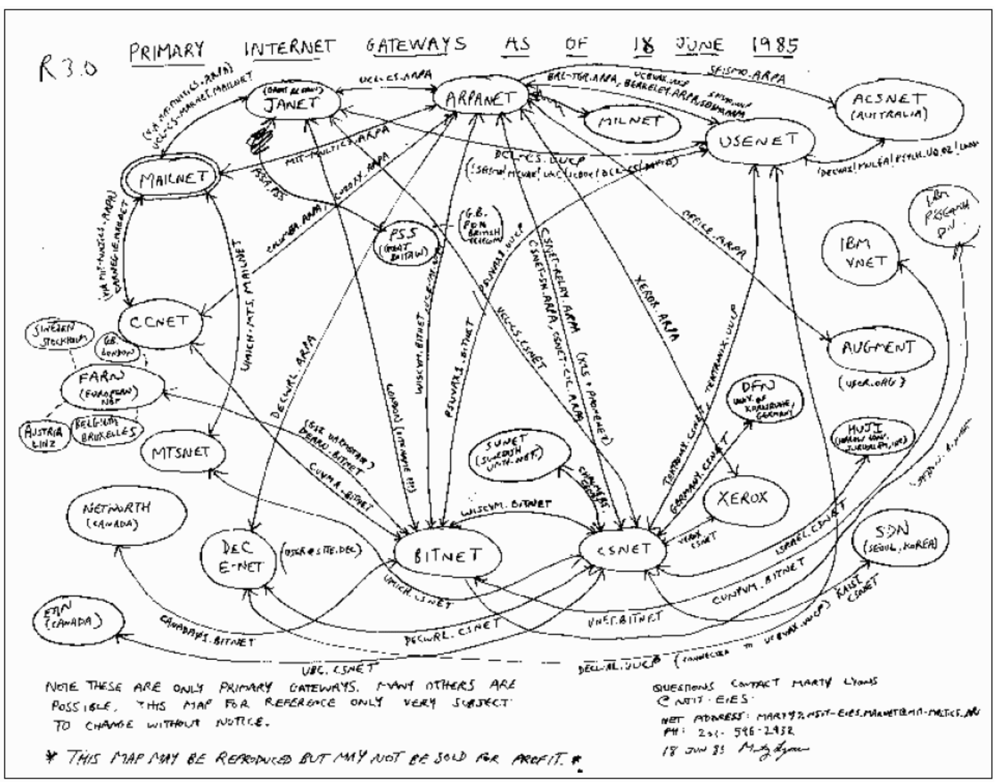

Figure A1.2.2. Hand-drawn map of various Internet networks, by Marty Lyons (1985)

However, as more computer ‘hosts’ linked to the Internet than had originally been envisaged (in 1984, the number of hosts topped 1000 for the first time), predictions were voiced that the entire system would eventually grind to a halt. Consequently, in 1985 the NSFNet constructed its own backbone network in order to assuage the envisaged traffic. This technological advancement[58] broke the capacity bottleneck in the system which then encouraged an exponential surge in Internet use. By 1986, the number of hosts had reached 5000 and a year later the figure had climbed to 28,000 hosts. By 1989, the number surpassed 150,000 (Pike, 1995; Griffiths, 2002).

ARPANET itself formally expired in 1990 with the majority of users utilising the newer NSFNet backbone. As the 1990’s dawned, many different social groups had the ability to connect to the Internet. However, the Internet was still quite a forbidding place for the uninitiated. With the exception of a few networks (e.g. BITNET and USENET), the networks were often intended for, and largely restricted to, closed communities of scholars. Access commands to find data were complicated and presentation of information was unwieldy. The few attractions for the commercial sector were e-mail, access to newsgroups, chat facilities and basic computer games.

The Internet and World Wide Web (WWW)

Although commercial exploitation of the Internet had begun in the late 1980’s, the expansion of the Internet continued to be driven by government and academic communities. Pressure began to build to allow commercial use of the network (which had been prohibited by NSFNET management in order to maintain use of the bandwidth for research purposes). In March 1991, the NSF modified its ‘Acceptable Use Policy’ to allow commercial use and began planning for transition of the NSFNET to commercial network providers. The Internet quickly started to grow beyond its research roots to include both a broad user community and increased commercial activity. Commercialisation of the Internet was not only predicated upon

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[58] Another essential development was the introduction in Domain Name Servers (DNS). Nodes were divided into six basic Internet ‘domains’[58]: edu (educational), com (commercial), gov (governmental), org (international organisation), net (network[58]) and mil (military). Additionally, some international nodes chose to be denoted by country-code domains, such as .uk, .de, .jp.

the development of competitive, private network services, but also the development of a user-friendly interface to access commercial products and services.

In 1991, Tim Berners-Lee of the European Laboratory for Particle Physics (commonly known as CERN) created the World Wide Web (WWW); a protocol for the exchange of hypertext and multimedia through the Internet[59] (Berners-Lee & Fischetti, 1997). By using Hypertext Transfer protocol (HTTP), website addresses were readily accessed and corresponding documents were readily retrieved for viewing.

Initially, the WWW was primarily text-based until the U.S. National Center for Supercomputing Applications (NCSA) released 'Mosaic' (1993). Mosaic can be credited with popularising the World Wide web, having "incited a rush of excitement and commercial energy unprecedented in the history of the Net" (Wolfe, 1994). Figure A1.2.3 depicts a screen shot of the Mosaic Web browser interface, circa 1993. Both contemporary (2000-2004) and recent (post-2005) web browsers[60] are still largely based on this interface design.

Date	Event
1990	First commercial provider of Internet dial-up access. Countries from 5 continents connecting to NSFNET
1991	World Wide Web released by CERN. NSF allowed commercial use of its network
1992	Internet Society (ISOC) is chartered
1993	White House goes online. MOSAIC: graphical-based browser released
1994	Yahoo! launched
1995	Netscape, Amazon, Ebay, Internet Explorer launched
1996	Google launched
1997	Netflix launched
1999	Napster launched
2000	Paypal launched
2001	iTunes launched
2002	Blogs and wikis start to become popular
2003	Facebook, MySpace, Skype and Mozilla Firefox launched
2004	Flickr launched
2005	YouTube launched
2006	Twitter launched
2007	Facebook widgets available
2008	Google Chrome launched

Table A1.2.3. Internet timeline: Commercialisation of the Internet

[59] The first ever website was http://info.cern.ch/hypertext/WWW/TheProject.html
[60] See Appendix 15 for Glossary of Technical Terms.

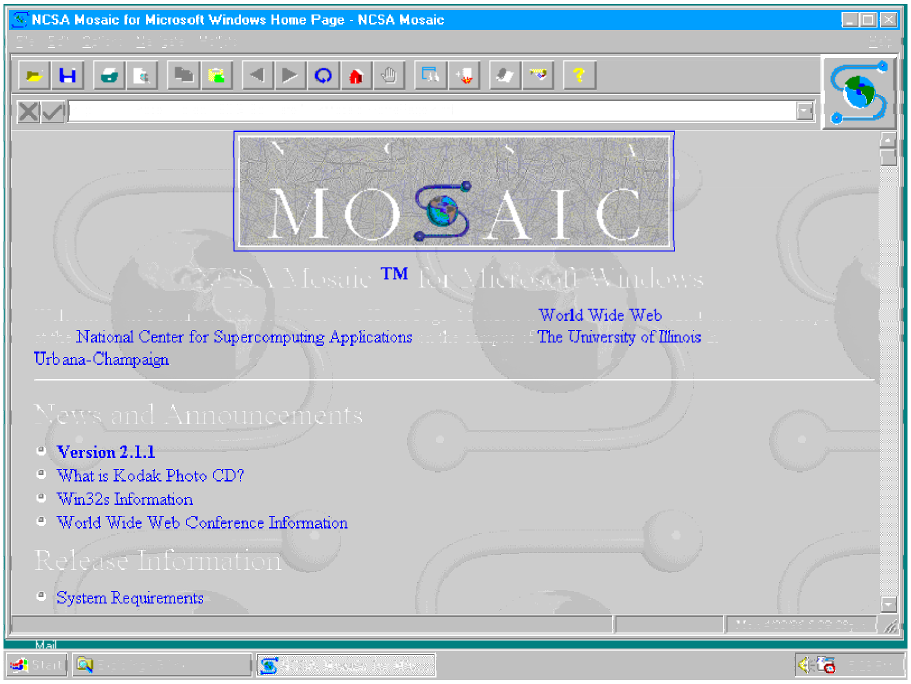

Figure A1.2.3. Screen shot of the Mosaic Web browser interface

The potential of this user-friendly interface to create graphically attractive web-sites and the ease with which these sites could be accessed opened the Internet to whole new groups of users. Whereas previously, the Internet was largely only available to researchers and technophiles, the true popularisation of the Internet began. Millions of new home users obtained access to the Web when Compuserve, America Online, and Prodigy provided gateways to the Internet. After a lot of popular press covered use of the Web in university and corporate environments, the Internet and 'Web' quickly became household words throughout the world.

Since its genesis in 1993, the World Wide Web has grown phenomenally. By the end of 1993, there were approximately 623 websites online; just one year later there were over 10,000 (Zakon, 2006). Although exact figures are impossible to obtain, it is estimated that there are currently over 215 million websites (with unique domain names) as of February, 2009 (Netcraft, 2009) and upwards of one trillion unique URLs[61] as of July, 2008 (Alpert & Hajaj, 2008).

[61] See Appendix 15 for Glossary of Technical Terms.

The Internet versus the WWW

The terms ‘Internet’ and ‘Web’ are often used interchangeably and are commonly thought to be synonymous. The conflation is understandable: a user interacting with a computer is conscious not so much of the Internet as the email application being used or the web page from which the user is gathering information. The Internet is made manifest through the applications that are visible on a computer screen (Cannon, 2002).

There are, however, significant differences between the Web and the Internet. At its most basic definition, the Internet is an electronic communications network. It is a collection of computer networks connected through either copper wires, fibre optic cables or wireless connections that enable people to communicate and share information. In contrast, the World Wide Web is a large system of interlinked hypertext documents accessed via the Internet. The Web is just one of the many applications that run on the Internet (email, USENET, IRC, chat, multi-user domains (MUDs), streaming media, IP telephony, file transfer protocol, peer-to-peer file transfer to name just a few [62]). On the Internet, the connections are between computer networks; on the Web, connections are hypertext links (Berners-Lee, 1998). Thus, the Internet is the hardware, the means of transmitting information, whereas the Web is the software, just one application that is used to access the information.

[62] See Appendix 15 for Glossary of Technical Terms.

APPENDIX 2.1: METAPHOR VERSUS OTHER TROPES

It is not always easy to distinguish metaphor from some of its semantic cousins, including simile, analogy, synecdoche, metonymy and catachresis. A brief definition of each trope follows, including a description of how each varies from metaphor.

Similes and Analogies

A simile is usually regarded as a simple comparison of one thing to another, including the words ‘like’ or ‘as’; for example, ‘the Internet is like a spider’s web’. A simile often uses a subject that is reasonably well-known (a spider’s web) to describe something that is impossible for humans to fully understand (the Internet). Similes are generally used in figurative settings for effect and emphasis (Soskice, 1985).

Analogy is very similar to simile, but its usage is ‘stretched’ to fit new applications. Analogy is thus used to compare concepts that are not normally associated; for example, ‘the Internet is like a book’. Our common knowledge of books helps us to more fully understand the nature of the Internet, a phenomenon that is less commonly known to us. In this way, analogy is more useful in explaining a thought process or a line of reasoning or the abstract in terms of the concrete, and may therefore be more extended than a simile (Harris, 2005).

Simile, analogy and metaphor are similar in that they all seek to establish understandings by the creation of mappings between domains. However, simile/analogy usually refers to the construction of *explicit* mappings between two domains, whereas metaphor is more often implicit. The comparison is usually limited with simile and analogy; not all attributes are intended to be mapped from the source to the target domain. In contrast, metaphors are statements of identity (Downs, 1981). By using phrases such as ‘the Internet is *like* a gaseous cloud’, both analogy and simile keep the source and target domains safely separated. In contrast, metaphor draws a more immediate connection and its comparison is one of identity, e.g. ‘the Internet *is* a card index filing system’. This startling fusion of attributes between source and target domains creates a new perspective, allowing us to see something in a new way. As Black (1962, p. 37) notes, 'metaphor creates the similarity [rather than] formulates some similarity antecedently existing'. In contrast, analogies are used for explanation; they establish a set of equivalences between well-known and lesser-known concepts. Thus, metaphors are typically used for 'expressive-affective purposes, and analogies for explanatory-predictive purposes' (Gentner, Bowdle, Wolff & Boronat, 2001, p.240).

Synecdoche and Metonymy

Synecdoche is a rhetorical device whereby the whole is referred to by naming a part, or the part is referred to by naming the whole (Turbayne, 1970). The latter is exemplified in the following phrase; 'California ruled in favour of free speech on the Internet'. Here, the whole (California) is used to represent the part (California Supreme Court). Metonymy is similar to synecdoche. Metonymy means giving something a name that belongs to one of its attributes (ibid.). For example, when someone says they 'Googled the information', they are using the search engine Google to symbolise the activity of searching the Internet for information.

Metonymy and synecdoche work by the association between two concepts, whereas metaphor works by the similarity between them. In other words, metonymy and synecdoche are used when one does not wish to transfer qualities from one referent to another, as is achieved with metaphor.

Catachresis

Catachresis s a type of metaphor that supplies a term where one is lacking in the vocabulary. It is the process of using an extravagant metaphor using words in an alien or unusual way (Harris, 2005). For example, you can substitute a noun for a verb or a verb for a noun; e.g. 'the little old lady *turtled* along the information superhighway'. Unlike metaphor, catachresis may not necessarily make a comparison between domains.

APPENDIX 9.1: IMAGE CONCOURSE

All images used in this Ph.D. thesis are the property of their respective owners, as outlined below, and are used with permission.

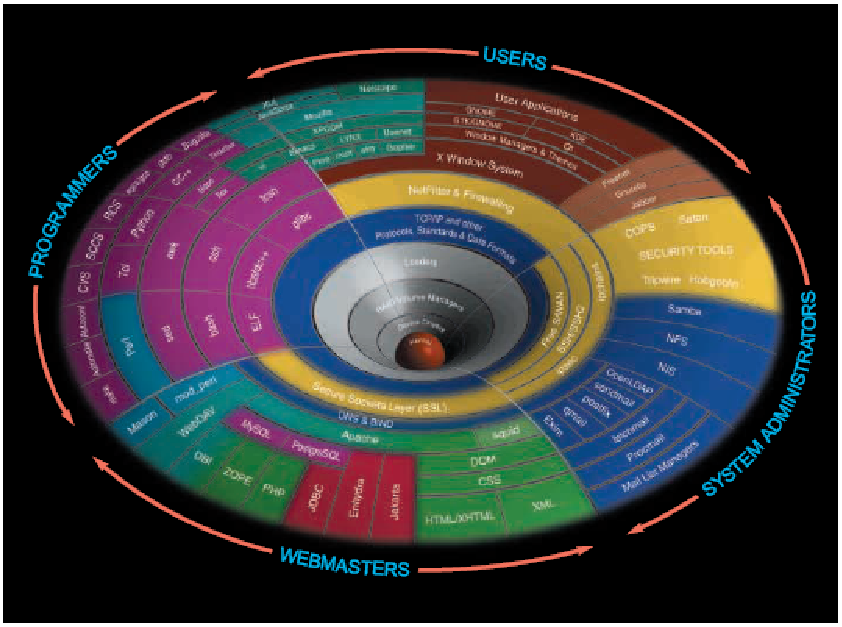

Image 1. Anatomy of a Linux System, by Tim O'Reilly. Used with permission.

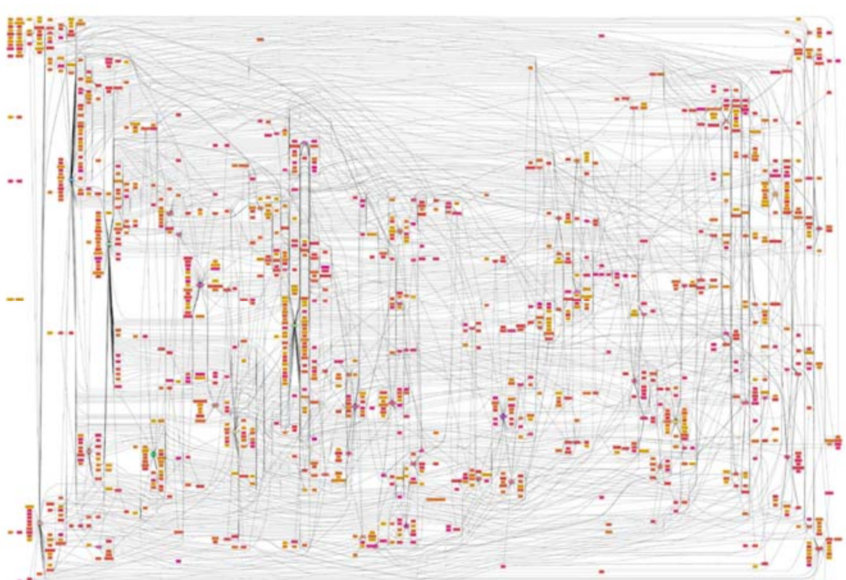

Image 2. Cobot map of social relations in a MOO, by Charles Isbell and Michael Kearns. Used with permission.

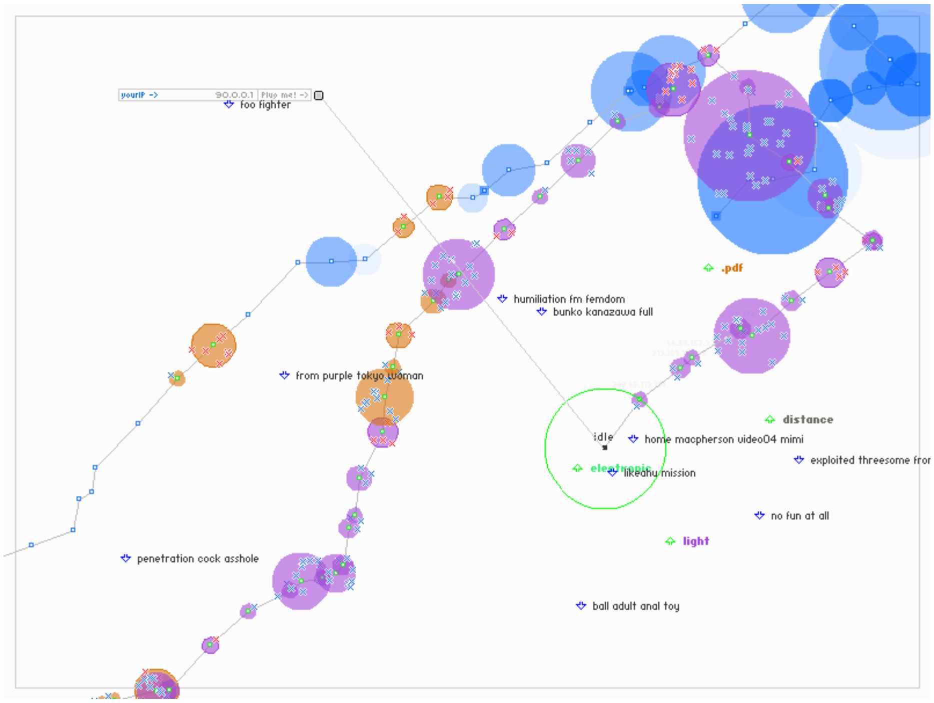

Image 3. The minitasking visual gnutella client. © 1998-2005, Schoenerwissen/OfCD. Used with permission.

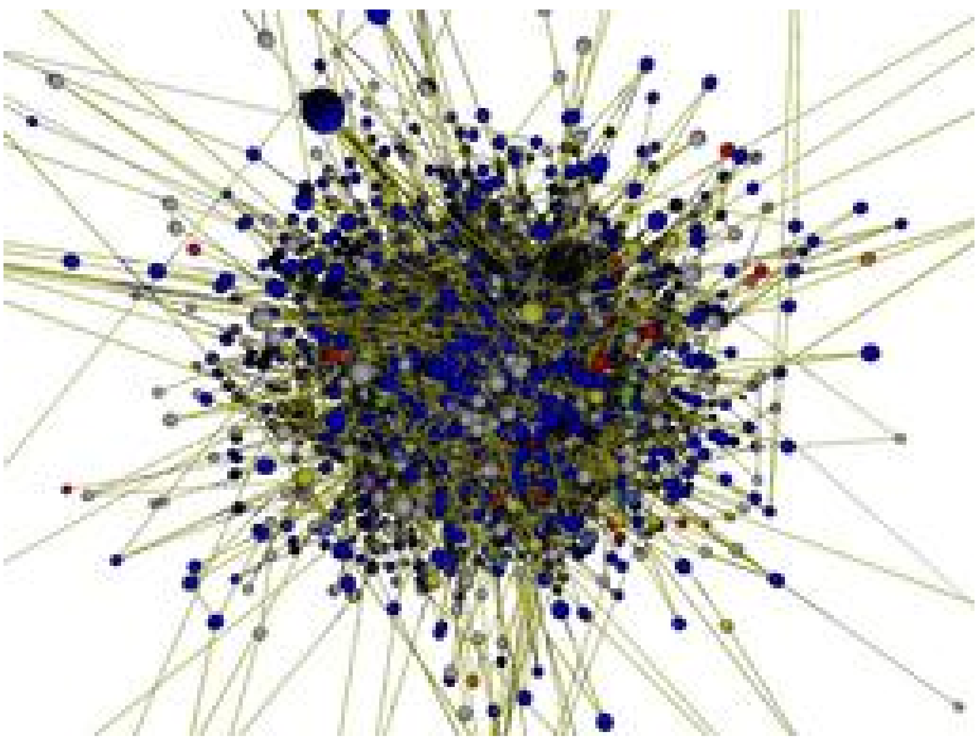

Image 4. Mapping the structure and performance of the Internet. © 2001, Stephen Coast. Used with permission.

Image 5. The Web Forager, by Stuart Card, George Robertson and William York. Used with permission.

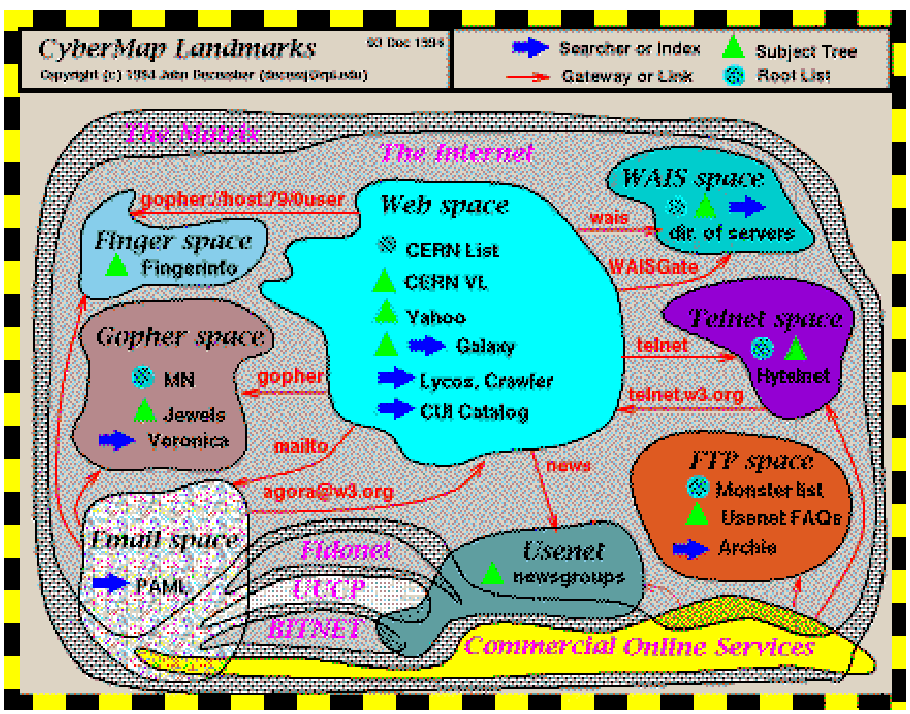

Image 6. Conceptual cybermap, showing the key information domains and landmarks of cyberspace, circa 1994/95, by John December. Used with permission.

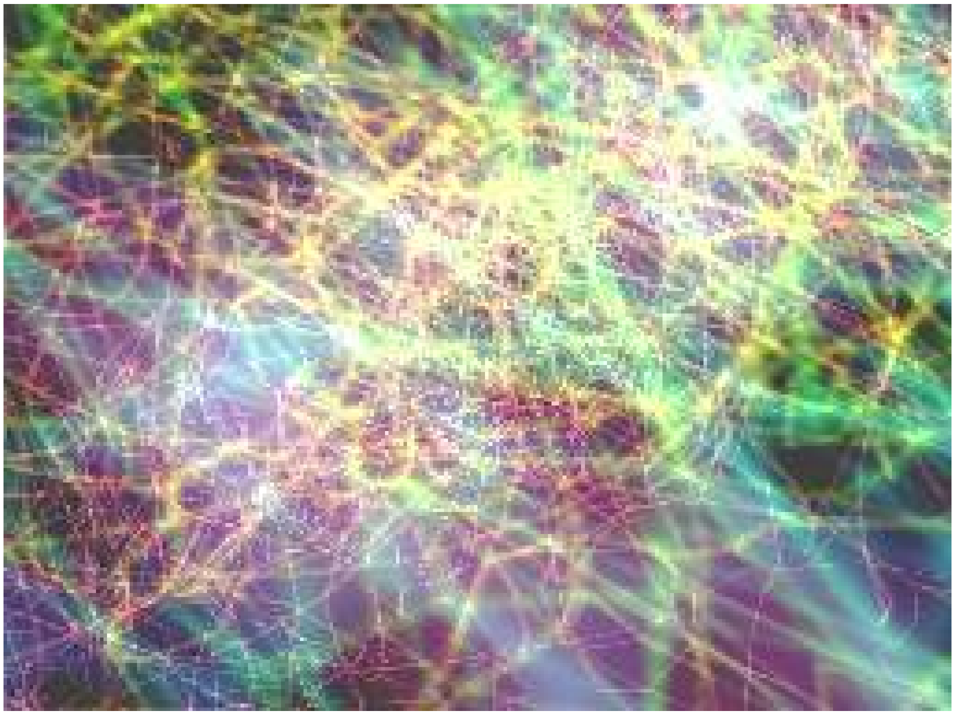

Image 7. **A** visualization tool called MilkDrop, which uses 3D graphics to create a visual journey through sound, by Ryan Geiss. © 2001-2005, Nullsoft, Inc. Used with permission.

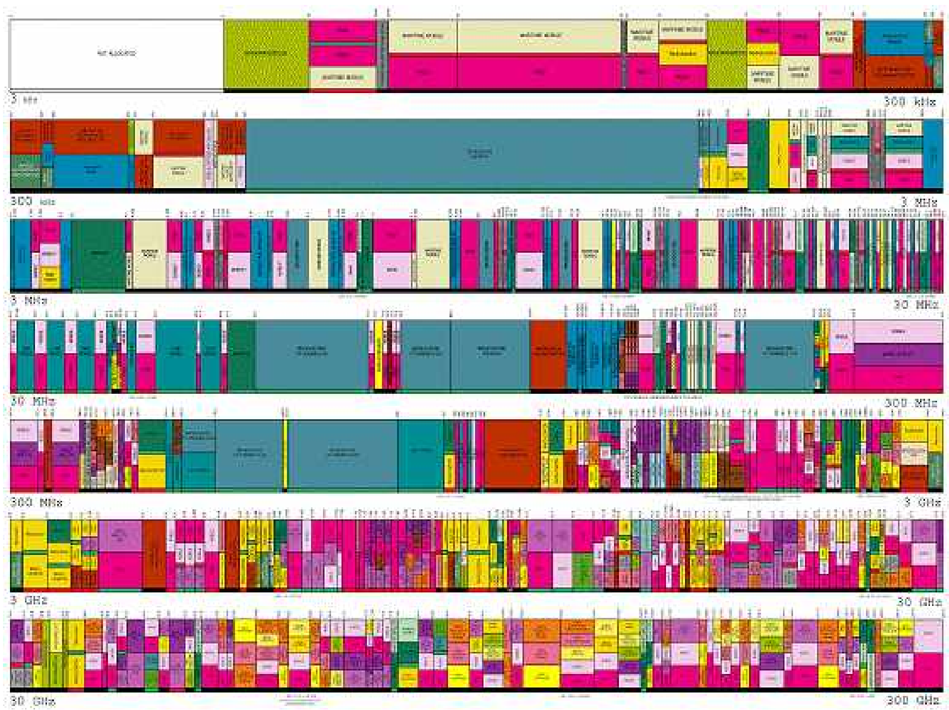

Image 8. US radio frequency allocation map, by the National Telecommunications and Information Administration (NTIA). © 2003. Used with permission.

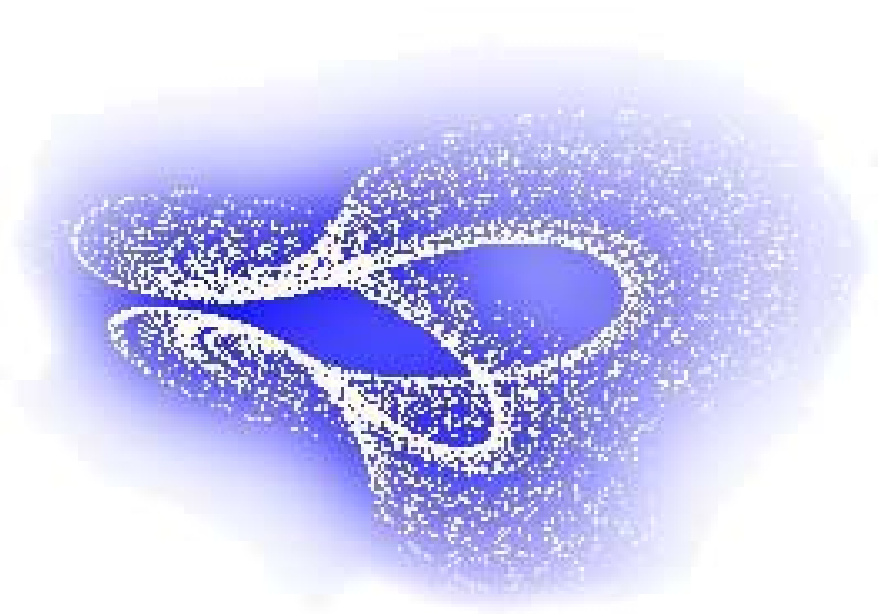

Image 9. Computer visulisalisation of a differential equation, by the Consortium of ODE Experiments (C*ODE*E) 1992-1997. Used with permission.

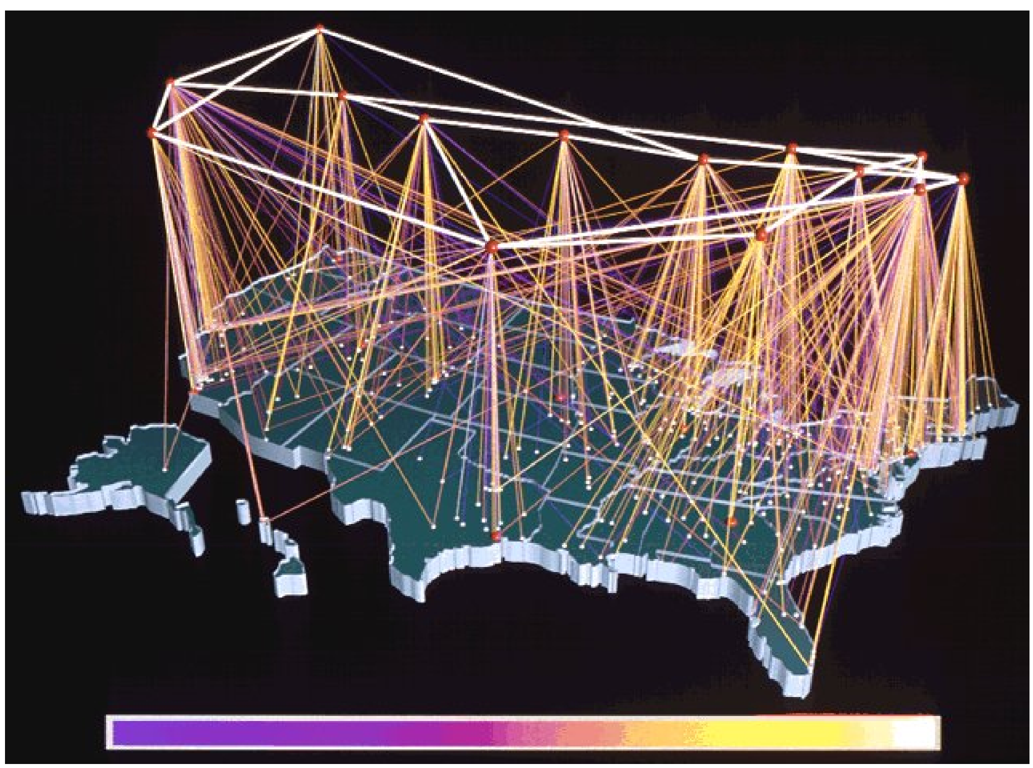

Image 10. Visualization of the NSFNET in 1992, by Donna Cox and Robert Patterson. © 1992, NCSA/UIUC. Used with permission.

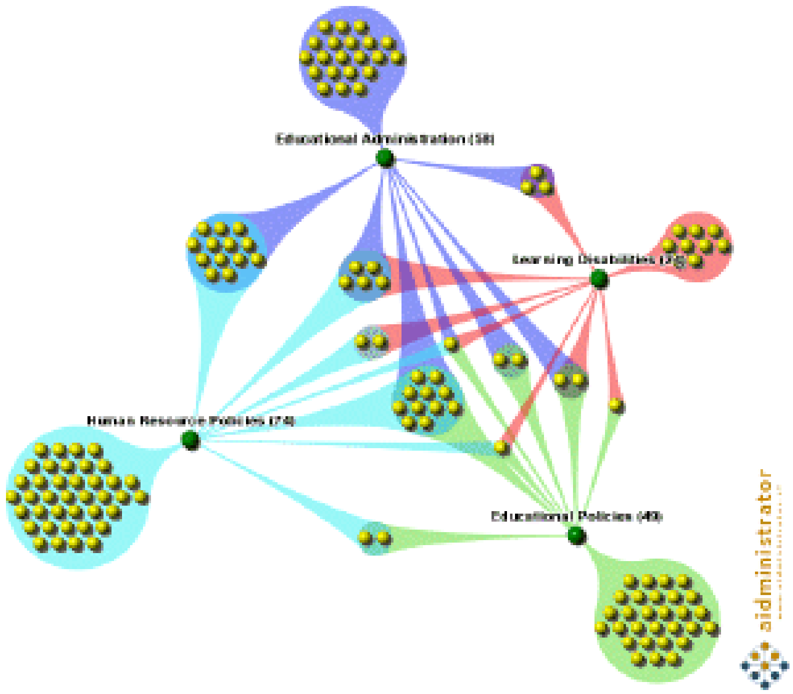

Image 11. The application of a new version of the algorithm to a database of documents on educational issues, by Aidministrator. Used with permission.

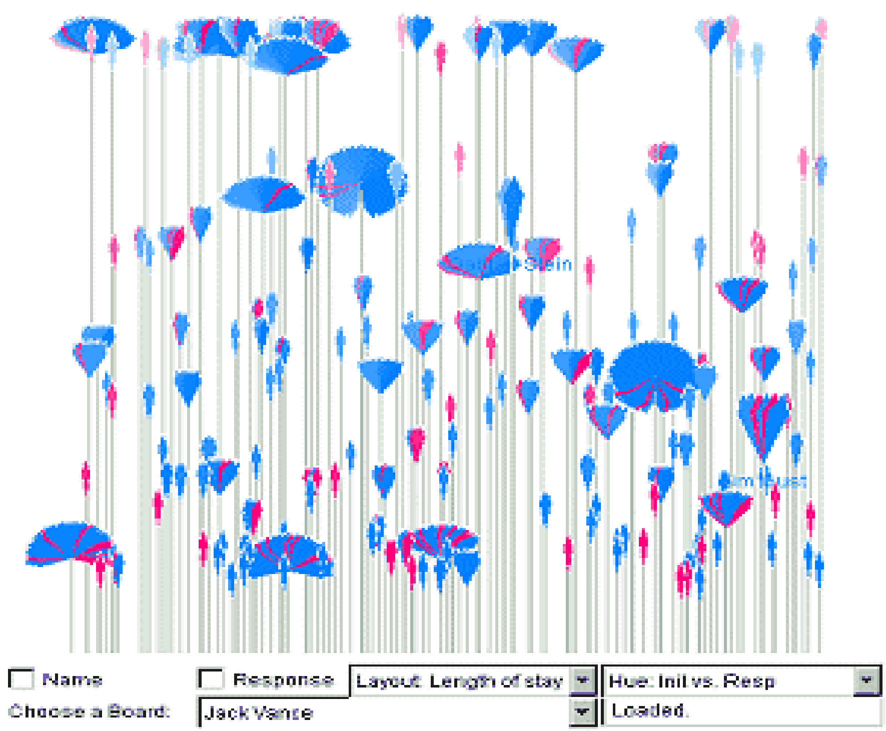

Image 12. PeopleGarden: visualisation of conversations on web-based chat boards, by Rebecca Xiong. Used with permission.

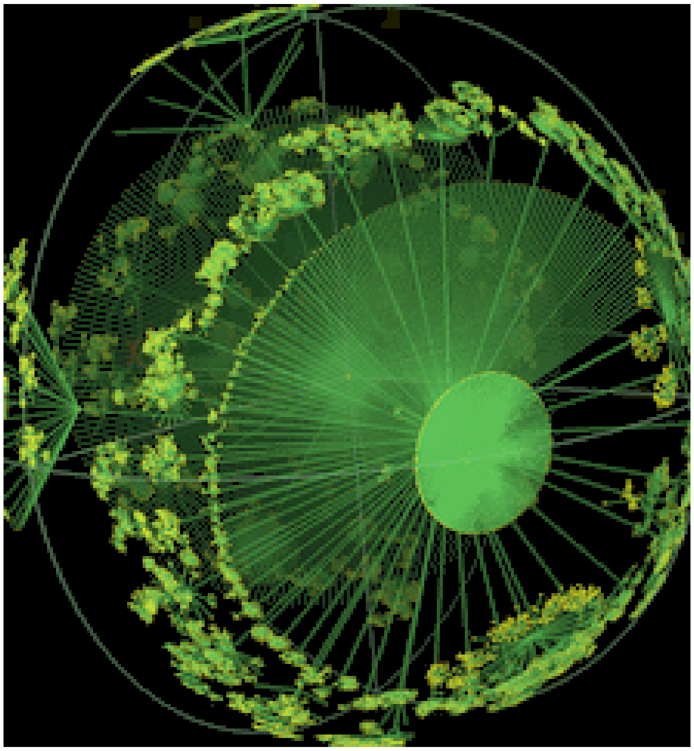

Image 13. 3D hyperbolic graphs of Internet topology, by Young Hyun at the Cooperative Association for Internet Data Analysis. Used with permission.

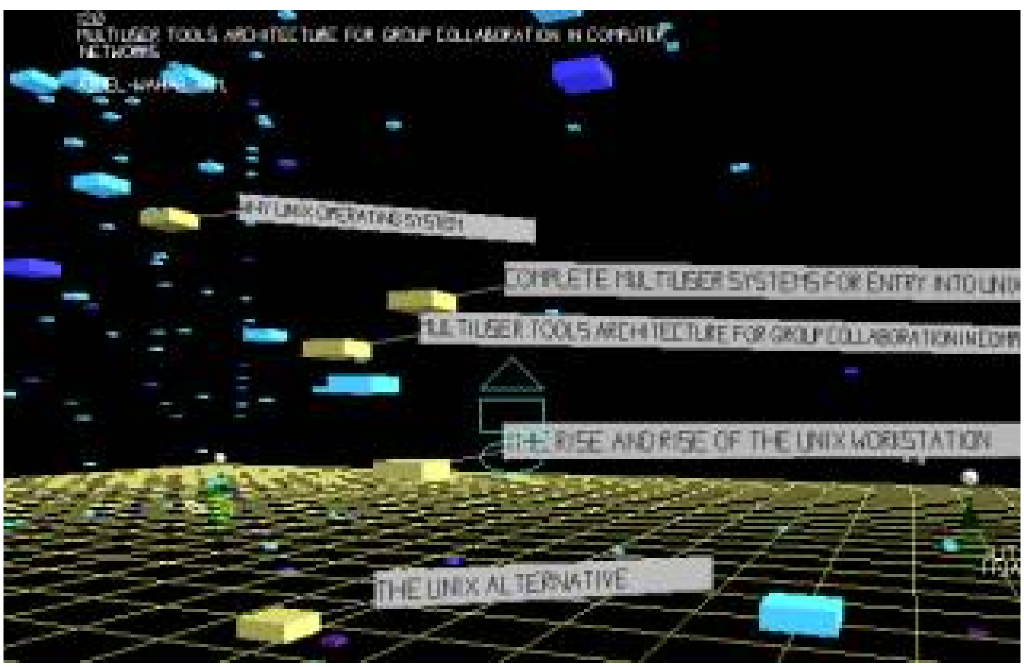

Image 14. Populated Information Terrains (PITS), an information visualisation technique, by Dave Snowdon, Steve Benford, University of Nottingham. Used with permission.

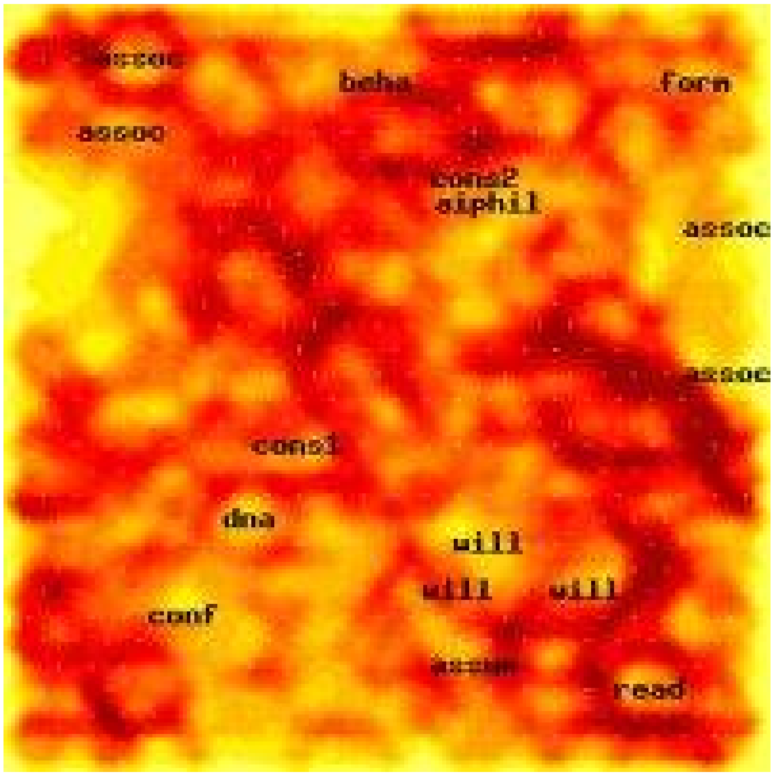

Image 15. WEBSOM document map of a Usenet newsgroup, by the Neural Networks Research Centre, Helsinki University of Technology, Finland. Used with permission.

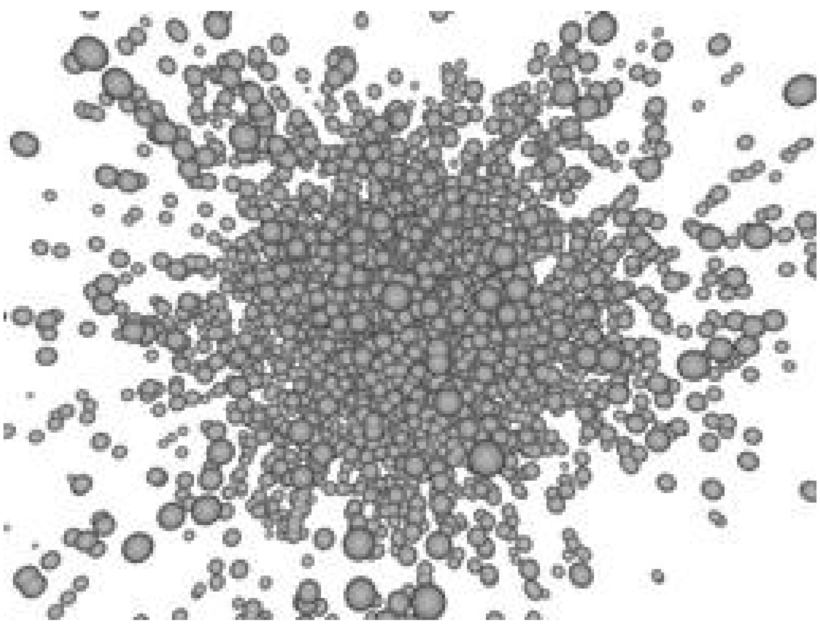

Image 16. Mapping the structure and performance of the Internet © 2001, Stephen Coast. Used with permission.

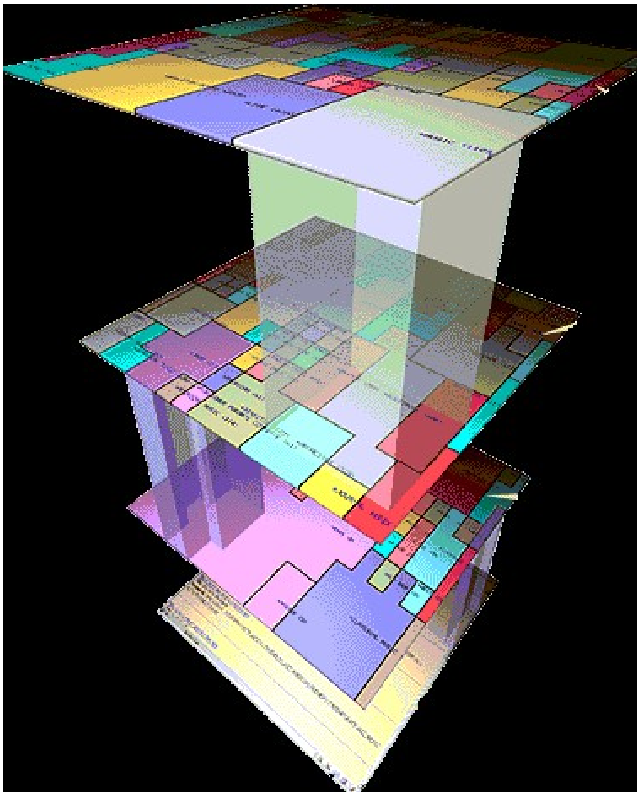

Image 17. ET-Map - a multi-level category map of the information space of over 100,000 entertainment related Web pages listed by Yahoo!, by Hsinchun Chen, at the Artificial Intelligence Lab, University of Arizona, USA. Used with permission.

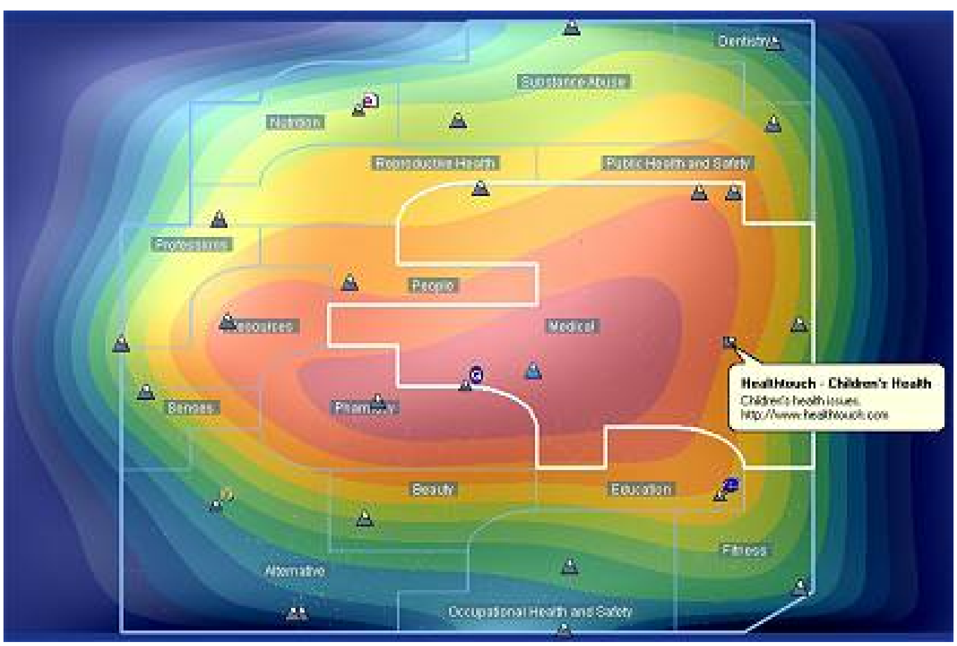

Image 18. WebMap, an interactive, multi-level visual directory that maps 2 million plus web sites. Used with permission.

Image 19. A 3D cityscape view of the Web generated by Map.Net. Used with permission.

Image 20. "Data Upload" sequence from the film Johnny Mnemonic (Tristar Pictures, 1995), by C.O.R.E. Digital Pictures © 1995. Used with permission.

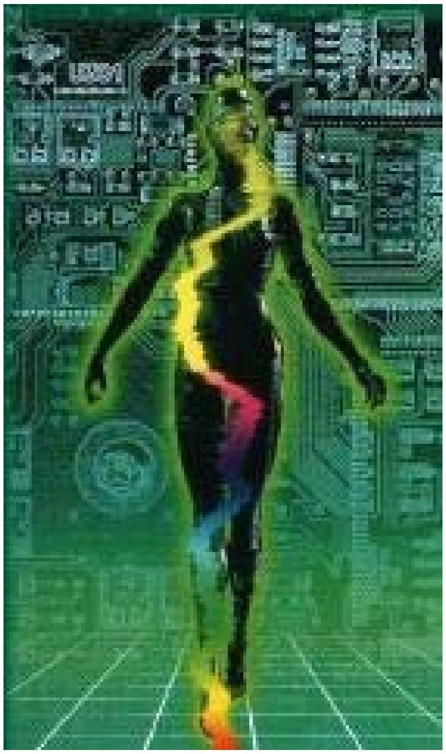

Image 21. An artistic rendition of the body in cyberspace.

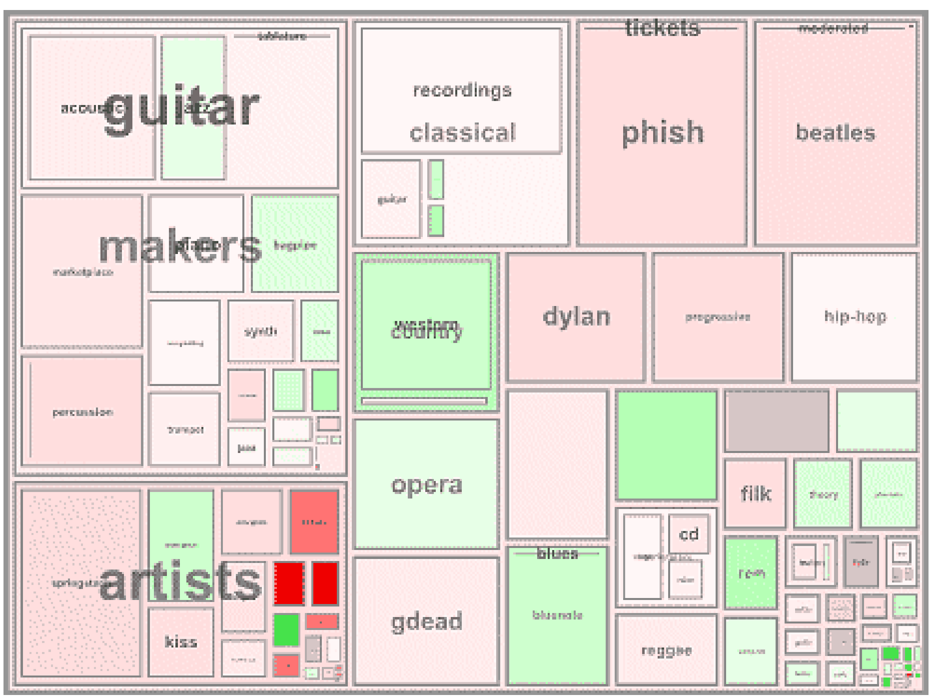

Image 22. A map of USENET newsgroups from the Netscan project at Microsoft Research, Andrew Fiore and Marc Smith. © 1998-2005, Microsoft Corporation. Used with permission.

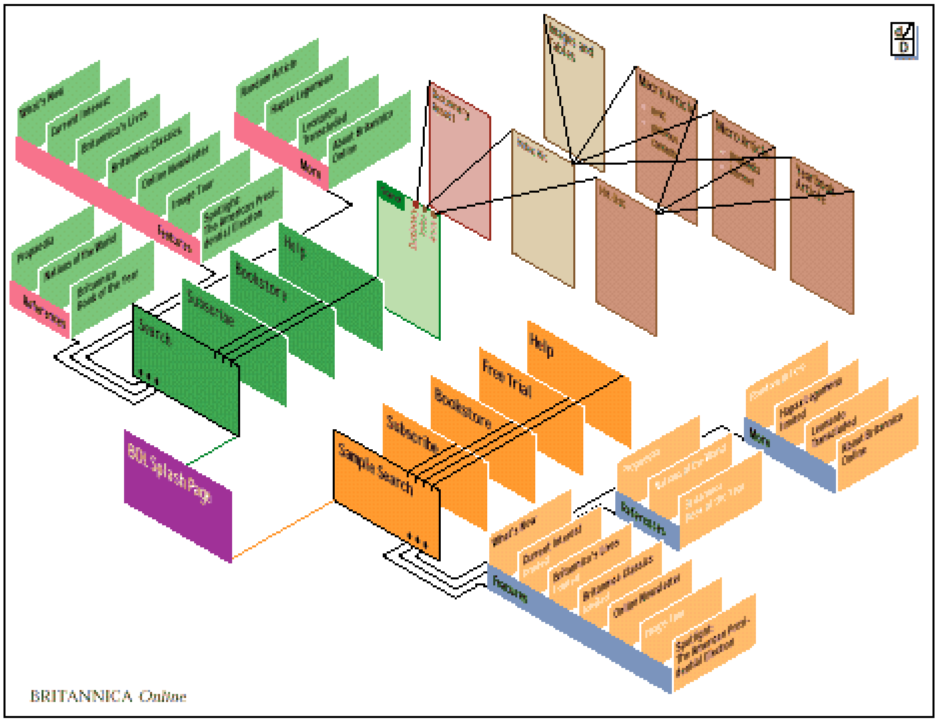

Image 23. Mapping of the Britannica Online website, by Dynamic Diagrams Inc. Used with permission.

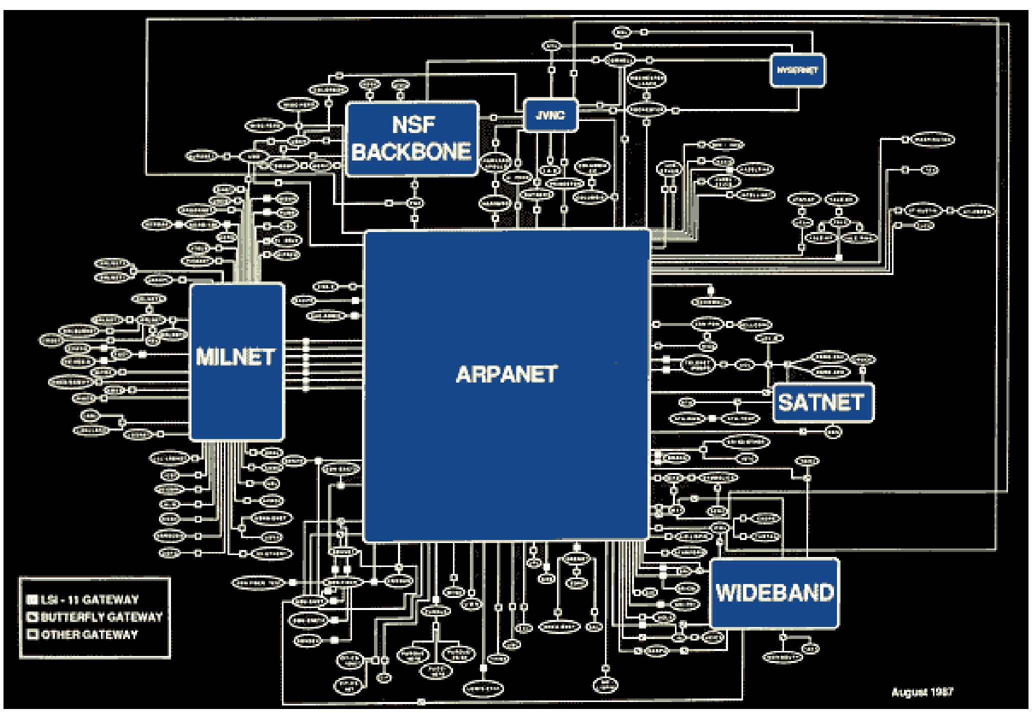

Image 24. Map of the core of the Internet in August 1987, by Craig Partridge. Used with permission.

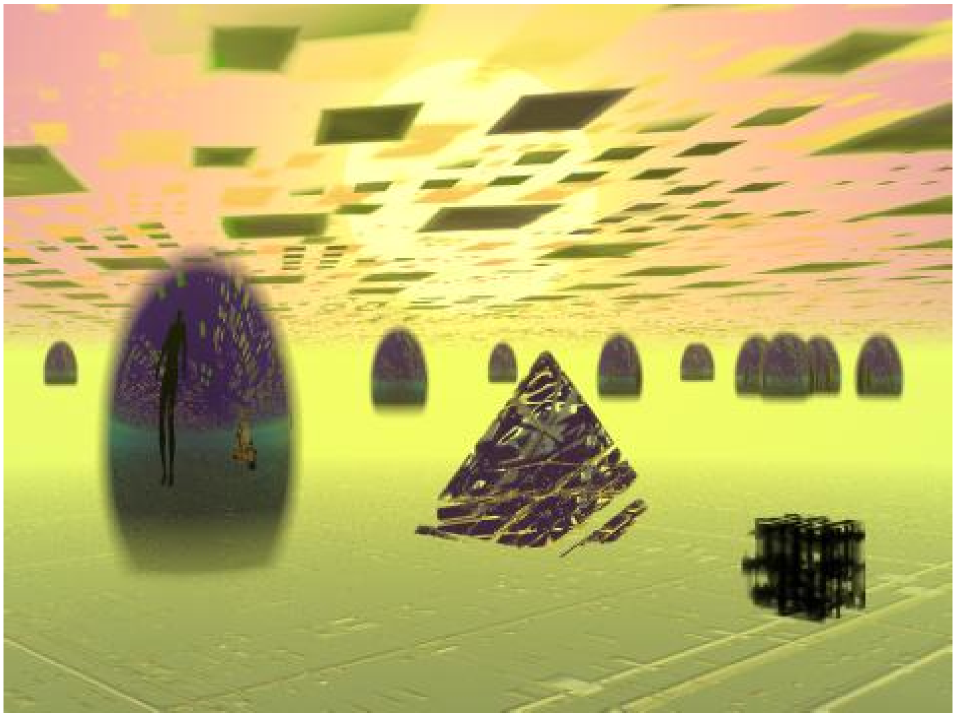

Image 25. 3D science fiction rendition of cyberspace.

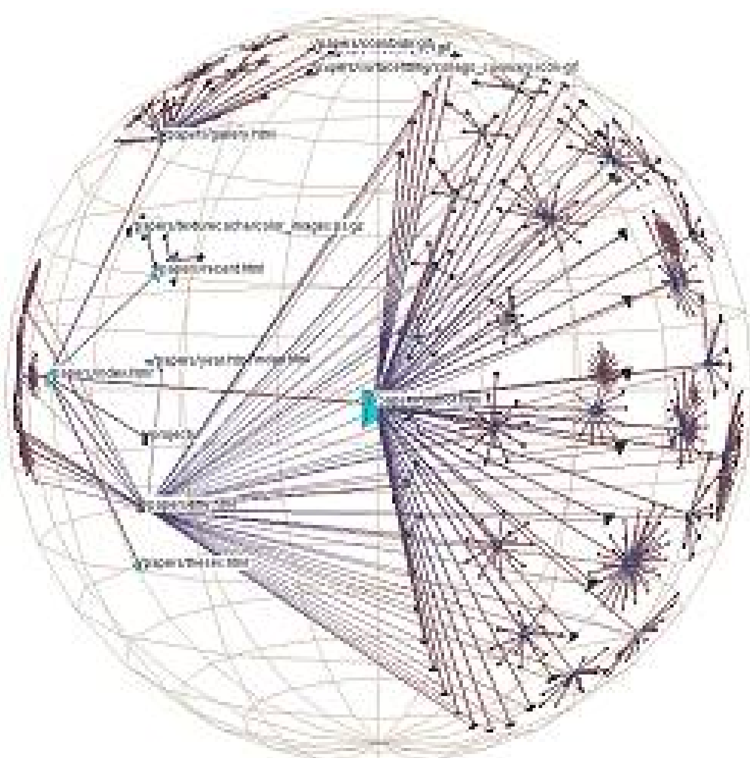

Image 26. Visualising the link structures of the WWW, by Tamara Munzner. ©1995, Association for Computing Machinery, Inc. Used with permission.

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[Image 15]. Retrieved February 12, 2003, from http://www.cybergeography.org/atlas/info_maps.html

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[Image 20]. Retrieved February 12, 2003, from http://www.cybergeography.org/atlas/artistic.html

[Image 21]. Retrieved February 12, 2003, from http://lordrob.home.att.net/cyberspace.jpg

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APPENDIX 9.2: TEXT CONCOURSE

1	It would probably look like a big Venn diagram; each topic would be a circle and within each circle you would have many pages so there would be overlapping circles.
2	I imagine the Internet as a big city; individual websites are grouped together in grids of city blocks. Important sites that are linked to many other sites are skyscrapers whereas houses represent sites that have the least importance or popularity.
3	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
4	I can't imagine the Internet. It is such a complex thing that has no parallel to anything else. The Internet just is.
5	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
6	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.
7	I imagine it as a map; regions on the map are like major categories. If you click on a region, you see hundreds of thousands of subject categories and millions of websites.
8	The Internet is a massive interlinked thing; it is a web of webs.
9	It is an urban landscape of skyscrapers of pulsing information and computer circuitry.
10	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or the pages being grouped according to content.
11	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
12	I see it as structured lines, like the information travelling down the wires.

13	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.
14	The Web is just these monstrous computers holding vast amounts of information just like a big hard drive.
15	It's a mass of coloured lines, like a ball of string.
16	It is just unique; a complex, interlinking entity.
17	The Internet is like a nervous system. It has a central spinal cord where all the information is controlled and where it comes from. Then, the information is sent like nerve signals back and forth in all different directions.
18	I imagine it as a more ethereal abstract thing that plucks bits of information out of the atmosphere.
19	It has a chaotic randomness like pixels in the sky, which is always changing, growing and morphing.
20	It's like leafing through a filing cabinet. You look for the information and pull out the file, look through it and if it's got what you want you photocopy it and if not, you put it back and try another drawer.
21	I see it as a number of layers; your top layers feed into or distribute to lower levels. It's like a complex tree diagram breaking down from the top.
22	It's a train network where you can see all the routes and the stations; the station is where you pick up the information, the rail tracks form branches where you can go along each track and search for information.
23	It's just a maze because there is no beginning and no end and it's totally interconnected.
24	The Internet is just a current of information in electrical form; like blue or green lights shooting down the wires.
25	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
26	It would be like a tree diagram; the bottom of the trunk would be your home page and then it would spark off to different websites, or different pages within a website. It would keep branching out as far as it could.

Table A9.2.1. Twenty six Text Q sample items

APPENDIX 9.3: CPQ OMISSIONS

The purpose of the third pilot was to test the Characteristic Profile Questionnaire. Feedback from participants indicated the need to omit some questions (based on wording, order and/or redundancy) from the following questionnaire sets.

Internet Attitude Scale (Nickell & Pinto, 1986)

'The Internet will never replace human life'
'People are becoming slaves to the Internet'
'Soon our lives will be controlled by the Internet'
'The overuse of the Internet may be harmful and damaging to humans'
'The Internet is lessening the importance of too many jobs done now by humans'
'The Internet's complexity intimidates me'
'The Internet will replace the working human'
'The Internet is bringing us into a bright new era'
'Soon our world will be run by the Internet'
'Life will be easier and faster with the Internet'

Table A9.3.1. Items omitted from Nickell and Pinto's (1986) Internet Attitudes Scale

GVU Tenth WWW User survey (1998)

Technical	How often do you browse with images/pictures turned off?
	Which cookie policies do you primarily use when browsing?
	Approximately how many items do your Favourites/Bookmarks contain?
Internet Problems	It costs too much
	Encountering pages with bad HTML
	Getting errors from pages that use Java, JavaScript, ActiveX, etc.
	Having problems with my browser
	Too many 'junk' sites
	Advertising banners that take too long to load

Table A9.3.2. Questions omitted from GVU survey (1998)

APPENDIX 10.1: ETHICAL CONSIDERATIONS

The topic of this research is not particularly sensitive; it is not likely to offend, cause embarrassment or distress and there are no threats to self-esteem or to values. Therefore, the problems of ensuring that only certain participants complete the research (for example, those over 18) are not applicable. This is an especially important consideration in Internet research; it is often difficult for researchers to know with certainty relevant characteristics of their participants for determining potential risks.

Furthermore, as the research topic is not sensitive, there are no known potential risks or adverse effects which might be incurred from participating in the research. Accordingly, it was not necessary to inform participants of any risks that may have influenced their willingness to participate. Similarly, issues of deception were not applicable to this study. Participants were explicitly directed to read the information on the website explaining the purpose of the study. Participation was voluntary; participants were given the opportunity to contact the researcher (via email) for any further information before participating in the study.

As a further measure to ensure well being, respondents had to consent to their participation prior to starting the study. After reading the appropriate introductory blurb on the research website, participants were directed to a separate web page outlining the terms of participation (see Figure A10.1.1 below). The terms stated their rights of confidentiality and anonymity, and the right to withdraw at any time and for any reason. They were given further opportunity to contact the researcher if they needed further information. The website was configured so that participants had to agree to these terms before submitting any data. By confirming the individual's consent to participate, these important ethical considerations were maintained.

A particular advantage of the online data collection method was that it effectively allowed participants to anonymously submit their data; they were not asked to provide an email address or names. Although the emailed data did record Internet Protocol (IP) addresses, it only records the location of the computer used, not the participants' private details. In sum, participants were made aware of the level of confidentiality to be expected, and this research was designed to ensure that this was maintained. Following the completion of the survey, full information was provided retrospectively about the aims, rationale and outcomes of the research to those who requested it.

By participating in this study, you are agreeing to the following terms and conditions:

I agree that:

- I have received enough information about the study. If not, click here.
- I have had an opportunity to ask questions about the study.
  If not, email me.
- I have received satisfactory answers to any questions. If not, email me.

I understand:

- That my participation in the study will involve answering questionnaires and judging images/textual statements
- That I am taking part on a voluntary basis
- That I will remain anonymous and my answers will be confidential
- That I have the right to withdraw from the study at any time

I agree to take part in this online study **Click here**
I disagree with these terms and conditions **Click here**

Figure A10.1.1. Research website consent form

APPENDIX 10.2: NEWSGROUP POSTING MESSAGE

How do you envision cyberspace?

Perhaps you see it as an urban landscape of skyscrapers of pulsing information and circuitry? Perhaps a multi-dimensional string puzzle emanating through a hierarchy of levels? Or a dynamic, amorphous, gaseous cloud?

Find out by participating in my online research - www.cyberviz.co.uk

Participation only takes 10-15 minutes. You complete a brief questionnaire and a fun interactive puzzle using images or descriptions of the Internet.

What's the study all about?

Humans often use mental representations to function in everyday life; calculating sums in the head, giving or following directions, for instance. Our mental representations are a powerful tool for understanding abstract ideas that cannot be easily expressed. This is especially important when people use the Internet, for it is a space that is hard to comprehend. Whilst searching for information, users often do not know where they are in the information space and do not remember how to get there. Users create a representation in the 'mind's eye' which helps them navigate the world of online information. However, the type of representation adopted will drastically affect the success with which users are able to understand and use the Internet.

Researchers have a key role to play in identifying how users mentally visualise the Internet. If we can understand how these create an image in the mind of the viewer we are well placed to design a more effective Internet. By investigating Internet representations, my research will help users, service providers and analysts comprehend the various spaces of online information, providing understanding and aiding navigation. This research will have a significant educational value by making complex spaces comprehensible. Interested? Go to www.cyberviz.co.uk.

Appendix 10.3: Example Email Messages

To selected email lists:

My name is Amy Hogan and I am a Ph.D. student at the University of Bath. My research investigates how users mentally visualise the Internet. I would very much like you to participate in my online study - www.cyberviz.co.uk. Participation only takes 10- 15 minutes and involves completing a fun, interactive puzzle using images or descriptions of the Internet. Find out a bit more about it below, or go directly to www.cyberviz.co.uk

How do you envision cyberspace?

Perhaps you see it as an urban landscape of skyscrapers of pulsing information and circuitry? Perhaps a multi-dimensional string puzzle emanating through a hierarchy of levels? Or a dynamic, amorphous, gaseous cloud?

Find out by participating in my online research - www.cyberviz.co.uk

What's the study all about?

Given the emergence of the Internet as critical infrastructure upon which businesses, organisations, institutions and consumers rely on its proper functioning, it is increasingly important for cyberspace to be understood. The explosive growth of the Internet calls for the need to organise, filter, and present information in ways which allow users to cope with the sheer quantities of information available. The Internet's hypertextual, abstract nature is unfamiliar to most; it is a space that is difficult to comprehend and mentally visualise. Visual metaphors are employed when users try to make sense of this foreign environment by describing the unfamiliar in terms of the familiar. In doing so, the technology is made meaningful.

My research will illustrate the many ways cyberspace is being envisioned by users of this online service. By combining pictorial representations and Q-Methodology, my research examines how these visualisations have important consequences for ways in which users relate to, interact with and understand cyberspace. I aim to investigate how such knowledge will help users, service providers and analysts to comprehend the various spaces of online information, providing understanding and aiding navigation. This research has significant educational value by making complex spaces comprehensible.

Go to www.cyberviz.co.uk.

Thank you.

Amy Hogan

To the random bulk email lists:

Participate in my online research about the INTERNET.

Go to www.cyberviz.co.uk to find out how YOU visualise cyberspace.

Participation only takes 10 or so minutes. You complete a brief questionnaire and a fun interactive puzzle using images or descriptions of the Internet.

How do you envision cyberspace?
Perhaps you see it as an urban landscape of skyscrapers of pulsing information and circuitry? Perhaps a multi-dimensional string puzzle emanating through a hierarchy of levels? Or a dynamic, amorphous, gaseous cloud?

Find out by participating in my online research - www.cyberviz.co.uk

What's the study all about?

Humans often use mental representations to function in everyday life; for instance, calculating sums in the head, giving or following directions. Our mental representations are a powerful tool for understanding abstract ideas that cannot be easily expressed. This is especially important when people use the Internet, for it is a space that is hard to comprehend. Whilst searching for information, users often do not know where they are in the information space and do not remember how to get there. Users create a representation in the 'mind's eye' which helps them navigate the world of online information. However, the type of representation adopted will drastically affect the success with which users are able to understand and use the Internet.

Researchers have a key role to play in identifying how users mentally visualise the Internet. If we can understand how these create an image in the mind of the viewer we are well placed to design a more effective Internet.

By investigating Internet representations, my research will help users, service providers and analysts comprehend the various spaces of online information, providing understanding and aiding navigation. This research will have a significant educational value by making complex spaces comprehensible. Interested?

Go to www.cyberviz.co.uk.

Thank you

Amy Hogan

APPENDIX 10.4: CHARACTERISTICS PROFILE QUESTIONNAIRE

Age ________________ **Gender** *Male* *Female* *Rather not say*

Highest level of education completed
GCSE (or equivalent)
A Level (or equivalent)
Diploma (or equivalent)
University Graduate
Masters Degree
Doctoral Degree
Professional Degree

1.	**How many years/months have you been using the Internet?**	__________________							
1a.	**How many hours a day do you spend using the Internet at WORK/SCHOOL?**	*None*	*< 30 mins*	*30min–1hr*	*1-3 hours*	*3-5 hours*	*5-8 hours*	*> 8 hours*
1b.	**How many hours a day do you spend using the Internet at HOME?**	*None*	*< 30 mins*	*30min–1hr*	*1-3 hours*	*3-5 hours*	*5-8 hours*	*> 8 hours*
1c.	**In total, how many hours per week do you spend using the Internet?**	*None*	*1-5 hrs*	*6-10 hrs*	*11-15 hrs*	*16-20 hrs*		
		21-25 hrs	*26-30 hrs*	*31-35 hrs*	*36-40 hrs*	*> 40 hrs*		

2. What do you primarily use the Internet for? (Please check all that apply)

Education	☐
Shopping	☐
Entertainment	☐
Work/Business	☐
Communication with others	☐
Gathering information	☐
Wasting time	☐
Other	☐

3. How often do you use the following each week?

Email	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*
Chat	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*
Newsgroups	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*
Online games	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*
Sex sites	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*
Shopping	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*
Downloading music	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*
Online Banking	*Never*	*Rarely*	*Sometimes*	*Often*	*Very Often*

4. **Which of the following have you done? For the tasks you have done, rate how capable you felt doing these.**

Ordered a product/service by filling out a form on the Web	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Made a purchase online for more than £100	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Created a Web page from scratch using an HTML editor	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Customised a Web page for yourself (e.g. using Geocities)	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Changed your browser's 'startup' or 'home' page	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Changed your 'cookie' preferences	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Participated in an online chat or discussion (not including email)	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Listened to a radio broadcast online	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Made a telephone call online	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Used an online directory to find an address / telephone number	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Taken an online class	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Sent a fax online	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Used streaming audio over the Internet	□	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*

Used video conferencing over the Internet	☐	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Used digital signature / ID cards	☐	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Used technologies such as Java, Shockwave, Applets	☐	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Downloaded software from the Internet	☐	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Transferred files between servers	☐	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
Completed an online survey	☐	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*

5. What types of information do you search for? (Please check all that apply)

Commercial Products / Services ☐

Health ☐

Financial ☐

Job / Home listings ☐

Reference material ☐

Other ☐

6a.	**To what extent do you use the Internet to search for specific information?**	*Never*	*Seldom*	*Sometimes*	*Mostly*	*Always*
6b.	**To what extent do you use the Internet to browse for general information?**	*Never*	*Seldom*	*Sometimes*	*Mostly*	*Always*
6c.	**To what extent do you use the Internet to just explore?**	*Never*	*Seldom*	*Sometimes*	*Mostly*	*Always*

7. **Out of 100%, estimate the percentage of the total time on the Internet spent:**

__________ *% Searching for specific information*

__________ *% Browsing for general information*

__________ *% Exploring*

(The 3 boxes should total 100)

8. **Think of an example when you were searching the Internet for specific information.** Describe in detail what you did to find what you wanted (not what but HOW you found the info). Open ended response

9. **Think of an example when you were browsing the Internet for general information.** Describe in detail what you did to find what you wanted (not what but HOW you found the info). Open ended response

10. **Think of an example when you were exploring the Internet just for fun.** Describe in detail what you did to find what you wanted (not what but HOW you found the info). Open ended response

11. **What do you find is the biggest problem using the Internet? (Please check all that apply)**

- Not being able to find the information I am looking for ☐
- Not being able to efficiently organise the information I gather ☐
- Not being able to find a page I know is out there ☐
- Not being able to return to a page I once visited ☐
- Not being able to determine where I am ☐
- Not being able to visualise where I have been and where I can go ☐
- It takes too long to view/download pages ☐
- Sites that require me to register with them ☐
- Encountering links that do not work ☐

Encountering sites that want me to pay to access information	□
Sites that are not compatible with all browsers	□
Sites with too many graphics or useless graphics	□
Other	□

12. Use these criteria for the next question:

Novice	Uses step by step instructions, usually needs some guidance
Intermediate	Uses basic and default features of a few Internet resources
Advanced	Uses more powerful features of many Internet resources
Expert	Has detailed knowledge of most Internet resources

Please select your skill level based on the above scale *Novice* *Intermediate* *Advanced* *Expert*

13. How frequently have you used the Internet instead of the following activities in the *past 6 months*?

Instead of watching TV?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*
Instead of talking on the phone?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*
Instead of sleeping?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*
Instead of exercising?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*
Instead of reading?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*
Instead of going to the movies?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*

Instead of going out / socialising?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*
Instead of doing household work?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*
Instead of working?	*Daily*	*Weekly*	*Monthly*	*< Once month*	*Never*

14.	**To what extent has the Internet become a part of your everyday life?**	*Not at all*	*Not very much*	*A little*	*Quite a bit*	*Completely*

15a.	**How capable do you feel using computers, in general?**	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
15b.	**How capable do you feel using the Internet?**	*Very Capable*	*Somewhat Capable*	*Neither un/capable*	*Somewhat Uncapable*	*Very Uncapable*
15c.	**How satisfied are you with your current skills for using the Internet?**	*Very Satisfied*	*Somewhat Satisfied*	*Neither un/ satisfied*	*Somewhat Unsatisfied*	*Very Unsatisfied*
16a.	**How easy is the Internet to use?**	*Very Easy*	*Somewhat Easy*	*Neither un/easy*	*Somewhat Uneasy*	*Very Uneasy*
16b.	**How easy is it to become skilful at using the Internet?**	*Very Easy*	*Somewhat Easy*	*Neither un/easy*	*Somewhat Uneasy*	*Very Uneasy*
16c.	**How easy is it to interact with the Internet?**	*Very Easy*	*Somewhat Easy*	*Neither un/easy*	*Somewhat Uneasy*	*Very Uneasy*

17. **Rate the following statements according to how strongly you dis/agree with them.**

The Internet is an efficient way of getting information	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
I feel intimidated by the Internet	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet is responsible for many of the good things we enjoy	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*

There are unlimited possibilities of Internet applications	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet is frustrating to work with	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet can eliminate a lot of tedious work	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet is dehumanising to society	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet is enhancing our standard of living	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The disadvantages of the Internet outweigh its advantages	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet helps me create new ideas	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet helps me put new ideas into action	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*
The Internet makes me uncomfortable because I don't understand it	*Strongly Agree*	*Agree*	*Neither dis/agree*	*Disagree*	*Strongly disagree*

18a.	**To what extent do you understand the Internet?**	*Completely understand*	*Mostly understand*	*Somewhat understand*	*Few things I understand*	*Nothing I understand*
18b.	**To what extent do you understand the terms used to describe the function/components of the Internet?**	*Completely understand*	*Mostly understand*	*Somewhat understand*	*Few things I understand*	*Nothing I understand*

19. Give a description of what you think the Internet is ... Open ended response

20. Complete the following statements ...

When I think of the Internet, I think of ... Open ended response

The Internet is like a.... Open ended response

21a. Think about sitting in front of your computer. You are about to access the Internet. Rate how clear your thoughts are when thinking about ...

The shape and size of the Internet	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*
How it is structured	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*
How it is linked	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*
How information is retrieved and shared	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*

21b. You are searching the Internet for specific information. Rate how clear your thoughts are when thinking about ...

Going to your home page	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*
The search engine	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*
Accessing the information	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*
Continuing your search for information	*Perfectly clear and vivid*	*Clear and reasonably vivid*	*Moderately clear and vivid*	*Vague and dim*	*No image at all*

22a.	**When thinking about the above scenarios, your thoughts were mainly ...**	*Pictures*	*Words*	*Mix of pics/words*	*Sounds*	*Smells*	*Tastes*
22b.	**On the whole, you tend to think in ...**	*Pictures*	*Words*	*Mix of pics/words*	*Sounds*	*Smells*	*Tastes*
22c.	**Which do you find more intuitive / easier to understand?**	*Pictures*	*Words*	*Mix of pics/words*	*Sounds*	*Smells*	*Tastes*
	Why? Open ended response ______						
22d.	**Do you use different senses when thinking about different things?**	*Yes*	*No*	*Don't Know*	*It depends*		
	Give some examples … Open ended response ______						

APPENDIX 10.5: MODIFICATIONS TO THE RESEARCH WEBSITE

The following small modifications were made to the research website during data collection.

Q sort and questionnaire order

The website was initially constructed so that participants completed the CPQ first. After that, they had the choice whether they wished to complete an image or text Q sort. However, at first, most of the responses received were the CPQ only; participants were not completing the Q sorts. Given that the CPQ-only data could not be included in the analysis, it was imperative that the website design be changed to overcome this issue. Approximately one month after the data collection began, the website was changed so that respondents were asked to complete a Q sort first (they were still given the choice as to which type of Q sort) and then the CPQ second. Table A10.5.1 indicates that this change decreased the number of participants completing the CPQ only by 50%.

Questionnaire Only Responses	***n***	***%***
Pre-sequence change	86	78%
Post-sequence change	24	22%
Total	110	100%

Table A10.5.1. The rate of CPQ-only responses pre- and post- website changes

Interestingly, the change in sequence did not have any significant effect on whether participants completed a Q sort only ($\chi^2(1, N = 29) = 0.003$, $p \leq 0.958$). As Table A10.5.2 indicates, the number of participants only completing a Q sort (text or image) remained fairly consistent regardless of whether they completed this task first or second[63].

[63] See Appendix 10.6 for the examination of whether the order of completion of the Q sort and CPQ affected the resultant emergent factors.

	Image Q sort only (n)	**Text Q sort only (n)**
Pre-sequence change	5	6
Post-sequence change	8	10
Total	13	16

Table A10.5.2. The effects of pre- and post- website changes on choice of Q sort

Q sort counterbalancing

A second modification was implemented half-way through data collection. A counterbalancing measure was introduced in order to ensure an equal distribution of participants completing each type of Q sort. For the first half of the study, the image Q sort choice was presented first, followed by the text Q sort. Accordingly, the majority of received responses were image Q sorts and only a few people were completing the text Q sorts.

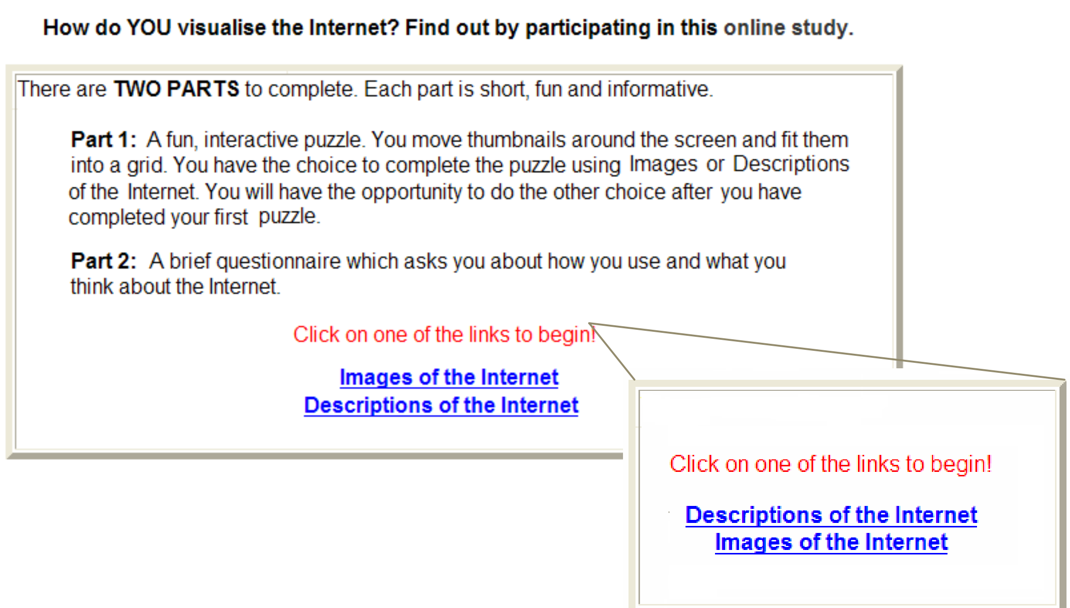


Figure A10.5.1. Change of link order

Approximately half-way through the data collection, the order of the links was changed so that the text choice was displayed first (see Figure A10.5.1). Consequently, a greater number of text Q sort responses were received, resulting in an almost equal distribution between the two media (Image Q sort $N = 114$, Text Q sort $N = 106$).

Code streamlining

The final website modification focussed on making the Q sort easier to complete. During the data collection period, participants indicated that they were dissuaded from completing the survey as their slower Internet connection meant it was taking too long to load the graphical elements. In order to overcome this, the graphics were rescaled and the html code cleaned up, making the load time faster. In case respondents still had problems with a slow Internet connection, a second link was added to the Q sort pages (see Figure A10.5.2). This allowed participants to open a new browser window and complete the CPQ whilst waiting for the graphics on the Q sort page to load.

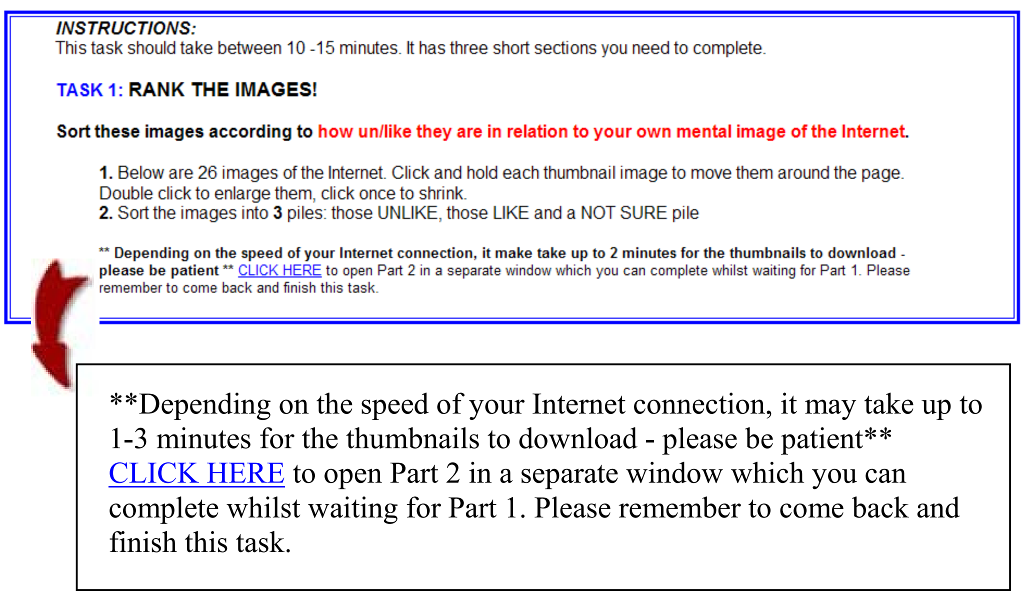


Figure A10.5.2. Website modification to enable concomitant completion

APPENDIX 10.6: ORDER ANALYSES

This appendix examines whether the order of completion of certain components in the research had any effect on the resultant emergent factors. The first section analyses whether the changes to the website impacted the results. The second section examines the data from the Dual participants to see whether completing an Image or Text Q sort first had any effect on their results. The final section discusses the implications of these findings.

IMPACT OF WEBSITE MODIFICATIONS ON ORDER OF COMPLETION

Recall from the Method Chapter that at the beginning of the data collection period, participants were not fully completing the study by only submitting the characteristics profile questionnaire and not completing either of the Q sort tasks. Consequently, the research website was changed so that respondents were asked to complete a Q sort first and then the questionnaire second.

This means that a certain proportion of participants completed the Characteristics Profile Questionnaire first and thus was able to enunciate their ideas prior to being exposed to the Q sample. The latter proportion of participants however, completed the Q sort task first and CPQ second. It is important to examine therefore, whether there are any 'priming' or 'contamination' issues that lead participants to respond in certain ways.

TEXT ORDER ANALYSIS

Order was calculated by the date/time the responses were received via email[64]. Table A10.6.1 indicates that 35% of participants completed the characteristics profile questionnaire (CPQ) first, followed by the Text Q sort. The majority (65%)

[64] Although the date/time was utilised to calculate the order of submission, this is not a completely accurate indication of which section was completed first. It is possible that the Q sort and demographic questionnaire could have been completed concomitantly and merely submitted in a random order. This is because the research website was set up so that whilst participants were waiting for the graphics on the Q sort pages to load, they could at least begin on the demographics questionnaire. It was hoped that this would maximise the number of participants completing the study – gaining those who were dissuaded from participating by long load times.

participated after the website changes were implemented and thus completed the Text Q sort first, followed by the CPQ.

	Order	***n***	**%**
Pre-website change	CPQ, Text Q	37	35%
Post-website change	Text Q, CPQ	69	65%
	Total	106	100%

Table A10.6.1. Text Q sorts, Order of completion

In order to analyse the presence of priming effects, a super-order factor analytic process is necessary.

Firstly, the text sample (*N* = 106) will be divided into 'CPQ First' and 'Text Q sort First' groups (*n* = 37 and *n*= 69 respectively). The individual Q sorts within each group will be factor analysed; this will generate idealised 'prototype' sorts based on whether the questionnaire or Q sorting task was completed first. These emergent factors will then be factor analysed again to examine the relationships between them. This will indicate whether different factors emerge as a function of order of completion. Note that, for each of the individual factor analyses outlined below, the number of factors extracted is decided upon by determining the solution that yields the least number of confounding sorts, the least number of participants which do not load on any factor and maximising the number of highly significant loadings onto each factor.

'CPQ First' Group

The 37 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors. The two factors accounted for 48% of the variance; factor 1 for 34% and factor 2 for 16%. The first factor was defined by 19 of the 37 Q sorts; the second by 11 of the 37 Q sorts. Three sorts were confounded (see Table A10.6.2).

Respondent ID	Factor 1	Factor 2
1	0.29	-0.08
2	0.03	0.27
3	0.05	**0.72X**
4	0.10	**0.59X**
5	0.26	0.35
6	0.45	0.49
7	-0.31	**0.63X**
8	**0.51X**	0.01
9	**0.59X**	-0.24
10	0.43	**0.67X**
11	**0.72X**	-0.32
12	**0.63X**	0.00
13	**0.57X**	0.30
14	0.29	**0.45X**
15	**0.69X**	0.08
16	-0.04	**0.62X**
17	**0.44X**	0.28
18	**0.71X**	-0.07
19	0.33	**0.68X**
20	**0.53X**	-0.03
21	0.34	-0.46
22	**0.78X**	0.20
23	0.02	**0.69X**
24	**0.61X**	-0.08
25	**0.56X**	-0.03
26	**0.63X**	0.22
27	**0.74X**	0.15
28	-0.06	-0.30
29	**0.46X**	-0.14
30	**0.66X**	-0.26

31	0.40	**0.67X**
32	**0.46X**	0.18
33	-0.40	0.35
34	-0.19	**0.53X**
35	0.30	**0.66X**
36	**0.76X**	0.01
107	**0.67X**	-0.15

Table A10.6.2. Defining sorts for 'CPQ First' Factor Analysis

'Text Q First' Group

The 69 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors. The two factors accounted for 40% of the variance; factor 1 for 25% and factor 2 for 15%. Table A10.6.3 indicates that the first factor was defined by 21 of the 69 Q sorts; the second by 18 of the 69 Q sorts. Eleven sorts were confounded.

Respondent ID	Factor 1	Factor 2
37	**0.40X**	0.18
38	0.45	-0.31
39	0.43	0.48
40	0.26	-0.05
41	-0.03	0.27
42	0.29	0.02
43	0.08	**0.68X**
44	0.37	-0.44
45	-0.01	**0.39X**
46	**0.57X**	0.08
47	**0.54X**	0.25
49	0.15	**0.56X**
50	0.52	-0.34
51	**0.44X**	0.16

52	0.29	**0.53X**
53	**0.71X**	-0.02
54	**0.47X**	0.10
55	0.15	**0.58X**
56	0.37	0.39
57	0.21	**0.61X**
58	0.31	**0.71X**
59	**0.66X**	0.33
60	**0.65X**	-0.36
61	**0.53X**	0.25
62	**0.38X**	-0.08
63	**0.61X**	-0.15
64	0.53	0.37
65	**0.48X**	-0.12
66	0.04	**0.60X**
67	-0.06	-0.02
68	0.33	0.47
69	-0.21	0.08
70	0.01	0.33
71	0.05	0.35
72	0.04	**0.43X**
73	0.38	**0.62X**
74	0.24	0.12
75	0.38	0.08
76	0.00	**0.58X**
77	**0.58X**	0.11
78	**0.63X**	-0.16
79	**0.69X**	0.08
80	-0.03	**0.66X**
81	0.19	-0.10
82	0.23	**0.55X**
83	**0.64X**	0.09

84	0.31	0.36
85	0.51	0.68
86	-0.01	**0.75X**
87	**0.47X**	0.16
88	0.27	0.18
89	0.50	0.58
90	0.43	0.39
91	0.25	0.03
92	0.02	**0.71X**
93	0.13	0.36
94	0.29	0.34
95	**0.46X**	-0.02
96	-0.23	0.26
97	-0.12	0.26
98	**0.58X**	-0.04
99	0.10	**0.59X**
100	0.02	**0.56X**
101	**0.56X**	0.05
102	**0.53X**	-0.04
103	-0.32	-0.09
104	0.04	0.29
105	0.23	**0.59X**
106	-0.11	0.32

Table A10.6.3. Defining sorts for 'Text First' Factor Analysis

Super-order factor Analysis

A total of four factors emerged from the 'CPQ First' and 'Text Q Sort First' groups. These four composite factor arrays were then submitted to the same factor analytic procedure. Using Centroid factor analysis with theoretical rotation, the four factors condensed around two operant super-factors (Table A10.6.4).

Original Factor		I	II
CPQ 1st	1	**0.91X**	0.09
	2	-0.14	**0.82X**
Text Q sort 1st	1	**0.88X**	-0.05
	2	0.31	**0.86X**

Table A10.6.4. Defining sorts for Text Order Super-Factor Analysis

The fact that these four factors clearly and significantly loaded onto two Super-factors indicates that there are only two perspectives operating. In other words, if different factors were in evidence as a function of the order in which participants completed the CPQ and Q sort, more than two super-factors would emerge.

IMAGE ORDER ANALYSIS

As with the Text analysis, order was calculated by the date/time the responses were received via email. Table A10.6.5 indicates that almost equal numbers of participants completed the research in the two submission sequences.

	Order	*n*	*%*
Pre-website change	CPQ, Image Q	54	47%
Post-website change	Image Q, CPQ	60	53%
	Total	114	100%

Table A10.6.5. Image Q sorts, Order of completion

In order to analyse the presence of priming effects, the same super-order factor analytic process as described in the above section will be applied. Firstly, the image sample (N = 114) will be divided into 'CPQ First' and 'Image Q sort First' groups (n = 54 and n = 60 respectively). The individual Q sorts within each group will be factor analysed; this will generate idealised 'prototype' sorts based on whether the questionnaire or Q sorting task was completed first. These emergent factors will then be factor analysed again to examine the relationships between them. This will indicate whether different factors emerge as a function of order of completion

'CPQ First' Group

The 54 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded 2 operant factors. The 2 factors accounted for 42% of the variance; factor 1 for 30% and factor 2 for 12%. The first factor was defined by 29 of the 54 Q sorts; the second by 8 of the 54 Q sorts. Seven sorts were confounded (see Table A10.6.6).

Respondent ID	**Factor 1**	**Factor 2**
1	**0.55X**	0.22
2	0.48	0.25
3	-0.06	**0.71X**
4	**0.80X**	-0.44
5	0.17	**0.49X**
6	0.01	**0.62X**
7	0.14	**0.69X**
8	0.12	**0.73X**
9	**0.53X**	0.16
11	0.47	0.20
12	0.30	-0.08
14	-0.23	**0.59X**
15	**0.84X**	-0.12
16	**0.86X**	0.03
17	**0.70X**	0.13
18	**0.59X**	0.23
19	-0.55	0.52
20	-0.12	**0.48X**
21	0.39	-0.17

22	**0.64X**	0.23
23	0.40	0.32
24	0.34	0.05
25	**0.82X**	0.17
26	**0.70X**	-0.13
27	**0.58X**	-0.25
28	**0.56X**	0.29
29	-0.26	0.16
30	**0.69X**	0.12
32	**0.71X**	-0.15
33	**0.77X**	-0.14
34	**0.52X**	0.10
35	-0.32	0.50
36	**0.77X**	-0.22
37	0.50	-0.51
38	0.12	-0.46
39	0.30	0.38
40	**0.63X**	0.29
41	**0.63X**	0.10
42	**0.79X**	-0.16
43	**0.67X**	0.02
44	0.42	0.59
45	**0.57X**	-0.12
46	**0.46X**	0.19
47	**0.75X**	-0.16
48	**0.57X**	-0.04
49	-0.27	**0.53X**
50	**0.87X**	0.09
51	-0.23	0.36
52	**0.62X**	0.00
53	0.16	0.33
54	**0.82X**	-0.32

55	**0.66X**	0.22
72	-0.44	0.41
115	-0.19	-0.48

Table A10.6.6. Defining sorts for 'CPQ First' Factor Analysis

'Image Q First' Group

The 60 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded 2 operant factors. The 2 factors accounted for 49% of the variance; factor 1 for 30% and factor 2 for 19%. The first factor was defined by 17 of the 60 Q sorts; the second by 20 of the 60 Q sorts. Eleven sorts were confounded (Table A10.6.7).

Respondent ID	Factor 1	Factor 2
56	**0.70X**	-0.04
57	0.36	0.08
58	0.20	-0.21
59	0.06	**0.53X**
60	0.33	-0.12
61	**0.61X**	0.04
62	0.14	-0.10
63	0.68	0.46
64	0.37	-0.39
65	**0.79X**	0.05
66	**0.55X**	-0.29
67	0.29	-0.03
68	**0.50X**	0.06
69	0.30	**0.66X**
70	0.46	-0.45
71	0.08	0.16
73	-0.09	**0.57X**
74	**0.56X**	-0.13

75	**0.66X**	-0.49
76	0.09	0.16
77	0.46	0.30
78	0.21	**0.67X**
79	0.01	**0.65X**
80	**0.60X**	0.16
81	0.37	0.28
82	-0.29	**0.58X**
83	0.47	0.54
84	0.47	0.45
85	-0.09	**0.68X**
86	0.09	**0.60X**
87	0.49	0.44
88	0.63	0.50
89	**0.55X**	-0.32
90	-0.08	**0.69X**
91	0.52	-0.43
92	0.00	**0.41X**
93	0.08	**0.55X**
94	0.50	0.41
95	-0.28	**0.74**
96	**0.63X**	0.06
97	0.12	**0.70X**
98	**0.76X**	0.07
99	-0.08	**0.57X**
100	**0.71X**	-0.26
101	0.45	0.60
102	-0.37	**0.63X**
103	0.03	**0.75X**
104	**0.51X**	-0.12
105	0.41	0.43
106	0.06	**0.43X**

107	**0.85X**	0.07
108	**0.67X**	-0.26
109	0.21	-0.20
110	0.34	-0.06
111	0.01	0.13
112	0.38	**0.64X**
113	0.00	**0.56X**
114	-0.18	**0.72X**
116	**0.91X**	-0.10
117	**0.71X**	0.17

Table A10.6.7. Defining sorts for 'Image First' Factor Analysis

Super-order factor Analysis

A total of four factors emerged from the two groups. The four composite factor arrays were submitted to the same factor analytic procedure. Using Centroid factor analysis with theoretical rotation, the four factors condensed around two operant super-factors (Table A10.6.8).

Original Factor		**I**	**II**
CPQ 1st	1	-0.22	**0.86X**
	2	**0.79X**	0.12
Image Q sort 1st	1	0.05	**0.92X**
	2	**0.80X**	-0.26

Table A10.6.8. Defining sorts for Image Order Super-Factor Analysis

The fact that these four factors clearly and significantly loaded onto two Super-factors indicates that there are only two perspectives operating. Thus, if different factors were in evidence as a function of the order in which participants completed the CPQ and Q sort, more than two super-factors would emerge.

ORDER OF COMPLETION – DUAL PARTICIPANTS

Chapter 9 examines the data from the twenty-four participants that voluntarily decided to complete both an Image and Text Q sort. Participants had the choice to complete either Q sort first; the only imposed restriction was that the CPQ had to be completed after the first Q sort and before the second. It is therefore pertinent to examine whether completing a Q sort in one particular medium first unduly influenced or 'primed' the responses in the subsequent Q sort.

Order was calculated by the date/time the responses were received via email. Table A10.6.9 indicates that approximately equal numbers of participants completed the two sorts in either sequence of submission.

Order	***N***	***%***
Text Q, CPQ, Image Q	10	42%
Image Q, CPQ, Text Q	14	58%
Total	24	100%

Table A10.6.9. Dual Participant Q sorts, Order of completion

In order to analyse the presence of contamination effects, a super-order factor analytic process is necessary. Firstly, the sample ($N = 24$) will be divided into four groups:

- Text Q sort First ($n = 10$)
- Image Q sort Second ($n = 10$)

- Image Q sort First ($n = 14$)
- Text Q sort Second ($n = 14$)

The individual Q sorts within each group will be factor analysed. The composite factors will then be factor analysed again to examine the relationships between them. This will indicate whether different factors emerge as a function of order of completion.

Text Q sort Analysis

Text Q sorts First

The 10 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors. The two factors accounted for 46% of the variance; factor 1 for 19% and factor 2 for 17%. The first factor was defined by 4 of the 10 Q sorts; the second by 5 of the 10 Q sorts. Only 1 sort was confounded (see Table A10.6.10).

Respondent ID	**Factor 1**	**Factor 2**
Dual 2	**0.72X**	0.14
Dual 3	0.01	**0.51X**
Dual 6	0.41	0.43
Dual 8	0.02	**0.48X**
Dual 12	0.10	**0.64X**
Dual 15	**0.75X**	0.06
Dual 18	**0.60X**	-0.09
Dual 19	0.25	**0.58X**
Dual 21	0.24	**0.48X**
Dual 24	**0.37X**	-0.06

Table A10.6.10. Defining sorts for Dual Participants 'Text First' Factor Analysis

Text Q sorts Second

The 14 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors. The two factors accounted for 39%

of the variance; factor 1 for 26% and factor 2 for 113%. The first factor was defined by 7 of the 14 Q sorts; the second by 4 of the 14 Q sorts. Two sorts were confounded (see Table A10.6.11).

Respondent ID	Factor 1	Factor 2
Dual 1	-1.05	**0.54X**
Dual 4	**0.89X**	-0.16
Dual 7	0.24	**0.63X**
Dual 9	**0.66X**	0.23
Dual 10	-0.23	0.39
Dual 11	0.42	0.33
Dual 13	0.23	**0.48X**
Dual 14	0.34	**0.54X**
Dual 16	**0.86X**	0.20
Dual 17	**0.51X**	0.22
Dual 20	**0.52X**	0.17
Dual 22	0.22	-0.08
Dual 23	**0.37X**	0.05
Dual 25	**0.72X**	0.43

Table A10.6.11. Defining sorts for Dual Participants 'Text Second' Factor Analysis

SUPER-ORDER FACTOR ANALYSIS

A total of four factors emerged from the two Text submission sequences. These four factor arrays were then submitted to the same factor analytic procedure. Using Centroid factor analysis with theoretical rotation, the four factors condensed around two operant super-factors (Table A10.6.12).

Original Factor		**I**	**II**
Text Q sort 1st	1	0.19	**0.91X**
	2	**0.79X**	0.14
Text Q sort 2nd	1	0.23	**0.91X**
	2	**0.79X**	0.13

Table A10.6.12. Defining sorts for Dual Participants Text Order Super-Factor Analysis

The fact that these four factors parsimoniously and significantly loaded onto two Super-factors indicates that there are only two perspectives operating. Once again, if different factors were in evidence as a function of the order in which participants completed the Text Q sorts (first or second), more than two super-factors would emerge.

Image Q sort Analysis

Image Q sorts First

The 14 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors accounting for 42% of the variance; factor 1 for 24% and factor 2 for 18%. Table A10.6.13 indicates that the first factor was defined by 4 of the 14 Q sorts; the second by 3 of the 14 Q sorts. Three sorts were confounded.

Respondent ID	**Factor 1**	**Factor 2**
Dual 1	0.01	0.29
Dual 4	0.58	0.56

Dual 7	-0.05	**0.50X**
Dual 9	**0.77X**	0.04
Dual 10	-0.09	**0.71X**
Dual 11	**0.54X**	-0.14
Dual 13	0.13	**0.70X**
Dual 14	0.61	0.52
Dual 16	0.72	0.57
Dual 17	0.37	0.20
Dual 20	**0.84X**	0.00
Dual 22	0.20	0.27
Dual 23	**0.58X**	-0.41
Dual 25	-0.21	0.03

Table A10.6.13. Defining sorts for Dual Participants 'Image First' Factor Analysis

Image Q sorts Second

The 10 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors accounting for 33% of the variance; factor 1 for 13% and factor 2 for 20%. The first factor was defined by 4 of the 10 Q sorts; the second by 5 of the 10 Q sorts. Only one sort was confounded (Table A10.6.14)

Respondent ID	**Factor 1**	**Factor 2**
Dual 2	-0.01	**0.69X**
Dual 3	0.02	**0.74X**
Dual 6	**0.62X**	-0.25
Dual 8	-0.08	**0.43X**
Dual 12	0.43	0.42
Dual 15	-0.03	**0.62X**
Dual 18	**0.40X**	-0.03
Dual 19	0.02	**0.34X**

Dual 21	**0.64X**	-0.00
Dual 24	**0.43X**	-0.14

Table A10.6.14. Defining sorts for Dual Participants 'Image Second' Factor Analysis

SUPER-ORDER FACTOR ANALYSIS

A total of four factors emerged from the two Image orders. These four factor arrays were factor analysed using Centroid factor analysis with theoretical rotation. The four factors condensed around two operant super-factors (Table A10.6.15).

Original Factor		**I**	**II**
Image Q sort 1st	1	**0.76X**	-0.19
	2	0.31	**0.90X**
Image Q sort 2nd	1	**0.84X**	0.08
	2	-0.29	**0.80X**

Table A10.6.15. Defining sorts for Dual Participants Image Order Super-Factor Analysis

The fact that these four factors clearly and significantly loaded onto two Super-factors indicates that there are only two perspectives operating. If different factors were in evidence as a function of the order in which participants completed the Image Q sorts (first or second), more than two super-factors would emerge.

IMPLICATIONS

It seems therefore that the order in which participants completed both components of the research did not have any significant impact on the resultant factors. Whilst the possibility of carry-over effects cannot be ruled out entirely, this super-order factor analysis indicates that it is unlikely.

Indeed, the issue of contamination is not one that Q Methodology really concerns itself with. In R Methodology, order effects as a potential contaminate would be a threat to the data’s internal and external validity. In experimental designs, researchers seeks to remove ‘noise’ in order to reveal an underlying and absolute truth; biases such as carry-over effects deviate from a participant’s “real opinion”. Thus, it makes sense to examine whether a person's data could have been quite different, if the bias or ‘contamination’ would not have existed.

Q Methodology however does not postulate that an entity to be measured within a certain person exists independent of the measurement process. In other words, perspectives emerge as a direct result of the interaction with the Q sample items. Participants engage in an active reconfiguration of meaning, creating new (and often unanticipated) perspectives to emerge from how they each configure the Q sort. Thus, even if participants who conducted the Q sort as the second component would have sorted differently had they done it as the first component, neither of the two emergent perspectives would be an erroneous or faulty representation of the person's view as it existed at that time and under those specific circumstances. Regardless of the order of completion, the emergent perspectives would nonetheless be an accurate snapshot of the viewpoints that existed at the time of Q sorting.

APPENDIX 11.1: IMAGE Q SORTERS: DESCRIPTIVE STATISTICS

The 114 Image Q sorters are a predominantly young sample, with over 50% being under the age of 24 (note, there is a small faction that is slightly more mature in age). The majority have achieved at least A-Level qualifications. Almost two-thirds of the group have used the Internet anywhere between 5-8 years and accordingly perceive themselves to have advanced Internet skills. On average, they report using the Internet at home and at work up to three hours a day, totalling 21-25 hours of weekly usage (Table A11.1.1).

Basic Demographics	Age	17-19 (35%) 20-24 (20%) 30-39 (20%)
	Gender	Female (58%), Male (42%)
	Highest Qualification	A-Level (47%)
	Years using the Internet	5-6 years (37%) 7-8 years (25%)
	Hours per day at Work	1-3 hours (27%)
	Hours per day at Home	1-3 hours (36%)
	Hours per Week	21-25 (17%) 11-15 (16%)
	Perceived Skill	Advanced (38%)

Table A11.1.1. Basic demographics of Image Q sorters, N = 114

This group partakes in all the main uses of the Internet; gathering information and communication are the most predominant (Table A11.1.2). Email is the most common medium for communication, although some also use chat interfaces for this purpose. Participants in this group also like to use the Internet to entertain themselves and waste time, but not to work. This group also uses the Internet for more functional activities, such as educational purposes and online banking.

Usage	Primary Uses	Communication (92%) Gathering information (88%) Education (78%) Entertainment (56%) Waste time (54%)
	Frequency of Use	Email (very often, 95%) Chat (never 34%, very often 44%) Banking (sometimes 28%, often 18%)
	Tasks Accomplished	11-15 tasks (36%) 6 -10 tasks (28%)

Table A11.1.2. Internet Usage of Image Q sorters, N = 114

This group estimate spending over half their time on the Internet searching for specific commercial and reference information. They also browse the Internet for other types of information (Table A11.1.3).

Information Retrieval Behaviours	Types of Information	Reference (93%) Commercial (78%) Other (54%)
	Information Search Patterns	Mostly search (63%) Sometimes browse (54%) Seldom/Sometimes explore (40% / 32%)
	Estimated %	Search approx. 60-70% of the time Browse approx. 30% of the time Explore approx. 5-10% of the time

Table A11.1.3. Information Retrieval Behaviours of Image Q sorters, N = 114

The thirteen problems presented to the participants in the CPQ can be divided into two types: the first six problems deal with participants' obstacles, the other six deal with problems inherent in the technology itself. Interestingly, this group does not report having many user-based problems; almost half indicate that they have issues finding the information they are looking for (Table A11.1.4). In contrast, this group does report having technical problems surrounding accessing information (such as sites that require registration or payment, and encountering broken links).

Internet Problems	Perceived Problems – User	Finding information (46%)
	Perceived Problems – Technical	Registering for information (85%) Payment for access (75%) Broken links (70%)

Table A11.1.4. Perceived Internet problems of Image Q sorters, N = 114

Given the range of primary uses, it is not surprising that this group often replaces a number of offline activities with the Internet; most notable are watching TV, talking on the phone, reading and using the Internet instead of working. It follows that the majority say the Internet has become a part of everyday life ‘quite a bit’ and ‘completely’ (Table A11.1.5).

Impact of Internet	Infiltration into Life	Instead of TV (66%), phone (63%), reading (47%) and work (42%)
	Permeation of Internet	Quite a bit (46%), Completely (36%)

Table A11.1.5. Impact of Internet for Image Q sorters, N = 114

There is an optimistic outlook towards the Internet in terms of having a positive impact on their lives. The majority feel that the Internet is an efficient way of gathering information and can reduce tedium. Over half the group agrees that the Internet helps them to be creative and enables them to actually implement their creative ideas. A little ambivalence does exist in the extent to which the Internet is responsible for the good things they enjoy in life, and also how much it enhances their standard of living. Interestingly, despite the positive outlook, a quarter finds the Internet frustrating to use (Table A11.1.6).

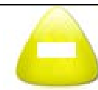
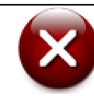
Attitudes towards the Internet			
	Is efficient (87%)		
	Not intimidated by Internet (83%)		
		Responsible for good things (43%)	
	Unlimited possibilities (41%)		
	Is not frustrating (33%)	Is frustrating (33%)	Is frustrating (25%)
	Can eliminate tedious work (84%)		
	Is not dehumanising (51%)		
	Enhances standard of living (39%)	Enhances standard of living (40%)	
	Advantages outweigh disadvantages (75%)		
	Create new ideas (60%)		
	Put new ideas into action (60%)		
	Feel comfortable (90%)		

Table A11.1.6. Internet attitudes of Image Q sorters, N = 114

The only difficulty this group report having is visualising the overall shape and size of the Internet (Table A11.1.7). Just over half have a clear picture of how the Internet is structured and linked. The majority however seem to have a much clearer representation of the process of searching for and accessing information.

Mental Visualisation of the Internet	CLEAR	UNCLEAR
		Internet shape/size (43%)
	Structure (56%)	
	Linkage (60%)	
	Information retrieval (64%)	
	Home page (84%)	
	Search engine (86%)	
	Accessing information (73%)	
	Continuing search (65%)	

Table A11.1.7. Internet Visualisation of Image Q sorters, N = 114

APPENDIX 11.2: IMAGE SUPER-FACTOR ANALYSIS

This appendix outlines the first-level factor analysis of the 114 Image Q sorts. The Q sorts were randomly divided into four smaller sub-samples and factor analysed individually. The number of factors extracted was decided upon by determining the solution that yielded the least number of confounding sorts, the least number of participants which did not load on any factor and maximising the number of highly significant loadings onto each factor.

GROUP 1:

32 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors. The two factors accounted for 39% of the variance; factor 1 for 23% and factor 2 for 16%. Table A11.2.1. indicates that the first factor was defined by 10 of the 32 Q sorts; and also the second by 10 of the 32 Q sorts. Seven sorts were confounded.

Respondent ID	**Factor 1**	**Factor 2**
1	0.36	0.39
5	0.00	**0.50X**
9	0.41	0.54
11	0.34	0.33
12	0.22	**0.49X**
14	-0.49	**0.70X**
16	**0.79X**	0.32
21	0.37	0.35
23	0.20	**0.49X**
25	**0.75X**	0.22
26	**0.69X**	0.30
29	-0.39	0.29
32	**0.78X**	-0.05

34	**0.50X**	0.09
35	-0.36	-0.03
36	**0.78X**	0.24
37	**0.67X**	-0.17
44	0.19	0.29
46	0.40	0.41
63	0.31	**0.69X**
68	0.15	0.37
73	-0.22	**0.48X**
75	**0.73X**	0.02
76	-0.24	0.33
82	-0.32	0.24
84	0.33	**0.53X**
87	0.22	**0.64X**
91	**0.86X**	-0.06
104	**0.67X**	0.09
105	0.20	**0.45X**
106	-0.29	**0.58X**
117	0.38	0.52

Table A11.2.1. Defining sorts for group 1, Image Super-Factor Analysis [65]

GROUP 2:

27 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors. The two factors accounted for 45% of the variance; factor 1 for 28% and factor 2 for 17%. Table A11.2.2 indicates that the first factor was defined by 11 of the 27 Q sorts; the second by 10 of the 27 Q sorts. Three sorts were confounded.

[65] Participants 5, 12, 23, 34, 73 and 105's Q sorts were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

Respondent ID	Factor 1	Factor 2
15	**0.91X**	-0.04
22	**0.61X**	0.17
30	**0.62X**	0.05
33	**0.81X**	-0.11
38	0.07	-0.19
39	0.36	0.26
42	**0.81X**	0.02
49	-0.24	**0.65X**
50	**0.87X**	0.02
51	-0.30	0.39
53	0.10	**0.48X**
59	-0.25	**0.65X**
65	**0.78X**	0.13
69	0.15	**0.52X**
70	**0.61X**	-0.05
77	0.32	**0.60X**
79	-0.28	**0.69X**
83	0.26	**0.65X**
85	-0.33	0.43
89	**0.72X**	-0.21
93	-0.12	**0.44X**
97	-0.16	**0.70X**
108	**0.76X**	-0.16
112	0.48	-0.34
114	-0.49	0.62
115	-0.15	**0.54X**
116	**0.81X**	0.24

Table A11.2.2. Defining sorts for group 2, Image Super-Factor Analysis [66]

[66] Participant 53 and 93's Q sort were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

GROUP 3:

25 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors, three perspectives (factor 1 had both a positive and negative component). The three factors accounted for 35% of the variance; factor 1+/- for 24% and factor 2 for 11%. Factor 1+ was defined by 13 of the 25 Q sorts; factor 1- by 2 of the 25 Q sorts and the factor 2 by 4 of the 25 Q sorts. None of the sorts were confounded (Table A11.2.3).

Respondent ID	**Factor 1**		**Factor 2**
	+	**-**	
2	**0.42X**	-0.42	0.25
7	0.19	-0.19	**0.56X**
8	0.04	-0.04	**0.82X**
17	**0.73X**	-0.73	0.33
18	**0.56X**	-0.56	0.31
20	-0.30	0.30	**0.41X**
27	**0.64X**	-0.64	-0.23
40	**0.51X**	-0.51	0.31
43	**0.69X**	-0.69	0.00
47	**0.81X**	-0.81	-0.08
48	**0.54X**	-0.54	0.09
52	**0.61X**	-0.61	0.15
54	**0.85X**	-0.85	-0.24
56	**0.76X**	-0.76	0.09
57	0.18	-0.18	0.30
58	0.23	-0.23	-0.36
72	-0.49	**0.49X**	0.33
74	0.23	-0.23	0.32
78	0.04	-0.04	**0.60X**
86	0.18	-0.18	-0.03
95	-0.30	0.30	0.35
100	**0.65X**	-0.65	0.04

102	-0.47	**0.47X**	0.14
111	0.21	-0.21	-0.35
113	0.03	-0.03	0.14

Table A11.2.3. Defining sorts for group 3, Image Super-Factor Analysis[67]

GROUP 4:

30 Q sorts were subjected to Centroid factor analysis with no rotation. The factor analysis yielded two operant factors. The two factors accounted for 38% of the variance; factor 1 for 22% and factor 2 for 16%. The first factor was defined by 11 of the 30 Q sorts; the second by 7 of the 30 Q sorts. Four sorts were confounded (see Table A11.2.4).

Respondent ID	Factor 1	Factor 2
3	0.34	**0.72X**
4	0.46	-0.59
6	0.41	**0.63X**
19	-0.19	**0.79X**
24	0.30	-0.02
28	**0.60X**	-0.21
41	**0.64X**	-0.04
45	0.38	-0.56
55	**0.66X**	-0.38
60	0.32	-0.17
61	**0.78X**	0.09
62	0.15	-0.16
64	0.21	-0.50
66	0.35	-0.49
67	0.36	0.06

[67] In order to generate a separate factor array for positive and negative loadings, it is necessary to duplicate the factor in PQ Method. This accounts for why a factor which has both positive and negative components has identical loadings. It is merely an artifact of the analysis procedure and these identical loadings did not occur naturally in the data. Participants 2, 20, 40, 72 and 102 Q sorts were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

71	0.02	0.10
80	**0.70X**	0.11
81	**0.41X**	0.26
88	**0.60X**	0.16
90	0.09	**0.75X**
92	0.11	**0.58X**
94	**0.56X**	0.28
96	**0.50X**	-0.20
98	**0.85X**	-0.04
99	-0.02	**0.47X**
101	0.55	0.45
103	0.05	**0.61X**
107	**0.94X**	0.00
109	0.11	-0.12
110	0.25	-0.02

Table A11.2.4. Defining sorts for group 4, Image Super-Factor Analysis [68]

[68] Participants 81 and 99 Q sorts were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

APPENDIX 11.3: IMAGE SUPER-FACTOR Z SCORE COMPARISON

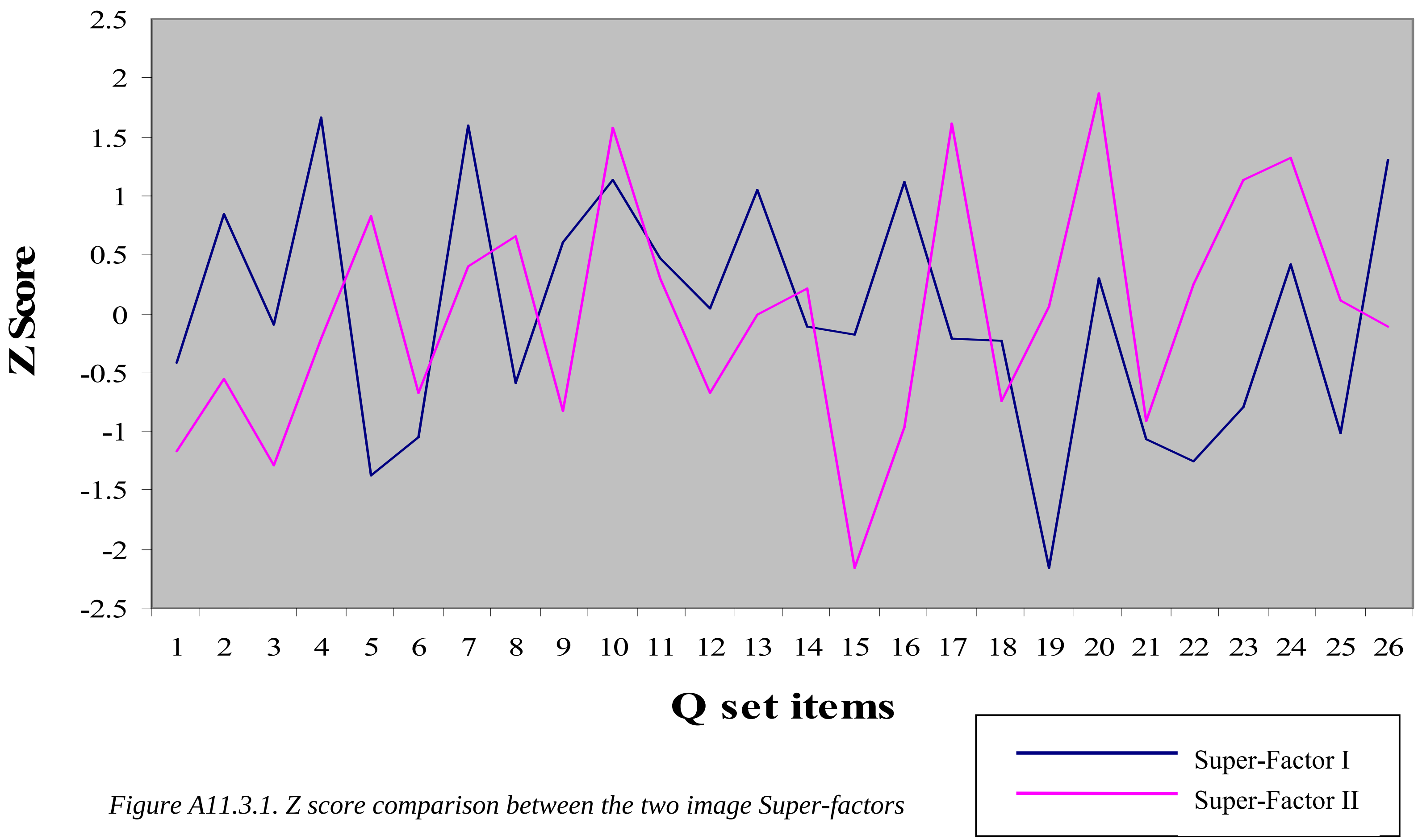


Figure A11.3.1. Z score comparison between the two image Super-factors

APPENDIX 11.4: GEOGRAPHIC LOCATIONS OF PARTICIPANTS

When participants submitted their responses via email, the only identifying characteristic was the Internet Protocol (IP) address. Each individual response indicated the user's IP address, which enabled participants Q sort and Characteristics Profile Questionnaire (CPQ) responses to be matched up.

It is possible to infer geographical location from a user's IP address. Every computer connected to the Internet is assigned a unique IP address. Since these numbers are usually assigned in country-based blocks, an IP address can often be used to identify the country from which a computer is connecting to the Internet. A plethora of geolocation software is available online to translate an IP address into geographical location (country, region, city, latitude, longitude and ZIP code). Since its inception in 1999, geolocation technology is widely used in multiple domains such as e-retail, banking, online gaming and law enforcement, for preventing online fraud, managing digital rights and even psychological research.

By using a free online geolocation tool[69], participants' IP addresses were used to identify their geographical location. The following section outlines the geographical breakdown for participants completing an Image Q sort, Text Q sort and those who completed both.

IMAGE Q SORT AND CPQ RESPONSES:

Figure A11.4.1 indicates that over half of the participants originated in the UK (54%) and over a quarter from North America (28%). Of the remaining participants, 5% came from other European countries (Finland, France, Germany, Poland and Spain); 4% from Asia (Israel, India, Thailand and South Korea); 2% from Australasia (Australia and New Zealand) and 2% from South America (Brazil and Peru). No responses came from Africa.

[69] http://www.ip2location.com/

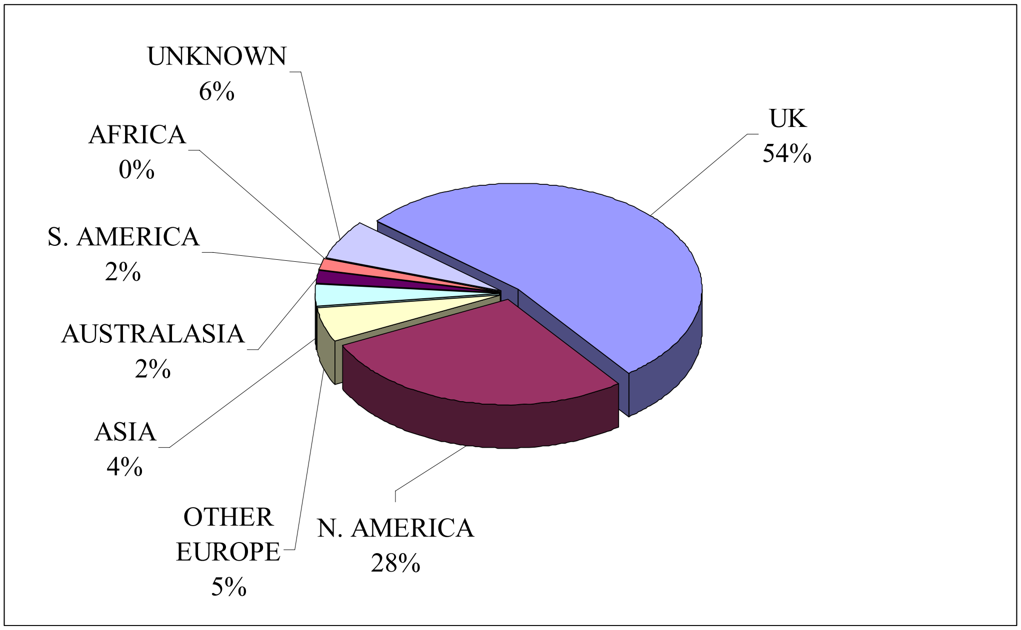


Figure A11.4.1. Geographical distribution of participants who completed an Image Q sort

TEXT Q SORT AND CPQ RESPONSES:

Figure A11.4.2 indicates that almost 40% originated from North America; the UK running a close second with 33% of participants. A large proportion (21%) of the remaining respondents came from other European countries (Finland, France, Germany, Netherlands, Norway, Hungary, Austria, Greece, Denmark, Spain, Romania, Ireland and Italy); 2% from Australasia (Australia and New Zealand); 1% from Asia (China); and 1% from Africa (Tanzania). No responses came from South America.

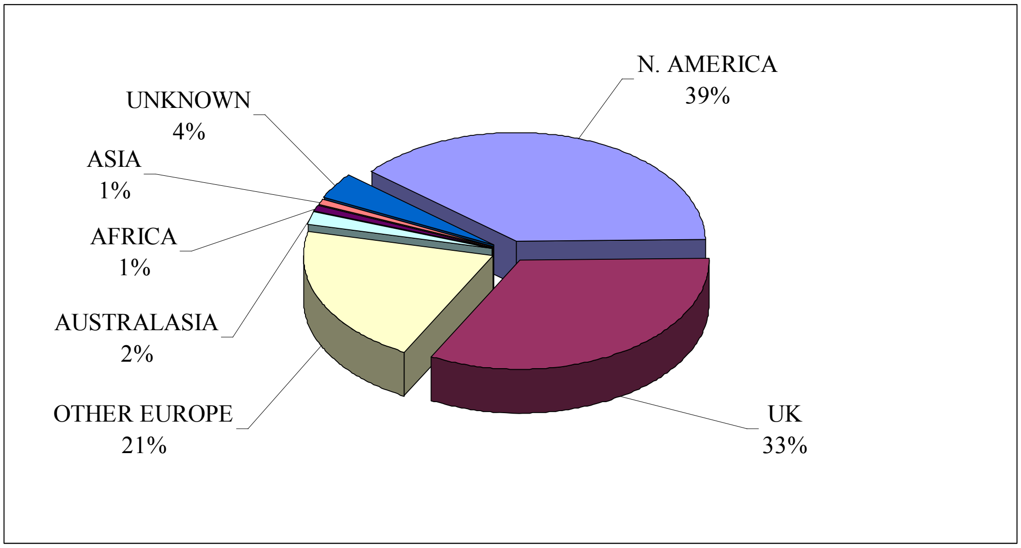


Figure A11.4.2. Geographical distribution of participants who completed a Text Q sort

DUAL PARTICIPANT Q SORT AND CPQ RESPONSES:

Figure A11.4.3 indicates that equal proportions of participants originated from North America and the UK (42% each). The remaining participants came from other European countries (Germany and Sweden) and 4% from Australasia (Australia). No responses came from South America, Africa or Asia.

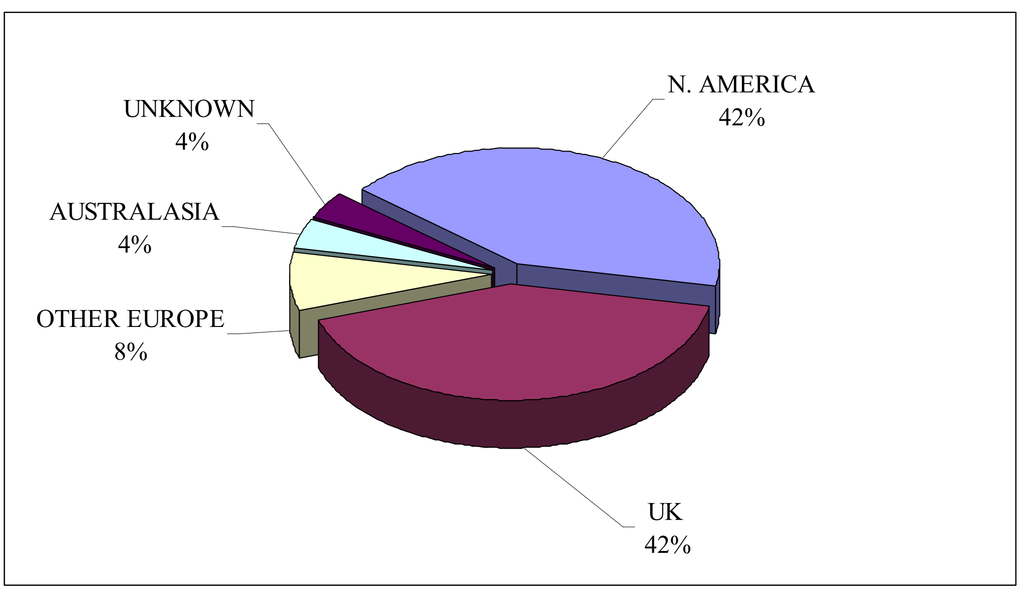


Figure A11.4.3. Geographical distribution of Dual participants

GEOGRAPHICAL LOCATION ACCORDING TO FACTORS

Table A11.4.1 indicates the predominant geographic location of participants which loaded onto each factor. Although participants were obtained from 28 countries in six continents, the majority of those which loaded onto each factor were from the UK or North America.

Location	**Image Super-factors**			**Text Super-factors**		**Dual Factors - Image**		**Dual Factors - Text**	
	I		II	I	II	I	II	I	II
	*n=9**	*n=17***	*n=31*	*n=32*	*n=11*	*n=10*	*n=8*	*n=10*	*n=9*
UK	33%	88%	61%	38%	22%	20%	75%	60%	22%
Other Europe	11%			22%		10%		10%	11%
N. America	33%	12%	19%	34%	56%	60%	13%	20%	67%
S. America			3%						
Asia	11%			3%					
Australasia	11%			3%		10%			
Unknown			16%		22%		13%	10%	

Table A11.4.1. Geographic breakdown of participants loading onto each of the factors

* Older sub-group of Super-factor I: Chaotic Communication Networks

** Younger sub-group of Super-factor I: Functional Static Communication

POTENTIAL LIMITATIONS OF THIS METHOD

The numbers currently used in IP addresses range from *0.0.0.0* to *255.255.255.255*. This does not provide enough possibilities for every Internet device to have its own permanent number. Therefore, depending on how the user connects to the Internet, the IP address can be the same every time one connects (a static IP address), or different every time one connects, (a dynamic IP address). Subnet routing, Network Address Translation and the Dynamic Host Configuration Protocol (DHCP) server all allow local networks to use the same IP addresses as other networks elsewhere even though both are connected to the Internet. However, devices such as network printers, web servers and email servers are often allocated static IP addresses so they can always be found. Considering the nature of respondents' emailed data submission, it is most likely that web and email servers were primarily used to send data to the researcher. It is most likely therefore that each respondent carried a unique IP address, which could then be used to identify their geographical location. However, there is always the possibility that some of the respondents' IP addresses were not unique, and therefore only a tenuous link between IP address and global location can be made.

APPENDIX 12.1: TEXT Q SORTERS: DESCRIPTIVE STATISTICS

The 106 Text Q sorters are largely an older group; although 36% of the group is aged 24 and under, 27% are aged between 30-39 and 28% are over 50 years. Indeed, this Text group is significantly older than the participants who completed Image Q sorts ($F(1, 216) = 12.16$, $p = .001$). Accordingly, there is a diverse range of highest qualification achieved and years experience using the Internet. Just under a half of the group use the Internet at work anywhere between 1-5 hours; 40% use the Internet at home between 1-3 hours, cumulating in a bimodal usage per week; 18% use it between 6-10 hours and 18% between 16-20 hours. This group perceive themselves to be advanced users of the Internet (Table A12.1.1).

Basic Demographics	Age	15-19 (19%), 20-24 (17%) 30-39 (27%), 50 and above (28%)
	Gender	Male (54%), Female (46%)
	Highest Qualification	A-Level (29%), Master's (22%) Doctorate (20%)
	Years using the Internet	9-10 years (28%), 5-6 years (25%) 7-8 years (25%)
	Hours per day at Work	1-5 hours (48%)
	Hours per day at Home	1-3 hours (40%)
	Hours per Week	6-10 (18%), 16-20 (18%)
	Perceived Skill	Advanced (40%)

Table A12.1.1. Basic demographics of Text Q sorters, N = 106

This group partakes in most of main uses of the Internet; gathering information and communication (via email) are the most predominant (Table A12.1.2). Participants in this group also like to use the Internet for more functional activities such as online banking, educational and work purposes. Whilst the majority does not use the Internet to generally waste time or entertain themselves, they do sometimes shop online.

Usage	Primary Uses	Communication (85%) Gathering information (83%) Education (75%) Work (58%)
	Frequency of Use	Email (very often, 94%) Shopping (sometimes 47%) Banking (sometimes – very often 48%)
	Tasks Accomplished	11-15 tasks (35%) 16-20 tasks (26%)

Table A12.1.2. Internet Usage of Text Q sorters, N = 106

This group estimate spending over half their time on the Internet searching for specific commercial and reference information. They also browse and explore the Internet for health related information (Table A12.1.3).

Information Retrieval Behaviours	Types of Information	Reference (90%) Commercial (72%) Health (50%)
	Information Search Patterns	Mostly search (55%) Sometimes browse (49%) Seldom/Sometimes explore (37% / 33%)
	Estimated %	Search approx. 70-80% of the time Browse approx. 20-25% of the time Explore approx. 5-10% of the time

Table A12.1.3. Information Retrieval Behaviours of Text Q sorters, N = 106

Given this group perceive themselves to have advanced levels of skill, it follows that they report having little difficulties using the Internet. Only a third purport having user-based difficulties, such as finding and organising information. The only technical problems they encounter are with sites that require registration or those that have broken links (Table A12.1.4).

Internet Problems	Perceived Problems – User	Organising information (37%) Finding information (33%)
	Perceived Problems – Technical	Registering for information (72%) Broken links (61%)

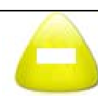
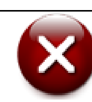
Table A12.1.4. Perceived Internet problems of Text Q sorters, N = 106

This group often replaces a number of offline activities with the Internet; most notable are watching TV, talking on the phone and reading. Accordingly, the majority say the Internet has become a part of everyday life ‘quite a bit’ and ‘completely’ (Table A12.1.5).

Impact of Internet	Infiltration in Life	Instead of TV (69%), phone (63%), reading (50%)
	Permeation of Internet	Quite a bit (48%), Completely (37%)

Table A12.1.5. Impact of Internet for Text Q sorters, N = 106

Overall, this group has a very positive outlook towards the Internet. The majority feels comfortable with the Internet and is not intimidated by it. They perceive the Internet is an efficient way of gathering information and can reduce tedium. Interestingly, just over a quarter finds the Internet frustrating to use (Table A12.1.6). However, despite their frustrations, three-quarters believe the advantages of the Internet outweigh its disadvantages.

Attitudes towards the Internet			
	Is efficient (91%)		
	Not intimidated by Internet (80%)		
	Responsible for good things (49%)		
	Unlimited possibilities (59%)		
	Is not frustrating (35%)	Is frustrating (38%)	Is frustrating (28%)

	Can eliminate tedious work (77%)		
	Is not dehumanising (67%)		
	Enhances standard of living (51%)		
	Advantages outweigh disadvantages (75%)		
	Create new ideas (63%)		
	Put new ideas into action (58%)		
	Feel comfortable (93%)		

Table A12.1.6. Internet attitudes of Text Q sorters, N = 106

The only difficulty this group report having is visualising the overall shape, size and structure of the Internet (Table A12.1.7). The majority however seem to have a much clearer representation of how the Internet is linked and how information is shared and retrieved. Indeed, with the exception of continuing the search for information, the process of accessing information is perfectly clear.

	CLEAR	UNCLEAR
Mental Visualisation of the Internet		Internet shape/size: (70%)
		Structure (59%)
	Linkage (76%)	
	Information retrieval (58%)	
	Home page (85%)	
	Search engine (92%)	
	Accessing information (78%)	
	Continuing search (69%)	

Table A12.1.7. Internet Vis

APPENDIX 12.2: TEXT SUPER-FACTOR ANALYSIS

This appendix outlines the first-level factor analysis of the 106 Text Q sorts. The Q sorts were randomly divided into four smaller sub-samples and factor analysed individually. The number of factors extracted was decided upon by determining the solution that yielded the least number of confounding sorts, the least number of participants which did not load on any factor and maximising the number of highly significant loadings onto each factor.

GROUP 1:

26 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two operant factors. The two factors accounted for 35% of the variance; factor 1 for 28% and factor 2 for 17%. Table A12.2.1 indicates that the first factor was defined by 11 of the 26 Q sorts and the second by 9 of the 26 Q sorts. Three sorts were confounded.

Respondent ID	Factor 1	Factor 2
1	0.24	0.02
5	0.04	0.29
9	**0.66X**	-0.08
10	0.21	**0.79X**
12	**0.51X**	0.13
14	0.46	-0.34
20	**0.62X**	0.00
21	**0.40X**	-0.04
23	-0.15	**0.58X**
24	**0.68X**	-0.01
27	**0.62X**	0.38
29	**0.57X**	0.02
31	0.21	**0.64X**
32	0.32	0.30

38	-0.15	**0.57X**
50	-0.14	**0.43X**
53	0.07	**0.50X**
59	0.36	**0.66X**
61	0.40	0.50
64	0.47	0.46
68	**0.62X**	0.23
77	0.11	**0.64X**
79	0.16	**0.68X**
93	**0.41X**	0.14
94	**0.38X**	0.08
107	**0.62X**	0.12

Table A12.2.1. Defining sorts for group 1, Text Super-Factor Analysis[70]

GROUP 2:

24 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded three factors, 5 perspectives (factors 2 and 3 had both positive and negative components). The three factors accounted for 43% of the variance; factor 1 for 18%, factor 2 for 15% and factor 3 for 10%. The first factor was defined by 8 of the 24 Q sorts; the second (+) by 3 sorts, the second (-) by 2 sorts; the third (+) by 2 sorts and the third (-) by 2 of the 24 Q sorts. Five sorts were confounded (see Table A12.2.2).

[70] Participants 12, 21, 50, 53, 93 and 94 Q sorts were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

Respondent ID	Factor 1	Factor 2		Factor 3	
		+	-	+	-
11	0.38	**0.66X**	-0.66	0.09	-0.09
22	**0.74X**	0.18	-0.18	0.14	-0.14
25	**0.68X**	0.22	-0.22	0.25	-0.25
33	0.06	-0.57	**0.57X**	-0.11	0.11
35	**0.45X**	-0.26	0.26	-0.12	0.12
46	**0.55X**	-0.15	0.15	-0.10	0.10
49	0.36	0.40	-0.40	0.29	-0.29
51	**0.42X**	-0.17	0.17	0.16	-0.16
52	**0.63X**	0.06	-0.06	0.18	-0.18
54	0.57	-0.34	0.34	0.42	-0.42
60	0.28	-0.73	**0.73X**	-0.11	0.11
62	0.35	-0.34	0.34	-0.08	0.08
71	0.26	0.21	-0.21	**0.49X**	-0.49
73	**0.68X**	0.45	-0.45	-0.16	0.16
74	**0.39X**	0.11	-0.11	-0.06	0.06
75	0.29	-0.02	0.02	-0.14	0.14
78	0.46	-0.53	0.53	0.25	-0.25
81	0.02	-0.22	0.22	**0.65X**	-0.65
83	0.47	-0.16	0.16	-0.44	0.44
91	0.27	-0.19	0.19	0.15	-0.15
92	0.29	**0.67X**	-0.67	-0.27	0.27
95	0.29	-0.18	0.18	-0.60	**0.60X**
99	0.27	**0.66X**	-0.66	-0.23	0.23
106	0.09	0.27	-0.27	-0.52	**0.52X**

Table A12.2.2. Defining sorts for group 2, Text Super-Factor Analysis[71]

[71] Participants 35, 51, 71 and 74 Q sorts were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

GROUP 3:

25 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded three operant factors. The three factors accounted for 41% of the variance; factor 1 for 25%, factor 2 for 10% and factor 3 for 6%. Table A12.2.3 indicates that the first factor was defined by 12 of the 25 Q sorts; the second by 4 of the 25 Q sorts and the third factor by 2 of the 25 Q sorts. Three sorts were confounded.

Respondent ID	**Factor 1**	**Factor 2**	**Factor 3**
2	0.12	0.22	-0.19
8	**0.64X**	-0.09	-0.33
13	**0.56X**	0.08	-0.07
15	**0.59X**	0.18	-0.35
18	**0.70X**	-0.04	0.17
30	**0.62X**	-0.31	0.21
37	0.24	0.24	0.13
40	0.13	0.23	**0.46X**
42	0.01	-0.03	0.07
43	**0.77X**	-0.27	-0.21
44	-0.14	**0.43X**	0.03
45	0.37	-0.06	-0.51
58	**0.79X**	0.16	-0.17
63	0.20	**0.69X**	-0.07
67	-0.02	-0.09	**0.45X**
72	0.33	-0.23	0.17
76	0.48	-0.49	0.19
80	**0.63X**	-0.46	-0.14
84	**0.49X**	0.18	0.23
86	**0.66X**	-0.34	0.19
89	**0.80X**	0.21	0.33
90	0.50	0.39	0.20

96	0.15	**0.58X**	0.20
98	0.10	**0.40X**	0.18
105	**0.79X**	0.15	-0.21

Table A12.2.3. Defining sorts for group 3, Text Super-Factor Analysis [72]

GROUP 4:

31 Q sorts were subjected to Centroid factor analysis with theoretical rotation. The factor analysis yielded two factors, 3 perspectives (Factor 2 had both positive and negative components). The two factors accounted for 41% of the variance; factor 1 for 27% and factor 2 for 14%. Table A12.2.4 indicates that the first factor was defined by 12 of the 31 Q sorts; the second (+) by 3 of the 31 Q sorts and the second (-) by 4 of the 31 Q sorts. Two sorts were confounded.

Respondent ID	**Factor 1**	**Factor 2**	
		+	-
3	0.36	**0.67X**	-0.67
4	**0.64X**	0.36	-0.36
6	**0.64X**	0.20	-0.20
7	0.22	**0.67X**	-0.67
16	0.33	0.54	-0.54
17	**0.53X**	0.09	-0.09
19	-0.06	-0.76	**0.76X**
26	**0.62X**	-0.17	0.17
28	0.02	-0.40	**0.40X**
34	0.06	**0.59X**	-0.59
36	**0.49X**	-0.27	0.27
39	**0.65X**	-0.11	0.11
41	0.05	-0.25	0.25
47	**0.48X**	0.01	-0.01
55	0.44	-0.33	0.33

[72] Participants 40, 44, 67, 84 and 98 Q sorts were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

56	**0.52X**	-0.28	0.28
57	**0.51X**	-0.27	0.27
65	0.39	0.30	-0.30
66	0.23	-0.52	**0.52X**
69	-0.19	-0.28	0.28
70	0.24	-0.19	0.19
82	0.36	-0.33	0.33
85	**0.74X**	-0.39	0.39
87	**0.55X**	0.03	-0.03
88	0.38	-0.11	0.11
97	0.00	-0.43	**0.43X**
100	0.26	-0.44	0.44
101	**0.49X**	0.29	-0.29
102	0.41	0.21	-0.21
103	-0.23	0.02	-0.02
104	0.17	-0.22	0.22

Table A12.2.4. Defining sorts for group 4, Text Super-Factor Analysis [73]

[73] Participants 36, 47, 57, 97 and 101 Q sorts were flagged as defining sorts as they represent a clear-cut view of one particular perspective.

APPENDIX 12.3: TEXT SUPER-FACTOR Z SCORE COMPARISON

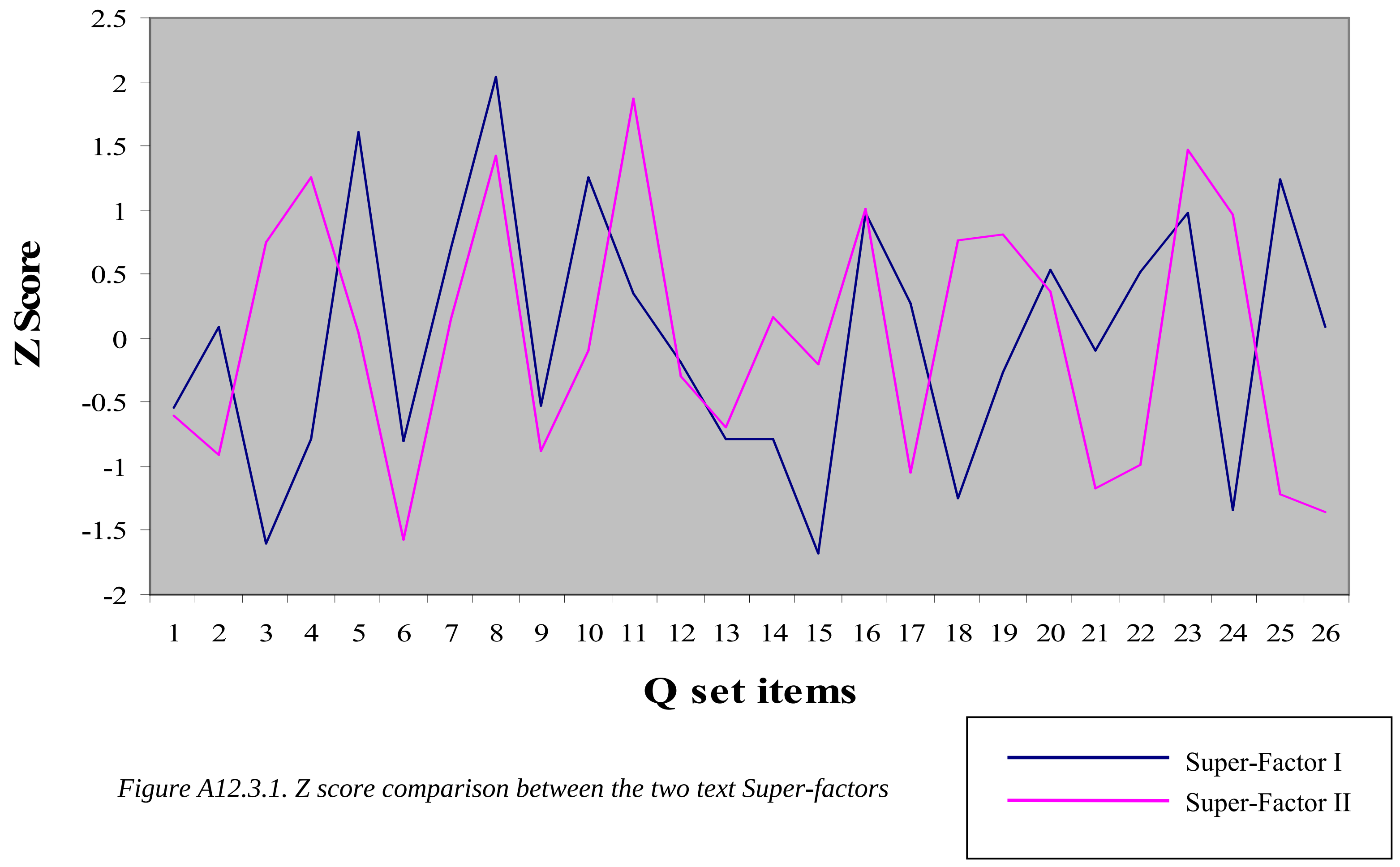


Figure A12.3.1. Z score comparison between the two text Super-factors

APPENDIX 12.4A: TEXT Q SORT FACTOR ARRAY

SUPER FACTOR I

Array Rank	Z Score	Item No.	Text
(+4)	2.039	8	The Internet is a massive interlinked thing; it is a web of webs.
(+3)	1.607	5	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
(+3)	1.249	10	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or the pages being grouped according to content.
(+2)	1.245	25	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
(+2)	0.981	16	It is just unique; a complex, interlinking entity.
(+2)	0.973	23	It's just a maze because there is no beginning and no end and it's totally interconnected.
(+1)	0.704	7	The Web is just these monstrous computers holding vast amounts of information just like a big hard drive.
(+1)	0.533	20	It's like leafing through a filing cabinet. You look for the information and pull out the file, look through it and if its got what you want you photocopy it and if not, you put it back and try another drawer.
(+1)	0.525	22	It's a train network where you can see all the routes and the stations; the station is where you pick up the information, the rail tracks form branches where you can go along each track and search for information.

(+1)	0.354	11	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
(0)	0.272	17	The Internet is like a nervous system. It has a central spinal cord where all the information is controlled and where it comes from. Then, the information is sent like nerve signals back and forth in all different directions.
(0)	0.093	2	I imagine the Internet as a big city; individual websites are grouped together in grids of city blocks. Important sites that are linked to many other sites are skyscrapers whereas houses represent sites that have the least importance or popularity.
(0)	0.086	26	It would be like a tree diagram; the bottom of the trunk would be your home page and then it would spark off to different websites, or different pages within a website. It would keep branching out as far as it could.
(0)	-0.093	21	I see it as a number of layers; your top layers feed into or distribute to lower levels. It's like a complex tree diagram breaking down from the top.
(0)	-0.187	12	I see it as structured lines, like the information travelling down the wires.
(0)	-0.257	19	It has a chaotic randomness like pixels in the sky, which is always changing, growing and morphing.
(-1)	-0.533	9	It is an urban landscape of skyscrapers of pulsing information and computer circuitry.
(-1)	-0.541	1	It would probably look like a big Venn diagram; each topic would be a circle and within each circle you would have many pages so there would be overlapping circles.
(-1)	-0.79	4	I can't imagine the Internet. It is such a complex thing that has no parallel to anything else. The Internet just is.
(-1)	-0.794	14	I imagine it as a map; regions on the map are like major categories. If you click on a region, you see hundreds of thousands of subject categories and millions of websites.

(-2)	-0.794	13	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.
(-2)	-0.805	6	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.
(-2)	-1.245	18	I imagine it as a more ethereal abstract thing that plucks bits of information out of the atmosphere.
(-3)	-1.335	24	The Internet is just a current of information in electrical form; like blue or green lights shooting down the wires.
(-3)	-1.607	3	It’s like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
(-4)	-1.682	15	It’s a mass of coloured lines, like a ball of string.

APPENDIX 12.4B: TEXT Q SORT FACTOR ARRAY

SUPER FACTOR II

Array Rank	Z Score	Item No.	Text
(+4)	1.864	11	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
(+3)	1.475	23	It's just a maze because there is no beginning and no end and it's totally interconnected.
(+3)	1.429	8	The Internet is a massive interlinked thing; it is a web of webs.
(+2)	1.257	4	I can't imagine the Internet. It is such a complex thing that has no parallel to anything else. The Internet just is.
(+2)	1.007	16	It is just unique; a complex, interlinking entity.
(+2)	0.971	24	The Internet is just a current of information in electrical form; like blue or green lights shooting down the wires.
(+1)	0.815	19	It has a chaotic randomness like pixels in the sky, which is always changing, growing and morphing.
(+1)	0.758	18	I imagine it as a more ethereal abstract thing that plucks bits of information out of the atmosphere.
(+1)	0.742	3	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
(+1)	0.358	20	It's like leafing through a filing cabinet. You look for the information and pull out the file, look through it and if its got what you want you photocopy it and if not, you put it back and try another drawer.
(0)	0.166	14	I imagine it as a map; regions on the map are like major categories. If you click on a region, you see hundreds of thousands of subject categories and millions of websites.

(0)	0.151	7	The Web is just these monstrous computers holding vast amounts of information just like a big hard drive.
(0)	0.041	5	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
(0)	-0.099	10	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or the pages being grouped according to content.
(0)	-0.208	15	It's a mass of coloured lines, like a ball of string.
(0)	-0.301	12	I see it as structured lines, like the information travelling down the wires.
(-1)	-0.602	1	It would probably look like a big Venn diagram; each topic would be a circle and within each circle you would have many pages so there would be overlapping circles.
(-1)	-0.701	13	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.
(-1)	-0.873	9	It is an urban landscape of skyscrapers of pulsing information and computer circuitry.
(-1)	-0.914	2	I imagine the Internet as a big city; individual websites are grouped together in grids of city blocks. Important sites that are linked to many other sites are skyscrapers whereas houses represent sites that have the least importance or popularity.
(-2)	-0.982	22	It's a train network where you can see all the routes and the stations; the station is where you pick up the information, the rail tracks form branches where you can go along each track and search for information.

(-2)	-1.049	17	The Internet is like a nervous system. It has a central spinal cord where all the information is controlled and where it comes from. Then, the information is sent like nerve signals back and forth in all different directions.
(-2)	-1.163	21	I see it as a number of layers; your top layers feed into or distribute to lower levels. It's like a complex tree diagram breaking down from the top.
(-3)	-1.215	25	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
(-3)	-1.355	26	It would be like a tree diagram; the bottom of the trunk would be your home page and then it would spark off to different websites, or different pages within a website. It would keep branching out as far as it could.
(-4)	-1.574	6	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.

APPENDIX 13.1: DUAL Q SORTERS: DESCRIPTIVE STATISTICS

The 24 Dual sorters are a predominantly young sample, with almost 40% aged 24 and under (a small faction is more mature in age). The majority report having between 9-10 years of experience using the Internet, regardless of age. The highest level of education achieved is equally divided between two categories: A-Level (21%) and Doctoral degree (21%). The majority of the group uses the Internet at work for 5-8 hours per day and at home for 1 to 3 hours. It is not surprising therefore that most report using the Internet in excess of 40 hours per week. This group perceive themselves to be advanced users of the Internet; indeed, 71% think of themselves as advanced or expert users (Table A13.1.1).

Basic Demographics	Age	20-24 (38%) 40-49 (25%)
	Gender	Female (54%), Male (46%)
	Highest Qualification	A-Level (21%) Doctoral (21%)
	Years using the Internet	9-10 years (38%)
	Hours per day at Work	5-8 hours (33%)
	Hours per day at Home	1-3 hours (29%)
	Hours per Week	Over 40 hours (25%)
	Perceived Skill	Advanced (50%), Expert (21%)

Table A13.1.1. Basic demographics of Dual participants, N = 24

This group partakes in the all main uses of the Internet; gathering information and communication (via email) are the most predominant, followed by education and work purposes (see Table A13.1.2). These Dual participants also like to use the Internet to shop and for online banking.

Usage	Primary Uses	Gathering information (92%) Communication (83%) Education (75%) Work (75%)
	Frequency of Use	Email (very often, 79%) Shopping (sometimes 54%) Banking (sometimes 25%, never 25%)
	Tasks Accomplished	11-15 tasks (46%) 16-20 tasks (38%)

Table A13.1.2. Internet Usage of Dual participants, N = 24

This group estimate spending over half their time on the Internet searching for specific reference and other types of information. They sometimes browse or explore the Internet, although to a lesser extent than searching (Table A13.1.3).

Information Retrieval Behaviours	Types of Information	Reference (88%) Other (96%)
	Information Search Patterns	Mostly search (67%) Sometimes browse (50%) Sometimes explore (42%)
	Estimated %	Search approx. 60% of the time Browse approx. 25% of the time Explore approx. 15% of the time

Table A13.1.3. Information Retrieval Behaviours of Dual participants, N = 24

This group does not report having many user-based problems; over a third indicates that they have issues finding specific web pages and organising the information they gather (Table A13.1.4). In contrast, this group does report having technical problems surrounding accessing information (such as sites that require registration or payment, and encountering broken links).

Internet Problems	Perceived Problems – User	Finding Web page (37%) Organising Information (37%)
	Perceived Problems – Technical	Payment for access (83%) Registering for information (79%) Broken links (54%)

Table A13.1.4. Perceived Internet problems of Dual participants, N = 24

The most notable activities which are replaced by the Internet daily are watching TV, talking on the phone and using the Internet instead of working. It follows that the majority say the Internet has become a part of everyday life 'quite a bit' and 'completely' (Table A13.1.5).

Impact of Internet	Infiltration in Life	Instead of TV (67%), phone (50%), and work (50%)
	Permeation of Internet	Quite a bit (50%), Completely (46%)

Table A13.1.5. Impact of Internet for Dual participants, N = 24

There is an optimistic outlook towards the Internet in terms of having a positive impact on our lives. The majority feel that the Internet is an efficient way of gathering information and can reduce tedium. Almost the whole group believes that the advantages of the Internet outweigh any disadvantages. Similarly, almost everyone reports that the Internet does not make them uncomfortable and that they are not intimidated by it. A little ambivalence does exist in the extent to which the Internet is responsible for the good things they enjoy in life, and also how much it enhances their standard of living. Interestingly, despite the positive outlook, just over a quarter finds the Internet frustrating to use (Table A13.1.6).

Attitudes towards the Internet			
	Is efficient (88%)		
	Not intimidated by Internet (92%)		
		Responsible for good things (50%)	
	Unlimited possibilities (54%)		
	Is frustrating (29%)	Is frustrating (42%)	
	Can eliminate tedious work (54%)		
	Is not dehumanising (67%)		
	Enhances standard of living (46%)	Enhances standard of living (42%)	
	Advantages outweigh disadvantages (92%)		
	Create new ideas (50%)	Create new ideas (33%)	
	Put new ideas into action (65%)		
	Feel comfortable (92%)		

Table A13.1.6. Internet attitudes of Dual participants, N = 24

In terms of having a mental representation of the more structural elements of the Internet, the only difficulties this group reports having is visualising the overall shape and size of the Internet, plus how it is linked (Table A13.1.7). Equal proportions have an unclear and clear view of how the Internet is structured. The majority however seem to have a much clearer representation of the process of searching for and accessing information.

Mental Visualisation of the Internet	CLEAR	UNCLEAR
		Internet shape/size (83%)
	Structure (42%)	Structure (42%)
		Linkage (58%)
	Information retrieval (75%)	
	Home page (84%)	
	Search engine (88%)	
	Accessing information (92%)	
	Continuing search (75%)	

Table A13.1.7. Internet Visualisation of Dual participants, N = 24

APPENDIX 13.2: DUAL PARTICIPANTS' IMAGE FACTOR Z SCORE COMPARISON

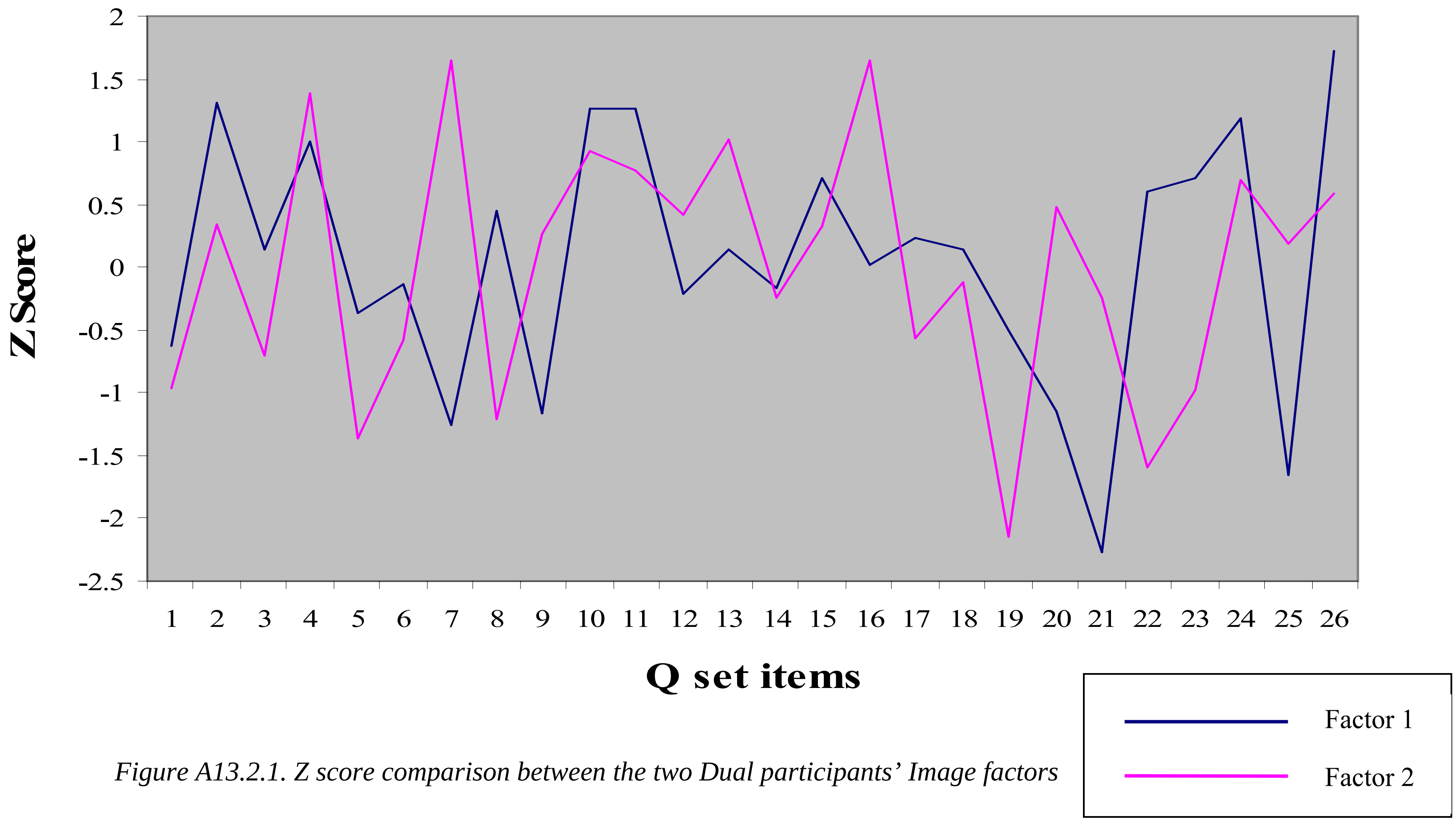


Figure A13.2.1. Z score comparison between the two Dual participants' Image factors

APPENDIX 13.3: DUAL PARTICIPANTS' TEXT FACTOR Z SCORE COMPARISON

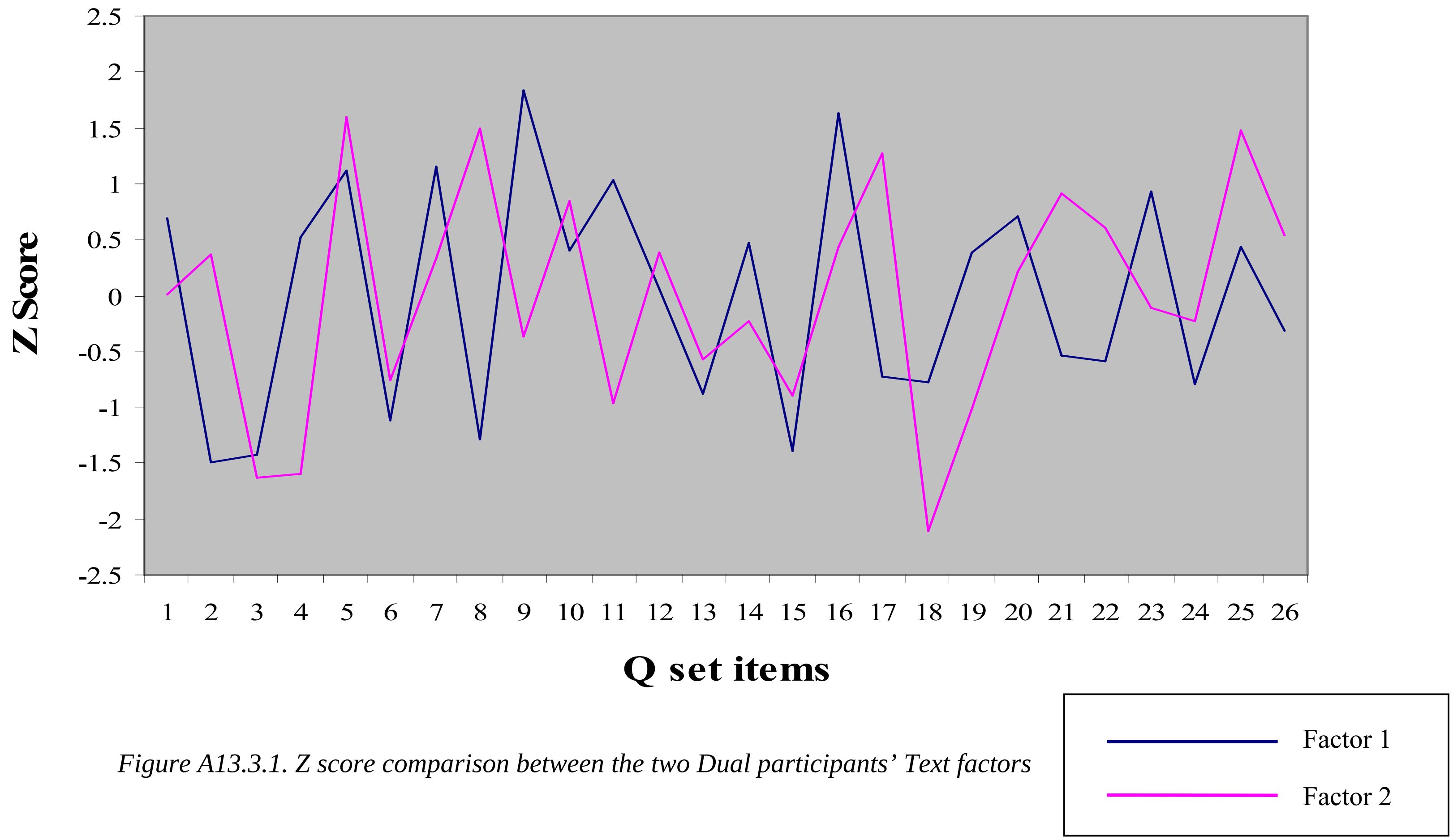


Figure A13.3.1. Z score comparison between the two Dual participants' Text factors

APPENDIX 13.4A: DUAL PARTICIPANTS TEXT Q SORT FACTOR ARRAY

FACTOR 1

Array Rank	Z Score	Item No.	Text
(+4)	1.843	8	The Internet is a massive interlinked thing; it is a web of webs.
(+3)	1.633	16	It is just unique; a complex, interlinking entity.
(+3)	1.147	7	I imagine it as a map; regions on the map are like major categories. If you click on a region, you see hundreds of thousands of subject categories and millions of websites.
(+2)	1.116	5	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
(+2)	1.038	11	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
(+2)	0.935	23	It's just a maze because there is no beginning and no end and it's totally interconnected.
(+1)	0.713	20	It's like leafing through a filing cabinet. You look for the information and pull out the file, look through it and if its got what you want you photocopy it and if not, you put it back and try another drawer.
(+1)	0.694	1	It would probably look like a big Venn diagram; each topic would be a circle and within each circle you would have many pages so there would be overlapping circles.
(+1)	0.525	4	I can't imagine the Internet. It is such a complex thing that has no parallel to anything else. The Internet just is.

(+1)	0.461	14	The Web is just these monstrous computers holding vast amounts of information just like a big hard drive.
(0)	0.434	25	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
(0)	0.395	10	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or the pages being grouped according to content.
(0)	0.387	19	It has a chaotic randomness like pixels in the sky, which is always changing, growing and morphing.
(0)	0.056	12	I see it as structured lines, like the information travelling down the wires.
(0)	-0.319	26	It would be like a tree diagram; the bottom of the trunk would be your home page and then it would spark off to different websites, or different pages within a website. It would keep branching out as far as it could.
(0)	-0.543	21	I see it as a number of layers; your top layers feed into or distribute to lower levels. It's like a complex tree diagram breaking down from the top.
(-1)	-0.596	22	It's a train network where you can see all the routes and the stations; the station is where you pick up the information, the rail tracks form branches where you can go along each track and search for information.
(-1)	-0.732	17	The Internet is like a nervous system. It has a central spinal cord where all the information is controlled and where it comes from. Then, the information is sent like nerve signals back and forth in all different directions.
(-1)	-0.782	18	I imagine it as a more ethereal abstract thing that plucks bits of information out of the atmosphere.

(-1)	-0.797	24	The Internet is just a current of information in electrical form; like blue or green lights shooting down the wires.
(-2)	-0.879	13	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.
(-2)	-1.124	6	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.
(-2)	-1.285	9	It is an urban landscape of skyscrapers of pulsing information and computer circuitry.
(-3)	-1.397	15	It's a mass of coloured lines, like a ball of string.
(-3)	-1.424	3	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
(-4)	-1.499	2	I imagine the Internet as a big city; individual websites are grouped together in grids of city blocks. Important sites that are linked to many other sites are skyscrapers whereas houses represent sites that have the least importance or popularity.

Appendix 13.4b: Dual Participants Text Q Sort Factor Array

Factor 2

Array Rank	Z Score	Item No.	Text
(+4)	1.595	5	Pages are points or nodes that are linked by edges and lines; it would end up being this massive interlinked thing with each page having links to other pages. You would get big clusters where there is a lot of interlinking.
(+3)	1.496	8	The Internet is a massive interlinked thing; it is a web of webs.
(+3)	1.482	25	The Internet has structures; like lots of little tree diagrams that are interconnected rather that one big tree diagram that represents the whole thing.
(+2)	1.279	17	The Internet is like a nervous system. It has a central spinal cord where all the information is controlled and where it comes from. Then, the information is sent like nerve signals back and forth in all different directions.
(+2)	0.916	21	I see it as a number of layers; your top layers feed into or distribute to lower levels. It's like a complex tree diagram breaking down from the top.
(+2)	0.846	10	You could think of it in terms of an absolute enormous hierarchy; of pages related to one another either through links through pages or the pages being grouped according to content.
(+1)	0.600	22	It's a train network where you can see all the routes and the stations; the station is where you pick up the information, the rail tracks form branches where you can go along each track and search for information.

(+1)	0.541	26	It would be like a tree diagram; the bottom of the trunk would be your home page and then it would spark off to different websites, or different pages within a website. It would keep branching out as far as it could.
(+1)	0.437	16	It is just unique; a complex, interlinking entity.
(+1)	0.376	12	I see it as structured lines, like the information travelling down the wires.
(0)	0.36	2	I imagine the Internet as a big city; individual websites are grouped together in grids of city blocks. Important sites that are linked to many other sites are skyscrapers whereas houses represent sites that have the least importance or popularity.
(0)	0.338	7	I imagine it as a map; regions on the map are like major categories. If you click on a region, you see hundreds of thousands of subject categories and millions of websites.
(0)	0.208	20	It's like leafing through a filing cabinet. You look for the information and pull out the file, look through it and if its got what you want you photocopy it and if not, you put it back and try another drawer.
(0)	0.002	1	It would probably look like a big Venn diagram; each topic would be a circle and within each circle you would have many pages so there would be overlapping circles.
(0)	-0.118	23	It's just a maze because there is no beginning and no end and it's totally interconnected.
(0)	-0.227	24	The Web is just these monstrous computers holding vast amounts of information just like a big hard drive.
(-1)	-0.227	14	The Internet is just a current of information in electrical form; like blue or green lights shooting down the wires.

(-1)	-0.366	9	It is an urban landscape of skyscrapers of pulsing information and computer circuitry.
(-1)	-0.574	13	I imagine it as my computer with this ring of things around me; these are access points to the Internet, like portals that I use to get into the Internet.
(-1)	-0.755	6	Like a molecule, which has a central starting point and a ring, which surrounds it and has stuff flying out from it.
(-2)	-0.896	15	It's a mass of coloured lines, like a ball of string.
(-2)	-0.964	11	The Internet is pretty amorphous. It's very dynamic, constantly changing, like a gaseous cloud; there's nothing rigid or formal there.
(-2)	-1.015	19	It has a chaotic randomness like pixels in the sky, which is always changing, growing and morphing.
(-3)	-1.598	4	I can't imagine the Internet. It is such a complex thing that has no parallel to anything else. The Internet just is.
(-3)	-1.636	3	It's like these little bits of information floating in the air and then when you call them onto your computer screen they are all pieced together in the right order and appear magically on your screen.
(-4)	-2.101	18	I imagine it as a more ethereal abstract thing that plucks bits of information out of the atmosphere.

Appendix 13.5: Characteristic Patterns Across Metaphor Clusters

Salient Characteristics	**Image Super-factor I**		**Text Super-factor II**	**Dual – Image Q sorts *Factor 2***	**Dual – Text Q sorts *Factor 1***
	Older	***Younger***			
Age & Gender	Male, 30-34	Female, under 19	Female, 20-24, 50+	Under 24	Under 24, 40+
Perceived Skill	Advanced / Expert	Novice / Intermediate	Intermediate / Advanced	Intermediate / Advanced	Advanced
Primary Use	1. Work 2. Info search 3. Communication	1. Communication 2. Education 3. Entertainment	1. Communication 2. Info search 3. Education	1. Info search 2. Education 3. Entertainment	1. Shopping 2. Wasting time 3. Entertainment
Perceived Problems	Organising info Returning to pages	Finding information	Organising Information Finding Information	Organising information Finding web pages	Organising info Finding web pages
Factor Interpretation:	**Chaotic Communication Networks**	**Functional Concretised Communication**	**Dynamic Complexity**	**Dynamic Abstract Clusters**	**Chaotic Interlinking**

Table A13.5.1. Demographic and usage patterns across 'Chaotic & Dynamic' metaphor cluster

Salient Characteristics	**Image Super-factor II**	**Text Super-factor I**	**Dual – Image Q sorts *Factor 1***	**Dual – Text Q sorts *Factor 2***
Age & Gender	Female, under 20	Male, 30-60	Male, ranges 20-60	Male, under 24
Perceived Skill	Novice / Intermediate	Advanced / Expert	Advanced / Expert	Advanced / Expert
Primary Use	1. Communication 2. Education	1. Communication 2. Info search 3. Work	1. Communication 2. Work 3. Info search	1. Info search 2. Communication 3. Work
Perceived Problems	Finding information	None	Finding information	None
Factor Interpretation:	**Contained Organisation**	**Triune Networks**	**Centralised Nodal Structures**	**Linkage Layers**

Table A13.5.2. Demographic and usage patterns across 'Centralised & Ordered' metaphor cluster

Appendix 15: Glossary of Technical Terms

Alt Text

Alt text, short for Alternative Text, specifies alternate text to display when the mouse hovers over an image embedded in the webpage (Gosselin, 2004). Alt text is especially useful for people with low bandwidth connections, who may opt not to load graphics. It is also useful for those with disabilities who use assistive technologies (such as speaking browsers).

Asynchronous conversations

Asynchronous conversations do not require that all parties involved in the communication need to be present and available at the same time. Examples of this include e-mail (the receiver does not have to be logged on when the sender sends the e-mail message), discussion boards, which allow conversations to evolve and community to develop over a period of time, and text messaging over cell phones (Learn That, n.d.).

Blogging

A blog (a shortened form of Web log) is a web-based publication consisting primarily of journal entries (normally in reverse chronological order). Blogging is the practice of posting an entry in your blog (Gardner & Birley, 2008).

Browser

A web browser is a software application that enables a user to display and interact with HTML documents on the World Wide Web (Parsons & Oja, 2002). Various browsers are available for personal computers; the most popular include Internet Explorer and Netscape/Mozilla/Firefox.

Chat room

A chat room is an online forum where people can chat online; users communicate by sending messages (most commonly via typed text) to other users in the same forum in real time (Levine, Young & Baroudi, 2005)

Cohort group

A group of individuals that share a common characteristic (Panacek, n.d.).

Confounding

In Q terms, confounding is when a *participant* loads highly onto two or more factors, making the contribution that participant makes to the factor indistinguishable from another factor. This should not be confused with confounding in the R Methodological sense, in which extraneous *variables* need to be controlled so that they do not exert an influence on the response variable.

Factors

Constellations of subjective responses extracted via Factor Analysis. In terms of Q Methodology, each factor represents an ideal Q sort calculated from the other Q sorts comprising it (Stephenson, 1978).

Flickr

Flickr is a digital photo sharing website. Its immense popularity can be attributed to its online community tools that allow photos to be tagged and browsed by folksonomic means. Flickr allows photo submitters to categorise their images by use of keyword 'tags', which allow searchers to easily find images concerning a certain topic such as place name or subject matter. It can be accessed at http://flickr.com/

Folksonomy

A folksonomy is a collaboratively generated, open-ended labelling system that enables Internet users to categorise online content. The freely chosen labels, called tags, help to improve search engine's effectiveness because content is categorised using a familiar, accessible, and shared vocabulary (Mathes, 2004). Two widely cited examples of websites using folksonomic tagging are Flickr (http://flickr.com/) and Del.icio.us. (http://del.icio.us/).

FTP (File Transfer Protocol)

A commonly used protocol for exchanging files over any TCP/IP based network (Gouda, 1998).

HTML

HyperText Markup Language (HTML) is the lingua franca of the Internet. It is a simple language used to create web pages and other information viewable in a browser. HTML is used to structure information, denoting certain text as headings, paragraphs and so forth (Gosselin, 2004). Originally defined by Tim Berners-Lee in 1993, HTML is now an international standard (ISO/IEC 15445:2000).

IP Address

Every computer connected to the Internet is assigned a number known as an Internet Protocol (IP) address. An IP address is a unique string of numbers that identifies a computer or server on the Internet. IP numbers are normally shown in four sets of numbers separated by periods, e.g. *216.239.51.100*. Each Internet domain name is associated with a unique IP addresses (Gosselin, 2004). This enables each device to identify and communicate with each other. It is fundamental that IP addresses are embedded in email messages because the sender IP address and destination IP address are required in order to establish communications and send data.

IP Telephony

Also known as Internet telephony, Broadband telephony, Broadband Phone, or Voice over Internet Protocol (VoIP), it s a technology that supports voice, data and video transmission via the Internet (Brown, 2004).

IRC (Internet Relay Chat)

A communication protocol which allows synchronous ("real time" or simultaneous) communication in discussion forums called ‘channels’ (Charalabidis, 1999).

JavaScript

JavaScript® is a script language, created by Netscape, which can be embedded into the HTML of a web page to add functionality (for example, being able to resize and move images on the screen).

MUDs

The acronym MUD refers to Multi-User Domain, Multi-User Dungeon or Multi-User Dimension. These are all names for a multiple user platform that supports situational simulation and real-time interaction. A variety of attributes are embedded in MUDs: computer-mediated simulation, community-forming, role-playing, and collaborative construction (Hsieh & Sun, 2006).

Newsgroup

Newsgroups, also known as Usenet, consist of messages which are posted on electronic bulletin boards (Levine, Young & Baroudi, 2005). Internet users can subscribe to many different newsgroups; each newsgroup covers a specific topic covering practically every human proclivity.

Newsgroup Spamming

Spamming is any unsolicited bulk electronic communication. Usually, the most common form of spam is e-mails advertising commercial products/services (Levine, Young & Baroudi, 2005). However, people spam for many purposes other than the commercial, and in many media other than e-mail. The prevalence of newsgroup spam led to the development and wide usage of the Breidbart Index (BI) as an objective measure of how bad a message is (Breidbart, 1994).

Peer-to-Peer File Transfer

A method of file-sharing over the Internet in which all computers are treated as equals (in contrast to a client/server architecture). Thus, users can download files directly from other users' computers, rather than from a central server (Subramanian & Goodman, 2005).

Phishing

The use of spoofed e-mails and fraudulent websites designed to trick users into divulging sensitive data (Dhamija, Cassidy, Hallam-Baker, & Jacobsson, 2006).

PQ Method

A program designed to statistically analyse Q data. PQ Method can be freely downloaded from http://www.qmethod.org/Tutorials/pqmethod.htm.

SSH

SSH or Secure Shell is a secure way of transmitting data over between local and remote computers. It utilises strong encryption and authentication to ensure confidentiality, integrity, and authenticity of the transferred data (Barrett, Silverman & Byrnes, 2005).

Streaming Media

Technical term for digital audio or video transmissions via the Internet. The multimedia is delivered n a continual data stream, so that it can be launched before the entire file has been downloaded (Krishnamurthy, 2004).

Synchronous conversations

Synchronous conversation include direct communication, where all parties involved in the communication are present at the same time. Examples include a telephone conversation, a company board meeting, a chat room event and instant messaging (Learn That, n.d.).

TCP/IP

TCP/IP is an agreed upon set of rules directing computers on how to exchange information with each other. The Transmission Control Protocol (TCP) and the Internet Protocol (IP) are the two most important communications protocols in the Internet protocol suite. These protocols were developed by Defense Advanced Research Projects Agency (DARPA) to enable communication between different types of computers and computer networks (Kozierok, 2005).

URL

A Uniform Resource Locator (URL) is essentially a web page address. It a standardised sequence of characters that is used for referring to resources, such as documents and images on the Internet, by their location (Parsons & Oja, 2002).