USER PERCEPTIONS OF INFORMATION QUALITY IN WORLD WIDE WEB INFORMATION RETRIEVAL BEHAVIOUR

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ABSTRACT

In less than a generation, the World Wide Web has grown from a relatively small cyber play-ground of academic "geeks" into an 11.5 billion-page collection of heterogeneous, inter-connected, network of information and collective knowledge. As an information environment, the World Wide Web is informatically representative of all that is good and bad about the human need to both absorb and transmit knowledge. The 'open' nature of the Web makes instantly available, to anyone who can "log-on", a boundless digital library of information, the quality of which cannot be enforced before, during, or even after its publication. Scrutiny of Information Quality (IQ), is therefore left up to those publishers conscientious enough to care about the quality of the information they produce, and the users who choose to employ the Web as an information retrieval tool.

The following thesis is a qualitative investigation of how the users of information make value-judgments about the information they encounter and retrieve from the Web. Specifically, it examines perceptions of IQ from the perspective of eighty "academic" high-end users, who regularly engage the Web and its search engines to search for and retrieve high-quality information related to their research, teaching and learning.

The investigation has adopted an interpretivist approach in the qualitative analysis of quantitative (10,080 separate pieces of user-data) data in the context of such established frameworks as Davis' (1986, 1989) Technology Acceptance Model (TAM), and Wang & Strong's (1996) contextual IQ framework that conceptualised dimensions of quality into four IQ categories, namely: intrinsic; representational; contextual; and accessibility IQ.

Through the detailed analysis of the driving theory behind these, and other associated models of: (1) user IT acceptance; (2) Information Seeking Behaviour (ISB); and (3) multi-dimensional characteristics of IQ; the researcher has sought to find synergies and develop an innovative framework by which to explore the impact of users' attitudes, expectations and perceptions of IQ on their Web information retrieval behaviours.

The findings associated with the thesis are consistent with the proposal of a new Ongoing Technology Acceptance Model (OTAM), which facilitates the measurement of users perception of the predictability of their technology interactions, and has the capacity to more accurately investigate user individual differences. Importantly, the OTAM allows the constructs of the original TAM, along with a new construct "Perception of Interaction" (PoI) to be used to investigate users *ongoing* use of technologies.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i) incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education.

(ii) contain any material previously published or written by another person except where due reference is made in the text; or

(iii) contain any defamatory material.

I also grant permission for the Library at Edith Cowan University to make duplicate copies of my thesis as required.

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phew ~ it's nearly over!

And finally: To my user-group of 80 academics from around the world. Thank you for completing a particularly large and demanding survey process. Especially to my two academics at Virginia Tech… I think of you often.

Dedication

To Sharon Martin….

At the beginning of processes we look ahead with expectations of what is to come, and at the end we look back at what has been. I would never have dreamed for a moment at the beginning of this process, that you would be gone before the end.

To Cherry "Gran" Blossom. The stable influence you have been through my entire life will never be forgotten. How I (selfishly) wish the cosmos had not taken you before I'd managed to finish…. but there's a chair in my garden where I sit and think of you often. Come and visit me sometime.

and …

To Jo….

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CHAPTER 1

Thesis Introduction

"User Perceptions of Information Quality

in World Wide Web Information Retrieval Behaviour"

1. Introduction

This PhD research is framed within the context of an ARC funded joint-project between the University of Wollongong and Edith Cowan University (Appendix 1.1) to develop an Internet crawler, which applies information quality driven algorithms in its process of crawling and ranking results to users' queries on the World Wide Web (Web). This part of the project relates to the Human/Computer Interaction (HCI) processes and specifically to the impact of perceptions of Information Quality (IQ) during web information retrieval behaviour.

1.2. The Research Scenario

IQ is a complex, multi-dimensional construct (Klein, 2001; Aladwani *et al.*, 2002; Lee *et al.*, 2003; Gendron *et al.*, 2004), made all the more challenging when investigated within the context of systems based human Information Retrieval (IR) behaviours, also recognised as involving multi-dimensional constructs (Schamber *et al.*, 1990; Wilson, 1999; Chang & Lee, 2001) including, but not limited to, relevancy judgments (Mizzaro, 1997 & 1998; Taylor *et al.*, 2007), cognitive authority (Rieh, 2002); cognitive flow (Hsu & Lu, 2004); information search processing (Kuhlthau, 1991, 1999); processing feedback mechanisms (Spink, 1997); cognition/interaction processes (Saracevic, 1996), and sense-making (Devin, 1983; Kari & Savolainen, 2002) to name just a few.

In the context of the current research then, user perceptions of IQ needed to be investigated within the context of Web-based information searching and retrieval behaviours, in order to be of some value to the larger ARC project. Importantly, the emphasis of this inquiry is not user/search-engine interaction per se, but rather user/information interaction in a search engine context. Being contextually driven adds yet another degree of complexity to this inquiry, as much of the previous systems-based research into IQ has been written from either an IQ *production* point of view (Strong & Miller, 1995; Hysell, 1999) or – as user-studies go – in the context of 'closed', and therefore quality controlled, business or library information systems (Farber, 2002; Rapp *et al.*, 2003, Melucci, 2004).

The Web provides a whole new and challenging context from which to investigate both user/system and user/information interaction: an information environment deficient in enforceable IQ standards (Chowdhury, 1999; Eppler & Muenzenmayer, 2002; Rieh, 2002; Croft & Peterson, 2002), an information user who's IR strategies are largely self-taught (Cunningham & Connaway, 1996; Applebee *et al.*, 2000), and a complex cognitive, interactive, contextual process (Marchionini, 2000; Ford *et al.*, 2005; Wirth *et al.*, 2007).

In addressing the scarcity of IS research that properly contextualises the HCI components of systems, Zhang & Li (2004) contend that an understanding of the component parts of human, technology and interaction will remain incomplete unless investigated within its appropriate organisational, or social context. Information Seeking Behaviour (ISB) is recognised essentially as a socially constructed behaviour (Beaulieu, 2000; Olsson, 2005), born from an information need (Wilson, 1981a; 1984), stemming from a perceived cognitive state (Belkin *et al.*, 1982). Examining ISB from a Social Cognitive Theory (SCT) point of view introduces concepts such as self-efficacy (Igbaria & Iivari, 1995); expectancy and attribution theories (Geoffrey, 2003) into an already complex phenomenon, particularly in relation to developing an understanding of users adoption (Chau, 1996) of IR systems.

1.2.1 Research Questions

Given the researcher's *contextual* approach, the research questions chosen to guide the investigation needed to be framed within the context of:

1.) Information retrieval (as opposed to information production)
2.) Individual characteristics/differences of the user-group;
3.) The type of information tasks typically undertaken;
4.) The informatic environment of the Web; *and*

5.) The interactive interface/characteristics of users' chosen search engine [1]

The research questions to be addressed in the current research are:

Information Quality (RQ.1)

RQ.1 – *How do users apply common perceptions of information quality to make value-judgments about the information they encounter and retrieve on the Web?*

- RQ.1 (a): What is information quality?
- RQ.1 (b): How do individual differences between users act as antecedents in the process of user determinations of information that is "fit-for-use"?

User Attitudes & Search Engine Interaction (RQ.2)

RQ.2 – *How do "individual differences" impact on high-end users' attitudes and perceptions regarding search engine effectiveness to retrieve quality information?*

The sub-questions of RQ.2 include:

- RQ.2 (a): how do individual differences act as antecedents on user perceptions of search and retrieval of quality information on the Web?
- RQ.2 (b): how effective are the TAM's PU and PEoU constructs at "telling the story" of on-going search engine usage?

Constructing a Framework for the investigation (RQ.3)

RQ.3 – *Can a framework be developed to model the processes of IQ perceptions in the context of IR, providing a more accurate lens through which to examine end-users individual difference?*

1.3 The Research Investigation

The central theme of this investigation is to develop an understanding of IQ. As stated, IQ is considered to be a multi-dimensional concept, in that multiple factors determine its state, existence and application. A somewhat general consensus has been reached in relation to a definition for IQ, sometimes used synonymously with Data Quality (DQ), as being information/data that is "fit-for-use" (also "fit-for purpose")

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[1] In the case of the current research, 74 of the 80 academics who completed the surveys stated that Google was their preferred search engine, 2 users said Google Scholar, and 1 user for each of Windows Search and Yahoo!

(Wang & Strong, 1996). Importantly, the "fit-for-use/purpose" paradigm, while still remaining ambiguous in relation to what IQ actually constitutes, is useful in that it implies that IQ is context driven (Lee *et al.*, 2002; Neus, 2003; Gendron *et al.*, 2004; Even & Shankaranarayanan, 2005; Neely, 2005; Song & Zahedi, 2006). The great value in assigning a context to IQ is that it:

1.) Enables researchers to conceptualise the processes involved in any user/information interaction processes (Wang & Strong, 1996; Shanks & Corbitt, 1999; Dedeke, 2000; Eppler & Wittig, 2000; Kahn *et al.*, 2002; Eppler & Muenzenmayer, 2002; Moraga *et al.*, 2006); *which then*
2.) Facilitates the process of associating characteristics (called "dimensions") with the information, which can be used as value-judgment criteria (Kahn *et al.*, 2002; Pernici & Scannapieco, 2002; Chang *et al.*, 2005); *and*
3.) Helps researchers to better understand what criteria users may employ in their value-judgements of information (Chung *et al.*, 2002; Li & Lin, 2006)

The context of this investigation into IQ is an exploration of how high-end [2] information users make value-judgments of the information they encounter on the Web. This is an important point, because the thesis itself is not, strictly speaking, about human ISB, it is about human perceptions of IQ. Specifically it is an exploration of human perceptions of IQ from the point-of-view of receivers (or users) of information. More specifically, given (1) the pervasive nature of Web technologies (Lyytinen & Rose, 2003; Ford, 2004; Hinson, 2006); (2) their current status as the largest instrument for information dissemination in human history (Case *et al.*, 2004); and (3) the unique perspective – that information users who choose to gather their knowledge from the Web are required to make their own choices regarding how "correct" that information is (Ford *et al.*, 2001; 2002; Wildemuth, 2002); researchers are afforded a unique opportunity to observe human IQ related decision-making processes across a truly wide spectrum of circumstances.

[2] In the context of the current research, high-end users are defined as users' who make relatively high quality-based demands of the information they encounter on the World Wide Web.

To that end, the principles involved in the following investigation, described by the researcher as a "contextually constructed" approach, have been designed to have application outside of their specific context.

1.3.1 Three Levels of Investigation

The approach to the research encompasses three levels of investigation;

1.) An exploration of users' attitudes and expectations regarding their current search engine engagement using the constructs of a modified "on-going" TAM model (*OTAM*);

2.) An investigation into user ISB's and individual user characteristics with the view of constructing sub-groups (called "group-cases") of users who share similar behavioural and personality characteristics;

3.) An exploration of user perceptions of known Web IQ issues using the sixteen common dimensions of IQ identified in the literature review, and examined in the context of the proposed Combined Conceptual Life-Cycle (CC/LC) model of IQ.

1.3.2 User Surveys

Four (participant self-observation) user surveys were developed to investigate the three levels of investigation identified in the previous section.

- ***Survey #1 TAM-IR:*** examined users' attitudes and expectations regarding their search engine interaction.
- ***Survey #2 TAM-IQ:*** examined users' attitudes and expectations in relation to the process of using the Web to find and retrieve high quality information
- ***Survey #3 ISB-Survey:*** examined various information seeking and searching behaviours, cognitive behaviours, and search engine strategies.
- ***Survey #4 IQ-Survey:*** examined users' general perceptions of IQ using sixteen identified IQ dimensions, and Web user behaviours in relation to user perceptions of IQ.

The data from the four surveys, in addition to the user demographic data gleaned from the registration form, provide a rich picture of the user-group. Cross analysis of the data within and between surveys has allowed for a novel, yet rigorous, examination of user perceptions and behaviours in relation to Web IQ.

1.3.3 Supporting Theory

Literature/theory review is a central component of the research, which has facilitated the development of three theoretical frameworks used in the analysis of user data. Namely:

1.) The *Combined Conceptual / Life Cycle* (CC/LC) model of IQ; (figure 2.2) used to develop a means of identifying the user/information interaction contexts of the sixteen common dimensions to be tested in the current research.

2.) The *On-going Technology Acceptance Model* (OTAM); (figure 2.25) a modified TAM which facilitates the measurement of users' perception of the predictability of their technology interactions. *Perception of Interaction* (PoI) is added to Perceived Usefulness (PU) and Perceived Ease of Use (PEoU), modifying the TAM and allowing it to be used to investigate users *ongoing* engagement of technologies.

3.) The *Interdisciplinary framework for investigating ISB*; (figure 2.25) adapted from Wilson (1997) and Ford *et al*. (2001, 2005). A framework which enabled the identification of the various theoretical structures of the current research, which spans across multiple disciplines, in a way that facilitates the discovery of synergies between them.

In addition, also developed, is:

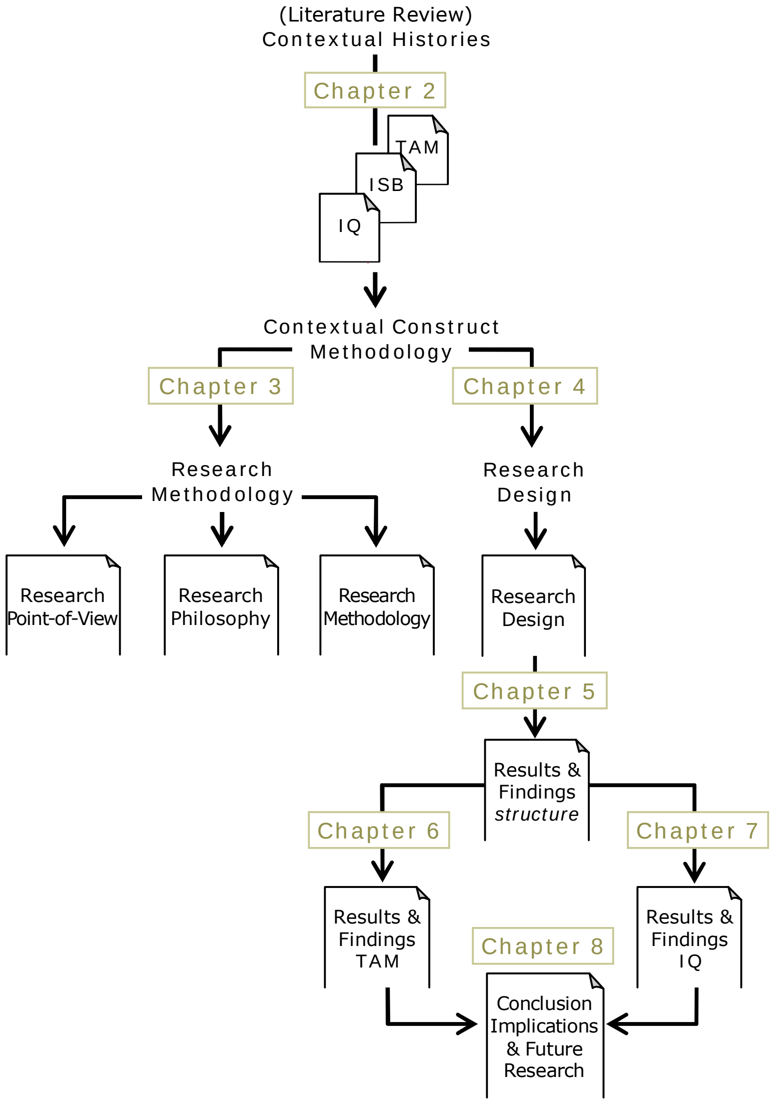
1.) A *macro model of Human Information retrieval behaviour* on the Web; (figure 2.27) which places user IQ related value-judgments into the context of Web information search and seeking processes.

2.) A novel methodology, the *Contextual Construct Methodology* (CCM); (figures 3.1; 3.8 & 3.9) developed to facilitate the construction of user sub-groups, called "group-cases", and the units of analysis between them.

1.4 The Research Structure

The conceptual research structure of (1) Contextual Histories; (2) Contextual Constructs; and (3) Developing Theory; are represented in figure 1.1

Figure 1.1: The Research Structure



The content of the PhD is as follows:

Part 1: Introduction

This provides an introduction to the general scope and content of the PhD as provided above.

Part 2: Literature Review

Chapter 2: "Contextual Histories"

A comprehensive cross-disciplinary review of the major historical developments in the research literature pertaining to IQ, ISB and TAM.

Presented largely in chronological order, the literature review – like the rest of the dissertation – takes a contextual approach in that the researcher looks specifically for appropriate literature that builds itself conceptually on previous research and findings.

The literature review also presents the theory-driven frameworks which will guide the analysis of the user data from the research surveys. Namely;

i. Combined Conceptual / Life Cycle (CC/LC)
ii. On-going Technology Acceptance Model (OTAM)

Part 3: Research Methodology & Design

Chapter 3: "Contextual Construct Methodology"

A Contextual Approach to Developing Methodology

Covers the first three phases of the contextual construct methodology.

The framework presented is a novel model, which presents research, by and large, as an extension of the research lens developed by the researcher during the dissertation process.

Discussed in the methodology chapter, are the first three parts of the CCM:

i The Research Point-of-view
ii. The Research Philosophy
iii. The Research Methodology

Guidelines for the interpretivist approach are also presented, along with the schema of each "group-case" and "units-of-analysis" approach to data collation and analysis.

Chapter 4: "Guidelines for Data Engagement"

The Research Design

Develops a picture of how the methodology theory has been adopted practically in the context of the research, and describes the various research tasks involved in the building of the research blue-print, data-collection and analysis.

Detailed discussion of the research questions covers the rationale for the research data collection, types of surveys, and analysis of data, including group-case design and units-of-analysis.

Part 4: Results & Findings

Chapter 5: "Constructions of Analysis"

Presents characteristics of the user-group and presents and describes fourteen potential "group-cases" to be used to investigate individual differences between clusters of users. A rationale for the various group-cases is presented.

Chapter 6: "User attitudes and perceptions"

Presents the results to the two TAM/OTAM surveys, investigating which individual differences between sub-groups of users are the strongest influences on users' attitudes and expectations of search engines & IR on the Web.

The original mind-map used to map-out the elements being tested by the TAM is also presented, demonstrating how the OTAM came to be.

The OTAM proposes that a third construct, Perception of Interaction (PoI), used to measure users ongoing perception of the predictability of their system interaction is able to better facilitate the investigation of individual differences within the user-group.

Chapter 7: "Information Quality in Web Information Retrieval"

User Web IQ dimensions are examined in the context of four group-cases, namely

i. Academic Discipline
ii. Academic Role
iii. Information Tasks
iv. Age-Range

Preliminary findings are discussed, and the CC/LC is revisited as a guiding framework from which to investigate results.

Part 5: Implications & Future Research

Chapter 8: "The learning"

A brief summary of some of the significant findings from chapters 6 & 7 are presented along with a discussion of the findings in relation to the research questions presented in chapter 4 (Research Design: "Guidelines for Data Engagement").

Implications and future directions for the research are also presented.

CHAPTER 2

Literature Review

"Contextual Histories"

Research into Information Quality,

Information Seeking Behaviour & Technology Acceptance

2. Introduction

The following review presents an examination of a representative body of literature associated with academic research into human information retrieval behaviour, including information seeking behaviour (ISB), cognitive-driven information search process (ISP); information quality (IQ), and technology acceptance and adoption for the purpose of information/data retrieval.

As with the entire PhD, developed within a philosophical framework of "contextual" analysis, the literature is presented largely in chronological order, an approach which allows for the examination of various theories within the historical context of their initial development. Related theories that provide frameworks for the models discussed herein, such as social cognitive, attribution, and human behaviour theories are also contextually examined.

Importantly, the review is not bound within one research discipline or methodology, but examines the issues associated with information behaviour and retrieval from a multiple disciplinary and methodological perspective, in an attempt to identify synergies between existent models of information quality, technology adoption, and human information seeking behaviour.

2.1. Information Quality

The intended outcome of this examination into IQ is two fold. Firstly, to develop a conceptual understanding of what IQ is, and secondly to examine ways in which the human perceptions of IQ can be applied to technology driven information systems in the context of the larger project of which this dissertation is a part.

2.1.1 What is information quality?

Defining IQ: "Fit-for-Use" (purpose)

Information quality is commonly described in the literature as a multi-dimensional concept (Ballou *et al.*, 1998; Klein, 2001; Pipino, 2002) with varying attributed characteristics depending on an author's philosophical and systems interaction point of view. Most commonly, the term "data quality" (often used synonymously with "information quality") is described as data that is "fit-for-use" (also "fit-for-purpose") (Wang & Strong, 1996), which implies that IQ is *relative*, as information considered appropriate for one use may not possess sufficient attributes for another use (Tayi & Ballou, 1998).

The "fit-for-use" paradigm has been embraced by researchers for a number of reasons. Firstly, it puts into common language the *action* of information quality while still remaining enigmatic and relative like the concept it is used to define. More importantly though, it gives information quality a *context* (Strong *et al.*, 1997a); that is; it suggests that information quality cannot be defined and assessed outside of the reason for which it exists.

Shanks & Corbitt (1999) contend that IQ should be assessed within the context of its generation, while Katerattanakul *et al.* (1999) add that it needs to be assessed according to its intended use. The reason for this contextual approach is both simple and logical, because it recognises that the attributes and dimensions used to assess IQ can vary depending on the context in which the data is to be used (Shankar & Watts, 2003).

The problem with defining IQ in such non-specific terms is that researchers are still no closer to actually defining what a "quality" piece of information is, or what criteria can be used to quantify or measure it. In addition, within the context of information retrieval (IR), that which represents a quality piece of information is highly reliant on the perceptions of the retriever of that information. The reality is that users of information are making choices regarding its quality constantly as they interact with the systems they use. Strong *et al*. (1997a) propose the currently widely accepted view that assessing IQ involves understanding it from the users' point of view; that is; quality cannot be assessed independent of the people who use the data (Strong *et al.,* 1997a)

Investigating IQ: The Information Retrieval environment of the Current Research

The user and information context to be addressed in this PhD is information retrieval in the information environment of the World Wide Web, an information environment devoid of the enforceable standards of quality associated with previous information environments (Hawkins, 1999; Brooks, 2003), where users (information seekers) are largely "on their own" in regards to searching, finding and retrieving target information (Hektor, 2003; Nicholas *et al.*, 2004, 2007). Understanding IQ from the point of view of the user (or searcher) of web-based information, involves understanding the processes of information seeking behaviour within this open system environment.

More often than not, Web information retrieval involves using a search engine, a specific set of keywords or concepts – which make up a user's query, followed by a decision process where the user makes *value judgements* concerning the results returned by the search engine to their query. These value judgments involve the user making choices according to concepts such as accuracy, currency and usefulness (Rose & Levinson, 2004).

Rose & Levinson (2004) advocate that a user's perception of what is accurate, current, important or useful is not only determined by what information they are searching for, but by *why* they seek it. The reality that two information searchers can use the same query to convey different meanings or search goals is one of the issues that makes developing search engine algorithms which facilitate a searcher's information needs such a difficult proposition. This proposition would be made immeasurably easier if the search engine could better understand the *intent* of a query.

It is the intent of a user's query that determines the mental coat hangers by which users make value-judgments relating to the quality of a search engine's return to their query (Lee *et al.,* 2003; Prabha *et al.,* 2007). Although the majority of research into IQ within the information systems (IS) discipline continues to reaffirm the widely held belief that these coat hangers are judgments relating to such dimensions as accuracy, usefulness, currency, and the like (DeLone & McLean, 1992; Goodhue, 1995; Lee *et al.*, 2002), research within the library information science (LIS) discipline includes concepts such as user-motivation (Barnett, 1999); information need (Chi *et al.*, 2001); user self-efficacy (Yee *et al*, 2004); and various user cognitive processes (Quinn, 2003); as important variables in a user's perception and judgments relating to IQ.

The focus on IQ from the perspective of Web-based information retrieval is a relatively new research area, but is absolutely critical if information retrieval systems are to become effective tools for retrieving quality information from the ever burgeoning World Wide Web.

2.1.2 Defining IQ with a View to Measuring it

Despite the sizeable body of literature available on IQ, relatively few researchers have tackled the difficult task of quantifying conceptual definitions of its various constructs. In acknowledging this general criticism levelled at IQ research, Naumann & Rolker (2000) suggest the reason actual assessable dimensions and associated quality scores are so difficult to define and calculate, is because the notion of quality essentially remains a *subjective* one.

Table 2.1 summarises twenty IQ frameworks collated from the previous decade of IS research. While varied in their approach and application, the frameworks share a number of definitive characteristics regarding their ultimate classifications of the dimensions of information quality.

Table 2.1: Comparison of information quality Frameworks

Yr	Author	Model	Constructs	
1996	(Wang & Strong, 1996)	A Conceptual Framework for Data Quality Summary: » 4 Categories » 16 Dimensions	Category	Dimensions
			Intrinsic IQ	Accuracy, Objectivity, Believability, Reputation
			Accessibility IQ	Accessibility, Security
			Contextual IQ	Relevancy, Value-Added, Timeliness, Completeness, Amount of Info
			Representational IQ	Interpretability, Ease of Understanding, Concise Representation, Consistent Representation
	(Zeist & Hendriks, 1996)	Extended ISO Model Summary: » 6 Quality characteristics » 32 Sub-characteristics	Characteristics	Sub-characteristics
			Functionality	Suitability, Accuracy, Interoperability, Compliance, Security, Traceability
			Reliability	Maturity, Recoverability, Availability, Degradability, Fault tolerance
			Efficiency	Time behaviour, Resource behaviour
			Usability	Understandability, Learnability, Operability, Luxury, Clarity, Helpfulness, Explicitness, Customisability, user-friendliness
			Maintainability	Analysability, Changeability, Stability, Testability, Manageability, Reusability
			Portability	Adaptability, Conformance, Replaceability, Installability

Table 2.1: Comparison of information quality Frameworks (cont…)

Yr	Author	Model	Constructs		
1997	(Beck, 1997)	Evaluation Criteria for web information sources Summary: » 5 Criteria	**Criteria**		**Dimensions**
			Accuracy		reliable, error-free, verified
			Authority		attributed authorship, publisher - info origin
			Objectivity		free of bias, purpose of the web page
			Currency		last update, working hyperlinks
			Coverage		topics, depth of material, uniqueness of material
	(Harris, 1997)	User-focused checklist (CARS) to help researchers look for clues regarding website information quality Summary: » 4 contexts » at least 16 dimensions	**CARS (context)**		**Dimensions to be assessed**
			Credibility		trustworthy source, author's credentials, evidence of quality control, known or respected authority, organizational support.
			Accuracy		up to date, factual, detailed, exact, comprehensive, audience and purpose reflect intentions of completeness and accuracy
			Reasonableness		fair, balanced, objective, reasoned, no conflict of interest, absence of fallacies or slanted tone
			Support		listed sources, contact information, available corroboration, claims supported, documentation supplied
1999	(Alexander & Tate, 1999)	Applying a Quality Framework to Web Environment Summary: » 6 Criteria	**Criteria**		**Dimensions**
			Authority		validated information, author is visible
			Accuracy		reliable, free of errors
			Objectivity		presented without personal biases
			Currency		content up-to-date
			Orientation		clear target audience
			Navigation		Intuitive design
	(Katerattanakul *et al*, 1999)	IQ of Individual Web Site Summary: » 4 Quality Categories (adapted from Wang & Strong)	**Category**		**Dimension**
			Intrinsic IQ		Accuracy and errors of the content Accurate, workable, and relevant hyperlinks
			Contextual IQ		Provision of author's information
			Representational IQ		Organisation, Visual settings, Typographical features, consistency, Vividness / attractiveness
			Accessibility IQ		Navigational tools provided
	(Shanks & Corbitt, 1999)	Semiotic-based Framework for Data Quality Summary: » 4 Semiotic descriptions » 4 goals of IQ » 11 dimensions	**Semiotic Level**	**Goal**	**Dimension**
			Syntactic	Consistent	Well-defined / formal syntax
			Semantic	Complete and Accurate	Comprehensive, Unambiguous, Meaningful, Correct
			Pragmatic	Usable and Useful	Timely, Concise, Easily Accessed, Reputable
			Social	Shared understanding of meaning	Understood, Awareness of Bias
2000	(Dedeke, 2000)	Conceptual Framework for measuring IS Quality Summary: » 5 Quality Categories, » 28 dimensions	**Quality Category**		**Dimensions**
			Ergonomic Quality		Ease of Navigation, Conformability, Learnability, Visual signals, Audio signals
			Accessibility Quality		Technical access, System availability, Technical security, Data accessibility, Data sharing, Data convertibility
			Transactional Quality		Controllability, Error tolerance, Adaptability, System feedback, Efficiency, Responsiveness
			Contextual Quality		Value added, Relevancy, Timeliness, Completeness, Appropriate data
			Representation Quality		Interpretability, Consistency, Conciseness, Structure, Readability, Contrast
	(Naumann & Rolker, 2000)	Classification of IQ Metadata Criteria Summary: » 3 Assessment Classes » 22 IQ Criterion	**Assessment Class**		**IQ Criterion**
			Subject Criteria		Believability, Concise representation, Interpretability, Relevancy, Reputation, Understandability, Value-Added
			Object Criteria		Completeness, Customer Support, Documentation, Objectivity, Price, Reliability, Security, Timeliness, Verifiability
			Process Criteria		Accuracy, Amount of data, Availability, Consistent representation, Latency, Response time
	(Zhu & Gauch, 2000)	Quality metrics for information retrieval on the WWW Summary: » 6 Quality Metrics	**Assessment Class**		**IQ Criterion**
			currency		measured as the time stamp of the last modification of the document.
			availability		calculated as the number of broken links on a page divided by the total numbers of links it contains.
			information-to-noise ratio		computed as the total length of the tokens after pre-processing divided by the size of the document:
			authority		based on the Yahoo Internet Life (YIL) reviews [27], which assigns a score ranging from 2 to 4 to a reviewed site.
			popularity		number of links pointing to a Web page, used to measure the popularity of the Web page
			cohesiveness		determined by how closely related the major topics in the Web page are

Table 2.1: Comparison of information quality Frameworks (cont…)

Yr	Author	Model	Constructs
2001	(Leung, 2001)	Adapted Extended ISO Model for Intranets Summary: » Adaptation of Zeist & Hendriks Extended ISO Model, applied to Intranet environments » The grey, italic sub-characteristics are not considered needed to achieve IQ	**Characteristics** — **Sub-characteristic** Functionality — *Suitability*, Accuracy, *Interoperability*, *Compliance*, Security, Traceability Reliability — Maturity, Fault tolerance, Recoverability, Availability, Degradability Usability — Understandability, Learnability, Operability, Luxury, Clarity, Helpfulness, Explicitness, user-friendliness, Customisability Efficiency — Time behaviour, Resource behaviour Maintainability — Analysability, Changeability, Stability, Testability Manageability, Reusability Portability — *Adaptability*, *Installability*, *Replaceability*, *Conformance*
2002	(Kahn *et al*,, 2002)	Mapping IQ dimension into the PSP/IQ Model Summary: » 2 Quality Types, » 4 IQ Classifications, » 16 IQ dimensions	**Quality Type** — **Classification** — **Dimension** Product Quality — Sound Information — Free-of-Error, Concise, Representation, Completeness, Consistent Representation Product Quality — Useful Information — Appropriate Amount, Relevancy, Understandability, Interpretability, Objectivity Service Quality — Dependable Information — Timeliness, Security Service Quality — Useable Information — Believability, Accessibility, Ease of Manipulation, Reputation, Value-Added
	(Liu & Chi, 2002)	Evolutional Data Quality	**Quality Type** — **Dimension** Collection Quality — Accuracy, Objectivity, Trustworthiness, Completeness, Clarity Organisation Quality — Reliability, Consistency, Storage Efficiency, Retrieval Efficiency, Navigability Presentation Quality — Semantic Stability, Faithfulness, Neutrality, Interpretability, Formality Application Quality — Ease of Manipulation, Timeliness, Privacy, Security, Relevancy, Appropriate Amount of Data
	(Eppler & Muenzenmayer, 2002)	Conceptual Framework for IQ in the Website Context Summary: » 2 Manifestations, » 4 quality categories, » 16 Quality dimensions	**Quality Type** — **Categories** — **Dimensions** Content Quality — Relevant Information — Comprehensive, Accurate, Clear, Applicable Content Quality — Sound Information — Concise, Consistent, Correct, *Current* Media Quality — Optimized Process — Convenient, *Timely*, Traceable, Interactive Media Quality — Reliable Infrastructure — Accessible, Secure, Maintainable, *Fast*
	(Klein, 2002a)	5 IQ Dimensions (chosen from Wang & Strong's 15 Dimensions.	**IQ Dimensions** — **Preliminary Factors** Accuracy — Discrepancy, Timeliness, Source/Author, Bias/Intentionally False Information Completeness — Lack of Depth, Technical Problems, Missing Desired Information, Incomplete When Compared with Other Sites, Lack of Breadth Relevance — Irrelevant Hits When Searching, Bias, Too Broad, Purpose of Web Site Timeliness — Information is Not Current, Technical Problems, Publication Date is Unknown Amount of Data — Too Much Information, Too Little Information, Information Unavailable
2003	(Shankar & Watts, 2003)	Theoretical Model for Data Quality Assessment.	**IQ Dimensions** — **Preliminary Factors** Object — Accuracy, Completeness, Timeliness User — Believability, Relevance
	(Sturges & Griffin, 2003)	Tool for Archaeological website quality evaluation Summary: » 5 contexts » 14 'named' dimensions (up to 10-15 more implied) (much borrowed from Smith,1997)	**Criteria** — **Explanation** Scope — subject breadth - comprehensiveness subject depth - appropriate level to audience Purpose/Audience — consistency, appropriateness Content — accuracy, authority, copyright, currency, uniqueness, links, quality, and overall quality Graphic & Media Design — attractive, well organised, good quality illustrations, navigational aids Workability — user friendliness, computer environment, searching, browsability and organization, interactivity, connectivity
2004	(Tombros, Ruthven & Jose, 2003)	5 dimensions for judging quality in web pages The arrow (right) is the IQ part of the model.	**Web Feature** — **Metric/Criterion** Text — Content, Numbers, Titles/Headings, Query Terms, Text Quantity Structure — Layout, Links, Links Quality, Table Layout Quality — Scope/Depth, Authority/Source, Recency, General Quality, Content Novelty Non-textual — Pictures Physical Properties — Page Not Found, Page Location, Page Already Seen, Others

Table 2.1: Comparison of information quality Frameworks (cont…)

Yr	Author	Model	Constructs		
2005	(Stvilia *et el.* 2005)	Application of 7 known IQ metrics to automated system (evaluation) tool, to measure IQ of Wikipedia content	**Metrics**	**measured by automated tool**	**Related Dimensions**
			Authority/Reputation	by the *authors* of the material	Reliability
			Completeness	by broken hypertext links within articles	
			Complexity	by the readability of the content	Understandability
			Informativeness	by diversity of content	Value-Added
			Consistency	by number of non-unique authors	
			Currency	by how current (up-to-date) content is	
			Volatility	by time taken to fix erroneous content	Security, Believability
2006	(Song & Zahedi, 2006)	IQ dimensions that influence users judgments of Web-based Health infomediaries	**Construct**	**Author's description**	**Related Dimensions**
			Adequacy	completeness, coverage (scope), and level of bias in information	Completeness, Coverage, Scope/Depth
			Relevance	practical (personal) applicability of information to individual user	Applicability
			Usefulness	(overall) perceived usefulness of information *[TAM of info not system]*	Accessibility & Availability
			Reliability	accuracy and credibility	Accuracy, Credibility
			Understandability	clarity and ease of comprehension – i.e.; accessibility of health jargon *[TAM of info, not system]*	Understandability
			Ease of Use	[TAM] ease of (system) navigation	Efficiency, Usability
			Interactivity	benevolence and personalisability	Value-Added,
			HI's Trust signs	policies & security, disclosures & ownership,	Objectivity, Security

The twenty frameworks cited in Table 2.1 have a rich and varied history and systems context. The list includes;

1.) Highly conceptual IQ identification models;

- CIQF - Categorical Information Quality Framework (Wang & Strong, 1996);
- SDQF - Semiotic Data Quality Framework (Shanks & Corbitt, 1999);
- Conceptual Framework for measuring IS Quality (Dedeke, 2000);
- Mapping IQ into the PSP/IQ (becomes AIMQ) (Kahn *et al.*, 2002);
- IQM - Information Quality Measurement Methodology (Eppler & Muenzenmayer, 2002)

2.) Frameworks that push existing models in order to apply them to a Web environment

- Extension of IQF into Web environments information contexts (Katerattanakul *et al.*, 1999)
- Detection of IQ problems by users on the WWW (Klein, 2002a)

3.) Development of IQ conceptual models into machine readable metrics

- Quality metrics for information retrieval on the World Wide Web (Zhu & Gauch, 2000)
- Classification of IQ Metadata Criteria (Naumann & Rolker, 2000)
- Using IPMAP to create machine readable (quality related) metadata about data (Shankar & Watts, 2003)

- Quality metrics used to create Wikipedia IQ evaluation tool (Stvilia *et el.*, 2005)

4.) Applying IQ guidelines to build user-resources and "how to.." frameworks for searchers of information – specifically user/searchers on the World Wide Web.

- CARS Checklist for Information Quality (Harris, 1997);
- (Web) Evaluation Criteria (Beck, 1997);
- Web Wisdom (Alexander & Tate, 1999);

Conceptual Models of IQ: Discussion

The valuable paradigm of contextual IQ postulated by Wang & Strong (1996) allowed the authors to separate user/information interaction into two distinct contexts; (1) information production; and (2) information use. The further conceptualisation of IQ into categories associated with production or use proved to be a valuable methodology for identifying the ultimate dimensions proposed to be applied by users in their process of information interaction.

Wang & Strong (1996) built a contextually driven conceptual framework that categorised characteristics, which the authors' called "dimensions", into four contexts (or types) of information;

1.) Intrinsic IQ;
2.) Accessibility IQ;
3.) Contextual IQ:
4.) Representational IQ.

In the context of these four categories, sixteen different dimensions of IQ were identified and listed in Table 2.1.

The process of determining conceptual contexts for IQ enables researchers to begin putting that which is, conceptually speaking, relatively intangible, into tangible descriptions that can be explored in concrete terms.

Shanks & Corbitt (1999) conceptualised IQ in relation to cultural meanings; that is; how IQ could be understood in terms of the quality related meanings imposed on it as a socially created construct. Investigated from this more philosophically driven approach, the authors built IQ into a semiotic framework comprised of four levels.

1.) Syntactic: concerned with the physical/empirical structure of information

2.) Semantic: concerned with the wholeness of information

3.) Pragmatic: concerned with usage of information

4.) Social: concerned with the socially driven meanings of information.

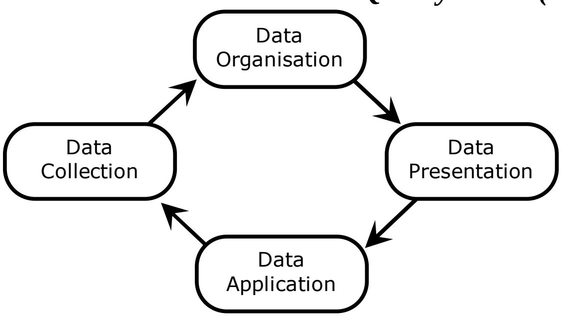
At a theoretical level, the semiotic framework recognises its own constructivist view-point, that information itself is symbolic, and the framework acknowledges the building of imposed constructs in order to meaningfully classify the various characteristics of information quality. This type of conceptualisation of IQ is ultimately concerned with the application of symbolic representation of systems "quality" in line with the view that communication and language are themselves symbolic (Budd, 2004; Goulding, 2005)

By beginning at a conceptual level, researchers are able to contextualise an investigation of the more abstract or esoteric characteristics of "quality" as a phenomenon. Where Shanks & Corbitt take a semiotic, philosophical approach, Dedeke (2000) takes a more pragmatic approach, identifying quality characteristics in terms of how they might be manifest in an electronic systems environment. It should be noted that subsequent semiotic (Shanks & Corbitt, 1999) approaches removed the "social" construct (Price & Shanks, 2004, 2005a) of the 1999 model presented in Table 2.1. The researcher, however, sees this social construction of information quality as an important concept in the context of the current research; that is; information retrieval.

IQ as a Life-Cycle

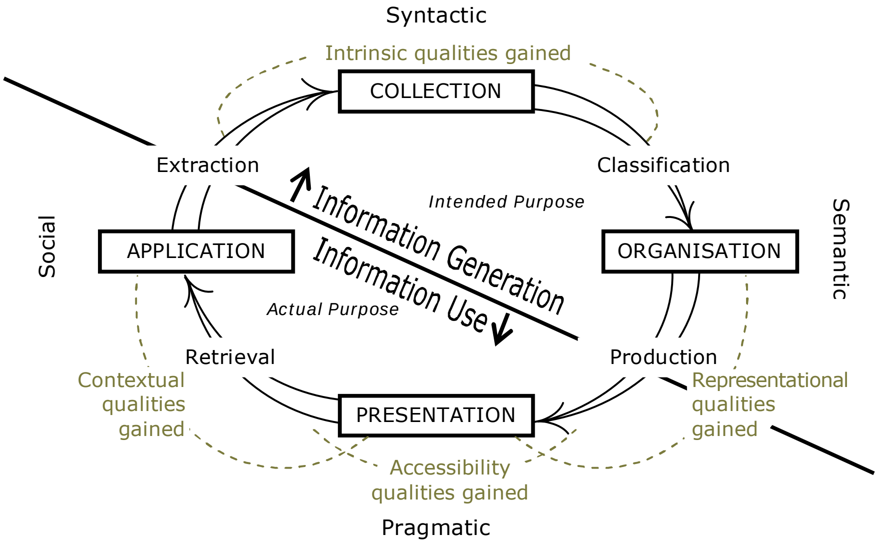
Liu & Chi's (2002) "Evolutional Data Quality" framework, built largely on a foundation of Wang & Strong's (1996) four category IQ model, conceptualises the process of user/information *interaction* into a cycle that includes the separation of IQ into two contexts; namely; (1) information *production*; and (2) information *use*.

Figure 2.1: Liu & Chi's Evolutional Data Quality model (2002)



The current research seeks to develop Liu & Chi's (2002) life-cycle conceptualisation of IQ by looking for synergies between the various conceptual models presented in table 2.1 and placing them into a more detailed model that contextualises information interaction into this four-stage life-cycle. The revised model is presented in Figure 2.2 as a *Combined Conceptual/Life-Cycle Model of IQ*.

Figure 2.2 Combined Conceptual/Life-Cycle Model of IQ



The combined conceptual/life-cycle model sees the classification of information purpose (called "generation") and user's retrieval purpose (called "information use") as useful to any investigation into IQ. The researcher contends that the dimensions used, and their level of critical importance to data quality will vary depending on whether research is examining data quality from a production perspective or from an information retrieval perspective. The combined life-cycle model demonstrates a level of synergy between the conceptual models previously discussed, but also super imposes a set of user information "actions" that take place dependent on the stage of life-cycle information interaction. takes place. These actions are representative of typical user/information interactions that take place during the IQ life-cycle, and include;

1.) Information classification (Palmquist, 1996; Bates, 1998 & 2002a; Wu, 2001);
2.) Information production (Shankaranarayanan *et al*., 2000; Kovac & Weickert, 2002; Scannapieco *et al*., 2002)
3.) Information retrieval (Spink & Saracevic, 1998; Fidel *et al*., 2004); *and*
4.) Information extraction (Gaizauskas & Robertson, 1997; Toms, 1997).

The perspective of the current research is information retrieval, which takes place in the ***information use*** side of the model, and provides the context for the user IQ related data analysis later in this research. The over-arching assumption of the CC/LC model is that IQ dimension importance and the value-judgments made in relation to them is heavily dependant on where in the life-cycle user/information interaction takes place. This is consistent with Wang & Strong's (1996) contention that IQ as a construct and a value is essentially contextually driven.

IQ as a set of "dimensions"

Despite the varied research contexts of the IQ frameworks and models presented in Table 2.1, an analysis of the **Constructs** column reveals a remarkable commonality amongst the eventual elements identified by researchers as being important "dimensions" of IQ. These include such traditional dimensions as accuracy, consistency, timeliness, completeness, accessibility, objectiveness and relevancy. Table 2.2 provides a summary of the most common dimensions and the frequency with which they are included in the twenty IQ frameworks of Table 2.1. Dimensions are named and the number of times they appear in Table 2.1 is recorded. A short definition of each dimension is also provided.

Table 2.2: The Common Dimensions of IQ/DQ

	Dimension	# of times	Definitions & Relating Dimensions
1	Reliability	17	The degree to which information is worthy of being depended on. Is built from other dimensions relating to authority, authorship and reputation.
2	Accuracy	14	The degree to which information is correct, or free from error
3	Timeliness/Currency	14	The degree to which information is up-to-date, relative to the task at hand
4	Scope/Depth	13	The degree to which the amount of information available from a source has the appropriate amount (or coverage) of information required.
5	Relevancy	12	The degree to which information is applicable and helpful for the task at hand. Includes other dimensions such as useful.
6	Accessibility & Availability	10	The degree to which information is easily retrievable by information seekers. Refers to both a physical access (i.e. through a network or internet) and cognitive access (i.e. easily read).
7	Usability	9	The degree to which information is can be easily found (i.e. navigated) and easily used.
8	Consistency	8	The degree to which information is presented in an orderly, logical format that is compatible with other information contained within the same place
9	Objectivity	8	The degree to which information is aware of (i.e. stated), or free from bias.
10	Understandability	9	the degree to which information is capable of being understood or interpreted.
11	Completeness	9	The degree to which all the necessary parts or elements of the required information are present.
12	Security	9	The degree to which information is considered safe because of appropriate restricted access.
13	Value-Added	8	The degree to which information delivers benefit by providing unique or distinct material.
14	Concise	6	The degree to which information is expressed in a compact, easy to understand manner.
15	Believability	5	The degree to which information is regarded as true or credible, and therefore capable of being believed.
16	Efficiency	3	The degree to which information is able to quickly meet the 'information needs' of a searcher.

The sixteen dimensions identified in Table 2.2 summarise the common dimensions of IQ identified in much of the information systems IQ literature over the last decade. The list is, of course, not exhaustive, but a select representation of the body of systems-related IQ research from the previous decade. Of particular applicability to the current research are the IQ models and corresponding dimensions discussed and associated with research into the open information system of the World Wide Web. A closer examination of this body of literature reveals that authors generally appropriate a largely similar set of dimensions regardless of the system's context. With that said, if the frequency in which specific dimensions occur across multiple framework is an indication of their level of importance to IQ within an information environment, then it could be argued that there are some significant differences between the importance of identified dimensions within a closed system – such as a business system, compared to an open system – such as the World Wide Web.

IQ in the Context of its System Use

Of the twenty different IQ frameworks summarised in Table 2.1, nine are set in a closed, controlled systems environment and eleven are set in the environment of the World Wide Web. Because the actual numbers of frameworks representing each environment are different, a direct comparison of occurrence frequency of the dimensions involved would be invalid. However, the frequency of occurrence within a specific type of system can be used to *rank* the dimensions within that system context, in which case a number of key IQ dimensions which are assumed to play a major role in traditional systems IQ, appear to play a more minor role in Web-based systems. Table 2.3 compares the rank of each of the sixteen most frequently occurring dimensions from Table 2.2 within their systems context.

As illustrated in Table 2.3, a close analysis of the literature regarding IQ in traditional systems versus IQ on the Web reveals that dimensions such as reliability and accuracy are important constructs regardless of the information system. Interestingly though, dimensions such as relevancy, understandability, accessibility and availability appear to have notably less impact on perceptions of information quality in a Web environment, while dimensions such as currency, objectivity and value-added (uniqueness) are more important.

Table 2.3: The rank of IQ dimensions in traditional vs. Web-based systems

Dimension	Rank (according to frequency of occurrence) System Quality	WWW Quality
Relevancy	1	[↓4] =5
Reliability	=2	[↑1] 1
Understandability	=2	[↓12] 14
Accuracy	=4	[↑1] 3
Scope/Depth	=4	[↑2] 2
Accessibility & Availability	=4	[↓3] =7
Security	=4	[↓1] =5
Timeliness/Currency	8	[↑4] 4
Usability	=9	[↓2] =11
Consistency	=9	[↑2] =7
Completeness	=9	[↓2] =11
Concise	=9	[↓2] =11
Objectivity	=13	[↑5] =7
Value-Added	=13	[↑5] =7
Believability	=13	~
Efficiency	16	~

↑ indicates more important in WWW
↓ indicates less important in WWW

2.1.3 Tangible Metrics for IQ in the context of Web-based Information Retrieval

One of the goals of the current research is to investigate to what degree the currently accepted IQ dimensions impact users' perceptions of quality as they search and retrieve content from the World Wide Web. A practical application to the of the findings of such a study would be to employ these contextually appropriate set of dimensions to the crawling algorithms of a Web-based search engine. The challenge then, is not only to develop metrics that *realistically represent* actual user information behaviour and strategies, but to make them tangible enough to develop into web-crawler algorithms.

What follows is a closer investigation at the IQ frameworks from Table 2.1 which have explored ways to adapt IQ dimensions into a machine readable format.

Pragmatic Models of IQ:

Aligning machine generated algorithms with common Web information characteristics

Zhu & Gauch's (2000) approach is a relatively simple one, where crawling technology is enhanced with logical algorithms that quantify characteristics such as currency or availability. Table 2.4 illustrates Zhu & Gauch's six proposed algorithm additions to a crawler, which are then used by the crawler to assign an IQ rating to a web page.

Table 2.4: Zhu & Gauch's approach to developing tangible assessment methods for IQ

Assessment Class	Machine Readable IQ Criterion
currency	measured as the time stamp of the last modification of the document.
availability	calculated as the number of broken links on a page divided by the total numbers of links it contains.
information-to-noise ratio	computed as the total length of the tokens after pre-processing divided by the size of the document:
authority	based on the Yahoo Internet Life (YIL) reviews, which assigns a score ranging from 2 to 4 to a reviewed site.
popularity	number of links pointing to a Web page, used to measure the popularity of the Web page
cohesiveness	determined by how closely related the major topics in the Web page are

A more contextual approach: applying multi-level meta-data to train a crawler

Naumann & Rolker's (2000) approach is more complex, using a three-fold assessment for the quality of an information source, according to the (1) subjects; (2) objects; and (3) processes; involved in information retrieval. The premise of this model is based on two basic assumptions:

1.) The perceived quality of information is influenced by three factors:
- the *perception* of the user;
- the *information* itself;
- the *process of accessing* the information.

2.) The information retrieval process involves three entities:
- the user,
- the information, and
- the retrieval system

Both the influences and the processes involved with information quality and retrieval are used to assign quality scores within three contexts, (1) Subject criteria; (2) Process criteria; or (3) Object criteria. The scores are used to create metadata that is then used to assign a Page Rank for the information source when it is listed in the results of a user's query. The higher the IQ ranking, the higher in the list of results the target web page will sit. Figure 2.1 illustrates Naumann & Rolker's (2000) model for classifying the IR entities, IQ factors (or influences) and IQ assessment contexts.

By grouping the entities and factors involved with both IQ and IR into *Subject*, *Object* and *Process* Criteria (*see IQ Contexts column in figure 2.1*), Naumann & Rolker (2000) are then able to easily identify IQ criterion specifically related to the process of information retrieval, and assign assessment methods to them. Table 2.5 lists the IQ criterion identified by Naumann & Rolker (2000) and suggested methods for assessment

Figure 2.3: Illustration of Naumann & Rolker's Model for building quality related metadata of an Information Source

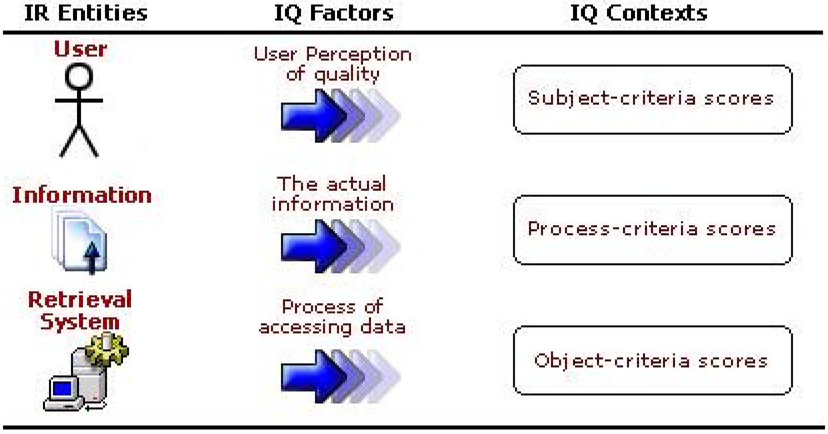


Table 2.5: Classification of IQ Metadata Criteria (Naumann & Rolker, 2000)

Assessment Class	IQ Criterion	Assessment Method
Subject Criteria	Believability	*user experience*
	Concise representation	*user sampling*
	Interpretability	*user sampling*
	Relevancy	*Continuous user assessment*
	Reputation	*user experience*
	Understandability	*user sampling*
	Value-Added	*Continuous user assessment*
Object Criteria	Completeness	*Parsing, sampling*
	Customer Support	*Parsing, contract*
	Documentation	*Parsing*
	Objectivity	*Expert input*
	Price	*Contract*
	Reliability	*Continuous assessment*
	Security	*Parsing*
	Timeliness	*Parsing*
	Verifiability	*Expert input*
Process Criteria	Accuracy	*Sampling, cleansing techniques*
	Amount of data	*Continuous assessment*
	Availability	*Continuous assessment*
	Consistent representation	*Parsing*
	Latency	*Continuous assessment*
	Response time	*Continuous assessment*

The potential effectiveness of Naumann & Rolker's framework is the theoretical recognition of the information environment in which IQ measurements are being applied as well as the ultimate purpose for which the information contained in the system is being sought. It attempts to assign meta-data ratings to Web-based content – using relatively vague entities such as believability and interpretability – by involving the user/searcher in the process of classification and measurement

Identifying information "problems" in machine readable terms

Eppler & Muenzenmayer (2002) provide a helpful list of potential IQ related problems associated with individual web pages, using the IQM (information quality measurement) methodology. This methodology works in a reverse type process, where common *problems* (called "Web-Indicators") are identified first and then placed within the context of an accepted IQ dimension (called "IQ-Criterion"). The type of Web Application Tool that can be utilised to measure the extent of the problem is then identified. Table 2.6 summarises this process.

Table 2.6: Measuring IQ-criteria for the website context with relevant indicators and adequate tools (Eppler & Muenzenmayer, 2002)

IQ-Criterion	Web-Indicator	Measurement Tool
1. Accessibility	# broken links # broken anchors	Site Analyser
2. Consistency	# of pages with style guide deviations	Site Analyser
3. Timeliness	# of heavy (over-sized) pages/files with long loading times	Site Analyser
4. Conciseness	# of deep (highly hierarchic) pages	Site Analyser
5. Maintainability	# of pages with missing meta-information	Site Analyser
6. Currency	Last mutation > six months	Site Analyser
7. Applicability	# of orphaned (not visited or linked) pages or user rating	Site Analyser in combination with Traffic Analyser, user Surveys
8. Convenience	Difficult navigation paths: # of lost/interrupted navigation trails	Traffic Analyser, Web Mining Tools
9. Speed	Server and network response time	Server & Network Monitoring Tools, or Site Analyser
10. Comprehensiveness	user rating	user Surveys
11. Clarity	user rating	user Surveys
12. Accuracy	user rating	user Surveys
13. Traceability	# of pages without author or source	Site Analyser
14. Security	# of weak log-ins	Site Analyser/Port scanner
15. Correctness	user ratings	user Surveys
16. Interactivity	# of forms # of personalisable pages	Site Analyser

A sound Methodology for a Contextual IQ Assessment Framework

Leung (2001), like Naumann & Rolker (2000), concentrates on the user-application process in order to develop a framework to assess quality. This time, the focus specifically concerns the information and application-processes contained within an *Intranet* environment, where organisational users are responsible for continuing updates of information, as opposed exclusively to information retrieval on the World Wide Web. Many of the governing principals and decision making processes outlined in Leung (2001) fall into the same type of contextual approach as Naumann & Rolker (2000), allowing for the identification of the appropriate IQ dimensions within a TCP/IP systems environment.

Leung (2001) suggests that any metric initiative must address the needs of its potential users and should be objective, cost effective and informative. These guidelines can be summarised in the following methodology.

1.) Identify the user
2.) Identify the metric application(s)
    (the applications and process that make up the system)
3.) Identify the dimensions to be assessed
4.) Prioritise the dimensions to be assessed by applying an
    Importance, *Urgency* and *Cost* metric to each dimension.
5.) Develop specific assessment metrics for prioritised dimensions

Leung (2001) developed user surveys to measure the quality of the Intranet system used in the study, which was appropriate for the dimensions, applications and general technology being assessed. In the case of developing crawler algorithms, collecting information from users concerning their experience with Internet information retrieval would serve chiefly to confirm any identification of the major IQ problems currently plaguing the World Wide Web. Ultimately however, the type of assessment required needs to be both ongoing, machine readable and automated.

The principals of identifying the user, the technology environment and the individual IQ dimensions, followed by prioritising the dimensions and developing technology based assessment metrics were used by Knight & Burns (2005) to develop a contextually based framework in which to build a workable model for measuring and applying IQ related algorithms to an Internet focused crawler. The resulting IQIP (identify, quantify, implement and perfect) is one of the models developed for the current research, and will be discussed in greater detail in the following section.

2.1.4 IQIP: A Model for Measuring IQ during Crawler IR

The Information Environment of the World Wide Web

Applying IQ metrics commonly to the World Wide Web has its own set of problems. Firstly, there are no quality control procedures for information uploaded onto the Web and secondly, users of the information have to make judgements about quality for themselves (Bradley, 1998; Rieh, 2002;), creating a uniquely subjective environment where one user's quality could be of little or no value to another user. This makes quality dimensions such as relevancy and usefulness not only enormously important but also extremely difficult to gauge.

From a systems perspective, the idea is no longer to simply build a crawler that can weave its way through the different electronic formats on the World Wide Web in order to find content related to a user's query, but one that can apply quality related algorithms to both the crawling and ranking strategies of a query search (Tsoi *et al.*, 3002a, 2003b). Those algorithms would need to go beyond the PageRank strategies employed by many Internet crawlers, combining an ability to “tunnel” through lower ranked pages and quality criteria to return fewer, but better, results per user-query.

In addition to this, the selection of which IQ dimensions to convert into algorithms is made all the more difficult because of the wide range of contexts in which information is used on the World Wide Web, as the importance of specific IQ dimensions will depend greatly on whether they are being identified for; (1) producers of information; (2) the storage and maintenance systems used for information; or, (3) for the searchers and users of information.

This is where the application of Leung's (2001) principles of identifying (1) the user; (2) the environment; and (3 & 4) the appropriate dimensions of quality; can be extended into a framework that allows for the consideration of IQ context in order to manage the choice and implementation of quality related algorithms of an Internet crawling search engine.

IQIP: Identify, Quantify, Implement and Perfect.

Figure 2.2 illustrates the **IQIP**;

- Identify – *the user, environment and task*;
- Quantify – *prioritise appropriate dimensions of information quality using a 'Dimension Score'*;
- Implement – *the chosen IQ dimensions into the Web Crawler*; and
- Perfect – *improve the crawler through system and user feedback.*

The Model will now be discussed in detail.

(1) Identify

The model proposed that there are three *entities* that need to be identified and understood, namely;

1.) The user;
2.) The information/system environment; *and*
3.) The information task.

The user: The end-user should be known so that cognitive, sociological and quality choice processes are better understood (Rose & Levinson, 2004). Understanding what motivates users is imperative because it grounds the conceptual constructs of information quality into a context (Johnson, 2003) by which it can be assessed.

For the purpose of the current research, the user group has been identified as "high" information users, and is represented by university employed lecturer and researcher academics, and post-graduate level students, who regularly use the Internet for information search and retrieval purposes. This group of users (or "searchers") provided both quantitative and qualitative data relating to their information retrieval behaviour and how they made value judgments regarding search-engine returns on their information queries. The design, implementation, data-collection and analysis of the five surveys and questionnaires associated with the research are discussed in detail in Chapter 4 (*Research Design*) of the dissertation.

It should be noted here that the *user* and *tasks* associated with this implementation of the IQIP model are "high" information users, looking for quality information, rather than general users appropriating the Internet for other activities such as "surfing" or "entertainment". With that said, the framework is designed as a "contextual" approach to IQ algorithm implementation, and the researcher sees no reason why it could not be adapted to apply to other human-computer interaction (HCI) contexts.

The Environment: The true nature of the systems environment must be analysed and understood fully so that the appropriate established IQ dimensions are chosen. In this case, the environment includes (1) the World Wide Web; and (2) a Web

Page Crawler (type of search engine). Understanding the unique characteristics of these two environments should help identify which information quality dimensions are likely to thrive or be compromised within their context.

The major characteristics of the World Wide Web can be characterised as follows:

1.) Open, accessible (M^ac^Gregor, 2005);
2.) Distributed, networked & hyper-linked (Bilal & Kirby, 2002; Thelwall, 2003);
3.) Extremely large – possibly immeasurable – in content and structure (Brewington & Gybenko, 2000; Brooks, 2001);
4.) Evolving, not-static, (Lim *et al.*, 2001; Chen *et al.*, 2001; Jacobs, 2002);
5.) Different from traditional information retrieval environments (Brooks, 2003);
6.) Having no enforceable quality or retrieval standards (Eppler & Muenzenmayer, 2002);
7.) Unsafe, with component parts vulnerable to breakdown and attack (Eppler & Muenzenmayer, 2002).

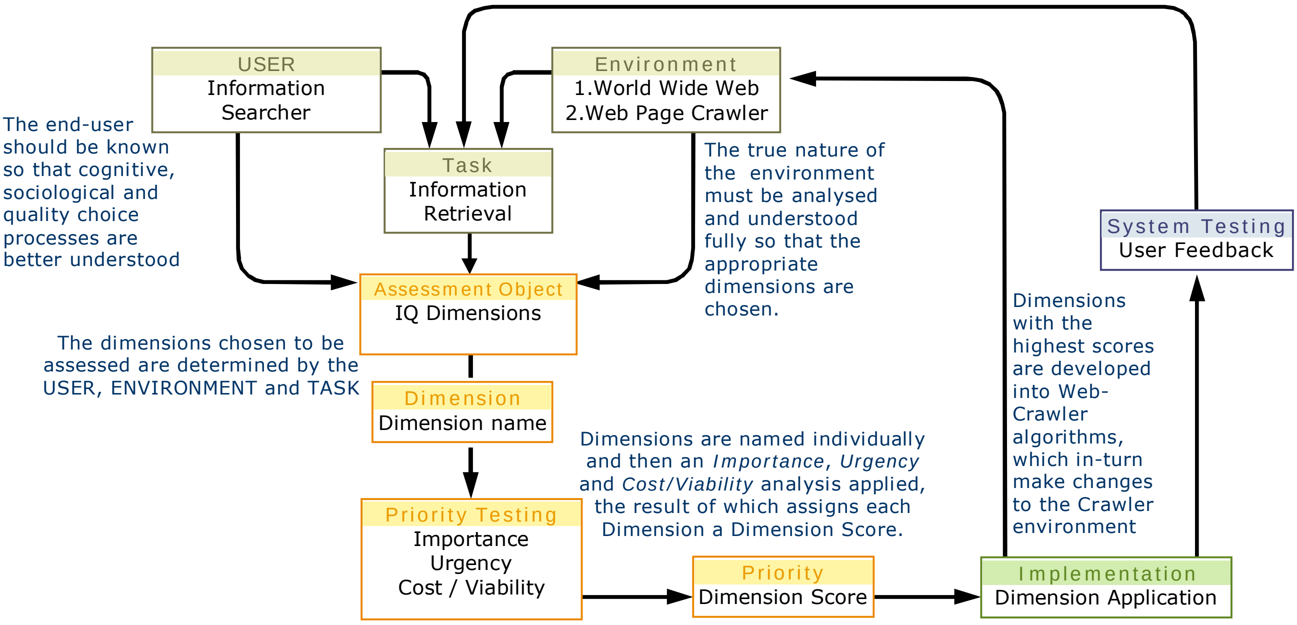
The major characteristics of Web Page Crawlers environments are typically;

1.) inconsistent with returns on queries (Iivonen, 1995; Kreymer, 2002);
2.) limited in what web-formats they are able to parse;
3.) a "snap-shot" of the World Wide Web at a specific time in history (Brooks, 2003) rather than a complete index of data/information available;
4.) flexible and changeable at a developer level – *allowing for constant improvement*

The Information Task: The information task must be understood within the context of the end-user and the systems environment (Marchionini, 1995) so that the appropriate dimensions – relevant to the task – can be quantified accordingly. In this case, the task is the retrieval of high quality information from the World Wide Web. An understanding therefore of users' perceptions of IQ and their role in determining users' information retrieval behaviours, is required.

In the context of the IQIP, which involves the implementation of IQ dimensions to a search engine's algorithms, an analysis of the associated elements of ***the information task*** should take place during this first *Identify* phase in order to produce a valid set of IQ dimensions that can be used in the second phase of the framework. The understanding of IQ dimensions within the IQIP framework then, is not so much to establish what IQ is, but rather to develop a way to prioritise and quantify previously selected IQ dimensions so that the appropriate IQ characteristics are applied to the context of a project. The process of each of the four phases is illustrated in figure 2.3

Figure 2.3: IQIP – A model to Identify, Quantify, Implement & Perfect the process of IQ dimension application to Web Crawler quality retrieval algorithms



(2) Quantify

The IQ dimensions chosen for application to the IQIP framework are commonly selected from the established IQ literature. Typically, an assessment regarding their applicability is achieved through user-group data collection or meta-analysis of existing literature. In the case of the current research, both of these research strategies have been employed.

The process of quantifying which dimensions to develop into crawler algorithms involves the application of Leung's (2001) Importance, Urgency and Cost metric. The cost metric is extended further to include the concept of *viability*. This is so that other "costs" – besides financial ones – can be included in the dimension implementation analysis. In other words, the costs in the sense of what technical skills or system equipment the project team has at its disposal becomes an important part of the analysis of what IQ dimensions become priorities. It allows the project team to address their limitations within the context of the project, and so able to realistically determine what can be achieved.

The Importance, Urgency and Cost/Viability metrics are used to assign each selected IQ dimension a “Dimension Score”, which are used to:

1.) Identify which IQ dimensions to convert into algorithms
2.) Better manage the process of designing and applying algorithms.
3.) Make the crawler more practical and functional, better able to meet the information needs of users

Again, it should be clarified, that this phase of the IQIP does not actually identify IQ dimensions. Instead it applies a “dimension score” to already selected IQ dimensions – which were determined in the ***Identify*** phase – in order to apply the appropriate dimensions to page-rank and crawling algorithms of an internet crawler.

(3) Implement

The implementation phase involves creating Web Crawler algorithms for those IQ dimensions with the highest “dimension score”. In keeping with Naumann & Rolker's (2000) model of understanding quality criterion within the context of their assessment class – that is; the context in which the quality is used, algorithms are developed that trigger the Web Crawler to produce Metadata about the pages it crawls.

This metadata is used initially to include or exclude specific pages from the results of a query on the grounds of the dimensions with the highest dimension score. Subsequent algorithms can be used to group results together into clusters according to topics, or into a Page Rank according to Dimension scores.

It should be noted here as well, that the initial crawling of a dataset could be considered to be a different system process than that of page/result indexing or ranking. This is because the “environment” – initially the WWW complete with its IQ related characteristics – has now changed to a dataset of documents that meet certain quality and query related criteria. In this way, it is possible to implement whether the crawler continues to proceed its crawl through the hyperlinks on a web page that ranks low according to the page’s quality dimensions score. Those pages that rank highly for quality are then seen as “chosen” results, and become the new information environment context for further refining of the crawler's algorithms, developed within iterative phases of the IQIP framework. This is the "perfect" phase of the model.

(4) Perfect

An important characteristic of the implementation of quality related algorithms is that as the system crawls and achieves results, those results should feedback to the crawler and improve its ability to continue crawling. The feedback can be achieved in two ways;

1.) through automated processes of log-analysis of successful query results, and
2.) through user-feedback from a control group of system users/testers.

The evaluation of the effectiveness of implemented IQ dimension algorithms – achieved through both log-analysis and system testers – is an important phase of the IQIP because it affords the algorithm developers the means by which to continually fine-tune the effectiveness of their crawling scripts. The way the IQIP works, in a continual feedback loop, creates a pathway back into the initial *identify* phase of the project, which means that not only are developers able to remove developed algorithms that have proven to be ineffectual, they can also re-identify dimensions that were either misrepresented or even left-out all together.

2.2 Information Retrieval and the World Wide Web

Information retrieval (IR) research in the context of the World Wide Web involves the investigation of a number of complex processes. Some user-related – including cognitive processes (Robertson, 2000; Fidel *et al.*, 2004), motivational issues (Fourie, 2006; Wirth *et al.*, 2007), information needs (Chi *et al.*, 2001; Wu *et al.*, 2001; Pors, 2006); technology attitude and adoption (Venkatesh *et al.*, 2004; Liaw *et al.*, 2006;); and some system related – including search engine algorithms (Pan, 2007); artificial intelligence (Fox, 1987), interface design (Kim, 2000) and customisation (Sutcliffe *et al.*, 2000; Rieh & Xie, 2006;).

This section of the literature review explores a contextual history of the research into user-related systems-based human information behaviour (HIB). Research literature relating to how users seek out and retrieve information in electronic environments will be examined and traditional behavioural models considered in regards to their applicability to the information environment of the World Wide Web.

2.2.1 What is information retrieval (IR)?

Information retrieval entails the integration of a number of complex processes within the context of three major factors or entities:

1.) An information Need; (Broder, 2002)
2.) An information Searcher; (Kuhlthau, 1991)
3.) An information Environment (Johnson & Meischke, 1993)

Not only does each of these entities possess unique characteristics depending on the situation, they also have a considerable influence on each other, resulting in a substantial number of variables (Ingwersen, 2000) in relation to user information seeking or searching behaviour and search behaviour strategies.

2.2.2 Information Behaviour

Human information behaviour (HIB) is best described as the interactive process between a searcher, the information a searcher seeks, and the environment in which the searcher hopes to find the information they are seeking. (Wilson, 1997). It differs from information seeking behaviour[3] (ISB) in that ISB typically represents one component of the human information behaviour concept, which can also include components such as the nature of the information, its specific context, format, or target audience, and other variables associated with its perceived usefulness or relevancy to the searcher, as well as searcher characteristics such as level of cognitive ability or self-efficacy.

Heinström (2000) suggests information behaviour is best understood in the context of the information needs of the searcher; inner – or cognitive – processes of the searcher; and environmental factors relating to the information. These factors have an

[3] The term information seeking behaviour is at times exchanged for "information searching behaviour", depending on the author or the system in which the user/searcher is looking for information. For example, within the context of an electronic environment, the action of seeking literally involves "search" strategies – so the seeking behaviour is appropriately described as "search behaviour". This should not be confused with the term "information searching process" (ISP), which is generally used to specifically describe the cognitive processes involved in searching activities

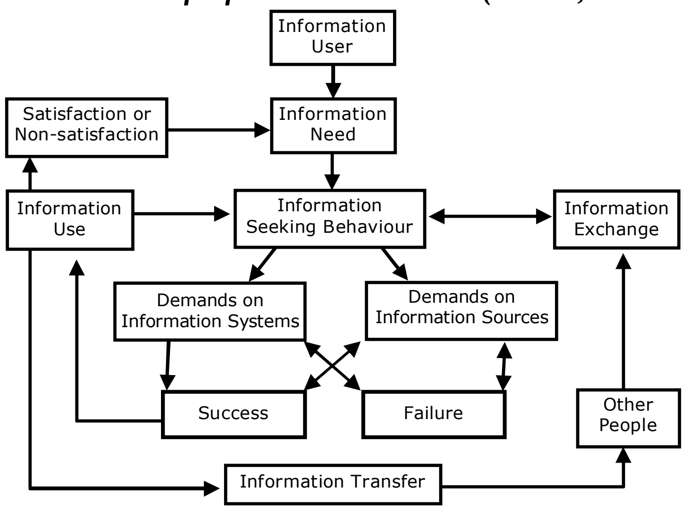
iterative effect on the searcher's *method of responding to their information need* (Heinström, 2000).

Information Behaviour Models

Decades of research into how users find and retrieve information have produced a variety of proposed information behaviour and information seeking and searching behaviour models. Central to most contemporary models is Wilson's (1981a) notion that the searcher's information need, their personality, and the environment in which they choose to look for the information are core variables that continually influence each other and the overall search process.

Wilson's (1981b) early ground breaking research into information behaviour used a framework that modelled information search and retrieval within systems environments from a "*user studies*" perspective, with a heavy emphasis on how the user interacted with the information sought and found, rather than how the user interacted with the search system.

Figure 2.4 A model of information behaviour (Wilson; 1981 & 1994)



This insight – of modelling how a searcher interacts with the information sought – can become somewhat lost when trying to model *Systems* related information behaviour (Wilson, 1994), compared with information behaviour in traditional information environments. Human/Computer Interaction (HCI) research has typically concentrated on understanding how users' feel about, interact with, and utilise technology, rather than the cognitive processes associated with the task for which they employ that technology. This deficiency becomes particularly apparent when modelling the human/system interactive process of an activity that is largely cognitive (Zhang, 2002; Fidel *et al*., 2004), such as information retrieval.

2.2.3 Modelling Information Seeking Behaviour

What follows is a literature study of some of the significant developments in systems related information behaviour models since Wilson's 1981 model. Because of the noted influence of the “information environment” to the information behaviour of an individual searcher, the major developments in information behaviour modelling will be considered within their historical context. Models will be compared with each other, in order to understand their influence on subsequent models, as well as to gain an understanding of the evolutionary nature of the ISB research discipline. Synergies will also be sought between the various models.

It is acknowledged by the researcher that there is a substantial body of research conducted by countless authors in this field. This section attempts, therefore, to cover some of the major developments, culminating in a discussion relating to the integration of some of the common denominators, into a framework of how searchers interact with Internet-based search engines. With this in mind, the literature review is divided into two model types. The first presents models that explore information behaviour in general terms (*section 2.2.4*), with the second (*section 2.2.5*) presenting models that emphasise the *interactive* nature of information retrieval and the role of system feedback in electronic or online environments.

Background: Historical Context of Systems related Information Behaviour Models

The historical context of the major information behaviour model developments is closely aligned with two *On-line* technology revolutions. The first involved the creation of early online information retrieval systems (Savage-Knepshield *et al*., 1999); used by “information professionals” – who usually searched on behalf of the person who would ultimately use the found information (Farber, 2002). The second major development has been the advent of the World Wide Web and its search engines, which have made available to *any* Web-user, a practically immeasurable amount of information, with its own unique set of information characteristics.

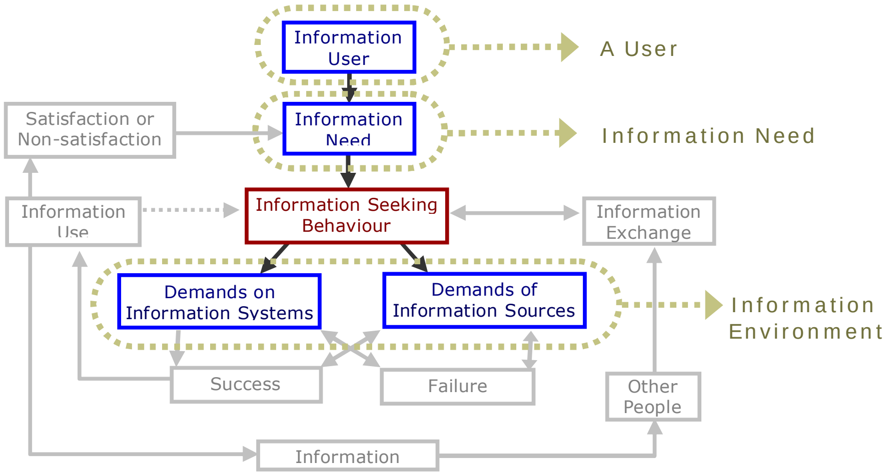
Research into the human components of Information Retrieval (IR), interactive IR and the resultant development of information behaviour models have reflected this dramatic shift in both the end-user/searcher and the information environment.

2.2.4 Information Behaviour and Information Seeking Behaviour Models

Wilson – 1981a: model of Information Behaviour

Wilson's complex model (*see figure 2.4*) proposed in 1981 and further amended in 1984, was a complicated framework that attempted to capture the user/information interaction process, rather than just the user/system interaction process.

Figure 2.5a: Wilson's (1981a) model of Information Behaviour – detail



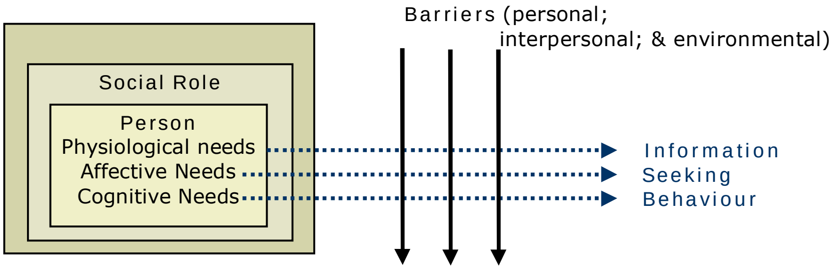
The model includes the three previously identified entities (*section 2.2.1*) involved with any information retrieval operation: namely (1) a user; (2) an information need; and (3) an information environment (see figure 2.5a), as well as the iterative variables of successful (or non-successful) outcomes of specific searches, the possible involvement of other information users, and the ultimate satisfaction (or non-satisfaction) in information results or outcomes on the part of the searcher.

Central to this model is the **information need** – which was said to be framed by the user's;

1.) Environment;
2.) Role; and
3.) Physiological, affective and cognitive needs. (see figure 2.5b)

The information need was then said to influence a user's information seeking behaviour, although not before it was tempered by any personal, interpersonal, or environmental barriers that the user might encounter.

Figure 2.5b: Wilson's (1981a) model of Information Seeking Behaviour

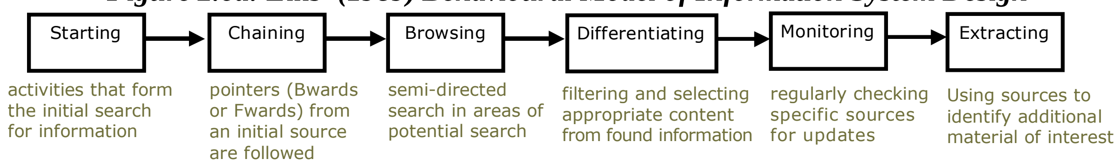


The generic nature of Wilson's model however, meant that it lacked a clear description of how users/searchers interact with an IR *system* in order to find and retrieve the data they sought. What Wilson labeled simply as "information seeking behaviour" needed to be defined and explored further. Furthermore, a more extensive understanding of the information systems and information sources needed to be addressed in future models in order to better appreciate how the information environment – already acknowledged as a major influencing factor – actually impacted information seeking and information seeking behaviour.

Ellis – 1989a: Behavioural Model for Information System Design

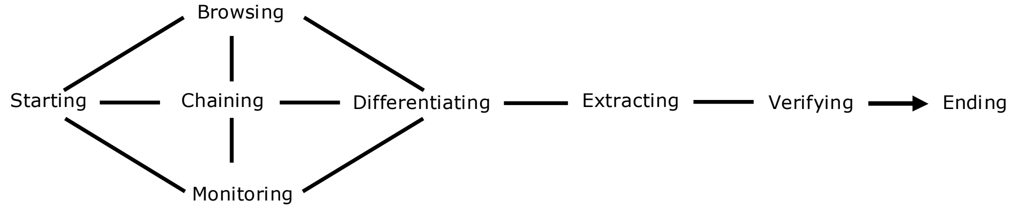
Ellis' (1989a; 1989b) research into information behaviour produced a model describing six information seeking actions/strategies exhibited by users of information retrieval systems. The framework is illustrated and briefly described in figure 2.6a and figure 2.6b.

Figure 2.6a: Ellis' (1989) Behavioural Model of Information System Design



Ellis et al. – 1993: The model was further refined with an additional two actions, *verifying* and *ending*; in 1993 (Ellis *et al*; 1993), and the user/searcher actions became described as "features" rather than stages indicating that the behaviours did not necessarily take place in a *linear sequence*, although clearly some behaviours were part of a sequence of behaviours.

Figure 2.6b: Behavioural Model for Information System Design (Ellis et al. 1993)



The framework is built on the observable behaviours and strategies employed by various sets of user groups (*see* Table 2.7). The extent of user cognitive process description relates directly to the behaviour being displayed by the user group in question. Although Ellis used a *Grounded Theory* approach (Ellis, 1989a) when building the model, subsequent testing of the framework using different user groups has produced similar results. It is worth noting that although the model has evolved over time (*see* Table 2.7) the structure has remained largely unchanged.

Table 2.7: Comparison of Ellis' Information Seeking Behaviour Models (1989 – 1997)

Modelling Information Seeking Behaviour (Ellis; 1989a)	Info Seeking patterns of Academic Researchers (Ellis; Cox & Hall; 1993)	Patterns of Engineers & Research Scientists in an Industrial Environment (Ellis & Haugan; 1997)
Startings	Starting	Surveying
Chaining	Chaining	Chaining
Browsing	Browsing	Browsing
Differentiating	Monitoring	Monitoring
Monitoring	Differentiating	Distinguishing
		Filtering
Extracting	Extracting	Extracting
	Verifying	
	Ending	Ending

Kuhlthau – 1991: model of the stages of information-seeking behaviour

Where Ellis' framework was built on the observable behaviours and strategies of sets of user groups, Kuhlthau's (1991) approach was to model user/searcher behaviours in the context of assumed rather than observable cognitive processes. The resulting observable behaviours are not dissimilar in the two models, however Kuhlthau's presuppositions – borrowed from Kelly's (1963) personal construct theory – meant a framework could be developed that suggested there was a *logical sequence* to information seeking behaviour.

Personal construct theory (Kelly, 1963) states that from the time individuals are able to consciously comprehend their surroundings, they are forming perceptions and constructs of the world in which they live. Each new experience is judged according to these self-made constructs, resulting in the continual reinforcement and/or development of those constructs. Kelly suggests that by the time individuals reach adulthood their "core constructs" – that is; their deeply-held values and principles – are somewhat set and unlikely to change, even when faced with contradictory information.

Using constructivist theories, Kuhlthau describes a user's Information Search Process (ISP) as a *constructive activity in which the user attempts to find meaning from information* (Kuhlthau, 1991). Central to this model is the view that information seeking is a process of "sense-making", in which a searcher is actively involved in finding meaning that fits in with what he or she already knows, through a series of choices (Kuhlthau, 1991 p.361).

The stages of Kuhlthau's information search process model; the searcher's feelings, thoughts, and actions; and the associated tasks are represented in Table 2.8

Table 2.8: Kuhlthau's (1991) Model of the Information Search Process

Stages		Initiation	Selection	Exploration	Formulation	Collection	Presentation
Human Experience Associated with stages	**Affective** (feelings)	Uncertainty	Optimism	Confusion/Doubt	Clarity	Direction Confidence	Satisfaction or Disappointment
	Cognitive (thoughts)	General – Vague			Narrowed Clearer	Increased Interest	
	Physical (actions)	Seeking Background Information			Seeking Relevant Info		Focused Info
Tasks		Recognise	Identify	Investigate	Formulate	Gather	Complete

Despite the different approaches to modelling user information seeking by Ellis (1989a) and Kuhlthau (1991), the similarities in their observed behaviours are quite remarkable (see Table 2.9), giving credence to Kuhlthau's hypothesis that there seems to be at least some information seeking strategies inbuilt into the human condition.

Table 2.9: Observed Information Seeking Stages/Behaviours in Ellis & Kuhlthau's Models

Ellis (1989a)	Starting	Chaining	Browsing	Differentiating	Monitoring	Extracting	Verifying	Ending
Kuhlthau (1991)	Initiation	Selection	Exploration	Formulation		Collection	Presentation	

The weakness of both models is their somewhat one-dimensional approach to the concept of the "context" of the observed information seeking behaviours. Ellis places a heavy emphasis on the systems (electronic) environment context of the information being sought, while Kuhlthau concentrates on the user's cognitive predispositions towards information and learning. In contrast, Johnson suggests a fundamental necessity of social action is that it must occur within a context (Johnson, 2003) and, at least in the social sciences, information seeking is essentially considered to be a social action (Talja, 1999; Ng, 2002). Moreover, without a better understanding of the context of an information search, the information models produced lacked the flexibility to identify key components of the information environment that can trigger *changes* in an individual's information seeking.

Johnson & Meischke – 1993: Comprehensive Model of Information-Seeking

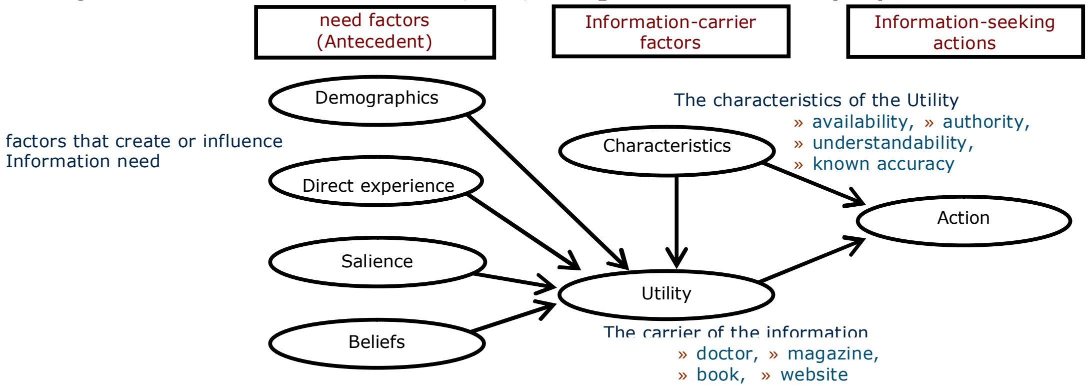
Johnson & Meischke (1991) acknowledge the influence of context in their research into how a positive diagnosis of breast cancer induced women to learn about their condition. They noted that an individual’s information seeking behaviour varied depending on whether they were looking for information about breast cancer (1) prevention; (2) detection; (3) treatment; or (4) dealing with the emotional issues involved with a diagnosis. They note too that an individual's choice of information source (information-carrier factors) varied depending on the type of information required.

By studying information seeking behaviour within the context of that behaviour, Johnson & Meischke (1993) were able to identify and validate;

1.) The relationship between specific motivating factors and an individual's personal information need;
2.) How the information need influenced choices relating to the information environment; and
3.) The relationship(s) between information environment and individual information seeking behaviours

In the case of the initial CISM model (figure 2.7), Johnson & Meischke's (1993) hypothesised that the information need (in this case, *health-related factors* relating to individual beliefs and experience of breast cancer) provided the motive for information seeking actions, which are then shaped by information carrier factors. In reality however, the authors found that depending on the actual health-related factors; for example if an individual was ***not*** diagnosed with cancer, or they had never been exposed to issues relating to cancer, then the *information carriers* also played a motivating role in an individual's information seeking. Observations such as this can provide a significant insight regarding the impact of World Wide Web push and pull technologies, or how search engines can engage their user-base with "recommended links" or specific page relevancy algorithms.

Figure 2.7: Johnson & Meischke (1993) Comprehensive model of Information-Seeking



2.2.5 Interactive Information Seeking Behaviour Models

The following set of models have been grouped together because of their emphasis on the interaction between the information need, searcher, and information environment. While interaction was probably always implied in previous models, its iterative affect on user search strategies, processes and outcomes was not always clearly defined.

Marchionini (1995): Information Seeking in Electronic Environments.

Like Kuhlthau, Marchionini's model (1995) is embedded in social cognitive and personal construct theories. Unlike Kuhlthau (1991) – whose primary focus was the affective and cognitive processes being experienced by individual information seekers, Marchionini takes a more focused contextual approach, where the cognitive processes of the searcher and the increasingly complex electronic information environment are considered within the scaffolding of their *interactive relationship* to each other.

Central to Marchionini's model is the paradigm that information seeking is a natural and necessary mechanism of human existence (Marchionini, 1995). It follows then, that in the context of this social science concept of human existence – seen as a series of interactions with one's environment – that Marchionini defines information seeking fundamentally as an interactive process within an information environment. Understanding the information environment then, is as important as understanding the searcher's cognitive processes; as it is the interaction between the two that establishes and reveals the actual information seeking strategies of the user.

Marchionini's Information Seeking Context (1995)

Marchionini identified eight information seeking components, which can be described as falling into four information entities (or *contexts*). These contexts are summarised and compared to previous information seeking model contexts in fig 2.8.

The key difference between Marchionini's information seeking context and those discussed previously is the addition of a fourth context, namely; the *interaction* between the three previously considered key entities involved in information searching:

1.) An information Need; (Broder, 2002; Bates, 1989)

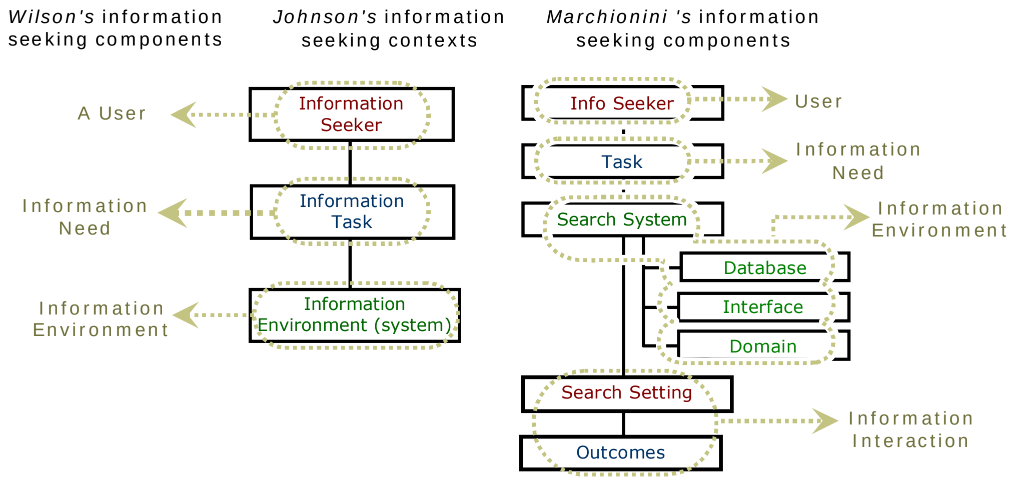
2.) An information Searcher; (Kuhlthau, 1991; Ellis, 1989a)

3.) An information Environment (Johnson & Meischke; 1993)

4.) The various interactions between the entities of the searcher, the information need and environment (Marchionini, 1995)

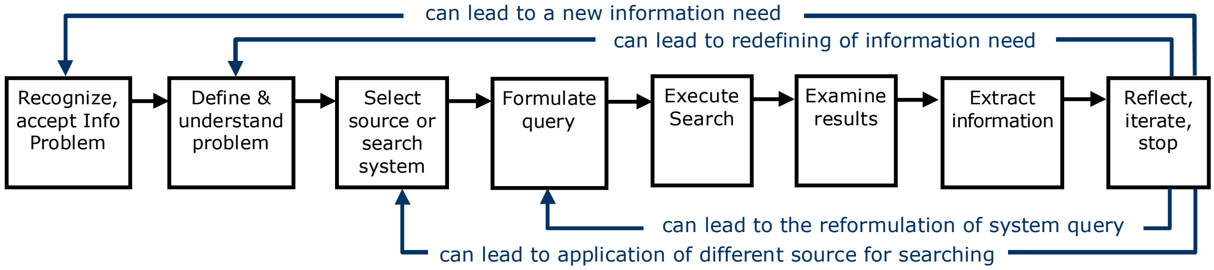
Marchionini's information seeking model – built on the contextual understanding developed from the information seeking contexts – is presented in figure 2.9.

Figure 2.8: The prominent role of the user, information need, & information environment paradigm in Wilson's (1981a), Johnson & Meischke's (1993), and Marchionini's (1995) information seeking model



Even with interaction as a primary focus, a key supposition of this model is that information seeking is a relatively linear process. The model acknowledges iteration taking place at the 'reflect, iterate, stop' phase, but the implication is that the seeker is still looking and evaluating one information need at a time. The evaluation either leads to the identification of a whole new information need, or reveals possible problems in the search process, resulting in the searcher re-defining the information need, employing another electronic source, or simply formulating a new query. A second weakness of the model is that is does not articulate the role of "browsing" type information behaviours.

Figure 2.9: Marchionini (1995) Information Seeking in Electronic Environments



In their observations of users who searched for information on the World Wide Web, Catledge and Pitkow (1994) found that users were as likely to use *browsing* strategies as they were to develop structured queries. These findings are backed up by authors such as Cunningham and Connaway (1996), who observed that high-end users (such as researchers) were far more likely to use a browsing-based "berrypicking" mode of retrieval in conjunction with relatively vague direct queries.

That browsing, and more specifically the concept of berrypicking (Bates, 1989), is not discussed in Marchionini's model is most likely because of the historical backdrop of the research. In the early '90's the World Wide Web was still in its infancy, and virtually all participants used in prior research into information retrieval and information search behaviour still fell into the "information professional" category (Farber, 2002; Markey, 2007) . These 'end-users' were, in fact, only end-users in the sense that they interacted with a retrieval system. They were not the end-user of the information found. Moreover, they were end-users who had been specifically trained to use the systems, and so possessed a learned bias towards set strategies of searching online and database systems (Mansourian, 2004).

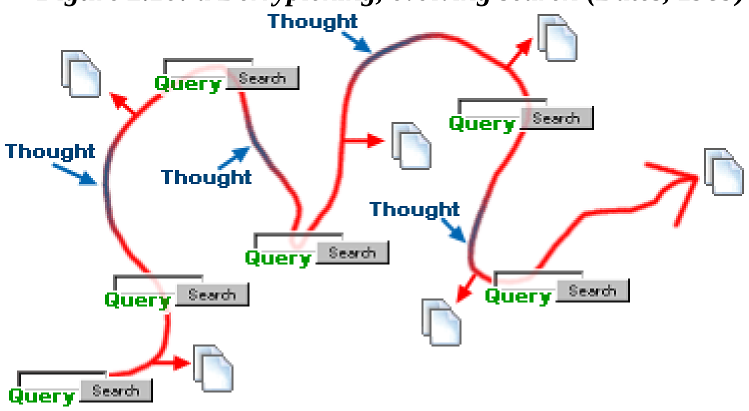
A second reason why Bate's model may not have been universally embraced by the then ISB research status quo was that it lacked the same degree of empirical testing as other models of its day. The model however was rigorously based in known literature, and built a logical (and novel) theory regarding end-user information seeking behaviour in much the same way that Wilson (1981a) had almost a decade before.

Bates (1989): The Berrypicking (evolving) model of Information Seeking

The basic premise of Bates' (1989) berrypicking model, first suggested as early as 1989, is that as an end-user searches both the information sought and the user's choices regarding what is a relevant result *evolves* and changes (Bates, 1989; MacPherson, 2004). Bates argues that the berrypicking model more closely represents the actual behaviour of information searchers than previous traditional linear models in that it usually begins with one feature, topic or reference; and moves through a variety of sources, with new information encountered giving new ideas and directions to the original query. In their observations of computer science researchers, Cunningham and Connaway (1996) note that in some cases the information need only emerges as the end-user moves through their information seeking behaviour. Initial search queries were found to be more vague than authors such as Marchionini (1995) had suggested.

The berrypicking, evolving search model of information retrieval is shown in figure 2.8. It illustrates Bates' argument that the result(s) of each query provoke a cognitive response on the part of the searcher, which can either reinforce a search query, lead to expansion or variation of a query, cause a complete overhaul, or even abandonment of a query.

Figure 2.10: a Berrypicking, evolving search (Bates, 1989)



The four major differences noted by Bates between traditional information seeking models and the berrypicking model include, (1) The nature of the query; (2) The nature of the overall search process; (3) The range of search techniques used; and

(4) The information domain (the specific data-driven environment) where the search is conducted.

The fifth major difference between Bates' model and previous models is that, implicit to the process of information search and retrieval, is *information use*. This type of evolving search can only really take place if the information searcher is also the information user – as the progression of the information sought and used is subject to the user making continual judgments regarding its relevancy and interoperability.

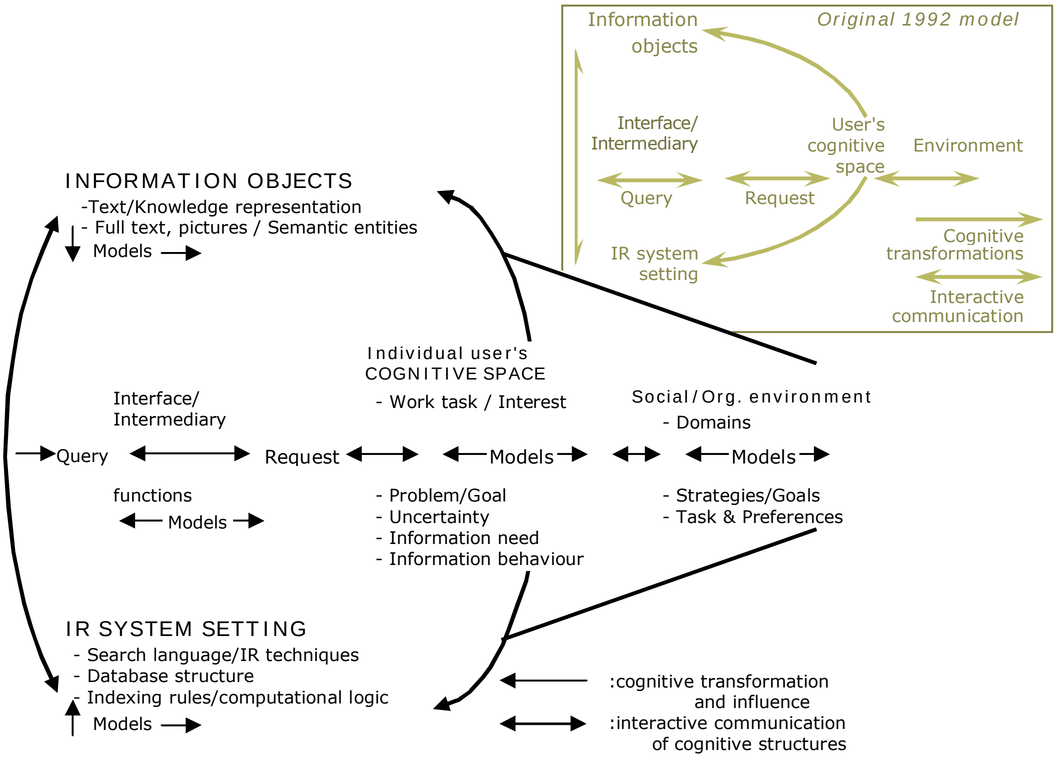
2.2.6 Self-searcher (information user) ISB models

The interactive nature of self-searchers' (end-users who are the information users) information seeking behaviour became a primary focus of information behaviour and information retrieval models developed in the mid-1990's. These have become the foundation for models that apply to the World Wide Web.

Ingwersen (1996): Cognitive Model

Ingwersen postulates that information retrieval is a set of dynamic interactive processes, which occur at multiple levels within the "cognitive space" of the user and the "information space" of the IR system.

Figure 2.11 Ingwersen's Cognitive Model of IR interaction (1992; 1996)



By using this poly-representation (1992; 1996) for information behaviour, Ingwersen is able to at least begin to model an interactive process, said to occur not only between a user and the IR system, but also between the user and the information objects within the system.

Ingwersen's model still acknowledges Wilson's (1981a) original model of information behaviour occurring within the context of (1) a user; (2) an information need; and (3) an information environment (see Figure 2.5a), but now with a more focused understanding of the actual information system being used, and the interactive cognitive processes that occur between the user and system in order for information to be retrieved and ultimately used.

Saracevic (1996): Stratified Interactive Model

The Stratified interactive model (Saracevic, 1996) of information retrieval is based on an Acquisition-Cognition-Application (A-C-A) type model of interaction. It borrows heavily (conceptually) from HCI literature, and is based on the assumption that users interact with IR systems in order to *use* information; that is; *apply* the information *acquired* through a *cognitive process*.

Including "information use" as a part of the model is – like interaction – somewhat implied in previous models, but had not yet been explicitly positioned into the information seeking behaviour models, perhaps because it can be safely assumed that a user would not take the time to specifically seek out information unless they were going to use it for something. Saracevic however, suggests that understanding the reason why a user seeks information, is an important part of discerning the influencing factors on the interaction between the user, the IR system, and the information objects of the system.

Saracevic (1996) proposed three levels, or strata, of interaction.

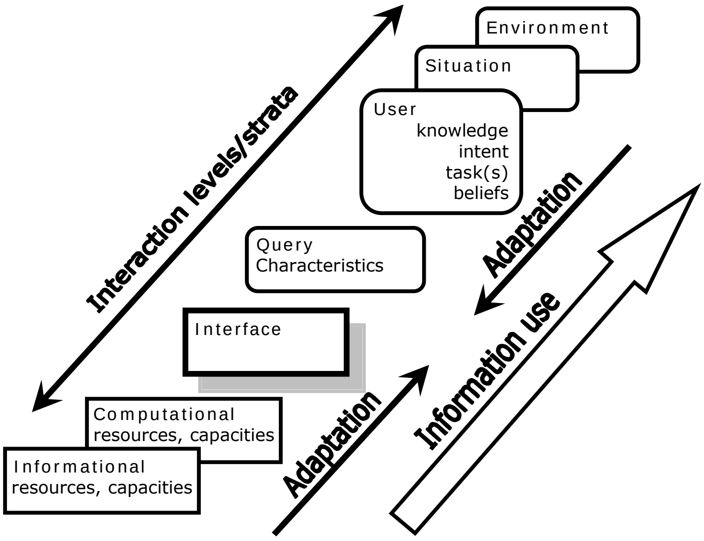
1.) A surface level of interaction – a sequence of events (interactions) between the user and the interface of the IR system.
2.) A cognitive level of interaction – which identifies both the user's thinking and system's information objects as cognitive entities. At this level of interaction,

the user is making judgments regarding the results (or feedback) given by the system.

3.) A situational level of interaction – a context driven interaction, influenced by the original information need and how the user and/or system might categorise, or even iteratively change, the need.

The user's own pre-existing knowledge of the information, or the system, can influence each of the levels of interaction, as well as any changes in strategies and categorisations of the information made, as the user *chases* the information being sought.

Figure 2.12: Saracevic's Stratified Model of IR Interaction (1996)



Saracevic acknowledges that elements within the three levels of interaction can, and in fact do, change as the process of information retrieval is occurring. What, and how, those changes occur however, is not fully established in the model, since it lacks empirical evidence.

From the point of view of IR systems design, the great strength of Saracevic's model is that it shifts the focus on information retrieval from that of a static process to an interactive, and therefore highly dynamic, one (Saracevic, 1995; 1996), challenging system designers to re-consider the effectiveness of *automated* retrieval systems (Spink & Saracevic, 1997).

Spink (1997): Search Process Model

As the importance of interaction became established in the research literature relating to ISB within a systems environment, authors began to question how the interactive process actually took place. Until Spink's research in the mid-to-late 1990's, relatively little empirical research had been done that observed information retrieval from an interactive perspective. Spink's search process model (1997) is developed from the hypothesis that a variety of feedback mechanisms were the major influencing factors in the interactive information retrieval process, which involved such things as the user's "*evaluation of the IR system output, user's judgments, and query modification*" (Spink, 1997).

The empirical research undertaken by Spink, sets out to map *the types and frequency of interactive feedback during mediated information retrieval* (Spink, 1997). The goal was to identify user judgments, user search strategies and the interactive feedback loops within the search process. A major focus of the research is to understand the role of feedback in the interaction. Previous models had acknowledged feedback existed - mainly in relation to user relevance judgments and number of result (magnitude), however this research generally considered feedback to be somewhat linear, rather than a loop process.

Spink's research confirmed that these feedback mechanisms do in fact exist within the interactive IR search process, and proposed that a further three feedback mechanisms exist. The five different types of interactive feedback identified include;

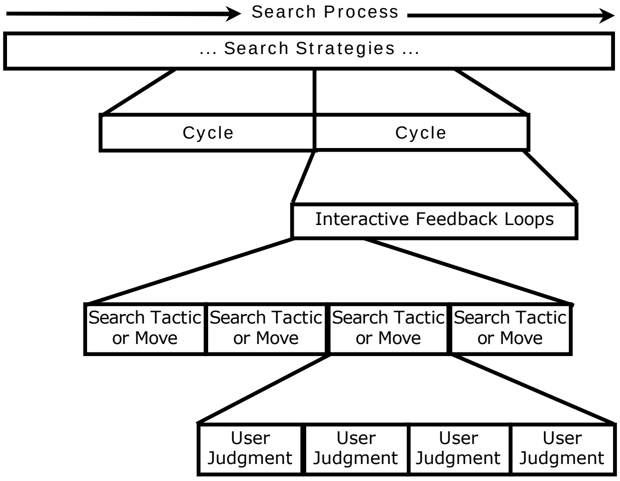
1.) ***Content Relevance Feedback*** (CRF) – consists of a query, followed by one or more relevance judgments, resulting in a modified or reformulated query.
2.) ***Term Relevance Feedback*** (TRF) – consists of a user utilising a term within the retrieved objects to modify any search strategies. This type of interaction occurred in 60% of observed online searches.
3.) ***Magnitude Feedback*** (MF) – consists of user using the number of results to either broaden or refine the search for information. This type of interaction occurred in 45% of the observed online searches.
4.) ***Tactical Review Feedback*** (TCF) – consists of users choosing to use strategy-related commands, such as the display sets (DS) command, to make judgments relating to the system's output, such as viewing a search history. Tactical

review feedback only occurred in 7% of observed online searches, however it would have been interesting to note whether intermediary type searchers (information professionals) represented a higher proportion of this type of feedback, as it implies a familiarity with both the IR system and specific IR system strategies.

5.) ***Terminology Review Feedback*** (TMR) – like the tactical review feedback, this strategy-related interaction involves the user requesting the display of terms in the inverted file. It occurs in only 1% of observed searches.

Importantly, the feedback mechanisms listed above did not occur as an either/or manifestation. As figure 2.13 illustrates, each search strategy could consist of more than one cycle of user-queries; that is; a user session/interaction with the system could consist of multiple feedback transactions, leading to additional inputs, or queries, which could in turn lead to different feedback and new inputs.

Figure 2.13 Elements of the Interactive Search Process (Spink, 1997)



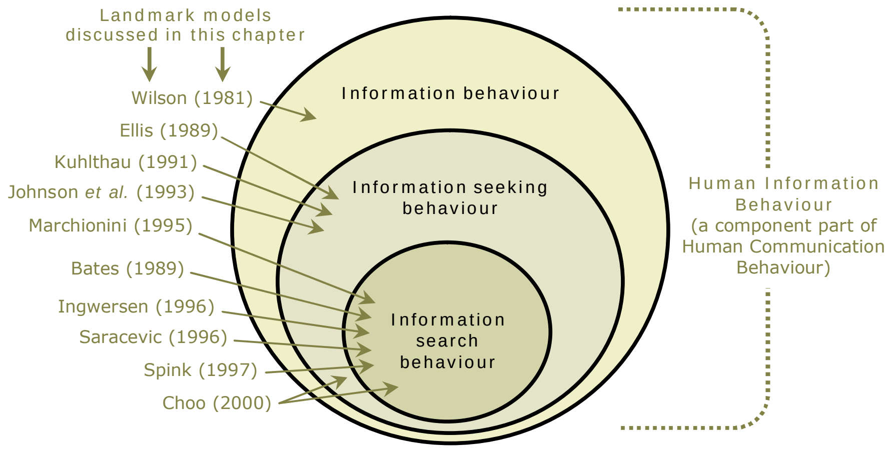
2.2.7 Building an Information Model for the World Wide Web

The berry-picking (Bates, 1989), cognitive (Ingwersen, 1996), stratified (Saracevic, 1996) and feedback process (Spink, 1997) models provide a sound backdrop for the emerging "*user*" and "*information environment*" of the online information retrieval systems of the early and mid 1990's. However, like the more linear models before them, they required a rethink and extensive testing before they could be applied to the emerging information environment of the World Wide Web.

Wilson (1999a): The BIG Picture of Information Behaviour: A Nested Model

In a review of the information behaviour, information seeking and searching process models developed since the landmark 1981 model of information behaviour, Wilson (1999) developed an integrated model that took a step back from the ever specialising models being developed, to revisit the issue of the "context" related to human information behaviour. The nested model (figure 2.14) of information seeking and information searching behaviour – best described as a "big picture", or macro, view of human information behaviour – describes information searching behaviour as a sub-set of information seeking behaviour, itself a sub-set of information behaviour. Figure 2.14 illustrates how the various models developed (and discussed in detail in the previous sections of this chapter) fit into one or more sub-sets of this big-picture nested model of human information behaviour, which Wilson proposed, is a component of human communication behaviour.

Figure 2.14. A nested model of the information seeking and information searching research areas



While the nested model of human information behaviour probably over-simplifies the multitude of processes involved in information needs, seeking, searching, and use, its value is that it begins to provide a contextual backdrop from which to examine the information behaviour of users on the World Wide Web. Researchers are able to identify and classify specific behaviours and processes within a larger contexts of multiple information (and communication) environments, different types of users/searchers, and different types of searches and searching strategies. It also broadens the possible application of research fields outside of the traditional ISB and IR related fields to the complex notion of how users find, refine and use information (Wilson, 1999a).

Understanding the contextual makeup of information retrieval on the World Wide Web is essential if researchers are going to even begin to understand how users search and find information on the Web. The practical application of such research would include the design of appropriate Internet search engine algorithms and interfaces, that better reflect (1) the cognitive processes of the typical web information seeker (Komlodi, 2004); and (2) the character of the information structure of the World Wide Web (Bates, 2002b). A big-picture focus also brings researchers back to the original supposition of information behaviour models, that information retrieval occurs in the context of an information need (or problem); an information searcher; and an information environment (Wilson, 1981a); and should always consider how these three contexts interact together (Marchionini, 1995) in order to appreciate the extreme diversity of information retrieval interactions (Kim, 2000; Griffiths *et al.*, 2002; Halttunen, 2003; Spink, 2004)

2.2.8 The User, the Utility and their Universe

Before the advent of the World Wide Web, the users of information retrieval systems were largely information professionals. These were made up of two types of individuals, those who were intermediaries – generally librarians who used online systems to search and retrieve information on behalf of a client (Farber, 2002) who was ultimately the user of the information; and "educated professional" end-users who sought information directly connected with their work or profession (Ojala, 1986).

The Web User

The enormous growth of the World Wide Web has provided an environment for a whole new user group with a vast computational capacity to search for information. This new "end-user" is different from the previous online environment end-user in a number of ways;

1.) They are not necessarily the "information professional" of the previous generation of online searchers (Farber, 2002).
2.) They are unlikely to have any formal training in developing appropriate search queries or retrieval strategies. In fact, the Web has introduced an entirely new generation of people – who have never even seen an information retrieval system – to online information retrieval (Brooks, 2003).

3.) They are likely to use a wider variety of search strategies, with more inconsistent results (Iivonen, 1995; Vakkari, 2001).
4.) They are usually cognitively and physically on their own – unable to directly ask intermediaries or other users how to refine a query or improve a search result (Rieh, 2004)
5.) They are likely to be searching for a wider variety of information type and format (Sellen *et al.*, 2002)
6.) They are more likely to be the "information-user" of the information they are seeking (Talja *et al.*, 2005)

This change in end-user profile means that new dynamic variables of different user interactions have to be considered (Spink & Saracevic, 1997); User cognitive ability (Freudenthal, 2001; Bilal, 2002); personality (Heinström, 2002; Julien & Michels, 2004) ; information task (Reid, 2000; Kellar *et al.*, 2007); search outcomes (Bates, 2002b); PC capabilities (Dotsika & Patrick, 2006); have all become important variables that can influence information search behaviour (Hsieh-Yee, 2001).

The Web Utility

The change in the "user" has been accompanied by a dramatic change in the on-line information environment. The World Wide Web and its search engine environments differ from traditional online library information systems in a number of key areas;

1.) Open architecture – resulting in no enforceable quality standards regarding the accuracy or quality of content (Hawkins, 1999)
2.) Open classification and meta-tagging system – resulting in web pages failing to be indexed appropriately by search engines (Doctorow, 2001)
3.) Highly dynamic use of the hypertext – (Blustein *et al.*, 1997) favouring browsing over query making in many instances.
4.) Dynamic/fluid content structure – resulting in pages being "moved" within directories of a given website, and frequent 404 errors (where pages no longer exist as formerly known URL's).
5.) Partial representation – at any one time a Search Engine can literally only provide a "Snap-Shot" of the Internet at one given time in history. Servers that

are offline, or networks that have temporarily been interrupted cannot be "indexed" by a crawling search engine. (Sullivan, 2002)

6.) Sheer volume – the sheer size of the Internet means that the Snap-Shot a Search Engine takes of the internet at any one time is likely to represent less than 30% of the known Web (Pokorný, 2004).

Understanding how these users interact with this "utility" is the key to developing sound information behaviour models and ultimately to building effective Web based IR systems.

Investigating the Web Universe

Initially, applying what had been learned from the years of research into human information seeking behaviour in online environments seemed the logical step to understanding how users would retrieved desired information on the World Wide Web. However, early ISB studies that focused on traditional, managed, IR systems were unable to provide a rich picture of the interactions of information retrieval on the Web (Wang *et al*., 2000).

In order to capture something of the heterogeneous nature of the Web, its wide variety of users, and the context in which information is sought, research methodologies used in IR and ISB investigations are becoming increasingly qualitative (Ondrusek, 2004; Martzoukou, 2005). However, analysis of large data-sets (Spink *et al*., 2000; Broder, 2002; Huberman *et al*., 1998) of user transactional data have also been applied in order to examine users interactions with Web-based search engines. The second method (log analysis) has become less 'available' since the meteoric rise of Google, now established as a major player in the Web search engine industry, as user-log related data related to Google is not as freely available as the previous generation of search engines. In addition to this, while analysis of keywords, results, search histories and user-logs provides an interesting picture of user actions and ultimate choices, they struggle to capture a user's cognitive processes involved with those choices. They also provide little user-related data regarding how users scan the content of web pages or 'browse' (navigate) hypertext links. In other words, they demonstrate *how*, but not *why*.

Experiment-based or observational methodology will produce the most accurate results only if variables between the users' and their information interaction can be identified and accounted for or controlled. As a result, many studies relating to Web information retrieval and seeking or searching behaviour are conducted using small groups of similar users. Studies that have adopted this methodology include;

1.) Hale & Moss (1999) also (Moss & Hale, 1999) ~ five participants & fifteen participants respectively;
2.) Navarro-Prieto, Scaife & Rogers (1999) ~ twenty-three University of Sussex students from the School of Cognitive and Computer Science (ten Computer Science, thirteen Psychology)
3.) Hölscher & Strube (2000) ~ twelve "expert" participants;
4.) Choo, Detlor & Turnbull (2000) ~ thirty-four IT specialists, managers, and research/marketing/consulting staff from seven organisations;
5.) Lazonder, Biemans & Wopereis (2000) ~ eight "expert" and seventeen "novice" participants;
6.) Saito & Mirva (2001) ~ ten participants with similar knowledge and experience;
7.) Ford, Miller & Moss (2001) ~ sixty-nine masters students using the AltaVista for prescribed searches.
8.) Choo & Marton (2003) ~ twenty four women IT professionals

Choo (2000, 2003): Behavioural Model for the World Wide Web

An important aspect of information retrieval on the World Wide Web relates to how users navigate (called browsing) the hypertext links of a web page (including the dynamic page/results of a search engine query) in order to meet their information need.

In their behavioural model for the World Wide Web, Choo *et al.* (2000) propose a model of information seeking behaviour that integrates Ellis' (1989a) behavioural model for information system design and Wilson's (1997) revised general model of information behaviour to capture some of the browsing related information seeking strategies (called *moves*) employed by users. Table 2.10 illustrates the "Web moves" identified by Choo, and their comparison to the "actions" of Ellis' behavioural model.

Table 2.10 Information Seeking Behaviours and Web Moves

	Starting	Chaining	Browsing	Differentiating	Monitoring	Extracting
Literature Search Moves (Ellis *et al.*, 1989a; 1993; 1997)	Identifying sources of interest	Following up references found in given material	Scanning tables of contents or headings	Assessing or restricting information according to their usefulness	Receiving regular reports or summaries from selected sources	Systematically working a source to identify material of interest
Anticipated Web Moves (Choo *et al.*, 2000; 2003)	Identifying Web sites/pages containing or pointing to information of interest	Following links on starting pages to other content related sites	Scanning top-level pages: lists, headings, site maps	Selecting useful pages and sites by book-marking, printing, copying and pasting, etc.; Choosing differentiated, pre-selected site	Receiving site updates using e.g. push, agents, or profiles; Revisiting 'favourite' sites	Systematically searches a local site to extract information of interest at that site

2.2.9 A framework to investigate Web information behaviour

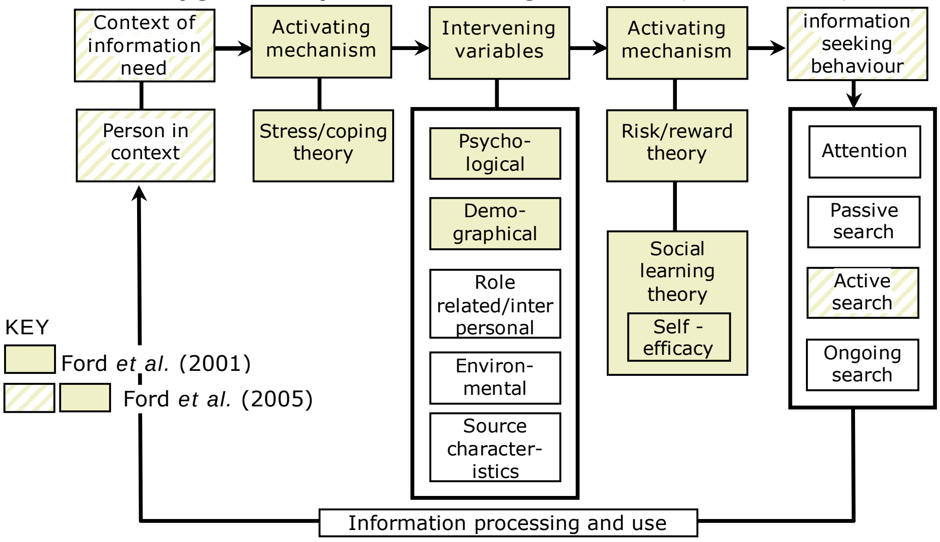
Any framework developed to investigate or present how users interact with and retrieve information on the Web must take both browsing type and query type behaviours into account. In doing this, questions relating to users' personalities and individual differences have become a key focus in much of the contemporary academic literature.

Ford, Miller & Moss (2001, 2005); Individual User Differences

Ford *et al.* (2001, 2005) identify a number of key characteristic differences between users that affect search strategies and performance. These include such attributes as (1) cognitive style; (2) prior experience; (3) Internet perceptions; (4) gender; and (5) age. By using Wilson's (1997) revised inter-disciplinary model of information seeking behaviour, Ford *et al.*, (2001, 2005) categorised individual user and system differences into pre-existing theoretical models from multiple research disciplines. Figure 2.15 illustrates Wilson's theoretical framework in which Ford *et al*,. examined the information seeking behaviour of sixty-nine masters level students engaging the AltaVista search engine in a prescribed information retrieval task.

In contextualising the observed behaviours of users into pre-existing theoretical frameworks Ford *et al.* were able to develop initial findings regarding the effect of identified individual differences in users on their information retrieval strategies and performance. For example, when examining Internet perceptions, it was found that poor information retrieval performance was linked to perceptions "*that the Internet is too unstructured, of not being in control, failing to keep on target, failing to find one's way around and getting lost*"(Ford *et al.*, 2001, p1060). A similar approach has been taken in the current research project. Pre-existing models such as the technology acceptance model (TAM), *discussed in detail in section 2.3 of this chapter*, have been integrated into an interdisciplinary framework of investigation into users' perceptions of information quality in World Wide Web IR behaviours. The logistics of how the framework has been adapted for the current research is illustrated and discussed in greater detail in section 2.4.

Figure 2.15 Ford et al. (2001, 2005) adaptation of Wilson's inter-disciplinary model of general information seeking behaviour (Wilson, 1997)



2.3 The Technology Acceptance Model (TAM) & the Internet

2.3.1 The TAM - a model to predict & explain user behaviour towards technology

Widely accepted for the last 20 years as a reliable method to understand and predict user adoption of Information Systems has been Davis' (1989) Technology Acceptance Model (TAM). Google Scholar reports that Davis' seminal papers "*Perceived usefulness, perceived ease of use, and user acceptance of information technology*" published by MISQ, and "User *acceptance of computer technology: a comparison of two theoretical models*" published by Management Science have been cited by at least 3398[4] (2116 and 1282) academic articles since they were published in 1989. (GoogleSchSearch001, 2007).

[4] The same search at GoogleScholar was made in 2005 for the PhD proposal document, when the citations figures were recorded at 1155 (771 and 444), indicating a growth of nearly 200%. Growth could however be the result of better Web-based electronic indexing, as well as increased citations.

2.3.2 Foundations of the TAM

TAM is built on the foundations of Ajzen & Fishbein's (1980) *Theory of Reasoned Action* (TRA), a social psychology model concerned with the determinants of consciously intended behaviours. Davis' goal was to develop a sound metric for "predicting and explaining use" of information technologies (Davis, 1989).

Central to both models is the idea of *behaviour intention* (BI), i.e. that a user's external behaviour is determined by internal behavioural intention. The models differ in that where TRA states a user's behavioural intention is determined by their *attitude* (A) and *subjective norms* (SN), TAM states a user's behavioural intention is shaped by their belief regarding the *perceived usefulness* (PU) and *perceived ease of use* (PEoU) of the adopted behaviour (in this case, the use of a computer/technology) which influences attitude towards the behaviour, leading to intent to behave, and the eventual behaviour.

Figure 2.16: Theory of Reasoned Action (TRA). The foundations of TAM

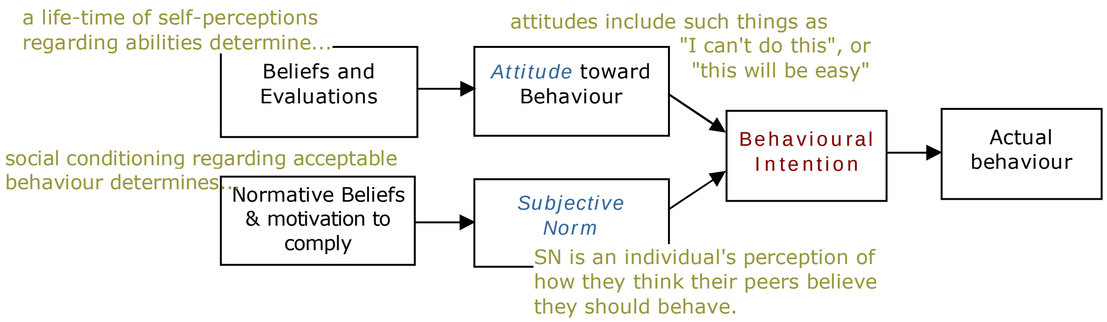


Figure 2.17: Technology Acceptance Model (TAM) 1989 Davis et al

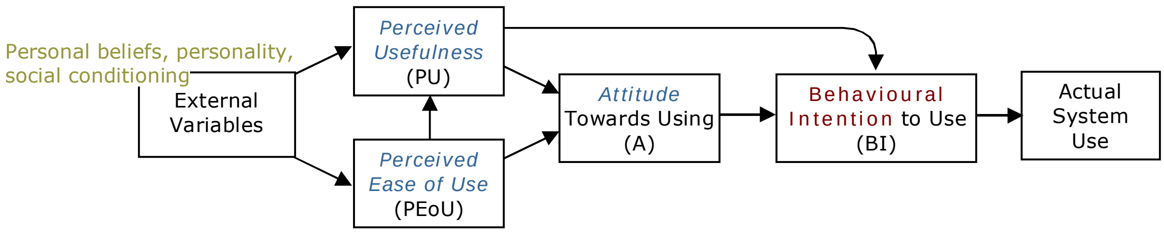


Figure 2.16 and 2.17 illustrate and summarise the TRA and the TAM. (*Notes and text emphasis have been added by the researcher*).

Perceived Usefulness & Perceived Ease of Use

The two major constructs of TAM are ***perceived usefulness*** (PU) and ***perceived ease of use*** (PEoU), with perceived usefulness replacing the TRA's ***subjective norm*** as the major determinant of a user's behavioural intent. Davis defines perceived usefulness as "*the degree to which a person believes that using a particular system would enhance his or her task performance*", perceived ease of use refers to "*the degree to which a person believes that using a particular system would be free of effort*". (Davis *et al*. 1989)

In early testing of Davis' model (Davis *et al*. 1989, Davis, 1989, Adams *et al.*, 1992), perceived usefulness emerged as having a significantly greater correlation with user behaviour than perceived ease of use. However, Davis notes that even if users knew a system to be useful, a perception that it was too hard to use negatively influenced their actual usage of it. (Davis, 1989).

2.3.3 Testing and extending the TAM

The TAM has been extensively tested and is generally accepted as a sound method for both understanding and predicting user behaviour with information technologies. Subsequent investigations and writings have, however, suggested a number of weaknesses inherent in the TAM. Firstly, TAM is so general that it lacks the constructs to allow for the vast variety of "*individual differences*" in users of information systems. (Taylor & Todd, 1995; Chau, 1996). Secondly, the basic assumption of the TAM is that behavioural intention is volitional (Dishaw *et al.*, 1999) which became a major issue in the years immediately following Davis' seminal papers, as more organisations began to mandate the implementation of information systems into their business. (Brown *et el.*, 2002) giving users no "choice" regarding which (or even whether) technology was adopted. The third limitation relates to the TAM's focus on predictive adoption of technologies. Designed as a tool to quantify users intended technology engagement, the TAM's constructs are heavily weighted towards the new use/adoption of information technologies, and therefore does not fully address users' "learned" or "habitual" behaviours (Limayem *et al.*, 2001; Seligman, 2006). Subsequent computer-use research has indicated a strong causative relationship between such user attributes as *habit* and technology usage (Verplanken *et al.*, 1998; Gefen, 2003), a condition that is said to bi-pass behavioural intention (BI) – a central construct of the TAM paradigm – all together.

The TAM's major strength however, is that it lends itself to being tested and extended. Where some authors have removed parts of the model – the early 90's saw a progression of publications that all but removed the "attitude" construct from TAM – other authors have added constructs or combined TAM with known constructs from other behavioural models.

TAM: a historical summary

The main supposition of Davis' (1986, 1989) model, was that PU & PEoU were the main influencing variables on individual user's attitudes and therefore intention to engage technologies. Davis *et al.* (1989) further stated that PEoU indirectly influenced BI through its effect on PU. Attitude was, by and large, bi-passed, assumed to be "positive" (i.e.; not variable-driven) in that users intention was voluntary.

Mathieson (1991), in comparing the TAM to the Theory of Planned Behaviour (TPB), contended that the TAM, although statistically sound – and far more simple to use that the TPB – had a tendency to over-simplify important predictors of behavioural intention, particularly in relation to users who experience initial difficulties in their systems use. Mathieson concluded that TPB could be used to fill-in-the-gaps of the TAM if the two models were used together in investigating users intended technology adoption. Adams *et al.* (1992) like Mathieson, advocated the inclusion of additional constructs to the TAM's PU and PEoU, namely *perceived inabilities* as a negative predictor of user attitude and BI.

Taylor & Todd (1995) reintroduced the TRA's subjective norm (SN) construct to the TAM's PU and PEoU in the context of the increasingly mandated technology use imposed by business and organisations through the 1990's. The "early adopters" of Davis' original TAM, who did not need the added social influence of colleagues and other professionals had now been replaced by a typical user who felt somewhat pressured to adopt technologies. Taylor & Todd added the construct of perceived behavioural control (PBC) as a means of quantifying users previous experiences with technologies, and devalued the "attitude" construct in the TAM paradigm.

By the time Lederer *et al.* (1998), Agarwal & Jayesh (1999) and Teo *et al.* (1999) published their TAM adaptations, the World Wide Web had become an established information environment. Once again, users were seen as having a greater degree of choice in the how, why and when of their technology adoption, and the principles of TAM were found to apply well to the prediction of technology use. With the increasing variables between user characteristics however, what Davis had termed "external variables" in the original TAM (1989) began to be explored with greater vigour. *Individual differences* in users (Agarwal & Jayesh, 1999), and task variables (Lederer *et al.*, 1998) were investigated in conjunction with the TAM to examine their relationship with the PU and PEoU constructs. Teo *et al.* (1999) went as far as introducing a new construct, *perceived enjoyment* (PE) to investigate the "entertainment" elements of the World Wide Web.

The various extensions of the TAM, including Dishaw & Strong's (1999) integrated TAM/TTF (task technology fit) model led to Venkatesh and Davis' (2000) publication of TAM II. This was an attempt by the authors to address the issues raised by multiple authors during the 1990's. Seen by its authors as a definitive paper, Venkatesh and Davis (2000) contend that many of the additional constructs introduced to the TAM, including constructs like perceived enjoyment could easily be classified within the PU or PEoU constructs. They did, however, reinforce the inclusion of subject norm (SN) elements to explain systems usage in mandated situations.

The meteoric rise of World Wide Web usage since the late 1990's facilitated a rush of papers that continued to add constructs to the TAM, including Moon & Kim's (2001) *perceived playfulness* (PPlay); Chau's (2001) *computer attitudes* (CA) – introduced specifically to test the role of prior computer experience in technology adoption; and Liaw & Huang's (2003) *individual differences* (IDV) and *system quality* (SQ) – introduced to investigate the growing divergence in quality standards of computer technologies available through the World Wide Web.

Shih's 2004 paper pushed Liaw & Huang's ideas further, applying the TAM specifically to the growing Internet activity of information retrieval. SQ was replaced by such constructs as *perceived performance* (PP) of the software engaged by the user (in this case Internet search engines) and *relevance* (R) of system and its results to user behaviours.

Table 2.11 is a summary of some of the important evolutions and extensions to TAM. The ***Yrs*** column illustrates that proposed modifications to TAM have followed general trends in IS. When Davis first constructed TAM nearly 20 years ago, technology usage was by and large volitional, and this variable was assumed as part of the TRA & TAM models (Davis, 1986). Within 10 years of Davis first writing this doctoral dissertation, information technologies had not only permeated almost all organisations, adoption of specific technologies had become mandatory in many of these institutions (Rawstorne *et al.*, 2000). Standard Operating Environments (SOE's) had become common practice, where users were directed in choice of hardware, operating system and software applications. Everything from which email client to which spreadsheet software was chosen for the user, and systems were fine-tuned to work with the SOE applications. This removal of system/application choice meant that, if TAM was to be used as a model to measure predicted and actual system usage, it needed the variable of presumed system/application choice to be addressed. Moreover, the *attitude* construct had to be defined in terms of this loss-of-choice, as user attitudes may be of greater importance in an environment where an application or system was made mandatory (Brown *et al.*, 2002). *Perceived usefulness* (PU) needed to include constructs relating to usefulness to an employee's social position within the organisation, rather than exclusively regarding the perceived usefulness of the system. *Perceived ease of use* (PEoU) was expected to have significantly less impact on user uptake of a mandated technology.

Table 2.11 The Evolution of the TAM and its Constructs

Yr	Author	Model	Constructs	Significant TAM developments/summary	Findings
1989	Davis (1989)	TAM	PU [Perceived Usefulness]; PEoU [Perceived Ease of Use];	» perceived usefulness was found to have a significant correlation with intended system usage	PU→usage; PEoU→usage;
	Davis *et al*. (1989)	TAM	PU; PEoU; A [Attitude]; BI [Behavioural Intention]; Usage	» Perceived ease of use indirectly predicts intended system use, » Perceived usefulness predicts system usage intentions, while perceived ease of use is secondary, acting thru perceived usefulness » Attitude was found to have little impact mediating between perceptions and intended use	PEoU→PU; PU→A PEoU→A; A→BI PU→BI; BI→usage
1991	Mathieson (1991)	TAM + TPB	PU; PEoU; A; TPB [Theory of Planned Behaviour]	» TAM is psychometrically sound and easy to apply, but omits variables that may be important predictors of usage » TPB may fill in some of TAM's missing pieces when assessing predictors for system usage.	
1992	Adams *et al*. (1992)	TAM	PU; PEoU; Usage;	» Found that in some cases, PEoU seemed to have little to no effect on intended usage » Suggested initial user difficulties with systems may be attributed to perceived inabilities, rather than system shortfalls.	PEoU↔PU PEoU→Usage PU→Usage

Table 2.11 The Evolution of the TAM and its Constructs (cont…)

Yr	Author	Model	Constructs	Significant TAM developments/summary	Findings
1995	Taylor & Todd (1995)	TAM & Prior Technology Experience	PU; PEoU; A; SN [Subjective Norm] PBC [Perceived Behavioural Control] BI; B [Behaviour]	» Re-introduced Subjective norm [behavioural intent determined by perceived social expectations] concepts to TAM model. » PEoU had a stronger influence on BI if the user had limited IS/IT experience, while PU had a stronger influence on BI if users were experienced with IS/IT. » Questions the validity of the Attitudes construct as a significant predictor of intention to use	PEoU→PU, PU→A PEoU→A, A→BI SN→BI, PBC→BI BI→B, PBC→B
1996	Chau (1996)	TAM	Perceived Nt Near-term Usefulness; Perceived Long-term Usefulness; PEoU; BI	» Removal the Attitudes construct determines a better understanding of perceived usefulness is required to better predict user BI. » Refines the PU construct into Perceived Near-term and Long-term Usefulness.	PEoU→Near term PU; PEoU→BI, Near term PU→Long term PU; Near term PU→BI; Long term PU→BI
1998	Lederer *et al.* (1998)	TAM & the Internet	PU; PEoU; Web Usability Principles; Information Task Focus	» The principles of TAM seem to apply to BI of Internet users... however, special consideration is required regarding what usefulness and ease of use principles are specific to the Web	
1999	Agarwal & Jayesh (1999)	TAM	IDV [individual Difference Variables]; PU; PEoU; BI	» extends the TAM by specifying the role of individual differences in users of Information Systems » IDV's identified that have significant effects on predicted system usage include; technology role, level of education, prior experiences, participation in training	IDV→PU→A, IDV→PeoU→A, A→BI
	Teo *et al.* (1999)	TAM & the Internet	PU; PEoU; PE [Perceived Enjoyment]; Usage	» examines how intrinsic motivating factors – such as Perceived Enjoyment – impact on internet usage.	PEoU→PU→Usage PEoU→PE→Usage
	Dishaw & Strong (1999)	TAM & other Models	TF [Tool Functionality]; TE[Tool Experience]; TaskC [Task Characteristics] TTF[Task-Technology Fit]; PEoU; PU; A; BI; Usage;	» Integrates the constructs of Task-technology fit [TTF] and TAM to develop a model to better explain systems choice and usage.	TF+TaskC→TTF; TF+TE→PEoU; PEoU→PU; TE+TTF→PU; PU→A; PU→BI→Usage
2000	Venkatesh & Davis (2000)	TAM 2	PU ; PEoU; SN	» Included Subject Norm to the original TAM model (calling it TAM 2) to account for situations where technology adoption was considered mandatory.	PU→usage; PEoU→usage; SN→usage;
2001	Moon & Kim (2001)	TAM & the Internet	PU; PEoU; A; BI; PPlay; [Perceived playfulness]	» Extends the TAM with the construct of Perceived Playfulness. » Borrowing ideas from Csikszentimihalyi's 'flow theory', which emphasizes the role of a context and interaction in human motivation.	PEoU→PPlay, PP→A, PPlay→BI, PEoU→A, PU→A, PU→BI, A→BI, BI→Usage
	Chau (2001)	TAM & Prior Technology Experience	PU; PEoU; BI; CA [Computer Attitudes]; SE [Computer Self-Efficacy]	» Considers the role of Computer Self-Efficacy (from Social Cognitive Theory) in systems usage. Self-Efficacy is self-belief in one's ability to perform a task.	CA→PU; A→PEoU; SE→PU; SE→PEoU; PU→BI; PU→BI
2002	Brown *et al.* (2002)	TAM & Mandated Technology	PU; PEoU; BI; A; SN; PBC	» Since the mandated situation removes a great deal of the user's choice in regards to system use, the Attitude construct becomes a more significant metric than in volitional circumstances. » TPB's Subjective norm becomes a significant construct, as mandated situations – usually organisational – do include social/institutional expectations of users.	PEoU→PU→A→ →BI→Usage PEoU→A→BI→ →Usage PBC→BI→Usage SN→BI→Usage
2003	Liaw & Huang (2003)	TAM & the Internet	PU; PEoU; BI; IDV; PE [Perceived Enjoyment]; SQ [System Quality]	» Develops the constructs of Individual differences and prior experience to develop a model that includes Perceived Enjoyment as a significant factor in Internet search engine usage.	IDV→PE→PU→BI IDV→PEoU→PU→BI SQ→PE→PU→BI SQ→PEoU→PU→BI
	Venkatesh *et al.* (2003)	Unified TAM	Empirically tested to see whether the many added constructs actually added to the TAM	» Tested the TAM model (as well as other theories relating to human behaviour) with the major constructs that had been added over the previous decade.	

Table 2.11 The Evolution of the TAM and its Constructs (cont…)

Yr	Author	Model	Constructs	Significant TAM developments/summary	Findings
2004	Shih (2004)	TAM & the Internet	R [Relevance]; PU; PEoU; A; PP [Perceived Performance]	» Extends TAM with the information behaviour model, developing a model where constructs fall into contexts associated with (1)Information Needs, (2)Information Seeking, & (3)Information Use	R→PU→A→PP R→PEoU→A→PP R→A→PP; R→PP
2006	McFarland & Hamilton (2006)	TAM & the Internet	ID Individual diffs; CE Computer efficacy; PEoU; PU; SU System Usage	» Extends TAM with external variables, which all impact four constructs. These four constructs also have an influence on each other	CE→PEoU→ →PU→SU PEoU → PU→SU PU→SU
	Burton-Jones & Hubona (2006)	TAM & the Internet	ID (sys experience, education, age); PU; PEoU; UV Usage Volume; UF Usage Frequency	» Involves the mapping of individual differences within a user-group in order to establish their impact on the TAMS's PU and PEoU constructs » Technology usage described in terms of IS-Usage (volume) and IS-Usage (frequency)	ID's→UV, UF ID's→PEoU→PU→ →UV,UF ID's→PEoU; PU→ →UV, UF

The **Constructs** and **Significant TAM developments** columns in Table 2.11 summarise the extensions that have been added to TAM during the last 20 years of IS research. Constructs such as subjective norm (originally included in the TRA) and perceived behavioural control were added to the model as a way to measure the significance of organisational and work-colleague pressure as motivating factors in intended use (Agarwal & Prasad, 1997; Venkatesh & Davis, 2000). Constructs such as *perceived playfulness, self-efficacy* and *perceived enjoyment* were added as a way of measuring the significance of some individual cognitive processes within the context of World Wide Web usage in the home. (Moon & Kim, 2001; Chau, 2001; Liaw & Huang, 2003).

2.3.4 TAM & The World Wide Web

A major growth area in IS since Davis' dissertation has been the commercialisation of the Internet into the World Wide Web. Personal use of the Web has grown phenomenally (Zhang & von Dran, 2001). As the capabilities of Web technologies and the number of users with access to them continue to grow, an understanding of the motivating factors relating to individual user's intended adoption (or non-adoption) of the technology becomes increasingly important. The TAM – extended with appropriate variables – can provide a useful insight into user/Web interaction.

Internet related extensions to the TAM

A number of issues are evident when applying the TAM to the context of the World Wide Web and its search engines.

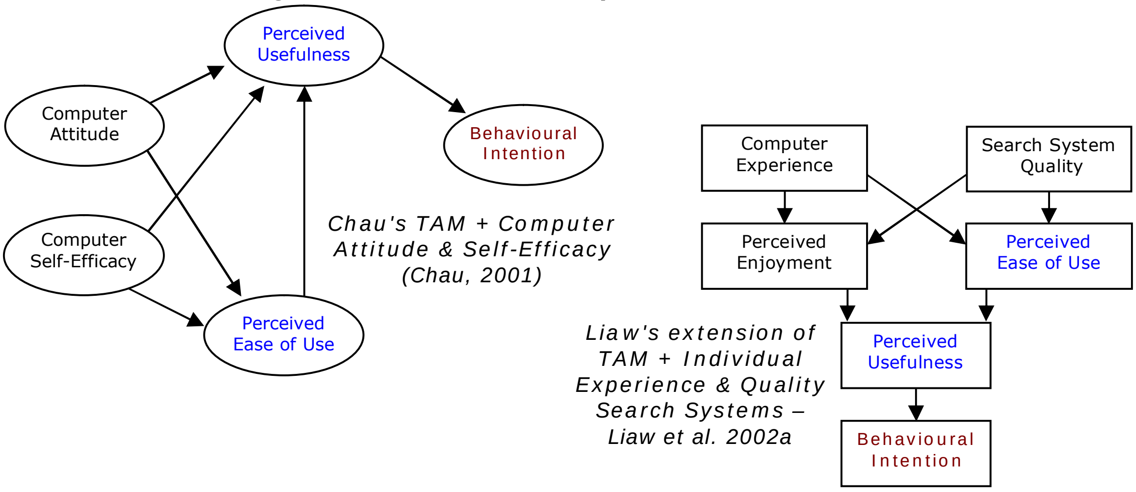
- The issue of ***Quality*** – both information quality & system quality (Liu & Ma, 2005; Ahn *et al.*, 2007; Varlander, 2007),
- The issue of ***Function*** – why users are engaging the Internet (Saeed *et al.*, 2003; Bodner *et al.*, 2001)
- The issue of ***Efficacy*** – how does the user perceive them self or the web-system as being able to achieve the purpose for which use is intended (Liaw, 2002a; Hasan, 2006;)
- The issue of ***Individual User Characteristics*** – the growing number of variables between individual use and usage conditions (Thong *et al.*, 2002; Burton-Jones & Hubona, 2005;).

Information & System Quality

The open architecture of the World Wide Web means that the information environment, although rich in diversity, has no enforceable standards in regards to information or system quality. Liaw *et al*. (2003) and Shih (2004) allude to this issue in their extensions of the TAM to include constructs such as user perceptions of *system quality* (Liaw *et al.*, 2003) and *relevance of information* (Shih, 2004). Neither author, however, addresses the issue of how perceived negative results in regards to system and information quality influence user behaviour at a cognitive level. This could be particularly relevant when applying the TAM to Web-based search engines. Understanding whether users attribute poor quality search engine results to (1) themselves; (2) search engine deficiencies; or (3) Internet IQ problems; could provide an insight into the conditions which cause users to adopt or change Internet search engines as their primary method for information retrieval on the World Wide Web. This is particularly relevant given that many research findings indicate a level of dissatisfaction amongst search engine users (Lai & Soh, 2004).

Figure 2.18 illustrates Chau's (2001) and Liaw's (2002a; 2002b) extensions of the TAM to include World Wide Web related constructs.

Figure 2.18 TAM extensions for the World Wide Web



TAM and Information Retrieval research

The lack of extension of the TAM model to include IR related constructs such as, information need, information chasing, satisficing and attribution theory – to name just a few – could be the result of; (1) the relatively few TAM related investigations within the IR discipline; and (2) the difficult goal of quantifying the complex cognitive constructs associated with human information behaviour. There has also been a tendency to utilise TAM to investigate user systems/technology interaction, rather than information interaction, a major paradigm of information behaviour research.

Early studies into Internet search engines reported that more than 30% of user queries generated a zero-hit result (Wang *et al.*, 2003). With the improved sophistication of search engines, this trend has been somewhat reversed, with users now reporting their queries produce far too many results.

Figure 2.19: Screen Capture from Altavista.com, June 2004 (www.altavista.com)

Interestingly, the same information searching, retrieval, indexing & ranking problems that plagued the first on-line IR systems still seem to plague their newer Internet crawler counterparts. While observing the users of an on-line library information system in 1987, Borgman (1987a; 1987b) identified users had difficulty;

1.) understanding how to implement their questions in terms of the system;

2.) retrieving substantial portions of the relevant material existing on a topic; *and*
3.) cutting down large retrieval to a manageable amount.

The issues addressed by Borgman in 1987 were said of a traditional online IR system, which had the advantage of being a static, classified, finite collection of data. It is reasonable to assume then, that these same issues are made far greater when the IR system is trying to classify a distributed, dynamic, and rapidly growing (Lawrence & Giles, 1998) information resource like the World Wide Web.

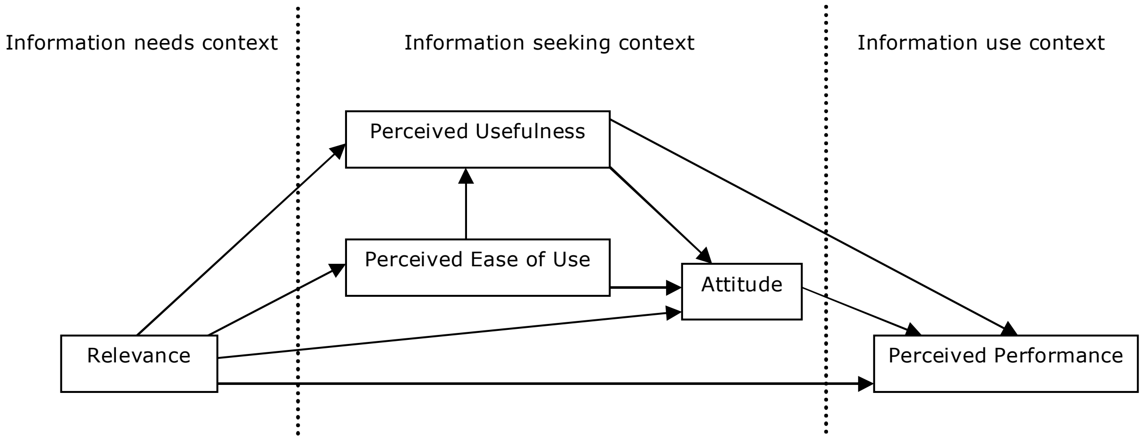
Iivonen (1995) set out to determine what query variables caused the dramatic inconsistencies of Internet search engine's returns. By analysing and comparing the types of queries that returned the most consistent and the least consistent results, Iivonen determined that the greatest variable was the *human actor* who interacted with the search engine. The evidence suggests that different human actors interpret and handle the same information in different ways, selecting different terms for the same search. And here-in lies one of the difficulties for information behaviour researchers when applying the TAM to internet search engines. By and large, users perceive at least two levels of interaction. One is their interaction with the technology (most commonly investigated by TAM research), and the second is their interaction with the actual information (Fidel *et al.*, 2004). In this context, more often than not, attitudes towards the system are governed by perceptions born out of users' interaction with the dynamically generated information, rather than by perceptions – on the part of users' – of their systems engagement. Shih (2004) recognises this by adding constructs such as *relevance* and *perceived performance* to the TAM.

Shih's TAM extension (2004) incorporates the information behaviour model (Choo *et al.*, 2000; Choo & Marton 2003) for empirically assessing the use of the Internet for goal-directed tasks by office workers. Shih breaks the information-user-Internet interaction down into three information contexts. (1) Information needs, (2) Information Seeking; and (3) Information Use. (see Figure 2.20).

In Shih's model, *perceived performance* refers to how the user perceives whether they, or the search engine, have the capacity to perform the query of the information seeking context, aiding the user to find the information they are looking for.

This emphasis on perceived performance introduces post-adoption constructs to the TAM. That is; perceived performance becomes a predicting construct for the choice of system/task relevance the next time the user wishes to perform information retrieval. Although not demonstrated in Shih's model explicitly, the model at least implies an iterative, cyclical process.

Figure 2.20: Shih's TAM + Information Context for use of the Internet – Shih 2004



The role of the "self" in TAM

The proliferation of home-users with access to the World Wide Web has introduced the concept and processes of electronic informational retrieval to a whole population of end-users who may have had little to no formal training in the use of such technologies (Wang *et al.*, 2003). This is reflected in the often ineffectual use of Internet search engines and despite clear help systems accompanying most search engines. In an analysis of 207 randomly selected web search queries, Barnett (1999) found that more than 13% of the searches used methods not supported by the specific search engines (Barnett, 1999). Barnett also found that a surprisingly high number of the searches that utilised *engine math* strategies; that is; using the "+" and/or "-" operators with a query; did so incorrectly, indicating that even users with at least some exposure to previous database searching still employed ineffective search queries.

Table 2.12 Summary of Barnett's "How people searched" Analysis – Barnett, 1999

method	% of searches
Type keywords into search field	36% of 207
Utilised Engine Math	31% of 207
- Engine math with only one word	(15% of 64)
Phrase Searching	11% of 207
Boolean logic (use of AND, OR etc)	10% of 207
Natural Language (asking a question) – not supported by the search engine	10% of 207

While a lack of technical skill is often presented as a major contributing factor in ineffectual searches, the number of successful search outcomes by novice users (Khan & Locatis, 1998), and the constantly returning search engine audience (Hsieh-Yee, 2001), suggests that user perceptions regarding, what Shih called *perceived performance*, is tempered by users' own self-perceptions of information retrieval effectiveness. That is; users are prone to attributing perceived performance on their own information behaviour, rather than an assessment of their actual successful or non-successful interaction with a search engine.

Successful Web searching is a strategy related task, that often requires the searcher to improvise based on the search results obtained (Quinn, 2003). Part of that improvisation is the natural flow of thoughts associated with a searcher's own self-perceptions of their effectiveness. The effective searcher is able to rethink and modify their strategy based on their ongoing interactions with the search engine being used. This is a highly cognitive process, involving subjective variables such as human memory, motivation, attention, concentration (Fugmann, 1973) and self-efficacy. Self-efficacy is a cognitive psychology term used to describe a user's self-perceptions regarding their role and ability to perform specific tasks. As an efficacy related process, Web search is also easily compromised by feelings of self-doubt or negative perceptions regarding the system or results of a search. One issue has become the sheer volume of information on the Web. Vigil (1983) contends that large volumes of information available to a searcher can create enough redundancy to engender a state of overload, which can create anxiety and confusion as the user attempts to make sense of the results (Vigil, 1983).

Fully understanding how *self* or *system* efficacy effects user perceptions and motivations in search engine engagement is an area still to be thoroughly pursued in the TAM literature. The implication is that PU and PEoU may fail to capture the true complexity of the interaction taking place. Quinn (2003) argues that user attributions of success or failure in search engine interaction will vary depending on constructs such as self-efficacy. Users with a high sense of efficacy would view search engine failure as due to wrong search terminology and adjust their strategy, while those with a low sense of efficacy may view their failure in terms of their own inability to use search engines effectively (Quinn, 2003).

Other issues that have been addressed in relatively recent TAM literature include investigations of emotive user-variables such as levels of anxiety (Hackbarth *et al.*, 2003; Seyal & Rahman, 2007). Regarding anxiety, Yee *et al.* (2004) suggests that while users require a modest level of anxiety in order to recognise when a search strategy is being ineffective, if that anxiety level is raised to a point where it causes a preoccupation or worry relating to the task, search performance decreases as the cognitive demands increase. The full effects of highly individual characteristics such as anxiety and self-efficacy on the PU and PEoU constructs of the TAM are only now beginning to be discussed in the TAM literature, particularly in relation to TAM and the World Wide Web. These are the "external variables" alluded to by Davis (1986, 1989) in the original versions of the TAM.

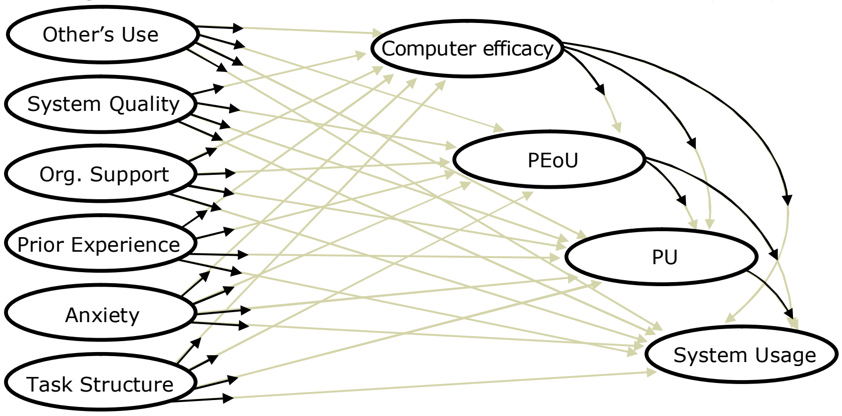
External variables & individual differences

McFarland & Hamilton (2006) contend that any reasonable investigation into the TAM should acknowledge the context specificity of the case in question, by modelling the external variables present. PU and PEoU are still seen as central to the TAM, but *computer-efficacy* (CE)[5] and *systems usage* (SU) are included as constructs that are mediated by the various external variables previously introduced to the TAM model. There is still no explicit indication of any cyclical or feedback mechanisms in the model, which the researcher contends is an inherent weakness of the various manifestations of the TAM model. No where is it considered, that affected constructs such as computer-efficacy or perceived usefulness, in fact, have the ability to mediate some of the causal external variables highlighted in McFarland & Hamilton's (2006) model (figure 2.23) through a feedback type mechanism.

Figure 2.21 illustrates McFarland & Hamilton's model, which contends that external variables (*on the left*) impact each of the four proposed constructs of CE, PEoU, PU and SU. It further suggests that each construct influences each of the subsequent constructs drawn below them in the model. Computer efficacy, for example, is seen to influence PEoU, PU and SU; while PEoU is seen to influence PU and SU; and so on.

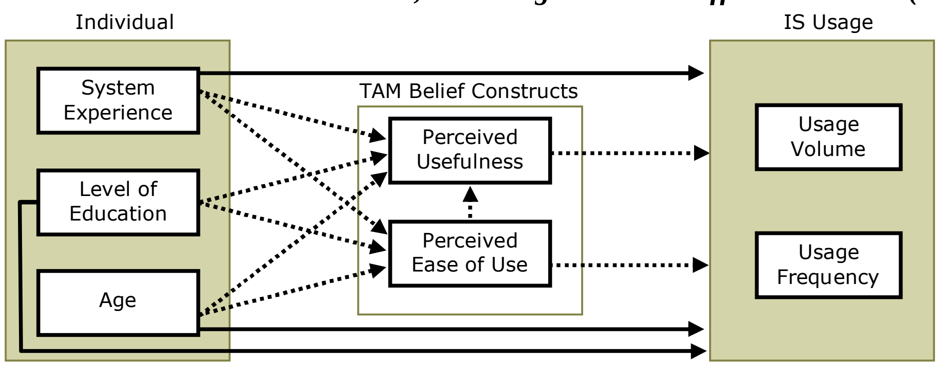
[5] Computer-efficacy – as it has been used in IS literature – could best be described as a user's self-perceptions of their general computer literacy and ability to utilise computers for numerous tasks.

Figure 2.21 McFarland & Hamilton Research model (2006)



Burton-Jones & Hubona (2005; 2006) also advocate the mapping of individual differences within a user-group in order to establish their impact on the TAM's PU and PEoU constructs. Technology usage is described in terms of both IS-Usage (volume) and IS-Usage (frequency).

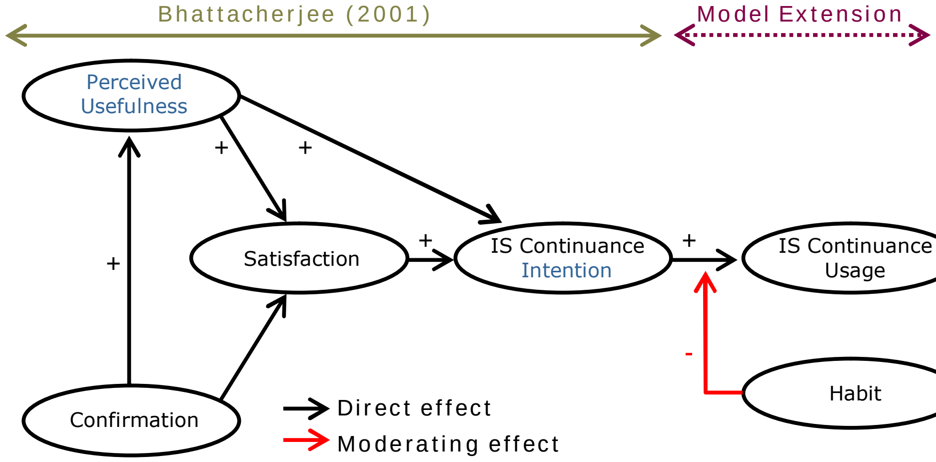
Figure 2.22: Burton-Jones & Hubona, mediating individual differences model (2006)



Like McFarland & Hamilton (2006), the model only implies a level of feedback, in that IS-Usage (volume & frequency) may add to a user's *system experience* , seen as an individual difference then influencing the PU and PEoU constructs.

The researcher contends, that the lack of focus and conceptualisation on if/how variables and constructs might influence (through feedback loops or otherwise) the "ongoing" use of technology, as apposed to merely "adopting" technologies is a continuing weakness of the TAM. One such issue already raised is the construct of habit, said to be the extent to which a response-driven behaviour has become automatic. Importantly to the TAM, habit has relatively little conceptual overlap with behavioural intention (Limayem *et al.*, 2003), in that once a behaviour becomes habitual it has become a sub-conscious response to a specific set of circumstances. That is; a user no longer has to consider their intent to behave in a certain way. In reference to technology use, Gefen (2003) contends that habit is a continuum, and that once a technology use is habitual, each subsequent use will reinforce the habit, making its influence ever more strong. The stronger the habit, the more automatic the behaviour, leading to a direct correlation between the increase of habit and the decrease of behavioural intent as predictors of the behaviour. The condition that habit requires behaviours to have occurred in a previous and repetitive fashion has led some authors to adopt the "prior experience" variable as a measure of user habit, however while past behaviour is an important predictor of future behaviour, the correlation between them is an indictor of the behaviour's stability, rather than an indicator of habit (Ajzen, 1991).

Figure 2.23: Extended Post-acceptance model of IS continuance (Limayem et al., 2003)



In addressing continued IT use, Bhattacherjee (2001) proposed the "*Post-acceptance model of IS continuance*", which Limayem *et al.*, (2001; 2003) further adapted to include the construct of habit. With its foundations in expectation-confirmation theory (Oliver, 1980), the Post-acceptance IS model also applies PU and BI as part of its model. Satisfaction replaces the PEoU construct, as it refers to an ongoing use rather than expected use of technology. The process still relies on the constructs acting as antecedents of ***intention to behave*** a certain way. Limayem *et al.*, (2001; 2003) extend the model by adding the habit construct, and in so doing, bi-pass the behavioural intention part of the model.

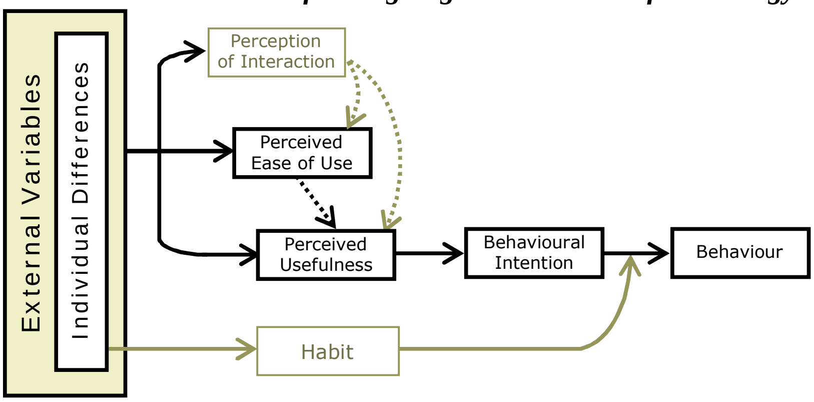
Bhattacherjee's Post-acceptance model highlights the direction some researchers have taken in addressing the TAM's lack of emphasis on ongoing technology use.

There is no reason, however, why the TAM itself cannot be modified to include on-going constructs that capture something of users attitudinal influences *during* the computer/human interaction process.

3.3.5 An On-going TAM model for information retrieval on the World Wide Web

The researcher proposes a modified TAM, on-going technology acceptance model (OTAM), which facilitates the inclusion of a construct to measure users perception of the predictability of their technology interactions. Where PU is seen to be measuring users' perceptions of the (outcome) "effectiveness" of engaging a technology and PEoU is seen to be measuring users perceptions of the "easiness" of engaging a technology, perception of interaction (PoI) measures users perceptions of the "processes" involved with interaction; that is; their perception of the understandability, repeatability and predictability of their engagement. It is important to note that this construct is not driven by the predictability of the outcome of an interaction, but by the predictability that the technology will behave in certain predictable ways during interaction. It is proposed to have the capacity to influence the PEoU and PU constructs, and so indirectly influence BI and B.

Figure 2.24 The OTAM constructs for on-going measurement of technology acceptance

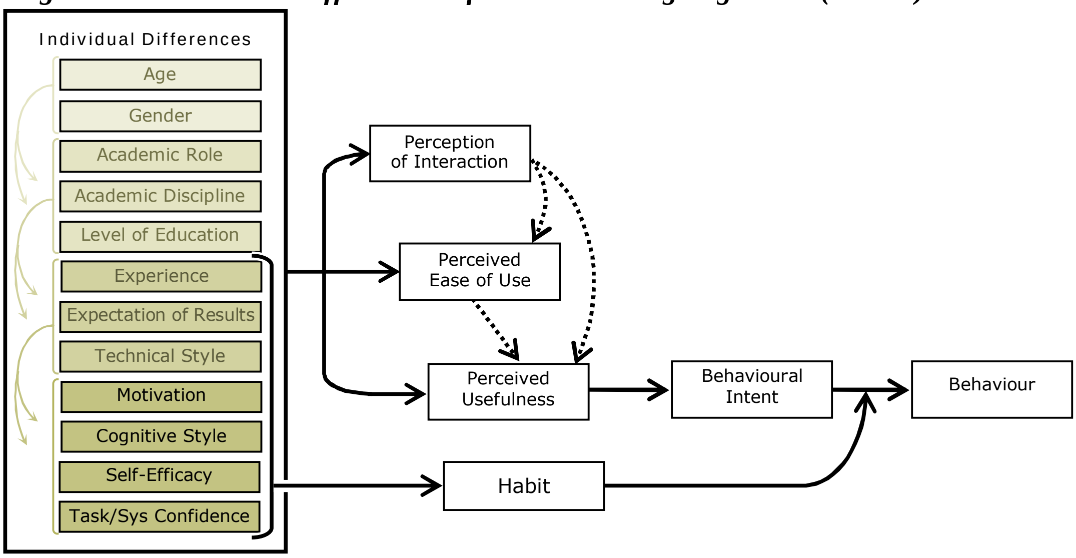


The model acknowledges McFarland & Hamilton's assertion that the individual differences of users must be mapped out to in order to fully understand these antecedents influences on PoI, PEoU and PU. Significantly however, the OTAM distinguishes between what some authors synonymously label "external variables" and "individual differences". In the context of the OTAM individual differences are those external variables that refer to human characteristics of the user-group. There are, of course, other external variables, particularly in relation to the World Wide Web, where something as simple as the technology being engaged, or the conditions of engagement, can vary between members of a user-group. Where possible, researchers should attempt to control these varying conditions in order to keep any user-results valid. Where condition variables cannot be controlled, they should be acknowledged and mapped, the same way individual differences are.

Finally, the OTAM includes the habit construct, which is seen as having a direct affective relationship with users' individual differences. That is; users' individual differences are seen as having an impact on whether/which behaviours become habitual in a user.

Figure 2.24 presents the basic constructs of the OTAM, and figure 2.25 presents the OTAM constructs in the context of the current research. Importantly, habit is seen as being influenced by user individual differences associated with their learned and cognitive responses to their world. The twelve identified individual differences in figure 2.25 are not considered by the researcher to be exhaustive. They merely represent the framework for user-data collation and analysis in the current dissertation.

Figure 2.25 Individual Differences influences on 'on-going TAM' (OTAM) constructs



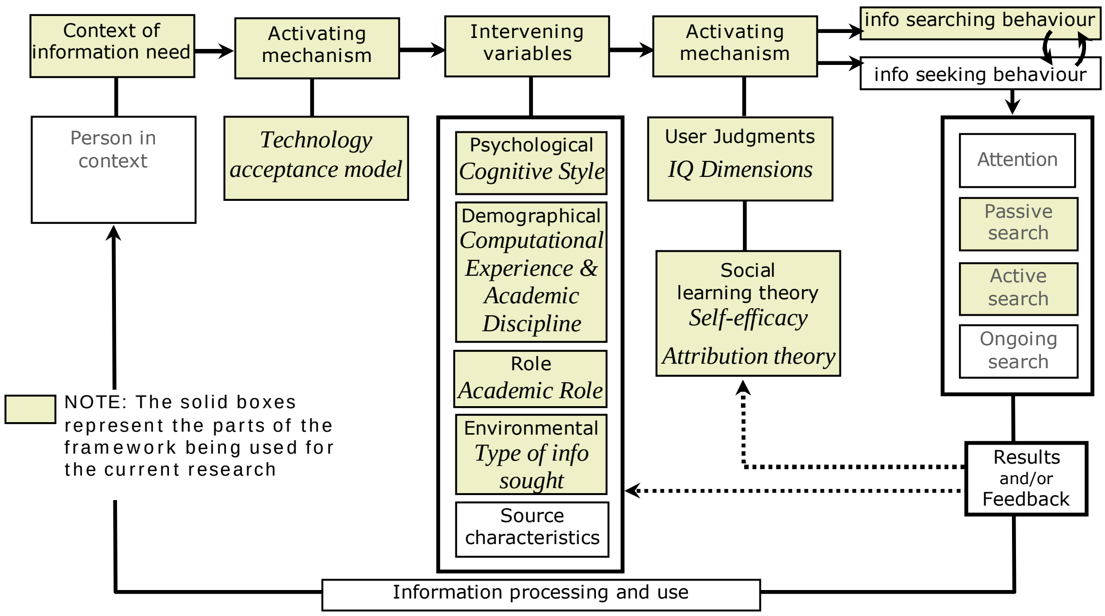
2.4 Applying the Theory to the Research

This literature review has covered some of the major theoretical developments of research into information quality, information seeking behaviour and the technology acceptance model. A number of theoretical frameworks have been proposed, which provide the foundation for the data design and analysis of the investigation. The information quality section built a combined conceptual life-cycle model (figure 2.2), which provides a contextual framework from which to begin examining user perceptions of information quality in the context of information use, rather than information production. Figures 2.24 and 2.25 presented the OTAM, a framework developed to investigate users' ongoing acceptance and use of Web-based search engines.

2.4.1 An Interdisciplinary Investigative Framework

Figure 2.15 presented an adapted framework for an interdisciplinary investigation of user information seeking behaviour (Ford, *et al.* 2001, 2005). Figure 2.26 presents the adapted framework in the context of the current research. It has been adjusted with descriptions of specific variables as they pertain to the research. For example; "Role" is described as "*Academic Role*", representing one of the user-variables upon which four sub-classes within the user-group can be identified, and results compared. In this application of the framework, Wilson's (1997) model does not so much describe expected user behaviours, but provides a theoretical backdrop where synergy between the various disciplines and parts of the investigation can be identified and used to better understand the user-group results.

Figure 2.26 An interdisciplinary framework for the current research project (adapted from Wilson, 1997)



The main departure from Wilson's framework is the separating of information seeking behaviour into *information seeking behaviour* and *information searching behaviour*. This is, in essence, not a significant departure however, as Wilson's macro "nested" model (see figure 2.14) demonstrates clearly that Wilson considers information searching behaviour to be a sub-set behaviour of information seeking behaviour. While the researcher agrees, in principal, that this is true, a significant number of web-users *begin* their interaction with the Web with "search" type behaviours ~ such as a search engine query, and then shift to "seeking" type moves (Choo *et al.*, 2000; 2003) ~ such as scanning or browsing (Hölscher & Strube, 1999; Wang & Kitsuregawa, 2001; Spink *et al.*, 2006). Essentially, in an episode such as this, it could be inferred that information seeking behaviour becomes a sub-set of the information search process. For this reason, information seeking and information search behaviour are classified in the current research as different user information behaviours, that users can iteratively swap between.

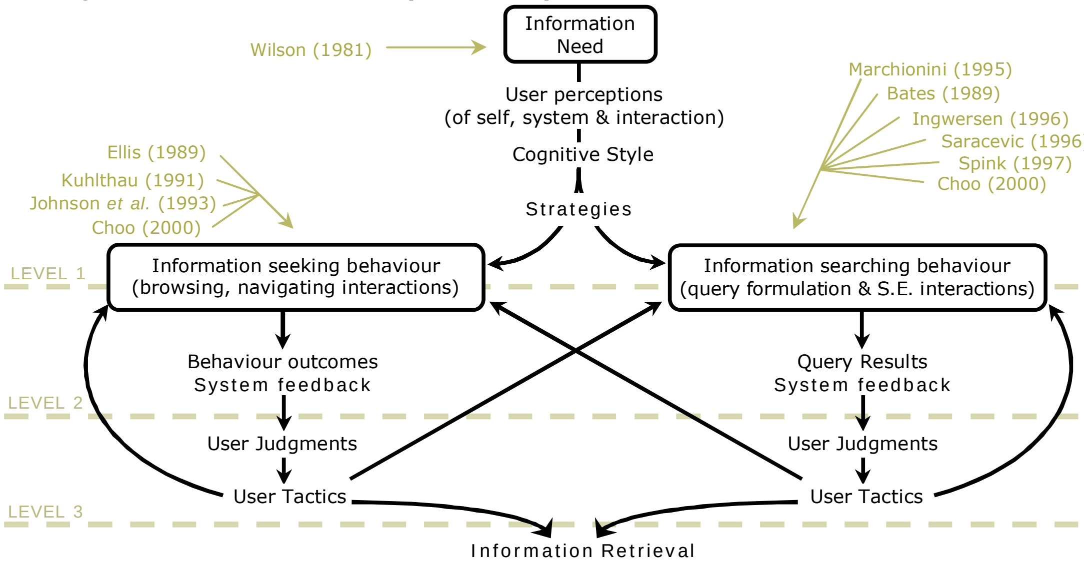
The interdisciplinary framework (figure 2.26) will be used to;

1.) Identify multi-disciplinary theories that can be applied to better understand human information behaviours
2.) Contextualise how and where the various identified theories contribute to the process of data collection, comparison and analysis.
3.) Help map-out patterns of information behaviour of the user-group, and therefore identify if relationships exist between various data-sets.

The framework is not, therefore, a predictive model for human information retrieval on the World Wide Web, although clearly there are some predictive elements associated with it. It is a tool used to map-out patterns of participants' information behaviour within multi-disciplinary constructs, helping to identify what (if any) types of relationships exist between participants' data-sets.

The framework is used in conjunction with a proposed theoretically-based macro model of information behaviour, which clusters the various information seeking and searching models discussed through section 2.2 of the literature review into a hierarchical model of user information retrieval behaviour.

Figure 2.27 A macro model of human information retrieval behaviour on the WWW



Together, the model (fig 2.27) developed from a theoretical understanding of how human information retrieval on the World Wide Web occurs, and framework (fig 2.26) developed to bring together the various theories associated with research at large, contextualise the theory investigated throughout this chapter and help demonstrate where synergies between multi-disciplines might exist. They also provide a useful means to schematically bring together the managing of data handling processes on the part of the researcher. A more detailed discussion of how the models have guided the data collection and analysis is provided in chapter 4 (Research Design).

2.4.2 Literature Review: Conclusion

The contextual and multi-discipline approach to the literature covered in this chapter is an indication of the design of the entire PhD research. The following two chapters will now introduce the Research Methodology and Research Design. A hybrid mixed-methods approach is presented and defended as a novel research methodology; that is; the contextual construct model.

CHAPTER 3

Research Methodology

"Contextual Construct Model"

A Contextual approach to developing Methodology

All research is based on assumptions about how the world is perceived and how we can best come to understand it (Trochim, 2000)

3. Introduction

The assumptions of any research are determined by its associated entities, such as the research discipline, the phenomenon being investigated and, to a varying degree, the personality and presuppositions of the researcher. These entities serve to build a *context* for any research, that guides its development from conception, to philosophy, to methodology, and finally to design and implementation. This chapter discusses the key methodologies associated with the current research, identifying how the researcher explored and determined the best approach to investigate and develop an understanding of the identified phenomena.

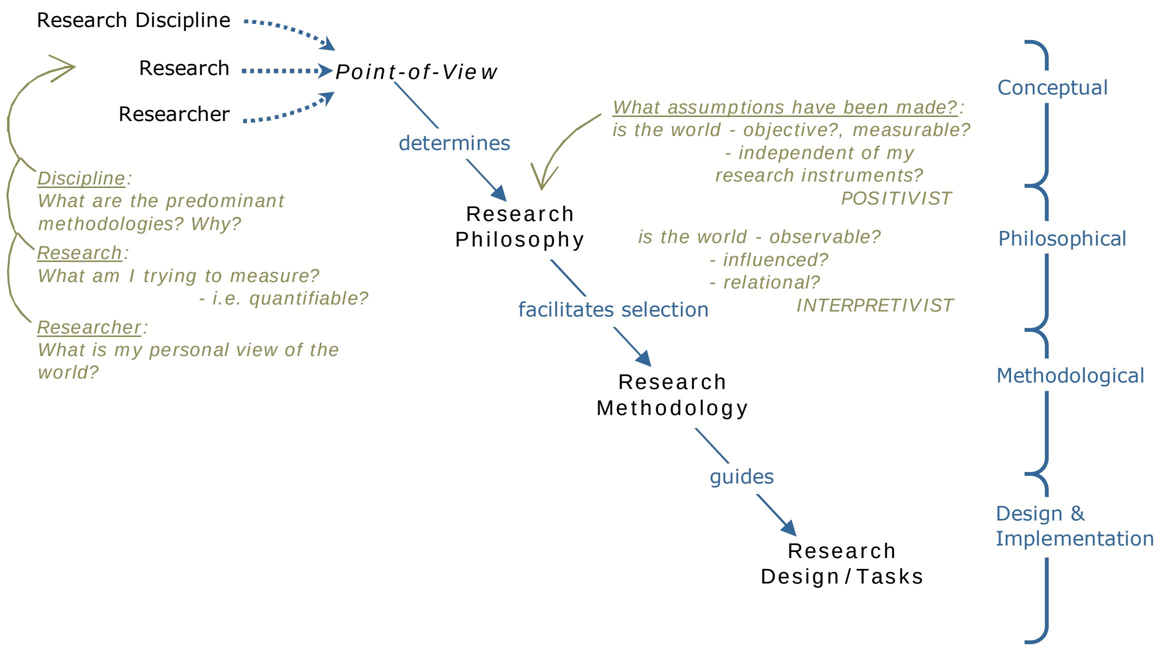
Identifying the context of any research is an important fundamental step in determining which methodologies are best suited. A clear understanding of the context, or *Big-Picture,* of the research will ensure that:

1.) The research philosophy fits-in with the constructs of the research discipline and the actual research project being undertaken;
2.) The methodology chosen is sound and appropriate in the context of the general research philosophy; and
3.) The research design; that is; how the component parts of the research fit together; is consistent with the research methodology.

The current research takes a contextual approach in both exploring and developing its methodology. Figure 3.1 illustrates a high-level contextual picture of a research project. It breaks down the planning of a research project into four evolving phases; (1) conceptual, (2) philosophical, (3) methodological and (4) design. During these stages, the researcher must consider such things as:

1.) the *Point-of-view* of the research;
2.) the Research philosophy;
3.) the Research methodology; and
4.) the Research design.

Figure 3.1 The Contextual Constructs Methodology



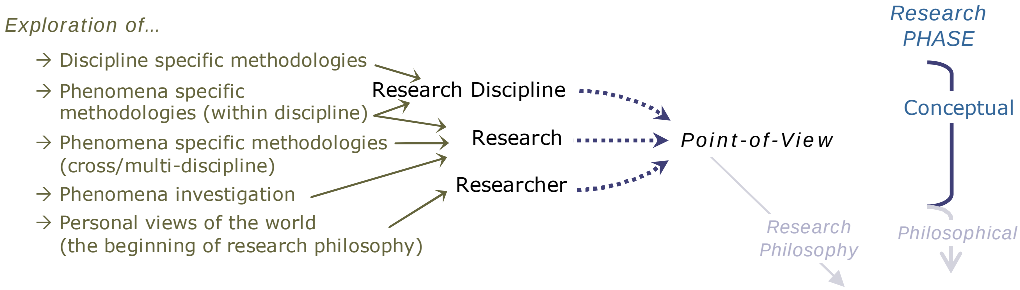
3.1 The Research Point-of-view

Remenyi *et al*., (1998) state that the primary drivers of research methodology are (1) the *topic to be researched*, and (2) the *specific research question*(s). Further to this however, in recognising Walsham's (1995) assertion that a researcher's knowledge of reality is itself a social construction, Trauth (2001) contends that *objective, value-free data simply cannot be obtained.* A third primary driver of research methodology then, is (3) the *researcher* themself.

In the contextual framework of figure 3.1, the "topic to be researched" is identified as being intrinsically linked to the *research discipline*; the "specific research questions" Remenyi *et al*., (1998) are seen as the actual *research*, and Walsham's (1995) belief that research is always tempered with the constructed truth of its creator, is identified as the *researcher*. These three entities are seen as being instrumental in determining a research project *point-of-view*.

Determining the point-of-view of any research is largely a conceptual process. It is the starting point of the journey. It involves identifying exactly what it is the researcher wishes to learn, and the *context* in which they wish to learn it. Figure 3.2 illustrates the researcher considerations at this foundational phase of any research.

Figure 3.2 Contextual Constructs of Research (Point-of-View)



A break in transmission: *The Chicken & the Egg*

An important characteristic of research is that, although its ultimate outcome is founded on logic, and can therefore be considered relatively "linear" in descriptive construction, as an entity, it is a *process* involving personal cognition. And cognition is anything but linear (Leonard *et al.*, 1999; White, 2007).

The process of a researcher discovering the point-of-view of the research is one of the most complex undertakings of a dissertation, and does not lend itself to a linear approach. In essence, this means that although – for the sake of clarity and non-repetitive writing – the process described herein is written in what amounts to a linear description, each identified part of the process does not necessarily take place in a specified order. Moreover, as the researcher, and research, develop and grow in sophistication, some parts of the research process are iteratively revisited.

3.1.1 A Discipline Context

A sound basis of any attempt to understand the "new" is an understanding of what is already known (Trauth, 2001). This involves identifying the research discipline context of the research so that literature and theory fashioned before can be examined and used to provide a strong theoretical foundation for how to investigate the phenomenon[6].

The examination of theory as it relates to a discipline context is multi-level. The researcher is required to conceptualise the phenomenon (or phenomena) they are going to explore during the course of the research project and identify the research discipline and sub-discipline context of their investigation. The researcher explores general research methodologies associated with their discipline, as well as a more focused exploration of the methodological approaches used previously to investigate the identified phenomena.

Discipline Context of the Current Research

The purpose of identifying the research discipline context is twofold;

1.) It helps identify key areas of research for the essential literature review (Webster & Watson, 2002);
2.) It provides a methodological context for the research – where the researcher can identify key methodologies commonly used for similar types of research.

The research disciplines that have been identified as being relevant to the current research are listed and classified according to the Australian Research Council's (ABS, 1998) *Research Fields, Courses And Disciplines Classification* [RFC] below;

Information Retrieval (IR)

Field: Information Systems (280100)

Broad Definition: research discipline that spans information, computer and cognitive sciences which deals with generation, representation, organisation, storage, retrieval and use of information.

PhD Context: specifically contextualised as information retrieval (as a user-behaviour) from the World Wide Web, and associated issues pertaining to IR in an electronic environment devoid of enforceable information quality standards.

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[6] The word phenomenon (singular) and phenomena (plural) is used broadly here to describe *"that which the researcher will be exploring as the focus of their PhD/research"*. The term is not used here to suggest the researcher engages "phenomenology" per-se, although this could be an appropriate strategy, depending on the focus of the research.

Information Quality (IQ)

Field: Information Systems (280100)

Field: Behavioural And Cognitive Sciences – *Psychology* (380100)

Broad Definition: discipline dealing with issues relating the concepts, metrics, standards and management of quality as it pertains specifically to information or data. Widely accepted as a multi-dimensional concept, it is currently defined in the literature as information that is "fit-for-use" (Wang & Strong, 1996).

PhD Context: perceptions of information quality have been examined from the user of the information's view-point; that is; how they view the content of the material they retrieve within the context of information search and retrieval on the Internet. Traditional constructs of quality in general, for example - what makes a good book? - may prove to be ineffectual in the hypertext Web environment.

Cognitive issues relating to issues like *dissonance*, *attribution*, *expectancy*, theories have been examined in the context of self-observed user survey results.

Human/Computer Interaction (also Computer-Human Interaction)

Field: Information Systems (280100)

Field: Computer-Human Interaction (280104)

Broad Definition: discipline dealing with research into how human beings use and interact with computers. Areas include online users and their behaviour, characteristics of human cognition and interactions with systems, system user interfaces, information processing between human players and information systems, and the like.

PhD Context: the human-computer interaction research falls into two main categories, how the cognitive processes of individual users are manifest in Web information retrieval behaviours, and how interaction with a search engine crawler facilitates (or hinders) those cognitive processes.

Technology Acceptance Model (TAM)

Field: Information Systems (280100)

Field: Behavioural and Cognitive Sciences (380100)

Broad Definition: based on the Theory of Reasoned Action (TRA) - which supposes that the best predictor of behaviour is intent - TAM suggests perceptions of a system's "usefulness" and "ease of use" strongly influence behavioural intent, which in turn motivates a user to adopt the use of system (Davis, 1986; 1989).

PhD Context: the TAM supposition of user-perceptions regarding usefulness and ease of use will be examined in the context of users' ongoing adoption of specific on-line information retrieval behaviours. This has included explorations of how expectancy, attribution and other cognitive processes influence user-perceptions of IQ and IR success or failure, and their relationship with perceived usefulness and ease of use.

Information Seeking Behaviour (ISB)

Field: Cognitive Science (380300)

Broad Definition: research discipline centred on the exploration of a user's role in the process of information retrieval. ISB investigates the internal (cognitive) and external (procedural/strategic) user-behaviour of information seeking.

PhD Context: The ISB of the participants in this PhD has been surveyed and analysed in the context of the previously mentioned research areas as well as in the context of more cognitive aspects of ISB, namely constructivist based sense-making research (Dervin, 1983), which places a strong emphasis on searchers' being actively involved in finding meaning that fits in with what they already know through a series of information seeking choices (Kuhlthau, 1991). Models such as the TAM, perceptions of IQ, and user search engine experience have been used to develop a rich picture of human information search and retrieval on the World Wide Web. User data regarding their search result perceptions, attitudes and choices have been examined in relation to the understanding that individuals bring their own cognitive style and knowledge levels to their ISB, in order to scrutinise the variables associated with user subject/topic knowledge (Stenmark, 2001); user search engine familiarity; and user ISB.

Discipline Methodologies of Information Systems

A researcher's decisions regarding methodology and design will generally occur after the conceptual phase (see fig 3.1) of the research project, once research philosophy issues have been addressed. Never-the-less, accepted and widely used methodologies associated with the research's identified discipline(s) should be examined so that the researcher can make a sound choice regarding their approach to methodology related activities such as data-collection and analysis.

The specific methodologies associated with the current research will be discussed in greater detail in section 3.3. The discussion of methodologies here is largely conceptual, representing an investigation into some of the key methodologies used in the discipline areas of this research.

In an analysis of research methodologies[7] in computer related disciplines, Glass *et al.*, (2004) observed that;

1.) 9% of IS research was *descriptive* – research that describes data and characteristics about the phenomenon being studied;
2.) 66.8% of IS research was *evaluative* – research that uses both qualitative and quantitative methods including case studies, surveys and statistical analysis;
3.) 24.2% of IS research was *formulative* – research which involves framework and model building, classification, taxonomy and concept building.

Significantly, the vast majority (approx 70%) of the evaluative type research was *deductive* in approach. Deductive research is research that begins with a theory, develops a hypothesis from that theory, and then develops specific measuring tools by which to test the hypothesis. Both confirmation and non-confirmation of a hypothesis are considered acceptable outcomes from deductive research.

Table 3.1 presents Glass *et al.*, (2004) findings relating to research approaches in the field of IS. Table 3.2 presents the specific methodologies adopted within the context of those approaches.

The results in Tables 3.1 and 3.2 suggest that quantitative type methodologies are by and large the dominant force in information systems research. This is not surprising given the high level of deductive based evaluative research also observed in IS.

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[7] The evaluation of IS research methodologies used leading IS journals, including Information Systems Research, Management Information Systems Quarterly, Journal of Management Information Systems, Decision Sciences, and Management Science.

Table 3.1 Research Approaches in IS
(Glass *et al.*, 2004, p91)

Descriptive Research:	9.0%
Descriptive System	2.7%
Review of Literature	-
Descriptive Other	6.3%
Evaluative Research:	66.8%
Evaluative-deductive	46.7%
Evaluative-interpretive	4.7%
Evaluative-critical	-
Evaluative-other	15.4%
Formulative Research:	24.2%
Formulative-concept	1.0%
Formulative-framework	2.5%
Formulative-guidelines/standards	0.8%
Formulative-model	12.5%
Formulative-process, method, algorithm	4.7%
Formulative-classification/taxonomy	2.7%

Table 3.2 Research Methodologies in IS
(Glass *et al.*, 2004, p91)

Methodologies Used	
Action Research	0.8%
Conceptual Analysis	14.7%
Conceptual Analysis/Mathematical	12.1%
Concept Implementation (Proof of Concept)	1.6%
Case Study	12.5%
Data Analysis	5.3%
Ethnography	0.2%
Field Experiment	1.6%
Field Study	24.5%
Grounded Theory	0.2%
Hermeneutics	-
Instrument Development	3.5%
Laboratory Experiment - Human Subjects	16.2%
Literature Review/analysis	0.8%
Laboratory Experiment - Software	0.6%
Mathematical Proof	0.2%
Protocol Analysis	1.2%
Simulation	1.4%
Descriptive/Exploratory Survey	2.7%

Table 3.3 provides a list of some of the common methodologies employed in the field of information systems. For the purpose of clarity, they have been divided according to commonly associated research philosophies – which themselves are usually governed by the research's purpose as well as the common mode of academic thinking within their sub-discipline. It should be stated however, that polarising research methodologies into strictly positivist (quantitative) or interpretivist (qualitative) can prove to be restrictive and counterproductive (Olson, 1995; Onwuegbuzie & Leech, 2005). Researchers are increasingly recognising that many research projects, particularly those that span multiple research disciplines require a more hybrid or "mixed" methodological approach (Amaratunga *et al.*, 2002). The current research, described in detail in section 3.3, takes a hybrid approach.

Table 3.3 Common Research Methodologies in IS

Research Purpose	Research Philosophy	Research Methodology
Theory testing	Positivist – quantitative	Case Study (positivist approach)
		Experimental (field & laboratory)
		Observation (empirical)
		Statistical Analysis
		Surveys/Questionnaires
Theory building	Interpretivist – qualitative	Action Research
		Case Study (inductive approach)
		Conceptual Analysis
		Ethnography
		Exploratory Research
		Field Study
		Grounded Theory
		Participant Observation
		Observation
		Qualitative Analysis

Quantitative (deductive) Research: Positivism

Positivist researchers generally assume that reality is objective and can be described or measured using methods that are independent of the researcher (Myers, 1997). Common methodologies associated with this approach include; (1) empirical observation; (2) controlled experiments; (3) statistical analysis; and (4) survey / questionnaires. An important aspect of quantitative research is that the researcher must find a way to quantify characteristics of the phenomenon being studied. Table 3.4 compares the common constructs of quantitative research as named by Orlikowski & Baroudi (1991); and Babbie & Mounton (2001).

Table 3.4 The Constructs of Positivist Research

Orlikowski and Baroudi (1991)	Babbie and Mounton (2001).
Formal propositions (or hypotheses)	Emphasis on quantifiable constructs
Quantifiable variables	Experimental or statistical control of variables
Hypothesis testing	Assigning of numbers to variables of phenomenon
Drawing of inferences about phenomenon	

Systematic reviews of the academic publications in main-stream IS journals demonstrate that positivism remains the orthodox approach to IS research (Walsham, 1995; Glass *et al.*, 2004; Vessey *et al.*, 2004). This tacit acceptance of the positivist view-of-the-world means that, to a degree, researchers adhering to this approach require less justification regarding their epistemological[8] position (Walsham, 1995).

Qualitative (inductive) Research: Interpretivism

Fidel (1993) describes qualitative research as non-controlling, holistic, process orientated, open and flexible, diverse in methodology, humanistic, and inductive. It is these open-ended, almost indefinable qualities of qualitative research that open the approach to its greatest criticisms from positivist researchers, who believe "*if it can't be measured, it doesn't exist*". The problem with this "*if a tree falls in the forest*" mentality is that it assumes, *that which is outside of a researcher's experience either cannot be known, or is not worth knowing*. Whole avenues of inquiry become non-applicable.

[8] In simple terms, a researcher's epistemology is related to their perceptions of the world and the phenomenon they are studying. Epistemology will be addressed in greater detail in the *Research Philosophy* (section 3.2) of this chapter.

Moreover, positivism's basic assumption that a researcher can objectively study a phenomenon leaves no room for the inherent subjectivity of human inquiry (Bruner, 1986).

At an epistemological level, interpretive research adopts the position that a researcher's knowledge of reality is socially constructed and, since the enquirer uses their own preconceptions in order to guide the process of inquiry, the result is that value-free data actually cannot be obtained (Walsham, 1995). Central to the interpretivist researcher then, is the recognition of their own "self" and the bias they bring to their research (Krieger, 1991), and central to interpretive research is the *context of the phenomenon* being studied (Myers, 1997; Amaratunga *et al.*, 2002).

Olson (1995) describes the interpretive approach to research as having the goal of understanding the social world from the viewpoint of the actors within it, and is oriented toward detailed descriptions of the actors' cognitive and symbolic actions. For this reason, interpretative studies are best suited to situations involving human behaviour, particularly when the researcher is attempting to understand the reasons for human behaviour.

In 1995, Walsham pointed to the growing number of interpretative research articles being published and the change in the dominance of a small number of orthodox journals with an explicit positivist philosophy, as evidence of the emerging acceptance of interpretivism in IS research. This trend has continued in the decade since, as IS researchers attempt to address complex issues related to management, organisation and individual user behaviour (Pather & Remenyi, 2004).

Common methodologies associated with the interpretative approach include; (1) case studies; (2) ethnography; (3) participant observation; (4) grounded theory (observation); (5) action research; and (6) conceptual analysis.

Table 3.5 Characteristics of Positivist & Interpretivist Research Approaches

Quantitative	Qualitative
» Epistemology – the world is objective and can be measured	» Epistemology – the world is subjective and no research is value-free
» Assigns measurements to phenomenon	» Assigns meaning to phenomenon
» Deductive	» Inductive
» Positivist	» Interpretivist
» Used to test theory	» Used to build theory

Table 3.5 outlines the basic differences between positivist and interpretivist approaches to research. As stated previously, however, it is not always helpful to polarise the two approaches to such an extent (Onwuegbuzie & Teddlie, 2003). Trochim contends "*all quantitative data is based upon qualitative judgments; and all qualitative data can be described and manipulated numerically*" (Trochim, 2002). The issue of polarising research approach, as governed by epistemology, will be addressed in greater detail in the following section of this chapter.

Table 3.6 lists some of the common advantages and disadvantages of the interpretive/qualitative approach to research. While these issues will not necessarily present themselves in every qualitative project, it is useful to know the common advantages and limitations of this approach before they are encountered.

Table 3.6 The Advantages & Disadvantages of the Qualitative Research Approach

Advantages	Disadvantages
» offers the best methods for exploring complex issues relating to human behaviour (Fidel, 1993) (Amaratunga *et al.*, 2002)	» results or conclusions are "true" only in that particular setting, cannot be generalised (Fielden, 2003)
» factors such as physiological factors, motivating factors (Amaratunga *et al.*, 2002)	» difficult to find an unambiguous and definitive statement as to what qualitative research is (Amaratunga *et al.*, 2002)
» data collection times and methods can be varied as a study proceeds (Amaratunga *et al.*, 2002)	» vulnerable to a tendency (on the part of the researcher) to focus on only a few qualities of interest, and ignoring others (Fidel, 1993)
» inherent flexibility (Amaratunga *et al.*, 2002)	» lacks the tradition of positivism (Trauth, 2001)
» greater contextual awareness, providing a far richer picture of the phenomenon (Dooly, 2002)	» still relatively new paradigm, requiring greater methodology justification (Walsham, 1995)
» best approach for phenomenon discovery, exploring new areas, and developing hypotheses (Amaratunga *et al.*, 2002)	» ↑ ethical considerations in interpretation and handling of phenomenon being studied (Stahl, 2005)
» favours methodological pluralism, appropriate for researchers interested in the "human" and "social" aspects of IS (Landry & Banville, 1992)	

Quantitative Vs. Qualitative Research

In a review of the emergence of interpretive based research in the IS discipline, Walsham argued that "*supporters of positivism do not in general need to justify their epistemological position*" (1995). Whether this is actually true or merely a perception of researchers of the interpretivist persuasion, it would seem that researchers adopting this approach often spend more time and energy developing and defending their methodology. Perhaps it is the lack of a consistent definition or paradigm – in that the very act of developing a contextual approach to research, data collection and analysis makes each methodology somewhat research-project specific – that causes this need to justify the research approach in greater detail. In addition, there remains what Hume (*cited in* Rosenberg, 1993) called "*the problem with induction*", described in terms of a research assumption of the "uniformity of nature". That is; an assumption that "the future will be like the past" (Wood, 2000). Given that qualitative research epistemologically accepts the view that the world is not necessarily uniform, there remains – at least in the view of the positivist – an irreconcilable chasm between interpretivist research and the process of inductive scientific inquiry, which assumes basic uniformities within the natural world.

Mixed Research, Pluralism, Triangulation, & Critical Realism

Triangulation is the act of combining various methodologies from both positivist and interpretivist epistemologies (Amaratunga *et al.*, 2002; Modell, 2005). It was developed by researchers who believe that qualitative and quantitative research are not actually opposed, but rather simply focus on the different dimensions of the same phenomenon (Das, 1983; Mathison, 1998; Onwuegbuzie & Leech, 2005). This argument however is countered by writers such as Orlikowski and Baroudi, who believe that triangulation of methodologies is simply not possible; "*there is no sense in which the interpretive perspective can accommodate positivistic beliefs. Interpretive research is seen to be based on philosophical assumptions which are essentially different from those of the positivist perspective*" (Orlikowski & Baroudi, 1991 p.16). Nevertheless, a growing number of researchers believe that not only is a mixed methodology possible, it is in fact, desirable (Ramsay, 1998; Christie 2000; Thurmond, 2001; Dooley, 2002; Greene & Caracelli, 2003; Krauss,2005; Williamson, 2006).

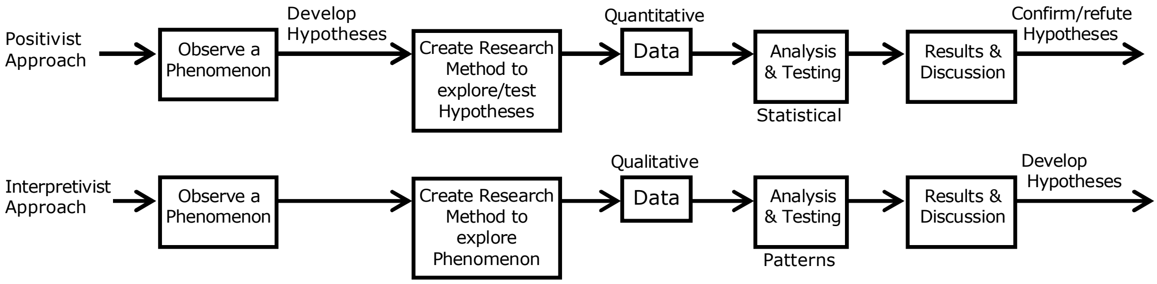
In addressing "mixed" research approaches, Amaratunga *et al*. (2002) suggest that using a combination of research approaches can compensate for the inherent weaknesses within each one. Fellows & Liu (1997) contend that the use of quantitative and qualitative techniques together to study a phenomenon can provide powerful insights into the results of the research. Rossman and Wilson (1991) argue that the use of triangulation allows the research to: (1) use both quantitative and qualitative methods to confirm and corroborate their research finds; (2) develop more elaborate analysis of the phenomenon, therefore producing a richer picture of the research; and (3) identify and develop multiple lines of inquiry regarding the phenomenon.

The rich picture of a phenomenon that can be developed using triangulation is described by Lee (1991) as providing the researcher with three "levels of understanding".

1.) The subjective understanding of the human participants in any social situation;
2.) The interpretive understanding of the researcher arising from the researcher's in-depth contact with the participants; and
3.) The positivist understanding arising from formal testing in an "objective" way by the researcher.

In this way, Lee suggests that positivist and interpretivist approaches are neither opposed, nor irreconcilable (Lee, 1991). Figure 3.3 illustrates that at the most basic fundamental level, both approaches are driven by a need to scientifically understand or explain observed phenomena, which motivates a scientific enquiry of that phenomena. A positivist approach to research is said to begin with a hypothesis, that is; a possible explanation for the observed phenomena; which leads to the researcher adopting a methodology designed to test if the hypothesis is true. An interpretivist approach, by comparison, begins with the researcher adopting a methodology designed to more closely observe and analyse the phenomena and develop possible explanations regarding its characteristics.

Figure 3.3 The fundamental elements of Research



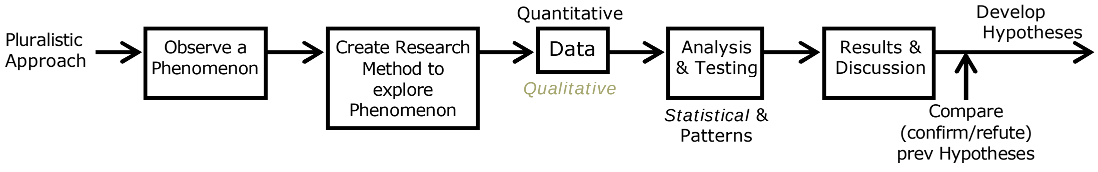
Methodological pluralism embraces both quantitative/deductive and qualitative/inductive research approaches by supposing that both approaches have degrees of the other inherent within them (Amaratunga *et al.*, 2002).

Critical Realism – a growing paradigm within the IS field of research – like triangulation, embraces the concept of methodological pluralism (Landry & Banville, 1992), drawing its epistemology from such schools of thought as positivism, interpretivism and critical research. Critical researchers believe that bias is an inherent characteristic of humans, and – given that research is conducted by humans – that all research is to some degree biased (Pather & Remenyi, 2004). In this respect, it could be argued that critical realism is an interpretive approach to research, except that for the realist, reality itself is not a social construct (as an interpretivist would believe) since it pre-exists the social analysis of it (Dobson, 2002). Therefore, for the critical realist, only the knowledge of reality is inherently subjective, reality itself remains relatively objective and unchanging. This belief – that there exists a natural uniformity to 'reality' outside of the researcher's contextual interpretation of it – allows the critical researcher to better address Hume's "*problem with induction*" by assuming a degree of scientific predictability in the phenomena being investigated. In this way, critical realism, as a research philosophy, more or less requires a pluralistic approach to its adopted methodology in that it embraces both the absolutes of positivism and the recognised bias of interpretivism.

At an ontological and epistemological level, any pluralistic approach recognises the inherent subjectivity of researchers, and the need to develop rich methodologies to understand the social context of human behaviour. Pluralism's great strength however, is not that it embraces interpretivist view-points, but that it makes available to the researcher a rich tapestry of research methods and tools that may otherwise not be available if the researcher took an absolute positivist or absolute interpretivist approach. Where a positivist could aim for replicatability and generalisability, and the interpretivist could enhance the in-depth understanding of a phenomenon, a mixed (or pluralistic) approach can provide methods for the researcher to achieve both outcomes (Mingers, 2001a; 2001b).

Figure 3.4 illustrates how the current research adopts a pluralistic approach to investigating user perceptions of information quality in the context of information retrieval. The complex, multi-dimensional nature of the phenomena being studied governed a multi-dimensional investigation that used methods commonly associated with qualitative research to explore quantitative, statistical data.

Figure 3.4 Pluralistic research approach of the current research



Information Systems Research Trends

In theory, at least at a conceptual level, it would seem all three approaches discussed in this section are appropriate and acceptable within the field of IS research. The emergence of alternative-research friendly journals in the early 1990s is suggested by Walsham (1995) to be evidence of the growing acceptability of non-positivist based IS research, as is the changing in editorial notes and types of research being considered for publication at traditionally orthodox positivist IS journals like MISQ. However, the few studies that have sought to produce empirical data regarding what the major IS journals are actually publishing (Orlikowski & Baroudi, 1991; Cheon *et al.*, 1993; Mingers, 2003; Chen & Hirschheim, 2004; Choudrie & Dwivedi, 2005) have found that the "*positivist paradigm continues to dominate the IS research community*" (Chen & Hirschheim, 2004) with a growing emergence of *critical epistemology* through the early 1990's (Orlikowski & Baroudi, 1991).

Table 3.7 presents the empirical data associated with Orlikowski & Baroudi's (1991) and Chen and Hirshheim's (2004) studies into the research methodologies published at a select set of top IS journals. The results demonstrate that while interpretivist research has made some in-roads into mainstream IS research, positivist research has remained the predominant paradigm in the published research.

Table 3.7 Methodologies used in established IS Journals (1991 & 2004)

	Orlikowski & Baroudi (1991)	Chen & Hirshheim (2004)
Dates	1985 - 1989	1991-2001
Articles	155 articles	1, 893 articles
Journals	MISQ	MISQ
	CACM (Communications of the ACM)	AMIT/IO
	Management Science	EJIS
	Proc of ICIS conference	Proc of ICIS conference
		JIT
		ISJ
		ISR
		JMIS
Findings	Positivist = 96.8%	Positivist = 81%
	Interpretivist = 3.2%	Interpretivist = 19%
	Critical = 0%	Critical = 0%

KEY: MISQ=MIS Quarterly; AMIT=Accounting, Management & Information Technology; EJIS=European Journal of Information Systems; ICIS=International Conference on Information Systems; JIT=Journal of Information Technology; ISJ=Information Systems Journal; ISR=Information Systems Research; JMIS=Journal of Management Information Systems.

The reviews offer some valuable insights into general trends in published IS methodologies, administered some thirteen years apart. With that said however, both historical reviews also have a number of limitations that should be addressed before authoritative conclusions can be drawn from their findings.

1.) Both studies assume a causal relationship between the “quantity” (number of publications) of a paradigm typology and their representation of trends in, or influence on, IS research in general. That is; the greater the number of papers published, equals the greater the representation. The problem with this, is that it assumes other methods of representation assessment, such as a citations analysis, would not be of equal value when determining influencing trends in IS research.
2.) Both studies use a limited number of journals. Orlikowski & Baroudi (1991) use just four mainstream journals, Chen & Hirshheim (2004) use just eight.
3.) The studies, by and large, use different journals, with only MISQ and Proceedings of the annual ICIS Conference being common between them.
4.) Chen & Hirchheim's (2004) findings relating to publication patterns between US-based and European-based journals could be questioned, given that;
    - not only US researchers publish in US journals and not only Europeans publish in European journals;
    - editorial boards are increasingly diverse – and not necessarily all geographically located in the country of publication.
    - the causative relationship between different trends in US verses European journals and which journals researchers’ explicitly target for publication is not fully discussed.
5.) Apart from the Proceedings of the ICIS Conference, no other research conference publications are included. While the varying degrees of academic rigour associated with conference proceedings would account for their exclusion, it could be argued that a research project/paper investigating current trends in any field of research needs to include conference research papers as they often represent the most up-to-date research in their field because of their relatively quick turn-around.
6.) The lengthy turn-around period between journal paper submission, review, acceptance and publication in the top IS journals means that published works in 1999 may have been submitted in 1996 or ’97. If that research is the cumulative

result of a PhD, then one could expect the research cycle began between two to four years previous to submission. It is therefore not inconceivable that an MISQ publication in 1999 began its research life in the early 1990's. The articles cited in the two reviews in question, then, do not necessarily represent the latest trends in IS.

7.) It could be argued that a better approach to determining the latest research trends in IS would be an empirical examination of IS related PhD publications. Publication occurs immediately after the dissertation is examined, and the methodology has to be fully addressed – usually in greater detail than in other academic publications. Even with the identified limitation that PhD researchers represent the less "experienced" of academic researchers, the rigour generally required and the influence of experienced supervisors provides a fertile ground for investigating current trends, and possible future directions in IS research.

8.) The classification of "mixed" methodologies is still somewhat ambiguous particularly in Chen & Hirshheim (2004), with publications using both positivist and interpretivist methodologies being classed in both categories, rather than just in their own *exclusive* category.

IS Research – Why still so Positivist?

Chen & Hirshheim make two valuable – if not controversial – points in their discussion of the results in their empirical study. They question whether researchers predictably choose specific approaches to their research in order to be published in specific mainstream journals (2004, p224), and they question whether editors of mainstream journals are "gatekeepers" or "facilitators" of research trends in IS (2004, p226). This could be particularly true in a research discipline such as IS, where rigour and validity – rather than innovation – are considered a central paradigm for research publication.

Significantly, both studies use their *discussion* and *implications* sections to advocate a call for more interpretivist based research in IS. Orlikowski & Baroudi suggest that "*a single research perspective [positivism] for studying information systems phenomena is unnecessarily restrictive*" (1991, p1). Chen & Hirschheim (2004) describe the progress of interpretivist research in IS over the decade since

Orlikowski & Baroudi's study as "marginal", and conclude that the pluralist paradigm requires continuous advocacy if it is to make greater in-roads into mainstream IS research.

At a time when the IS discipline is going through what some authors' have described as an "*identity crisis*" (Benbasat & Zmud, 2003) there has never been a greater need for IS researchers to consider their methodological options. Benbasat & Zmud suggest the ever increasingly "eclectic" nature of both the practice and study of IS calls for multiple paradigms and approaches when researching IS. This is of particular concern in relation to the lack of diversity in research approaches within the specific IS research area of *technology adoption* (Choudrie & Dwivedi, 2005).

As a response to the narrow investigative approaches to technology adoption and use in the field of IS, and the complexity of the phenomena being investigated, the current research takes a pluralistic approach, combining methods associated with both quantitative and qualitative research in order to develop a richer and more insightful understanding of the complex patterns and relationships associated with user perceptions of information quality, systems-based information seeking behaviour and technology adoption. The intuitive approach has necessitated that the researcher investigate and discuss general methodology and methodological theory in some detail in order to develop a research design process that, while novel, would be considered rigorous and valid.

3.1.2 The Phenomena of the Research

"*what one wants to learn determines how one should go about learning it*"

(Trauth, 2001)

Identifying the Phenomena and its Discipline context(s)

Determining the key characteristics of the phenomena being investigated is one of the first steps towards developing a sound framework to guide the process of how the research will be approached. In the case of the current research, for example, one of the phenomenon being investigated is information quality (IQ). As a cognitively-driven (Kopcso *et al.*, 2000; Zhang & von Dran, 2000; Rieh, 2002), relative/contextual (Strong *et al.*, 1997a, 1997b; Dedeke & Kahn, 2002; Gendron & D'Onofrio, 2002; Matheus,

2004) , and somewhat intangible (Sarkis & Sundarraj, 2000; Varlander, 2007) entity, user perceptions of "quality" – as they pertain to information quality – cannot always be definitively measured or quantified. Although many of the characteristics or "dimensions" of IQ such as accuracy, relevance, timeliness, consistency, reliability, and usefulness, have been named and tested in academic literature, the generally widely accepted definition of IQ as being 'information that is "fit-for-use" (also "fit-for-purpose") (Wang & Strong, 1996), reaffirms IQ to be a largely context driven and subjective phenomenon.

The characteristics of the phenomena

A key task in identifying the boundaries of the investigation is a development of what amounts to a schema of the phenomena of the research. Such an activity involves identifying whether the major research "object" is:

- one phenomenon possessing a range of characteristics;
- a set of phenomena possessing convergent characteristics; *or*
- a set of phenomena possessing divergent characteristics

The current research, in simple terms, is a broad investigation of high-end user IQ perceptions of Web-based content, and how those perceptions impact user information seeking behaviour. Developing a schema of the phenomena involved in the investigation however, reveals the "object" to be far more complex. In real terms, the phenomenon of "IQ perceptions" is manifest through the characteristics of several co-existing phenomena, including;

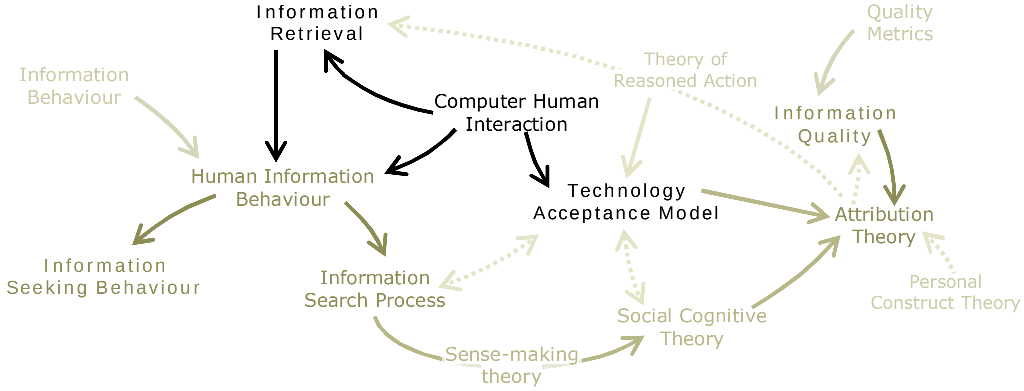
- Human-computet interaction (also, computer-human interaction).
- Information seeking behaviour (ISB) – inc; human information behaviour (HIB); information retrieval (IR); and information search process (ISP)
- Technology acceptance / technology adoption (TAM)
- Information quality perceptions; inc; quality metrics
- Social cognitive theories, inc; attribute theory, personal construct theory

Figure 3.5 illustrates a schematic representation of the various phenomena of the current research. The complexity of the phenomena and the multiple relationships between the parts of the whole required a multi-discipline approach in regards to theory research and literature review.

The growing understanding of the phenomenon:

1.) *indirectly drives* the research philosophy, as the researcher makes conceptual decisions about the nature of the phenomena, the nature of themself, and the nature of the world.
2.) *directly drives* the tangibles of the research, such as what type of data collection strategies will be used.

Figure 3.5 The component phenomena of the Current Research



Once the phenomena being investigated are identified, basic conceptual questions of them must be asked. Can the phenomenon be observed? Can it be quantified? Can it be defined? Can it be contextualised? The answers to these questions form the basis of the research problem to be investigated in the research, and help shape the actual *research questions* developed for the research project.

Research Questions

Conceptualising and articulating the research questions helps focus the scope of the research (Eisenhardt, 1989; Heinström, 2003; Kari, 2004), thereby helping the researcher to:

1.) Determine the key characteristics of the phenomenon to be investigated
2.) Identify key areas of academic literature needed to fully investigate the research problem;
3.) Identify discipline (or disciplines) context of the research, as well as areas of synergy across multiple disciplines;
4.) Determine a target user-population (where applicable);
5.) Identify the type of data to be collected.

The research questions, their epistemological assumptions, and sub-questions of the current research are presented in chapter 4 (Research Design).

Examining Discipline specific Research Approaches to the Phenomena

As the research project begins to take shape, and the scope is narrowed through the identification of the phenomena being investigated and design of research questions to guide the examination of those phenomena, a more focused inquiry of research methodologies can take place. The focus of the methodological investigation this time is on previous research approaches to the phenomenon being examined, and therefore need not be limited to the discipline context of the investigation.

Finding Synergy: Developing a rich-picture framework

In the case of the current research, the process of examining multi-discipline research methodologies in regards to the phenomena is where synergies began to be found. The researcher began to see clear commonalities in theoretical models from divergent disciplines that investigated similar phenomena from different perspectives. Opening the investigation to the influence of multiple disciplinary approaches became an important influence on the researcher's epistemological assumptions of phenomena and the investigative/research process.

***3.1.3 The Researcher: Positioning the "self"** – first considerations of philosophy*

Trauth (2001) contends that the five major influencing factors on one's approach to any research include;

1.) The research problem;
2.) The researcher's theoretical lens;
3.) The characteristics of the phenomena;
4.) The researcher's skills;
5.) Academic politics.

The research problem and characteristics of the phenomena were addressed in section 3.1.2. Academic politics, which relate closely with the research discipline was addressed in section 3.1.1. Discussed here, are the issues relating to the researcher as a "self" driven cognitive entity in their own right. The structure of the "self" involves such constructs as what Trauth calls a researcher's "*theoretical lens*" and "*skills*", which have a guiding influence on the research's *Point-of-view*.

Fielden (2003) describes the involvement of a researcher's own influencing point-of-view as "inevitable". Inevitable because a researcher's own individual mind-set, biases, skills and knowledge become an intrinsic part of the research process (Janesick, 2000). In relation to interpretivist research – which epistemologically recognises researcher bias – Krieger (1991) contends that the realisation of the "self" is, in fact, "*fundamental to qualitative research*". Olesen concurs, that the realisation of the self provides an additional resource upon which research results can be viewed or interpreted (Olesen, 2000).

The recognition that the researcher plays a role in research is not only a paradigm of the interpretivist school of thought. Pather & Remenyi (2004) observe that critical researchers too, "*often conduct their research in the context of Marxism, feminism, corporate power structures anti-racism and anti-colonialism*" (2004, p144), idealistic, constructed truths, that influence a researcher's view of the world.

Importantly, both critical realism and interpretivist views have developed out of a need to address and overcome the limitations associated with positivism (Hjørland, 1998; Wallace, 1998; Pather & Remenyi, 2004), recognising that information systems research problems often exist in a *social* context that numbers and rigorous statistical tests may not necessarily be able to measure effectively (Pather & Remenyi, 2004).

From a purely pragmatic point-of-view, critical and interpretivist researchers recognise that the researcher is part of the world being studied (Schostak, 2002). The act of the research investigation has the capacity to affect what is being researched, which, in turn, has the capacity to influence perceptions of the phenomena and therefore interpretation of results.

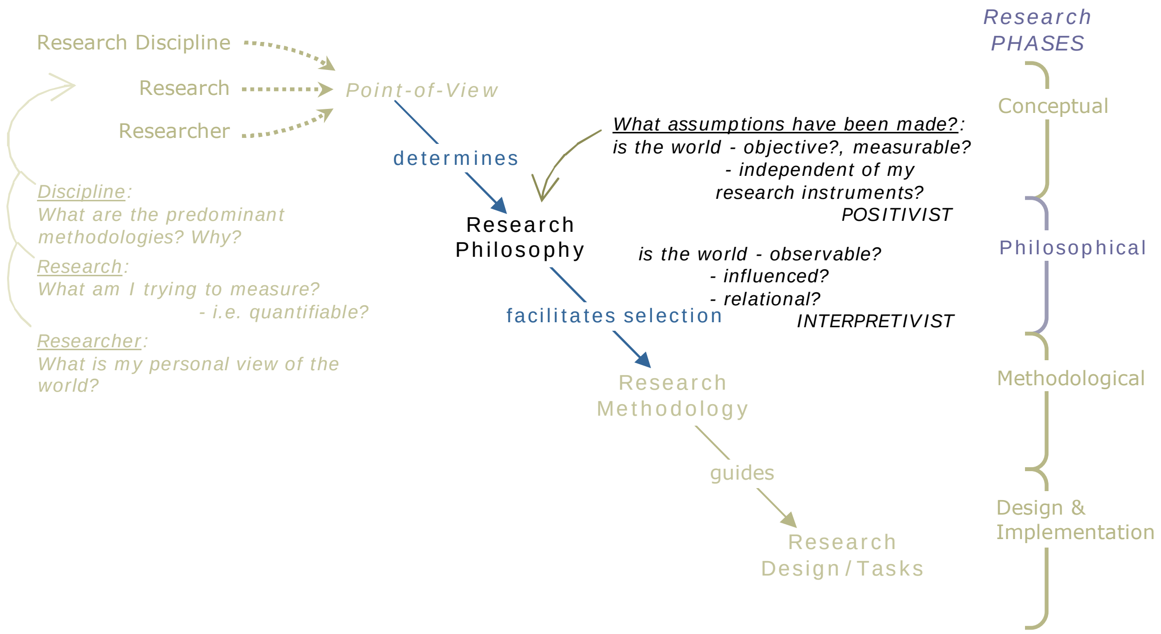
From the list of influencing factors, Trauth (2001) identifies two affective researcher-driven qualities; (1) the researcher's theoretical lens; and (2) the researcher's skill. According to Schostak (2002), the act of researching can and does have an effect on these. That is; as a researcher envelopes themself in the theory and academic literature associated with their discipline and phenomena being studied, they can expect to become more knowledgeable and therefore continually adapt and refine their theoretical lens. The same can be said of a researcher's skill. The act of researching; controlling research boundaries, developing data collection tools, collecting data, analysing the data, recognising limitations, and formulating conclusions have the accumulative affect of improving a researcher's skill. *No researcher would expect to be in the same cognitive-space at the end of a research project than at the beginning.*

3.2 The research philosophy

> *"The alternative to philosophy is not no philosophy, but bad philosophy. The 'unphilosophical' person has an unconscious philosophy, which they apply in their practice - whether of science or politics or daily life*" (Collier, 1994: p17).

Figure 3.6 illustrates where in the research life-cycle a research philosophy is generally considered by the researcher. The research *Point-of-view* was discussed in detail in the previous section (3.1). The Contextual Constructs Model presented in this chapter (fig 3.1), contends that this point-of-view; influenced by the research discipline, research itself, and the researcher; now determines the research philosophy.

Figure 3.6 The Contextual Constructs Model of Research (Research Philosophy)



3.2.1 The role of assumptions and epistemology

The way a researcher perceives the world, to a great extent, determines their philosophical assumptions about that world, which in turn are intrinsically connected to any underlying research epistemology (Myers, 1997). Epistemology refers to the assumptions one makes about ones knowledge of reality and how obtains and/or understands that knowledge. As researchers then, it is important to know what these assumptions are (Cecez-Kecmanovic, 2001; Stahl, 2005).

Collier's (1994) contention that "no philosophy" is actually "bad philosophy" serves to remind the researcher that not being aware of their philosophical assumptions does not mean those assumptions do not exist. In the same way, an awareness of one's philosophical assumptions does not give a researcher the licence to produce known-biased research. Instead, an awareness of underlying assumptions about the world should provide researchers with the tools by which they can recognise particular bias in the research, and therefore limit its influence on the validity of the research as a whole (Dey, 2001).

The ultimate role of epistemological assumptions is that they act as a guide for the research and the methods chosen to study phenomena. Dobson (2002) suggests the value in understanding one's philosophical position; (1) provides the researcher with the power to argue for different research approaches; and (2) allows the researcher to confidently choose their own sphere of activity. To that end, Walsham (1995) advocates that researchers need to reflect on their philosophical stance and explicitly define their stance as part of their research write-up.

Determining a research philosophy

Galliers (1992) proposes that choosing a research approach involves determining which approach best suits either; (1) the "object" or phenomena to be studied; or (2) the goal of the research; that is; theory testing, theory building or theory extension. Dobson (2002) pushes this idea further however, suggesting it is two-dimensional to take an either/or view of research. Rather, determining a philosophy involves understanding *both* the object *and* the research purpose, and any relationship between them. The researcher would argue that the object, understood in the context of the research purpose, is in fact, a clear understanding of the phenomena to be studied, in that the object (phenomena) is understood to be a contextual entity, and the context provides at least part of the researcher's understanding of their investigation. Figure 3.7 illustrates the traditional relationship between research purpose, underlying epistemology and the resultant methodologies.

Figure 3.7 Determining a philosophy

Research Purpose	Underlying Epistemology	Resultant Methodologies						
Theory testing	Deductive reasoning	generalised ideas			→			specific observations
		Theory	→	Hypothesis	→	Observation	→	Confirmation
Theory building	Inductive reasoning	specific observations			→			generalised ideas
		Observation	→	Pattern	→	Tentative hypothesis	→	Theory

The categorising of the research purpose (i.e., theory testing versus theory building), while extremely useful in helping a researcher identify their epistemological position, is considered by some authors (Kaplan & Duchon, 1988; Sonnenwald & Iivonen, 1999; Thurmond, 2001; Dooley, 2002; Onwuegbuzie & Leech, 2005; Krauss, 2005; Williamson, 2006; Presbury & Fitzgerald, 2006) to be limiting in that it locks the researcher into relying on only one research paradigm, or view of reality.

A philosophy for the current research

In the case of the current research, the broad phenomenon being investigated was user perceptions of information quality (IQ) in the context of World Wide Web information retrieval behaviours. Understanding this phenomenon, actually involves measuring three phenomena, two of which are assumed to already exist. The phenomenon to be investigated assumes that;

1.) Users who are looking for information on the Web have a pre-conceived perception of information quality; and
2.) Users utilise their perceptions of IQ to find and retrieve relevant information.

To a degree then, the phenomenon basically assumes that user perceptions of IQ are manifest in their information seeking and retrieval behaviours.

It is this somewhat assumed characteristic of the phenomenon being studied that lends the research to both a positivist or interpretivist approach. From a positivist view, it could be proposed that user perceptions of IQ impact Web-IR strategies, and the user data could be used to affirm or discredit hypothesis. For the researcher however, the resulting research would be somewhat two dimensional and lack anything truly ground-breaking in so far as it would have limited the exploratory scope of the project. Of far greater worth – and contribution – would be a multi-dimensional understanding of how users make choices regarding the information they retrieve, how they decide what is "quality" and what is not, how their behaviours manifest users' perceptions and choices, or how the perceptions might impact actual behaviours. An investigation of this nature would involve beginning to understand the phenomena in;

1.) A social context (that of information seeking and information retrieval behaviour);
2.) A cognitive context (that of perceptions of what quality is, or is not); and
3.) An environment context (that of the information characteristics of the Web environment, and user information tasks).

It is this rich picture of information seeking and retrieval behaviour being sought that lends the research to a more interpretivist approach in its examination of IQ judgments, in the context of specific human information behaviour. *Context* becomes of central importance in this approach, because it recognises IQ judgments as contextually driven value-judgments. For example, a library patron looking for a specific book might use a library catalogue to check the availability of the book, determine a Dewey classification number, and then become frustrated when the book is not located according to its classification. If this occurred numerous times in the same library, it could be assumed that the patron's perception of the particular library might falter. The IQ dimensions used to make this value-judgment include such criteria as availability and accessibility. Confronted with the same scenario on the Web, most often represented in the form of broken hypertext links, does the issue of information not being where it's supposed to be, invoke the same value-judgment in the user as its occurrence in previous information environments? While a good basic understanding of how users actually feel about broken hyperlinks on web pages can be achieved using a positivist approach, understanding how those broken links may (or may not) affect the user's perception of the web page, or the quality of the information on the web page, requires a more detailed analysis. How users perceive what is "quality" may not, in theory, have changed, however in practice – in the context of Web-IR – actual behaviours may not necessarily reflect current understanding and theory relating to users' perceptions of IQ.

Thus, the research has taken a pluralistic, or mixed, approach to study the phenomena. At an epistemological level, the research takes an interpretivist approach, recognising that "truth" is socially constructed and contextual; and attempts to define, observe and analyse the phenomena within the three stated contexts of Web-IR. Given that perceptions of quality are subjective, and that IR strategies are a largely cognitive process, studying the user perceptions of quality in the context of these strategies requires a multi-dimensional, pluralistic, and context driven approach. To insure validity, reliability and some generalisability of the findings however, *data collection* methods chosen are largely quantitative in design.

In short, the research could be described as a *qualitative, contextual and multi-dimensional analysis of quantitative data.*

3.3 The Research Methodology

At an operational level, a research methodology refers to the procedural framework within which the research is conducted (Remenyi *et al.*, 1998). It is the use of specific methods to:

1.) gather adequate and representative evidence of a phenomena (Buckley *et al.*, 1975);

2.) develop appropriate ways to analyse collected data (Fielden, 2003); and

3.) demonstrate the validity or reasonableness of any findings or conclusions (Amaratunga *et al.*, 2002).

3.3.1 How research philosophy facilitates research methodology

Research philosophy encompasses the epistemological assumptions of the research and the researcher. It differs from actual methodology in that it provides the foundation for the methods or strategies by which a researcher will investigate phenomena. The literature investigating research approaches and methodologies in the field of information systems can, at times, cause a degree of confusion, given the various uses of value-laden words to describe such elements as "approach", "methods", and "strategies". For the purpose of clarity, the current research describes *research approach* as a high-level function that encompasses the epistemology and philosophy. The *methodology* then, is the actual strategies employed to develop the tools for data collection, the practical workings of which are governed by the *research design*. The research design – seen as the blueprint for the delivery of data collection tools and interaction with the user-group – will be discussed in detail in the following chapter.

The ultimate role of the research philosophy then, is used to;

1.) establish the researcher's epistemological stance, and
2.) provide a foundation for the choice of which established research methodologies within the research field can be used for data collection and analysis.

Epistemology and philosophy therefore, are different entities. A pluralistic epistemology, for example, allows for the use of both quantitative and qualitative methods of data collection and analysis. It should be stated here, that a quantitative or qualitative "approach" is not the same as a quantitative or qualitative "method". The approach merely establishes the research parameters within which associated methods can be used. For example, a qualitative approach can use both quantitative and qualitative methods of data collection. The analysis of the data however, will most likely be *interpretivist* or *critical* in its epistemology, hence why it is called a qualitative investigation.

Determining the philosophical approach then, helps the researcher further develop their "theoretical lens", and facilitates the choosing of appropriate methodologies with which to investigate the research phenomena.

3.3.2 Methodology and validity

The concept, and necessity, of validity is central to all research. It is the quality by which research can be judged as valid, reliable, and – where appropriate – generalisable. There are four possible levels of validity that a researcher may wish to establish (Pandit, 1996; Dooley, 2002; Rowley, 2002):

1.) *Construct validity* – is established through the correct design and use of data collection tools for the specific concepts being studied. This is particularly important when a researcher choses to construct additional or secondary data (Slater & Atuahene-Gima, 2004), such as clustered results, as part of their analysis.

2.) *Internal validity* – is required to demonstrate if there is any relationships between parts of the phenomena

3.) *External validity* – is required if a researcher wishes to establish a level of generalisability regarding the findings of their research. That is; demonstrate that what is applicable to the research situation can also be applied to "other" situations.

4.) *Reliability* – established by using a credible and consistent line of enquiry and data collection. That is; that the use of the same data-collection would produce the same results in multiple settings.

In general, validity is established through the use of correct research methodology, and is intrinsically linked to *research design*. Data collection, as well as the analytical methods used to examine the data collected, must be delivered in such a way that the results do not exhibit inconsistencies as a result of design limitations or variables.

It should be noted, that not all levels of validity are achievable, or necessary, for all research. For example, research that is not trying to establish a relationship between any of the phenomena being studied does not necessarily require internal validity. In the same way, a highly interpretive case study that is seen by the researcher as a "one-off" – and therefore not requiring of the findings to be generalisable – does not necessarily require external validity. Construct validity however, is essential to all research, if the findings are to be considered valid and reliable, even within their own unique context. The validity considerations of the current research will be demonstrated and discussed in the following (*Research Design*) chapter.

3.3.3 Methodologies for Data Collection & Construction

Table 3.8 presents Rowley's (2002) list of associated interpretivist related strategies and what type of investigation they are best suited to.

Table 3.8 Choosing a research strategy (Rowley, 2002)

Strategy	Form of research question (type of inquiry)
Experiment	How, why
Survey	Who, what, where, how many, how much
Archival analysis	Who, what, where, how many, how much
History	How, why
Case study	How why

The current research, investigating user IQ perceptions in the context of their Web-IR strategies, needed to establish the actual strategies of the user group (who, what, where) as well as the any changes in strategies when the user encounters changes in IQ (how). Of the research methods available then, the researcher has chosen to *observe* participants' *self-evaluative* information; through the use of *survey methods*; and then develop a *multiple group-case contextual analysis* of the user survey results. Contextual analysis of user results will occur at both a data-compared-to-data level (group-cases), and through the continual analysis in the context of previous theory.

Participant self-observation (indirect observation)

"*When one's concern is the experience of people, the way that they think, feel and act, the most truthful, reliable, complete and simple way of getting information is to share their experience*" (Waddington, 1994)

Information retrieval – in the context of the current research – is seen essentially as a interactive human behaviour, encompassing both social and cognitive processes. For this reason, the principles inherent in observation research methods (Baker, 2006) are seen as an important tool in understanding the user-group's information behaviour.

There is much evidence within the field of library information science to suggest the best way to understand a behaviour is to observe it (Bailey *et al.*, 1998; Anderson, 2001; Lin, 2001; Huang, 2003; Strang, 2007; Xu & Liu, 2007). This presents the current research with two dilemmas. Firstly, the phenomena being investigated cannot be directly observed in its own right, it is merely implied by the information behaviour of the user. Essentially, perceptions of IQ are a cognitive process that motivate and facilitate specific information retrieval behaviours in the user. To overcome this problem, the research became survey based, with users being asked to describe their perceptions as well as their various information retrieval strategies and behaviours in considered contexts. While this opened the research to a potentially larger user-group representation, it also lead to the second dilemma of the research, that no direct physical observation of the user behaviour could take place. Instead, it would need to be *indirect* observation through users' own self-evaluation.

Indirect observation of user information behaviour in electronic environments has traditionally taken place with the use of transaction-log analysis (TLA). Described by Davis as a "*non-intrusive method for collecting data from a large number of individuals for the purpose of understanding online user-behaviour*" (2004, p327) TLA involves the researcher observing keyword(s) (in the form of a search-engine query) used by online searchers through transaction (or log) recording of their search engine interaction. The behaviours recorded and analysed can be as simple as merely observing the patterns in keywords, or as complex as following each individual's log from start (keyword/phrase) through to completion (the actual web page selected by the user as being relevant to their query). The major shortfall with this type of indirect observation is that while it may produce a large amount of user-behaviour related data, it still does not facilitate the researcher in identifying the reasons *why* the user chose specific query results as being relevant to their search. In other words, while transaction logs may provide a detailed record of individual search strategies, they cannot reveal a full picture of why those strategies were chosen. Why did the user refine their search? Why did the user change from a *keyword* search to a *phrase* search? Was it to confirm, refine, or change their query? Was it an indication that the user recognised their original keywords were ineffective, or did the results to their initial query trigger a thought regarding a different way to find the target information?

It was the goal to understand the process of user choices in information retrieval that caused the researcher to determine that indirect observation through TLA would only provide a small part of the whole information retrieval puzzle. Moreover, its micro focus of "*this choice*" resulting from "*this query*" would only provide a record of what was relevant to one particular user on one particular occasion.

The alternative to using TLA was to attempt to "get-into-the-head" of the user-group, by developing an understanding of their general choices when interacting with search engines. Not so much to identify why a user deemed a particular result as relevant to a specific query, but rather to observe and understand how users make general strategy related choices to all of their queries.

The decision to focus on this aspect of information retrieval was deemed as an effective way to investigate users general perceptions of what they expected would result in a successful search for information on the Web. The assumption being, that a successful outcome would contain quality information; that is; information that was "fit-for-use/purpose" (Wang & Strong; 1996).

The challenging aspect of this focus became finding a way to "observe" user behaviour more effectively than analysing transaction logs of their search engine interactions. The method that was chosen was to develop a series of Web-based surveys and questionnaires that would provide multiple view-points of a user's attitudes, expectations, interactions and strategies when using a search engine to search for high-quality information. While the method is not participant observation in the strict sense that the researcher is not actually watching/observing a user's behaviour, it employs the general theoretical foundation of observation research in that the surveys and questionnaires seek to understand the user's information behaviour through the user's self-descriptions (Leonard *et al*., 1999) of their search engine interaction.

Who, What & How to observe

As with all the methodology related research choices discussed in this chapter, the decisions relating to who to observe (the target user-group); what to observe (the user-data that would provide clues regarding the phenomena); and how to observe (the method of data collection and analysis) was determined contextually.

1.) WHO to observe – choosing a User-group:

Choosing the right "sample" group is critical if the user results are going to be considered valid in relation to how those user-results prove relevant and helpful to the research as it investigates the phenomena. In the case of the current research, the phenomenon was users' IQ perceptions in their Web-based IR strategies, and therefore required a "high-end" (informatically speaking) group, who had more than likely raised at least some of their various information seeking behaviours to a conscious level. For this reason, the user-group chosen were current practicing academics, academic researchers and post-graduate (masters and PhD) level university students.

It is important to note, that the target user-group did not have to manifest high-levels of technical experience or computer literacy in regards to their use of the Web or its search engines, although this did turn out to be the case for the majority of users.

Instead, it was assumed that academics, academic researchers and post-graduates would, by and large, manifest a discerning eye regarding information quality, regardless of the information-context of retrieval.

The second criterion for user-group inclusion stated in the call-for-participants documentation, was that users' principally engaged web-based search engines for the purpose of high quality information retrieval – rather than to be "entertained". This did not exclude users who engaged other (non-web) methods of information retrieval in addition to their Web-based IR. The emphasis was that when users did engage the web, it was usually for the purpose of finding information that required a relative degree of IQ related decision making.

2.) WHAT to observe:

Three lines of enquiry were identified by the researcher as context-specific influencing variables on users' IQ perceptions during Web-IR:

1.) the information environment of the Web;
2.) the target information being sought; and
3.) the impact that encountering IQ problems had on user perceptions

The information environment of the Web: High-level information users' choices regarding IQ in electronic information retrieval systems have been observed in previous studies (Ocholla, 1996; Fescemyer, 2000; Kim, 2001; Meho & Hass, 2001; Nicholas *et al.*, 2003; Gardiner *et al.*, 2006). What makes this investigation unique is that the current research examines *both* the attitudes and behaviours of academic Web searchers, in an effort to explore what each might reveal about the other. Moreover, the information environment context is the Web, rather than specific academic databases, on-line libraries, or systems-based repositories. The lack of enforceable IQ standards within the Web information environment enables a broader, multi-dimensional investigation of user IQ perceptions, and so provided the impetus for a significant number of questions contained in user-surveys, including questions relating to users' *expectations* of information retrieved from the Web.

Target information being sought: A second identified line of questioning related to the type of information users generally looked for. The thinking behind this line of enquiry was to establish and compare how target information might affect the IQ dimensions users employed when making value-judgments of the information they encounter.

Impact of encountering IQ problems: The third avenue of enquiry centred around the various problematic information characteristics (*dimensions*) frequently encountered by users when retrieving information from the Web, and the impact this had on their perceptions of the information's quality.

3.) HOW to observe:

The chosen method for data collection was unsupervised questionnaires and surveys. The driving force behind this approach was to (1) gather large amounts of data – and so increase the study's generalisability; (2) move away from transaction log analysis, and provide a means of gathering large amounts of more meaningful data; (3) develop a picture of users' self-evaluative perspectives relating to perceptions of IQ and information seeking behaviour.

Survey/Questionnaire

In the field of information systems, surveys and questionnaires are one of the most common data collection methods. Chen & Hirschheim's (2004) empirical study of publication trends in IS research found that out of 1,893 articles examined, 37.5% used survey type methods to collect user/phenomena data.

Surveys are popular for a number of reasons;

1.) Relatively specific data can be collected from a large number of users. The sum total of which means – provided enough users input into the data – findings are relatively generalisable (Amaratunga *et al*, 2002; Pinsonneault & Kraemer, 1993)
2.) Surveys are ideal for the purpose of establishing, describing, or comparing patterns of phenomena behaviour (Goodman, 2003).
3.) Distribution of self-administered surveys is not limited to one geographical location – allowing for a wider, sometimes global, sample population (Majid & Anwar, 2000; Hayslett & Wildemuth, 2004)

4.) Surveys can be used to study a wide variety of phenomena, from user attitudes and beliefs to actual behaviours. That is; they are flexible enough to investigate opinion or facts, or both, depending on the purpose of the research for which they are employed (Ilieva *et al.*, 2002)

Generally speaking, there are two methods of delivery for survey data collection. The first is *supervised surveys*, where the researcher is present as respondents answer questions. The second is *unsupervised surveys*, which involve users self-selecting to be part of an already distributed survey. In this type of survey, users do not necessarily interact directly with the researcher. The current research has used this approach.

One of the criticisms levelled at unsupervised surveys as a data collection tool is that more often than not, participants are self-selected. That is; users become involved by their own choice. This has led some researchers to conclude that only a select "type" of user/personality is being measured (Madge & O'Connor, 2003). Another identified issue is that users may not answer survey questions completely honestly. Users may "sanitise" (Knapp & Kirk, 2003) their responses for a number of reasons, particularly if their attitudes or behaviour are self-perceived to be outside of the "social norm" (Rubin & Babbie, 1993). Paradoxically, it could be argued, that the participant self-selection in unsupervised surveys may, in fact, counter the contention that users may fabricate more acceptable responses, given that participation is voluntary. It is more likely that hand-picked participants would feel the pressure to answer a survey "correctly".

Of greater concern to unsupervised research is that participants can actually misread or misunderstand questions (Kitchenham & Pfleeger, 2002b). The self-service/automated process of question delivery means that users cannot ask for question clarification *as* they complete the survey. On the other hand, if the way to overcome this problem is to allow participants to be able to contact the researcher before they answer the question, there is a danger that the researcher could influence the user's responses. The great advantage of unsupervised surveys, allowing users to answer questions as they see fit, is therefore also one of their inherent limitations. Problems of question clarity therefore should be addressed by the researcher before the survey is released to the target user-group. One way to do this, is to develop a pilot survey, with users/testers providing feedback to the researcher regarding the clarity of the survey questions. How the current research addressed this and other identified issues are discussed in detail in the following (*Research Design*) chapter.

The major limitation of survey-type data is that surveys rarely give a full sense of more complex user-behaviours and attitudes. Analysis can therefore be somewhat superficial or statistically oriented, which is often inadequate when trying to explain or measure social, cognitive or user attitude processes. This characteristic of survey-based research has been addressed in the current research firstly by the design and distribution of multiple surveys, each of which examine different phenomena associated with participant information retrieval behaviour on the Web, and secondly by the development of "group-cases" and "units of analysis" designed help the researcher compare and contrast user-responses as they relate to; (1) a user's own earlier responses, (2) differences between individual users; and (3) differences between clustered groups of users. This could be described as a multiple-case (or mini-case studies) strategy.

The advantages and disadvantages of unsupervised surveys are presented in Table 3.9, along with a brief description of how these strengths and weaknesses are expected to affect the current research, which uses unsupervised surveys as its chief data-collection tool.

Table 3.9 Addressing the advantages & disadvantages of Survey data-collection in the current research.

Advantages	Disadvantages
Efficient method for collecting data from a large number of respondents. (Pinsonneault & Kraemer, 1993) ↳ Will allow for the current research to be generalised and applied to high-end IR on the Web more broadly.	Often considered an inadequate method for understanding complex phenomena that involve human social or cognitive behaviour (Amaratunga *et al.*, 2002) ↳The mixed-methodology approach to the research should allow for qualitative analysis of the user-data and provide a rich-picture of user information behaviour.
Delivery of questions and analysis of answers can be tightly controlled to improve the internal validity of results (Kitchenham & Pfleeger, 2002a) ↳The surveys are delivered via the Web, with users required to complete surveys in a specific order. That is; survey #2 only becomes available to a participant on their completion of survey #1.	Typically, response rates to surveys are very low. (Hayslett & Wildemuth, 2004) ↳The web-based (CGI/HTML) format of the surveys ensures that they will be available 24/7 for a period of 12 months. It is hoped that the continued availability of the surveys, and multiple calls for participants through various distribution channels will ensure a large enough sample group.
Not limited to one geographical location (Majid & Anwar, 2000) ↳Surveys were delivered on the World Wide Web, receiving responses from academics in Canada, the U.S., Europe, South Africa and Australia.	May not provide a full-picture of user-behaviour, since users are obliged to select answers from pre-determined variables ↳A large number of questions have been asked, providing 10,080 separate pieces of data from which to develop a full-picture of user-behaviour.

Web-based Self-administered Surveys (mode of delivery)

The distribution of the surveys and questionnaires for the current research was web-based. A number of possible variables between web-based and print-based surveys have been identified, particularly in relation to how the mode-of-delivery might influence specific characteristics of the survey. These include:

1.) User-group/population representation and results

One of the major concerns regarding web distributed surveys is the sample of the target user-group they may (or may not) represent (Pittenger, 2003). If it is true that users of the web typically have different characteristics than the general population (Hayslett & Wildemuth, 2004) then care had to be taken to ensure the research's web-based surveys were used to collect appropriate types of user-data.

Of greater concern to researchers like Morrel-Sammuels (2003) and Ilieva *et al.*. (2002) however, is the danger of mixing non-Web and Web based survey results without fully addressing the issue of sample-group (and therefore internal) validity. In a recent study on whether print-based and web-based surveys would yield similar user results, Huang (2006) concluded that there was "*no significant difference in participant responses to survey questions between print and Web survey methods*" (p346). This is in contrast to Shaw & Davis' (1996) study from a decade previous, that reported "*significant differences in responses between electronic and paper respondents*". Further investigation by Shaw and Davis of their own results however, revealed the questions where respondents provided "significantly difference" answers corresponded directly to demographic differences between the two groups. To this end, Hayslett & Wildemuth (2004) contend that if the demographic group responding to an online survey posses similar characteristics to the group responding to a print version of the same survey, then results can be deemed "internally valid"

Significantly, Hayslett & Wildemuth's study of the "relative effectiveness" of web-based surveys found more noteworthy variables between Web and print based surveys than user sample representation (2004). These included variables between such survey characteristics as (1) response-rate; (2) response times; and (3) response accuracy.

2.) Response rates and speed

According to Hayslett & Wildemuth (2004), survey response-rates are generally lower for Web-based than print-based surveys, however response-time is considerably quicker. This may be because of the relative ease of web-based survey submission. The technical characteristics of the “must have” script on web-form surveys – where users must provide an answer to designated questions – means that electronic survey questions are rarely missed.

3.) Response accuracy – eg; “social norm” related bias.

The tendency to “embellish” survey responses – so that users are seen in a more favourable light – has been shown to be affected proportionally to the level of sensitivity of the questions. That is; the more sensitive (private) the question, the more likely that users may manipulate responses that are closer to the “social norm” (Martin & Nagao, 1989). It is yet to be established conclusively whether web-based surveys increase or decrease this “social desirability” (Huang, 2006) variable. Anecdotal evidence seems to suggest social norms have less impact in Web-based surveys (Tourangeau *et al.*, 2003), however this seems to be at odds with Huang's (2006) findings and previously widely held views about web-based surveys and user-security/privacy concerns.

It should be noted that the issues relating to population representation, response rates, and the like, are not unique to Web-based surveys. They are standard survey-related issues, regardless of the mode of delivery. In that respect, Huang contends that Web-surveys are simply a new mode of data-collection delivery, rather than a new data-collection method (Huang, 2006), so the same questions relating to choosing a mode-of-delivery, relate to Web-based, print, telephone, SMS or face-to-face survey delivery, apply. For example; telephone surveys are not appropriate for a user-group who is hearing impaired, the same as print surveys are not appropriate if the sample group being sought are relatively illiterate.

4.) Response coverage – sample group representation.

When considering the mode-of-delivery, the researcher should bear in mind that directly comparing the pattern and/or response differences between respondents of a survey utilising multiple modes of delivery could be considered problematic, since the type of person partaking in each mode may be quite different (Huang, 2006). Of greater value is to consider the appropriateness of a delivery-mode to the sample user-group being sought. In regards to Web-based delivery of surveys, Dillman & Bowker (2001) suggest that when nearly all members of a population being sought have Web access, coverage and sample-group representation becomes less of a problem. In the case of the current research, the user-group are high-information users, who already utilise the Web to retrieve information relating to their research. In this regard, it was entirely appropriate to use web-based surveys to collect the desired user data, and the sample group attained were seen as being representative of the user-group sought. The design and distribution of the surveys – in relation to attaining the best sample group possible is discussed further in the following *Research Design* chapter.

3.3.4 Methodologies for Data Analysis

The data-collection strategies discussed in the previous section could fit into a quantitative methodology driven research project. A significant shift in methods takes place however, in the data-analysis phase of the research. It is at this stage that the research becomes inductive in focus, adopting strategies most often associated with explorative (Onwuegbuzie & Leech, 2005) and multiple case-study (Zach, 2006) research.

Inductive Research & Theory Building

In the previous section the researcher argued that the current research represents a novel investigation into how users appropriate their perceptions of IQ – in some cases, honed and perfected in previous “closed” electronic information environments – to the new “open” information environment of the World Wide Web. This view, coupled with the distinct possibility that some members of the target user-group may be young enough to have never experienced a closed electronic information environment before their exposure to the Web (Brooks, 2003) means that existent theories relating to IQ and electronic information retrieval may require significant adjustment before being applied to Web-based information seeking behaviours. For this reason a decision to *chase* the user-data, rather than simply “test” it in the light of existent theory, became the driving analytical paradigm for the current research (Onwuegbuzie & Teddlie, 2003).

Strategies associated with Glaser & Strauss (1967); and Strauss & Corbin's (1994) *Grounded Theory*; McClintock *et al. Case Cluster Method* (1979); Eisenhardt's *Theory Building* (1989); Charmaz's *Constructivist Grounded Theory* (2000); Yin's *Multiple Case Studies* (1981); and Denzin's *Triangulation* (1970, 1978) methods were examined for commonalities and appropriateness of application to the current research.

The purpose of the investigation was not to find a single methodology with which to guide the data analysis phase of the current research, but to provide a theoretical backdrop by which the researcher could develop a novel, yet theoretically sound, framework for data analysis. To that end, the following discussion of the various methodologies is not intended to be exhaustive, but rather is written with the view of applying the common strings between them to the data analysis strategies of the current research. The over-arching purpose of which, was to discover ways to inductively analyse the user-data for the purpose of data pattern discovery and theory building.

Grounded Theory:

The three basic elements of Grounded Theory (GT) are (1) concepts; (2) categories; and (3) propositions (Pandit, 1996). *Concepts* are words that "label" user responses/actions into a descriptive mode. For example, a GT driven research into online information seeking behaviours by Ellis conceptualised the various observed behaviours into a set of concepts, namely; (1) Starting; (2) Chaining; (3) Browsing; (4) Differentiating; (5) Monitoring; and (6) Extracting (Ellis, 1989a; 1989b). *Categories* group concepts together and provide the guiding principles by which theory can be developed. Finally, *propositions* are GT's version of positivist research's "hypothesis". Originally called hypothesis (Glaser & Strauss, 1967) the term propositions was appropriated because, generally speaking, inductive research investigates conceptual patterns in relationships, in contrast to deductive research which attempts of measure those relationships.

Pandit (1996) describes the phases of GT research as (1) Research design; (2) Data collection; (3) Data ordering; (4) Data analysis; and (5) Literature comparison. Of particular interest to the researcher are the intensive strategies described with data-ordering and data-analysis. It is during these two phases that a GT researcher attempts to conceptualise and categorise their user data.

Mills *et al.* (2006a; 2006b) describe the associated strategies of data handling in GT research in terms of a "constant comparison" methodology. That is; the GT researcher identifies categories – particularly at least one core category – and using such strategies as diagram creation (such as relationship flow-chats), coding, theoretical sampling, matrix creation, and the like, constantly compares collected data to collected data, developing a constantly deeper and deeper understanding of the phenomenon. This type of cross-analysis between the collected data does not provide new data per se, just new and different ways of looking at or seeing the data.

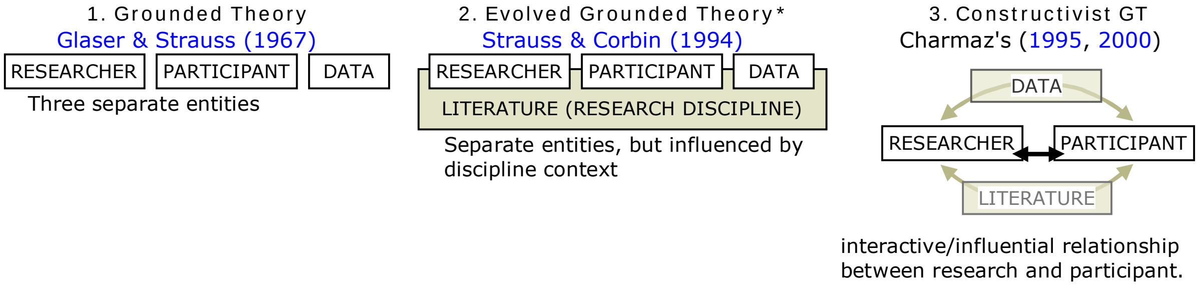
The paradox of GT lies in its rejection of the positivist and critical researcher view of a "pre-existing reality/truth", yet it embraces the notion that the GT researcher can design data-collection and analyse data results from an objective non-biased viewpoint – and in fact, must do so. This paradox is addressed by Charmaz's (2000) introduction of *constructivism* to the GT paradigm.

Constructivist Grounded Theory:

Constructivism embraces the notion that the GT researcher is – by nature – biased, and these bias are manifest throughout a research project. In other words, the research design of data-collection methods is not free from the researcher's point-of-view; neither is the researcher/participant interaction; nor the ultimate classification and conceptualising of user data. To that end, Charmaz (2000) does not describe data as "value-free" – "*Data do not provide a window on reality. Rather, the 'discovered' reality arises from the interactive process and its temporal, cultural, and structural contexts*" (Charmaz, 2000, p.524). The interactive process alluded to here by Charmaz, is the one between the researcher and participant, that "*produces the data, and therefore the meanings that the researcher observes and defines*" (Charmaz, 1995, p.35). This is not acknowledged in the traditional GT paradigm, where the researcher, participant and data are seen as separate entities.

Concerning the relatively recent fusion of constructivism into the GT paradigm, Mills *et al.*. (2006a) contend that although Charmaz has "*emerged as a leading proponent of constructivist grounded theory*" (2006a, p6) the progress of constructivist typology within GT has been an evolutionary one – with writers like Strauss and Corbin (1994) increasingly recognising the iterative role of a GT researcher's associated discipline (see figure 3.8). Constructivism is concerned with ways in which people construct meaning (Williamson, 2006). Given that the goal of GT is for a researcher to construct meaning to the user data, a merging of the strategies involved in the two research frameworks is not all together surprising. The major differences however, lies in their principal philosophical view regarding how people (including researchers) find and construct meaning.

Figure 3.8 Evolution of Grounded Theory



* (Mills, 2006) – refers to the subtle changes to Strauss' model as "evolved" GT

Constructivism:

Traditional GT advocates the "value-free" nature of data – a view critical realism would also adhere to. Constructivism however, postulates that no data is free of value, and certainly no interpretation of data is free of the values imposed on it by the individual and social context of the researcher and participant. Glaser's (2002) counter-argument against the concept of constructivist grounded theory highlights what the traditional GT research would view as constructivism's slippery slope "*to avoid the work of confronting researcher bias*".

Constructivist grounded theory "*overtly reshapes the interactive relationship between researcher and participants in the research process*" (Mills, 2006b) and emphasises a co-construction in the development of meaning through data analysis. Far from being a way to avoid confronting researcher bias, *constructivism serves to build a reciprocal relationship between the researcher and participant* with the goal of developing a stronger contextual view of the data, rather than the GT researcher's own view.

The over-arching problem with this approach however, is that it assumes the "participant point-of-view", or the "participant/researcher relationship" are the best and most appropriate view-point from which to examine user results. Where GT may expect too much of the "data" – the emphasis of constant-comparison being data versus data with some suggesting a researcher need not have understood the bulk of associated literature at the time of analysis; constructivist GT may expect too much of the research/participant relationship. The researcher holds the view that ultimately, participants are as prone to bias as any researcher, and a too-close relationship between the researcher and participant has the potential to skew user results.

Notwithstanding the described criticisms, GT and constructivist GT present useful strategies regarding the qualitative analysis of data, emphasising a contextual approach where a researcher is able to examine and classify patterns in the user data with the view of building sound theory.

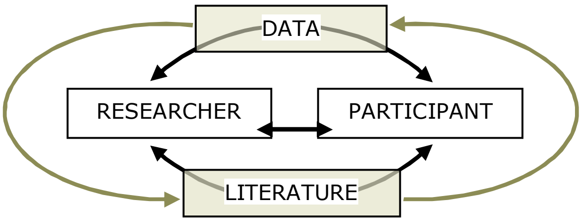
Multi-method Contextual Construct Approach:

The researcher proposes a multi-method approach that utilises the *constant-comparison* strategies of GT and constructivist GT, identifying and comparing data and data patterns, without becoming bogged down in only one epistemology or view of the world and how people find and construct meaning. The value in such an approach is that it allows the research to develop data analysis strategies that recognise and utilise:

1.) Data versus data (constant comparison) analysis (GT)
2.) The social context of the researcher, participant and phenomenon being investigated. This is particularly important given that;
    i. the researcher is affiliated with the "target" user-group
    ii. perceptions of IQ have a strong "contextual" value
    iii. information behaviour is often described as a "social" phenomenon.
3.) the existent literature and theory already developed regarding the phenomenon being investigated.

The third point, regarding the role of existent theory associated with the phenomenon (in this case information quality and human information behaviour), is particularly important given that it is not emphasised in either GT or constructivist GT as part of an evolving research lens, through which the researcher builds their growing understanding of the phenomenon. Figure 3.9 illustrates this multi-methods contextual approach to data analysis, showing the relationship between the literature and data somewhat neglected in the previous models in figure 3.8.

Figure 3.9 Multi-method Contextual Data Analysis



Contextual Construct Model

The research methodology built for the current research, and proposed by the researcher as a novel approach to constructing research data collation and analysis is the *Contextual Construct Model* (CCM).

The researcher has gone to great lengths to emphasise and describe the contextual focus of the CCM throughout the research life-cycle (figure 3.1). This focus on context continues in the data-analysis phase of the research, which utilises a number of mixed-method approaches in inductive research. These will now be discussed in relation to their theoretical frameworks and practical application to the current research.

Triangulation:

Triangulation is the use of a "*combination of methodologies in the study of the same phenomenon*" (Denzin, 1978, p.291). Its great advantage is that it allows a researcher to capture a more "*complete, holistic, and contextual portrayal of the unit(s) under study*" (Jick, 1979, p.603) through such outcomes as;

1.) Revealing unique findings that single-method approaches may be blind to (Jick, 1979)
2.) Discovering areas of both convergence and divergence in the user data (Thurmond, 2001)
3.) Increasing validation of results when multiple-methods reveal the same characteristics of the phenomenon (Martzoukou, 2005).
4.) Neutralising bias inherent in single-method data analysis (Niglas, 2000)

Denzin (1978) contends that triangulation can occur at one (or more) different levels of a research project. Levels of triangulation include;

1.) *Data triangulation* – the use of multiple data sources to investigate a single phenomenon

2.) *Investigator triangulation* – the use of more than one researcher to investigate a single phenomenon.

3.) *Theory triangulation* – the use of multiple theories when examining a phenomenon

4.) *Methodologic triangulation* – the use of multiple methods to study a single phenomenon. Also called "mixed-method" triangulation, Methodologic triangulation is commonly classified as *within-method* or *between-method* (across-method) triangulation, and can occur at both the data collection and/or data analysis stage of research (Lincoln & Guba, 1985).

A fifth area of triangulation, identified by Thurmond (2001) is;

5.) *Data analysis triangulation* – the use of multiple methods to analyse data. This is distinguished from data triangulation in that a single type of data or data source can be analysed using both qualitative and quantitative methods.

While the CCM philosophically embraces all of the described levels of triangulation, the current research, at least at a methodological level, is best described as *methodologic triangulation*, in that a completely quantitative data-collection method – usually associated with hypothesis testing, or confirmatory research, has been combined with an intuitively inductive approach to data-analysis, producing both confirmatory and novel results. Notwithstanding, there are small instances of various triangulations, including;

Data triangulation: The data "representation" is triangulated in the sense that the actual phenomenon being investigated varies between the surveys. The design of the data collection into four separate surveys, investigating the phenomena of; (1) technology adoption; (2) information seeking behaviour; and (3) perceptions of information quality; is described in detail in the following (*Research Design*) chapter.

Theory triangulation: The current research brings together theory from multiple research disciplines. The collected data has been examined in the context of theories relating to technology adoption (TAM), human information behaviour (HIB), social cognitive theory; attribution theory; and information quality (IQ) theory. Synergies have been sought in the bringing together of existent theory and the analysis of the data occurs in the context of these synergies.

Data Analysis triangulation: Data analysis is triangulated in that analysis has utilised a broad range of methods including numerical assignments to data, multiple case-study (called "group-cases") strategies, and constructed data-clusters and classification techniques. The researcher recognises that the clustering of data-results into classified "group-cases" for the purpose of comparing and contrasting sub-groups' results involves the imposing of constructed meanings onto collected data. The CCM therefore, is best described as being constructivist in epistemology.

Multiple Group-Cases & Units of Analysis:

At the heart of the CCM is the construction of clusters of data into meaningful "group-cases" which are used to compare user results in a variety of contexts (McClintock *et al.*, 1979). Using this method, a group-case can be either the context for data cross-analysis, or can provide the actual data for the units of analysis. Figure 3.10 is an example of how a group-case provides data for an investigation into the current research's TAM results. Shown are two of the "group-cases" of the research; namely (1) Academic Role; and (2) Motivation (to use search engines), user characteristics which are used to analyse divergence in sub-group user-results.

Figure 3.10 Group-case Construction example #1
(two of the group-cases in TAM context)

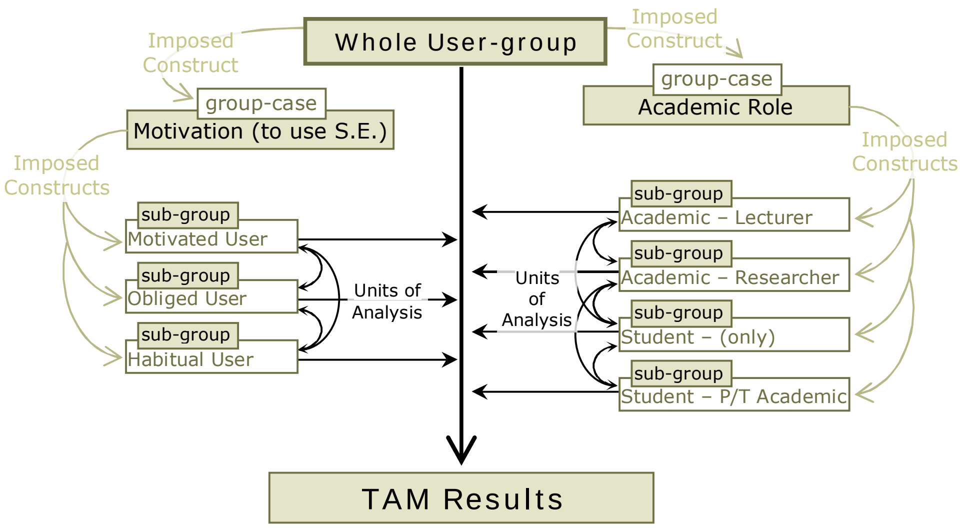
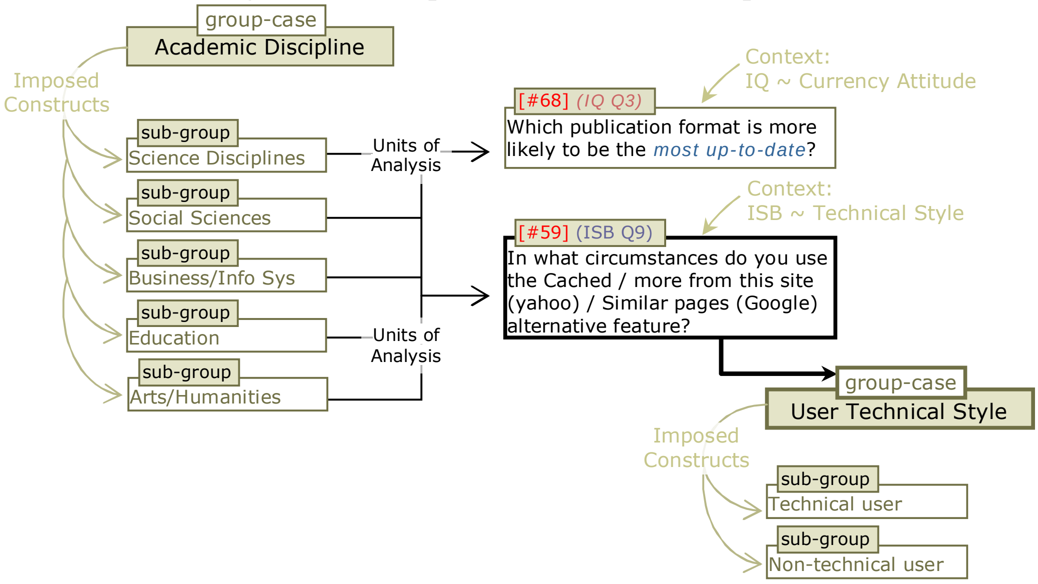


Figure 3.11 illustrates the same principal as figure 3.8 except that units of analysis are designed to indicate important divergence in sub-group results (within one

group-case) to specific phenomena. Importantly, the group-cases themselves, are constructed from the results to specific survey questions, which is illustrated in figure 3.11 with the construction of the "technical style" group-case. The fourteen group-cases used in the current research are presented in Chapter 5 (*Constructions of Analysis: The User-Group; and its sub-groups*).

Figure 3.11 Group-case Construction example #2



Case-Studies & Theory Building:

The current research has adopted Eisenhardt's "roadmap" for the treatment of case-studies[9] that enables a researcher to inductively analyse user data to develop theory that is "*novel, testable and empirically valid*" (1989, p.532). Eisenhardt contends that case study research is a strategy that focuses on understanding the dynamics of a phenomenon within a specific setting (1989, p.534) that is flexible enough to user either qualitative or quantitative, or both qualitative and quantitative data and methods in its investigative process. Importantly, as a research strategy, case studies can also be used to create descriptive research or to generate theory (1989, p.535).

The eight steps involved in Eisenhardt's road-map for generating theory from case study research, and their application to the current research are presented in Appendix 3.1. Much of Eisenhardt's model has been adopted in the research tasks associated with the current research which are labeled and discussed in detail in the

[9] The term "case-study" in the current research is used in its broadest sense, to represent a "setting" or "context" within which to investigate a phenomenon. To prevent confusion with more qualitative case-study definitions, each case – or setting – used to cluster user results is called a "group-case".

following (*Research Design*) chapter. The specific strategies relating to data collection, case and construct classifications, and the data analysis, involve the utilisation of some of the constructivist grounded theory and triangulation techniques discussed previously.

It should be noted here that although Eisenhardt's model stresses the iterative nature of each phase of the research, the practical descriptions of the tasks involved place literature (theoretical) analysis and comparison at only three of the eight stages of Eisenhardt's road-map. The researcher contends that the bodies of discipline related literature should, and do, influence each (and all) phases of the research project. To that end, McClintock *et al*.. (1979) provide some useful strategies associated with their "*case-cluster method*" which involves applying the logic of survey sampling methods to qualitative case studies.

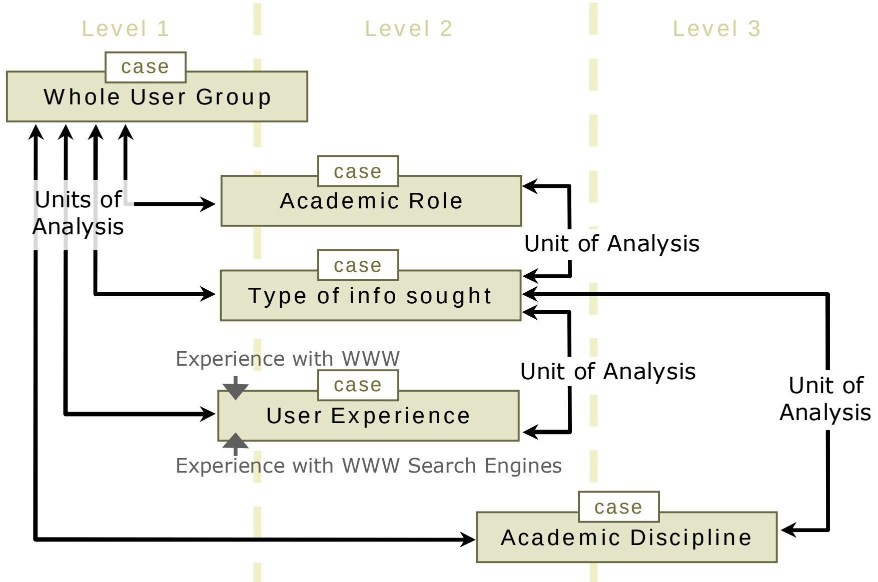
Broadly speaking, the case-cluster method involves;

1.) The definition and sampling of "units of analysis" within/between each case study: These units must be;
   - theoretically meaningful; i.e.; conceptualised and classified within the context of existent theory; and
   - represent the phenomenology of the user-group; i.e.; intuitively understand and investigate the phenomenon within a constructivist type framework, that recognises the contextual "meaning" of the phenomenon to the user-group.
2.) The stratified sampling of data: The investigation of the user-data/results in the context of defined logical cases that allows for both within-case and cross-case analysis of the "group-cases" and "units of analysis".
3.) The optional creation of quantitative data sets: The creation of standardised codes that associate measurable variables between defined cases and units of analysis.

Appropriated to the current PhD research are the strategies involved in the first two descriptions of the case-cluster method. Figure 3.12 schematically illustrates how the "cases" (called group-cases in the current research) and "units of analysis" were assigned in the first instance. The eventual clustering, naming and analysis-relationships of the research are illustrated in figure 4.7 in the *Research Design* chapter. In keeping with McClintock *et al*.. (1979), what constitutes a "case" and what constitutes a "unit of analysis" were chosen logically according to how defined sub-sets of user data (cases) might influence the variables (units of analysis) in the user results.

According to Eisenhardt, the choice of "cases" – while flexible – should be based on such characteristics as; their ability to (1) replicate previous cases; (2) establish and/or extend emergent theory; (3) fill theoretical categories; and (4) provide examples of polar types [behaviours] (Eisenhardt, 1989). Yin (1984) further contends that each case can have numerous levels of analysis. It follows then, that similar degrees of flexibility and rigour apply to selecting these units of analysis as to cases. In the current research, the group-cases were chosen to allow constant comparison analysis of data versus data according to such case variables as *Academic Role* (e.g., lecturer, researcher, postgraduate student), or *Type of information being sought* (e.g., journal publication, lecture material) and their possible relationship to differences in use results.

Figure 3.12 The group-case and units-of-analysis (schematic) of the Research



It should be noted that the choice of "group-cases" and "units of analysis" was both (1) *pre-defined* – according to such previously established constructs as "gender" (Gecas, 1989; Gefen & Straub, 1997; Julien & Michels, 2000; Venkatesh *et al*., 2004; Hargittai & Shafer, 2006; Ong & Lai, 2006); "age" (Cole, & Balasubramanian, 1993; Morris & Venkatesh, 2000; Freudenthal, 2001;).or "user role" (Vandenbosch & Huff, 1997; Lucas & Spitler, 1999); and (2) *iterative*, – with some data-clusters being classified after the researcher's observation of initial patterns in the user data. The creation and/or refinement of the group-case was still subjected to change as results continued to be recorded and analysed. An important aspect of inductive research is that pre-suppositions and bias inherent in the researcher must be acknowledged, and then continually challenged. The defining of group-cases and units of analysis has the potential to act as a vehicle by which the researcher can compare and contrast user results according to specific contexts, thereby generating and testing emergent theory, while all the time remaining attuned to and testing their own bias.

3.4 Conclusion

The current chapter presented a detailed exploration of the first three phases of the contextual constructs methodology (figure 3.1) associated with the current research. Because of the novel approach presented, the researcher has gone to great lengths to develop a robust argument for a contextual, mixed-methods investigation of the multi-dimensional phenomena associated the research at large. The following chapter will now focus on the research design elements of the presented methodology.

CHAPTER 4

Research Design

"Guidelines for Data engagement"

4. Introduction

The previous chapter introduced the contextual construct model used in the current research to help the researcher develop a valid and rigorous approach to the methodology-related aspects of the research project. Methodologies relevant to an exploratory, inductive research approach were presented and discussed in the context of how they applied to the current research. The discussion was largely theoretical, developing a picture of the multi-discipline context of the research, philosophical foundation and epistemology, and specific methodologies for data collection and analysis.

The research design chapter now develops a picture of how the theory has been adopted practically in the context of the research, describing the various research tasks involved in the building of the research data-collection and analysis.

4.1 Approaching the Research

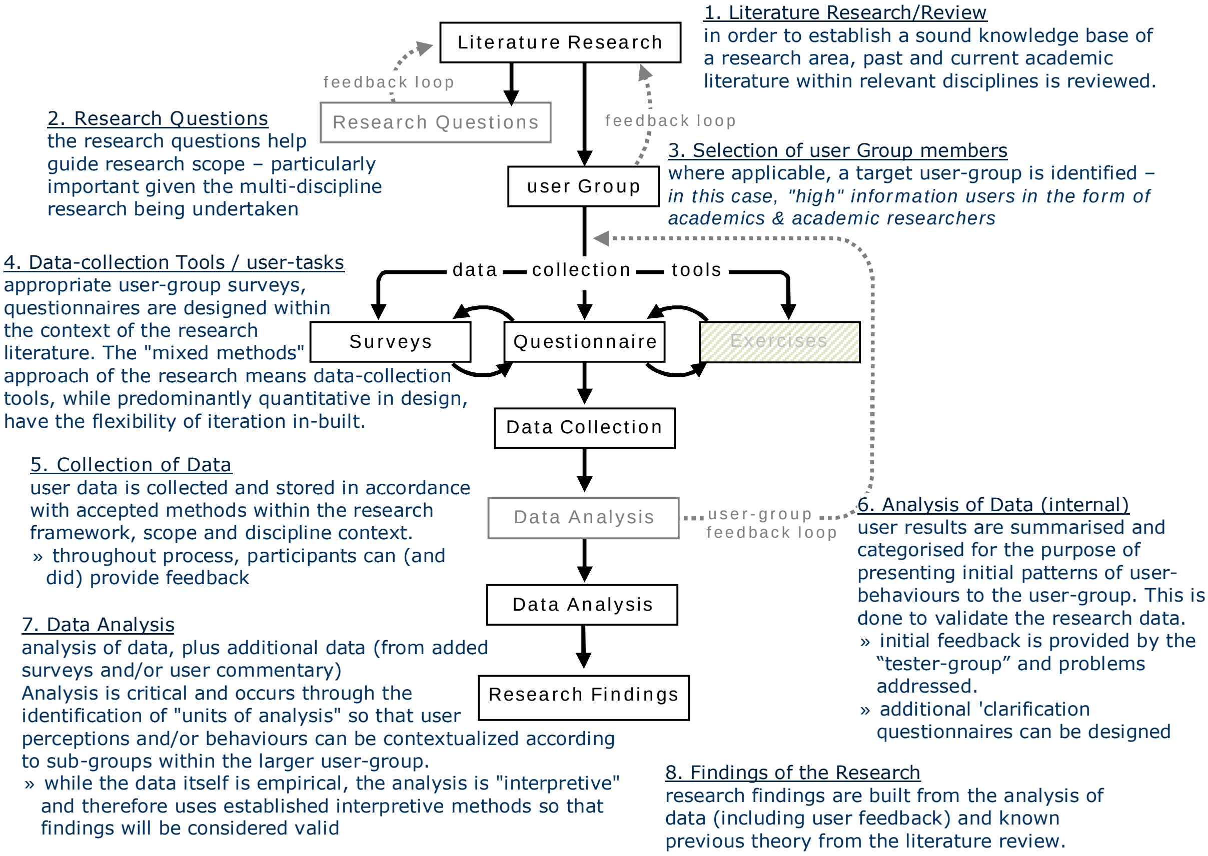
The general development of the research design, as with much of the research, was seen as a contextually-driven, iterative process where improvements were made to design aspects and data-collection as limitations or issues were discovered. Ongoing adjustments had to be considered carefully however, and could only be made if the changes did not impact on the validity of data already gathered.

4.1.1 Research Tasks

The first step involved in the design process was to identify the various research tasks involved in the research. Figure 4.1, developed within the first few months of starting the research, illustrates the initial identification of the research tasks.

The process was seen as an iterative/cyclical one, where the initial literature review helped identify the research problem/questions, which facilitated a feedback loop back to more literature review. The identification of the user-group also facilitated a feedback loop to additional literature, and a third feedback loop occurred after the first pilot group's completion of the surveys to be used for data collection. Participants in the actual user-group were also provided with a "feedback" mechanism at the end of each of the four surveys they completed, where comments could voluntarily be made.

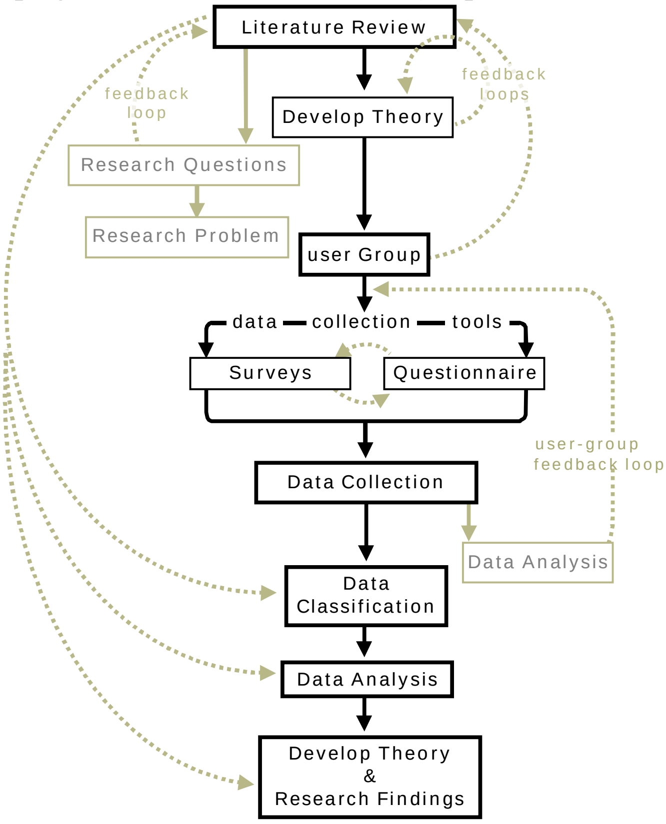
Figure 4.1 A Holistic (Cyclical) Approach to Research Tasks



Literature Review

In the context of the research process as a whole, a literature review was the first task identified by the researcher. The importance of a strong theoretical foundation became increasingly clear as the PhD progressed, and the cyclical process diagram (figures 4.1) needed to be adjusted accordingly (figure 4.2). As the methodologies to be used in the research were chosen and consolidated, it was realised that theory building would become an important component of the research, and literature review became an iterative component undertaken at every stage of the research life-cycle.

Figure 4.2 The Focused holistic (cyclical) Research Tasks, based on the theory associated with the developing contextual construct model (chapter 3: Research Methodology)



The review of literature took three directions during the research life-cycle.

1.) Early reviews: focused on identified research areas within the field of information science and used to build a knowledgeable foundation early in the research project.

2.) Early/Middle review: focused on methodologies, initially within fields associated with information systems. The review of methodology related literature became increasingly phenomena driven as the researcher developed a greater comprehension of the research problem

3.) Middle/Late review: focused on theoretical models from multiple disciplines, investigating similar phenomena as the research. This became an important part of the research approach, as established theory became the a driving mechanism in the exploration and validation of user results.

Research Scope

The initial identification of appropriate academic literature for review was plagued with problems relating to research scope. This was reflected in the research proposal document written during the first six months of the PhD. The development of the research questions then became an important contributing factor in deciding how to micro-manage which literature would provide the best theoretical foundation for the research. The literature review then became topic-driven, rather than discipline-driven, which better suited the inter-disciplinary nature of the research.

To a degree, research has a life of its own, born within the perceptions, skills and developing "research lens" (Trauth, 2001) of the researcher. In keeping with Kelly's (1963) "personal construct theory", the researcher found the more literature that was read and absorbed, the more that was capable of being absorbed. The growing knowledge base then became an important aspect of the natural evolution of the research.

4.1.2 Focusing the Research (Research Questions)

As stated, the research initially struggled in regards to scope. As part of a larger ARC Discovery project between multiple universities, this was inevitable, and the research questions became an important instrument that helped focus the research.

The research questions were used principally to;

1.) focus the research;
2.) determine a target user-population; and
3.) identify the type of data to be collected.

Establishing a Context of Inquiry

The broad goal of the research was to investigate "*User IQ perceptions in WWW information retrieval behaviour*". Given that unless a user knows the specific URL of target information, Web-IR most often occurs through search engine interaction, the information context of the inquiry was not so much about how users make value-judgments regarding quality on individual web pages, but how they exhibit IQ perceptions in their initial information search during search engine interaction.

The behavioural context then, is user information seeking behaviour (ISB) – or, more specifically, the information search process (ISP) component of ISB. Questions such as "what is information quality" then, needed to be framed in the context of how users make decisions regarding the results to their search engine queries. Importantly, the emphasis of the inquiry was not search engine interaction per se, but information interaction in a search engine context.

The research questions that governed the early focus of the research are presented below. Like most over-arching research questions, each question both assumes certain truths and implies a number of sub-questions. All of these need to be recognised and examined in order for the research questions to be fully investigated.

Information Quality (RQ.1)

The IS research pertaining to IQ commonly describes the characteristics of quality as "dimensions" (Miller, 1996; Strong *et al*., 1997b; Klein, 2001; Kahn *et al*., 2002; Lee & Strong, 2003) of quality. These dimensions are said to be the criteria upon which users of information make value-judgments of the information they encounter. The first research question then, needed to investigate how users cognitively engage these theoretically established dimensions of IQ during Web search and Web-IR.

RQ.1 – *How do individual users apply common perceptions of information quality to make judgments about the information they retrieve from the World Wide Web?*

RQ.1 Assumptions & Sub-questions

RQ.1 assumes that:

1.) *users have pre-existing perceptions* of what constitutes information quality;
2.) users – either consciously or unconsciously – *use their perceptions to make value judgments* about the usefulness of information they wish to retrieve from the WWW.

RQ.1 implies that;

3.) users can find quality information in a variety of information environments, but for various reasons have chosen the WWW to apply their craft.

The sub-questions to be examined in order to fully investigate RQ.1 include:

- ***RQ.1 (a): What is information quality?***

- ***RQ.1 (b): How do individual differences between users act as antecedents in the process of user determinations of information that is "fit-for-use"?***

The difficult part of investigating RQ.1 and its sub-questions is that "information quality" cannot be quantifiably defined beyond what Wang and Strong (1996) describe as information that is "fit-for-use" (also "fit-for-purpose")[10]. Moreover to ask users directly "how would you decide what information is 'fit-for-purpose'?" is asking them to describe a cognitive process that:

1.) Is highly complex (Detlor, 2003; Quinn, 2003);
2.) Is deeply ingrained from years of information behaviour (Mansourian & Madden, 2007);
3.) Is subjective – related to their own knowledge constructs (Strube, 1999);
4.) May be carried out unconsciously as well as consciously (Quinn, 2003);
5.) The user may lack the vocabulary to explain (Madden *et al*., 2006).

The value-laden meaning of the language of information quality dimensions, such as "relevance", "accuracy", "reliability" and "believability" serve to further complicate the issue for the researcher asking a user-group to define what quality is and how they cognitively apply it in their information searching and retrieval behaviour.

For these stated reasons, the determining assumption of the current research is that users, whether consciously or unconsciously, whether they can articulate the process or not, use perceptions of IQ to make value-judgments about the information they encounter on the Web, and that those perceptions of what is "fit-for-use/purpose" are manifest in successful information retrieval.

If this is true, then observing user information behaviour should at least begin to produce a picture of what information quality is, how users perceive it, and how it impacts on their information retrieval behaviour.

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[10] For the purpose of this research, the term "fit-for-purpose" is preferred because of the implied meaning when the terms ("fit-for-use" and "fit-for-purpose") are used in the negative. For example, "not-fit-for-use" implies greater negative connotations than "not-fit-for-purpose" – which implies a context for information use that recognises information may not fit the purpose of intended use, but may still possess "quality" outside of the specific context in which it was found.

User attitudes and their Search Engine Interaction (RQ.2)

Research question 2 applies the constructs of the TAM (Davis, 1989) in an investigation of users' general attitude towards using Web-based search engines. The model is not used in its common "predictive" methodology, but instead is used to determine if/how external variables associated with such entities as users' personality, skill, experience and cognitive style, are antecedents for users' overall perceptions of the effectiveness of their search engine interaction.

RQ.2 – ***How do "individual differences" impact on high-end users' attitudes and perceptions regarding search engine effectiveness to retrieve high quality information?***

RQ.2 Assumptions & Sub-questions

RQ.2 assumes that:

1.) the target user-group will have a relatively sophisticated awareness of the cognitive processes involved with their information tasks and search engine interactions.

2.) there is a strong likelihood that at least some individual differences between users have an impact on the PU & PEoU constructs of the TAM.

The sub-questions of RQ.2 include:

- **RQ.2 (a):** ***how do individual differences act as antecedents on user perceptions of their search and retrieval of information on the Web?***
- **RQ.2 (b):** ***how effective are the TAM's PU and PEoU constructs at "telling the story" of on-going search engine usage?***

Constructing a Framework for the investigation (RQ.3)

The researcher contends that neither the TAM nor the current IQ models fully allow for a robust understanding of users individual differences in search engine interaction and the retrieval of quality information. To that end, a third research question addresses the exploratory nature of the research.

RQ.3 – ***Can a framework be developed to model the processes of IQ perceptions in the context of IR, providing a more accurate lens through which to examine end-users individual difference?***

4.2 Developing Data-Collection Tools

As discussed in the previous chapter, the research goal of understanding the complex cognitive processes involved in human information behaviour (HIB) guided the researcher to adopt a multi-method approach to data collection and analysis. The desire that the research should have a wider circle of application, determined that the data-collection tools be designed using a quantitative typology, where the results from a relatively robust user-group, answering specific ISB related questions, could be directly compared, and inferences made regarding human information behaviour outside of the direct PhD user-group.

4.2.1 On-line (Web) Surveys

Given that the target user-group were users who engage the Web (and its search engines) to retrieve high-quality information, it was decided that an appropriate mode of delivery for the surveys and questionnaires was the Web itself. To that end, a domain name (www.informationqualityonline.com) was registered and used as the delivery space for interaction with the user-group.

User Group Inclusion

Given that the goal of the research was to investigate the impact of IQ perceptions on WWW information retrieval behaviour, it was determined that the user-group needed to be "high-end" users in an *informatics* sense, as opposed to a technology sense. The initial contact with the user group, a web-based "Application to be part of the user-group" (*see* Appendix 4.1), did not ask users to identify their web search experience. The only governing criteria was that the user should be either;

1.) A university-based academic (chiefly lecturer or researcher); or
2.) An enrolled post-graduate (U.S. "graduate") student in a masters, honours, or doctoral program.

To ensure that users met one of the above criteria, the application form included a question asking users to identify their highest academic qualification as well as their current academic engagement. A highest qualification equal to a completed undergraduate degree was only accepted in a user if their current university engagement was a post-graduate course or academic position. This same rule applied to users with higher-degree qualifications. Users were also asked to identify the academic institution in which they were currently involved. As the data collection continued, a small number of former academics in "professional" positions – all of whom had attained a PhD level university qualification – registered. These users were allowed to complete the surveys and questionnaires, however it was determined these results would be merely a point of observation for the researcher in qualitatively comparing results with the actual user-group. Results from the "professional" group are not included in any of the research findings.

The user-group application form was used to gather the following user-profile information:

1.) User-group applicability information (university qualification and current university engagement);
2.) Identification (email contact for distribution of subsequent surveys and questionnaires);
3.) Demographic related (chief university role description; primary language; and industry/discipline area chiefly associated with);

Survey Distribution

Once the target user-group had been identified (Kitchenham & Pfleeger, 2002d), strategies for survey distribution were required. It was reasoned that electronic distribution with active hyper-links to the www.informationqualityonline.com website (where the "*Application to join user-group*" form was hosted) would be more effective than print-based distribution. Call for Participation PDF's were created (Appendix 4.2 & 4.3) and distributed through 28 Australian-based postgraduate associations, academic community blogs, as well as a number of academic web-based list-servers, such as SIG's at ACM and ISWorld. Users who registered, were also invited to distribute the PDF "Call for Participation" documents onto their PhD students and academic colleagues. The website was also used to invite participation, along with email distribution of the Call for participation documentation to known academic and post-graduate level students by the researcher. Direct links to the surveys themselves were not provided, as users were encouraged first to read a summary of the research, target user-group, and ethics documentation before applying to take part in the surveys.

Response Rate & (Sample) Coverage

A known issue relating to survey type data collection is the typically low response rates (Neus, 2000; Madge & O'Connor, 2003; Orr, 2005) from the target user-group. In the current research, this issue was further complicated by the unknown number of potential users reached with the various announcements made through list-servers and established academic blogs. Kitchenham and Pfleeger (2002a; p20) contend that in order for surveys to "*yield meaningful results*" the researcher should ensure a significant proportion of the target user-group who receive a call-for-participation actually participate in the surveys.

According to Kitchenham and Pfleeger (2002a; p20), a characteristic of *reliability* in survey research, is the inclusion of response-rate measurements. Moreover, they further suggest that a significant level of non-response can "compromise the validity" of any survey results. A major problem with Web-based survey distribution, is that calculating the number of potential receivers of the call-for-participation documentation is all but impossible, as list-server announcements may only be viewed by a fraction of the list-server population on any given day. Even email based announcements may never be viewed by members of the target population.

How then, does a researcher calculate the number of users who have viewed any Web-based call-for-participation documentation? In the case of the current research, it was decided to utilise installed "Web-log" software on the *information quality-online* domain server. *Advanced Web Statistics 5.9* (from awstats) software allowed the researcher to see how many times individual call-for-participation (Appendix 4.2 & 4.3) documents, and the "Application for Registration" (Appendix 4.1) were viewed, and compare this to the number of registrations received in any given month. Appendix 4.8 displays the monthly figures for; (1) the number of times each (domain hosted) call-for-participants (*CFP*) documentation was viewed; (2) the number of times the registration documentation was viewed; (3) the number of times the informed consent documentation was viewed; and (4) the number of registrations received. *The period of time covered is from the time surveys were made available to the public through to when data-collection was completed.*

It should be noted that such figures still remain an in-exact record of possible response-rates. The awstat records of individual pages visited at the research's URL ***do not*** identify;

1.) if/when a specific page was visited by one individual user on more than one occasion;
2.) if/when a user chose to ‘save’ any PDF documentation to their own hard-drive, in order to distribute it themselves to other members of the target user-group;
3.) if/when a user read *CFP* documentation but did not then register because they did not meet a described criteria for user-group participation

Response-rates are an important consideration because they provide a possible guide relating to how well the eventual user-group *sample* represents the target user-group as a whole (Kitchenham & Pfleeger, 2001; 2002a). Because of the potential issues identified as problematic to calculating a response-rate for the current research, it was decided that another method of observing/monitoring user registration and results was required.

It could be argued that;

1.) the greater the number of actual respondents the less impact on overall results the response-rate would have; *and*
2.) as the respondent numbers increased, if results remain relatively consistent, the less impact response-rate would have (Kitchenham & Pfleeger, 2002d).

As the respondent numbers increased to over 50 users, general results were viewed and found to be following relatively similar patterns. While fifty users might be considered problematic in regards to sample validity, a number of factors were working in the research’s favour.

1.) The research was determined to be exploratory in nature, rather than testing specific hypotheses;
2.) Data analysis utilised qualitative methodologies;
3.) The researcher, by role and vocation, was a member of the target-group population;

4.) The sheer number of questions involved for each participant completing the full set of surveys meant that fifty users would generate some 5,200 answers to examine for pattern similarity.

Results were therefore considered to be reliable in relation to their sample of the target group, even though a definitive response-rate could not be absolutely established.

Response Time & Completion

An issue that became apparent as data-collection started was the completion-rates of respondents. Numerous participants registered to be part of the user-group, only to either not complete all four surveys, or – in some cases – not even begin the first survey.

A major contributing factor to users not completing all surveys may have been that the data collection process involved users completing multiple surveys. The decision to create multiple surveys was influenced by a number of factors;

1.) Three separate bodies of data/user information were being collected; that is; TAM related, ISB related, and perceptions of IQ;
2.) Internal validity required that some types of questions needed to be addressed before other types of questions; *and*
3.) The total number of questions being asked would have entailed an extensively large survey being designed. Such a survey may have been time consuming enough for some users to stop the survey before completing the whole survey, or not taking part in the survey at all.

The researcher addressed completion-rate issues by keeping a record of the "status" (which surveys had been completed) of each respondent. Given that the maximum response-time (how long a user could take to submit all surveys) was set at around 6 months, reminder emails were periodically used to prompt registered users which survey they last completed, and which survey they were required to do next. This strategy proved to be highly effective.

Logistic/Construction Considerations

<u>Survey Construction</u>

Kitchenham and Pfleeger contend that the starting point of survey construction should involve: (1) investigating the research literature to "*determine how previous studies collected their data*" (2002b) and (2) a clear understanding of the survey(s) "*purpose and objectives*" (2002b). Basing survey construction on a previous construction model means that a researcher can be relatively confident that the basic elements have already been tested for validity and reliability (Chen & Lou, 2002; Edwards, 2004; Ha *et al*., 2007). It also means that research results can more easily be compared with results from previous research using similar survey construction.

In the current research, two previous construction models have been adapted and utilised respectively.

1.) TAM format; *and*
2.) General multiple choice constructions.

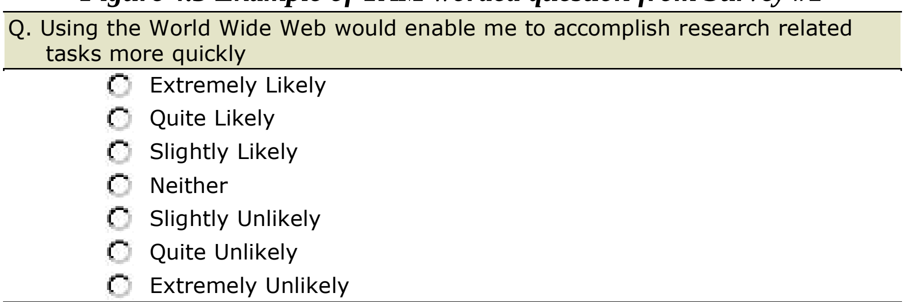
<u>The TAM Surveys</u>:

TAM surveys use a standardised "attitude" measuring format. First person scenarios are used to describe a common situation the participant is likely to encounter. The participant then uses a seven-point ordinal scale to describe the applicability of each scenario to them.

In the current research, TAM type surveys are used to measure each participant's attitude towards their:

1.) Information retrieval on the World Wide Web (Appendix 4.4); and
2.) Retrieval of quality information on the World Wide Web (Appendix 4.5)

Figure 4.3 Example of TAM worded question from Survey #1



Initial consideration was given whether to include the "neither" option for the TAM surveys as it has been argued that allowing a neutral answer can be counter-productive when participants' opinion/attitude are being sought by a survey (Talja, 1999; Torkzadeh & Lee, 2003; Mills *et al.*, 2006a). However, it has been equally argued that it is not advisable to force a participant to manufacture an opinion regarding something for which they may genuinely not have an opinion (Kitchenham & Pfleeger, 2001; Mastaglia & Kristjanson, 2001;). Moreover, in order to keep a level of integrity of the TAM based surveys that would allow the results to be compared with previous TAM results, it was necessary to keep the TAM format intact.

Multiple Choice Surveys:

The remaining two surveys were designed as multiple-choice surveys.

1.) Information seeking behaviour survey (Appendix 4.6); *and*
2.) Perceptions of information quality survey (Appendix 4.7)

Multiple choice was chosen because the objective was to establish patterns of user perceptions and behaviours. Multiple choice surveys are effective for a number of reasons (Fink, 1995; Andrews *et al.*, 2003; Page-Thomas, 2006):

1.) Greater clarity regarding each question's meaning and the type of answer being sought can be established by providing possible alternative answers (Page-Thomas, 2006;)
2.) Participants do not need to think about the phrasing of their answers, making the questionnaire relatively easy (Huang, 2006)
3.) The process of writing multiple possible answers to a question can often highlight to the researcher if ambiguities exist in the question; *and*
4.) Closed questions are often easier for the researcher to compare and analyse (Oppenheim, 1992; Chen *et al.*, 2004; Orr, 2005).

A degree of care was required when constructing the multiple choice questions to ensure that each answer contained variables that were realistic, clear, and didn't contain contrasting or ambiguous statements. Any problems regarding the construction and wording of questions were highlighted during the pilot/testing phase of the research.

Initially a “WIRT” (Web Information Retrieval Task) was designed (Appendix 4.9) with the view of log-analysing user strategies. However the test was abandoned as part of data collection for the following reasons:

1.) User strategy "testing" is/was never a goal of the current research;
2.) The value of contrived (not real) information retrieval observation has been questioned by a number of authors (Spink & Cole, 2001).

Designing the Questions:

The TAM and multiple choice questions asked in the four user surveys were guided by the extensive theory covered in the literature review. How individual questions were developed and what they were trying to measure, is discussed in the context of the user results to those questions, covered in the results chapters of the PhD.

Survey Testing: The Pilot Study

A pilot study was designed to test:

1.) The process of participant survey engagement;
2.) The wording construction of each question; and
3.) The provenance, recording and storage of participant results.

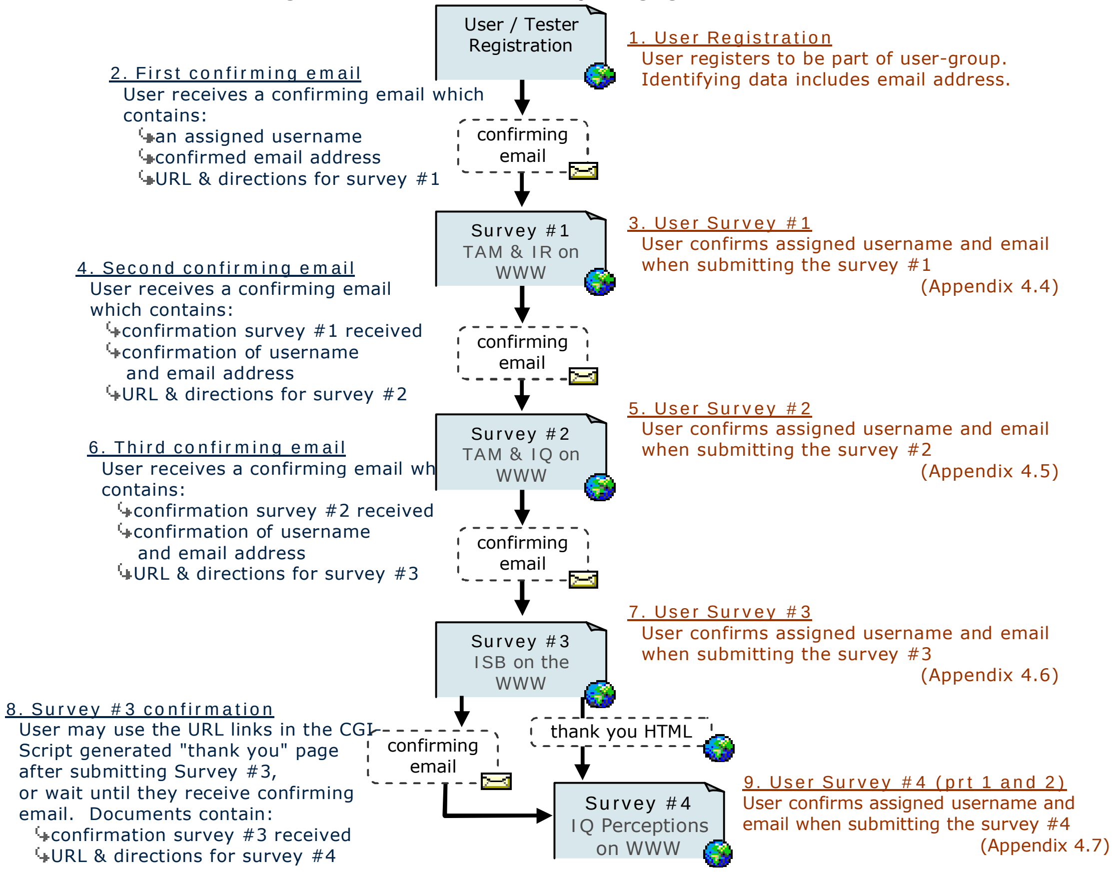
Ten colleagues of the researcher who met the target user-group criteria were invited to participate in the pilot study. Eight of those colleagues accepted the invitation, of which seven completed the actual study.

1.) Process of participant survey engagement:

Because of the multi-dimensional nature of the user-data being sought, it was recognised early in the survey development that participants would be required to engage with multiple, topic specific surveys. It was of concern to the researcher that participants not only all complete the surveys in the same order as each other, but that they complete them in a specified order. The increasingly complex content (and therefore the cognitive load on participants) of each corresponding survey was the initial reasoning behind the chosen order of the surveys. Of greater concern however, was that the questions in survey #3 and #4 may have introduced ideas and concepts relating to user ISB and perceptions of IQ that participants may not have consciously considered before. If this was true, then completing survey #3 and #4 before the first two TAM surveys could have an influence on how users answered the TAM questions. The disadvantage to this approach was that each user's first survey interaction involved the relatively bland TAM surveys.

The pilot study group gave the researcher a contrived environment in which to test the best method of multiple survey delivery – one survey at a time for each user. The users involved in the pilot study were called "testers" and a process of ordered user/survey engagement was developed. Figure 4.4 illustrates how the user/survey engagement occurred.

Figure 4.4 The User/Survey Engagement Process



Tester feedback: Tester feedback regarding the user/survey engagement proved extremely useful. The email confirmation process slowed down the engagement somewhat, in that no user could go through the entire process without a break. However it was seen as being an important tool in ensuring each survey was completed properly before the next was attempted, and in limiting participant fatigue. The confirming email process also become a valuable tool for qualitative interaction as users were able to ask clarifying questions - if required - between or before each survey.

2.) Wording and construction of questionnaires:

Each "tester" survey also included additional questions at the end of each survey asking for feedback regarding construction and wording of actual questions.

Tester feedback: The feedback proved invaluable in the design/layout of the TAM surveys (see figure 4.5) which was overwhelmingly considered to be too compact. The eventual layout chosen for the released TAM surveys is illustrated in figure 4.3.

Figure 4.5 The Original Design/Layout of TAM Survey Questions

Q. Using the World Wide Web would enable me to accomplish research related tasks more quickly								
Likely	extremely	quite	slightly	neither	slightly	quite	extremely	Unlikely
Q. Using the World Wide Web would improve my research results and performance								
Likely	extremely	quite	slightly	neither	slightly	quite	extremely	Unlikely

Tester feedback also highlighted a number of issues relating to the wording of questions. For example; question three from the *TAM: information retrieval survey* (survey #1) was originally worded "*Using the World Wide Web would increase my research results and productivity*". Two testers found the question problematic in that they felt the question was measuring two variables: (1) research results; and (2) productivity. Both testers contended that while use of the Web may increase their research results, they considered it a strong possibility this could also decrease their productivity – rather than increase it as the question suggested. As a result of this feedback, the question was reworded to "*Using the World Wide Web would increase my productivity*".

3.) Provenance, recording and storage of participant results:

Finally, the pilot study provided the opportunity for the researcher to develop a storage system for raw user-data, as well as a recording system for user results, that would both display results as they were being entered into the system and allow user-progress to be monitored.

Because the tester-group (4 x academic lecturers and 3 x PhD students) were from the actual target user group for the research, their results also provided a practical guide for the expected user-results once the surveys were made publicly available.

Overall, the pilot study went relatively smoothly and allowed the researcher the chance to iron out several glitches in the data-collection system, early on the development process. Some problems however, were not identified until after the actual data-collection began, and these will be discussed briefly in the following section.

Addressing Construction Issues

In accordance with the qualitative emphasis outlined in the previous "*Research Methodology*" chapter, user/researcher interaction outside of the four surveys was permitted. This interaction was carefully considered by the researcher, so as to not influence user results. The flexibility of interaction however did allow for the researcher to 'fix' some construction or design issues as they arose, provided they did not alter subsequent user-results.

The first construction issue identified early in the data-collection (only 10 users had registered at this early stage) was when the researcher realised the "age-group" related demographic question had been left off the *Application for user-group registration* form. This was immediately added to the registration form and a post-script added to survey #3 (which no users had yet completed) requesting that "*user0001 through to user0010 complete the following question.....*". All applicable users finally did answer the age demographic questions.

A second construction issue became apparent at the "*Research Design*" chapter write-up stage, as the researcher's own knowledge of survey construction, reliability, and validity became more solid. It became apparent that the 32 questions in Part 2 of survey #4 (Appendix 4.7) – which asked participants to "indicate how often you encounter the following issues" provided only four variables (1) frequently; (2)occasionally; (3) infrequently; and (4) never. Ordinal scales dictate that for the most valid results, participants should be given at least 5 variables. Moreover, since the variable "never" was included, then so too should "always" have been included. The possible limitations this design/construction flaw may have caused have been addressed in the context of the results for this question, in Chapter 7.

Records Storage and Information Security

Submission: The one registration and four survey documents were all built using CGI-Script and FormMail server software. An open-source approach was taken allowing the researcher complete flexibility with each survey's interface design. Raw user-data was therefore received via email. Two separate email addresses received each email, in the event that something should go wrong with the primary email account. The secondary email account was hosted on a secure server, providing a back-up of all submitted user-data.

Storage: Storage of the raw email data was achieved by each users having a separate directory which housed all correspondence with that user. The directories were periodically backed-up to an external hard-drive, in the event that something should go wrong with the hosting P.C.

Records: Raw data was initially placed into MS Access and Excel created databases and spreadsheets, which were also periodically backed-up to an external hard-drive.

Security: The area of the working PC where email correspondence and database directories were stored was password protected so that only the researcher had authorised access.

Preparation for Data Analysis

Presentation: Once enough participants had submitted surveys the researcher needed a way to automate the presentation of various results to;

1.) Enable data analysis to begin;
2.) Provide summarised results to research partners involved in the larger ARC Discovery project; *and*
3.) Present various results back to the participants, giving them the opportunity to comment & feedback on results.

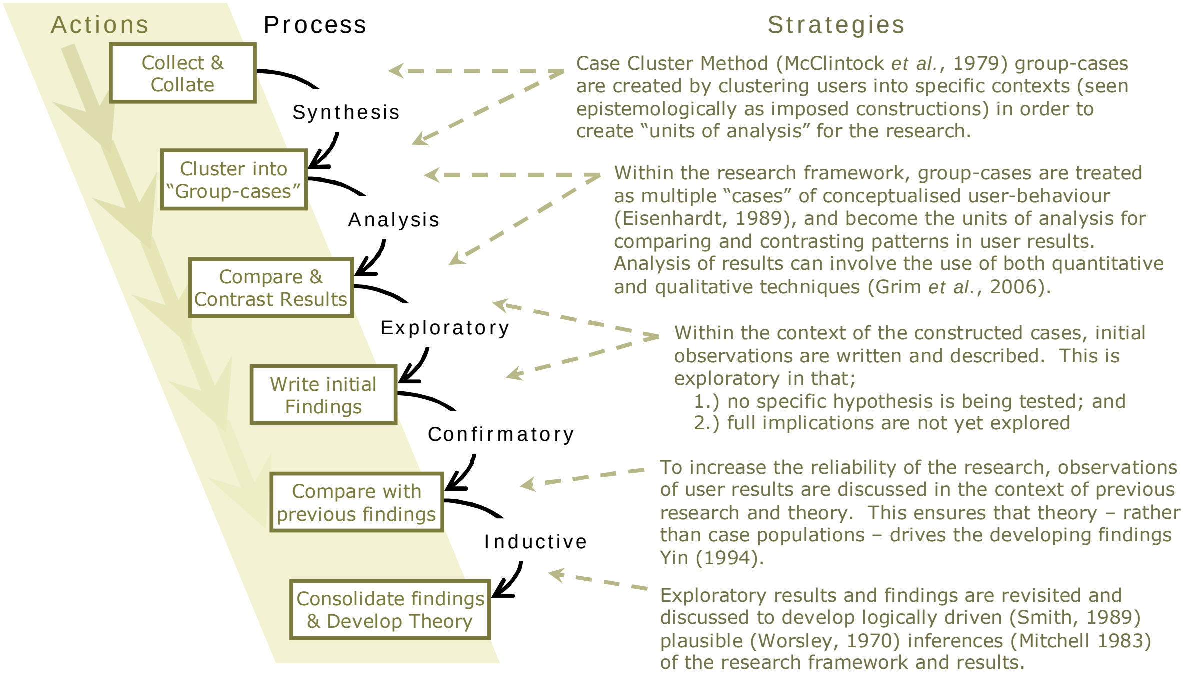
While MS Access and Excel both provided relatively stable environments in which to store results, they lacked the sophistication of a hosted results database that would (1) automatically update summaries of results when new data was entered into the system; (2) present specific results through the use of researcher queries; and (3) generate html pages of participant results for viewing by the other researchers involved in the ARC project.

SurveyMonkey: To meet this need, the server-based software "SurveyMonkey" was chosen. Although this meant rebuilding surveys in the SurveyMonkey Web environment, users were not asked to interact with the newer versions of surveys. Instead their results were fed into the software by the researcher and the results pages were only made available to the research partners and supervisors. The surveys were also able to be designed according to how results would be presented and compared, as well as group-case classification data added, rather than in the same order and user-friendly layout of the original surveys. It should be noted that SurveyMonkey was never used to store personal data of participants. Results were recorded against each users' assigned username for the purposes of the research participation.

4.3 Data Analysis

The data analysis phase of the research, illustrated in figure 4.6, involved the (1) synthesis and (2) analysis of user results, within a framework of (3) exploration; (4) confirmation; and finally (5) induction; processes. The following section describes the various strategies undertaken to handle and analyse the collected user results.

Figure 4.6 The Data Analysis Framework



4.3.1 Empirical Results

Empirical results to each survey and questionnaire were input into the web-based *SurveyMonkey* database software. The design of the questions and results in

SurveyMonkey did not have to strictly follow the original surveys, which were built with user-friendliness in mind. Instead, separate forms and extra classification (for data clustering) were designed, allowing the researcher to observe and compare results horizontally – between answers from the same user, as well as vertically – between groups of users. Limitations in the software's ability to compare results between separate databases/surveys were addressed by the creation of contrived surveys that included questions/results from multiple surveys.

Individual Survey patterns/results

The surveys were designed in a way that they could produce both stand-alone data *and* a body of results. The purpose of this was to allow patterns of user attitudes and behaviour to be recognised, recorded and analysed in the context of each survey type – such as specific TAM results for user attitudes and expectations regarding their retrieval of quality information on the Web; or a cross-analysis between different types of surveys such as TAM results according to user characteristics established in the ISB survey. This utilised the constructed "group-cases" described in the previous methodologies chapter.

Cross-analysis between surveys

Each survey result had the potential to be analysed in the context of the variations between user-profiles and constructed group-cases, which were established in the registration form (*appendix 4.1*), survey #3 (ISB Survey, *appendix 4.6*) and survey #4 (IQ survey, *appendix 4.7*). The group-case driven results are presented in the following chapter of the PhD.

4.3.2 Critical Analysis of Data

Chapter 3 (*Research Methodology*) describes in detail how the current research is not merely a quantitative analysis of user results. Observed patterns in user attitudes, expectations and behaviours presented as quantitative results – while interesting – fail to establish the contextual meaning (Stake, 1978; Yin, 1984) of those results.

The goal of the current research is to gain an understanding of user perceptions of IQ in the context of their Web-IR. The process of understanding such elements as the "how" and "why" of user behaviour – when the boundaries of each investigated phenomenon are not always clearly definable – required a mixed-method, contextual, and critical approach. Beyond the initial summaries of observed user-patterns then, the researcher has chosen to develop multiple case-studies (or contexts) – through the construction of “group-cases” within the user results – and analyse the results between these specific contexts of user characteristics.

Units of Analysis

Units of analysis can best be described in terms of clustering results into “units” of similarity, in order to record whether there are patterns within those clusters. McClintock *et al.* (1979) contend that while units of analysis are typically defined as (1) individuals; (2) groups; and (3) organisations; they can also be (4) an activity; (5) a dimension; or even (6) a specific user/organisational behaviour. In the context of the current research, each unit-of-analysis will be considered in the context of; (1) a defined “group-case”; and (2) the data/results between defined group-cases; and will be used to establish similarities in user behaviours within a group-case, as well as differences in user behaviours between those cases.

In this regard, each unit of analysis is a contrived entity that is determined by conceptual similarities between the variables within each case. For example, a group-case could be something as broad as the gender of a participant and the units of analysis are the variables in answers to particular questions across any number of the surveys. The patterns in the user-results to a defined group of questions would then be grouped according to gender, to find similarities (if any) in the results within the “female” or “male” group of users, or differences (if any) between the same two groups of users.

Ultimately, creating case-defined units of analysis provide the researcher a tool by which to cluster user-results, and so focus the research through contextualising those results.

The Group-case: constructing a context

The goal of contextualising results is essentially to establish meaning to those results. Chapter 3 (*Research Methodology*) discussed the interpretivist view of how investigating a phenomenon within a context provides a back-drop by which meaning of participant results can be better understood. From a *big picture* point-of-view, the context of the current research is not just to understand users’ perceptions of information quality, it is to understand the manifestation of these IQ perceptions in users' Web-based information retrieval behaviour. In this regard, it could be argued that, at a macro-level, the first case context is "information retrieval on the World Wide Web" and that the research into IQ perceptions is then conducted within this context. At a broad level, this serves to focus the research, enabling it to be compared to previous research and theory (Tsikriktsis, 2002; Chima, 2005) which has examined user perceptions of IQ in similar or different contexts.

In the same way that the broad research context can provide meaning in relation to other research, establishing cases and units of analysis within the research helps to provide meaning to results internally. Cases and units of analysis can be established through:

1.) Imposed existing theoretical frameworks – e.g. the different elements of human information retrieval such as information need; TAM theory; attribution, IQ and ISB theories;
2.) Known characteristic variables between types of users – e.g. gender; user experience; cognitive style; and academic position/role;
3.) The creation of sub-groups of clustered similar results to the same questions – e.g. did users of predominantly "phrase search" techniques (Survey #3, Q.10) have a higher or lower expectation of how often their searches were "successful" (Survey #3, Q.14) than users of predominantly "keywords" techniques? The same unit of analysis could be used to compare answers to other questions such as whether users attribute a "successful search" to their search engine choice or their own search strategies (Survey #3, Q.15)

Cases & Units of Analysis – caution required

For research to limit bias, and its findings to be considered reliable and valid[11] (Guba, 1981; Patton, 2002; Shenton, 2004) imposed cases and units of analysis should be carefully considered in the context of the research as a whole, in order to ensure the trustworthiness of the research. They should be focused enough to provide a way for

[11] Some researchers still hold the view that research constructs such as reliability and validity are strictly the domain of the positivist researcher. Stenbacka (2001), for example, argues that since reliability is chiefly concerned with the concept of measurement, it has no relevance to qualitative research. This view is not universal however, particularly for researchers engaged in mixed-methods or triangulated research.

the researcher to establish patterns in user-results, yet broad enough to have a meaningful application outside of the research (Eisenhardt, 1979).

In relation to the current research, the researcher chose and developed the units of analysis using;

- previous research frameworks (Sonnenwald & Iivonen, 1999; Ford et al., 2001; Kim *et al.*, 2007)
- discussion with fellow researchers and supervisors associated with the ARC Discovery project (Johnson, 1997; Denzin & Lincoln, 1998; Niglas, 2000)
- logical assumptions/analysis (Worsley, 1970; Mitchell, 1983; Smith; 1989)

It is proposed that user behaviour will be analysed in the group-case contexts of;

1.) User experience (Palmquist & Kim, 2000; Hyldegaard & Seiden, 2004);
2.) User academic role (Dong, 2003; Aharoni *et al.*, 2005; Gardiner *et al.*, 2006; Prabha *et al.*, 2007);
3.) User academic discipline/affiliation (Seyal *et al.*, 2002; Applebee *et al.*, 1997; Fescemyer, 2000; Meho & Hass, 2001; Miller, 2002; Ellis & Oldman, 2005);
4.) Type of information most often sought (Seyal *et al.*, 2002; Toms *et al.*, 2003; Pharo, 2004);
5.) User cognitive style (Palmquist & Kim, 2000; Workman, 2004);
6.) User motivation to use search engines (motivated, obliged or habitual) (Venkatesh, 1999; Liaw, 2002a & 2005; Chung & Tan, 2004);
7.) Gender (Burdick, 1996; Gefen & Straub, 1997; Venkatesh & Morris, 2000; Trauth, 2002; Schottenbauer *et al.*, 2004; Hargittai & Shafer, 2006);
8.) User attention to detail (mistakes made on the forms);
9.) User age-range (Applebee *et al.*, 1997; Porter & Donthu, 2006);
10.) Highest university qualification (Kim & Allen, 2002);
11.) User pre-supposed expectations of search engine results (Zhang & von Dran, 2001);
12.) User self-efficacy (Liaw, 2002a; Quinn, 2003; Yee *et al.*, 2004);
13.) User technical style (which search engine tools are utilised) (Heinström, 2002).
14.) User task/system confidence (Liaw, 2002a; Pace, 2004);

The group-cases were chosen because of their expected potential impact on user results. Any changes in patterns of results will be compared to (1) the whole user-group's results; and (2) variables in results between the sub-groups classified within each group-case.

Cases & Units of Analysis – multiple case studies

For the purpose of the current research, the units of analysis are determined to be the variables within and between a single defined *group-case*, and patterns of user results are analysed within the context of each of these cases. In this way, because of the presence of multiple units of analysis, the predominant methodology for data analysis falls loosely into a "*multiple case-study*" paradigm.

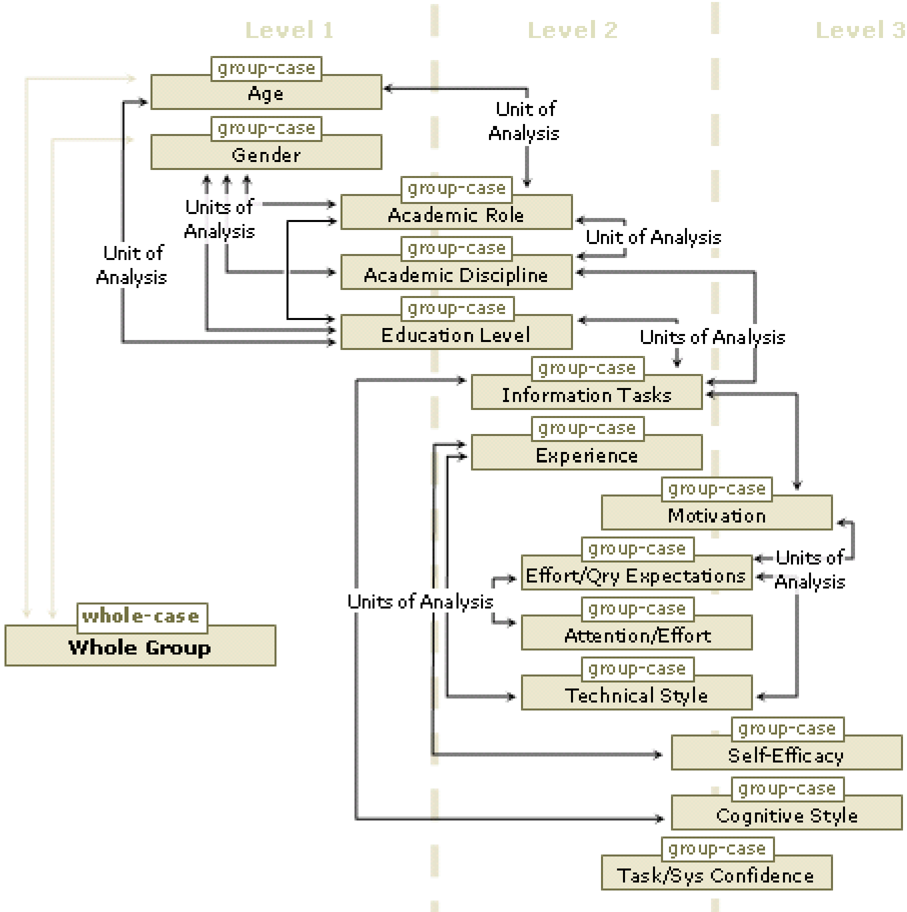
The great advantage to interpretive case-study research is that it allows the researcher the freedom to observe and analyse the phenomenon from multiple perspectives (Stake, 1995; Dooley, 2002) using multiple methods (Marghescu *et al.*, 2004; Onwuegbuzie & Leech, 2007). The triangulation of multiple methods data analysis in this research, makes its design truly pluralistic. This approach allows the researcher to bring together multiple view-points with which to observe and analyse the phenomena, with each analysis cycle contributing to a growing rich picture of the phenomenon. These methods could be considered, strategically, as involving grounded theory (GT) strategies. However, a more constructivist paradigm has been applied epistemologically, specifically in the contrived construction of group-cases and units of analysis.

Ultimately, this is a process-view of case-study research (Yin, 1994) where the combinations of data-types and layers of analysis can contribute what Eisenhardt (1989) refers to as "*synergistic*" understandings of the parts of the phenomenon.

Importantly, Dooley (2002) contends – in reference to the evaluation and analysis phase of any research – that the process of finding and interpreting any relationships between the user-data must be done in relation to the research questions. This harks back to the previous point regarding the cautious choice required for units of analysis. The large volume of data collected for the current research includes many results relating to Web user ISB with potential application outside of the scope of the

PhD. Information search strategies relating to gender, for example, while interesting in their own right, have no application to the research questions unless it can be found that male and female participants have different perceptions of information quality. Therefore, each defined group-case, or layer of analysis, has been purposefully chosen to provide a multi-dimensional picture of the same phenomenon – *user perceptions of IQ and their demonstration in user web-based information retrieval behaviour*. Figure 4.7 illustrates the process how each group-case (unit of analysis) builds a growing understanding of the phenomenon by providing case-contexts in which to observe, evaluate and analyse user survey results.

Figure 4.7 The "case" and "units of analysis" context of data analysis



Cases & Units of Analysis – triangulation

The development of multiple cases within the larger user-group is expected to provide contexts by which the researcher can better identify, explore and summarise users' general attitudes towards search engines and specific perceptions of IQ, through the observing of patterns in user information seeking behaviour. The challenge is firstly to construct valid group-cases that will reveal meaningful convergence and/or divergence in user results, and secondly to *chase* the right data that will reveal findings pertinent to the research questions.

4.4 Developing Findings

The purpose of this final part of the Research Design chapter is not to discuss the research findings per se, but rather to present how the researcher has approached the analysis and presentation of the user-results. Actual results and findings are presented in chapters' 5 through 8 of the PhD document.

4.4.1 Analysis of Results

The contextual construction model is based largely on an intuitive approach to observing, analysing and comparing research data. Wang & Strong (1996) observe this type of approach is common when a researcher is intrinsically connected to the phenomena being investigated. In the case of the current research, the researcher fits precisely into the identified target user-group. Jick (1979) and Dooley (2002) further argue that the triangulating investigator has the opportunity to rely more heavily on their own intuition when developing the logic of their research. The researcher would argue that such an approach is, in fact, deeply rooted in the "thought experiment", that is, the posing of research hypothetical questions.

In the current research, the "data" to be analysed is not pre-supposed to only be user-results, as such, but can include previous theory, observations, analysis notes and the like. The approach, therefore, to developing findings in the current research is both simple and logical, encapsulating Watt's (2007) supposition that data can gradually transform itself into findings, since "*analysis takes place throughout the entire research process*". Already described in both this and the previous chapter is the process of clustering user-data into "group-case" constructs of similar or divergent user characteristics. Once this has taken place, a context for data comparison has been created (Yin, 1994; Dooley, 2002), and analysis of the data can begin. It should be again noted, that each group-case context is seen as a constructed truth. While the requirement of these constructions is that they are robust enough to be considered theoretically valid, they are non-the-less seen as imposed on the data.

Description of Results

The first step in analysis sees the researcher writing clear and concise descriptions of the observations made of the user-results in the context of the constructed group-cases. Observations are written as descriptions of results and can include three levels of internal comparison;

1.) Comparison of a sub-group's results against whole user-group results
2.) Comparison of sub-group results within a constructed group-case; and
3.) Comparison of a sub-group's results against other sub-group results from another group-case.

Importantly, descriptions are written in the context of the research lens developed over the length of the whole research. Possible findings or implications of the observations are noted by the researcher, ready to be discussed in the context of any initial findings. Although this is seen as part of hypotheses generation, the process does not take place external to the observations and discussion just made. On the contrary, the contextual approach implores the researcher to write possible findings immediately as observations are made. Which of these preliminary findings are then highlighted for further discussion will depend on their relevance to the research questions.

Hypotheses generation

Preliminary findings are recorded and discussed during the observation and discussion of a specific phenomenon, analysis of, or cross-analysis between, user results data. In the current research, these sections of the findings chapters are labelled "*Some Findings*". The implication is that no record of possible findings needs to be considered exhaustive, and the researcher can move relatively quickly onto the next observation of results discussion. A second assumption of this strategy is that, provided enough analytical thought goes into each 'observations' discussion, a rich picture can slowly develop of the phenomena being investigated as new findings are made, and some findings repeated.

Significantly, preliminary findings sections do not, and should not, become full arguments for the findings they record. This helps to address the natural human-inquiry tendency to begin "reading" results into the data being observed, analysed and described. The emphasis, then, is on the process of an *exploration* of results, with preliminary findings directly reflecting the observations and analysis just made. .

Addressing Limitations

Specific limitations of the research are often first encountered during the analytical process, where anomalies may be found or confirmed during data description and analysis. In the same way that preliminary findings are written in the context of where/when they are observed, in the contextual construct model, limitations are also recorded in context of where/when they are encountered. This provides a useful tool for addressing any limitations in relation to any preliminary findings just made.

4.4.2 Theory Building

Developing hypotheses

Those preliminary findings found to be relevant to research questions – which represent the identified research problem being addressed – can now be revisited and built into research hypotheses. In this context, hypothesis generation and development can take place from a big-picture view-point, as the researcher revisits multiple findings statements, written as the observations were being made and discussed. Limitations have already been addressed, and patterns of findings have already been established. The growing knowledge and skill of the researcher is now utilised as multiple findings, patterns of findings, and limitations, are analysed in the context of the original research questions. Importantly, these antecedents to the final development of research hypotheses have been built piece by piece without the researcher feeling pressured to develop initial findings.

The Researcher's Lens

Trauth's (2001) "research lens" construct was introduced in the point-of-view section of chapter 3. This lens is seen as being relatively fluid in that it develops and grows as the researcher moves through the research project. The ultimate analysis of the preliminary findings is seen as being heavily influenced by the research lens developed by the researcher. It follows then, that where the researcher has not taken the time to truly develop their lens in relation to previous theory, methodology and design, fractures will begin to manifest in the reliability and validity of any findings and developing hypotheses.

Validation of Results

From a pragmatic point of view, the methodology of generating multiple preliminary findings allows the researcher – at the hypotheses development stage – to step back from the research somewhat, and consider all findings in the context of; (1) various findings; (2) previous theory, (3) novel theory, and – where appropriate – (4) user-group feedback.

User-group Feedback

Herein lies a final advantage in the described strategy. Preliminary findings can be summarised and presented to the participants and their feedback sought as a way of validating results. If undertaken before the final development of the hypotheses and theory, user-feedback can be included in the research's findings. Like all research methods, the possible subjectivity of participant feelings regarding the preliminary results should be acknowledged and addressed.

Previous Theory & Logical Induction

If user-group feedback is not sought, and such a strategy is not always logistically possible, the research preliminary findings must be validated in light of previous and current theory. Given the extremely demanding nature of the registration process and four extensive surveys of the current research, which generated some 10,080 separate pieces of data, the researcher has taken the approach of logically discussing user results, preliminary findings and limitations in the context of the previous theoretical models and novel theoretical models presented in chapter 2.

The problem with this approach lies in what Mitchell (1983) describes as the scientific community's positivist assumptions of inductive reasoning, that the only valid basis of inference is that which has been developed in relation to statistical analysis (cited in: Smith, 1989). But, as Worsley (1970) contends; the "*general validity of analysis does not depend on whether (a) case being analysed is representative of other cases of this kind, but rather upon the plausibility of the logic of the analysis*". The reality is, even statistically valid research is accepted (or rejected) on the grounds of the plausibility of the logical arguments associated with it.

4.5 Conclusion

The current chapter has addressed the various strategies of data engagement of the research, illustrated in figure 4.6. Included have been some of the common considerations of survey-driven data collection, and a more detailed discussion of the analysis process first presented in chapter 3. The contextual construct model, also introduced and discussed in the chapter 3, has been described in terms of how it philosophically drives the methods and strategies chosen. Finally, the strategies for data analysis and presentation of research findings have been presented, and are now used as a framework to guide the results chapters of the PhD.

CHAPTER 5

Results & Findings

Constructions of Analysis: The User-Group; and its sub-groups

5. Introduction

The following chapter presents some initial observations regarding the general characteristics of the user-group in this research study. It also presents the various constructed "group-cases" associated with the research, created from clustering sub-groups of users who possess similar characteristics, which will be used, as part of the research analysis framework (figure 4.6), to compare and cross analyse user results.

5.1 User Profile

The target user-group for the current research needed to be users who demand a high level of quality in the information they retrieve from the World Wide Web. To this end, it was determined that such a group could be found amongst "academic" users of the Web. A call for participation was sent out to appropriate university organisations, on-line academic community groups and list-servers, asking for users who met the following criteria.

1.) Users who were "academics", or "postgraduate level" students – including users who fell into both these categories
2.) Users who used the World Wide Web to retrieve information that related to their work/research as academics and/or post-graduate students

The user-group did not necessarily have to feel "comfortable" retrieving work/research related information from the Web, but needed to do so relatively regularly and be personally familiar with the process of using the Web as an information retrieval tool for the high quality content associated with their work, research, or both.

Users who engage the Web as a means of professional networking, or even entertainment were not excluded from the target user-group. The surveys and questionnaires they completed however, did not relate to these interactions.

The goal of the research was to survey a relatively intellectually sophisticated group of users. An assumption was made that academics and postgraduate level students, Honours, Masters and PhD level university students, would possess; (1) a relatively high degree of information quality perception; and (2) the ability to make relevant quality related judgments of the information they encounter on the Web.

The level of survey questioning also lent itself to the assumption that this group of users would have a relatively high degree of cognitive awareness, and possess the ability to articulate their strategies in relation to the decision-making processes involved in information search and retrieval on the World Wide Web. Some redundancies were built into the surveys however, to allow for the possibility that some users may not have previously considered some of the issues raised in the surveys. The design and make-up of the questions – in respect to their validity – is discussed in detail in the Research Design chapter (chapter 4). The purpose of this first "Results" chapter is to:

1.) Present the user-group, describing some of the group's characteristics and what those characteristics imply about the user-group as a whole; and
2.) Present the constructed "sub-groups" existent within the whole group.

5.2 General Characteristics of the user group

5.2.1 ~ Technologically Sophisticated

Experience using World Wide Web technologies

Although not a goal of the research in that no pre-defined minimum level of user "experience" was used as a guidance for user-group inclusion, the users were found to be highly experienced in using technology and the Web for high-end information retrieval. No participant had been using the Web and its search engines for less than three years, with the vast majority (95%) having used search engines for more than five years. In fact, nearly three quarters claimed to have been using Web technologies for more than nine years, with more than half the user-group (60%) having engaged Web-based search engines for more than nine years. Even more remarkable is that with user data being collected between March 2006 and March 2007, over a fifth of the user-group had been using Web technologies since before 1995.

Table 5.1(a & b): Users Experience (in years) engaging Web Related Technologies

Table 5.1a: Web Technologies

[#51] (ISB Q.2) ~ How many years experience do you have using the World Wide Web?	%	#
↓ 1 year	0%	0
1–2 years	0%	0
3–5 years	5%	4
5–8 years	18.8%	15
9–12 years	55%	44
↑ 12 years	21.2%	17
Total Respondents		80

Table 5.1b: Web Search Engines

[#52] (ISB Q.3) ~ How many years experience do you have using WWW Search Engines?	%	#
↓ 1 year	0%	0
1–2 years	0%	0
3–5 years	5%	4
5–8 years	35%	28
9–12 years	45%	36
↑ 12 years	15%	12
Total Respondents		80

"Early adopters"

User-group global distribution was fairly evenly spread across the U.S./Canada (35%), Europe/Africa (21.2%) and Australasia (43.8%), with the 9-12 years experience and 12+ years experience demonstrating equally diverse global distribution (Table 5.2), indicating the group, by and large, to be relatively "early adopters" of the global technologies that would become the World Wide Web.

Table 5.2: Global Distribution of User-Group (inc. 9-12yrs & 12+yrs WWW experience)

[#19] (Profile Q.3.4) ~ Global Distribution of User- Group [80 users]	%	#
Australasia	43.8%	35
Europe/Africa	21.2%	17
North America	35.0%	28
Total Respondents		80
QUERY [#19 & #51] Global distribution of users with 9-12 years WWW Experience [44 users]	%	#
Australasia	40.9%	18
Europe/Africa	18.2%	8
North America	40.9%	18
Total Respondents		44
QUERY [#19 & #51] Global distribution of users with 12+ years WWW Experience [17 users]	%	#
Australasia	52.9%	9
Europe/Africa	11.8%	2
North America	35.3%	6
Total Respondents		17

The generally high level of experience using search engines by the user-group is supported by their responses to Q.9 of the ISB survey [#52], where more than three quarters of respondents claim to interact with the more technical features included with their search engine query results. These features include such features as Google's "similar pages" and "cached" (see fig 5.1) version of a web page.

Nearly 60% of users said they had returned to their search engine results list to view the "cached" version of a web page when they found the link (fig 5.1 "title-link") produced a 404 (Page cannot be found) error, indicating they understand how to use the search engine to access information that for some reason was/is currently inaccessible.

Figure 5.1: Google & Yahoo "results" interface (showing alternative/features links)

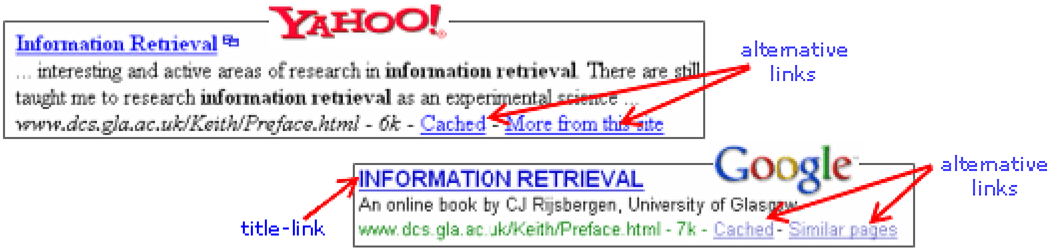


Table 5.3: Users' application of technical features included with search engine results

[#59] (ISB Q.9) In what circumstances do you use the Cached/more from this site (yahoo) / Similar pages (Google) alternative feature?	%	#
I have never used the Cached / more... / Similar pages links	23.8%	19
If the title-link proved to be a good link, I may go back to the search engine (Google) and use the Similar pages link	10%	8
If I click-thru the title-link and I get a 404 type error I will go back to the S.E. and click-thru to the Cached version	57.5%	46
If the URL listed appears to have merit I may choose the more from this site link	8.8%	7
Total Respondents		80

→ nearly a quarter of users do not use SE features to help them search?

→ nearly 60% of the user-group specifically use the "cached" feature when links to results are broken

Less technically sophisticated sub-group

Table 5.3. illustrates a relatively technically experienced group of users. However, it also highlights a sub-group of users (23.8%) who stated they had never used these more technical search engine features. This led the researcher to ask why nearly a quarter of the user-group had never used the technically related search engine features to help them find their target information on the Web. The superficial assumption that a user's years of experience using search engines may have influenced this result was found to be false, with very similar "years of experience using search engines" results for both non-technical and technical users. In fact, users who had *never* engaged alternative link type features were more highly represented in the 12+ years experience (Table 5.4) than users who did utilise these technologies. The user data however, did reveal some interesting differences in user results between participants who had never used specific search engine technical features and those who did. These will be examined further in Section 5.3.13

Table 5.4: Years experience using Search Engines (technical vs. non-technical users)

[#52] *(ISB Q.3)* How many years experience do you have using WWW Search Engines?	users who DO NOT use technical features to help IR	users who DO use technical features to help IR
3–5 years	5.3%	4.9%
5–8 years	31.6%	36.1%
9–12 years	42.1%	45.9%
↑ 12 years	21.1%	13.1%

5.2.2 ~ Informatically sophisticated

For the purposes of the research, the target user-group needed to be informatically sophisticated, and demonstrate a high degree of cognitive awareness of their information retrieval strategies, and how they make value judgments regarding the information they encounter on the World Wide Web. Users were asked to identify both their highest academic qualification and their current academic "role". Table 5.5 illustrates the high level of education enjoyed by the user-group. It should be noted, that in order to qualify for user-group inclusion, users with a completed under-graduate degree had to either be currently employed by a university as a researcher/lecturer or be studying for a post-graduate level qualification.

Table 5.5 Users highest completed university education level

[#12] (Registration Q.3-2) Indicate your highest *completed* university education level	%	#
Completed Undergraduate degree	43.8%	35
Completed Post-graduate degree	15.0%	12
Currently studying DBA	3.8%	3
Completed Masters degree	20%	16
Completed PhD doctorate	17.5%	14
Total Respondents		80

The current study in no way advocates that academia holds a monopoly on intelligent individuals or high-end information users. It simply assumes that, in order to participate in post-graduate academic activities, the vast majority of users would posses above average cognitive capabilities and demand a high level of quality in their target information retrieval. To validate each user's claim regarding their academic qualifications, users were also asked to identify their "academic role" (see discussion Section 5.3.2) and their university affiliation (Appendix 5.1).

User results supporting the assumption regarding the informatic sophistication of the user-group include those relating to information processing as part of information search and retrieval. Users professed to engaging associated information such as a web page's URL to help make decisions about the potential quality of their S.E. results.

Table 5.6 User interaction: Associated information about a web page

[#63] *(Q13)* When you open the selected result (hyperlink), what does the URL suggest to you about the potential quality of the web page?	%	#
What is a URL?	0%	0
I do not use the URL to help me make a value judgment about the web page	0%	0
I use the URL to help work out the source of the web page content, but I do not use this knowledge to make a value judgment about its content	13.8%	11
I use the URL to help work out the source of the web page content, AND then use this knowledge to make a value judgment about its content	86.2%	69
Total Respondents		80

5.2.3 ~ High Self-efficacy

An outstanding characteristic of this user-group was their high levels of self-efficacy and task/system confidence in their ability to search and retrieve their target information. When asked how often they expected to successfully find the information they were looking for, a staggering 88% of participants answered *most* or *every* time. Conversely, no participant indicated that they rarely found their target information.

The high expectations of the user-group regarding being able to locate their target information was found to be directly related to their perception of their own ability to use effective searching strategies. Users *attributed* their ability to successfully find target information most or every time to their own good strategies, rather than other technology-related related characteristics such as a good search engine, or the information structure of the World Wide Web. This indicates the user-group to possess very high levels of self-efficacy.

Table 5.7 presents the user-group's perceptions and expectations of a "successful" information retrieval episode involving a search engine. Self-efficacy – defined as a user's own perception of their role and ability to successfully complete a set task – was a characteristic used to classify a "group-case" of users within the whole user-group. For the purpose of the current research, each set of sub-groups is seen as a "group-case" by which to firstly cluster results of users who share similar characteristics and secondly to provide a framework for analysis of user-results between sub-groups.

Table 5.7 User perceptions of their "successful" Web Searches

[#64] (ISB Q14) How often do you expect to successfully find relevant information when utilising a Web search engine?	%	#
every time	7.5%	6
most times	81.2%	65
sometimes	11.2%	9
rarely	0%	0
Total Respondents		80

[#65] (ISB Q15) A "successful" search outcome to a query is the result of...	%	#
good luck	0%	0
a good search engine	13.8%	11
my good searching strategies	65%	52
the information environment of the WWW	21.2%	17
Total Respondents		80

5.2.4 ~ High Level Search Engine Experience

Table 5.1 presented the level (in years) of experience enjoyed by the research user-group, with 60% of users claiming to have been using Web-based search engines for almost a decade or longer. This is supported by user results (Tables 5.8a & 5.8b) to questions relating to which search engine features they exploit once a search engine presents any results to their queries. Table 5.6 illustrated how users make use of associated information such as a result's URL to help determine whether to "click-thru".

Table 5.8a User interaction: deciding which search engine result to "click-thru"

[#58] (ISB Q8) How would you use the presented information (in the summary) to determine which result would be appropriate to 'click thru' to?	%	#
I use the title-link when deciding whether to click-thru to the result	0%	0
I use the title-link and the description of web page	23.8%	19
I use the title-link and URL info	8.8%	7
I use the title-link, description & URL info	67.5%	54
Total Respondents		80

Table 5.8b User interaction: technical features usage in search engine results

[#59] (ISB Q9) In what circumstances do you use the Cached / more from this site (yahoo) / Similar pages (Google) alternative feature?	%	#
I have never used the Cached / more... / Similar pages links	23.8%	19
If the title-link proved to be a good link, I may go back to the search engine (Google) and use the Similar pages link	10%	8
If I click-thru the title-link and I get a 404 type error I will go back to the Search Engine and click-thru to the Cached version	57.5%	46
If the URL listed appears to have merit I may choose the more from this site link	8.8%	7
Total Respondents		80

The overall impression of the user-results present a user-group that is: (1) highly experienced; (2) technically Web and search engine savvy; and (3) confident in their own ability to successfully find their target information.

5.3 Sub user-groups (The Group-cases of the Research)

Sub-groups within the whole user-group are seen as "group-cases" of users who share common characteristics. Classification, was both pre-defined, at the survey design phase of the research; and evolutional, in the sense that some group-case characteristics only became apparent after results were examined and collated.

What follows is a description of the various group-cases by which the data has been contextualised. Group-cases will be described in terms of such things as their context to: (1) previous research/theory; (2) the whole user-group; (3) the phenomenon of user perceptions of information quality; and (4) differences in information seeking behaviour. The variables in user-results in the context of each group-case are the "units of analysis" which will be examined for the purpose of building theory relating to how users perceptions impact their information seeking behaviour. A more in-depth discussion relating to data analysis between the classified group-cases will be presented in the following chapters. The remainder of this chapter will present the pre-defined and evolved group-cases, and where applicable, some observations – for the purposes of clarity regarding group-case classification – and variables in results may be discussed

5.3.1 User Experience (Web-based Search Engines)

Often presented as a major influencing factor in user behaviour in previous literature/theory (Song & Salvendy, 2003; Hyldegaard & Seiden, 2004; Toms *et al.*, 2004; Fusilier & Durlabhji, 2005; Castañeda *et al.*, 2007) user levels of search engine experience was determined as a pre-defined group-case. Participants were asked to identify how long they had been using information technology; the World Wide Web; and specifically Web-based search engines.

Four different levels of experience (referred to as "sub-groups") were identified;

1.) 3 to 5 years experience using Web-based search engines;
2.) 5 to 8 years experience using Web-based search engines;
3.) 9 to 12 years experience using Web-based search engines; and
4.) 12+ years experience using Web-based search engines;

The smallest sub-group was also the least experienced, 5% of users with 3 to 5 years experience. The largest sub-group was the 9 to 12 years experience, at 45% of the user-group. Collated results for each of the sub-groups (i.e.; 3 to 5 years; 5 to 8 years; 9 to 12 years; and 12+ years) are presented in Appendix 5.2

5.3.2 Academic Role

An academic "role" for each user was determined by asking the user-group to firstly identify whether they were: (1) a student; (2) a researcher; (3) a lecturer; or (4) a combination of two or three of the roles. The list of roles in the online form allowed users to select more than one role, and was followed by a clarifying text box, where users indicated the percentage of their time they spent in that specific role. From this information, users were classified as one of the four following academic roles.

1.) Academic ~ Type 1: Academic who identifies chiefly as a *Lecturer*

2.) Academic ~ Type 2: Academic who identifies chiefly as a *Researcher*

3.) Student ~ Type 1: Postgraduate student who identifies as a *Student* only

4.) Student ~ Type 2: Postgraduate student who identifies they engage in paid academic activities including research and/or lecturing, *Student/Academic*

Table 5.9 Users self-identified academic "role"(profile)

[#17] (Registration Q3-5) ~ *Classification* Academic profile	%	#
Academic~Type 1	16.2%	13
Academic~Type 2	16.2%	13
Student~Type 1	38.8%	31
Student~Type 2	28.8%	23
Total Respondents		80

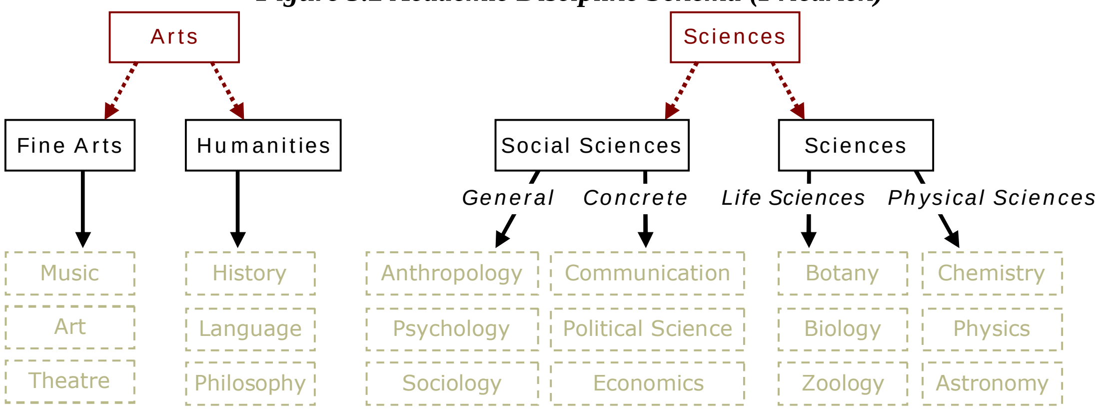
Like "user experience", "academic role" was a pre-defined case that was seen as an important indicator of the type of information users might look for (Agarwal & Prasad, 1999), as well as how they might make value-judgments relating to information quality. This contextual approach to user sub-group classification is seen as an important element of the research methodology in that it adheres to Wang & Strong's (1996) paradigm that "information quality" is defined by its context as information that is "fit for use/purpose". If academics search for different types of information according to their "role", then it is reasonable to expect significant variables in their survey results according to those roles.

5.3.3 Academic Discipline

The research methodology chapter presented the argument that the discipline in which research takes place has a profound influence on a researcher's own research lens, and the way they handle and interpret data in the context of pre-existing methodologies and theories (Trauth, 2001). In the same way it can be assumed that research disciplines also possess their own influencing standards relating to such phenomena as information quality and academic rigour. Users' academic discipline, like their level of experience and academic role, was a pre-defined case determined at the survey design phase because of its expected influence on user results (Hjørland, 2002; Heinström, 2002).

To determine their academic affiliations, users were asked to name; (1) their highest academic qualification (*in discipline terms, e.g. Bachelor of Science*); (2) the institution where they gained that qualification; (3) their current area of academic engagement; and (4) their current institution. The institutional context of their various academic engagements was seen as an important element in determining each user's academic discipline because universities tend to classify disciplines differently. The following schema, a visual representation of Friedrich's (Rutgers, ND) written schema, was used to guide the initial classification of each user's discipline.

Figure 5.2 Academic Discipline Schema (Friedrich)



Developing a schema with which to classify the disciplines of each user proved problematic in that where one institution might classify a degree in Psychology as a Bachelor of Arts, another institution would classify a similar degree as a Bachelor of Science. Users were asked to clarify which area they self-labelled themselves and this was used to help build an "academic discipline" picture of the user-group. Not withstanding that some users perceived their research/engagement to be interdisciplinary, Table 5.10a presents the user sub-groups according to their academic discipline.

Table 5.10a: User represented academic disciplines

[#22] (Registration Q3.3, Q3.4, Q3.6, Q4.4) = *Classification: discipline area*		%	#
01. Science~CompScience~Technology (inc Library Sci)		8.8%	7
02. Science~PhysicalScience~Science Technology		15%	12
03. Science~Applied/SocialScience~Science Tech		5%	4
04. Science~LifeScience~HealthScience		8.8%	7
05. Science~Business~InfoSystems (inc Accounting)		17.5%	14
06. Science~SocialScience(non- Psychology)		5%	4
07. Science~SocialScience~ Psychology		8.8%	7
08. Education~Education-Science (inc Edu Technology)		10%	8
09. Education ~Education-Arts (inc Humanities)		10%	8
10. Arts~Humanities (inc Comms, Philosophy)		11.2%	9
		Total Respondents	80

Users were classified into the following areas/disciplines;

1.) Science ~ Computer Science ~ Technology (inc. Library Science)

2.) Science ~ Physical Science ~ Science Technology (inc. Physics)

3.) Science ~ Applied/Social Science ~ Science Technology

4.) Science ~ Life Science ~ Health Science

5.) Science ~ Business ~ Information Systems (inc. Accounting)

6.) Science ~ Social Science (inc. Political Science, Law, Communications)

7.) Science ~ Social Science ~ Psychology

8.) Education ~ Education-Science (inc. Education Technology)

9.) Education ~ Education-Arts (inc. Humanities)

10.) Arts ~ Humanities (inc. Communications, Philosophy, Psychology, Sociology, History. Fine Arts)

There was a relatively even spread of users across the research disciplines, with business (information systems), at 17.5%, being the highest represented group. The researcher was concerned regarding the small size of the some of the sub-groups and a second case-group was constructed (which grouped similar disciplines together) in the event that user sub-group results proved to be too divergent to be meaningful. It should be noted, *wherever the second academic group-case has been used for data analysis that fact has been made clear in the description of results.*

Table 5.10b: User represented academic disciplines (Group-case 2)

[#22] (Registration Q3.3, Q3.4, Q3.6, Q4.4) = *Classification: discipline area*		%	#
COMBO: Science Disciplines		23.8%	19
COMBO: Social Sciences		27.5%	22
COMBO: Business/Info Sys		17.5%	14
COMBO: Education		20%	16
COMBO: Arts/Humanities		11.3%	9
		Total Respondents	80

5.3.4 Type of information most often sought

A fourth pre-defined case involved clustering sub-groups of users who searched for similar types of information. Information task has been hypothesised in numerous studies as having an influence on specific information search behaviours (Abels *et al.*, 1996; Ocholla, 1999; Johnson *et al.*, 2003; Pharo & Järvelin, 2004; Page-Thomas, 2006), as well as users perceptions of information quality (Raghunathan, 1999; Byström, 2000; Kopcso *et al.*, 2000). Sixteen common information tasks were identified, and users were asked to select whether they under-took each task (1) exclusively; (2) Frequently; (3) Sometimes; (4) Rarely; or (5) Never. The purpose was not so much to rank common academic tasks undertaken using the World Wide Web, but was to create sub-groups (e.g.; users who frequently or exclusively undertake specific information tasks) that could then be used to query user results to key IQ perceptions questions in the various surveys. If Wang & Strong (1996) are correct in their supposition that information quality is related to the use or purpose of the information engagement, then it is reasonable to assume key IQ perceptions may vary between the sub-groups "type of information most often sought".

Table 5.11 illustrates "type of information most often sought" by the user-group.

Table 5.11 Types of Information tasks undertaken using the WWW

[#78] (ISB Q13) ~ Record how often you search for the following on the WWW

	How Frequently (in percentage)					TOT	
	Never	Rarely	Some	Freqntly	Exclsvly	%	# in sub-group
a. Peer Reviewed Academic Publications	0	4	15	78	4	82	65 users
b. General News Articles	2	19	29	46	4	50	40 users
c. Online tutorials & technology help	4	21	45	26	4	30	24 users
d. News related to your research area(s)	1	11	39	46	2	48	39 users
e. Citations & References searches	1	8	29	59	4	63	50 users
f. Online magazine articles (e.g. TIME)	16	39	31	12	1	13	11 users
g. Journal Articles (NON-Peer reviewed)	10	38	32	18	2	20	16 users
h. Industry related research articles (e.g. Gartner)	25	28	34	12	1	13	11 users
i. Conference Web-sites	1	20	46	28	5	33	26 users
j. Conference Proceedings	1	25	44	29	1	30	24 users
k. Peer review process (you as reviewer)	35	31	30	2	1	3	3 users
l. Job Search (in academia)	16	24	38	21	1	22	18 users
m. Professional membership (e.g. IEEE, ACM)	16	28	32	22	1	23	19 users
n. Research Grant information & applications	11	29	39	19	2	21	17 users
o. Academic forums & discussions (inc. blogs)	6	30	21	40	2	42	34 users
p. Other University Course Content & Lecture Slides	5	21	40	30	4	34	27 users

Users who *exclusively* or *frequently* undertake a specific type of information task are considered as possessing appropriate levels of discernment to make reasonable value judgments regarding the information encountered in the context of that task. For the purposes of cross-analysis between user results, users who frequently or exclusively undertake a specific information task are clustered into a sub-group to examine whether they possess similar perceptions of information quality.

The sub-groups within the information tasks group-case varied greatly in terms of numbers. Of the greatest concern was the very small number of users who made up some of the sub-groups. To address this, identified information tasks were further grouped according to their similarities.

Tasks were classified into the following sub-groups:

1.) *Group 1: High Academic Activities*
    Peer Reviewed Academic Publications; Citations & References searches; Conference Proceedings; Peer review process; Research Grants & Apps
2.) *Group 2: General Academic Activities*
    Online news related to your research area(s); Journal Articles (NON-Peer reviewed); Conference Web-sites
3.) *Group 3: Academic Resources Activities*
    Online tutorials & technology help; Uni Course Content & Lecture Slides
4.) *Group 4: Interactive Internet Activities*
    Job Search (in academia); Academic forums & discussions (inc. blogs)
5.) *Group 5: Industry related Activities*
    Industry related research articles; Professional membership
6.) *Group 6: General Web-delivered Activities*
    General News Articles; Online magazine articles

The final step in making the information task data compatible with cross-analysis, was to ensure each of the 80 users' data was associated with only one of the six sub-groups. Each of the user's individual results were examined to ascertain which sub-group represented their most frequent engagement with the Web, and users' were then placed into one sub-group according to those results. Appendix 5.1 presents the participant results used to classify individual users into an "information task" sub-group.

The information task sub-groups make-up was as follows;

1.) high academic tasks (20 users);

2.) high academic tasks; combined with other activities (8 users);

3.) general academic tasks (14 users);[12]

4.) academic resource-driven tasks (10 users);

5.) web-driven (web-delivered) tasks (10 users);

6.) industry-driven tasks (6 users);

7.) interactive academic tasks (12 users)

5.3.5 Cognitive Styles

Some sub-groups of users only became apparent as results were collated into conceptual contexts. For example, users were asked to identify which search-query strategy they preferred when initially engaging a search engine. A link between preferred search-query strategies and cognitive style was then established in that – although cognitive style is established by many user-characteristics besides search strategy – it was understood that a user's preferred way of associating words or language with specific meaning, i.e., wholist-analytic (Ford *et al.*, 2001) ~ *considered, contextual phrase-searching or boolean*, versus more loose (ongoing) representation during search/inquiry ~ *multiple key-words*, would be influenced by their cognitive style (Knight & Spink, 2008).

From the results, users were divided into three sub-groups;

1.) *Keywords Searcher*: User who identifies their most often used initial search query strategy is multiple keywords

2.) *Phrase Searcher*: User who identifies their most often used initial search query strategy is to phrase search

3.) *Boolean Searcher*: User who identifies their most often used initial search query strategy is to use Boolean strategies

Cognitive style has been defined as a user's preferred (and habitual) approach to both organising and representing information (Frias-Martinez *et al.*, 2007), and keyword

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[12] For the purposes of close analysis, the 'general academic tasks' sub-group was further divided into 3a: general academic tasks only (7 users) and 3b: general academic task; combined with other activities (7 users). These were used during analysis to investigate any differences between users who principally engaged the Web for general academic purposes, and users who chiefly engaged the Web for general academic and 'other' purposes.

and boolean search strategies have been used previously to investigate user cognitive style (Moss & Hale, 1999; Ford *et al.*, 2005).

Table 5.12 Users preferred initial engagement with search-engines

[Q60] (ISB Q10) ~ What search strategy do you most often use when initially starting a search	%	#
one keyword	0%	0
keywords	60%	48
a phrase search	27.5%	22
boolean search	12.5%	10
Total Respondents		80

Table 5.12 illustrates that the majority of participants use multiple keywords when they query a search engine, with less than a third using phrase searches and only one-eighth preferring the more technical-type boolean search . Interestingly, regardless of their preferred strategy, all participants' strategies involved the use of multiple words, with no user stating they would only use *one* keyword. This provides an interesting insight into how high-end users, most often engaging search-engines for high-end information retrieval, perceive that words may require a context with other words in order to establish their meaning.

The association of preferred search-strategy with *cognitive style* – rather than technical style/ability – is confirmed by the user results regarding their technical search engine strategies. Tables 5.3 and 5.8b demonstrate that for the whole user group, 23.8% of users have never used search-engine technical features such as *cached*, *more pages* or *similar pages* links. This figure, at 50%, is much higher amongst Boolean searchers – who it would be reasonable to assume would have more advanced "technical" search-engine interaction. Table 5.13 compares Boolean searchers technical features use with the whole user groups results.

Table 5.13 Boolean Searchers use of S.E. technical features

[#59] (ISB Q9) In what circumstances do you use the Cached / more from this site (yahoo) / Similar pages (Google) alternative feature?	Whole User Group	Boolean Searchers
I have never used the Cached / more... / Similar pages links	23.8%	50%
If the title-link proved to be a good link, I may go back to the search engine (Google) and use the Similar pages link	10%	10%
If I click-thru the title-link and I get a 404 type error I will go back to the Search Engine and click-thru to the Cached version	57.5%	40%
If the URL listed appears to have merit I may choose the more from this site link	8.8%	0%

5.3.6 Motivated, Obliged and Unmotivated (Habitual) users

Like the cognitive style classification, the motivating factors regarding users' choice to engage search engines for information retrieval evolved into a "group-case" during data analysis and collation. As a classification, users' reasons for using search engines became apparent during analysis of the TAM results. A historical review of the TAM research reveals that a major contributing factor to variations in user results can be whether users make a conscious *choice* regarding their use of a particular technology (Rawstorne *et al.*, 2000; Brown *et al.*, 2002).

The sub-groups of users identified in this classification include;

1.) *Motivated Searcher*: User who engages search engine technology because they find them to be highly effective.
2.) *Obliged Searcher*: User who engages search engine technology because they believe there is no other way to perform search/retrieval on the Web.
3.) *Unmotivated (habitual) Searcher*: User who engages search engine technology out of habit or ease of access.

Table 5.14 illustrates the user distribution into the three sub-groups for motivating factors of user/search-engine engagement group-case.

Table 5.14 Motivating factors in User/Search-Engine Engagement

	[#56] (ISB Q6) ~ Why do you use Internet search engines?	%	#
motivated searcher →	I find them to be highly effective at retrieving the information	50%	40
obliged searcher →	there is no other choice if I do not know a URL	22.5%	18
unmotivated → (habitual) searcher	habit... it's what I've always done	20%	16
	convenience... it's much easier than the library	7.5%	6
		Total Respondents	80

5.3.7 Gender

A typical sub-user group distinction in much of the research into user cognitive behaviour is gender (Gefen & Straub, 1997; Venkatesh *et al.*, 2004; Ong & Lai, 2006; Hargittai & Shafer, 2006). The current research presents an opportunity to empirically examine whether gender is a factor in user information seeking behaviour and user perceptions of information quality. It should be noted, however, that "gender" is seen by some researchers as a culturally imposed construct (Wall & Kristjanson, 2004), the deconstruction of which, in all likelihood, will fall outside the bounds of the PhD document. It is expected however, to provide a fertile ground for future research using the same data sets.

Users were asked to identify their gender in their registration/application to be part of the research's user-group. The break-down of male to female participants is presented in Table 5.15, which reveals that more than two thirds of the user-group are female.

Table 5.15 Gender break-down in the current Research User-group

[#23] (Registration Q4.2) ~ Gender	%	#
Male	32.5%	26
Female	67.5%	54
Total Respondents		80

5.3.8 Attention to detail

In the course of filling out their application forms, users were asked to record their first and surname in separate form fields, and then verify their date of submission from a drop-down menu. From the data collected, 15% of users wrote their first name and surname into the wrong fields; that is; they wrote their first name in the Surname field and vice-versa. Around 16% of users recorded the wrong date, either choosing the wrong month or year from the drop-down menus.

Table 5.16 Attention to detail classification data

[#7] (*from* Registration Q2.1 & 2.2) ~ Users First and Surname dialogue boxes [Did the user put their name right way?]	%	#
Yes	85%	68
No	15%	12
Total Respondents		80

[#10] (*from* Registration Q1.2) ~ Date of Application [Did the user record the date correctly?]	%	#
Yes	83.8%	67
No	16.2%	13
Total Respondents		80

From the user results presented in table 5.16, four sub-groups relating to each user's attention to detail were created;

1.) *Wrong Name sub-group*: User who put their name details incorrectly into the submission form (12 users)

2.) *Wrong Date sub-group*: User who selected the wrong date (month or year) from the drop-down menu (13 users)

3.) Wrong Name or Date sub-group: User who filled in either their name OR the date incorrectly. (20 users)
4.) Wrong Name and Date sub-group: User who filled in both their name AND date details incorrectly. (5 users)

The purpose of creating this sub-group is not to single-out users who "got it wrong", but rather to investigate how individual users' own *attention to detail* regarding simple or repetitive information tasks impacts on their information seeking behaviour or perceptions of information quality. Is this group of users more or less forgiving of poor-returns from a search engine query? Which of the eighteen "information quality" dimensions are they more likely to cognitively engage when making decisions about the quality of the information they retrieve?

5.3.9 Age-Range

Along with gender, age is another common sub-group characteristic used when investigating user-group behaviour (Cole & Balasubramanian, 1993; Turk-Charles *et al.*, 1997; Morris & Venkatesh, 2000; Freudenthal, 2001; Arning & Ziefle, 2007). For the current research, users were asked to select which age-range they fell into; 18 to 23; 24 to 29; 30 to 35; 36 to 45; 46 to 55; or 56+.

The decision process involved in selecting the specific age-range sub-groups was complicated by the lack of consistency in age-range demography represented in the reviewed literature. Cole & Balasubramanian's (1993) study identified just two age-groups; "older" ~ 60 to 89 age-range; and "younger" ~ 20 to 59 age-range; in their examination of users nutritional information seeking behaviours. Similarly, Freudenthal (2001), investigated how two age-ranges, 18 – 25 years and 60 – 70 years, performed information retrieval tasks associated with specific questions; and Lu *et al.*, (2006) examined individual Chinese users decisions about wireless mobile data services in the context of ; a "youth" group ~ age-range, 25 and younger; and an "aged" group ~ age-range, 30 and over. This tendency to investigate two data sets is repeated in Arning & Ziefle (2007), who examined the difference in user acceptance of PDA technology using two age-range groups, 18 – 27 years and 50 – 69 years. While all four cited studies share the commonality of comparing two age-range data sets, this is where the similarities end, with each study defining "older" and "younger" as different age-ranges.

Even when authors identify multiple age-range data-sets, such as in Moffat *et al*., (2001) and Hess *et al*., (2005), commonality amongst the age-ranges utilised is not a given. Hess *et al*., (2005) identified six data-sets using a continuous age distribution scale; 20 to 29; 30 to 39; 40 to 49; 50 to 59; 60 to 69; and 70 to 83, to investigate age-related susceptibility to irrelevant information. Moffat *et al*., (2001), on the other hand, identified three age-ranges; "young", younger than 45; "middle", 45 to 65 years; and "old", older than 65; to examine age differences in users' spatial memory in navigating virtual environments. In another example, Lee, *et al*., (2007) identified four age-ranges; (19 to 28; 29 to 38; 39 to 48; and Over 49) in their examination of online shoppers.

With no firm framework to model the current research on, the choice of age-range distribution became driven by logical age-range clusters, grouped according to an academic, albeit assumed, typology;

- 18-23 y/o ~ users who are most likely to be studying a in the early stages of a postgraduate or their academic career;
- 24-29 y/o – users classified as having entered "mature age" status as university students, that is, not school-leavers, and studying a postgraduate;
- 30-35 y/o – users who have most likely chosen their discipline specialty and begun their PhD, as well as the group most likely to be P/T academics;
- 36-45 y/o; the group most likely to be at the height of their academic career;
- 46-55 y/o, the group most likely to have completed their PhD and providing guidance and mentorship to other academics.

Importantly, the choice of age distribution was not arbitrary, but was carefully considered in the context of probable demographic differences within the target user-group. Table 5.17 presents the age-range distribution of the user-group.

Table 5.17 The Age-Range of the User-group

[#25] (Registration Q4.4) Age group	%	#
18 – 23	12.5%	10
24 – 29	51.2%	41
30 – 35	10%	8
36 – 45	13.8%	11
46 – 55	12.5%	10
Total Respondents		80

Table 5.17 illustrates that the vast majority of users fell into the 24-29 age-range. It is important – when investigating whether age is a predictable variant in user-behaviour – that other differentiating factors are also considered. For example, the majority of 24-29 year olds also self-identified at "students" (*see 5.3.2 Academic Role*). If similar patterns were to be observed in this sub-group's information seeking behaviour, or perceptions of IQ, the researcher would need to investigate further to determine whether the behaviours are more likely because the sub-group are students, or whether their biological age is a stronger predeterminate of certain behaviours.

5.3.10 University Qualification

As part of their registration process, users were asked to record their highest completed university qualification. "Currently studying Undergraduate Degree" was included as an option as a safe-guard to ensure only academics and postgraduate students were included in the user-group. "Currently studying DBA" was included because some institutions allow this post-graduate level degree to be studied without a student having officially completed an undergraduate degree.

Table 5.18 Highest University Qualification

[#12] (Registration Q3.2) Highest *completed* university education level	%	#
Completed Undergrad	43.8%	35
Currently Undergrad	0%	0
Completed Post-grad	15%	12
Currently DBA	3.8%	3
Completed Masters	20%	16
Completed PhD	17.5%	14
Total Respondents		80

5.3.11 User Relevance Expectations in S.E. Query results

As part of the third survey (*i.e. ISB Survey*) which investigated user information seeking behaviour, users were asked to select which description best portrayed their perception of search engine results to their queries. Much of the TAM related research into user attitudes and adoption of technologies advocates that a user's expectation of a technology has a profound impact on how they interact with that technology (Petersen *et al.*, 2002; Staples *et al.*, 2002; Lindgaard & Dudek, 2003; Tesch *et al.*, 2005). Question 'ISB-Q.12' therefore, asked users to describe their perceptions of search engine results in relation to their relevance to the searcher's own query.

Table 5.19 illustrates that 13.7% of users feel the results contain web pages' relevant to their query, while 60% of users recognised that the results would likely contain content that matched their chosen keywords, inferring that the results could contain relevant content, but how relevant would need to be determined by the user. Interestingly, just over 26% of the users indicated that they entertained the possibility that the list of results to their search engine query could contain irrelevant results.

Table 5.19 User perceptions of the relevance of Search Engine results

[#62] (ISB Q12) ~ The list of results a search engine returns to your query represents?	%	#	
Links to the most relevant web pages to my query on the Internet	1.2%	1	→ Result WILL be relevant
A selection of links to web pages containing content relevant to my query	12.5%	10	
A selection of links to content that may or may not be relevant to my query	26.2%	21	→ Result MAY/MAYNOT be relevant
A selection of links to web pages containing content that match my chosen keywords	60%	48	→ Result MAY be relevant
Total Respondents		80	

From this data, three sub-groups were created:

1.) users who believe search engine results to their search query *will be relevant*;

2.) users who believe search engine results to their search query *may be relevant*;

3.) users who believe search engine results to their search query *may or may not be relevant*.

It should be noted, that the investigation of user expectations of their search query results cannot properly be examined in isolation from other group-case constructs identified in this chapter. According to Vroom's (1964) "expectancy theory", users' expectations of a given behaviour enjoy a complex relationship with such individual characteristics as their motivation to perform that behaviour (*addressed in* [Q#56]), their anticipated outcomes of the behaviour (*addressed in* [Q#64]), as well as their perceived self-efficacy regarding their ability to achieve the anticipated outcome. (*addressed in* [Q#65]). In this regard, Rappaport (2004) postulates that, provided the user anticipates a positive outcome for a behaviour, expectancy theory governs that the user will possess a higher motivation to perform that behaviour. Moreover, the user who attributes the positive outcome to their own "self", that is, has a high degree of *self-efficacy*, will possess an even higher motivation to perform that behaviour (Bem, 1972; Staw, 1976; Arnold, 1985) since they perceive to have a degree of control of the outcome.

A full investigation that would do justice to the intricate relationships between expectancy, attribution and self-efficacy, falls outside the scope of the PhD document, however – like the suggested deconstruction of the concept of "gender" (section 5.3.7) – the current data sets are expected to provide a rich opportunity for future research into these mechanisms of user technology adoption.

5.3.12 User Self Efficacy

Self-efficacy refers to the perception a user has of their own role in an outcome to a specific process or behaviour (Compeau *et al.*, 1999), and is considered to be an important motivational construct (Gist & Mitchell, 1992) in the adoption of specific user behaviours. In the current research it is used to measure the role the information searcher feels they play in a successful search/retrieval task. The user data demonstrates that 65% of the user-group attribute a successful search outcome to their own effective searching strategies. These users are considered to possess a high degree of self-efficacy. Users who selected variables such as the search engine or the information environment of the World Wide Web were deemed as attributing their success to something other than themselves. This group accounts for 35% of users. Table 5.20 illustrates how the researcher classified the two groups.

Table 5.20 User perceptions of their role in the information search/retrieval process

[#65] (ISB Q15) ~ A "successful" search outcome to a search engine query is the result of...	%	#	
good luck	0%	0	→ attributes to OTHER
a good search engine	13.8%	11	→ attributes to OTHER
my good searching strategies	65%	52	→ attributes to SELF
information environment of the WWW	21.2%	17	→ attributes to OTHER
Total Respondents		80	

5.3.13 Technical Vs Non-technical Searchers

Users were asked to describe in which circumstances they engage the more "technical" features associated with search engines. These include such features as links to "similar pages" (not included in the list of results); "cached" version of the target web page; and "more pages from…" (pages on the same domain as the result). Figure 5.1 displayed screen-captures of the types of additional features available at Google and Yahoo! to help users search for their target information.

Interestingly, even with such an experienced group of users, nearly a quarter of them had never used any of these additional features and links included with their list of search results. The purpose of this case (illustrated in Table 5.22) was to investigate whether users who did utilise technical type features had different IR behaviours and/or perceptions of IQ than users who did not. It was also seen as an opportunity to investigate which other user-characteristics (also classified into group-cases) may influence users' choice to engage technical features or not.

Table 5.21 Technical vs. non-technical searchers

[#59] (ISB Q.9) In what circumstances do you use the Cached/more from this site (yahoo) / Similar pages (Google) alternative feature?	%	#
I have never used the Cached / more... / Similar pages links	23.8%	19
If the title-link proved to be a good link, I may go back to the search engine (Google) and use the Similar pages link	10%	8
If I click-thru the title-link and I get a 404 type error I will go back to the S.E. and click-thru to the Cached version	57.5%	46
If the URL listed appears to have merit I may choose the more from this site link	8.8%	7
Total Respondents		80

nearly a quarter of users do not use SE features to help them search

76.2% of users (just over three quarters of users engage features such as "cached" or "similar pages" in a variety of circumstances.

5.3.14 Task/System Confidence

The task/system confidence of the user-group demonstrated itself to be extremely high, with 88.7% of the user-group stating they expect to find relevant information during search engine engagement, *most* or *all* of the time. The construct is seen as measuring users' perceptions of their ability to achieve a successful information outcome (in the case of the current research, the retrieval of quality information) through their search/query interaction with a Web-based search engine.

The concept of confidence is seen as being closely aligned with users' self-efficacy (Igbaria & Iivari, 1995; Agarwal & Karahanna, 2000), however a number of writers have recognised the distinction between a user's self-concept of their role and ability to perform a task, and their confidence that the system/technology is able to help them successfully complete that task.

In the context of the current research, user task/system confidence is seen as a separate construct to self-efficacy, and even "computer self-efficacy" (Compeau & Higgins, 1995) – described as an individual's perception of their ability to use technology to accomplish given tasks. While sometimes defined in the same terms as self-confidence, efficacy represents much more than a user's perception in their ability to perform a specific task. It also relates to other user cognitive behaviours such as attribution – the elements of an interaction that an individual credits with being responsible for success or failure (Stajkovic & Sommer, 2000). The task/system confidence group-case therefore, is seen as measuring users' expectations and attributions of successful information retrieval, and does not necessarily have to involve the user self-evaluating their own role in that success. Not withstanding this important delineation between self-efficacy, system/computer efficacy, and task/system confidence, the three constructs have much in common and are seen to heavily influence each other.

Table 5.22 User perceptions of how often they achieve "successful" search outcomes

[#64] (ISB Q14) How often do you expect to successfully find relevant information when utilising a Web search engine?	%	#	
every time	7.5%	6	→ very high confidence
most times	81.2%	65	→ high confidence
sometimes	11.2%	9	→ average confidence
rarely	0%	0	
Total Respondents		80	

It is hoped that by separating self-efficacy (who/how is responsible for success), and task/system confidence (how often is success) into separate group-cases, a little more can be learned about each construct, particularly in relation to their influence on the user perceptions associated with the TAM, presented in the following chapter.

5.4 Comparing Data between the "cases"

The development of the various "group-cases" presented thus far occurred at both the data design and data collation phases of the research. The pre-designed cases represent some of the more standard demographic sub-groups within a target user group, such as gender, age, experience levels and user roles. The evolving cases were ones that became apparent as the data was initially analysed for the purpose of its collation into data sets.

Whichever way a "case" came to be part of the research, it represents an attempt on the part of the researcher to let the data contexts speak for itself. To develop specific contexts in which to compare and contrast user results in order to (1) empirically test currently accepted theory; (2) add to current theory; and ultimately (3) develop new theory.

A methodology of constant-comparison has been adopted so that the same user data could be viewed and analysed in a variety of contexts, with the aim of developing a stronger understanding of (1) the variables in user information seeking behaviour; (2) user perceptions of information quality and (3) what role those perceptions might play in the variables in user information seeking behaviour.

A more detailed explanation of the driving methodologies of the current research are available in Chapter 3 (Research Methodology) and Chapter 4 (Research Design). The purpose of this chapter was to introduce the actual group-cases which have provided the contextual user-data for the various units of analysis discussed in the following three chapters. It should be stated that the group-cases chosen do not necessarily represent an exhaustive list of categories possible with the current user data. Indeed, with 10,080 separate pieces of data available in the research database, they may represent a relatively small cluster of user characteristics. Notwithstanding, the research goals have driven the choice of group-case construction, a schematic diagram of which is provided in the Research Design chapter (figure 4.7)

The following chapter will investigate user results in relation to the constructs of the OTAM (presented in the Literature Review) using twelve of the fourteen group-cases presented in this chapter.

CHAPTER 6

Results & Findings

User attitudes and perceptions of search engines & information retrieval on the WWW

6. Introduction

Presented in this chapter is an inductive investigation of the user-group's attitudes and perceptions of Web-based search engines using a TAM framework, in the context of twelve of the group-cases presented in the previous chapter.

6.1: The Technology Acceptance Model

The technology acceptance model (TAM) provides a framework for measuring a user-group's attitude towards specific technologies. Built on the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975), the TAM postulates that a user's attitude towards a technology profoundly impacts their intended interaction with that technology. Davis (1986, 1989) proposed that user attitude is regulated by two main constructs. Namely;

1.) Perceived Usefulness (PU); and
2.) Perceived Ease of Use (PEoU).

As a model for user information system adoption, the TAM has now been tested and extended by a multitude of researchers for some twenty years (Mathieson, 1991; Adams *et al*., 1992; Chau, 1996; Taylor & Todd, 1995; Lederer *et al.*, 1998; Agarwal & Jayesh, 1999; Dishaw & Strong, 1999; Teo *et al.*, 1999; Venkatesh & Davis, 2000; Moon & Kim, 2001; Brown *et al.*, 2002; Liaw & Huang, 2003; Shih, 2004; Burton-Jones & Hubona, 2005 & 2006; McFarland & Hamilton, 2006), which are discussed at length in the Literature Review chapter.

6.1.1 Current Research Context

In the context of the current research, TAM constructs were determined as a useful starting point for developing an initial general impression of the participants' attitudes towards Web-based search engines. By and large, the TAM is used in deductive research to *quantifiably* measure and predict users' intention to use an information system, based on their attitudes towards the system (Raghunathan, 1999; Lin & Lu, 2000; King & He, 2006; Kwon *et al.*, 2006). This presents two problems for the researcher. Firstly, the current research is an inductive investigation of user attitudes and perceptions in the context of their Web-based information retrieval; and secondly, the TAM was designed to test users' early adoption of various information technologies and systems (Kim & Malhotra, 2005; Wang *et al.*, 2006). Clearly, the current user-group does not fit into the early adoption category, with no single user possessing less than three years experience interacting with Web search engines.

In addressing the first issue, the research could best be defined as a mixed methodology with qualitative analysis of quantitative data, which the TAM provides in abundance. And, although still numbering in the very small minority, qualitative analysis is not completely foreign to TAM studies, with researcher – particularly of late – taking this approach (Gerrard *et al.*, 2006; Lin, 2006) in an effort to address the large number of TAM related studies that have merely served to replicate previous studies (Lee *et al.*, 2003; Benbasat & Barki, 2007) without producing anything significantly new (Bagozzi, 2007). The second issue highlights a generally accepted limitation of the TAM (Karahanna *et al.*, 1999; Bhattacherjee, 2001; Limayem *et al.*, 2003), that it requires a change in focus if being used to investigate continued technology/systems usage. Not withstanding these issues, the TAM still provides a researcher with useful, generalisable data regarding users' attitudes towards the technologies with which they engage. What follows is a broad qualitative analysis of various influencing factors on Web search engine attitudes of high-end information users.

6.2: TAM paradigm, measuring user attitudes towards Search Engines

As stated, the two major constructs of the TAM are (1) perceived usefulness; and (2) perceived ease of use. PU and PEoU were used to build two sets of twelve questions (six for each construct),to measure each user's general attitude towards;

1.) Information retrieval using Web-based search engines; and
2.) Retrieving high quality information from the World Wide Web.

Results were then placed together, so that each of the six elements (characteristics) of the PU and PEoU constructs was addressed twice, the ultimate score for which was averaged between the two results.

6.2.1 Perceived Usefulness and Perceive Ease of Use Questions

Within the PU construct, questions relating to such elements as search engine *results*, *effectiveness*, *productivity* and *speed* were addressed. Within the PEoU construct, questions relating to such elements as *task ease* (i.e.; find-ability and locate-ability), *clarity* and *flexibility* were addressed. Questions were all asked in the "positive", and a standard seven-point multiple choice (highly likely through highly unlikely) applied. Table 6.1 presents the questions asked in the TAM surveys and the constructs those questions were designed to measure.

Table 6.1: TAM (PU & PEoU) Questions for the current research

Construct		Question
PU	Survey #1:	Q1. Using the WWW would enable me to accomplish research related tasks more quickly
	Survey #2:	Q1. Using the WWW would enable me to locate quality information more quickly
	Survey #1:	Q2. Using the WWW would improve my research results and performance
	Survey #2:	Q2. Using the WWW would improve the quality of my research results
	Survey #1:	Q3. Using the WWW would increase my productivity
	Survey #2:	Q3. Using the WWW would make me more productive
	Survey #1:	Q4. Using the WWW would enhance my effectiveness as a researcher
	Survey #2:	Q4. Using the WWW would enhance my ability to find quality information
	Survey #1:	Q5. Using the WWW would make it easier for me to do my research
	Survey #2:	Q5. Using the WWW would make it easier for me to find quality information
	Survey #1:	Q6. I would find access to the WWW useful for my research
	Survey #2:	Q6. I would find access to the WWW useful for retrieving quality information
PEoU	Survey #1:	Q7. Learning to find information on the WWW would be easy for me
	Survey #2:	Q7. Learning to find quality information on the WWW would be easy for me
	Survey #1:	Q8. I would find it easy to locate information I am looking for on the WWW
	Survey #2:	Q8. I would find it easy to locate quality information from non-quality information as I search on the WWW
	Survey #1:	Q9. My interactions with information on WWW Websites would be clear and understandable
	Survey #2:	Q9. The steps necessary to select quality info from search results would be clear and understandable
	Survey #1:	Q10. I would find the WWW flexible to interact with
	Survey #2:	Q10. I would find the WWW flexible when locating the type of information I am looking for
	Survey #1:	Q11. It would be easy for me to become skillful at using the WWW
	Survey #2:	Q11. It would be easy for me to learn how to find quality information on the WWW
	Survey #1:	Q12. I would find WWW technologies easy to use
	Survey #2:	Q12. I would find searching for quality information easy to do

6.2.2 Measuring the Elements of the TAM's Constructs

Each element's score was determined by averaging results to both questions relating to the specific element being tested. Once results began to be analysed however, it became clear to the researcher, that the elements of the PU and PEoU constructs contained their own ambiguity regarding which construct was being tested. Amongst the PU questions, for example, was the question "*Using the WWW would make it easier for me to do my research*". This question was asked in the context of easy accessibility to search engines being perceived by a user as being useful. So, although this was clearly a question asking directly about PEoU, the context, and therefore measurement was PU.

This ambiguity of the TAM's constructs is both a weakness and strength of the model. There are many user attitude constructs that can, and do, exist in their own right, which can be explained or classified as PU and/or PEoU. Examples of this include the social normative element, which could be classified within the PU construct, and perceived enjoyment (PE) elements, classified within the PEoU construct.

In order to determine what attitudes were actually being measured, the researcher went back to the drawing-board and developed a mind-map of each element. PU elements became labelled as measuring a user's perception of the "*effectiveness*" of an action, PEoU was labelled as measuring a user's perception of the "*easiness*" of an action, and a third construct relating to "*processes*" was classified, which measured a user's perception of the understandability and repeatability; that is; *predictability*, of an action.

The elements identified in Figure 6.1 became a guide for clustering user-results into three specific constructs. It should be stated here however, that each classification still possesses a degree of ambiguity in that some elements being tested could fall into more than one construct. For example; "*easy (to apply)*" could be included as either an "easiness" or a "processes" element, because it could refer to either the easiness or repeatability of an action.

Table 6.2 presents the questions in the context of the mind-map's constructs and the elements determined to be being measured by each question. Effectiveness and easiness were once again classified as PU and PEoU respectively, and process related elements were classified as Perception of Interaction (PoI).

Figure 6.1: A mind-map of the elements being measured by the TAM constructs

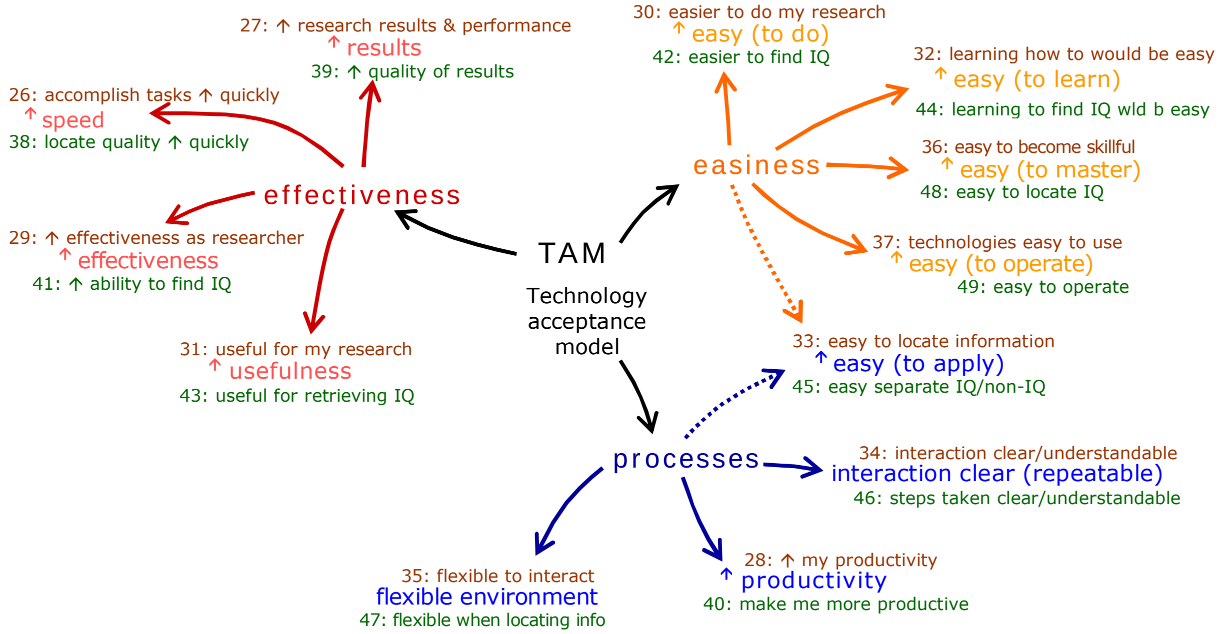


Table 6.2: TAM Constructs being measured by the current research

TAM Construct	Mind-map classification	Element being measured		Question
PU	*effectiveness*	Speed	Survey #1:	Q1. Using the WWW would enable me to accomplish research related tasks more quickly
			Survey #2:	Q1. Using the WWW would enable me to locate quality information more quickly
		Results	Survey #1:	Q2. Using the WWW would improve my research results and performance
			Survey #2:	Q2. Using the WWW would improve the quality of my research results
		Effectiveness	Survey #1:	Q4. Using the WWW would enhance my effectiveness as a researcher
			Survey #2:	Q4. Using the WWW would enhance my ability to find quality information
		Usefulness	Survey #1:	Q6. I would find access to the WWW useful for my research
			Survey #2:	Q6. I would find access to the WWW useful for retrieving quality information
PEoU	*easiness*	Easy (to do)	Survey #1:	Q5. Using the WWW would make it easier for me to do my research
			Survey #2:	Q5. Using the WWW would make it easier for me to find quality information
		Easy (to learn)	Survey #1:	Q7. Learning to find information on the WWW would be easy for me
			Survey #2:	Q7. Learning to find quality information on the WWW would be easy for me
		Easy (to apply)*	Survey #1:	Q8. I would find it easy to locate information I am looking for on the WWW
			Survey #2:	Q8. I would find it easy to locate quality information from non-quality information as I search on the WWW
		Easy (to master)	Survey #1:	Q11. It would be easy for me to become skillful at using the WWW
			Survey #2:	Q11. It would be easy for me to learn how to find quality information on the WWW
		Easy (to operate)	Survey #1:	Q12. I would find WWW technologies easy to use
			Survey #2:	Q12. I would find searching for quality information easy to do
PoI	*Process*	Productivity	Survey #1:	Q3. Using the WWW would increase my productivity
			Survey #2:	Q3. Using the WWW would make me more productive
		Interaction Clarity	Survey #1:	Q9. My interactions with information on WWW Websites would be clear and understandable
			Survey #2:	Q9. The steps necessary to select quality info from search results would be clear and understandable
		Interaction Flexible	Survey #1:	Q10. I would find the WWW flexible to interact with
			Survey #2:	Q10. I would find the WWW flexible when locating the type of information I am looking for

* note: PU: Easy (to apply) was ultimately moved into the PoI construct, becoming PoI: Easy (to apply).

6.3 Representing TAM Results numerically

Generally speaking, data analysis of the TAM surveys is designed to follow a quantitative methodology, where standard statistical analysis methods are employed and tools such as Cronbach scales are used to test validity of results. The over-riding objective being, to develop a valid picture of the relationships between the constructs being measured, in order to statistically predict a user group's intent regarding technology adoption.

Given that: (1) the current research was designed not so much to predict user adoption of search engines but to investigate how users generally feel about their continuing utilisation of search engine technology; and (2) the investigation is inductive in approach; a way had to be developed to able to relatively compare and contrast user results. The initial recording of a "positive" result if users selected "highly likely", "quite likely" or "likely" for their responses did not separate the results enough. Moreover, a method for separating results such as (25% = "highly likely" + 75% = "quite likely") from (50% = "highly likely" + 50% = "quite likely") was required. To that end, a method for designating a numerical value for specific results was devised in order to separate close results, the purpose of which was to enable the researcher to more accurately compare those results.

In the process of developing a method which attributed a single numerical value to each result, a number of assumptions were made of the participant results. Firstly, because all questions were asked in the *positive*, a result of "neither likely or unlikely" was considered a non-positive result. Secondly, because of the user group's relatively high level of experience with search engines, results were expected to be generally very high, which led to the third assumption, that the weighting of a negative formula to a "neither likely or unlikely" result would be a reasonable method to create a greater range in survey results.

Figure 6.2 illustrates how the percentage results to each TAM question were put through a weighting multiplication formula in order to arrive at a numerical value for the result. In this case, "*using the WWW would enable me to accomplish research related tasks more quickly*" was attributed a score of 12.31.

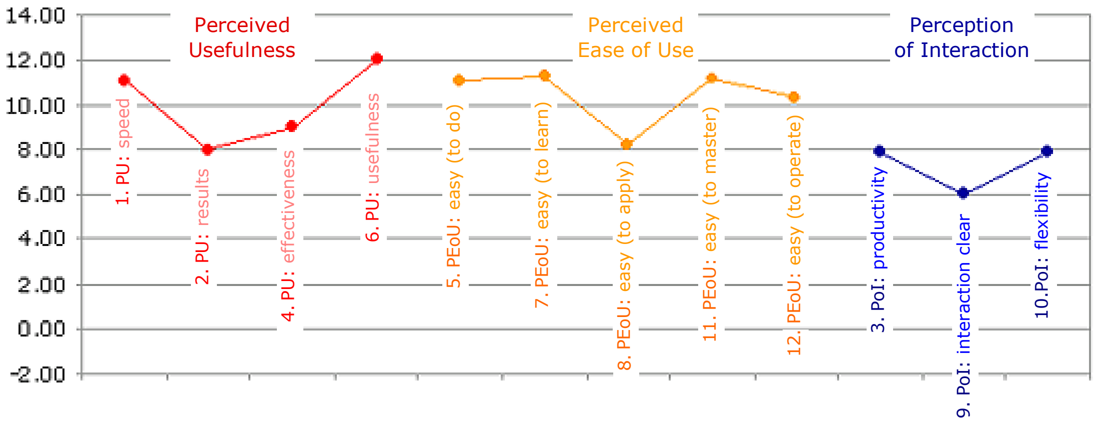
Table 6.3: Numerical handling of TAM results for "relative" comparison

26. *1-[PU]:* Using the World-wide web would enable me to accomplish research related tasks more quickly	Responses %	#	Value	Weighting
Extremely Likely	56.2%	45	8.43	← % x 15
Quite Likely	37.5%	30	3.75	← % x 10
Slightly Likely	5%	4	0.25	← % x 5
Neither	0%	0	0	← % x -5
Slightly Unlikely	1.2%	1	-0.12	← % x -10
Quite Unlikely	0%	0	0	← % x -15
Extremely Unlikely	0%	0	0	← % x -20
Total Respondents		80	12.31	← Result

Using this formula, a maximum score for any survey question was 15.00, which could only be attained if 100% of users selected "extremely likely". Figure 6.4a illustrates the TAM relative results for the whole user-group after the numerical formula has been applied. Results have been clustered into the three perception constructs identified in the mind-map (fig 6.1) and Table 6.2, with the question number displayed for clarity.

Figure 6.3a: TAM relative results

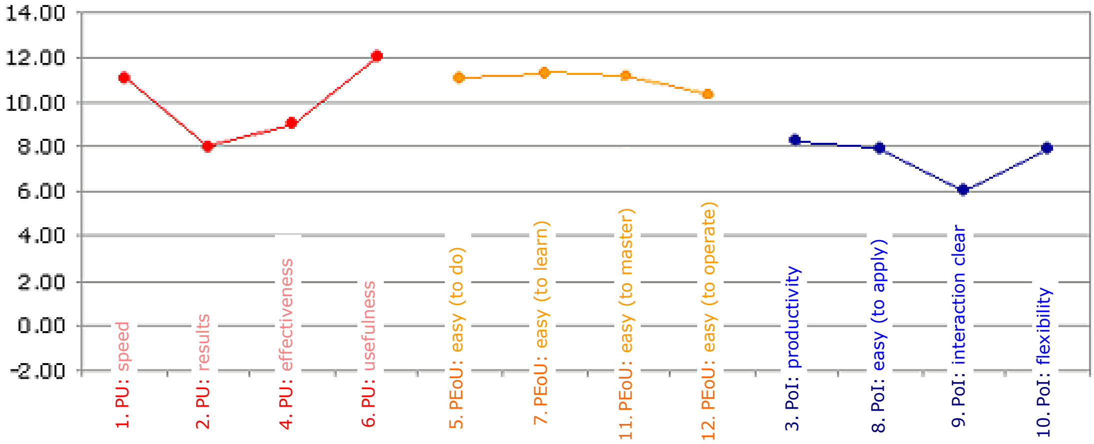
Perceptions of quality information retrieval using Web search engines (whole user group)



Of interest is that the interactive type perceptions, which related to the predictability or repeatability of search-engine interactive outcomes, consistently produced the lowest results. Moreover, this pattern is reinforced when the two lowest PU and PEoU results are examined more closely. *Q2.PU: expected S.E. results*, and *Q8.PEoU: easy to apply action to new information tasks*, could be seen as measuring something of the predictability or repeatability of an interactive information retrieval session. These elements consistently returned lower results in most sub-groups within the user group. Ultimately, it was decided to re-classify the "*PEoU: easy (to apply)*" element into the PoI construct, because of its association with predicting ongoing interaction (or application). The "PU: results" element was left within the PU construct because it was seen to be asking for user perceptions regarding the predictability of an outcome, rather than the predictability of a process. Figure 6.4b illustrates the final (whole group) results to the TAM questionnaires using the numerical formula.

Figure 6.3b: TAM relative results

Perceptions of quality information retrieval using Web search engines (whole user group)



6.4 External Variables & Individual Differences

Many of the foundational concepts of the TAM and TRA models are found in the field of social psychology (Succi & Walter, 1999; Harris, 2003). Over various evolving states (Lee *et al.*, 2003) the TAM, in particular, has been tested and extended with various other constructs as a way of both reckoning whether PU and PEoU tell the entire story of user technology adoption, as well as to determine if other constructs might act as antecedents to PU and PEoU. Clearly, that the model has been tested so extensively adds to its rigor, yet also serves to highlight that researchers continue to feel uncomfortable with the notion that PU and PEoU represent an adequate description of the motivating factors for user adoption, or continued use, of technology. Moreover, what Davis categorised as "external variables" in the original TAM (1986, 1989) has served as a fertile ground for many writers investigating whether such variables should serve as (1) determining influences on user PU and PEoU; or whether (2) they are themselves TAM-like constructs.

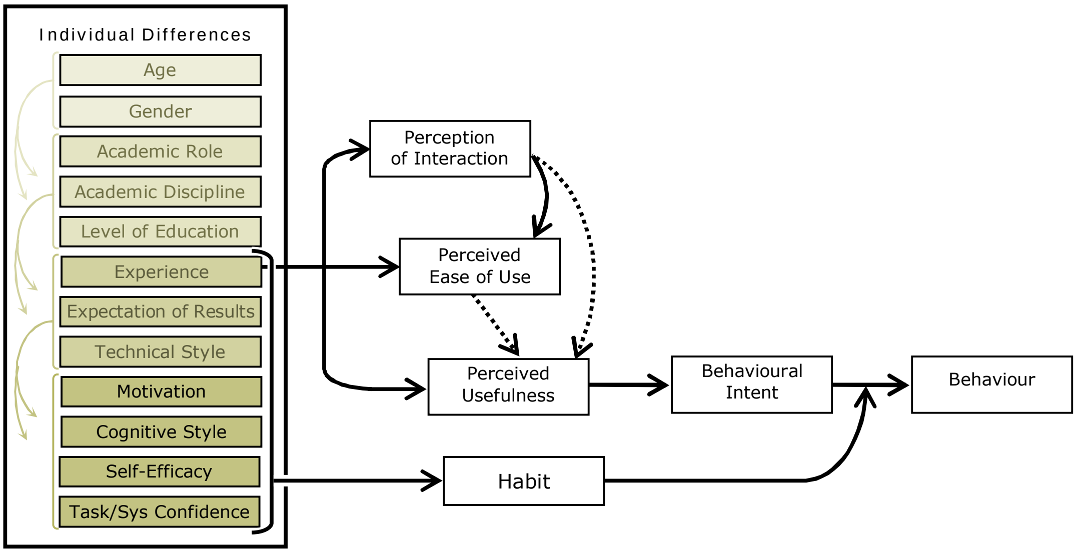
The current research understands these external variables as motivating factors that influence PU and PEoU, while adding PoI as a construct affecting user attitude in an "on-going usage" sense, rather than "adoption" sense. These external variables are seen as also influencing this new construct, PoI. The research also separates "external variables" into those variables that relate to the individual users; that is; "*individual differences*", and variables that relate to system or environmental characteristics. For research findings to attain a degree of validity, external variables such as the system or technology being tested, or the user-tasks and interaction with the system, need to be as similar in scope as possible. In the case of the current research, the user-group was chosen from "high-end" information users, the system is search-engine interaction with the World Wide Web, and the user-task is the retrieval of high-quality information. TAM-type question surveys were designed in order to develop a picture of the user-group's general perceptions and attitudes towards search engines and the task of retrieving quality information, as opposed to how they might feel about a specific *imposed* search task. Individual user-characteristics (labeled "individual differences") were then identified within the whole user-group in order to see which, if any, of those characteristics might influence the TAM constructs of PU, PEoU and PoI.

Figure 6.4 illustrates the various individual characteristics that were identified as existing within the whole user-group. The list does not represent all possible sub-groups within the whole group, but were selected for the TAM comparative investigation because they represent;

1.) Some of the more common external variables used in previous TAM research;
2.) User characteristics that the researcher expected may have an influence on the TAM constructs.

Selecting individual difference variables that had been investigated in previous research, such as: age (Liu *et al.*, 2000; Arning & Ziefle, 2007); gender (Gefen & Straub, 1997; Agarwal & Prasad, 1999; Venkatesh & Morris, 2000; Venkatesh *et al.*, 2004); level of education (Chuang & Chuang, 2002; Burton-Jones & Hubona, 2005); experience (Taylor & Todd, 1995; Gefen, 2003); motivation (Chung & Tan, 2004; Yi *et al.*, 2006); cognitive style (Rapp *et al.*, 2003); and self-efficacy (Chau, 2001; McFarland & Hamilton, 2006) provided a sound method for testing the validity of results. Selecting other, more research specific characteristics, such as; academic role; academic discipline; expectations of search engine results; user technical style; and user task/system confidence; provided the chance to explore and develop new theory regarding how these sporadically researched characteristics might act as influences on TAM results. The theoretical underpinnings and relationships between the proposed constructs in figure 6.4 are developed in greater detail in Chapter 2 (*Literature Review*) and Chapter 4 (*Research Design*). In keeping with an inductive investigative approach, the proposed model illustrated in figure 5.6 was developed during the process of data analysis and literature/theory constant-comparisons.

Figure 6.4: Individual Differences influences on 'on-going TAM' constructs (context of the current research)



The individual differences listed in figure 6.4 were examined for variations in TAM results. In keeping with the analysis strategy illustrated in figure 4.7 (*Research Design chapter*), each individual difference is referred to as a "group-case", and the divisions within the group-case are referred to a sub-groups. For example, the "User-Experience" group-case is represented by the sub-groups; (1) users with 3-5 years experience using search engines; (2) users with 5-8 years experience using search engines; (3) users with 9-12 years experience using search engines; and (4) users with 12 (or more) years experience using search engines.

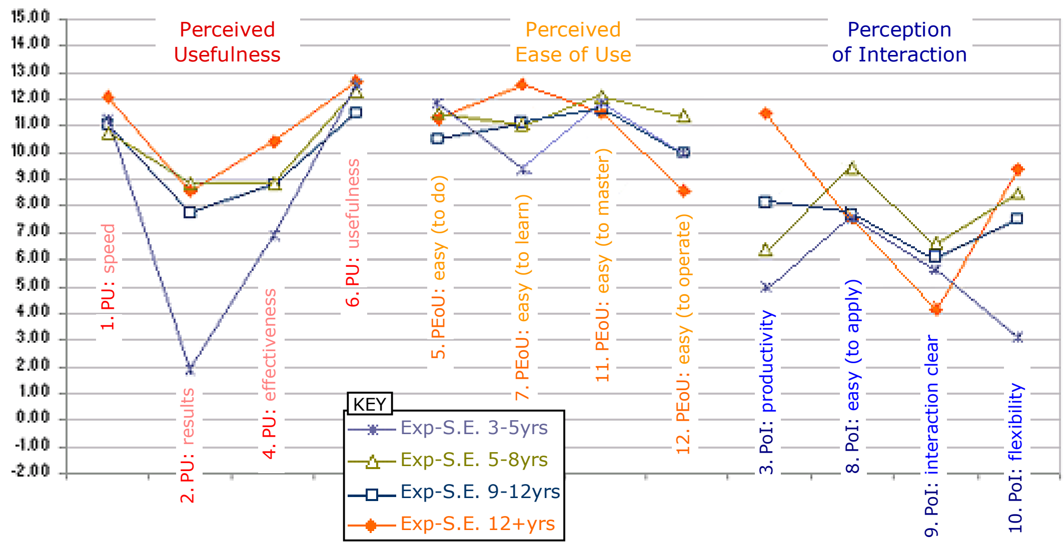
The method of observation and analysis will be presented as follows. Each group-case will be discussed in context of its internal results to the proposed TAM constructs; PU, PEoU, and PoI, with observations and some initial findings presented. Because it is entirely possible that one group-case may prove to have an affective relationship with another group-case, internal results within a group-case may also be examined and discussed in the context of other sub-group's results. Limitations will also be discussed, as they are encountered, within the context of each initial group-case discussion. Importantly, to keep the observations and discussion cognitively flowing, and to prevent the researcher becoming bogged-down in one early “finding”, extensive analysis regarding the observations and findings takes place in Chapter 8.

6.4.1 User Experience & TAM Results

User Experience: Observations & Discussion

As initially expected, the sub-group with the most divergent results between its members were the users with the least experience using search engines. Interestingly, the group with the most experience, returned the second most divergent results. A possible explanation for this apparent contradiction could relate to the sub-group sizes, with both groups representing relatively small samples of the whole group. That is; 3-5 years experience being just 5% of the whole group, and 12+ years experience being 15% of the whole group. Given their small representation of the whole group, the researcher would advise caution against developing theory from this sample. Not withstanding, the two sub-groups with healthy over-all user population representation, i.e. 5-8 years (at 35%) and 9-12 years (at 45%) demonstrate little variance in PU and PEoU results.

Figure 6.5: User-Experience (group-case) results for TAM constructs



“User Experience” group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Range in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
12+yrs experience [12 users] 15%	10.94*	10.94	8.13*	10.00*
9-12yrs [36 users] 45%	9.77^	10.80	7.36	9.31
5-8yrs [28 users] 35%	10.18	11.52*	7.74	9.81
3-5yrs [4 users] 5%	8.13	10.79^	5.32^	8.08^
Average Range	3.28	2.00	4.28	3.18

Apart from the "PU:results" scores (derived from questions relating to an anticipated improvement in research performance and quality), the elements of the PoI construct represent both the lowest scores and greatest divergence in sub-group results. This is consistent with the whole user-group results for PoI, which suggest that the greatest dissonance issue facing Web search engine users remains search engine unpredictability. Moreover, this issue does not seem to dissipate over time, even as the user gains more experience using the system.

As an element of the PoI construct, user perceptions relating to improved productivity, seem to be directly influenced by a user's years of experience, the more years of experience, the higher the perception that search engine usage would improve the user's productivity in regards to information retrieval. Interestingly, the most experienced sub-group, who stated their productivity would improve the most, gave the lowest score regarding the clarity of the very interactions they expected to improve their productivity. This apparent contradiction would suggest that one of the results of increased experience with a system is a greater tolerance for any cognitive dissonance associated with system interaction.

User Experience: Some Findings

The level of experience has a direct effect on users' perception of their potential productivity when engaging search engines. The more experience, the greater the belief – on the part of the user – that their search engine engagement will be productive. This finding is repeated in the *PEoU: easy to learn* results, which also demonstrates a direct relationship with years of experience – the more experienced the user, the easier they would find to learn the strategies and interactive steps required for effective search engine based information retrieval. Of interest then, is the apparent contradiction between these perceptions and users' perceptions regarding the consistency and predictability of these interactions.

Overall, *user-experience* ranked fourth highest in divergence within its' sub-group results, with perceived usefulness and perception of interaction showing the greatest variety of responses for this case. This suggests that user experience has a significant influence on users' attitude towards the system. This is in line with previous research findings (Taylor & Todd, 1995; Agarwal & Prasad, 1999; Fusilier & Durlabhji, 2005; Lee *et al.*, 2007) that indicates previous exposure to a system, or relative system, is likely to have a positive influence on the constructs measured in the TAM, particularly in relation to PU (Chang *et al.*, 2005), albeit at times, indirectly through increased user self-efficacy (McFarland & Hamilton, 2006).

User Experience: Limitations

The researcher sees two significant limitations governing any findings regarding this case-group. Firstly, level of experience was established by asking users how many years they had engaged search engines. That is; "how long". This does not establish "how often", which it could be argued is also an important indicator of user level of experience. The second limitation relates to the small number of representative users in the least experienced sub-group of 3-5 years experience. Given that the user-group profile was post-graduate, research and lecturer academics however, it may be difficult to actually find individuals with less than 5 years search engine experience.

6.4.2 User Role & TAM Results

User Role: Observations & Discussion

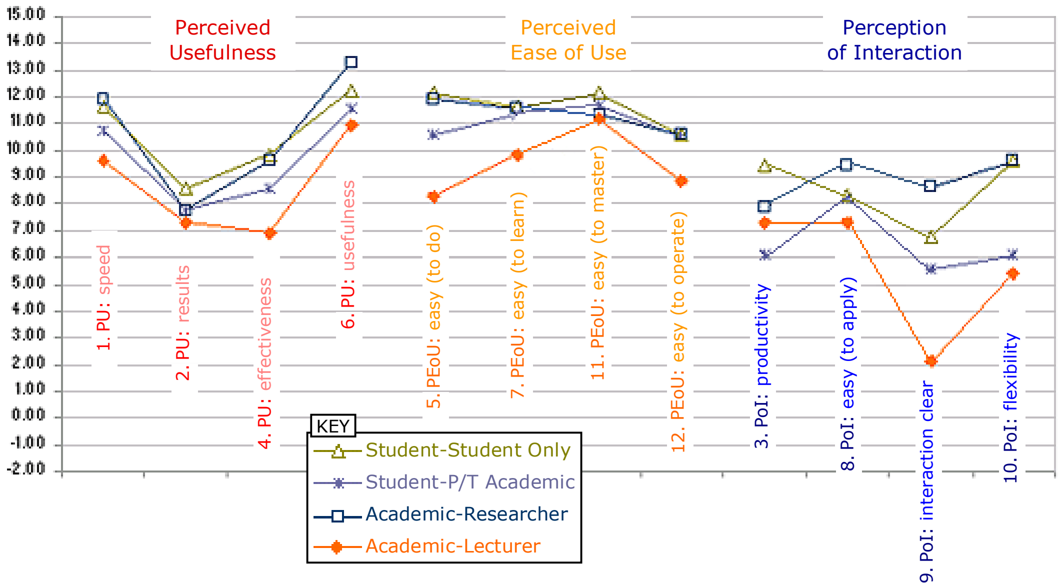
User academic-role ranks eighth (out of twelve) for variance in the TAM sub-groups results. While, at a superficial level, this would suggest academic role as having an insignificant influence on behavioural intention (BI) to use search engines, of interest is that it is the "academic-lecture" sub-group that causes the majority of this divergence, particularly in relation to PEoU and PoI constructs. In fact, apart from *PoI: productivity*, the academic-lecturer sub-group consistently returns the lowest results for all the TAM questions. An explanation was sought by the researcher for this phenomenon, and it was found that more than half (7 out of 13) of the academic-lecture group fell into the 46-55 age range. This age range returned the lowest results in the "Age-Range" group-case, illustrated in figure 6.11, particularly for PEoU and PoI results. Removing the seven 46-55 age-range users from the academic-lecturers sub-group drastically changed their results; bringing them significantly closer into line with the other academic-role sub-groups. It also however, changed their PU results in the negative. That is; PU results for the academic-lecturer subgroup *dropped* once the seven 46-55 age-range users were removed. This could prove to be a significant finding for two reasons:

1.) Previous TAM research (Davis *et al*., 1989; Chau, 2001) asserts that PU has the greatest affective relationship on users' BI to use a system; and

2.) If younger academic-lecturers demonstrate poor results relating to the "usefulness" of information retrieval from the World Wide Web, then it implores further investigation relating to this phenomenon's impact on university teaching and learning practices.

The most divergent results for the group-case "academic role" came in the PoI sub-constructs, which is consistent with the results for the whole user-group.

Figure 6.6: Academic Role (group-case) results for TAM constructs



"Academic Role" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results PU	 PEoU	 PoI	 TAM (all)
Whole Group	10.02	10.93	7.51	9.49
Acd-Researcher [13 users] 16.2%	10.63*	11.35	8.90*	10.30*
Stud-Stud Only [31 users] 38.8%	10.57	11.64*	8.53	10.25
Stud-P/T Acd [23 users] 28.8%	9.65	11.03	6.47	9.05
Acd-Lecturer [13 users] 16.2%	8.71^	9.52^	5.53^	7.92^
Average Range	2.19	2.12	4.06	2.79

User Role: Some Findings

The divergence in results between the academic role sub-groups follow relatively similar patterns, suggesting that a user's academic role does have a slight impact on their perception of the PU, PEoU and PoI of search engines, however, the researcher has noted there appears to be a strong correlation (measured statistically) between the academic role and age-range group cases;

- 70% of academic lectures fall into the 46-55 age-range;

- 75% of academic researchers fall into the 30-35 age-range;
- 43.9% of students who are also P/T academics are aged 24-29; and
- 80% of full-time postgraduate students are in the 18-23 age-range.

Given that the Age-Range group-case ranks third highest for divergence in results, it is likely that at least some of the variance in the academic role sub-groups are caused by the age-range of the participants. For this reason, academic role is seen as having little influence on TAM construct results, however, a relationship between participant age and role is proposed.

User Role: Limitations

It is acknowledged that the very strong relationship between participant age and their academic role has, in all likelihood, skewed the academic role group-case results. Further investigation of this relationship is necessary before sturdy findings relating to user academic role and search engine attitudes can be established.

6.4.3 User Cognitive style & TAM Results

Cognitive Style: Observations & Discussion

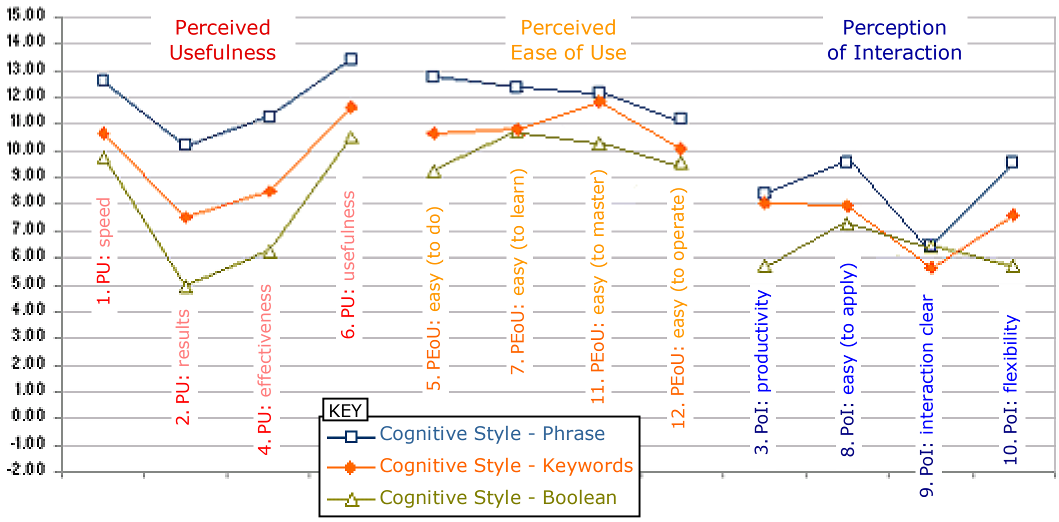
Cognitive Style, as it pertains to users' preferred strategies in search engine queries, ranks sixth (out of twelve) for its variance in sub-group results. Phrase searchers exclusively scored higher than keywords and boolean searchers, with boolean searchers usually scoring the lowest. Significantly, even though boolean searchers scored every other perception element lowest, their *PoI:clarity of interaction* perception scored the highest of the sub-groups. This is consistent with a boolean searcher's strategy of gaining greater control through manipulating search query interaction with the use of boolean tactics, supporting Chen *et al.*, (2004) and (Graff, 2003), who found that users' cognitive styles significantly influences their information interaction – in terms of user control – within the system interface.

Of particular interest to the researcher is cognitive style's impact on the PU construct, which ranked third highest, behind the *task/system confidence* and *academic discipline* group-cases. The pattern of influence is also highly consistent (except for *PoI:clarity of interaction*) across all three of the TAM constructs measured.

Cognitive Style: Some Findings

In light of previous TAM research findings that PU is the strongest precursor to technology adoption and use (Davis *et al.*, 1989; Chau, 2001) the impact of cognitive style on user attitudes towards search engines should not be understated. Specifically, the concept of users' cognitive style has been extensively researched in the various fields associated with information seeking and retrieval behaviours (Moss & Hale, 1999; Kim, 1999; Palmquist & Kim, 2000; Palmquist, 2001; Ford *et al*, 2002; Chen *et al.*, 2004), and has been linked with other user characteristics, such as gender (Ford & Miller, 1996; Ong & Lai, 2006) and perceived systems performance (Workman, 2004). The considered importance of users' cognitive style in user/information-interaction is reflected in its presence in the information seeking behaviour (ISB) theoretical model (Knight & Spink, 2008) proposed in Section 2.2.10 of Chapter 2 (*Literature Review*), and illustrated in figure 2.27.

Figure 6.7: Cognitive Style (group-case) results for TAM constructs



"Cognitive Style" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
Phrase [22 users] 27.5%	11.88*	12.11*	8.50*	10.83*
Keywords [48 users] 60%	9.59	10.84	7.31	9.24
Boolean [10 users] 12.5%	7.88^	9.94^	6.31^	8.04^
Average Range	4.00	2.29	2.42	2.90

The intrinsic nature of the cognitive style user characteristic (Joughin, 1992), as opposed to external variables such as a user's research discipline, is seen in the current research, as lending itself to the finding that it plays a significant attitudinal role in search engine adoption and use. This is particularly true in relation to its influence on the PU construct, where it ranks third highest out of all twelve group-case clusters.

Cognitive Style, as a construct, has presented problems for TAM researchers, firstly in relation to Davis' broad-brushstroke of "individual differences" (Davis, 1986, 1989) influencing construct, and secondly in relation to the TRA's separation of the "affective" and "cognitive" as distinct constructs (Fishbein, 1967), where the affective alone is said to influence "attitude" (Agarwal & Prasad, 1999). At a conceptual level, *attitude* is said to underlie the TRA (Fishbein & Ajzen, 1975) and subsequent TAM, leaving a gap in both models, which postulate that cognition is linked not to attitude, but to belief, through that which is learned. Of interest then, is that the TAM results indicate cognitive style has its most consistent influence on the PU construct. Pajares (1997) describes learned behaviours as those that occur when an acted, or observed (vicarious learning) behaviour produce a valued result, which motivates an individual to adopt and repeat the behaviour. Conceptually, this is very close to the TAMs perceived usefulness construct. Providing evidence then, that (1) choice of query strategies are – in all likelihood – closely aligned with a user's pre-existing cognitive style, and (2) cognitive style has a direct relationship with perceived usefulness through users perception of the effectiveness of their preferred strategy.

Cognitive Style: Limitations

The obvious limitation of the cognitive style classification is the limited amount of data used to create the construct in the first place. As part of a study investigating a multitude of user characteristics however, the researcher required a wide variety of possible classification tools in order to develop a broad indication of possible antecedents to user search engine attitudes. In this context, initial user query strategies are not seen as representing the whole story of cognitive style per se, but rather as a representation of a cognitive variance in the user-group, most likely to be caused by a user's cognitive style. An association supported in the reviewed literature (Nahl & Tenopir, 1996; Moss & Hale, 1999; Ford, 2000; Graff, 2003; Chen *et al.*, 2004).

6.4.4 User Motivation & TAM Results (Motivated, obliged and unmotivated users)

Motivation: Observations & Discussion

In the context of the research, motivation is representative of the broad reason a user chooses to engage a search engine as opposed to other information retrieval tools. In other words, the motivation is not the actual information purpose or goal for which a search engine is used, but the motivating factors behind *why* users chose internet search engines as another information search and retrieval tool.

Ranking fifth overall in its sub-group results variations, statistically speaking, motivation ranks as having a lower impact on user attitudes than such group-cases as academic discipline, age-range, and user experience. It ranks fourth however, for the original two constructs (PU and PEoU) and, when it is examined more closely, shows itself to rank higher than user experience and age-range for PU, and higher than user experience in PEoU.

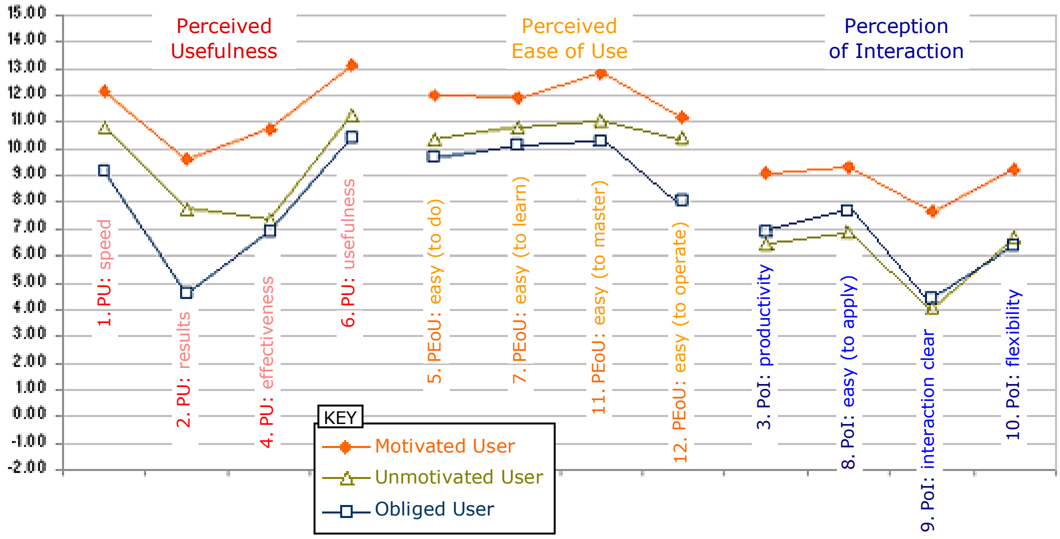
Motivation: Some Findings

As expected, motivated users; that is; those users who engage search engines because they find them to be a highly effective information retrieval tool, returned the highest results for all the TAM constructs within this group-case (Davis *et al*., 1992). These results validate the constructed group-case itself, which overtly measures users general attitude towards search engines. Teo *et al*. (1999), in fact, describe extrinsic motivation and "perceived usefulness" as one and the same. The antecedents to the general attitude then, i.e.; users individual results to each sub-construct/element being investigated, are consistent with users feeling motivated, unmotivated or obliged to use search engines.

Significantly, so called "unmotivated" users return higher results for the PU and PEoU constructs than obliged users. This too, was to be expected. Firstly, given the *passive* role this sub-group of users perceive they play in their interaction with the system, and secondly, the previous TAM research (Taylor & Todd, 1995; Venkatesh & Davis, 2000) that demonstrates users who feel obliged to use a system require positive subjective norm antecedents in order for their PU and PEoU results to reflect a positive attitude towards that system. It should be noted that the terms *unmotivated* and *passive* are used to describe a user whose choice to use search engines is not actively made.

That is; the engagement is the result of previously formed behaviours, or *habit*. The research by Verplanken *et al.*, (1998) into the role of habit versus planned (or intended) behaviour purports that once a behaviour is habitually strong, users rely on their habit to a greater degree than conscious choice strategies. Furthermore, from experiments conducted, the authors conclude that even when the process of choice is externally manipulated, it does not over-ride the effect of habit. Gefen's (2003) research supports this conclusion, finding that once "*specific IT behaviour become routine habit,* [it] . . *should become a primary predictor of use*" (2003, p3).

Figure 6.8: Motivation to use S.E. (group-case) results for TAM constructs



"User Motivation" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
Motivated [40 users] 50%	11.41*	11.99*	8.83*	10.74*
Unmotivated [22 users] 27.5%	9.29	10.66	6.05^	8.66
Obliged [18 users] 22.5%	7.77^	9.55^	6.35	7.89^
Average Range	3.64	2.44	2.74	2.94

The results for *User Motivation* group-case support the notion that *habit* has a stronger influence on users attitude toward search engine use than obligation does. As it stands then, the lower PU and PEoU results for obliged users not only validates the "user motivation" group-case classification through confirmation of previous research results (Verplanken *et al.*, 1998; Limayem *et al.*, 2001; Gefen, 2003), but begins to provide evidence that PoI construct – which does not simply replicate previous results – is, in fact, measuring a different type of attitudinal interaction with the system than PU and PEoU. Three of the four PoI sub-constructs tested are the only elements to return a more positive result for obliged users than unmotivated users.

Motivation: Limitations

The researcher sees no practicable limitations in the user-motivation classified group-case. Each sub-group is of a reasonable size; the question used to classify the case-group was clear and valid, developed within Triandis' (1980) construct description of habit as including an individual's "judgments of the likelihood that a behavior will take place in different kinds of situations" and avoiding using "prior experience" as it's chief indicator (Ajzen, 2002; Davidov, 2007). In addition, the over-all results provide strong evidence for the inclusion of the PoI construct into an "on-going" technology acceptance model.

Conceptually however, the findings related to the possible influence of "habit" on user attitudes are, in all likelihood, understated. Here-in lies the weakness of any user-survey related data. That a user states they use search engines because they find them to be highly effective at retrieving information from the Web does not mean they do not use search engines habitually. In other words, a user could engage search engines by habit, yet still have the opinion that they are highly effective. In addition, user-survey data relies on its participants clearly understanding a researcher's questions, as well as accurate self-evaluation. In addressing the possible issues relating to user self-reported distortions, particularly in relation to a construct as abstract as "habit", Triandis (1980) advocates that surveys can be built in such a way that several measures converge, so that a more accurate picture of a construct can emerge. Habit, while not initially identified as an important construct in the current research, was found to be an emerging affective construct in users ongoing search engine interaction.

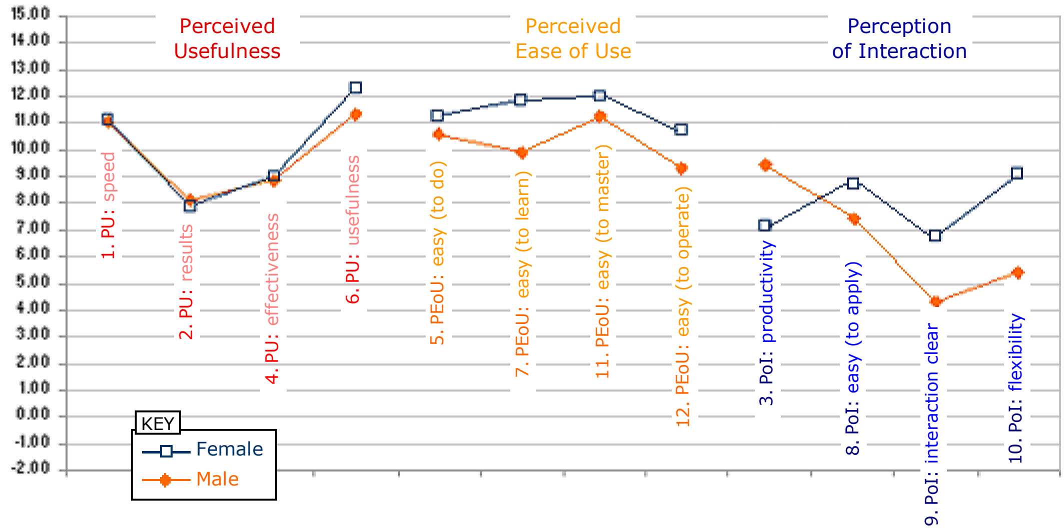
6.4.5 Gender

Gender: Observations & Discussion

A number of studies in both TAM and ISB (Gefen & Straub, 1997; Teo *et al.*, 1999; Venkatesh & Morris, 2000; Ford, 2004; Gerrard, 2006) has investigated possible gender-based differences in human/computer interaction (HCI), based mostly on the supposition that – generally speaking – men and women process information differently.

The results in the current research shows little to no variance between gender results for PU, said to be the major influencing factor on BI to use a system (Davis *et al*., 1989; Liu & Ma, 2006; Benbasat & Barki, 2007). What small variance there is, is consistent with Gefen & Straub's (1997) findings that women would give a higher value to PU sub-constructs than men; but is inconsistent with Venkatesh & Morris (2000), who found the opposite to be true. Venkatesh & Morris' findings have since been replicated by Liao & Cheung (2001) and Slyke *et al.*, (2002). All the cited studies however agreed that woman would rate PEoU higher than men, and this is confirmed in the current research.

Figure 6.9: Gender (group-case) results for TAM constructs



"Gender" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
Female [54 users] 67.5%	10.09*	11.46*	7.92*	9.82*
Male [26 users] 32.5%	9.84	10.27	6.64	8.92
Average Range	0.34	1.19	2.44	1.32

With these results in mind, the researcher was left considering why men returned lower values for the PU and PoI constructs than woman, which was seemingly at odds with previous research findings. This raised the thorny issue of gender-related research within the field of IS. One of the major criticisms of IS research is the lack of theory developed in regards to gender-driven technology adoption and use (Adam *et al.*, 2004). The criticism appears to be well founded. A citations analysis of the six "meta-analysis" TAM papers reviewed in the literature for the current research, reveals this deficiency in black and white;

- Of the 101 papers reviewed in Saeed *et al*., (2003), only two directly addressed gender issues;
- Lee *et al*., (2003) reviewed 139 papers, of which only four directly addressed gender;
- Legris *et al*., (2003), reviewed 30 papers, one of which tackled gender;
- Ma & Liu (2004) reviewed 58 TAM papers, with only one focusing on gender;
- King & He (2006), in reviewing 108 papers, cited one addressing gender;
- Schepers & Wetzels (2007), in their review of 102 TAM papers, cited three that concentrated on gender.

In all, the meta-analysis' cited research represents a total of seven published papers, only two of which (Gefen & Straub, 1997 & Venkatesh & Morris, 2000) would be considered truly "seminal" TAM related IS papers, written over the 20 year period since Davis' published the TAM dissertation. What this inadequate body of gender-focused research implies is that there is lack of depth in the IS discipline's analysis of "gender" as a social construct, the result of which includes a discipline-wide tacit acceptance of stereotypical characteristics "*where women's characteristics are often seen as having less value than men's*" (Adam *et al*., 2004). That is, that men prefer "*technology that is useful*", and women prefer "*technology that is easy to use*". What the researcher takes issue with, is not that the cited research has come to these stereotypical findings, but that, without a proper discourse regarding the contextual construct of "gender", universally accepted findings (at least in the field of IS) are not contextually analysed past a shallow explanation of "men do this" and "women do this". In this regard, the researcher endeavoured to look more closely at the gender group-case results in an effort to determine if other user-characteristics might be responsible for any gender group-case results. This was done, in part, to address any tacit acceptance that results were purely gender driven, but also to investigate why the research's male sub-group returned lower than expected PU results.

A cross analysis between the *Gender* and *User Motivation* group-cases found that nearly one in three males (30.8%) felt "obliged" to engage search engines, while less than one in five females (18.5%) felt this same obligation. As already observed in the previous *User Motivation* group-case discussion, obliged users generally return poorer TAM results for PU and PEoU unless driven by a strong subjective norm motivator (Taylor & Todd, 1995; Venkatesh & Davis, 2000). Given the relatively individual web-search interaction expected of the target user group, the social norm construct would not be considered as influencing user results.

The greatest variance in results between the gender group-case's sub-groups related to PoI sub-constructs. Except for *PoI: productivity*, females returned higher scores than males. This generally more positive attitude towards search engine interaction by females is supported by a cross analysis with the *Task/System Confidence* group-case results (figure 6.17). Constructed from question [#64] "*How often do you expect to successfully find relevant information when utilising a Web search engine?*", the Task/System Confidence group-case results (section 6.4.12) demonstrate that users who expected to achieve a successful outcome "every time" returned the highest PoI results of any sub-group in the entire investigation. Accordingly, nearly 1 in every 10 women (9.3%) answered "every time" to this question, compared to less than 1 in 25 men (3.8%).

Gender: Some Findings

The gender of users seemed to have a relatively minor influence on user attitudes towards search engines, particularly in relation to PU construct results. With an average variance of 0.34, gender differences in PU is so minimal, that the researcher would expect to see no difference in user BI based on gender.

The small variance in PEoU can be accounted for by more males feeling "obliged" (30.8%) to use search engines than females (18.5%) given that social normative influence on individual use of search engines would be relatively limited, the expected effect of which would be slightly lower PU and PEoU scores for males. In addition to this, the relative number of females who engage search engines habitually is three times greater than males (35.2% of females, versus 11.5% of males). The habitual use of search engines, it is expected, would result in slightly higher PU and PEoU scores for females.

The strongest cognitive influence on the variance between the PoI results for male and female users is their *task/system confidence*. Figure 6.17 illustrates the enormous divergence in user results according to how often they expect their search engine interaction to result in a successful outcome. As stated in the previous section, nearly one in every ten females users expect their search engine interaction to result in the successful retrieval of relevant information *every* time they engage such a system. This expectation is drastically different for male users, with less than one in twenty five males having the same level of task/system confidence.

From a logical, interpretive perspective, it makes sense that users who have a high task/system confidence would return better scores relating to their PoI with the system, especially given that PoI has been designed to measure users perception of the predictability of their system interaction. This finding is also supported statistically by the user data in figure 6.17, which demonstrates a massive average variance of 6.82 in PoI results according to users' task/system confidence. To this extent, the gender related variances, although relatively limited, support previous findings in social psychology research, that the differences between male and female interactions are largely cognitively driven, relating to the way they process and interact with information and systems (Kimura, 2004; Bridge *et al.*, 2006).

Table 6.3 presents some of the individual differences between male and female results found by the researcher as contributing to the variance in TAM gender results.

Gender: Limitations

A possible limitation to the gender group-case findings could relate to uneven distribution of male to female participants. Females out-number males by more than two to one. Notwithstanding, the number of male users (at 26) is still significantly high in relation to the population distribution within other group-case scenarios.

Table 6.3: Motivation, Task/System Confidence & Query Result Expectations influence on Tam gender-based results

Gender → ↓Group-case Comparisons	Male [26 users]		Female [54 users]
Motivation: motivated	57.7% [15/26]		46.3% [25/54]
Motivation: obliged	30.8% [8/26]	⟷	18.5% [10/54]
Motivated: unmotivated (habit)	11.5% [3/26]	⟷	35.2% [19/54]
Confidence: Every time	3.8% [1/26]	⟷	9.3% [5/54]
Confidence: Most times	92.3% [24/26]		75.9% [41/54]
Confidence: Some times	3.8% [1/26]		14.8% [8/54]
Results: will be relevant	3.8% [1/26]	⟷	18.6% [10/54]
Results: will May/May-Not relevant	19.2% [5/26]	⟷	29.6% [16/54]
Results: May be relevant	76.9% [20/26]		51.9% [28/54]

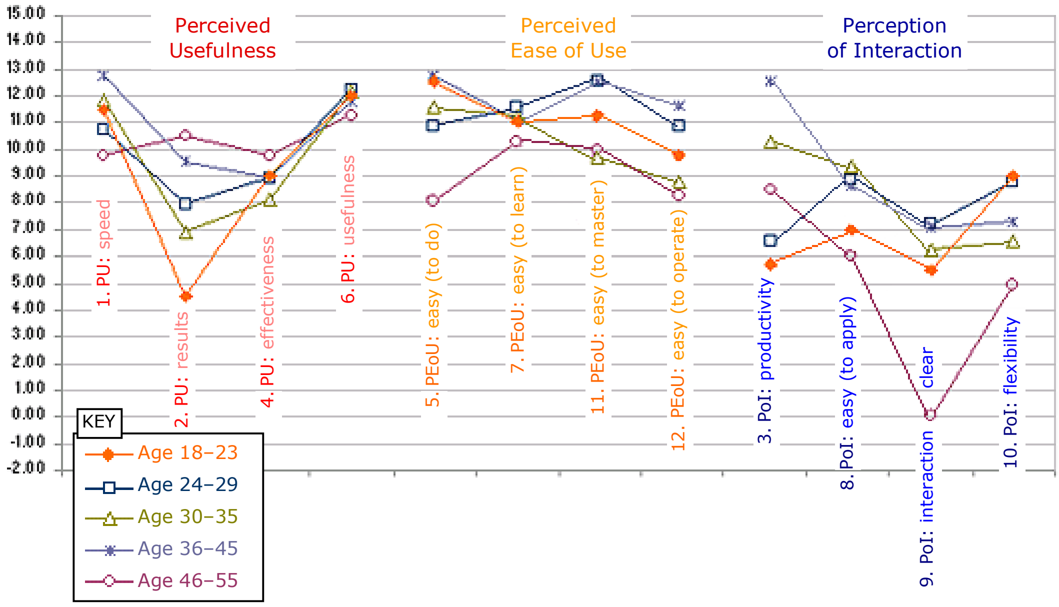
6.4.6 Age-Range

Age: Observations & Discussion

The age-range group-case displayed the third highest overall variance between its sub-groups. This result is consistent with much of the previous TAM research, which indicates a strong relationship between user age and variables in technology attitude.

Overall, the 36-45 age-range enjoyed the most positive attitudes towards their use of search engines, scoring the highest in each of the PU, PEoU and PoI constructs. The 46-55 age-range returned the lowest results for PEoU and PoI, which seems in contrast to their PU results, where they recorded the second highest scores. The 18-23 age-range returned puzzling results, scoring lowest in PU and second lowest in PoI.

Figure 6.10: User Age (group-case) results for TAM constructs



User "Age" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
18–23 [10 users] 12.5%	9.25^	11.13	6.81	9.06
24–29 [41 users] 51.2%	9.98	11.44	7.84	9.75
30–35 [8 users] 10%	9.77	10.31	8.13	9.40
36–45 [11 users] 13.8%	10.76*	12.00*	8.87*	10.54*
46–55 [10 users] 12.5%	10.31	9.13^	4.88^	8.10^
Average RANGE	2.88	3.04	5.33	3.75

The high divergence in user results according to their age-range, although supportive of previous research (Lu *et al.*, 2006; Arning & Ziefle, 2007; Wang *et al.*, 2008), was perplexing, and the researcher sought to find possible reasons for the variance. Why should a group of relatively sophisticated cognitive ability return such divergent results dependant on nothing more than their age-group affiliation? Pervious research, in an effort to explain divergent TAM results in relation to age, has tended to categorise "age" as playing a somewhat *passive* role in user attitudes and BI. That is; age is hypothesised as having an indirect relationship to attitude through its influence on other antecedents of attitude, such as;

1.) Level of *experience* and *length of time* in the workforce (Agarwel & Prasad, 1999);
2.) Level of *education* and its affect on *workplace performance* (Davis & Davis, 1990);
3.) Level of *education* and its affect on *cognitive maturity* (Mathieson *et al.*, 2001).
4.) *Gender* and its affect on sexual/social *maturity* (Lu *et al.*, 2006)
5.) Level of *income* and its affect on *behavioural intention* (Lee *et al.*, 2007)

The participant population of the group-case data-sets which represented these common antecedents were examined to establish if there was any relationship between the age-range of participants and their; levels of experience; level of education; cognitive style; academic role; expectancy; and motivation to use search engines as an IR tool. Appendix 6.3 presents the comparison between age-range of participant and the various influencing antecedents proposed in previous research as having an affective relationship with age of users.

Age: Some Findings

Age-Range and *User Experience* was found to have a mixed influence on attitudes in relation to participant age-range. The most experienced group (46-55) returning the lowest overall TAM survey scores, and specifically the lowest PoI and PEoU results. Complicating any interpretation of their results further, this same age-group returned the second highest results for the PU construct, said to be the strongest determinant on behavioural intention to engage a system. Results for users who possessed more than nine years experience were as puzzling as the twelve plus experience-group, with the 46-55 age-group again having the highest representation of "experience", yet returning the lowest results. A preliminary conclusion could be drawn, suggesting that the greater the experience of search engine interaction, the greater the awareness of the technology's flaws, resulting in poorer TAM results, except the group indicating the least experience (18-23 age-group) returned relatively poor results also, ranking fourth for overall TAM results, and fifth for PU.

Not withstanding possible anomalies in the survey methodology, these differences may indicate that "experience" influences attitude on two levels. While lack of experience could always manifest itself in the lower results for those participants unfamiliar with a system, higher levels of experience may not always indicate more positive results given that experience can include negative interactions with a system (Sandhu & Corbitt, 2003; Bhattacherjee & Premkumar, 2004; Chung & Tan, 2004).

Importantly, human interaction with a system, in this case search engines, takes place not only at a mechanical or technical level, but at cognitive and affectual level as well. The results in the current research suggest that the complex nature of human cognition does not lend itself to a defining a clear linear relationship between user-age → experience → system attitude. Results suggest that while both participant *age-range* and *level of experience* influence user system attitude, the age of a participant has a far stronger effect on this attitude, and this stronger effect cannot be explained by age-related user experience alone. To that end, the age-range group-case and three other experience-driven individual differences were compared to see if an indirect relationship could be established between age-range and system attitudes. (1) *education level completed;* (2) *task/system confidence;* and (3) *academic role*; were cross analysed against age-range to determine what relationship, if any, existed between the group-cases.

Although task/system confidence (in its own right) demonstrated itself to have a profound influence on user attitudes towards search engines, no concrete relationship could be established to show a user's age influenced this task/system confidence. Age-range showed itself to have a minimal relationship with a user's education level, in that the older a user is, the more likely they are to have completed their post-graduate and/or PhD. This relationship is however only strictly true as an overall figure, with the 30-35 yrs age-range in fact demonstrating the highest education levels for one sub-group. In addition to this, in trying to determine whether the age/education variables influenced other TAM results, no relationship was found. The strongest correlation was found between user age-range and academic role. This had been somewhat predicted in the classification of age-ranges when data collection was being designed.

Finally, age-range was found to have little to no relationship with internally-driven individual differences such as *cognitive style* and *user motivation*. In fact, exhaustive cross analysis between the various group-cases found only a ***limited*** relationship between;

1.) ↑ age-range and ↑ academic role;
2.) ↑ age-range and ↑ levels of experience; and
3.) ↑ age-range and ↑ level of education

The relationships, however, were found to be quite tenuous, and the researcher would err on the side of caution regarding any suggestion that they would categorically establish an indirect relationship between age-range and the wide divergence of systems attitudes displayed in the age-range group-case. Moreover, *user experience*, *academic role*, and completed *level of education* rank only fourth, eighth and ninth in TAM variations in group-case results.

It is, of course, possible that the high divergency in age-related variables are driven by a complex multiple affectual relationship with level of experience, academic role, and level of education, *combined*.

Age: Limitations

The only real limitation (methodologically speaking) of the age-range group-case could be in relation to the choice of asking participants to select an age-range rather than to simply state their actual age. An actual age figure however, would have required the researcher establish age-group classifications at the analysis stage in any case, in order to create large enough clusters of data to make meaningful comparisons between the user results. In all likelihood, very similar age-range constructions would have been created because of the likely demographic those age-ranges are perceived to represent. That is; 18-23 y/o – users who are most likely to be studying a in the early stages of a postgraduate or their academic career; 24-29 y/o – users classified as having entered "mature age" status as university students; 30-35 y/o – users who have most likely chosen their discipline specialty and begun their PhD; 36-45 y/o; the group most likely to be at the height of their academic career; and 46-55 y/o, most likely to have completed their PhD and providing guidance and mentorship to other academics.

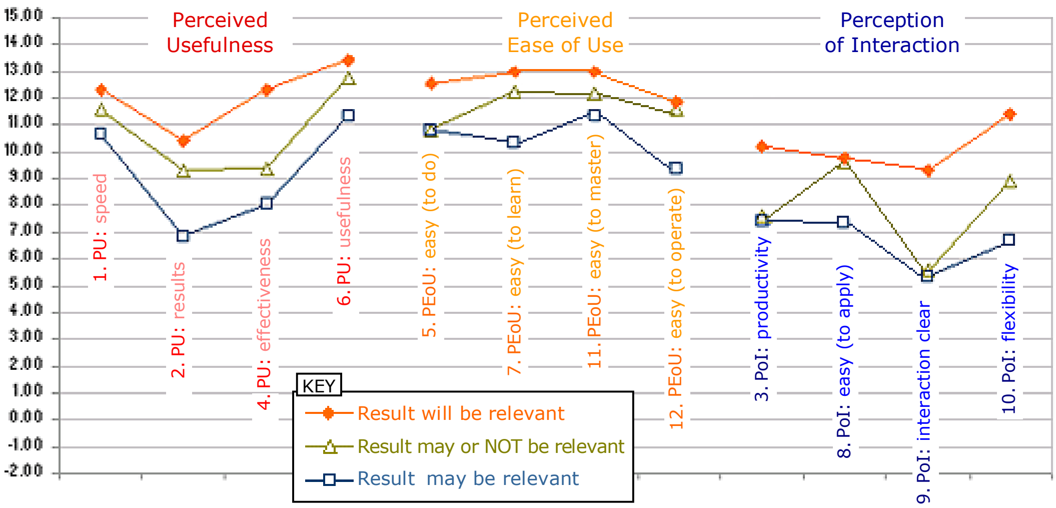
Not withstanding this point, the age-range variance suggests that user age has a profound impact on user systems attitudes, much of which can only be explained by users affiliation to multiple sub-groups in other group cases. Age-range then, represents an area of possible future research, as it is also one of the inevitable (intrinsic) variables between system users, which cannot be controlled by information system providers.

6.4.7 User Relevance Expectations (in SE results) & TAM Results

Expectancy (of SE query results): Observations & Discussion

Users who had extremely high expectations of the relevance of search engine results to their queries, demonstrated some of the most positive results of the entire study for all three TAM constructs. This is consistent with DeSanctis (1983), who linked high levels of systems expectations with highly positive use of that system. In regards to TAM related research, user expectancy is often measured as "perceived performance" (Bhattacherjee, 2001; D'Ambra & Wilson, 2004; Dadayan & Ferro, 2005), and ranks consistently as one of the strongest predictors of user BI (Wang *et al.*, 2008).

Figure 6.11: User Expectations of SE returns (group-case) results for TAM constructs



"Query Results Expectations" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
will B relevant [11 users] 13.7%	12.12*	12.56*	10.18*	11.62
may or may NOT be relevant [21 users] 26.2%	10.74	11.70	7.95	10.13
may be relevant [48 users] 60%	9.21^	10.46^	6.71^	8.79
Average Range	2.91	2.11	3.48	2.83

Of interest in the context of this group-case was the results for the sub-group #2, who were willing to entertain the possibility that some search engine query results may include results that are *not* relevant to their queries. This sub-group recorded higher scores than the sub-group #3, who stated they believed results may be relevant, without demonstrating a conscious cognition that results may also *not* be relevant.

Expectancy of Query Results: Some Findings

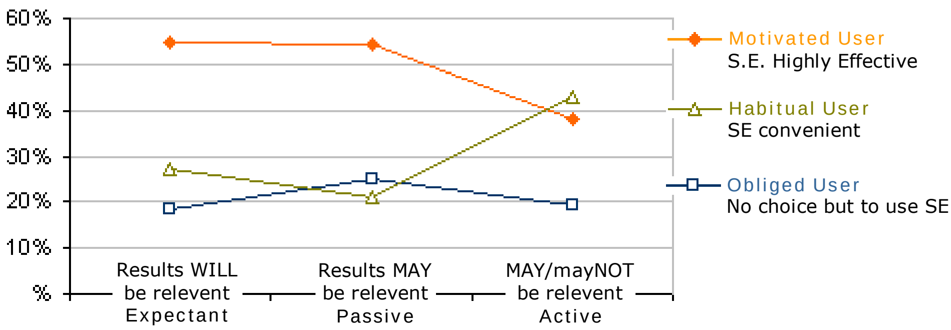
If the belief of the 60% of users (sub-group #3) who stated that search engine results *may be relevant* were to be considered in the "passive"; that is; this sub-group represents a group of users who *do not actively consider that results may not be relevant*, then this passivity could account for their lower results than the sub-group who actively chose to recognise that search engine results can contain results that are irrelevant to their query. The implication is that the more "active" sub-group is more likely to recognise and embrace their own cognitive role in the process of web-based information retrieval. If this supposition is correct, the researcher would expect it to be reflected in users' answer to the ISB-Survey Q.6 [#56] examining the motivating reason why users engage search engines.

Table 6.4 and figure 6.12 collate user results to ISB-Q6 [#56] which assessed users' motivation by asking "*why do you use Internet search engines?*" with user expectancy results.

Table 6.4: Search Query Expectations vs. Motivating reason to S.E. use

Relevance Expectations → Why use SE ↓	Will Be Relevant (expectant)	May be relevant (passive)	May/May not Be Relevant (active)
Find SE's highly effective (motivated)	54.6%	54.2%	38.1%
Ease/convenience (habitual)	27.3%	20.9%	42.9%
Have no other choice (obliged)	18.2%	25%	19.1%

Figure 6.12: Search Query Expectations vs. Motivating reason to S.E. use



The cross analysis reveals some interesting correlations between user motivation and expectancy. Highly motivated users are two times more likely than habitual users, and three times more likely than obliged users, to perceive a search engine *will* return relevant results to their queries. This is a clear confirmation of Vroom's (1964) hypothesis that expectancy is intrinsically linked to motivation. That is; the higher the (positive) expectancy of a behaviour, the greater is the motivation to perform that behaviour (Rappaport, 2004). Human nature, being what it is though, sees this same group of motivated users also some 2.5 times more likely than habitual users, and two times more likely than obliged users, to perceive a search *may* return relevant results to their queries, making them the most "*cognitively passive*" group. That is; the group least likely to consider the irrelevancy of some search-engine results.

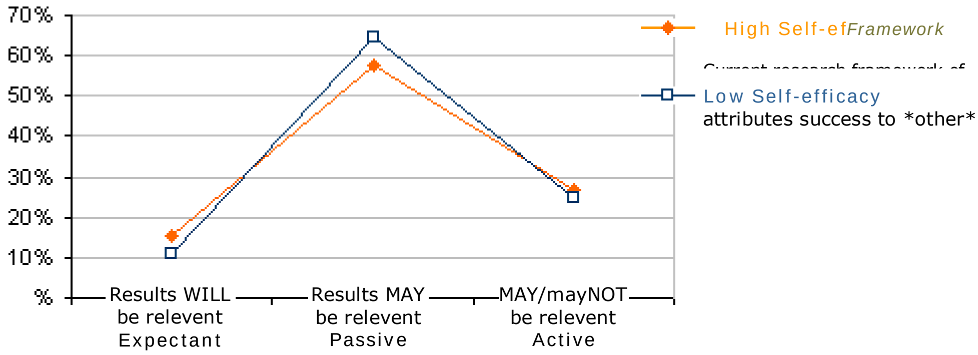
Table 6.6: The level of Cognitive Engagement by Motivated, Obliged & Habitual users

[#56] (ISB.Q6) Why do you use Internet search engines? (select the most appropriate response)		%
I find them to be highly effective at retrieving the information I am searching for (motivated)	Expectant	54.6%
	Passive	54.2%
	Active	38.1%
there is no other choice if I do not know a Webpage's URL (obliged)	Expectant	18.2%
	Passive	25.0%
	Active	19.1%
habit /convenience.. it's what I've always done when searching for information on the Internet (habitual)	Expectant	27.3%
	Passive	20.9%
	Active	42.9%

Some of the most intriguing results are those associated with habitual users of search engines. Figure 6.13 illustrates that they are the most likely sub-group to consider the non-relevancy of some search engine results to user queries. This firstly supports Gefen's (2003) research that, over time, *habit* becomes a greater predictor of behaviour than the PU and PEoU constructs of TAM, and secondly classifies habitual users as the most *cognitively active* searchers. A cognitively active searcher can be described as an individual who actively processes and responds to the information presented in the search interface (Dillon, 1987), engaging and monitoring both their goal and the system's responses during the process of information seeking and retrieval (Persson, 1998). Murray (2000) describes this active state as "mindfulness", in which the user "consciously engages with the immediate elements of the communication environment, and challenges 'premature cognitive commitments' to the meaning to be constructed” (p.337). Cognitively active searchers are classified as such then, because they take greater cognitive ownership of the information search-retrieval process.

Given the supposition that users who consider search query returns may include irrelevant results would embrace a more “cognitively active” role in Web information search and retrieval, the researcher considered whether this could be expected to be reflected in this sub-group returning higher self-efficacy results than users who do not actively consider that search engine results may be irrelevant. However, when a cross-analysis was made between user expectancy and user self-efficacy, there was almost no difference in expectancy between the two self-efficacy (high and low) results.

Figure 6:13 Search Query Expectations vs. Self-efficacy



Relevance Expectations → Self-efficacy ↓	Will Be Relevant (expectant)	May be relevant (passive)	May/May not Be Relevant (active)
Attribute *self* (high Self-efficacy)	15.4%	57.7%	26.9%
Attribute *other* (low Self-efficacy)	10.7%	64.3%	25%

The constructs of *self-efficacy* and *expectancy* are, at times, confused or used interchangably (Bandura, 1977; Gist & Mitchell, 1992). This is particularly true in the field of IS, which has found itself adopting (and adapting) various theories originally associated with the social and psychological sciences, as a bases for investigation the human component of user technology adoption and human computer interactive processes (Chau,1996). The cross-analysis between the expectancy and self-efficacy group-cases firmly confirms that they are separate constructs (Stajkovic & Sommer, 2000) the former being primarily about *expected outcome*, the latter more about *locus of control* in the process of achieving an outcome. Both constructs are intrinsically linked to motivation, but not necessarily always to each other. Self-efficacy will be discussed in greater detail in the following section.

Expectancy of Query Results: Limitations

The creation of theory – as it relates to ambiguous cognitive processes such as active versus passive searching, or habit versus learned behaviours – requires a more concentrated research strategy than the one employed for the current research. The researcher here, has only just begun to scratch the surface regarding the influence of constructs such as habit and cognitive load expectations/tolerance on TAM related user attitudes. The body of user-data unfortunately does not allow for an in-depth analysis of these antecedents, as the focus was deliberately broader. The user-data however, does seem to reveal that something outside of PU, PEoU and PoI is able to supersede these constructs when users return relatively negative results for the elements they measure.

Like the age-range group-case, the user expectations of search query results data reveals interesting directions for future research in regards to the technology acceptance model.

6.4.8 User Self Efficacy & TAM Results

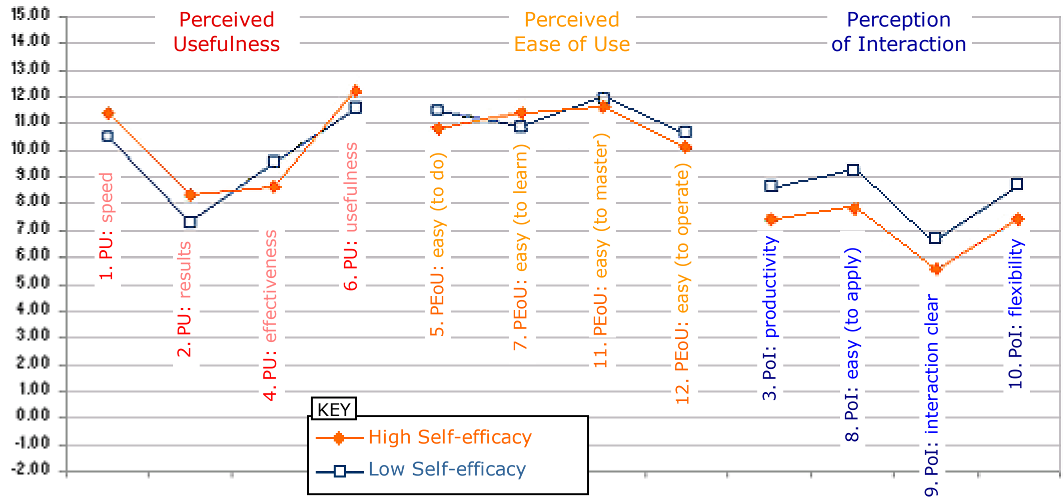
Self Efficacy: Observations & Discussion

Except for the PoI construct, the variance between the high and low self-efficacy sub-groups is relatively minimal, varying less than one point for most results. This is consistent with a number of previous studies which have generally found that users' degree of self-efficacy has relatively little, to a slightly positive, impact on their PU or PEoU of the system with which they engage (Igbaria & Iiravi, 1995; Compeau & Higgins, 1995; Lewis *et al.*, 2003). Generally speaking, the majority of studies which have tested self-efficacy as a variable construct between their user-groups, returned lower than expected influences on the TAM constructs. Ratten & Ratten (2007), for example, hypothesised self-efficacy would have a significant influence on intention use WAP banking amongst youths, but the hypothesis was "found to be false". In the case of Igbaria & Iivari (1995), two out of the four proposed hypotheses relating to self-efficacy were found to be not supported (NS). That is, the authors could not establish a relationship between (1) self-efficacy and perceived usefulness; or (2) self-efficacy and actual computer use. A third hypothesis, which was confirmed, found an existent relationship between self-efficacy and PEoU. Importantly, the fourth hypotheses, also confirmed, found an affectual relationship between self-efficacy and anxiety levels –

which it could be argued from previous research is a given in any behavioural outcome, not just those relating to computer usage.

The general expectation – on the part of researchers – that self-efficacy should impact these TAM constructs may come from the misconception that self-efficacy, as a concept, represents such constructs as *expectancy* (discussed in the previous section), or the degree of user *self-confidence* of a successful outcome while interacting with a system. Conceptually speaking, self-efficacy denotes the role a user perceives their personal cognitive processes play in specific task-related interaction with a system. While it may indicate a user's level of confidence in their ability to successfully complete specific system-related tasks, which is rightfully seen as impacting a construct such as PU and PEoU, a user's level of confidence can come from either a confidence in themselves or a confidence in the system. In real terms, what that means, is a user with high self-efficacy and low system confidence would, in all likelihood, return a similar PU and PEoU result as a user with low self-efficacy and high system confidence.

Figure 6.14: User Self-efficacy (group-case) results for TAM constructs



"Self-efficacy" group-case * = highest grp score; ^ = lowest grp score	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
High Self-efficacy [52] (65%)	10.16*	10.98*	7.07	9.40
Low Self-efficacy [28] (35%)	9.73	11.25	8.32*	9.77
Average Range	0.88	0.52	1.25	0.88

That efficacy and confidence are two different constructs is illustrated when self-efficacy TAM results are compared to task/system-confidence TAM results. User results for the question [#64] "*How often do you expect to successfully find relevant information when utilising a Web search engine?*" were classified as:

- "all the time" = very high confidence;
- "most of the time" = high confidence; and
- "sometimes" = average confidence.

Section 6.4.12 discusses the TAM results for the "task/system-confidence" group-case, which are not only very different from the TAM results for the self-efficacy construct, but with their great degree of variance between its sub-groups, demonstrate a much stronger relationship with user perceptions of PU, PEoU and PoI.

Self Efficacy: Some Findings

In general, the majority of previous research associated self-efficacy with the PEoU construct, with a handful of studies also finding a relationship with PU. The greatest divergence in self-efficacy results in the current research, however, is demonstrated in the PoI construct. This is not surprising given that the *PoI:productivity* component of PoI could quite easily be classified within PU, and *PoI:easy to apply*, *PoI:clarity* of interaction, and *PoI:flexibility*, could be considered as PEoU measures. This implies that the results from previous studies that found a relationship between self-efficacy and PU or PEoU derived their results from measuring the more interactive type components of technology engagement.

The PoI construct is designed to measure users ongoing perceptions of the predictability of their interactions with search engines. The sub-group with the lower self-efficacy returned better results for PoI than the high self-efficacy group, indicating that the higher self-efficacy sub-group have a greater recognition of the system's flaws, and the inconsistencies of their interactions with it (Ong *et al.*, 2004; Ceaparu *et al.*, 2004). This would be consistent with the recognition that they play a more cognitively active role in the process of web-based IR; that is; higher self-efficacy. Importantly, other researchers have also noted a higher self-efficacy's negative impact on various elements of the TAM's constructs (Chau, 2001), although it does this while still having a positive impact on intended use.

Self Efficacy: Limitations

The over-riding weakness of any self-efficacy investigation lies in the ambiguity of self-efficacy as a construct. While it is possible to establish statistically whether users see themselves as having a role in successful task/system interaction, establishing the degree of that role is a difficult proposition. Moreover, because self-efficacy includes affective relationships with other self-perceptive constructs such as user self-confidence, locus of control, and attribution beliefs, it is difficult to establish exactly what is being measured. This difference is highlighted when the TAM results for the self-efficacy group-case (figure 6.13) are directly compared to the task/system-confidence group-case (figure 6.17), which illustrate vastly different impacts on PU, PEoU and PoI.

6.4.9 Technical Style

Technical Style: Observations & Discussion

User technical style ranks eleventh (out of twelve) for its effect on user attitudes towards search engines. As expected, the sub-group who engaged some of the technical features associated with search engines, with three exceptions, scored consistently higher than the group who did not engage the additional technical features. Interestingly, the three results which technical users scored lower than non-technical users were *PEoU:easy to learn*, *PEoU:easy to operate*, and *PoI:clarity of interaction*.

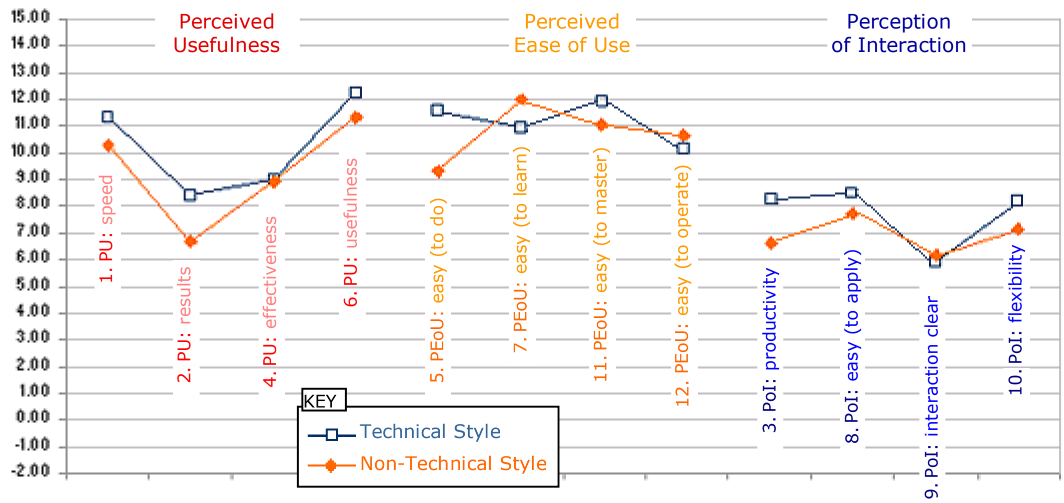
Participants classified as 'technical users' engaged such search engine features as Google's "*similar pages*" (13.1%) and "*cached version*" (75.4%) links, and Yahoo's "*other pages from this domain*" (11.5%). The similar pages and other pages features were engaged when users desired additional information to that which was presented as a result by the search engine to their query. The cached version feature was the most frequently applied tool, and was used when the live Google hyper-link returned a "404: Page cannot be found" error. The cached version was recognised as the last previous known version of the currently unavailable (live) web page.

The conditions then, in which users choose (similar and same pages feature), or are compelled (cached version) to employ search engine technical features, are circumstances that oblige the user to become more active in the information interaction and retrieval process, making the interaction more complex. This increased level of sophistication in search engine interaction may account for technical users; (1) being more aware of any flaws in the automated functions of the system; and (2) having less confidence and certainty in the system, hence, the lower results for the *PEoU:easy to learn*, *PEoU:easy to operate*, and *PoI: interaction clear* sub-constructs.

Technical Style: Some Findings

Like high self-efficacy users, technical users would demonstrate a more active role in their information search and retrieval interactions with search engines. This is reflected in both groups returning lower than expected PoI results, as they recognise a greater reliance on their technical tactics in order to achieve the desired outcome from their system interaction.

Figure 6.15: Technical Style (group-case) results for TAM constructs

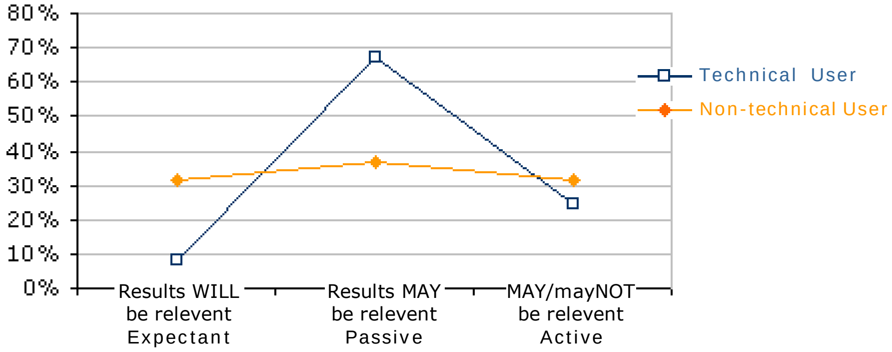


"Technical Style" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
Technical [61 users] 76.2%	10.24	11.17	7.70	9.70
Non-Technical [19 users] 23.8%	9.31	10.76	6.91	8.99
Average Range	0.92	1.15	0.93	1.00

Interestingly, technical awareness and tactics do not appear to exhibit a relationship with the cognitive responsiveness aspects of search engine interaction. That is, how active or passive their response is at the second phase of a search, the interaction with a list of search engine results/returns on their query. This is an important point in relation to TAM investigations of user-computer interaction, because what this group-case seems to clearly demonstrate is that users can (and do) manifest different perceptions towards the same TAM constructs, depending on what phase of interaction they are considering.

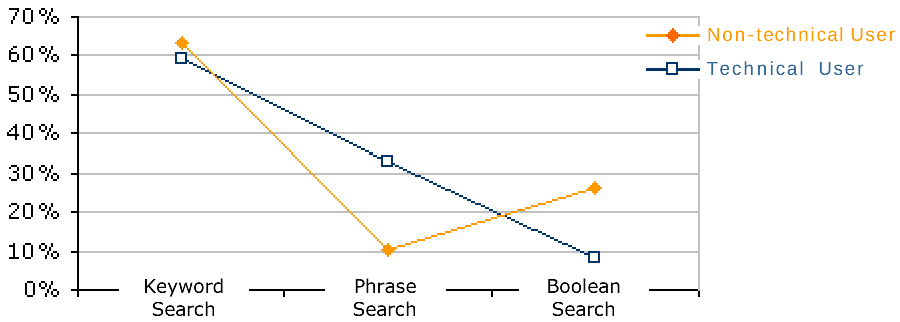
What is clear here, is that although technical users demonstrate a higher motivation in their initial engagement of search engines, which correctly manifests itself in higher PU results, the information retrieval part of the search process – when it is time to make choices regarding the search engine's return on their search query, the technical searcher demonstrates themselves to be four times *less* likely to possess a highly positive expectancy of search engine results than the non-technical searcher.

Figure 6.16: Technical Searchers expectancy regarding relevance of SE Results



In tern, technical searchers present as being 1.7 times more likely to have a *cognitively passive* expectancy (figure 6.17). This somewhat indifferent conscious consideration regarding the second phase of search engine interaction – when the user interacts with a list of possible choices (i.e., results to their query), appears to be addressed in two ways by this sub-group of users. Firstly, they are more open to technical feature alternatives, in the event that something goes wrong with their choice, and secondly, they transfer a higher cognitive loading into the initial interaction with the search engine, in the form of the highly specific *phrase search*. Figure 6.18 reveals that technical searchers are over three times more likely to use a quotation phrase search than their non-technical counterparts.

Figure 6.17: Technical Searchers Vs Cognitive Style Results



The motivation behind this for technical users appears to be multi-dimension. Firstly, it would mean a reduction in cognitive load in the results-interaction phase of their search, but most importantly, it would over-ride the lower expectancy of query results experienced by this sub-group.

It should be noted, that the technical searcher's low expectancy of search engine query results is considered by the researcher to refer only to the second phase of their search interaction. Their motivation level results (table 6.6) demonstrate that 50% of them (which is slightly higher than their non-technical counterparts) chose to engage search engines because they perceive them to be "highly effective".

Table 6.6: Motivation levels of Technical and Non-technical Searchers

[#56] (Q6) Why do you use Internet search engines		%
Motivated: I find them to be highly effective at retrieving the information	Technical	50.8%
	Non-Technical	47.4%
Obliged: there is no other choice if I do not know a URL	Technical	19.7%
	Non-Technical	31.6%
Habit: Convenience / habit... it's what I've always done	Technical	29.5%
	Non-Technical	21.1%

In regards to the constructs of the TAM, this induction is significant because it;

- demonstrates how a sub-group of users can return relatively poor expectancy results, while still returning relatively strong PU results;
- begins to validate the PoI construct by revealing how it is able to measure such constructs as user expectancy;
- provides for researchers, a framework that effectively broadens the scope of the original TAM to include instrumentation able to measure "on-going" user technology acceptance;
- raises the bar for future TAM based research, to more effectively investigate the complex, dynamic relationships between the social theory concepts (adapted from the social and psychological sciences) that it claims it is able to measure.

Technical Style: Limitations

Only a limited number of the technical features were investigated by the researcher in order to classify users' technical style. This was somewhat governed by the broad nature of the investigation as a whole, which was trying to capture a broad picture of the effect on user search engine attitudes using many individual user related variables. The assumption of the technical style group-case is that non-technical users would not engage such tools as “similar pages”, “other pages from this domain” and “cached version”, which seems a reasonable assumption. However, it is acknowledged by the researcher, that *user experience* may have an affectual influence on participant use, or non-use, of search engine technical features and tools. Table 6.7 presents the technical style of the participants in the context of their years of experience using search engines. Not withstanding the very small number of 3-5years experience sub-group (only 4 users), the division of technical versus non-technical users remains relatively consistent, regardless of how many years experience users’ accrue. This confirms previous theory (Venkatesh *et al.*, 2000) that technical style may be as much about intrinsic individual user characteristics as it is about a learned strategic response to a system.

Table 6.7: Technical Style (in context of search engine experience)

Experience Level (yrs) → ↓ Technical Style	3-5 yrs Experience	5-8 yrs Experience	9-12 yrs Experience	12+ yrs Experience
Technical user	75%	78.6%	77.8%	66.6%
Non-technical user	25%	21.4%	22.2%	33.3%

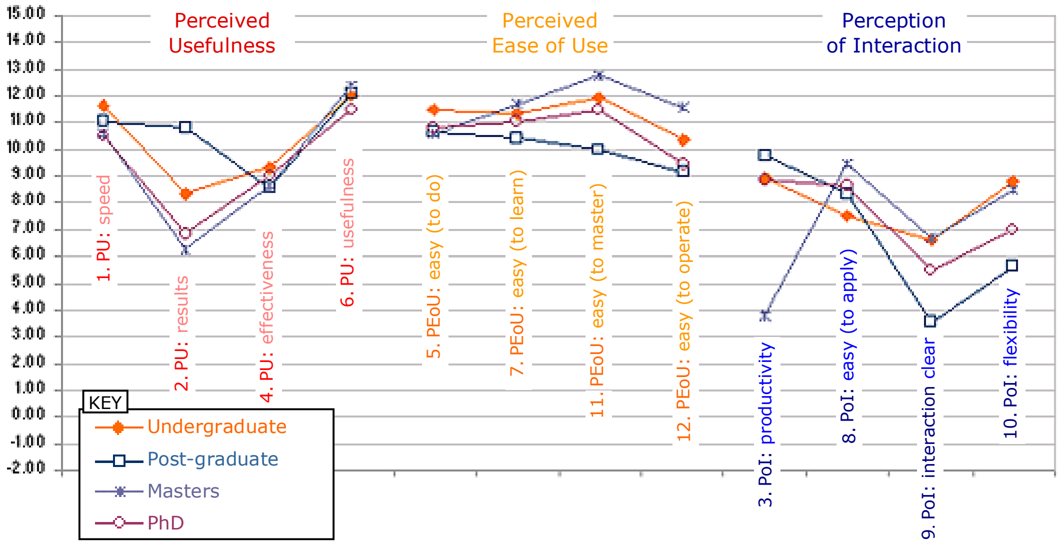
6.4.10 Level of Education

Education: Observations & Discussion

Users’ level of “completed” education ranks ninth for divergence in results, indicating it has a relatively minor effect on user attitude towards search engines. Overall users who selected they had completed a post-graduate degree returned the lowest results, however the difference in results was relatively small, particularly for the PU and PEoU constructs. The small range in results is demonstrated by the constant swapping of which sub-group returned the highest or lowest results, for example; users who had completed their post-graduates returned the lowest overall scores, but the highest PU scores. Those who had completed their Masters returned the lowest PU result, but the highest PEoU results.

PoI results demonstrated the most variety in results, with an average range between the sub-groups of 2.39. This was the sixth highest divergence in PoI results for the twelve tested group-cases.

Figure 6.18: Education Level (group-case) results for TAM constructs



User "Education" group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results PU	PEoU	PoI	TAM
Whole Group	10.02	10.93	7.51	9.49
U-grad [35 users] 43.8%	10.32	11.29	7.96*	9.85
Post-grad [12 users] 13.8%	10.63*	10.05^	6.83^	9.17
Masters [18 users] 22.5%	9.44^	11.63*	7.08	9.38
PhD [15 users] 18.8%	9.46	10.71	7.50	9.22
Average RANGE	1.84	1.84	3.49	2.39

Education: Some Findings

Except for participants' PoI results, the variance between the sub-groups is so low that the researcher found no solid relationship between education levels and the PU and PEoU constructs. Mathieson *et al.*, (2001) propose an indicative link between user education and expected levels of user "cognitive maturity", which the authors considered to be an influencing user characteristic on TAM results. The findings relating to the completed education group-case in the current research, however, suggest that either cognitive maturity has little to no influence on user PU and PEoU, or that cognitive maturity is representative of something far more complex than degrees and qualifications. With that said, it is not unreasonable to assume that participants who have completed a PhD dissertation would have a far more sophisticated cognitive maturity than those participants who have only completed their undergraduate degree. This suggests that the first statement regarding cognitive maturity and ability having little impact on whether users find search engines useful or easy to use is correct.

The major variance in this group-case relates to users' perceptions of the predictability of their interaction, but even here, there is no pattern to users results that would suggest a user's cognitive maturity influences the degree of satisfaction or dissatisfaction associated with their search engine interaction.

Education: Limitations

Apart from a cross-analysis between completed user education level and current academic role data, the education level participant information provides little indication of each user's current educational engagement. That is; the user data does not provide an adequate picture of whether those who have completed an undergraduate or post-graduate are continuing to push their cognitive development and furthering their education experience. That data also does not provide a picture of whether users are currently undertaking a post-graduate, masters or PhD, or how far into that qualification they currently are.

Table 6.8: Highest Education level Vs. Academic Role

Education Completed → ↓ Academic Role	U-grad [35 users]	P-grad [12 users]	Masters [18 users]	PhD [15 users]
Academic (Lecturer)	2.9%	25%	5.6%	52.8%
Academic (Researcher)	8.6%	8.3%	16.8%	40%
Student (Student)	62.9%	33.3%	27.8%	0%
Student (P/T Academic)	25.7%	33.3%	50%	6.7%

Table 6.9: Age-Range Vs. Academic Role

Education Completed → ↓ Age-Range	U-grad [35 users]	P-grad [12 users]	Masters [18 users]	PhD [15 users]
18–23	25.7%	0%	5.6%	0%
24–29	57.1%	41.7%	66.7%	26.7%
30–35	2.9%	8.3%	11.1%	26.7%
36–45	8.6%	33.3%	11.1%	13.3%
46–55	5.7%	16.7%	5.6%	33.3%

6.4.11 Academic Discipline

Academic Discipline: Observations & Discussion

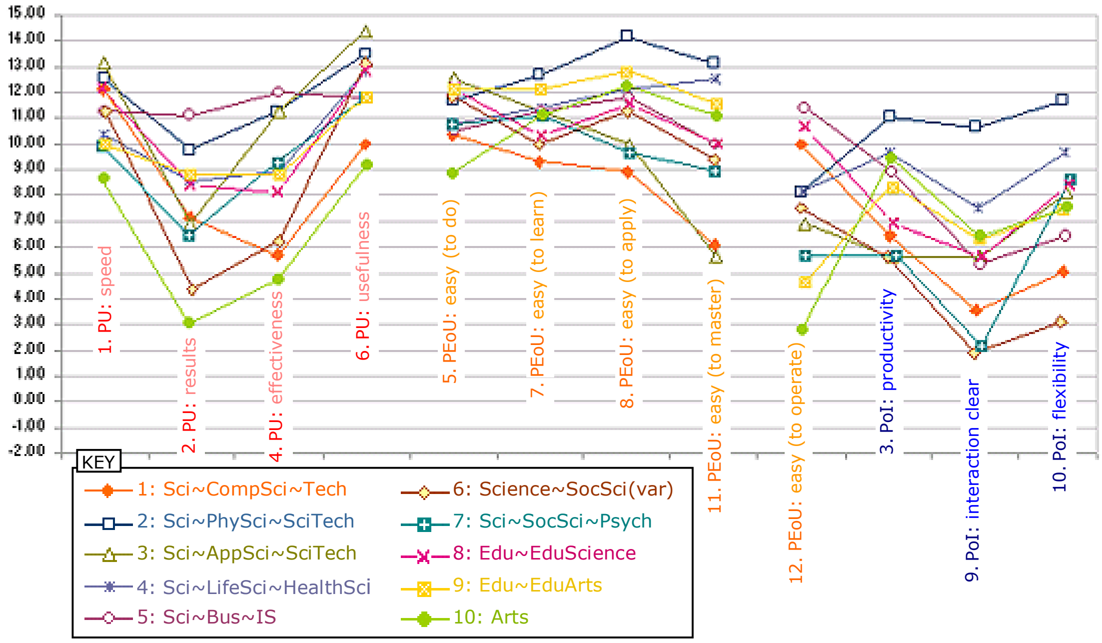
The academic discipline group-case demonstrated a very high degree of variance between its sub-groups, with users associated with the science & technology (in the physical sciences) disciplines demonstrating the highest overall score for each TAM construct. Generally positive scores were also associated with the health science and information systems academics.

The most intriguing results were those of the sub-group associated with the computer science discipline, scoring the lowest overall TAM results, and the lowest for the PEoU construct. PU and PoI also scored very low for this sub-group of users. Interestingly, computer science academics repeated some of these types of results when other non-TAM “attitude” questions were examined more closely;

- 42.9% felt search engines were *highly effective* (↓ 7.1% group norm)
- 0% felt search engine results ***will** be relevant* (↓ 13.7% group norm)
- 0% expected *successful search every time* (↓ 7.5% group norm)

Other disciplines to share some of these less optimistic attitudes towards search engines included social science (both psychology and non-psychology majors) and the arts/humanities groups.

Figure 6.19a: Academic Discipline (group-case) results for TAM constructs



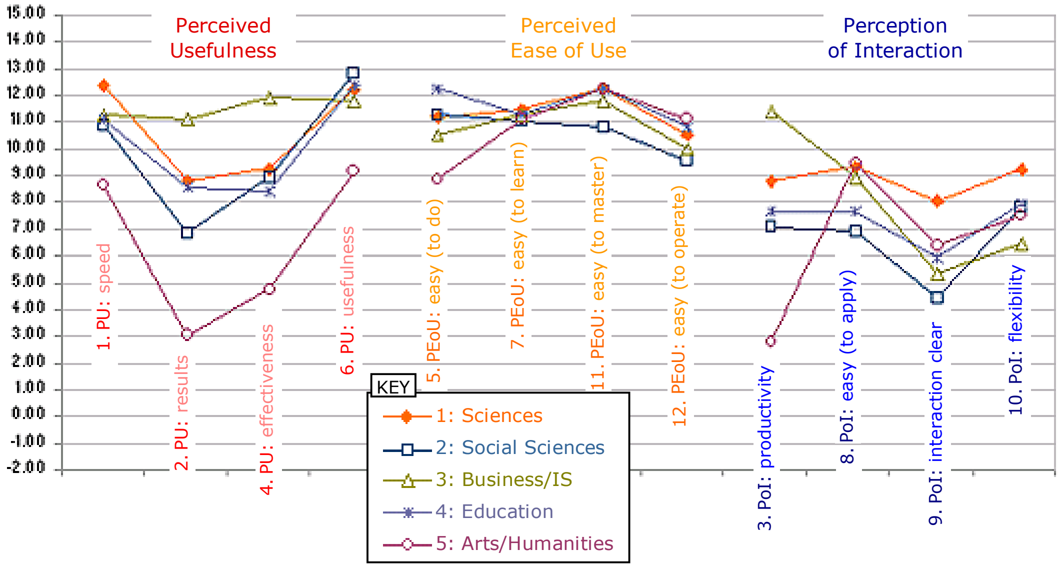
“Academic Discipline” group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results			
	PU	PEoU	PoI	TAM (all)
Whole Group	10.02	10.93	7.51	9.49
1: Sci~CompSci~Tech [7 users] 8.8%	8.76	8.67	6.26	7.89
2: Sci~PhySci~SciTech [12 users] 15%	11.77	12.92	10.37	11.69
3: Sci~AppSci~SciTech [4 users] 5%	11.41	9.85	6.57	9.27
4: Sci~LifeSci~HealthSci [7 users] 8.8%	10.18	11.70	8.76	10.21
5: Sci~Bus~IS [14 users] 17.5%	11.52	10.90	8.04	10.15
6: Science~SocSci [4 users] 5%	8.75	10.63	4.54	7.97
7: Sci~SocSci~Psych [7] 8.8%	9.38	10.10	5.54	8.34
8: Edu~EduScience [8] 10%	10.39	11.02	7.90	9.77
9: Edu~EduArts [8] 10%	9.85	12.19	6.72	9.59
10: Arts [9] 11.2%	6.39	10.83	6.53	7.91
Average Range	4.43	3.64	5.54	4.53

Although PEoU demonstrated the smallest variance within the academic discipline group-case, the divergence demonstrated a significant jump compared to other group-cases, with exception of age-range and task/system confidence. Academics associated with applied science and social science (non-psychology major) numbered only four users per sub-group however, and the researcher felt a need to eliminate group size as an influence on user results. A second academic discipline group-case ("*academic discipline – grouped*") was classified, using the following structure.

1.) Science disciplines (23.8%) ~ computer sciences; physical sciences;
2.) Social sciences (27.5%) ~ *applied sciences; life/health sciences; social science (non-psychology); social science (psychology);*
3.) Business / information systems (17.5%)
4.) Education (20%) ~ *science education; arts/humanities education;*
5.) Arts/Humanities (11.3%)

Interestingly, even with the larger sub-groups of the (grouped) academic discipline group-case, it still ranked second overall for divergence in TAM results. Although the PEoU range was narrowed significantly, PoI still had an average range of 4.38 (down from 5.54), ranking this construct second; and the divergence in PU results actually increased, average range in results jumping from 4.43 to 5.68.

Figure 6.19b: Academic Discipline GROUPED (group-case) results for TAM constructs



The Arts/Humanities sub-group in particular returned considerably low results in relation to their perceived usefulness of search engines, and PoI:productivity. This sub-group also demonstrated;

- ↑ obligation to user search engines, at 33.3% (↑ 10.8% group norm)
- ↓ in number of "active" searchers, at 0% (↓ 26.2% group norm)
- ↓ in frequency of perceived successful searches (↓ 12% group norm)
- ↓ self-efficacy (↓ 9.4% group norm)

Academic Discipline: Some Findings

The cross analysis of non-TAM survey results in the context of the academic discipline sub-groups allowed the researcher to investigate whether divergent results (whether extremely high or low) were co-present with particular user characteristics. Appendix 6.3 documents the full table of the cross-analysis.

Of particular interest were the user-characteristics associated with the second social science (group) academic discipline sub-group. Made up of applied science, life/health science, psychology and non-psychology major social sciences, the sub-group returned lower than average TAM results, particularly for the PEoU and PoI constructs. Cross analysed with user personal characteristic results, the group demonstrated a higher "habitual" use (36.4%) of search engines, ↑8.9% from the group norm. This could be significant for two reasons. Firstly, it confirms the results and findings in section 6.4.4, which demonstrated habitual use of search engines itself to be associated with lower TAM results than that of the "motivated" user, but higher than the "obliged" user, a window into which the (grouped) social science sub-group firmly fits. Secondly, the sub-group's higher habitual results co-presented with a higher perception of this sub-group's "active" participation in the search process, with 40.9% (↑14.7% from group norm) recognising the possibility of *non-relevant results* to search engine queries. This is consistent with the results and findings in section 6.4.7, which associated search engine habitual use with higher incidence of the more cognitively "active" searcher.

Academic Discipline: Limitations

A number of the sub-groups associated with the academic discipline group-case were too small to provide robust enough data for building strong theory. In an effort to consolidate the data, the researcher created a second academic discipline (grouped) group-case. Some of the observations and findings presented are in relation to the more robust groups. Except for the PEoU construct however, much of the results were relatively similar, lending a degree of validity to the classification of the first academic discipline group-case.

6.4.12 User Task/System Confidence

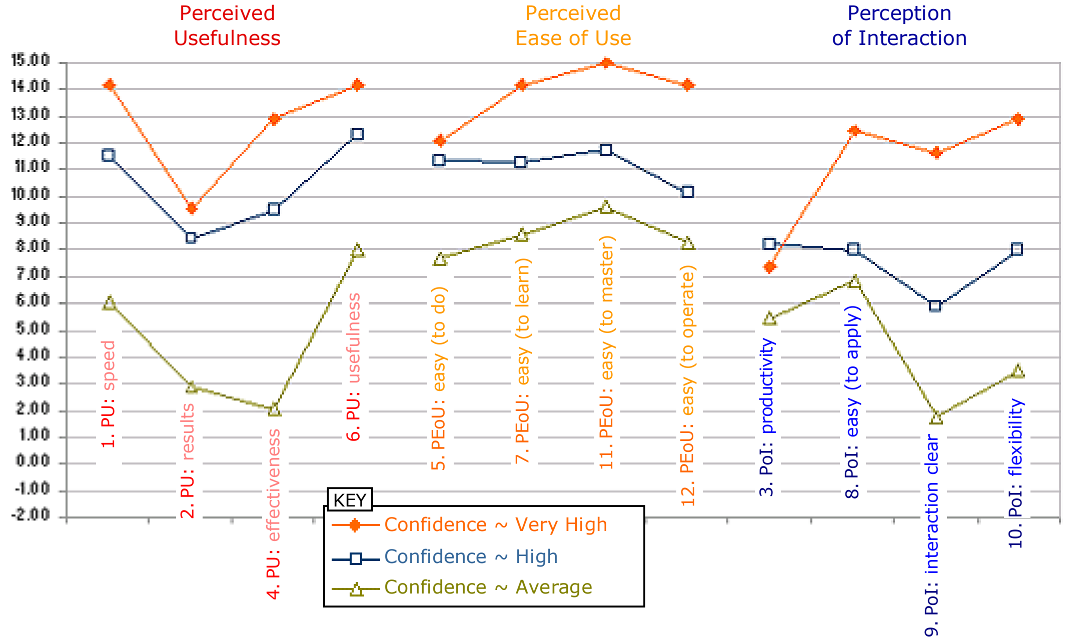
Task/System confidence is seen as a user's perception of their ability to successfully achieve the goal for which they engage a system. In the case of the current research, the task is information retrieval, and the system is a Web-based search engine used to search, find and retrieve target information. Although conceptually similar to what researchers have branded "perceived performance" (Raghunathan, 1999; Bhattacherjee, 2001; McKinney *et al.*, 2002; Shih, 2004), it implies a level self-evaluative perception pertaining to a user's own task-specific "computer-efficacy" Compeau & Higgins (1995). It seeks to investigate two things; (1) the user's degree of confidence that the system is able to perform the information task for which they have engaged it; thereby also involving (2) the user's degree of confidence in their ability to perform the specific task using the specific technology.

Users' task/system confidence was recorded by asking (#64) "*How often do you expect to successfully find relevant information when utilising a Web search engine?*" Conceptually, the question seeks to bring together both a user's pre-task (ex ante) expectation and post-task (ex post) evaluation. In this regard, it integrates some of the post-adoptive theory associated with the *Task Technology Fit* (TTF) model (Goodhue, 1995; Goodhue & Thompson, 1995; D'Ambra & Concepción, 2004a), and implies a user's level of "satisfaction" with the system (Khalifa, 2004; Tesch *et al.*, 2005)

Task/System Confidence: Observations & Discussion

The task/system confidence group-case returned the largest divergence in sub-group results across all three TAM constructs. Predictably, users with the lowest (classified "average") task/system confidence returned the lowest TAM results and users with "very high" task/system confidence returned the highest results.

Figure 6.20: Task/System “confidence” results for TAM constructs



“Task / System Confidence” group-case * = highest grp score; ^ = lowest grp score	Construct Averages & Ranges in results PU	PEoU	PoI	TAM
Whole Group	10.02	10.93	7.51	9.49
Confidence – Very High [6 users] 7.5%	12.71*	13.86*	11.15*	12.57
Confidence - High [65 users] 81.2%	10.48	11.17	7.59	9.75
Confidence - Average [9 users] 11.2%	4.86^	8.61^	4.51^	5.99
Average Range	7.99	5.25	6.82	6.68

Except for *PoI:productivity*, the pattern of results for this group-case were consistent for every construct and associated sub-constructs tested. Of note is not just that the results were predictable and consistent, but that the divergence between sub-groups was so marked, with the very high task/system confidence sub-group attaining the only 15 (maximum score) for any TAM sub-construct tested. Conversely, the average task/system confidence sub-group recorded some of the lowest results of all the classified sub-groups.

Hong *et al.*, (2006) address perceived performance in terms of users making judgments against a frame-of-reference, that is; relative to their already established expectations of a system. According to Oliver (1996) expectation is intrinsically linked to user satisfaction, which fluctuates depending on whether an experience meets, exceeds, or falls below an individual’s expectation. The relationship between users’ level of expectation and level of satisfaction is explicated in Oliver’s (1980)

"Expectation-disconfirmation theory" (EDT), an extension of cognitive dissonance theory.

The results for the task/system confidence group-case demonstrate some interesting results, particularly when cross analysed with other socio-cognitive constructs, such as expectancy (section 6.4.7) and motivation (section 6.4.4), also investigated in the research.

Figure 6.21: User Expectancy effect on Task/System "Confidence"

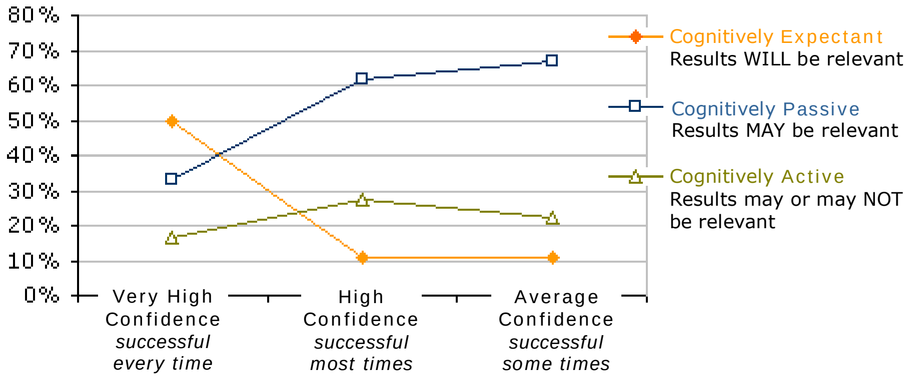


Figure 6.21 illustrates that cognitively expectant users; those users who expect search engine results *WILL* be relevant to their query, are most heavily represented in the very high confidence group; that is, those users who profess to successfully retrieving relevant information *every time* they engage a search engine. On the other hand, cognitively active users; those users who consider search engine results as likely to contain irrelevant material along with the relevant, are 4.5 times less likely to be filled with confidence regarding a successful outcome. The figure also illustrates, however, that high cognitive expectancy doesn't always amount to greater confidence. This is described in the EDT as negative disconfirmation. Simply explained, this is caused by the level disappointment experienced from a search outcome that is proportionally much lower than the initial expectation. In essence, this second outcome should occur more often than it does (Bhattacherjee & Premkumar, 2004) since, statistically speaking, it is more likely that high expectations would be negatively disconfirmed than low expectations positively disconfirmed (Yi, 1990). Moreover, the cognitive "cost" to the user when high expectations are not met would be expected to affect their level satisfaction to a greater extent than the positive affects of having an expectation more than met. That the second scenario occurs less frequently than it does,

as demonstrated in the current batch of results, is in all likelihood the result of users tempering their expectations in line with their previous experience of a system.

Task/System Confidence: Some Findings

The user results confirm previous research findings regarding theory related to users' perceived performance and confidence constructs – the higher a user's confidence that they will be able to successfully complete the task for which they have engaged a system, the better their general attitudes towards that system will be (Compeau & Higgins, 1995; Hong *et al.*, 2001).

In all, the sub-group of users with very high task/system confidence demonstrated;

- a higher motivation (66.7%) to use search engines (↑16.7% group norm)
- a significantly higher degree of faith (50%) that search engine returns would be relevant to their query (↑36.2% group norm)
- an equal weighting of attribution to self and system (50% each) when a search was successful.
- a high propensity for minimal strategic change when a search query proved to be unsuccessful, with 83.3% (↑36.2% group norm) stating they would change their keywords rather than selecting a different search-query strategy (at 16.7%, ↓29.5% group norm).

In short, users with very high task/system confidence displayed a reduced tendency to "own" the cognitive load of their search engine interaction, with 0% using the more difficult boolean search tactics (↓12.5 group norm); 50% high self-efficacy (↓15% group norm); and only 16.7% considering the possibility that search-engine query results might not be relevant (↓9.6% group norm). This finding is supported by evidence that users with relatively low task/system confidence demonstrated an increased tendency to own the cognitive load of their search-engine interaction, with 22.2% using boolean search tactics (↑22% high T/S confidence); 66.7% high self-efficacy (↑16.7% high T/S confidence); only 11.1% believing search engine query results would be completely relevant (↓38.9% high T/S confidence), 22.2% considering search engine query returns may be irrelevant (↑5.5% high T/S confidence); and a staggering 88.9% using all the summary information associated with search engine query results to make decisions about a result's relevancy to their information task (↑22.2 high T/S confidence).

Task/System Confidence: Limitations

The significance of the Task/System confidence findings and their potential application to how developers understand the complex relationship between system and cognitive loads in user/information and user/system interaction is unfortunately limited by the degree of whole-group representation in each sub-group of the task/system confidence group-case. The observations, discussion and findings relate to a total of only 15 out of 80 users. Even with the high degree of qualitative cross-analysis with other sub-groups, this still only represents 18.7% of the user-group.

Notwithstanding, the researcher contends that the preliminary findings associated with the task/system confidence group-case identifies an important issue related to the assumptions of positive user-attitude returns to TAM investigations. Amongst other things, the assumption of the TAM, and other technology usage type models, is that the higher/better a user's attitude is towards a system, the greater the influence is on their behavioural intent to use that system. The current research demonstrates clearly, that a user with a very high task/system confidence will return very high attitude results regarding their PU, PEoU and PoI of the system, and therefore – according to the TAM – will demonstrate a higher BI to engage that system.

The preliminary cross analysis of the actual information seeking behaviours; that is; the computer/human interactions; of the very high task/system confidence sub-group however, seems to imply that while the attitude is positive, user/information interaction may be compromised to the extent that the attitude induces a more cognitively lazy approach to information retrieval. If this is true, then although intent to use the system is increased, effective use may not necessarily be the ultimate outcome.

The limitation of small user-representation in the high and relative task/system confidence sub-groups means these findings can only be considered preliminary, and remain a stated area for future research, albeit an area with great potential to build user/system interaction theory.

6.5 Chapter Conclusion

The purpose of this chapter was to investigate the current user-group's stated attitudes towards, and expectations of, Web-based search engines using the constructs associated with Davis' technology acceptance model (1986, 1989). Users perceptions of the PU and PEoU of search engine systems, as well as their PoI regarding the ongoing predictability of their user/information and user/system interaction, have been examined in the context of selected group-cases of users; that is; constructed cases of users displaying similar or divergent "individual differences".

Each group-case has provided an observation context for the researcher, which has been used to develop a rich picture of the attitudes and expectations of users, and some initial findings has been developed and discussed in relation to how those attitudes might influence user/search-engine interaction. The contexts which have been used to investigate users' perceptions include demographic differences within the user-group, self-perceptive individual differences, and specific information retrieval inclinations and tactics.

Importantly, this has not been a traditional, quantitative TAM study used to investigate the antecedents of user search engine adoption. Instead, the constructs associated with the TAM have been used to qualitatively;

1.) Investigate users' ongoing attitudes towards, and expectations of, their search engine engagement;
2.) Cross analysis of perception and attitude results with participants' self-described information seeking, search strategies and retrieval behaviours; and
3.) Build theory relating to how user attitudes, individual differences, and information behaviour impact each other in user search engine engagement.

The inductive approach has used a mixed methodology, utilising quantitative data to build, rather than test theory. This approach, like all research approaches, is not without its weaknesses or it critics, however, it has been developed as a way to investigate the deeper, implied meanings of the user attitudes and behaviours it has examined. Where possible, limitations have been addressed in the context of the observations made and findings/theory building. As with most inductive research, patterns between the data clusters have been highlighted in an effort to explore their contextual meaning. The researcher recognises that many observations have been made, some of which ~ even if they are to be considered evidence of emerging theory ~ reach far beyond the scope of the current dissertation.

The various finding and suppositions made of the data associated with this chapter will be addressed again in the final chapter of the PhD (chapter 8), where emerging theory will be analysed in the context of previous research and theory, and any significant findings made in the following (chapter 7) information quality results chapter.

CHAPTER 7

Results & Findings

"Information Quality in Web Information Retrieval"

User IQ value-judgments in a Web Environment

7. Introduction

In the literature review information quality (IQ) was proposed to be an evolving, moving entity, with user interaction taking place throughout the information life-cycle. Value-judgments, therefore, are made at multiple stages of interaction, by both the producers and retrievers of information. In the context of the current research, IQ relates to the value-judgments made of information by the retrievers who interact with it. In this respect, it has been established that the investigation pertains to the value-judgements made of information in the "information use" section of the combined conceptual life-cycle (CC/LC) of IQ proposed in the literature review (fig 2.2 & 7.1).

7.1 The Investigative Framework

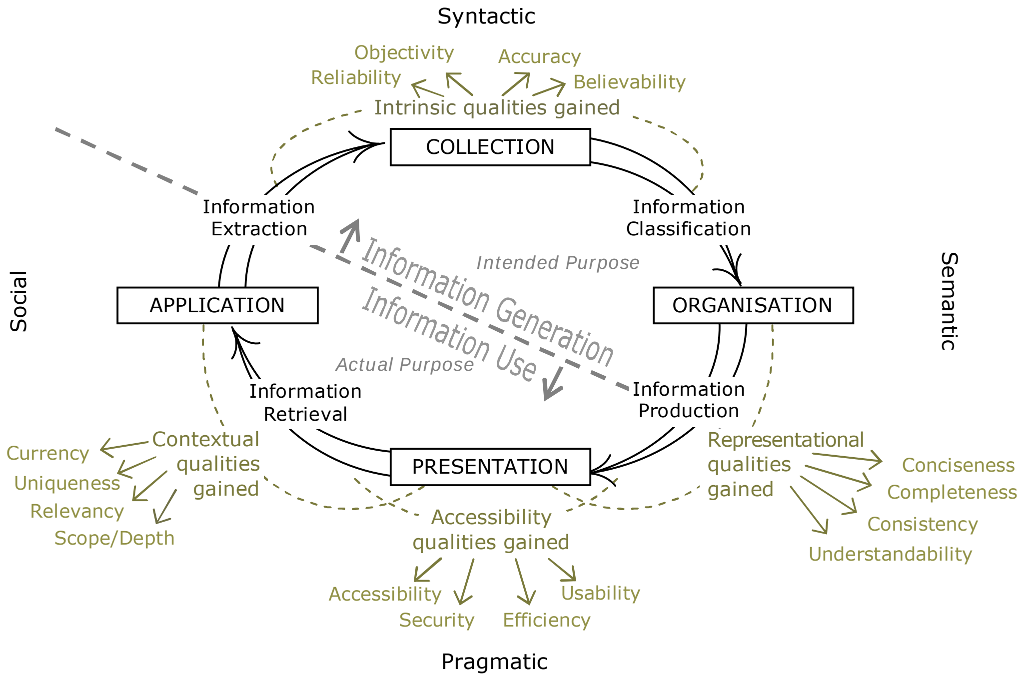
From a conceptual perspective, IQ is recognised as being representative of two separate phenomena. Firstly, IQ represents the actual (physical/digital) characteristics of information, and secondly, IQ is the imposed perceptions of an information user, made while interacting with that information. This is seen as an important distinction in the CC/LC, which models both the generation (production) and use (retrieval) of IQ. In doing so, the model is able to map-out where in the creation and/or retrieval of information, user perceptions of IQ are imposed onto the data.

Figure 7.1 presents the CC/LC model of IQ, first introduced in the literature review. The researcher contends that the model:

1.) represents a synergy between a number of previous conceptual IQ models (Wang & Strong, 1996; Shanks & Corbitt, 1998; Liu & Chi, 2002);
2.) superimposes four user/information interactions from IR, HIB and ISB literature; which are (1) information classification; (2) information production; (3) information retrieval; and (4) information extraction; *and*

3.) provides a conceptually robust back-drop for the contextualisation of the characteristics/dimensions of IQ.

Figure 7.1 Combined Conceptual/Life-Cycle Model of IQ



Wang & Strong (1996) established the now widely accepted paradigm that quality, as it relates to data/information quality, is information that is "fit-for-use/purpose". This recognises that IQ is determined in the *context* of specific user/information interactions. The CC/LC of IQ provides a conceptual framework by which the specific contexts of user/information interaction can be established, facilitating a contextual understanding of the various dimensions proposed to be central to IQ. The proposed dimensions of IQ to be used in the following investigation were presented in the literature review (table 2.2), and were chosen because they were found to feature most frequently in a selection of twenty IQ research publications between 1996 and 2005 (Alexander & Tate, 1999; Beck, 1997; Dedeke, 2000; Eppler & Muenzenmayer, 2002; Harris, 1997; Kahn *et al.*, 2002; Katerattanakul *et al.*, 1999; Klein, 2002a; Leung, 2001; Liu & Chi', 2002; Naumann & Rolker, 2000; Shankar & Watts, 2003; Shanks & Corbitt, 1999; Song & Zahedi – 2005; Sturges & Griffin, 2003; Stvilia *et al.*, 2005; Tombros, Ruthven & Jose, 2003; Wang & Strong, 1996; Zeist & Hendriks, 1996; Zhu & Gauch, 2000)

7.2 Quantifying Users' perceptions of Web IQ

7.2.1 Examining Sixteen Common IQ Dimensions

Participants were asked a series of thirty two questions, with each dimension being tested twice. It was recognised early in the research process, and from the initial feedback from the "tester" user-group, that it is far easier to describe what quality *is not*, rather than what quality *is*. Consequently, all questions were asked in the "negative", and described in terms of typical information problems encountered on the Web. Users were asked the same two questions of each of these thirty two described scenarios;

1.) *Indicate how often you encounter the following issue...* (description of scenario)
   (a) frequently; (b) occasionally; (c) infrequently; or (d) never
2.) Indicate how your perception of information quality of a visited *web page/website changes* when the described characteristic is encountered on those pages
   (a) Does not affect; (b) Marginally decreases; or (c) Greatly decreases my perception

Table 7.1 presents the 32 questions from the IQ Survey, in the order in which they were asked. Users were not informed regarding the "dimensions" (presented in column 1) that were being tested, they were simply asked to indicate how *frequently* they encountered the described scenario (presented in the second column) and to select how encountering the problem *affected their perception* of the information quality of the Web page.

Table 7.1: The sixteen dimensions tested in Survey #4 (Information Quality)

IQ Dimension	Question
Reliability	1. Information that lacks an attributed author
	2. Information that seems unreliable
Accuracy	3. Pages that contain numerous spelling errors
	4. Information that is incorrect
Timeliness/Currency	5. Pages that contain out-of-date/broken hyperlinks
	6. Out-of-date information
Scope/Depth	7. Too much information
	8. Too little information
Relevancy	9. Irrelevant Information
	10. Unhelpful information
Accessibility/Readability	11. Information aimed at the wrong audience (in the context of a website)
	12. Information that is difficult to read

Table 7.1 (cont…): The sixteen dimensions tested in Survey #4 (IQ)

IQ Dimension	Question
Usability	13. Web pages that are difficult to navigate
	14. Information that is hard to find
Consistency	15. Information that seems disjointed and difficult to follow
	16. Information that seems out of place (in the context of a website)
Objectivity	17. Information that is bias in nature
	18. Information that does not attempt sustain itself (e.g.; reference etc)
Understandability	19. Poorly written information
	20. Information that is difficult to understand
Completeness	21. Information that is not complete
	22. "Under Construction" or "Coming Soon" statements
Security	23. Un-secure/unprotected information (i.e.; sensitive information that should be protected)
	24. Information that probably breaches copyright laws
Conciseness	25. Long winded, unfocused information
	26. Information that contains poor grammar
Value Added	27. Information that is highly repetitive
	28. Un-inspired, boring information (nothing new or innovative)
Believability	29. Information that is clearly erroneous
	30. Information that lacks credibility
Efficiency	31. Information that doesn't meet your information needs
	32. Content that takes and a long time to download

The choice to test both the *frequency of users encountering* specific quality related problems and how *encountering those problems made users feel* was determined to be an effective way to:

1.) Examine assumed World Wide Web IQ deficits;
2.) Investigate users' value-judgments when they encounter specific Web-based IQ deficits;
3.) Examine the actual impact of users' encountering quality related problems on the Web on their perception of IQ; and
4.) Investigate whether/how users perceptions and value-judgments relating to IQ evolve and change according to the information environment in which they encounter target information.

7.2.2 IQ Dimensions Rating Scale

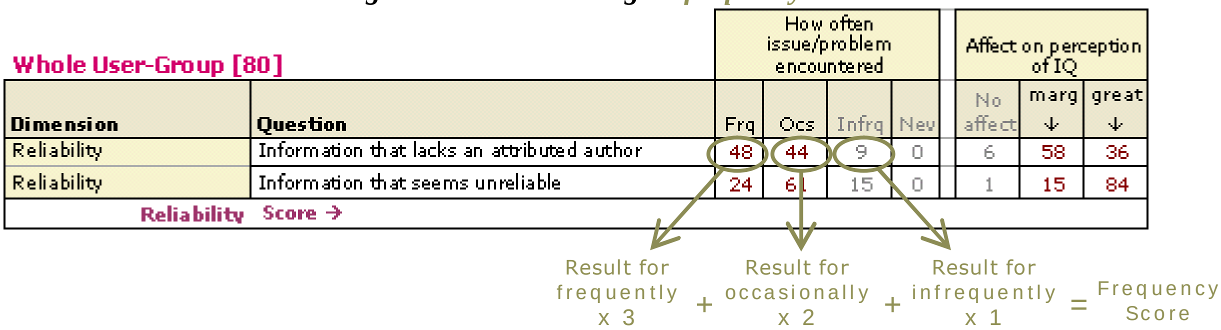
The *frequency* and *effect* results for the thirty two described scenarios needed to be examined, and a weighted formula applied to ensure that the user results for the various IQ dimensions could be meaningfully compared. Validity was sought by applying two formulas:

1.) A weighted formula according to how frequently a described IQ problem was encountered (= encounter score)

2.) A weighted formula according to how significantly encountering the described problem impacted on a user's perception of IQ (= effect score)

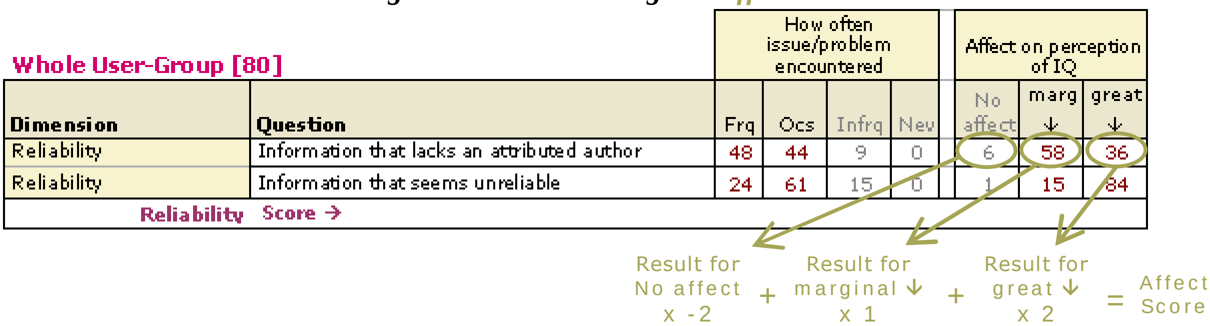
The encounter score and effect score were then added together (SUM), and then divided by the number of affective results used to attain the SUM, which in the initial case was 5. It should be noted, that ultimately, dividing by 5 is not absolutely necessary, it simply normalises the "*impact on perceptions*" score (see fig 7.2c) relatively smaller. Figure 7.2a to 7.2c describes how the weighted formula works.

Figure 7.2a: Calculating a "frequency" score



Whole User-Group [80]		How often issue/problem encountered				Affect on perception of IQ		
Dimension	Question	Frq	Ocs	Infrq	Nev	No affect	marg ↓	great ↓
Reliability	Information that lacks an attributed author	48	44	9	0	6	58	36
Reliability	Information that seems unreliable	24	61	15	0	1	15	84
Reliability Score →								

Figure 7.2b: Calculating an "affect" score



Whole User-Group [80]		How often issue/problem encountered				Affect on perception of IQ		
Dimension	Question	Frq	Ocs	Infrq	Nev	No affect	marg ↓	great ↓
Reliability	Information that lacks an attributed author	48	44	9	0	6	58	36
Reliability	Information that seems unreliable	24	61	15	0	1	15	84
Reliability Score →								

Figure 7.2c: Calculating an "Impact on perceptions" score

Frequency Score + Affect Score ÷ 5 = Impact on Perceptions

Justification of the Formula

The formula is designed to "weight" user results according to a ↑frequency = ↑weighting, and ↑effect = ↑weighting, logic. A second weighting logic was also applied to ensure that if a user recorded encountering a problem as having *no effect* on them, that this "*no effect*" impacted the ***affect score*** positively. This was seen as particularly important given that the impact of encountering was what is being measured. For this same reason, the "*never*" frequency result was not included in the weighted formula. Table 7.2 presents the users results for each IQ dimension score.

7.2.3 IQ Dimension Results

Table 7.2: Results for the sixteen dimensions tested in Survey #4 (IQ)

IQ Dimension	Question	Score
Reliability	1. Information that lacks an attributed author	71.8
	2. Information that seems unreliable	78.0
	Reliability	74.9
Accuracy	3. Pages that contain numerous spelling errors	64.6
	4. Information that is incorrect	71.2
	Accuracy	67.9
Timeliness / Currency	5. Pages that contain out-of-date/broken hyperlinks	47.4
	6. Out-of-date information	59.6
	Timeliness/Currency	53.5
Scope/Depth	7. Too much information	-0.8
	8. Too little information	53.0
	Scope/Depth	26.1
Relevancy	9. Irrelevant Information	44.0
	10. Unhelpful information	42.2
	Relevancy	43.1
Accessibility / Readability	11. Information aimed at the wrong audience (in the context of a website)	30.4
	12. Information that is difficult to read	45.4
	Accessibility/Readability	37.9
Usability	13. Web pages that are difficult to navigate	44.4
	14. Information that is hard to find	39.2
	Usability	41.8
Consistency	15. Information that seems disjointed and difficult to follow	60.0
	16. Information that seems out of place (in the context of a website)	32.4
	Consistency	46.2
Objectivity	17. Information that is bias in nature	64.0
	18. Information that does not attempt sustain itself (e.g.; reference etc)	68.8
	Objectivity	66.4
Understandability	19. Poorly written information	73.4
	20. Information that is difficult to understand	37.6
	Understandability	55.5
Completeness	21. Information that is not complete	58.6
	22. "Under Construction" or "Coming Soon" statements	43.8
	Completeness	51.2
Security	23. Un-secure/unprotected information	3.4
	24. Information that probably breaches copyright laws	25.2
	Security	14.3
Conciseness	25. Long winded, unfocused information	58.4
	26. Information that contains poor grammar	64.4
	Conciseness	61.4
Value Added (Uniqueness)	27. Information that is highly repetitive	54.6
	28. Un-inspired, boring information (nothing new or innovative)	42.8
	Uniqueness	48.7
Believability	29. Information that is clearly erroneous	60.0
	30. Information that lacks credibility	68.2
	Believability	64.1
Efficiency	31. Information that doesn't meet your information needs	41.6
	32. Content that takes and a long time to download	17.0
	Efficiency	29.3

7.3 User Perceptions of Web IQ: Results

The following section discusses the user results presented in Table 7.2, examining what they imply about participants' general perceptions of specific characteristics of IQ, and their relative importance during Web information search and retrieval. Importantly, the researcher contends that the featured IQ dimensions, as existent entities, are neither exhaustive nor able to exist completely independent of each other. The conceptualisation of IQ as a construct into a set of meaningful, measurable dimensions is fraught with the danger of over-simplifying what amounts to a multi-dimensional construct (Wang *et al.*, 1995; Klein, 2001; Gendron *et al.*, 2004) made up of numerous inter-connected, affective parts, which are consciously and unconsciously, heterogeneously engaged during user/information interaction.

In this regard, the itemising of individual dimensions into a most-to-least important list of user-driven IQ criteria is ultimately meaningless without developing a degree of understanding of how at least some of the 'parts' work together in impacting users' IQ perceptions. The following discussion of the user IQ dimension results, therefore, has been categorised according to the clustering of dimension types into the four stages of the combined-conceptual life-cycle (CC/LC) presented in figure 7.1, using Wang & Strong's (1996) CIQF categories of: (1)intrinsic IQ; (2) representational IQ; (3) accessibility IQ; and (4) contextual IQ.

The sixteen dimensions, categorised into the CIQF, are clustered as follows:

1.) Intrinsic IQ: Reliability, Accuracy, Objectivity, Believability;
2.) Representational IQ: Conciseness, Completeness, Consistency, Understandability;
3.) Accessibility IQ: Accessibility, Usability, Efficiency, Security;
4.) Contextual IQ: Currency, Uniqueness, Relevancy, Scope/Depth

The researcher contends that the categorised dimensions act as influencing antecedents on users' IQ perceptions at multiple levels, by influencing: (1) overall perceptions of IQ; (2) category specific perceptions of IQ; and (3) cross-dimensional perceptions of IQ (both within and between categories).

Table 7.3 presents a summarised version of the user-group's Web IQ dimension results. Although ranked in order of highest (seen as *most important*) through to lowest (*least important*) scores for each dimension, the researcher has contended that the process of users making value-judgments of the information they encounter is far more complex than attributing a single dimension here or there. To the right of the table are the IQ categories into which each of the sixteen measured dimensions have been placed.

Table 7.3: Summary of IQ dimension scores (whole user-group)

Rank	Whole User-Group [80]	Score	↓ IQ Category
1	Reliability	74.9	Intrinsic IQ
2	Accuracy	67.9	Intrinsic IQ
3	Objectivity	66.4	Intrinsic IQ
4	Believability	64.1	Intrinsic IQ
5	Conciseness	61.4	Representational IQ
6	Understandability	55.5	Representational IQ
7	Timeliness/Currency	53.5	Contextual IQ
8	Completeness	51.2	Representational IQ
9	Uniqueness	48.7	Contextual IQ
10	Consistency	46.2	Representational IQ
11	Relevancy	43.1	Contextual IQ
12	Usability	41.8	Accessibility IQ
13	Accessibility/Readability	37.9	Accessibility IQ
14	Efficiency	29.3	Accessibility IQ
15	Scope/Depth	26.1	Contextual IQ
16	Security	14.3	Accessibility IQ

What follows is an exploration of the user-group's dimension results in the context of the four IQ categories. Results will be discussed in relation, but not limited to, the whole group, and group-cases: (1) academic discipline; (2) academic role; (3) information task; and (4) age-range. Appendix 7.1 contains the summary tables for all the group-case variances in results.

7.3.1 Intrinsic IQ Dimension Results
(Reliability, Accuracy, Objectivity & Believability)

Intrinsic IQ: Some Observations

As expected, dimensions such as *reliability* (ranked 1st); *objectivity* (ranked 2nd); *accuracy* (ranked 3rd); and *believability* (ranked 4th); rank as the most important associative information characteristics in regards to the user-group's perception of target information's IQ. Of surprise are the lower ranking results for dimensions such as *usability* (ranked 12th); *uniqueness* (ranked 9th); *accessibility* (ranked 13th); *security* (ranked 16th); and *relevancy* (ranked 11th); all of which are dimensions proposed by numerous recent Web-related IQ research frameworks as being highly important Web IQ issues (Zhu & Gauch, 2000; Jeong & Lambert, 2001; Eppler & Muenzenmayer, 2002; Sturges & Griffin, 2003; Tombros *et al.*, 2003; Song & Zahedi, 2005).

Table 7.4 presents the user-group's results for the intrinsic dimensions of IQ. Individual dimensions are named in the left column, as is the dimension's rank (out of 16). The combined dimension score is also presented.

Table 7.4: User Results for Intrinsic IQ Dimensions (Reliability, Accuracy, Objectivity & Believability)

		How often issue/problem encountered				Affect on perception of IQ					
Dimension	Question	FRQ	OCS	InFRQ	NEV	Nil Effect	Marg ↓	Great ↓	Freq Score	Affect Score	Dimsn Score
Reliability (1)	Info lacks attributed author	48	44	9	0	6	58	36	241	118	71.8
	Info that seems unreliable	24	61	15	0	1	15	84	209	181	78.0
						Dimension Score (Reliability) →					74.9
Accuracy (2)	contains numerous spelling errors	15	49	34	2	6	24	70	171	152	64.6
	Information that is incorrect	8	62	29	1	1	12	86	174	182	71.2
						Score (Accuracy) →					67.9
Objectivity (3)	Info bias in nature	28	55	18	0	11	48	41	212	108	64.0
	Info not attempt sustain itself	42	42	12	2	9	36	55	216	128	68.8
						Score (Objectivity) →					66.4
Believability (4)	Info that is clearly erroneous	2	38	55	5	4	6	90	122	178	60.0
	Information that lacks credibility	6	61	32	0	4	15	81	172	169	68.2
						Score (Believability) →					64.1

Reliability

As a construct, reliability is an IQ dimension built on observable characteristics such as authorship, which implies other IQ attributes such as *authority* and *reputation*. (Keast *et al.*, 2001; Pernici & Scannapieco, 2002) Importantly, reliability denotes the presence of dimensions such as *objectivity*, *accuracy* and *believability*, in that without these characteristics, information would be considered, by the discerning recipient, to be unreliable. All four of these dimensions then, are considered "intrinsic" (Wang & Strong, 1996) characteristics of information, and must exist within (considered to be) quality information, regardless of its system context.

48% of users said they frequently encounter information that lacks authorship details, but only 36% said this greatly decreases their perception of the information's quality. This suggests that web users employ multiple methods to determine the source of data. Survey #4 (IQ.Q8) results (see Table 7.5) confirm this, with 35% of users stating knowing the authorship of information was only *relatively* or *marginally important*.

Table 7.5: General perceptions of Authorship on the Web

[#73] *(IQ Q8)* How important is knowing the *authorship* of the information on a web page to your perception of its *reliability*?	%	#
Not important	0%	0
Marginally important	8.8%	7
Relatively/fairly important	26.2%	21
Very important	36.2%	29
Essential	28.8%	23
	Total Respondents	80

Accuracy

The occurrence of users frequently encountering spelling errors or incorrect information is relatively low (15% for spelling and 8% for erroneous information). Of itself this may have left accuracy as a relatively minor dimension (in importance), however users return very high results for this dimension's negative impact on their perceptions of quality. 70% of users said encountering spelling errors greatly decreases their IQ perception of the information and 86% of users said their perception of IQ greatly decreases when they encountered information they considered to be incorrect.

Objectivity

Over one quarter (28%) of the user-group stated they frequently encounter Web information that is biased in nature. Significantly, 89% of them then stated encountering information of this kind has a negative affect on their perception of its IQ (41% greatly decreasing, and 48% marginally decreasing). An even greater number of users (42%) frequently encounter Web information that does not attempt to sustain its own argument(s), with 91% claiming this negatively affects their view (55% greatly decreasing and 36% marginally decreasing) of the information's IQ.

Significantly, information that does not attempt to sustain itself, which of itself does not necessarily mean that the information *is* biased, scored higher for both how frequently users encountered it, and its negative impact on users' perceptions of IQ. This is likely to be indicative of a cognitively sophisticated user-group, who exhibited a higher tolerance for bias than would be expected from a more general web-user population sample. Survey #4 (IQ.Q12) asked participants to describe their general feelings towards biased information on the Web (see Table 7.6).

Table 7.6: User Assumptions about the presence and role of bias information

[77] *(IQ Q12) Biased information* can be published on the www without any checks and balances. Which of the following best describes your own attitude towards biased information?	%	#
I believe no information is free from bias and read what I retrieve from the Web accordingly	75%	60
Biased information is fine, provided it is aware of its bias	13.8%	11
Biased info provides an important source of opposing points of view	10%	8
I am generally unaware of the bias in the information I retrieve from the WWW	1.2%	1
Total Respondents		80

Significantly, nearly a quarter of participants demonstrate a high degree of tolerance for biased information (23.8%), with nearly half of them (10% overall) stating that bias information is, in fact, an important means of learning opposing view-points on similar topics. This sub-group, defined as users with a *very high tolerance for bias*, presented strong evidence that the level of user tolerance for bias is directly related to users' attitudes towards authorship.

Table 7.7: Perceptions of Authorship on the Web
Whole Group (left) vs. Sub-group: "Very high bias tolerance" (right)

[#73] *(IQ Q8)* How important is knowing the *authorship* ... [Whole Group]	%	#
Marg/Relatively important	35%	28
Very important	36.2%	29
Essential	28.8%	23
Total Respondents		80

[#73] *(IQ Q8)* How important is knowing the *authorship* ... [V. High Bias Tolerance]	%	#
Marg/Relatively important	12.5%	1
Very important	37.5%	3
Essential	50%	4
Total Respondents		8

Believability

Believability describes the so called credibility of information, and like reliability, is intrinsically linked with characteristics such as authorship, and co-dimensions like accuracy and objectivity (Michnik & Lo, 2007). Although encountered relatively infrequently, the negative impact of encountering believability issues on the Web is extremely high, with 90% and 81% of users stating erroneous information and information that lacks credibility greatly decreases their IQ perception.

These extremely high levels of negative impact are not repeated in the subsequent (non-intrinsic IQ) dimensions measured in the survey.

Intrinsic IQ: Preliminary Findings & Discussion

The dominance of the intrinsic IQ dimensions in the user results is indicative of their stability and importance to users' perceptions of IQ. Although the researcher contends that itemising individual IQ dimensions according to their “importance” to the information search and retrieval process can be ineffectual to a full understanding of their interactive impact on user IQ perceptions, user results clearly indicate that some dimensions are considered more critical than others. Moreover, results also seem to indicate that clusters of dimensions do indeed work together to form categories of IQ, some of which are more critical than others.

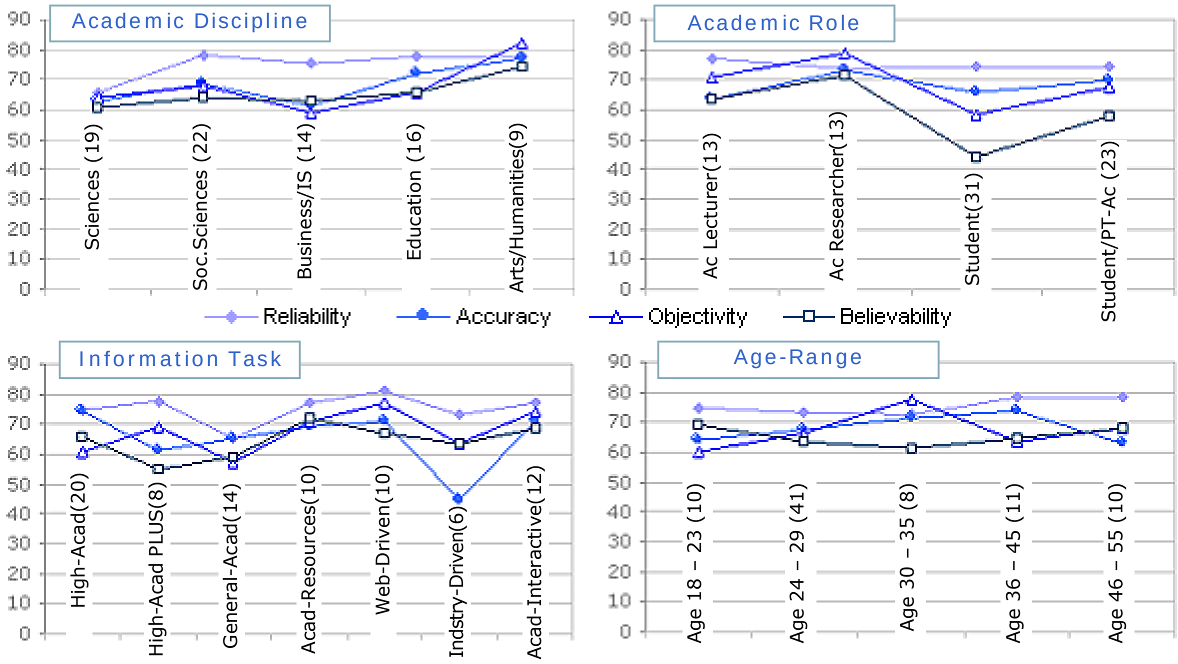
Importantly, the results are empirically supportive of:

1.) Wang & Strong’s (1996) conceptualisation of an “intrinsic” level to data/information quality;
2.) The initial IQ frameworks developed early in the Web’s *public* evolution by authors such as Beck (1997) Harris (1997) and Alexander & Tate (1999);
3.) The researcher’s contention that clusters of dimensions (rather than individual dimensions) combine and act as antecedents on users’ perceptions of IQ;
4.) The contention that some clusters of dimensions have a greater influence on users’ IQ perceptions than other clusters.

Intrinsic IQ: Variations in Results

Figure 7.3 presents the divergence in IQ dimension results for the group-cases: academic discipline; academic role; age-range; and information task.

Figure 7.3: IQ Dimension Divergence Intrinsic IQ



Of interest is the relatively low variance between the *academic discipline* sub-group results, particularly in relation to accuracy, objectivity and believability. The order of the four intrinsic dimensions does vary slightly between the five discipline areas, however – apart from in the arts/humanities, reliability remains the most important influencing variable on participants' perceptions of IQ. The arts/humanities is also the only sub-group to include another IQ dimension within their intrinsic IQ results, with *conciseness* ranking 4th, above believability. *Conciseness* actually ranked 5th in overall user-group results, and appears to be an important variable in users' perceptions of *Representational IQ*, which is discussed in the following section of this chapter.

Table 7.8: IQ Dimension summaries Intrinsic IQ (Academic Role)

Academic Lecturer (13)			Acadmc Researcher (13)			Student only [31]			Student/PT-Ac [23]		
1	Reliability (1)	76.9	1	Objectivity (3)	78.9	1	Reliability (1)	74.0	1	Reliability (1)	74.1
2	Objectivity (3)	70.5	2	Reliability (1)	73.8	2	Accuracy (2)	65.4	2	Accuracy (2)	69.8
3	Believability (4)	63.6	3	Accuracy (2)	73.3	3	Uniqueness (10)	60.6	3	Objectivity (3)	67.3
4	Accuracy (2)	63.3	4	Understndblty(6)	71.7	4	Conciseness (5)	59.5	4	Conciseness (5)	62.2
5	Conciseness (5)	56.9	5	Believability (4)	71.6	5	Objectivity (3)	58.5	5	Currency (8)	57.7
6	Completeness (7)	56.7	6	Conciseness (5)	71.1	6	Understndblty(6)	57.2	6	Believability (4)	57.7
7	Currency (8)	54.5	7	Currency (8)	59.7	7	Completeness (7)	54.7	7	Understndblty (6)	50.6
8	Uniqueness (10)	49.2	8	Uniqueness (10)	54.8	8	Currency (8)	47.0	8	Completeness (7)	44.0
9	Relevancy (11)	48.4	9	Relevancy (11)	54.6	9	Consistency (12)	46.7	9	Consistency (12)	42.2
10	Consistency (12)	46.8	10	Consistency (12)	52.5	10	Believability (4)	44.4	10	Uniqueness (10)	39.8
11	Understndblty (6)	44.5	11	Completeness (7)	50.9	11	Usability (9)	43.3	11	Usability (9)	38.4
12	Scope/Depth (15)	34.5	12	Usability (9)	49.8	12	Relevancy (11)	42.0	12	Accessibility (14)	34.7
13	Usability (9)	34.5	13	Accessibility (14)	44.1	13	Accessibility (14)	38.5	13	Relevancy (11)	33.6
14	Accessibility (14)	34.4	14	Scope/Depth (15)	30.0	14	Efficiency (13)	31.6	14	Efficiency (13)	28.1
15	Security (16)	33.2	15	Efficiency (13)	26.7	15	Scope/Depth (15)	23.1	15	Scope/Depth (15)	23.4
16	Efficiency (13)	29.1	16	Security (16)	17.6	16	Security (16)	19.0	16	Security (16)	12.4

A notable variance in results (not displayed in fig 7.3) occurs within the "student-only" sub-group of the academic role group-case (see Table 7.8). Dimensions associated with (Web) contextual IQ make an early appearance in the list, with *uniqueness* and *currency* being considered relatively more important than the intrinsic believability. Within the "industry-driven tasks" sub-group (information task group-case) a similar phenomena occurs, with dimensions such as uniqueness and currency ranking as more important than the intrinsic *accuracy*. Appendix 7.1 presents a full set of the group-case variations tables, as seen in Table 7.8.

A cross-analysis of the sub-group of users classified as predominantly engaging the Web for "industry-driven tasks" reveals that 83% of them are "student only" in academic role. This would account for the similarities in the two sub-group results, and indicates that users' academic role may have a degree of influence on the types of information tasks typically undertaken by participants. Whether it is the academic role or predominant information task engagement that acts as the stronger influencing antecedent to the sub-group's perceptions of IQ still requires further investigation before a solid finding can be proposed, however the contextual evidence of the sub-groups associated with their respective group-cases, gives preliminary support to information-task being the stronger of the two. Moreover, the relationship between the *industry-driven information task* and *student only* sub-groups is suggestive of;

1.) The information task sub-group being the more dominant of the pair[13]; and
2.) The relationship having little to do with perceptions of IQ.

Overall, except for the (discipline) arts/humanities and (role) researcher sub-groups, *reliability* establishes itself as the top influencing variable on all the sub-group's perceptions of IQ, with the three other intrinsic IQ dimensions; namely, objectivity, accuracy and believability swapping back and forth in rank. That these dimensions are grouped together in this way suggests that Wang & Strong (1996) got it right when they proposed these four dimensions as being similar in nature and indicative of the intrinsic characteristics of IQ.

Intrinsic IQ: Limitations

The broad nature of the current investigation has resulted in a number of instances where more specific user-data has been found to be lacking. The student-only sub-group results presented in Table 7.8 (column 3) are a case in point. It would have been useful to have been able to compare the divergence in this sub-group's results with user-data pertaining to *how often*, and for *how long*, participants' currently spend engaging the Web for information retrieval.

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[13] Statistically, if a user engages the Web predominantly to interact with industry-driven information, it is highly likely (83% chance) they will be a post-grad student. This is not true in the reverse. If a user is a post-grad student, there is a 16% chance they will engage industry-driven Web content

It may also be considered somewhat one-dimensional to calculate a dimension score from only two scenarios pertaining to each specific dimension. The sheer size of the surveys however governed the use of only two scenarios per dimension. With that said, the contention of the research and the evidence of the results suggests that perceptions of IQ dimensions, in all likelihood, do not exist as islands, but are inter-connected and fluid. Some described scenarios could easily be included as testing other dimensions. There were at least six scenarios, for example, that could have been used to test participants' perception of relevancy, including;

- irrelevant information (tested relevancy)
- unhelpful information (tested relevancy)
- too much information (tested scope/depth)
- information aimed at the wrong audience (tested accessibility)
- long winded, unfocused information (tested conciseness)
- information that doesn't meet your information needs (tested efficiency)

Given the time to continue with the research, this level of data analysis could be used to strengthen and validate current results. They also present an exciting avenue for further research.

7.3.2 Representational IQ Dimension Results (Conciseness, Understandability, Completeness & Consistency)

Where dimensions such as reliability, believability, accuracy and objectivity represent the intrinsic nature of information; the dimensions of conciseness, understandability, completeness and consistency represent what Wang & Strong (1996) classified as the "*representational*" characteristics of IQ. To a degree these dimensions, located in the "Information Generation" half of the CC-LC, represent something of the information producer's skill level, be they author, designer, developer or publisher. Given the open-access nature of Web information publication, skill (or lack thereof) related dimensions of IQ would be expected to be heavily represented in the next few dimensions.

Conceptually, these four dimensions characterise the *representational IQ* of information, constituting the look and feel (or interface) of user/information interaction.

Bovee *et al.*, (2003) contend that characteristics such as completeness and consistency physically represent *integrity IQ*, the way that previously discussed characteristics such as reliability and believability imply integrity IQ. This is summed up by what the authors' call information's *existence*, in that these types of information characteristics, unlike intrinsic characteristics, require the information to be viewed and examined in order for a value-judgment to be made.

Representational IQ: Some Observations

Overall, representational IQ dimensions make up the majority of the second cluster of user results in regards to their importance to the user-group's perception of IQ. Although not encountered as often as accessibility and contextual IQ dimensions, representational IQ dimensions account for four of the top ten most negative affects on participants' perceptions of IQ. Table 7.9 presents the user-group results for how frequently problems with information conciseness, understandability, completeness and consistency are encountered, and their impact on users' perceptions of quality.

Table 7.9: User Results for Representational IQ Dimensions (Conciseness, Understandability, Completeness & Consistency)

		How often issue/problem encountered				Affect on perception of IQ					
Dimension	Question	FRQ	OCS	InFRQ	NEV	Nil Effect	Marg ↓	Great ↓	Freq Score	Affect Score	Dimsn Score
Conciseness (5)	Long winded, unfocused information	10	51	39	0	8	49	44	171	121	58.4
	contains poor grammar	18	52	29	1	9	28	64	184	138	64.4
						Dimension Score (Conciseness) →					61.4
Understand-ability (6)	Poorly written information	21	65	14	0	4	24	72	207	160	73.4
	Info that is difficult to understand	11	59	29	1	36	45	19	177	11	37.6
						Score (Understandability) →					55.5
Completeness (8)	Information that is not complete	21	56	21	1	14	44	42	193	100	58.6
	"Under Construction/Coming Soon"	21	49	29	1	34	32	34	187	32	43.8
						Score (Completeness) →					51.2
Consistency (10)	disjointed and difficult to follow	10	54	35	1	5	50	45	170	130	60
	Information that seems out of place	2	42	45	10	24	49	28	105	57	32.4
						Dimension Score (Consistency) →					46.2

Conciseness

Out of the 32 dimension scenarios, issues relating to conciseness were encountered relatively infrequently, ranking 16th and 23rd for encounter frequency. Their negative affect on participants' perception of quality however ranked 7th and 10th, which accounts for conciseness being the highest impacting representational IQ dimension.

Participants' relatively low tolerance for poorly written material is somewhat indicative of the current user-group, who – as postgraduate and active academics – would, in all likelihood, posses higher than average comprehension and writing skills, and make value-judgments of the information they encounter accordingly. So, as stated, while representational IQ dimensions are pre-disposed according to the skill-level of the information producer, the value-judgements of these dimensions are attributed by the skill-level of the information retriever.

Understandability

Understandability presents an interesting user-group result in that its unweighted affect on users' perceptions of IQ rank 5th (for *poorly written content*) and 29th (for *difficult to understand content*) out of 32. This represents a massive divergence within the same dimension. Like the conciseness results, this could be indicative of an informatically sophisticated user-group, who cognitively "own" much of their user/information interaction, who do not view "difficult content" in a negative light.

Completeness

Incomplete information is relatively common-place on the Web, with 21% of users stating they frequently encounter information that does not appear to be complete. This same number of users frequently encounter web pages that contain such statements as "under construction" or "coming soon". Encountering incomplete information had a greater negative impact on users IQ perceptions (42%) than encountering "under construction" statements (34%), indicating that participants have a greater tolerance for information that is not-quite-started, than information that was not-quite-finished. This somewhat qualified tolerance for the "under-construction/coming soon" rhetoric encountered relatively regularly on the Web is the first indication in the user-group results of a degree of charity afforded to web-specific IQ issues.

Consistency

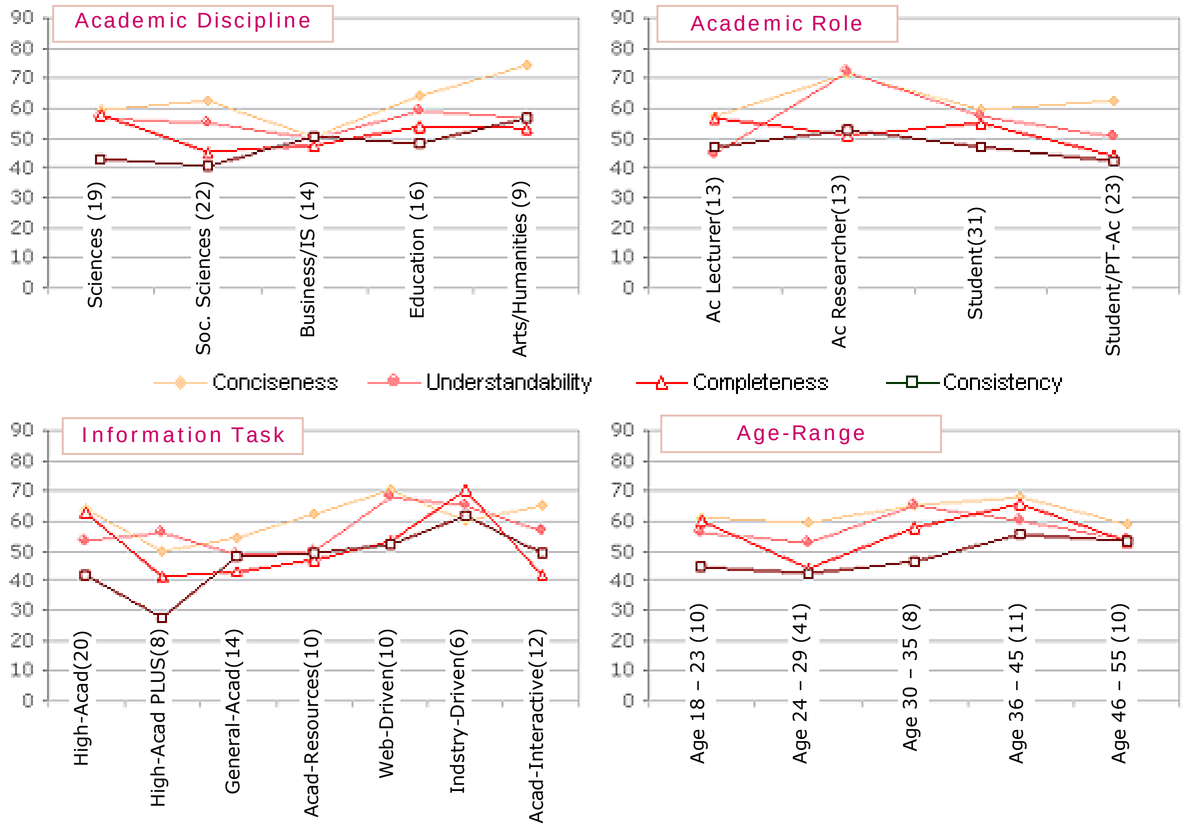
Like understandability and completeness the negative affect on IQ perceptions caused by consistency problems are divergent depending on whether the issue is caused structurally by the information itself, or something more vicariously imposed because of the information task or information environment. *Information that seems out of place* therefore ranks 23rd in its unweighted affect on perceptions of quality, as opposed to information that is disjointed and difficult to follow, which ranks 9th, with 45% of participants stating it greatly decreases their perception of IQ.

Representational IQ: Preliminary Findings & Discussion

The representational IQ dimensions observations seem to indicate that not only are conciseness, understandability, completeness and consistency demonstrative of the skill level of the information producer, but also engender the user to engage their own skill-set when making value-judgments related to them. Put simply, the user is required to make representational IQ value-judgments relative to their own cognitive ability and skill.

Representational IQ: Variations in Results

Figure 7.4: IQ Dimension Divergence Representational IQ



Divergence within the academic discipline group-case remains relatively stable, with conciseness ranking as the most important representational IQ dimension in four out of five sub-groups. The arts/humanities sub-group in particular value conciseness in the information they retrieve, although this was to be expected, as they ranked it 4th, ahead of the intrinsic believability. Of the four sub-groups in the academic role group-case, academic researchers had the highest overall expectations of the representational IQ, particularly in relation in relation to conciseness and understandability.

The greatest divergence overall was again exhibited by participants according to their predominant information task engagement. Conciseness ranked consistently amongst the sub-groups as highly important, although it interestingly ranked the lowest of the representational IQ dimensions for users who predominantly engage the Web for industry related information. This sub-group of users instead ranked completeness as the most important representational IQ, placing it higher than objectivity, believability and accuracy. The age-range sub-groups ranked representational IQ dimensions relatively consistently, with a steady incline in most of their information expectations through each chronologically older age-grouping. Until after age 45, where all expectations drop off slightly. The age range of 36-45 y/o generally had the highest critical assessment of the information they encounter on the Web.

7.3.3 Contextual IQ Dimension Results
(Currency, Uniqueness, Scope/Depth & Relevancy)

The framework utilised for the current exploration and discussion of user perceptions of IQ is the CC/LC model, which proposes that information is a dynamic and changing phenomena, and gains specific IQ characteristics dependent on where in the IQ life-cycle it is encountered and interacted with by humans. The specific IQ characteristics, or dimensions, are considered to be clusters of similar types of dimensions, which fall into four broad classifications, namely: intrinsic IQ; representational IQ; accessibility IQ and contextual IQ.

In order of ranking importance, the third cluster of IQ dimensions are those information characteristics associated with *contextual IQ*. Within the CC/LC framework, it is proposed that information actually gains the associated dimensions of *accessibility IQ* before it gains *contextual IQ* value-judgements. However, because the current discussion is centred on the user-results for the IQ survey, contextual IQ will be discussed before accessibility IQ, as the user-group consistently ranked contextual issues as having a greater impact on their perceptions than accessibility IQ.

Contextual IQ: Some Observations

Contextual IQ is made up of such quality dimensions as currency (up-to-date/recency), uniqueness (innovativeness), relevancy and scope/depth. Most often it relates to the actual content of information, and is directly related to the information needs of the information seeker (Toms *et al*., 2005) . Where value-judgments are made of the dimensions associated with representational IQ according to the seekers own information skill, contextual IQ value-judgments are made according to what the seeker is specifically looking for. This direct relationship between contextual IQ dimensions and user information need may account for why the associated dimensions have become a central focus in Web IQ research.

Recent research into Web IQ (Eppler & Muenzenmayer, 2002; Sturges & Griffin, 2003; Tombros *et al*., 2003; Song & Zahedi, 2005; Savolainen & Kari, 2006) have positioned the contextual and accessibility IQ related dimensions as central to information seekers' value-judgment processes. While the researcher is not questioning the frequency of user engagement in such cognitive processes as relevancy judgments, the current research exhibits clear empirical evidence that these judgements are not necessarily related to users' perceptions of quality.

Table 7.10: User Results for Contextual IQ Dimensions (Currency, Uniqueness, Relevancy & Scope/Depth)

		How often issue/problem encountered				Affect on perception of IQ					
Dimension	Question	FRQ	OCS	InFRQ	NEV	Nil Effect	Marg ↓	Great ↓	Freq Score	Affect Score	Dimsn Score
Currency (7)	Out-of-date/broken hyperlinks	22	68	10	0	31	51	18	212	25	47.4
	Out-of-date information	15	68	18	0	10	61	29	199	99	59.6
						Dimension Score (Currency) →					53.5
Uniqueness (9)	highly repetitive	12	55	31	1	14	45	41	174	99	54.6
	Un-inspired, boring information	24	56	20	0	40	30	30	204	10	42.8
						Dimension Score (Uniqueness) →					48.7
Relevancy (11)	Irrelevant Information	19	58	22	1	32	42	25	192	28	44
	Unhelpful information	29	58	12	1	42	31	26	212	-1	42.2
						Dimension Score (Relevancy) →					43.1
Scope/Depth (15)	Too much information	15	38	36	11	76	22	1	124	-128	-0.8
	Too little information	31	52	16	0	26	42	31	213	52	53
						Score (Scope/Depth) →					26.1

Currency

Currency is the degree to which information is up-to-date, relative to the information task being performed. A sizeable portion of the user-group (22%) indicated they frequently encounter out-of-date information in the form of broken hyper-links, ranking this dimension as the 11th most frequently encountered problem. With less than a 5th of the user-group (18%) stating that broken hyper-links greatly decreased their perception of IQ however, the overall net-affect of the problem is relatively minor. Interestingly, participants were less forgiving of non-link content being out-of-date, with 29% of participants affirming that encountering this problem greatly decreased their perception of the information's quality.

Uniqueness

A relatively low (12%) portion of users stated they frequently encounter information that is repetitive, with twice as many (24%) stating they frequently encounter un-inspired information that lacks novel or innovative qualities. Relatively high impacts were assigned to encountering these problems, with 41% of users stating repetitive information greatly decreased their perception of its IQ and 30% stating this same decrease in perceived IQ when they encounter information which lacks anything of new value.

Relevancy

Given the sheer volume of data made accessible to users by the Web, relevancy has been postulated by researchers and practitioners alike, to be one of the most important elements of information retrieval on the Web (Wang & Strong, 1996; Wang, 1998; Klein, 2001; Whitmire, 2004; Muylle *et al*., 2004; Price & Shanks, 2005a). The results of the current research however, seem to suggest that relevancy is rarely used to make *quality* related value-judgments about information which users encounter.

From a pragmatic view-point, the amount of information available on the Web means the odds are high that users will encounter irrelevant information relatively frequently. This is supported by relevancy ranking 6th and 15th for most frequently encountered problems. This could explain the high prominence of the relevancy construct in recent Web IQ research (Cosijn & Ingwersen, 2000; Dziadosz & Chandrasekar, 2002; Marton, 2003; Vakkari & Sormunen, 2004). The negative impact of encountering unhelpful or irrelevant information, however, is relatively small, which the researcher contends, renders relevancy – as a construct – a cognitive process which most users engage at a non-affective level. That is; encountering that which the user considers to be non-relevant, does not necessarily cause a negative emotive response.

Scope/Depth

Scope/depth refers to the degree of detail contained in information. Like currency, relevancy and uniqueness, scope and depth are relative terms in that the right "detail" depends on contextual elements such as a seeker's information need (Bryant, 2000; Prabha *et al.*, 2007). The relatively low impact of participants' encountering problems with scope/depth, particularly in relation to encountering "too much information" (1% of the user-group indicated this would greatly decrease their IQ perception) is suggestive of:

1.) A user-group who are aware of the highly "individual" information journey they take when engaging the Web to retrieve information; and
2.) A user-group who have a growing tolerance for web-specific IQ issues.

Contextual IQ: Preliminary Findings & Discussion

Like the previous two categories of IQ, the dimensions associated with the contextual IQ construct are found clustered near and around each other in relation to users' survey responses. This is supportive of the theoretical validity of the current research framework.

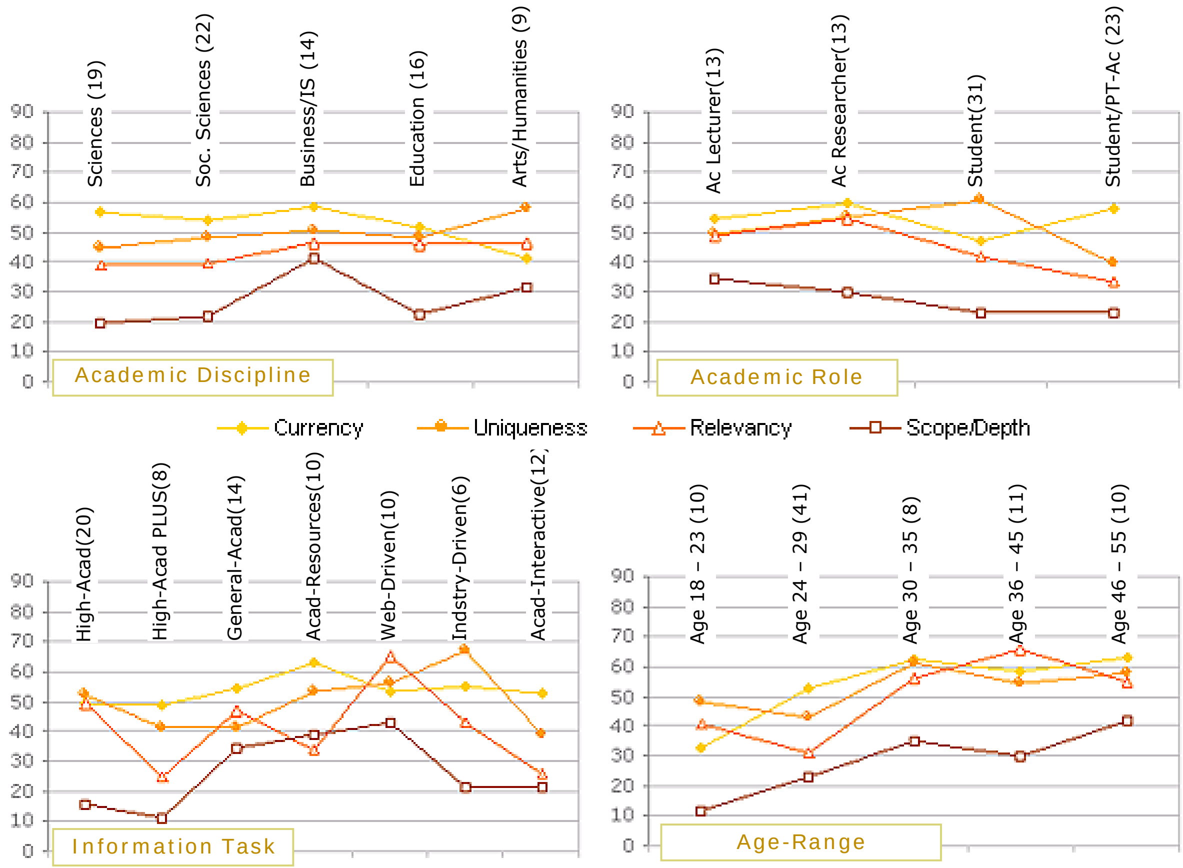
Contextual IQ: Variations in Results

Contextual IQ dimensions, are – by their very nature – given to being "context-specific", associated closely with a user's individual information needs (Talja *et al.*, 1999; Bawden, 2006). Consequently, the researcher expected divergence both within and between group-cases to be extremely high. The results for the contextual IQ scenarios (illustrated in figure 7.5) confirm this expectation, with all groups displaying significant variance in their perceptions of the importance of Contextual IQ dimensions.

The age-range and information task group-cases demonstrated the most divergence, albeit age-range's deviation is relatively consistent, involving most successive chronological groups possessing slightly stronger views on contextual IQ.

Overall, scope/depth was the most affected dimension across all group-cases, although, its divergence within the academic discipline group-case was heavily influenced by participants affiliated with business/IS disciplines. Interestingly enough, even though it statistically caused the most divergence, it consistently ranks below the other three contextual IQ dimensions.

Figure 7.5: IQ Dimension Divergence Contextual IQ



Of interest are the top contextual IQ issues identified by various sub-groups within group-cases:

- users who principally engage the Web for *industry related information* tasks value uniqueness/innovativeness above other contextual qualities;
- users who predominately search for academic resources value currency the most, as do business/IS affiliated academics, and academic researchers;
- users who engage Web-only information tasks, such as online news and magazines value relevancy;

On the other hand:

- in general, no sub-group considers scope/depth much of an issue, which could be an indication of the high-level content most of the current user-group engage on the Web;

- paradoxically, the same sub-group who value currency as they search and retrieve academic resources, rank relevancy very low, as do users who engage industry related information.

Contextual IQ: Limitations

In addressing the limitations the researcher acknowledges that throughout this chapter only four of the possible fourteen constructed group-cases described in chapter 5 have been used to explore variations in user results. This becomes particularly noticeable in regards to contextual and accessibility IQ, in that the influencing variables of the “individual” user become driving mechanisms in user choices about quality. Given more time, more group-cases could have been appropriated to the IQ study, in particular group-cases associated with previous research, such as gender, could have been included as a way of validating, or disputing, previous IQ research findings. Ultimately, the four group-cases associated with this chapter were chosen because it was anticipated:

1.) There would likely be an effectual relationship between users’ academic discipline and their perception of IQ, particularly in relation to pre-suppositions of the critical (intrinsic) characteristics of IQ
2.) That a user’s academic role would be indicative of the types of information interaction process they undertake;
3.) That users’ information tasks, assumed to be driven by an ‘information need’ would provide a valuable contextual picture of how preferred information behaviours might impact ongoing perceptions; and
4.) That users’ age-range, having had such a strong, and at times inexplicable, impact on the TAM results in the previous chapter, might shed some light onto an area of human/computer interaction rarely investigated.

7.3.3 Accessibility IQ Dimension Results
(Usability, Accessibility, Efficiency & Security)

The *accessibility IQ* construct represents the information characteristics associated with how users access and interact with information. In relation to Web IQ, this includes such dimensions as usability, accessibility, efficiency and security.

Accessibility IQ: Some Observations

In the CC/LC model of IQ, accessibility characteristics of information are gained at the pragmatic (Shanks & Corbitt, 1999; Price & Shanks, 2005a), presentation (Liu & Chi, 2002) stage of the life-cycle. The researcher contends this is where users make value judgments of information according to their technical/interactive experience and skills. Importantly, these value-judgements do not relate to the actual content of a web page, or more specifically, a user's cognitive interaction with the content of a web page. The perceptive judgments made about IQ in regards to usability, accessibility, efficiency and security relate to the motor aspects of user/information interaction.

Table 7.13 presents the user results for the four dimensions classified within the accessibility IQ category.

Table 7.13: User Results for Accessibility IQ Dimensions (Usability, Accessibility, Efficiency & Security)

		How often issue/problem encountered				Affect on perception of IQ					
Dimension	Question	FRQ	OCS	InFRQ	NEV	Nil Effect	Marg ↓	Great ↓	Freq Score	Affect Score	Dimsn Score
Usability (12)	Difficult to navigate	28	61	11	0	41	31	28	217	5	44.4
	Information that is hard to find	34	55	10	1	48	31	21	219	-23	39.2
									Dimension Score (Currency) →		41.8
Accessibility (13)	Aimed at the wrong audience	9	42	39	10	32	40	28	120	32	30.4
	Information that is difficult to read	6	56	34	4	21	41	38	152	75	45.4
									Dimension Score (Uniqueness) →		37.9
Efficiency (14)	Doesn't meet information needs	58	39	4	0	56	24	20	256	-48	41.6
	Takes a long time to download	10	55	32	2	65	21	14	166	-81	17
									Dimension Score (Relevancy) →		29.3
Security (16)	Un-secure/unprotected information	2	22	42	32	40	19	41	-4	21	3.4
	breaches copyright laws	9	42	40	9	41	32	26	124	2	25.2
									Score (Scope/Depth) →		14.3

Usability

Usability is the degree to which information can be easily located or found. Often discussed in association with "navigating", Web usability has become a central construct (Nielsen, 1999; Cockton, 2004; White & Marchionini, 2007) in User-Studies based research of the World Wide Web.

Interestingly, in accordance with usability becoming such a key issue in the literature (Mat-Hassan & Levene, 2001; Blackmon *et al.*, 2002; Kumar, 2004) and practice of web page interaction, participants ranked usability as their 4th (*information that is hard to find*) and 7th (*information that is difficult to navigate*) most frequently encountered problem. However, like a number of other contextual and accessibility IQ problems associated with the Web, the actual impact of encountering these difficulties turned out to be relatively minor, ranking 22nd and 27th out of 32.

Accessibility

Accessibility refers to the degree to which information is easily retrieved by the user. Importantly, accessibility operates on two levels:

1.) The technologies of the Web that make information search, navigation and retrieval possible; and
2.) The cognitive interaction between information and the user of information.

As expected, the technologically and cognitively advanced nature of the current user-group meant that accessibility issues were encountered infrequently, with only 9% of participants stating they frequently encounter information aimed at the wrong audience, and 6% stating they frequently encounter information that is difficult to read. The overall impact when issues of this nature are encountered however was higher than most accessibility IQ dimensions at 28% and 38% respectively.

Efficiency

Efficiency is the degree to which information is able to quickly and effectively meet the information needs of a user. As an identified dimension of IQ within the current study, efficiency has the dubious honour of being *the most frequently encountered* Web IQ issue for the current user-group, with 58% of the user-group stating they frequently encounter information that does not meet their information need(s). Perhaps because of the sheer volume of information available on the Web, the impact of encountering this problem is relatively low, with only 20% of the user-group stating it negatively impacts their perception of the information's quality.

Importantly, efficiency as a constructed dimension of IQ, highlights an important point about the inter-connectivity of IQ in general. As a characteristic of information, efficiency implies other characteristics such as consistency and conciseness – which are classified as representational IQ dimensions. Within its own category of IQ, efficiency also implies such characteristics as usability and accessibility.

This brings up an important point about the development and structure of the CC/LC model of IQ (figure 7.1). As a framework, the CC/LC has been developed for the current research, to guide the conceptual classifications of the multi-dimensional phenomenon that is information quality. In conceptualising something of the interactive user/information processes involved with information creation, presentation, seeking, value-judgements, and ultimate retrieval, the researcher contends that information production and use are a continuum, and – although for the sake of clarity there is a definitive structure to the framework, where one section begins and another ends, is, and should be, relatively fluid.

Security

Information security recognises the vulnerabilities posed by the "open" nature of the Web's TCP/IP infrastructure, and can be defined as the degree to which information can be considered "safe" because of mechanisms such as restricted access and copyright protection technologies.

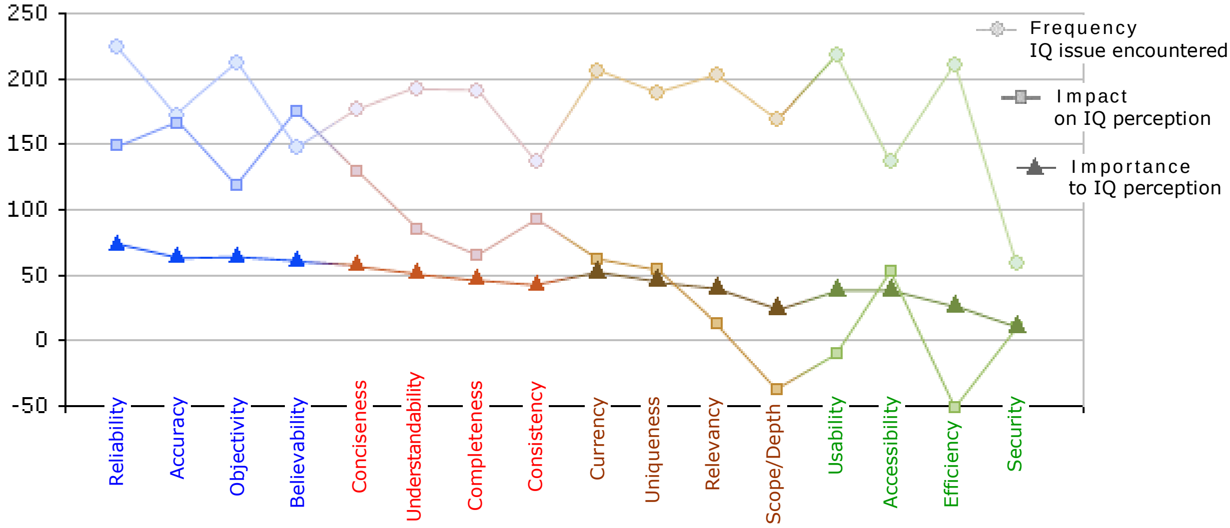
As a dimension of IQ, the user-group demonstrated either little to no knowledge, or little to no concern for information security. Encountering security related issues on the Web ranked at 26th and 31st, with only 9% of the user-group stating they frequently encountered content that breached copyright.

The overall lack of concern shown by the user-group regarding security is however, indicative of the context of the research, which is information retrieval rather than information production.

Accessibility IQ: Preliminary Findings & Discussion

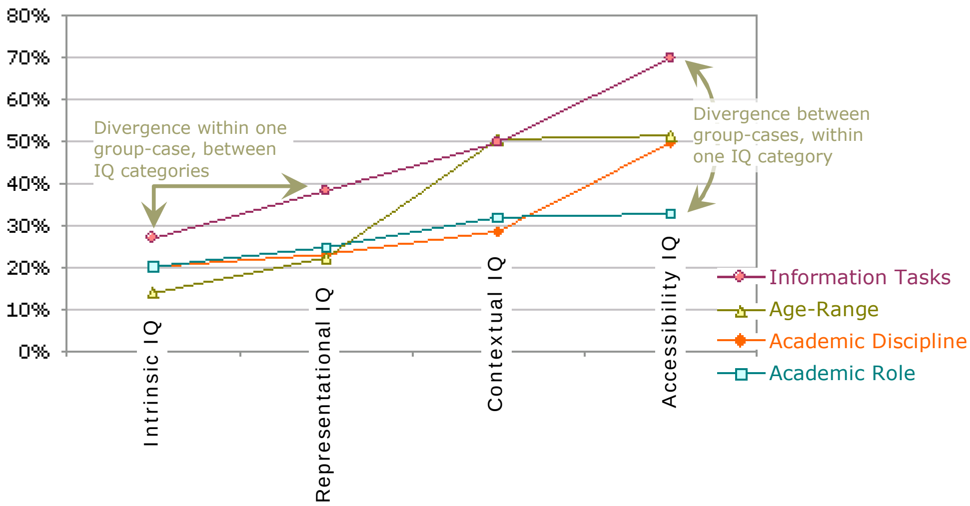
Accessibility IQ dimension relate to the interactive characteristics of the user/information relationship. Of interest, is that while each corresponding IQ dimension category, namely: (1) intrinsic IQ; (2) representational IQ; (3) contextual IQ; and (4) accessibility IQ; has demonstrated a steady decline in actual ranking related to how important they are to users perceptions of IQ, the divergence between the actual scores has also been growing the further into the IQ life-cycle user/information interaction takes place. Figure 7.6 illustrates that the major reason for the decline in dimensional importance to users is not related to how frequently an IQ issue is encountered on the Web, but as a result of a steady decline in impact on user IQ perceptions.

Figure 7.6: Frequency of IQ issue encounters & their impact on user IQ perception



Along with this steady decline in dimensional impact on (the whole user-group's) perceptions of IQ, a sub-group analysis also reveals a growing divergence of dimensional impact. Figure 7.7 illustrates the increasing divergence within each group-case as they move from perceptions of intrinsic IQ (left) through to accessibility IQ (right).

Figure 7.7: Average Divergence for each Group-case for intrinsic, representational, contextual and accessibility IQ



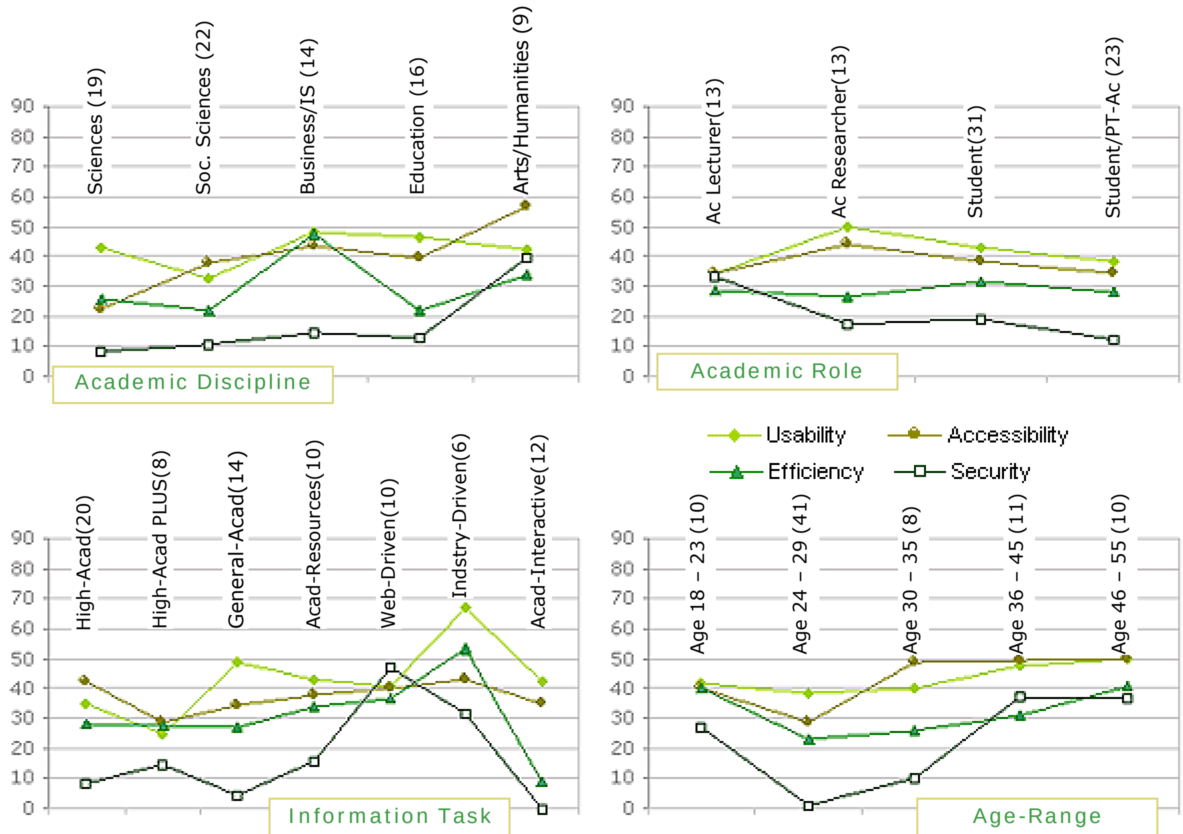
Using the information task group-case as an example, the graph reads as follows. In regards to intrinsic dimensions of IQ, the information task sub-groups demonstrated 27.1% variance in their perceptions of reliability, accuracy, objectivity and believability. For representational IQ dimensions (conciseness, understandability, completeness and consistency) the variations in their perceptions had grown to 38.4%. For contextual IQ (currency, uniqueness, relevancy and scope/depth) the sub-groups presented 49.8% variance in their perceptions. Finally, in regards to their accessibility IQ perceptions, variance stood at 69.7%. Table 7.14 in the following section of this chapter presents the figures of this growing divergence.

What makes this significant is that for each level of interaction where the users own individual personality, skills, and preferences play an increasing role in their perceptive interactions, perceptions of IQ increase in divergence.

Accessibility IQ: Variations in Results

The information task group-case returned the most divergent results, and participants' age-range again acted as a strong antecedent to user perceptions and attitudes.

Figure 7.8: IQ Dimension Divergence Accessibility IQ



Of note is how poorly security ranks in relation to its importance (for the majority of sub-groups) to data/information quality. Two of the three information task sub-groups expected by the researcher to be impacted by information security (i.e., users who engage the Web to retrieve Web-driven content; and users who retrieve industry-driven content) did, in fact, rank security higher than most. The third group (users who engage academic interactive content such as academic forum-boards and blogs) had a weighted impact score of zero.

The information task group-case again returned the most divergent results, supporting previous claims that user perceptions of IQ are effectively related to the type of information users' wish to engage (Wang & Strong, 1996; Strong *et al.*, 1997a; Huang *et al.*, 1999; Lee & Strong, 2003). Of note is the weighted importance placed on usability by users who predominantly engage the Web for industry type content. Academic researchers also ranked usability as a relatively important IQ dimensions. Overall, the academic role group-case demonstrated the lowest divergence in results. This is somewhat consistent with academic role TAM results, which demonstrated lower divergence than the researcher expected.

The age-range group-case returned some interesting parallels in dimension scores, with accessibility and security following almost identical pathways through the line-graph of results. Apart from the 18 – 23 age-group, usability and efficiency mirrored each other in the same way as accessibility and security.

7.4 User Perceptions of Web IQ: Discussion

The previous section of this chapter set out to describe and discuss the results of eighty academic users to a series of thirty two typical information problems on the Web. Discussed were users' perceptions in relation to Wang & Strong's (1996) four conceptual categories of IQ. The theoretical framework of the CC/LC model of IQ (figure 7.1), places Wang & Strong's categories into a life-cycle of information that facilitates an understanding of IQ in two contexts; namely (1) information generation; and (2) information use.

The context of the research is information use, and investigates user attitudes and perceptions of quality in the context of their Web-based information interaction and retrieval. The final part of this chapter will pull together some of the important observations and preliminary findings of this chapter, and propose how they might fit into the concept of IQ as a life-cycle.

7.4.1 Overall Category Results

Figure 7.9 presents an overview of each of the four category results for the group-cases: (1) academic discipline; (2) academic role; (3) age-range; and (4) information task. The results clearly demonstrate that;

1.) Users clearly consider some dimensions of IQ as more important than others

2.) Users clearly consider some clusters of dimensions (labeled "categories") as more important than others.

3.) Results for the 16 IQ dimension tested consistently clustered together in a way that confirms the IQ category groups as follows:

- Intrinsic IQ;
- Representational IQ;
- Contextual IQ; and
- Accessibility IQ

4.) Divergence between the dimensions within each of the four categories increases with each less important category. That is; intrinsic IQ, is considered the most important, and has the least variance between results, in contrast to the accessibility IQ, which is considered the least important of the categories, and has the most variance between its results.

Figure 7.9 :IQ Category Scores for each Group-case

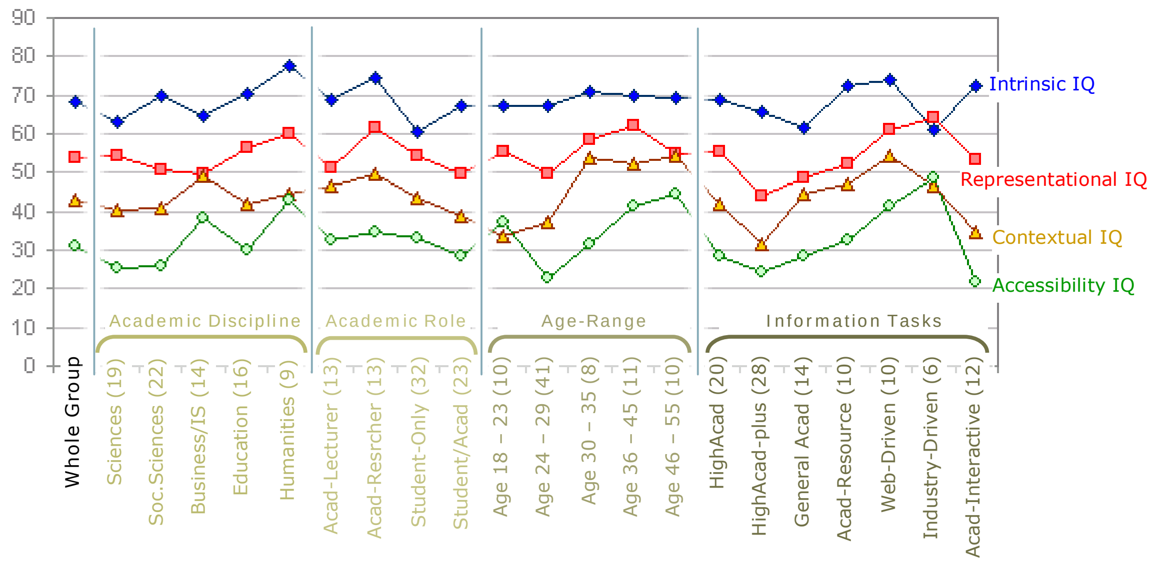


Table 7.14 presents the actual divergence between the IQ categories and the dimension that make up each category. Again, divergence increases with each corresponding category below intrinsic IQ.

Table 7.14: Specific Divergence for each Group-case for intrinsic, representational, contextual and accessibility IQ dimensions

IQ Category	Group Cases→ IQ Dimensions	Academic Discipline (5 sub-groups)	Academic Role (4 sub-groups)	Age Range (5 sub-groups)	Information Task (7 sub-groups)
Intrinsic IQ	Reliability	15.9%	4.0%	7.3%	19.8%
	Accuracy	18.4%	13.6%	14.5%	39.2%
	Objectivity	28.3%	25.9%	22.6%	25.7%
	Believability	18.6%	38.0%	11.2%	23.6%
	Average	20.3%	20.4%	13.9%	27.1%
Representational IQ	Conciseness	32.0%	20.0%	13.5%	28.6%
	Understandability	15.0%	37.9%	18.9%	28.7%
	Completeness	17.6%	22.4%	33.0%	41.0%
	Consistency	28.3%	19.6%	23.4%	55.4%
	Average	23.2%	25.0%	22.2%	38.4%
Contextual IQ	Currency	29.3%	21.3%	47.6%	22.5%
	Uniqueness	16.9%	34.3%	30.0%	41.2%
	Relevancy	16.5%	38.5%	52.4%	61.5%
	Scope/Depth	51.8%	33.0%	71.4%	73.7%
	Average	28.6%	31.8%	50.4%	49.8%
Accessibility IQ	Usability	31.7%	30.7%	23.4%	62.5%
	Accessibility	60.0%	22.0%	41.8%	33.5%
	Efficiency	28.6%	15.5%	43.4%	82.8%
	Security	78.9%	62.7%	97.3%	100.0%
	Average	49.8%	32.7%	51.5%	69.7%

Category more important to IQ perceptions

Category less important to IQ perceptions

Individual information need increasingly general

Individual information need increasingly specific

Figure 7.6 and Table 7.14 also both illustrate the *divergence* between each group-case's results. The researcher contends that this appears to occur simultaneously with moving through the IQ life-cycle, as the user moves further away from the critically important intrinsic IQ dimensions, and moves closer to the context specificity of target information.

7.5 Limitations & Conclusion

As far as the researcher is aware, this thesis represents one of the first broad-reaching investigations designed to measure how users' *individual differences* might impact general perceptions of IQ.

The researcher acknowledges the difficulty in the first, because of a lack of user-driven investigations of this nature, a lack of exemplars on which to model the design and analysis of the user survey data. In this regard, the researcher set out initially to build a conceptual model that would drive both the design of survey questions and, more importantly, the eventual analysis of participants results.

The study has brought together three distinct avenues of inquiry, (1) an adaptation of the TAM to investigate user perceptions and expectations of their search engine engagement; (2) an investigation of both general and specific search-engine driven information retrieval behaviours; and (3) an exploration of the impact of 32 common IQ related deficiencies associated with web page interaction. The study presents some noteworthy initial findings, and great potential for future research. It is however, still in its conception, and more specific user data is required to begin to empirically test a building hypotheses relating to *where* and *how* in the CC/LC user value-judgments actually take place.

The broad nature of the investigation represents both a strength and weakness of the PhD. While many divergent areas of human information interaction have been investigated and documented, and some synergies have been found, this has served to cause the researcher to ask as many questions as have been addressed. Moreover, it is increasingly evident, that the sheer amount of data, and associated possible findings, reach far beyond the scope of the PhD.

The final chapter will now attempt to pull together some of the divergent observations and preliminary findings written in chapters 6 and 7. In an effort to condense the scope of findings, these will be addressed in the context of the research questions of the dissertation, and analysed in the context of both previous research and emerging theory from the current research.

In keeping with the exploratory nature of the PhD, many preliminary finding statements have been made throughout chapters 6 and 7. Not all of these can, or will, be addressed in the concluding chapter, but provide a fertile ground for future research.

CHAPTER 8

Discussion of Findings

"User Perceptions of Information Quality in World Wide Web Information Retrieval Behaviour"

Findings, Implications & Future Research

8. Introduction

The purpose of this thesis has been to examine user perceptions of IQ in the context of their Web-based search and retrieval behaviours. The user-group chosen to facilitate the investigation were high-end "academic" users who regularly engage the Web to retrieve information related to their research and work. Participants were required to answer questions pertaining to:

1.) Their pre-existing attitudes and expectations of search engine based Web IR;
2.) Their typical searching and retrieval behaviours during various scenarios;
3.) The affective impact of specific Web IQ problems when encountered.

The researcher notes that a great deal of data has been generated in the process of this investigation, however by the very nature of a three year investigation, not all of it has been analysed within the context of this study. The novel, inductive methodology adopted, involves quantitative type surveys, which have the advantage of generating large amount of data, complemented by constructivist, qualitative analysis (into group-case constructions) of the data. Together, the process is able to generate an abundance of user-data and multiple contexts in which to examine it.

In the case of the current research, fourteen separate group-cases were constructed, some from direct user data to a specific survey question, such as "age-range", and others built from the analysis of clusters of participant responses, such as "information task". From the group-cases constructed, twelve were examined in the context of the TAM surveys (chapter 6), and four were used in the analysis of user IQ perceptions (chapter 7). It should be noted, that the group-cases selected and described throughout this thesis do not represent an exhaustive list, nor can the researcher claim that the group-cases ultimately chosen for specific episodes of data analysis were the best cases to scrutinise. They were, however, selected because they appeared to offer the most fruitful avenues for investigating individual differences. Ultimately, and realistically, around 40% of the data associated with the current research has been fully examined in the writing of the thesis.

As part of the contextual construct process, observations, preliminary findings and some limitations have already been made within the context of the discussions in chapters 6 and 7. The following sections of this chapter will summarise and discuss some of the more significant observations from the thesis as they relate to the research questions posed in chapter 4: *Research Design*. Overall limitations will be addressed at the end of the discussion, as will possible implications of the findings and suggested directions for future research.

8.1 Perceptions of Information Quality (RQ.1)

RQ.1 **–** *How do individual users apply common perceptions of information quality to make judgments about the information they retrieve from the World Wide Web?*

- RQ.1 (a): *What is information quality?*
- RQ.1 (b): *How do individual differences between users act as antecedents in the process of user determinations of information that is "fit-for-use"?*

Background

The current research represents a broad-reaching investigation into how users' individual differences impact their perceptions of Web IQ. There have been some studies in recent years, most notably; (1) Rieh (2000; 2002), who analysed 60 searches by 15 participants at Rutgers University, to investigate how users made specific choices about IQ and its relationship to cognitive authority. The study differs from the current research in that users predictive and evaluative judgments relating to authority was the driving paradigm for analysis. (2) Klein (2002a, 2002b), who adopted the user-driven, consumption model of Wang & Strong (1996), to survey 55 graduate and 57 undergraduate students regarding their perception of 50 described data attributes in relation to sourcing data on the Internet. Klein's study differs from the current research in that dimensions and attributes of IQ were not overtly measured this time. Instead, scenarios of typical problems were presented, and users' were asked to identify both how often they encountered the described scenario and how encountering the problem impacted their perception of the source's IQ.

The focus of the current research then, in contrast to Rieh, did not concentrate on one particular area of IQ. Nor did it seek to investigate, as in Klein's study, users' pre-supposed perceptions of specific data attributes should they use the Web as an information source for a specific project. Instead, the researcher sought to investigate users general perceptions of Web IQ by developing an understanding of the overall impact of encountering poor IQ.

8.1.1 What is information quality? RQ.1 (a)

The Literature Review presents some 20 models of IQ, gleaned from a decade of research into the phenomenon since Wang & Strong's 1996 user-driven model defined IQ from it's consumption perspective, as information that is "fit-for-use/purpose". This has been the driving paradigm for a contextual investigation into Web IQ.

Table 8.1 The 16 Common Dimensions of IQ/DQ measured in the study

	Dimension	Definitions & Relating Dimensions
1	Reliability	The degree to which information is worthy of being depended on. Is built from other dimensions relating to authority, authorship and reputation.
2	Accuracy	The degree to which information is correct, or free from error
3	Timeliness/Currency	The degree to which information is up-to-date, relative to the task at hand
4	Scope/Depth	The degree to which the amount of information available from a source has the appropriate amount (or coverage) of information required.
5	Relevancy	The degree to which information is applicable and helpful for the task at hand. Includes other dimensions such as useful.
6	Accessibility & Availability	The degree to which information is easily retrievable by information seekers. Refers to both a physical access (i.e. through a network or internet) and cognitive access (i.e. easily read).
7	Usability	The degree to which information is can be easily found (i.e. navigated) and easily used.
8	Consistency	The degree to which information is presented in an orderly, logical format that is compatible with other information contained within the same place
9	Objectivity	The degree to which information is aware of (i.e. stated), or free from bias.
10	Understandability	the degree to which information is capable of being understood or interpreted.
11	Completeness	The degree to which all the necessary parts or elements of the required information are present.
12	Security	The degree to which information is considered safe because of appropriate restricted access.
13	Value-Added	The degree to which information delivers benefit by providing unique or distinct material.
14	Concise	The degree to which information is expressed in a compact, easy to understand manner.
15	Believability	The degree to which information is regarded as true or credible, and therefore capable of being believed.
16	Efficiency	The degree to which information is able to quickly meet the 'information needs' of a searcher.

The result of the initial investigation into "*What is Information Quality?*" is the prosed CC/LC model of IQ (figures 2.2 & 7.1), which encompasses 16 dimensions of IQ (Table 8.1) identified as common characteristic-driven criteria for users value-judgments.

The same contextual constructs methodology was used in the IQ data analysis as the OTAM. The choice of which of the fourteen group-cases to use was more difficult than the TAM analysis however, in that there simply is not the abundance of previous (user-studies driven) research or findings available to help guide the project. Moreover, as results were derived, there was very little empirical data to compare the findings to.

The constructed group-cases used in the analysis of the IQ data are:

1.) Academic Discipline;
2.) Academic Role;
3.) Information Task;
4.) Age-Range

Categories of Web IQ

In the first instance;

- *the data is empirically supportive of Wang & Strong's (1996) original conceptualisation of IQ into four categories of associated dimensions.*

With very few exceptions, the group-case results placed individual dimensions into clusters of individual differences consistent with the following four categories:

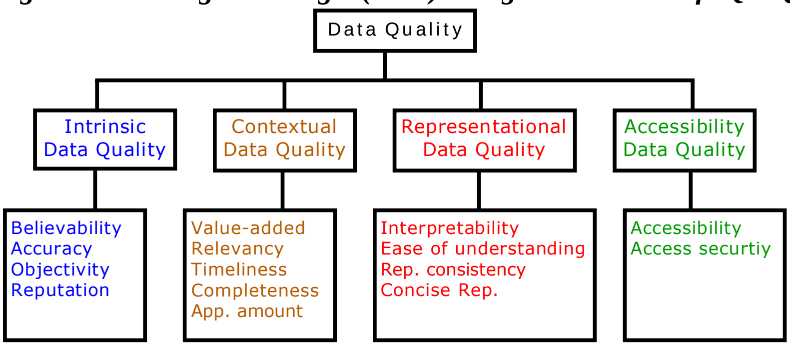
1.) Intrinsic IQ
2.) Representational IQ
3.) Contextual IQ
4.) Accessibility IQ

The overall conceptual landscape of the IQ dimensions associated with each category differs slightly from the Wang & Strong model however. Where Wang & Strong named 15 dimensions, the current research names 16, with notably more dimensions associated with the accessibility IQ category. This may have to do with the dozen years of end-user interactivity and information retrieval from the World Wide Web, which has grown extensibly in size and function since the 1996 seminal paper of

Wang & Strong. Figure 8.1a illustrates Wang & Strong's (1996) original model of categorised IQ dimensions. By contrast, figure 8.1b, illustrates the categories, and associated dimensions of the current research's CC/LC model of IQ.

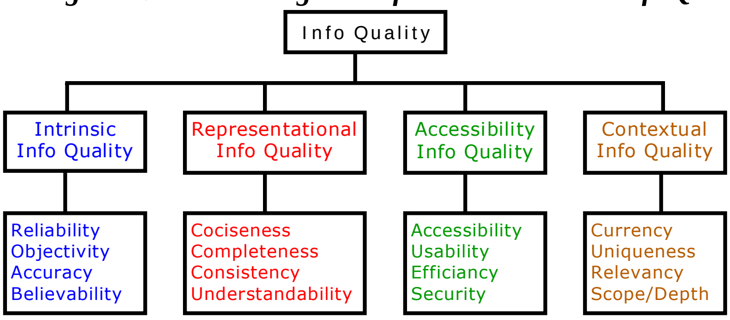
Conceptually, the models are almost identical. Intrinsic IQ is seen as being determined by integral characteristics of information (Wang & Strong, 1996), that is, those essential characteristics considered to give information its degree of integrity. The current research, however, is driven to consider the assertion from Bovee *et al.*, (2003) that conceptually, descriptors such as "reputation" *imply* information integrity, rather than provide a quantifiable construct with which to measure actual IQ. Accordingly, the intrinsic IQ dimension of reputation has been replaced with *reliability*, a measurable construct that facilitates users' value judgments in relation to intrinsic IQ.

Figure 8.1a Wang & Strong's (1996) Categorised Model of IQ/DQ



The current model also moves the completeness construct out of the contextual IQ category, and into representational IQ. Unlike, the original model, representational IQ is not seen as indicative of the format and meaning of information. Instead, representational IQ is seen as the tangible representation of interaction between information and information producer, and the cognitive interaction between information and information receiver.

Figure 8.1b The Categories of the CC/LC model of IQ



Finally, the accessibility IQ category sees the inclusion of two additional constructs, usability and efficiency.

Importantly, the IQ dimensions included within the CC/LC model were not empirically developed in the course of user-studies, but were germinate from the decade of research and theory since Wang & Strong's seminal paper.

Application of Results & the CC/LC

The prominence of the four intrinsic IQ dimensions across all the group-cases is seen as an indication of their critical stability. In the CC/LC model of IQ, which is able to illustrate where and how information characteristics are gained at specific user/information interaction points, the intrinsic data is seen to be gained at the collection/syntactic (Mari, 1999; Gendron, *et al.*, 2004; Price & Shanks, 2005a; 2005b) stage of information development.

Intrinsic IQ

Reliability, objectivity, accuracy and believability are considered to be the characteristics of information that are:

- ***not context specific to where information is encountered in the life-cycle*** *because what makes information reliable, objective, accurate or believable is the same, regardless of whether information is being produced or retrieved.*

Moreover, of all the dimensions investigated, they:

- *are* ***the least influenced by contextual/subjective characteristics of the system*** *in which they are disseminated or retrieved.*

This does not mean that users cannot assign varying degrees of value to theses dimensions, but that the value-judgments are influenced more by the intrinsic characteristics built into the information than by the context of information interaction.

With this in mind, it is not surprising that the user-group, as a whole, and within every group-case investigated assigned the four intrinsic dimensions as having the highest impact on their perception of IQ.

Figure 8.2a Intrinsic IQ Dimensions in the CC/LC model of IQ

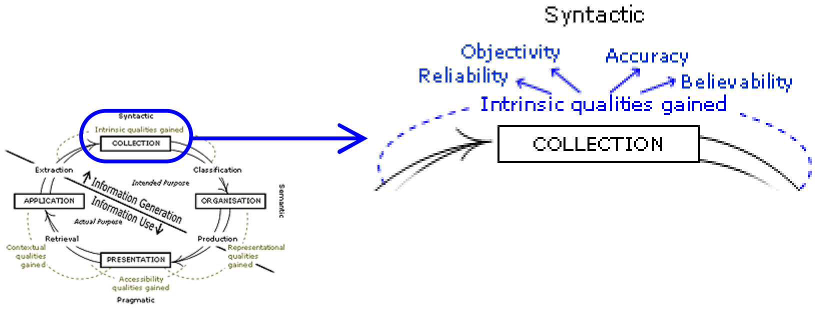
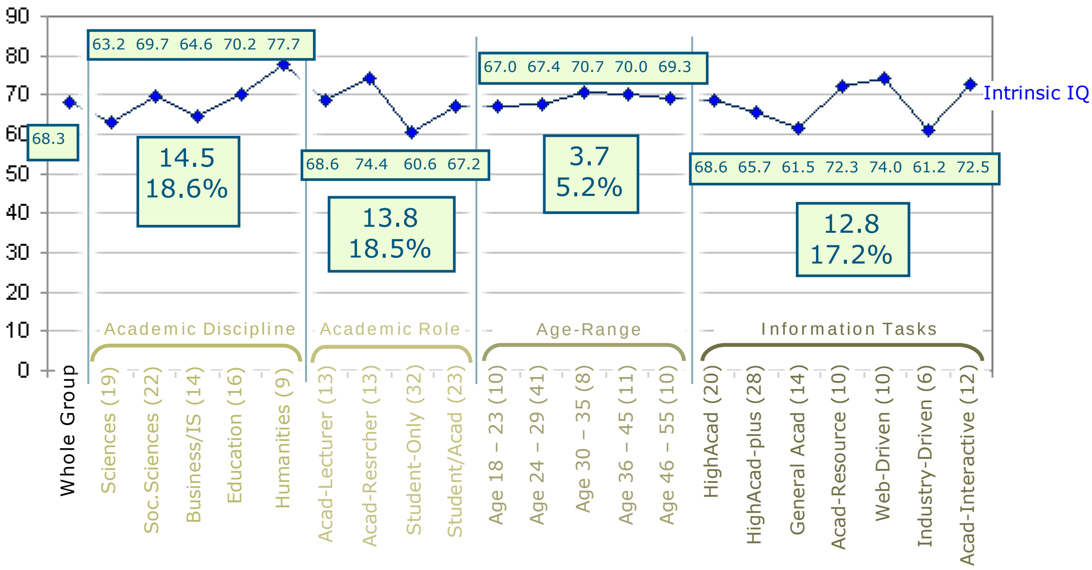


Figure 8.2a illustrates that the four dimensions categorised as intrinsic IQ, are gained at the beginning of the information life-cycle. Inherently linked with authorship, the dimensions of reliability, objectivity, accuracy and believability, are gained at the creation stages of *information production*, and are the beginning of quality. The beginning because if not acquired from its author, information will never be reliable, objective, accurate or believable. Unlike other more context specific dimensions of IQ, such as relevancy, usability, uniqueness and the like, information cannot, and does not, gain its intrinsic characteristics according to user information skills or needs. The intrinsic dimensions of information then, are the foundation upon which all other IQ is built.

Figure 8.2b Results of Group/Group-case Intrinsic IQ Dimensions



Even though intrinsic IQ is essentially gained during information production, figure 8.2b illustrates that the retrievers of information are still inclined to bring their own set of subjective perceptions of each intrinsic dimension's level of importance to overall IQ. Group-case results suggest that user perceptions of the importance of intrinsic IQ dimensions are socio-cultural driven, that is; individual differences in IQ perception appear to driven by socio-cultural factors such as academic role or discipline, and information task, rather than biological factors such as age or gender, or even cognitive differences such as cognitive or technical style of information interaction.

Future Research: This finding is a promising area of exploration for future research. Cross analysis between the four chosen group-cases results and the "age" and "gender" group-cases (Appendix 8.1) is supportive that differences in perception, at least at the most basic level of intrinsic IQ, is driven by an individual's acquired and constructed knowledge structures which numerous authors (Cosijn & Ingwersen, 2000; Pinto, 2003; MacDermid *et al.*, 2005; Talja *et al.*, 2005; Savolainen & Kari, 2006) attribute to the individual's socio-cultural context. Of course, gender presents an interesting case in that the constructed boundaries of "Gender" are blurred somewhere between biologically and socially driven differences.

Intrinsic IQ on the Web: Overview of Some User Results

- Reliability was named as the most important intrinsic IQ dimension;
- The most commonly encountered Intrinsic IQ dimension issue on the Web was reliability;
- Deficiencies in information's believability had the highest (raw) negative impact on perceptions of IQ;
- Objectivity caused the least concern to the user group, who demonstrated a high degree of tolerance for biased information;
- Users who demonstrated the highest tolerance for information bias were also the most likely sub-group of users to look for associated authorship details of the information they encountered on the Web;
- The information task group-case's sub-groups demonstrated the highest variance in perceptions of intrinsic IQ dimensions. The age-range sub-groups demonstrated the least.

Representational IQ

The representational characteristics of IQ, namely: conciseness; completeness; understandability and consistency; are those qualities which are:

- *most often* ***manifest according to the skill of the information author/producer****.*

The researcher also contends that *the value-judgments assigned to these representational IQ characteristics by the receivers of information are influenced by:*

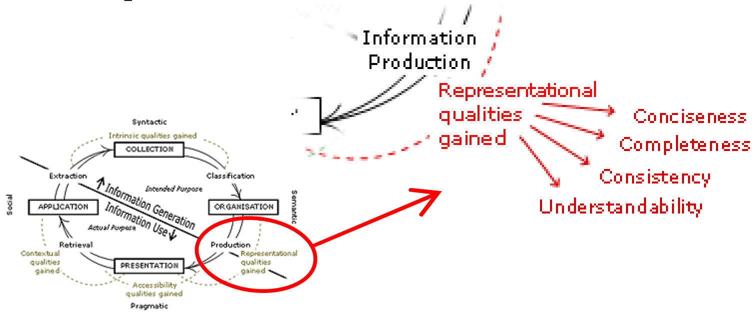
- *the users'* ***own self-perceptions;*** *and*
- *users' own* ***cognitive and information skills*** *and abilities*

In the case of the current user-group, self-perceptions were found to be particularly high and this was reflected in the level of importance placed on the representational IQ dimensions. For this reason:

- *information producers should be aware of their audience's skill-level;* as
- *the level of skill of the information receiver,* ***places specific demands on the dimensions associated with representational IQ****.*

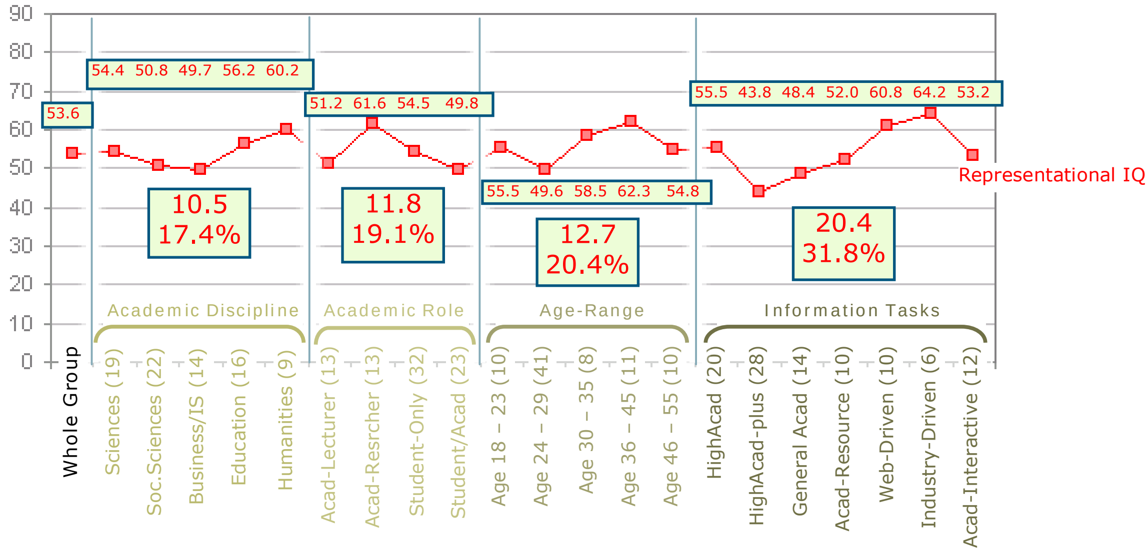
Figure 8.3a illustrates the proposal that representational IQ characteristics, like intrinsic IQ characteristics, are tangibly gained during *information generation.* This is an important point for the simple reason that how IQ is defined and developed differs depending on whether information is being produced or consumed (Burgess *et al.*, 2004). Moreover, the considerable emphasis on the importance of getting contextual and accessibility IQ issues right, particularly in relation to information delivery on the Web, has changed the focus of IQ production towards dimensions that are proving to be problematic in so far as attainability.

Figure 8.3a Representational IQ Dimensions in the CC/LC model of IQ



Future Research: A full discussion regarding the applicability of the CC/LC model of IQ to the context of information generation is outside of the scope of this dissertation. However, the CC/LC, which models IQ through a life-cycle of information generation, through to information consumption, and back to information re-generation, offers the tantalising potential to bring together dimensions of IQ in a way where synergies between production and retrieval could be found, and offers another rich avenue for future research.

Figure 8.3b Results of Group/Group-case Representational IQ Dimensions



Representational IQ on the Web: Overview of Some User Results

- Conciseness was named the most important attribute to the user-group's perception of representational IQ;
- Deficiencies in information's conciseness also had the highest (raw) negative impact on perceptions of IQ;
- Problems in relation to information's understandability was the most frequently encountered representational IQ issue on the Web, while problems with consistency was the least frequently encountered;
- Although generally encountered less frequently than contextual or accessibility IQ issues, deficiencies in representational IQ dimensions accounted for four of the top ten most negative impacts on users perceptions of IQ;
- The sub-groups associated with the information task group-case again demonstrated the highest degree of variation in their perceptions of representational IQ.

The sub-group variations within the group-cases examined confirm previous research that information task/need is a potent driver of user perceptions of IQ (Rieh, 2000; Kopsco *et al.*, 2001; Croft & Peterson, 2002; Toms *et al.*, 2005; Forslund, 2007; Varlander, 2007).

Interestingly, the results for the completeness dimension offer the first real evidence regarding the user group's qualified tolerance for a number of *Web-specific* IQ issues, in this case demonstrating relatively little displeasure with "under-construction /coming soon" webpages.

Future Research: Further analysis of user results in the context of other group-cases, including: (1) gender; (2) cognitive style; (3) technical style; (4) task/system confidence; (5) user experience; (6) expectancy; and (7) motivation; (see Appendix 8.1) revealed some interesting affectual relationships with perceptions of IQ. Most notably the very high variance in representational IQ results according to users' cognitive style, (37.4% variance) and conversely, the notably low variance according to users' technical style (6.7% variance). Kopsco *et al.*, (2000 & 2001) have noted in Web-based IR experiments with undergraduate students, that cognitive style appeared to have a significant relationship with user perceptions of IQ. Steers (1988) describes cognitive style simply as "the way in which people *process and organise information and arrive at judgments or conclusions* based on their observations of situations" (p.131, emphasis added). The cognitive style group-case, constructed from users' preferred search engine query formation, produced an unexpectedly high divergence in perceptions of IQ, second only to the information task group-case. The dynamic relationship, be it constructive or prohibitive (Barkhi, 2002), between user cognitive style and perceptions of IQ perceptions is identified as a rich domain for future research. The user data also provides a context for future examination of the relationship between cognitive style and technical search tactics. This is especially applicable given the very different results returned by the technical style group-case.

Contextual IQ

Contextual IQ dimensions, namely: currency; uniqueness; relevancy and scope/depth; are those characteristics most closely associated with users' information need and intended information use.

From an information production perspective,

- *the precursor of high contextual IQ in the information being produced relates specifically to how well the producer understands the reasons why the audience is look for specific information.*

User value-judgments of the dimensions associated with contextual IQ are:

- *information need (contextually) driven;*
- *profoundly influenced by relative user constructs such as their attribution tendencies and motivation to engage information*

Figure 8.4a Contextual IQ Dimensions in the CC/LC model of IQ

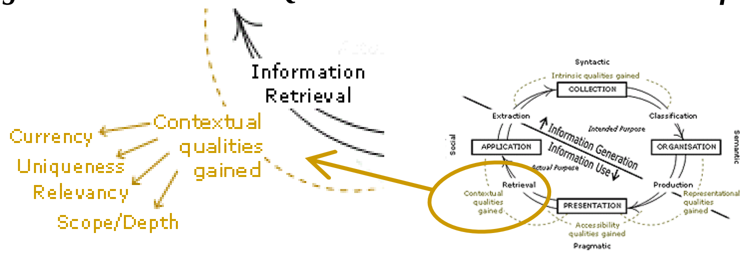


Figure 8.4a illustrates the researcher’s contention that contextual IQ dimensions are attained during the user/information interaction of information retrieval. That is; conceptually speaking:

- ***contextual IQ doesn’t actually exist as dimensions of IQ, until the moment users interact with the information.***

Information need is one of the most changeable constructs associated with information retrieval (Wilson, 1994); which explains firstly, why the dimensions associated with this phenomenon are considered “contextual IQ”; and secondly the high divergence in group-case’s sub-group results, as illustrated in figure 8.6. The point being, that *user contextual IQ value judgments about the information are not so much governed by the actual characteristics of the information, but according to how well the information fits the user’s need.*

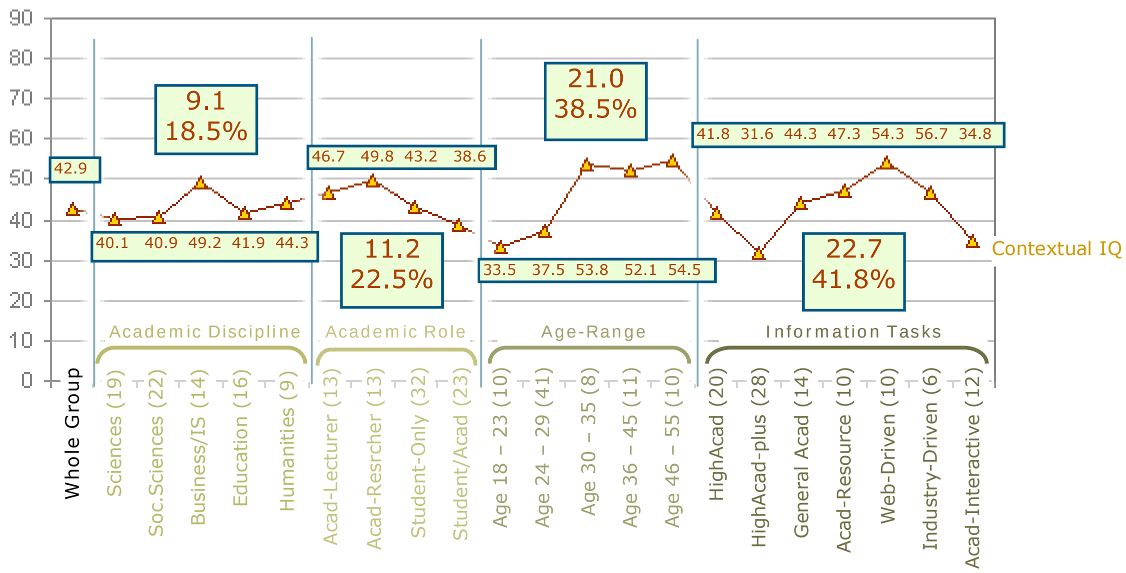
A great deal of research has been conducted exploring facets of the relationship between user information needs and information retrieval (Given, 2002; Bryant, 2004; Cooper *et al.*, 2004; Bruce, 2005; Weiler, 2005; Liew & Ng, 2006; Pors, 2006; Davies, 2007) particularly in relation to how information needs develop or change during the interactive information retrieval (IIR) process (Ingwersen, 2000; Wu *et al.*, 2001;

Borlund, 2003; Vakkari, 2003; Vakkari & Sormunen, 2004), but relatively few studies have overtly linked information needs, information searching, and perceptions of quality (Hawking *et al.*, 2001; Korjonen-Close, 2005). Moreover, to the researcher's knowledge, no previous study has investigated the impact of multiple user "individual differences" on their perceptions of IQ in the context of user information behaviour.

Contextual IQ on the Web: Overview of Some User Results

- Contextual IQ related issues were cited as the most commonly encountered problems on Web, with users coming across them 9% more often than representational IQ issues, 18% more frequently than accessibility IQ related problems, and just less than 1% more often than intrinsic IQ issues;
- User age-group results returned the highest variations in users' perceptions of IQ, however, a cross analysis between the two group-cases (1) age-range; and (2) information task; found a correlating relationship between a user's age and the typical tasks they were most likely to perform on the Web. For this reason, information task is still seen as having the highest impact on user perceptions of contextual IQ;

Figure 8.4b Results of Group/Group-case Contextual IQ Dimensions



- Variations in perceptions of IQ were found to be the relative to typical tasks;

  ~ users who principally engage the Web for industry related information tasks value uniqueness/innovativeness above other contextual qualities;

Intrinsic IQ
> Academic Discipline ~ 18.6%
> Academic Role ~ 18.5%
> Age ~ 5.2%
> Info Task ~ 17.2%
Representational IQ
> Academic Discipline ~ 17.4%
> Academic Role ~ 19.1%
> Age ~ 20.4%
> Info Task ~ 31.8%
Interactional IQ
> Academic Discipline ~ 41.8%
> Academic Role ~ 17.9%
> Age ~ 48.5%
> Info Task ~ 55.5%
Contextual IQ
> Academic Discipline ~ 18.5%
> Academic Role ~ 22.5%
> Age ~ 38.5%
> Info Task ~ 41.8%
> Academic Discipline Total: ~ 18.6% ~ 17.4% ~ 41.8% ~ 18.5% = 24.1%
> Academic Role Total: ~ 18.5% ~ 19.1% ~ 17.9% ~ 22.5% = 19.5%
> Age Total: ~ 5.2% ~ 20.4% ~ 48.5% ~ 38.5% = 28.1%
> Info Task Total: ~ 17.2% ~ 31.8% ~ 55.5% ~ 41.8% = 36.6%

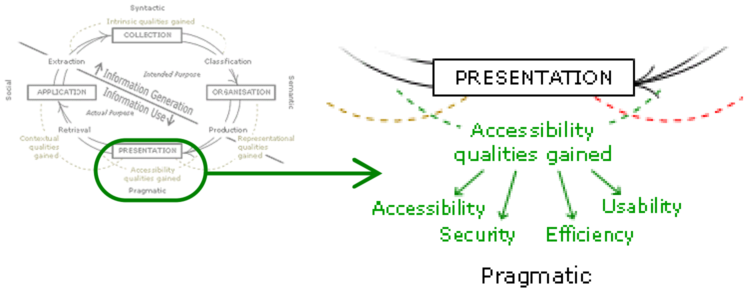
~ users who predominately search for academic resources value currency the most, (as do business/IS affiliated academics, and academic researchers);

~ users who engage Web-only information tasks, such as online news and magazines, place a higher value on relevancy.

Accessibility IQ

The accessibility IQ dimensions are the characteristics associated with the information delivery protocols of a system. In other words, accessibility, usability, efficiency and security relate to *how* information is sent and received in the process of both information production and retrieval. In the case of the current research, user value-judgments of accessibility IQ are made in relation to Web protocols, since this is the delivery context of the target information.

Figure 8.5a Accessibility IQ Dimensions in the CC/LC model of IQ



Importantly, and probably rightfully so, the criteria associated with accessibility IQ value judgments made by producers and receivers of information are not the same, and may explain why accessibility IQ dimensions ranked overall the lowest in importance for the user group, when it is a often a driving construct for information producers.

From the survey results, the researcher contends that;

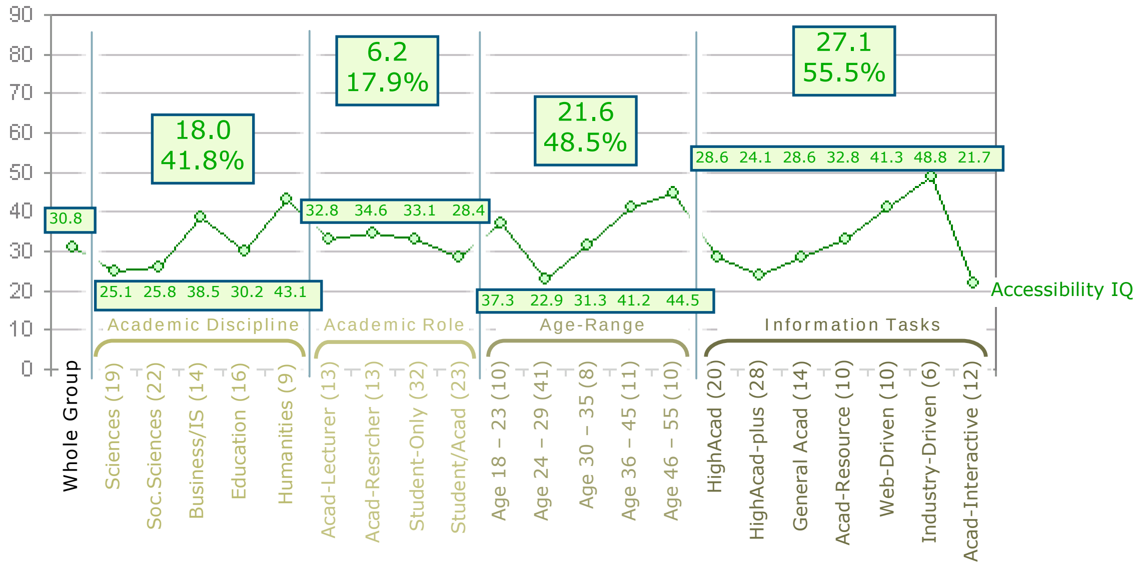
- *accessibility IQ, is of far greater importance to information producers than information receivers;*
- *criteria used in associated user value-judgments of accessibility IQ are opposites of the same entity.*

The second point is important if information producers wish to understanding what value-judgments are being employed by users of their information. If, for example, an accessibility value-judgment is made in relation to the "price/cost" of information, the user's judgment is made in relation to obtaining the information for as *little cost* as possible, but the information producer is concerned with the complete opposite, wishing to gain the *highest price* possible.

A second anomaly associated with accessibility IQ is the massive discrepancy between users' encountering accessibility issues and its general low impact on their perceptions of IQ. Problems relating to usability and efficiency both ranked as one of the top five issues encountered during Web IR, however they ranked 14th and 16th respectively (out of 16 dimensions tested) for their negative impact on users perceptions of quality. One reason for this could be the information environment of the Web itself, in that the cognitive price of not finding what is being searched for is relatively low. In traditional information environments, taking a wrong turn can result in hours of tracing back one's steps. For the most part, however, the price of a wrong click during Web navigation is a click on the browser's "back" button. In addition, the continually growing size of the Web ensures users that – as far as information retrieval goes – if one cannot find their target information at one location , the choice to move to another location is made relatively simple.

Accessibility IQ on the Web: Overview of Some User Results

Figure 8.5b Results of Group/Group-case Accessibility IQ Dimensions



- Problems related to the efficiency, in this case measured by users encountering information that did not meed their needs or information that took a long time to download, were the most frequently encountered accessibility IQ issue;

- Overall, accessibility IQ issues had the greatest impact on user who engage the Web for industry-driven tasks, which were identified as industry research and professional memberships such as online membership to the IEEE.

Future research: Given the high impact of user information-task on Web IQ perceptions across all four categories of quality, the research data offers a unique opportunity to investigate what types of tasks impact users perceptions of specific IQ dimensions.

8.1.2 Individual differences between users & perceptions of IQ RQ.1 (b)

Divergence in Results

Divergence was found to exist in all group-cases, and had a clear demonstrated relationship with the level of importance assigned to clusters of dimensions of IQ. The least variance was associated with the critically important intrinsic IQ dimensions, the second least variance was associated with the skill-associated representational IQ dimensions. Contextual IQ dimensions demonstrated the second most variance, which is consistent with users IR becoming more specific, and the greatest variance was reserved for the accessibility IQ dimensions.

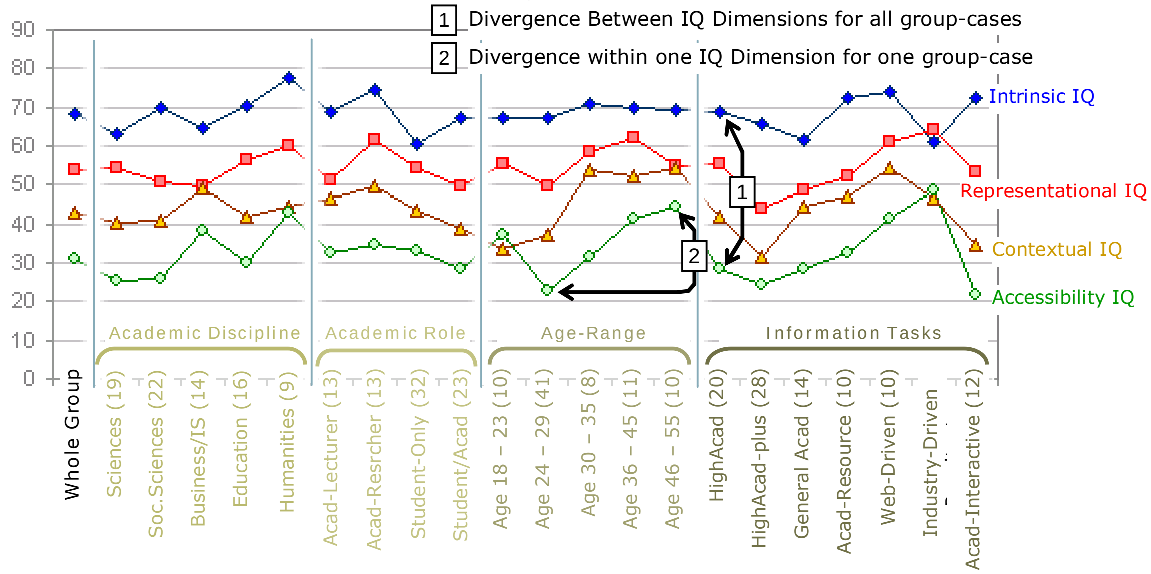
The divergence in results is indicative that:

- ***IQ is, in fact, relative to its context.***

Figure 8.6 presents the divergence within the four group-cases, which grows wider as for each IQ category below intrinsic IQ. The researcher contends that this occurs as users get closer to their target information and is indicative of the increasing specificity of their information need as users move away from general perceptions of IQ towards specific perceptions pertaining to their individual needs.

Interestingly, the only "information need" orientated group-case in the IQ study is the "information tasks" group-case, the sub-groups of which consistently returned the most divergent results across all four IQ categories, as well as the individual dimensions that made up those categories. This provides a promising context from which to investigate the relationship between information needs and perceptions of IQ.

Figure 8.6 :IQ Category Scores for each Group-case



8.1.3 Perceptions of IQ: Implications, Limitations & Future Research

Limitations

The overall limitations of the investigation of user Web IQ perceptions relate to;

1.) The relatively small size of the user-group.
2.) The narrow sample group (academics only)
3.) The broad nature of the investigation.
4.) The researcher's own limited experience at the time of data-collection design

Although 80 is a relatively large user-group from which to perform inductive research, the type of data-collected would also facilitate a deductive research methodology. Moreover, once data became clustered into constructed group-cases, the size of some of the sub-groups was at times problematic. Whenever this occurred, the researcher would have to re-think the break-down of the group-case without significantly impacting it conceptually.

The narrow target user-group of "academics" will be considered by some readers as limiting the generalisability of any findings associated with the current research. The researcher acknowledges that this is certainly true in the case of applying findings to users Web search and retrieval. The thrust of the PhD, however, was not an investigation of user Web search behaviour per se, it was an investigation of user perceptions of IQ in the context of their Web search behaviour. Given that, in previous research, user perception of IQ is seen, by and large, to be contextually driven, it is more than appropriate for the researcher to have identified a relatively specific target audience. Notwithstanding, the research survey structure has been designed to be applied to other specific target-groups, albeit that the researcher may need to change a number of context specific questions.

The broad nature of the investigation has been touched on numerous times throughout the dissertation. The initial impact of the extensive subject-matter related to scope and coverage in the literature review. The possible impact on the user-group should also be acknowledged, in that – with registration and four surveys, covering three distinct research areas and 140 questions per users – participant fatigue was a strong possibility. Of the 123 users who registered, 85 completed all four surveys, called a "survey-set". Five survey-sets were considered unusable, with the user having not met one of the criteria set out in the registration form. This left a total of 80 completed survey-sets, making the completion rate approximately 69%.

Finally, a number of design issues have been highlighted right through the dissertation in the context of when/when they were encountered or discovered. The researcher acknowledges that inexperience was undoubtedly a contributing factor, but has gone to great lengths to ensure all data used in the analysis stage was reliable and valid.

Limitations have been addressed throughout the thesis, particularly in relation to the analysis of set pieces of data and any observations and findings drawn from them. This includes addressing what some consider the major limitation of inductive research, that of statistically proving findings. Worsely's (1970) contention that validity is not accepted by statistics alone, but on the plausibility of the logic of the data analysis, should not be dismissed lightly.

Implications

The CC/LC model of IQ has, confirmed Wang & Strong's (1996) conceptual model of four categories (or types) of information, albeit by adding a total of three new dimensions and removing one to Wang & Strong's model. More importantly however, the CC/LC has placed IQ dimensions into a user/information interaction life cycle. The great potential of this relates to the specific types of scenarios and questions that can be asked of user-groups in future users-studies focused investigations of IQ.

The researcher presents the CC/LC model of IQ as a highly robust conceptual model, which can be used by researchers investigating IQ from either a production or retrieval perspective, as well as in relation to any information system. It facilitates researchers in the conceptualisation and then contextualisation of the IQ system they are investigating, guiding the design of specific data collection tools that will be adequate and appropriate to investigate IQ in specific contexts.

Future Research

The enormous amount of data associated with the current research has provided the researcher with a significant body of empirical evidence from which to continue investigating user perceptions of IQ, the antecedents to those perceptions, as well as the impact those perceptions have on users' information behaviour and general attitudes towards both information and information system.

Synergy in IQ concept: from generation to consumption

As stated previously, the CC/LC, which models IQ through a life-cycle of information generation, through to information consumption, offers the enticing potential to bring together dimensions of IQ in a way where synergies between production and retrieval can be found, offering a rich avenue for future conceptual and theoretical research into systems related IQ.

Individual Differences & antecedents of perceptions of IQ

Only four constructed group-cases were used in the IQ related data analysis, which perhaps should be addressed as a limitation of the current research. However, there remains an abundant amount of data available for future analysis and research, including investigations into;

- The relationship between users' cognitive style and perceptions of IQ.
- Cognitive style, technical search tactics and perceptions of IQ
- User Information needs and perceptions of IQ
- Gender differences in user attitudes and use of information technology

8.2 User Attitudes; Expectations; Individual Differences; and the constructs of the TAM in Search Engine Interaction (RQ.2)

RQ.2 – *How do "individual differences" impact on high-end users' attitudes and perceptions regarding search engine effectiveness to retrieve high quality information?*

- RQ.2 (a): *how do individual differences act as antecedents on user perceptions of the search and retrieval of information on the Web?*
- RQ.2 (b): *how effective are the TAM PU and PEoU constructs at "telling the story" of on-going search engine usage?*

In the OTAM investigation, the common TAM constructs of PU and PEoU, and the proposed PoI, were applied to examine users' expectations of their interactions with search engines and the Web, for the purposes of information retrieval. Variables between users within twelve constructed group-cases were examined and reasons sought when divergence was significant between a group-case's sub-groups. An extensive discussion relating to each of the twelve group-cases and preliminary findings are presented in chapter 6. Presented below is a discussion relating to some of the more significant findings in the context of the research questions, and their implications in relation to other TAM related research.

8.2.1 PoI Contributions (better aligning TAM with cognitive theories)

Cognitive Dissonance

User experience (sometimes "prior experience") features relatively heavily in the TAM literature (Thompson *et al.*, 1994; Taylor & Todd, 1995; Argarwal & Prasad, 1999; Dishaw & Strong, 1998; Schwarz *et al.*, 2004; McFarland & Hamilton, 2006; Ha *et al.*, 2007) with results indicating its strongest influence is on the PEoU construct. Ranking 4th highest in divergence between the sub-groups, the current research supports much of the previous TAM findings. But here, the research also makes two significant contributions.

- *lower levels of experience appear to be a stronger inhibitor than higher levels of experience is a precursor to good search engine use.*

Figure 6.6 clearly illustrates that for the PU and PEoU constructs, it is the "least experienced" group (3-5yrs) who diverge from the other sub-groups to any great extent. The difference between groups '5-8yrs', '9-12yrs' and '12+yrs' experience are not only very small, but swap over at various stages. This is indicative that

- *it is highly likely that "lack of" experience is the greater precursor to attitude and perceptions than prior experience.*

The PoI Construct & Cognitive Dissonance

The second contribution is in relation to the PoI construct. As a measure of "on-going" perceptions of user/system interaction, the researcher would contend that the PoI construct is a more realistic gauge of "experienced" users' feelings towards search engines than PU and PEoU, where divergence between their results is relatively stable. The poorer result for *PoI: interaction clear* (consistent with this more experienced group also ranking *PEoU:easy to operate*; and *PU:results* lower) suggests that this group is experiencing significant levels of cognitive dissonance.

Cognitive dissonance theory (Festinger, 1957) postulates that people adjust their internal attitudes (Whitworth *et al.*, 2007) to overcome stimuli that does not necessarily fit-in with what they feel should be true, and therefore limit any conflict between their expectations and experiences (Brown *et al.*, 2007). The user "experience" results to the PoI constructs, suggest that:

- *even long-term users experience a degree of cognitive dissonance concerning their search engine interaction.*

Moreover, that this dissonance does not prevent users from repeated search engine use suggests that:

- *a result of greater experience with a system is a higher tolerance for any cognitive dissonance associated with that system.*

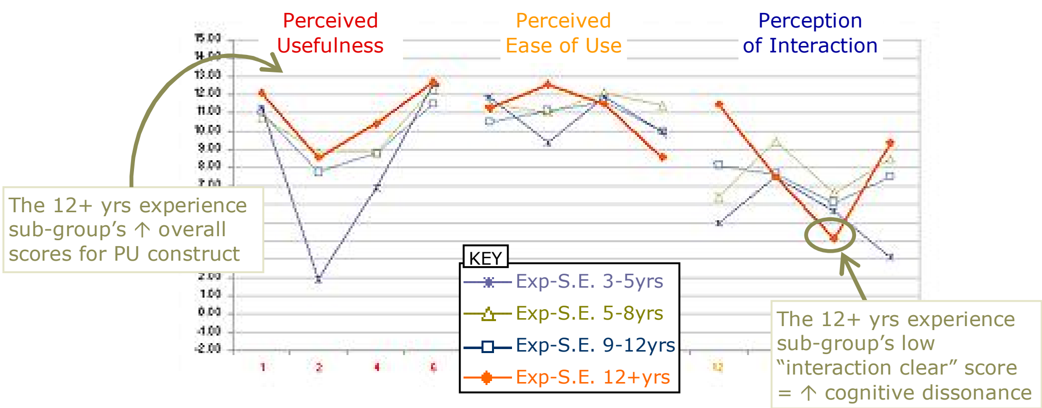
[Karahanna *et al*. (1999)] contend that users possess a natural need to reduce cognitive dissonance, and are able to do so if they can rationalise their usage behaviour. The authors further suggest that this process of being over-positive is one of the elements captured by the PU construct. If this is true, then the researcher would expect the 12+yrs experience group, who rank their understanding of their search engine interaction clarity surprisingly low, to have high PU scores. Figure 8.7 illustrates the line-graph results of the "user experience" group-case, and demonstrates that the 12+ sub-group do, in fact, have the highest PU scores of the group-case, while also recording the lowest score regarding the PoI's clarity of interaction.

Given the results of the 12+ years experience sub-group in relation to their low PoI:interaction but high overall PU, it is the researcher's contention, that;

Significant Finding:

- ***The PoI construct, and specifically the 'PoI: Interaction Clear' sub-construct, provide a framework by which users' levels of cognitive dissonance can be investigated using the OTAM model.***

Figure 8.7: Levels of Experience (group-case) results



Future Research

Karahanna *et al.*, (1999) indicated a relationship between higher cognitive dissonance and more positive PU results, contending that users attempt to stabilise any conflicting feelings associated with system interaction, by focusing on those things about the system that are useful. The OTAM provides a more useful model than the original TAM to investigate this phenomenon. In particularly, the PoI construct provides a framework with which to develop the investigative tools required to measure cognitive dissonance. This provides and exciting opportunity for future research into the antecedents of users' ongoing adoption (and non-adoption) of information technologies.

User Self-efficacy

Self-efficacy driven investigations in the context of the TAM have tended to return a mixed bag of results. Authors such as Venkatesh (1999) and Bhattacherjee (2001) align the TAM (in regards to self-efficacy elements) with Social Cognitive Theory's two expectancy suppositions, suggesting that the PU construct is similar to SCT's "outcome expectations" and PEoU encompasses similar elements as self-efficacy. The researcher contends that *neither PU or PEoU adequately address the complexities associated with user self-efficacy*. The addition of the PoI construct provides a more effective tool for properly investigating users' perceptions of their's versus the system's role in successful task completion. Of note, is that the divergence in results within the self-efficacy group-case for the PU and PEoU constructs were negligible, however, the sub-group with lower self-efficacy returned better results for the PoI construct than the high self-efficacy sub-group. Chau (2001) notes that self-efficacy has a negative impact on the TAMs constructs, but explains this impact in terms of high self-efficacy still having a positive influence on users' intended use of a system. The researcher contends, however, that the lower results for the higher self-efficacy group is indicative of this sub-group's awareness and recognition of the system flaws, and the inconsistencies of their interactions with the system. Their own high level of self-efficacy, or internalised locus of control, invariably attributes the outcome of an interactive task – in this case information search and retrieval – to their own capabilities or strategies, rather than that of the system. In this regard, users can return poorer results for the original PU and PEoU constructs, while still having an overall positive view of the system.

The PoI Construct & Self-efficacy

The added PoI construct to the OTAM is designed to measure users' perceptions of the predictability of their systems interaction. Given the more cognitively active role that individuals with high self-efficacy posses, the researcher would expect that:

- *high self-efficacy participants will invariably return lower results to some questions in a TAM survey, because they play a more cognitively active role in system engagement and task outcomes;*

In this regard:

Significant Finding

- ***Adding the PoI construct to the TAM allows researchers to more effectively investigate self-efficacy driven user results to the TAMs surveys.***

User Self-efficacy Vs. Self-Confidence

Results associated with the current research provide a clear indication that;

- *self-efficacy is not the same psychological construct as self-confidence.*

In fact, the researcher can find no other TAM driven research that demonstrates this as clearly as the OTAM results for the group-case constructions;

1.) "user self-efficacy" (figure 6.14); and

2.) "user task/system confidence" (figure 6.20).

An implication to IS research

There is a need for definitive clarity in the IS literature to redress possible confusion relating to cross-disciplinary terminologies like "self-efficacy". While it could be argued that the majority of IS literature is still empirically based, the researcher contends that all research is born out of conceptual awareness. If concepts are flawed, so too will data-collection design be flawed, which ultimately means so too will empirical results. To clarify this point, the researcher went back over some of the reviewed literature, and found that only 14% of the TAM papers[14] which included discussion relating to self-efficacy as a construct, also included discussion regarding one of self-efficacy's sub-constructs, "locus of control".

As a relatively young discipline, theory developed within IS literature is yet to experience full scrutiny from other scientific disciplines. This is however, changing, and the body of TAM literature in particular is being examined by researchers from multiple disciplines[15], including Nursing Studies (Ahasan *et al.*, 2001; Despont-Gros *et*

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[14] Of the 200 or so TAM papers reviewed for the research, 57 papers included discourse relating to "self-efficacy". Of those 57, only 8 discussed the concept on "locus of control".

[15] Studies cited here are not just IS researchers' publications in alternative disciplines, but also represent researchers from multiple disciplines using the TAM to investigate technology adoption issues.

al., 2004; Ammenwerth *et al.*, 2006; Breen & Zhang, 2008); Medicine (Aguillo, 2000); Library Science (Kuhlthau & Tama, 2001; Jiao & Onwuegbuzie, 2003); Business Studies (Bruner & Kumar, 2005; Seyal & Rahman, 2007) Science & Engineering (Roco, 2005); Marketing (Gerrard *et al.*, 2006; Jelinek *et al.*, 2006); and Education (Ip *et al.*, 2007). It behoves the IS discipline to more robustly define its conceptual terminologies, particular those that have been adopted and adapted from other disciplines.

8.2.2 Other TAM related findings & Future Research

The current data set is rich in observations and associated discussions relating to the TAM. Some of these will now be summarised, along with areas for future research.

Gender Results & the TAM

Gender sub-group results in the current study were unremarkable in divergence, although females returned slightly higher results for search engine PEoU, which is consistent with some previous findings (Gefen & Straub, 1997). Somewhat unexpectedly, females also returned noticeably higher results for the PoI construction, although it should also be noted that this followed a general pattern in virtually all the sub-groups; that is, the sub-groups in each group-case that returned the highest PEoU results, invariably returned the highest PoI results.

Future Research: Gender in Information Systems Research

While gender displayed relatively low-variance in user results in the OTAM part of this investigation, much is still left to be explored. Time restraints, unfortunately, governed that the third avenue of inquiry in the current research, that of system interaction in information retrieval behaviours was utilised chiefly for group-case construction. There remains an abundance of data from the ISB survey (survey #3) that is yet to be analysed in the context of the actual information behaviours surveyed. Do men and women use different strategies? interact with search engines differently? manifest different cognitive styles? employ different technical features? Moreover, the late cross-analysis of results between the four chosen IQ investigation group-cases and the group-cases not chosen revealed a remarkable stability in gender-driven IQ perceptions.

Adam *et al.*, (2004) contend that what little research has been done into gender differences in IS in recent years has been under-theorised, lacking in depth and understanding of the constructed social context of the gender concept. Venkatesh *et al.*, (2000) also suggest there is a lack of quality research into gender issues. In response to this, the researcher notes there is an abundance of gender related user data associated with this research yet to be explored, offering an attractive avenue for future research.

Perception of Interaction & Perceived Ease of Use

Future Research: PoI & PEoU

The researcher notes the hitherto lack of discourse concerning an observed pattern between PoI and PEoU results. The OTAM model identifies PoI as the primary driver of the relationship between these two constructs. Exactly how this relationship works, however, requires further research and investigation.

Biological Age & the TAM

Future Research: Biological Age & the TAM

The researcher notes that users' biological age had a profound impact on TAM results, and requires more focused research, aimed specifically at age-differences, in order to investigate the reasons why.

Investigating Ongoing Adoption of Information Technologies

The PoI construct associated with the OTAM offers a framework to explore a number of avenues for IS adoption future research. These include investigations into;

Future Research: Habitual Use of Search Engines – Implications for the TAM

The proposed OTAM, along with the user data of both habitual and non-habitual users of Web-based search engine technologies, provides a robust framework with which to investigate the effects of habitual technology use.

Future Research: User Cognitive Dissonance in Technology Interaction

The TAM has shown itself to somewhat ineffectual for investigating some of the complex cognitive processes involved with human-computer interaction (HCI). In particular, TAM investigations have failed to fully understand users' conflicting attitudes, or cognitive dissonance, in relation to their adoption and ongoing use of technologies. The PoI construct provides a framework by which to investigate seemingly conflicting user attitudes towards users' adoption of technologies.

Future Research: The "Cognitively Active" Searcher & Search Engine Use

Expectancy, as a cognitive construct, is by and large perceived as a positive antecedent in user adoption of technologies. The current research, however, has identified that when it comes to information search and retrieval, lower expectancy produces a more "cognitively active" user, who is more likely to recognise and embrace their own cognitive role in the process of web-based information retrieval and search engine interaction. This cognitively active searcher warrants further investigation, to determine the role of the "self" in TAM related attitudes towards Web search engines.

8.3 Constructing Frameworks for investigating IQ in Web IR (RQ.3)

(Implications & Frameworks for Future Research)

RQ.3 – *Can a framework be developed to model the processes of IQ perceptions in the context of IR, providing a more accurate lens through which to examine end-users individual difference?*

In the process of this study, the researcher has developed a number of models firstly as a framework to guide the current research, and then as a framework by which to investigate the user data. The initial framework which guided the investigation was an adaptation of Wilson's (1997) inter-disciplinary model of general information seeking behaviour (figures 2.15 & 2.26). The second framework developed was the Combined Conceptual Life Cycle (CC/LC) of IQ (figures 2.2 & 7.1) developed by combining much of the user-driven research into systems IQ over the last decade. Finally, the Ongoing Technology Acceptance Model (OTAM) (figures 2.24, 2.25) an extension of Davis' (1986) TAM was developed as a framework to investigate users perceptions of the predictability of their technology interaction processes.

8.3.1 An inter-disciplinary framework to investigate user Information Behaviour

An Abstract for Future Research (inter-disciplinary research)

Wilson's (1997) inter-disciplinary framework to investigate user information behaviour was developed as a scaffold to help researchers identify the multiple contexts in which various human information behaviour takes place. The over-riding contention being that, given information behaviour's unique position of having been investigated within multiple disciplines, any sound investigation of information behaviour would do well to consider the application of an inter-disciplinary approach.

Presented, is an adaptation of Wilson's framework to an investigation of user perceptions of information quality, during the process of Web information retrieval and search engine interaction. The framework facilitated the researcher in bringing together theory from multiple disciplines, including; (1) information systems; (2) information and library studies; and (3) social and cognitive science.

Importantly, the framework provides a cohesive structure through which synergies between multiple disciplines can be discovered and developed, while also providing a multi-dimensional context by which to investigate individual user (biological, psychological, social and demographic) characteristics, and their impact on user information retrieval behaviours.

Application of the inter-disciplinary framework in the current research

The inter-disciplinary framework was used in the current research to investigate multiple aspects of high-end users' web-based information retrieval decision making processes, which, from the first, was recognised as being a multi-dimensional and highly complex cognitive engagement between user, information and system.

Using Wilson's (1997) framework, and an example of its application performed by Ford *et al.* (2001), the research sought to bring together theory from such diverse disciplines as;

1.) *Information systems:*

- technology acceptance model (Davis, 1986 & 1989);
- systems information quality (Wang & Strong, 1996; Liu & Chi, 2002);

2.) *Information and library studies*:

- information seeking behaviour (Wilson, 1981a & 1994; Ellis, 1989a & 1989b; Bates, 1989 & 1990; Marchionini, 1995);
- interactive information retrieval (Ingwersen, 1992 & 1996; Saracevic, 1995 & 1996);
- cognitive search process (Kuhlthau, 1991 & 1999);

3.) *Social and cognitive science*:

- attribution theory (Weiner, 1974, 1980 & 1986);
- expectancy theory (Vroom, 1964);
- cognitive dissonance theory (Festinger, 1957 & 1959);
- self-efficacy theory (Bandur, 1977 & 1982).

Sub-discipline and various fields-of-study areas were also able to be identified and contextualised as guiding avenues of investigation. It is daunting proposition, for example, to begin examining a construct such as “feedback”, without first connecting it to (1) a field of study, such a *user-driven* feedback; or (2) a research sub-discipline, such as human-computer interaction. Finally, the framework allows the assimilation of intervening variables, in this case specific user individual differences, that could be incorporated into the investigation in order to develop a truly rich picture of the phenomenon being studied.

Figure 8.8a An Inter-disciplinary model to investigate user information behaviour

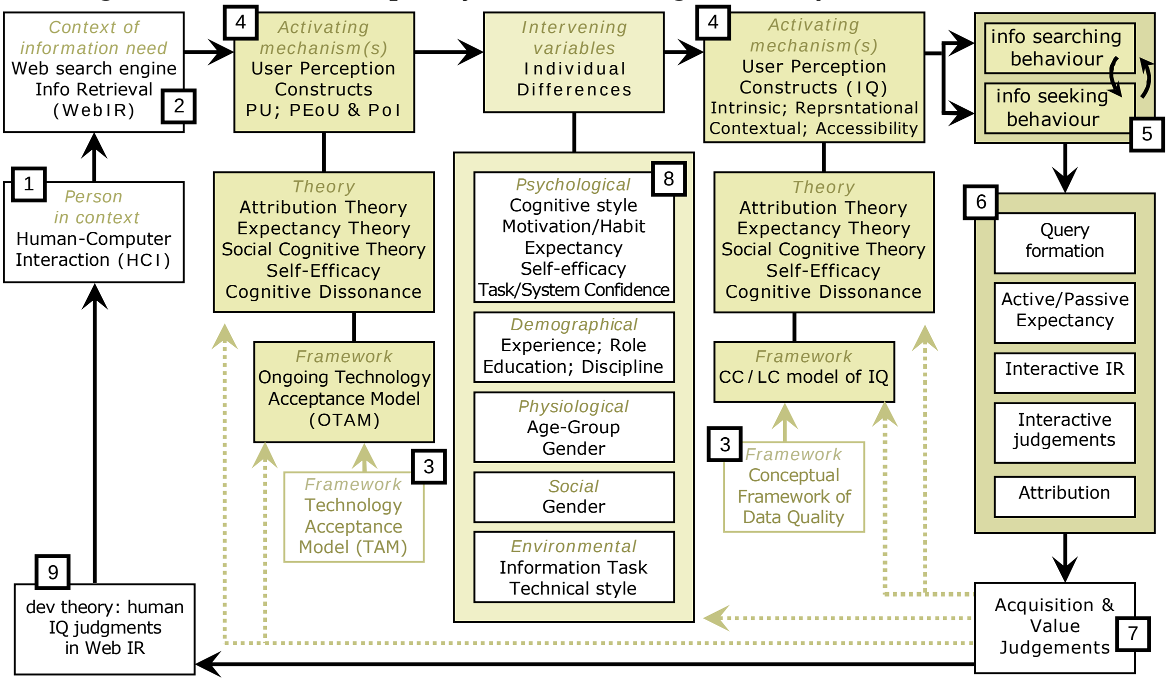


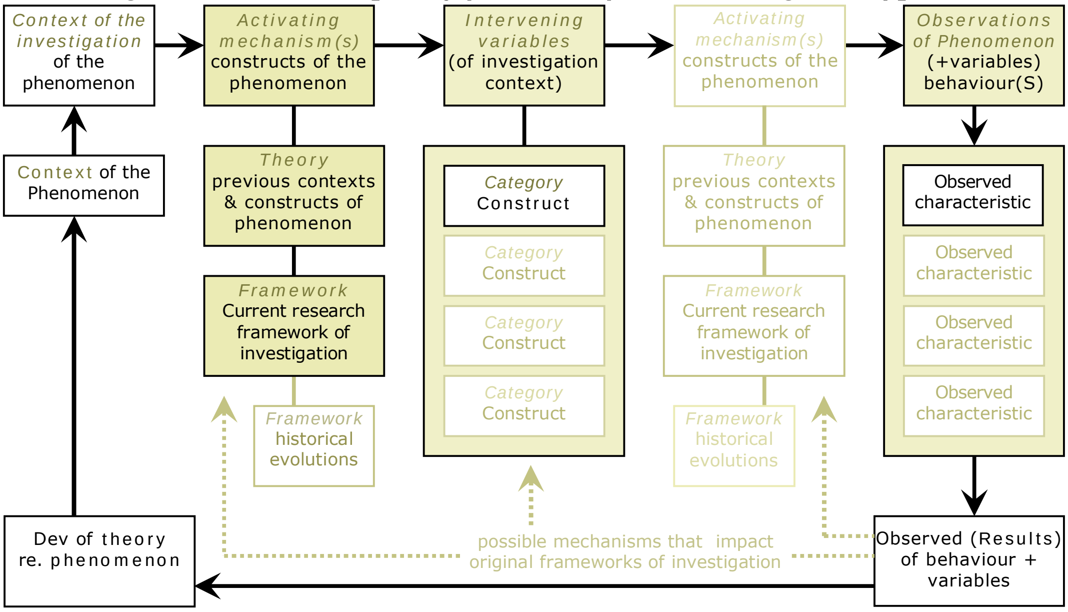
Figure 8.8a illustrates the final adaptation of the inter-disciplinary framework which guided the current investigation. Recorded are the various avenues of exploration used in the dissertation. The initial context of the investigation was established as human-computer interaction [1], specifically in the context of user information retrieval [2]. The OTAM and CC/LC of IQ framework/models, developed from previous theory regarding specific aspects of human-computer interaction [3], were used in conjunction with various inter-disciplinary theories (in this case, such theories as attribution and expectancy theory) to investigate users' perceptions of constructs such as PU, PEoU, PoI and perceptions of IQ [4]. Information behaviour, specifically information search and information seeking behaviour, is that which was observed [5], seen to be manifest in users' physical and cognitive behaviours [6], which were investigated in order to produce tangible results regarding user value-judgments of information on the World Wide Web [7]. During the course of the investigation, the user results [7] were investigated in the context of constructed individual differences between members of the target user-group [8], and finally a growing understanding of these results was used to explore and develop hypotheses [9] regarding the phenomenon of user perceptions of IQ in their Web IR behaviours.

It should be noted here, that although a third model (Macro HIRB model ~ fig 2.27; Knight & Spink, 2008) was developed during the course of the dissertation, time and scope constraints governed that it was not integrated into the inter-disciplinary framework. There is no reason, however, why it could not be used in future research.

Implication & Contribution of the inter-disciplinary framework

The previous section described how the inter-disciplinary framework was adapted and used in the current investigation. The great value of the framework, however, is its potential application to any inter-disciplinary investigation of multi-dimensional phenomena. Figure 8.8b illustrates a generic version of the framework, which researchers' can use to identify the various avenues of inquiry when investigating complex, cross-disciplinary phenomena.

Figure 8.8b Inter-disciplinary framework for rich investigation of phenomena



8.3.2 OTAM (Ongoing Technology Acceptance Model)

An Abstract for Future Research (OTAM)

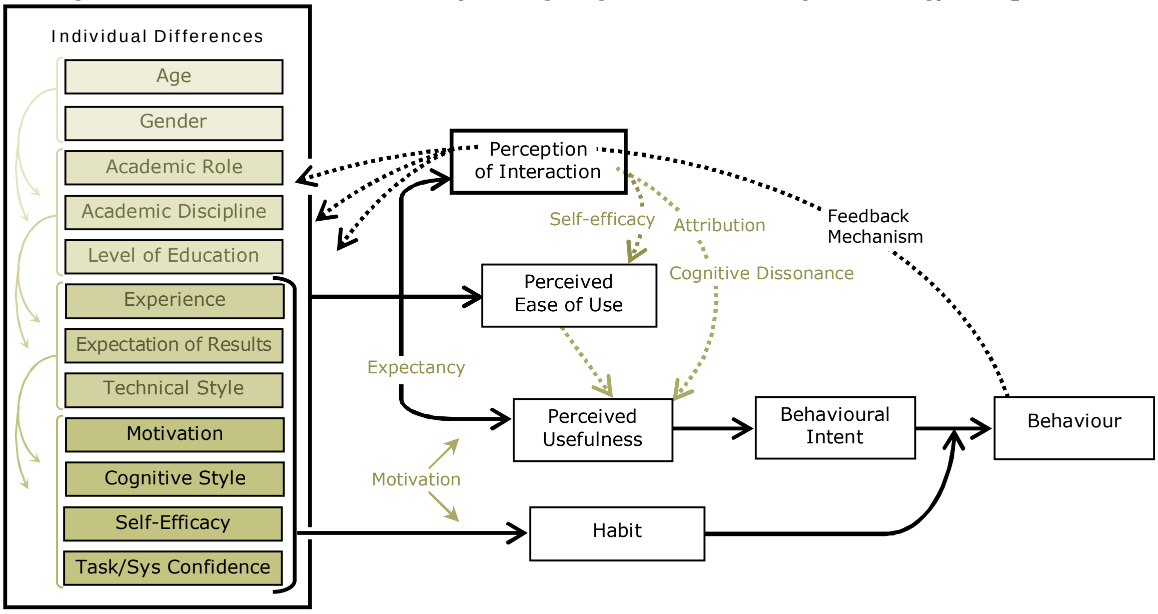
Two decades of testing and extension of Davis' TAM has failed to bring closure to the ongoing debate whether perceived usefulness (PU) and perceived ease of use (PEoU) present the whole picture of users intention to use technologies.

A modified technology acceptance model, On-going Technology Acceptance Model (OTAM) is presented, which facilitates the measurement of users perception of the predictability of their technology interactions. The OTAM allows the constructs of the original TAM to be used to investigate users ongoing use of technologies, and is seen as a natural evolution in the model given the pervasive, and therefore expected, role technology now plays in daily interactions. Perception of interaction (PoI) is added to the TAM, providing a construct by which researchers are able to better develop an accurate lens to investigate individual user differences in such complex cognitive constructs as self-efficacy and cognitive dissonance.

Application of the OTAM in the current research

Figure 8.9 illustrates the OTAM's application in the current research. Highlighted are some of pathways of influence of the various user individual differences examined during the course of this investigation, along with the feedback mechanism (introduced to the TAM for the first time) proposing PoI's influence on salient beliefs.

Figure 8.9 The OTAM constructs for on-going measurement of technology acceptance



Implication & Contribution of the OTAM

The contribution of the OTAM to an already over-loaded TAM-driven body of research is two fold. Firstly, the current investigation is an example of an inductive, qualitative investigation of the TAM constructs, rather than a repeat of the same old quantitative analysis designed to, once again, simply support Davis' (1986, 1989) hypothesis regarding the importance of perceived usefulness (Benbasat & Barki, 2007). Secondly, for the first time, a third *dynamic* construct has been added to the original TAM, which does not simply represent one or two user-driven "individual differences" of the user-group being applied to the investigation. Perception of interaction (PoI), or more accurately, *perceived predictability of interaction*, brings to the TAM a construct allowing the model to finally be applied to users' ongoing acceptance/adoption of technologies.

A "rich" investigation of the constructs of the TAM

The unconventional approach taken by the researcher involved seeing the PU and PEoU constructs as logical presuppositions of users' adoption of technologies. Of course an individual will utilise a tool if they perceive it to be useful, and of course they will engage that useful tool frequently if they find their engagement requires easily manageable amounts of cognitive effort.

The issue with TAM however is not the basic logic of its constructs. The problem with TAM is that, as an investigative framework, it has become a victim of its own success, so narrow in its methodological variance as to become its own paradigm (Straub & Burton-Jones, 2007), with few researchers venturing to investigate its constructs using different research approaches (Sharma *et al.*, 2004). Unfortunately, the result is a model shallow in it's ability to actually explore what PU and PEoU actually mean (Bagozzi, 2007). Moreover, when the same methodology is applied to users' complex individual differences within the context of a TAM study, nothing of any depth can be discovered or added to the model.

Bagozzi (2007) contends that almost "no research has deepened TAM in the sense of explaining PU and PEoU", going as far as to call the current extensions of the TAM as "conceptually impoverished". The researcher agrees unequivocally with Bagozzi, that a significant reason for this famine in deeper understanding of the driving constructs of the TAM could well be the dearth of research approaches designed to investigate the "why" of the *interaction* effects of the TAM.

The current research represents an attempt on the part of the researcher to offer to the pool of TAM literature an alternative investigation of its constructs. The result is the addition of a third construct, *perception of interaction*, designed to;

1.) Provide a construct which allows a feedback mechanism into the TAM, that is, a construct which facilitates the researcher in investigation how (initial) resultant behaviour of PU an PEoU impacts on future use.
2.) Provide a construct which allows researchers to investigate how users' individual differences might impact PU an PEoU (as well as PoI)
3.) Provide a construct which allows an investigation of user behaviour that appears to bi-pass the behavioural intention (BI) construct of the current TAM.

Whether PoI lives to become a fully accepted construct of a future version of the TAM remains to be seen, as the model still requires a great deal of exploration and testing, reaching far beyond the scope of this dissertation. The researcher acknowledges the possibility that PoI could in fact prove to become part of the existing TAM model, not as a construct, but as an over-arching framework within the model, allowing for a more useful investigation of PU an PEoU. Whichever is the case, an interaction construct is required within the TAM in order to address its "inability as a theory to provide a systematic means of expanding and adapting its core model" (Benbasat & Barki, 2007, p.212)

8.3.3 CC/LC model of IQ

An Abstract for Future Research (CC/LC)

User-studies driven investigations into Information Quality (IQ) lack a model by which researchers can conceptualise the context of their study and identify the important elements and IQ dimensions to be examined.

Presented is the Combined Conceptual Life Cycle (CC/LC) model of IQ, a framework which enables researchers to develop a more accurate research lens through which to examine user/information interaction and perceptions of IQ, in relation to both information production and information retrieval.

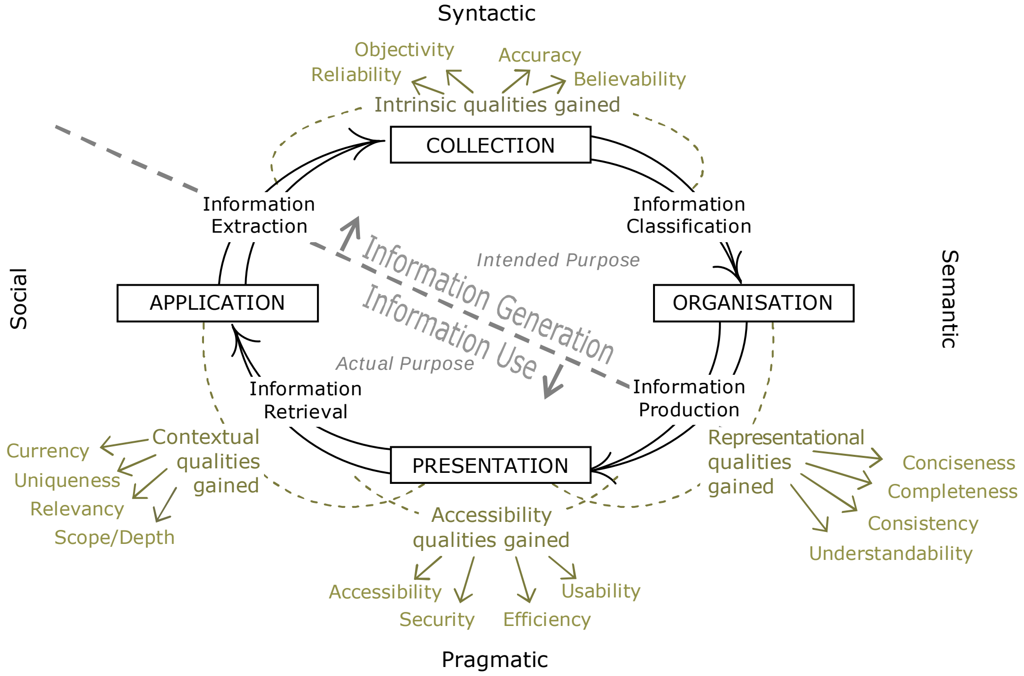
Application of the CC/LC in the current research

From a theoretically developed framework, designed to investigate users' perceptions of IQ during systems-based information retrieval, the CC/LC of IQ has come to postulate four basic propositions:

1.) Perceptions of IQ are driven, by and large, by where in the information life cycle user and information interact;
2.) IQ dimensions are conceptually connected into four interrelated clusters, which have a collective impact within their cluster, as well as on the other three clusters;
3.) Users perceptions of what IQ is, grows increasingly varied, the further into the IQ life-cycle that information travels;
4.) The negative impact of users' encountering problems with IQ – at least in a systems environment – diminishes the further into the IQ life-cycle that user/information interaction takes place.

Figure 8.10 presents the CC/LC model of IQ developed as part of the current research. It proposes that IQ is part of a life-cycle of user/information interaction, which provides the context of users' various perceptions of information's level of quality.

Figure 8.10 Combined Conceptual/Life-Cycle Model of IQ

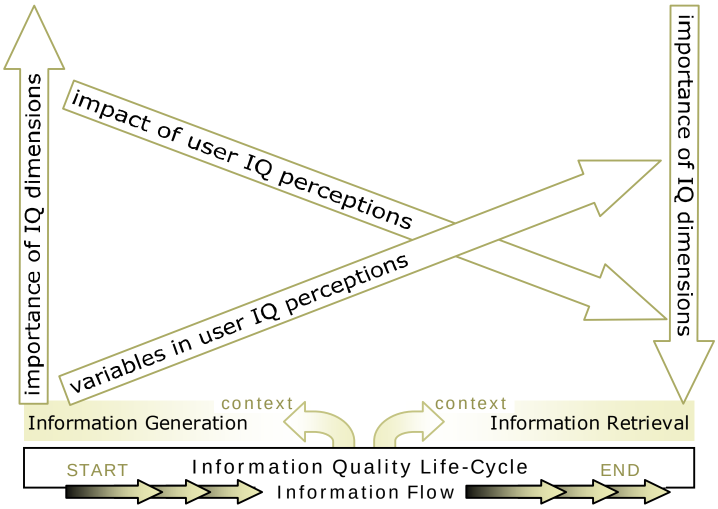


Implication & Contribution of the CC/LC

The current research, still in its conceptual infancy, has found empirical evidence to support the proposition that user perceptions of IQ are significantly affected by where in the IQ life-cycle user/information takes place. Importantly, the CC/LC of IQ has provided evidence that while one of the greatest intervening variables between individual users' perceptions of IQ is the specificity of a users' information task, this (task related) impact is not equal at all points in the IQ life-cycle. In fact, it would appear that none of the intervening variables have equal impact at all points of the IQ life-cycle. It is where in the life-cycle itself, that user-information interaction takes place, which governs the extent of both which dimensions are engaged, and their impact on user perceptions of IQ.

To better illustrate the four basic propositions proposed, figure 8.11 depicts the CC/LC model of IQ as if it were a linear process. User-information interaction is shown in the two contexts of (1) information generation; and (2) information retrieval. The importance of the various dimensions of IQ employed by users to make value judgments are shown to moderate and weaken as the life-cycle continues, and although variables in actual users' perceptions of IQ diverge through the life-cycle, their impact on actual value judgments of IQ diminishes..

Figure 8.11 The proposed impact of perceptions of IQ (in the context of the CC/LC)



Developed as a means to grasp user/information interaction based perceptions of IQ, the CC/LC was developed relatively late into the current research's evolution, while data analysis was taking place. User results were initially suggestive of the distinct clustering of dimensions into categories like those proposed by Wang & Strong (1996), and that this clustering took place within the context of specific contexts of user/information interaction. This led to the full theoretical development of the CC/LC model, with the analysis of user results both confirming and benefiting from its development.

The implications of the CC/LC are potentially quite profound, in that it provides information producers with a framework to begin understanding how users' of their information both interact with and make value-judgments about the information. Secondly, the proposed model opens up a whole new avenue of academic exploration of user perceptions of IQ.

8.4 Conclusion

The purpose of this PhD was to investigate users' perceptions of information quality in the context of their retrieving information from the ever-growing World Wide Web. A great deal of ground has been covered since the researcher began an ongoing review of associated literature, in early 2005. Not only has the research itself, developed a life of its own, but the researcher's own lens and understanding of both the phenomenon, and research processes used to investigate that phenomenon, has grown in sophistication and application.

Although the frameworks and models presented and explored, to varying degrees, answer the research questions associated with the doctorate. Many more questions and avenues of exploration have revealed themselves along the way, providing a rich protocol for future research.

On a personal note *(first person)*: *Of all the lessons learned, the one I, the researcher, take with me, is the one of the great value of research itself. Now, go and test the propositions I have made.*

REFERENCES

Abels, E. G., Liebscher, P., & Denman, D. W. (1996). Factors That Influence the Use of Electronic Networks by Science and Engineering Faculty at Small Institutions. Part I. Queries. *Journal of the American Society for Information Science, 47*(2), 146-158

ABS (1998) Research Fields, Courses And Disciplines Classification (RFCD), Australian Standards Research Classification, 1297.0., pp.17-74

Adam, A., Howcroft, D., & Richardson, H. (2004). Decade of neglect: reflecting on gender and IS *New Technology, Work and Employment, 19*(3), 222-240.

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication". *Vol.16*(iss.2), p.227 - 247.

Agarwal R & Prasad J (1997) The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decision Sciences 28*(3), p557–582.

Agarwal, R., & Prasad, J. (1999). Are individual differences germane to the acceptance of new information technologies? *Decision Sciences, 30*(2), 361.

Agarwal, R., & Karahanna, E. (2000). Time Flies When You're Having Fun: Cognitive Absorption and Beliefs About Information Technology Usage. *MIS Quarterly, 24*(4).

Aharoni, Y., Frank, A. J., & Shoham, S. (2005). Finding information on the free World Wide Web: A specialty meta–search engine for the academic community. *First Monday, 10*(12).

Ahasan, R., Partanen, T., & Keyoung, L. (2001). Global Corporate Policy for Financing Health Services in the Third World: The Structural Adjustment Crisis. *International Quarterly of Community Health Education, 20*(1), 3-16

Aguillo, I. (2000). A new generation of tools for search, recovery and quality evaluation of World Wide Web medical resources. *on-line Information Review, 24*(2), p138 - 143.

Ahn, T., Ryu, S., & Han, I. (2007). The impact of Web quality and playfulness on user acceptance of online retailing. *Information & Management, 4*(3), 263-275.

Ajzen, I & Fishbein, M. (1980) Understanding Attitudes and Predicting Social Behaviour. *Prentice-Hall, Englewood Cliffs, NJ,* 1980

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.

Ajzen, I. (2002). Residual Effects of Past on Later Behavior: Habituation and Reasoned Action Perspectives. *Personality & Social Psychology Review, 62*, 107–122.

Aladwani, A. M., & Palvia, P. C. (2002). Developing and validating an instrument for measuring user-perceived web quality. *Information & Management, 39*(6), p467 - 476.

Alexander, J. E., & Tate, M. A. (1999). Web wisdom: how to evaluate and create information quality on the web. *Mahwah, NJ: Erlbaum*.

Amaratunga, D., Baldry, D., Sarshar, M., & Newton, R. (2002). Quantitative and qualitative research in the built environment: application of “mixed” research approach. *Work Study, 51*(1), 117-131.

Ammenwerth, E., Iller, C., & Mahler, C. (2006). IT-adoption and the interaction of task, technology and individuals: a fit framework and a case study. *BMC Medical Informatics & Decision Making, 6*(3).

Anderson, T. D. (2001). Situating relevance: exploring individual relevance assessments in context. *Information Research, 6*(2), paper 97.

Anderson, T. D. (2005). Relevance as process: judgements in the context of scholarly research. *Information Research, 10*(2), 226

Andrews, D., Nonnecke, B., & Preece, J. (2003). Electronic survey methodology: A case study in reaching hard to involve Internet Users. *International Journal of Human-Computer Interaction, 16*(2), 185-210.

Applebee, A. C., Clayton, P., & Pascoe, C. (1997). Australian academic use of the Internet. *Internet Research, 7*(2), 85 - 94.

Applebee, A., Clayton, P., Pascoe, C., & Bruce, H. (2000). Australian academic use of the Internet: implications for university administrators. *Internet Research, 10*(2), 141 - 149.

Arning, K., & Ziefle, M. (2007). Understanding age differences in PDA acceptance and performance. *Computers in Human Behaviour, 23*(6), 2904-2927.

Arnold, H. J. (1985). Task Performance, Perceived Competence, and Attributed Causes of Performance as Determinants of Intrinsic Motivation. *The Academy of Management Journal, 28*(4), 876-888.

Attfield, S., & Dowell, J. (2003). Information seeking and use by newspaper journalists. *Journal of Documentation, 59*(2), p.187 - 204.

Australian Bureau of Statistics. (2003) "8146.0 Household Use of Information Technology, Australia " (online) http://www.abs.gov.au/Ausstats/abs@.nsf/lookupMF/ACC2D18CC958BC7BCA2568A9001393AE - viewed Aug 2003.

Babbie. E. & Mouton , J. (2001) The practice of social research. *Oxford University Press*, Cape Town.

Bagozzi, R. P. (2007). The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift. *Journal of the Association for Information Systems, 8*(4), 244-254.

Baker, L. M. (2006). Observation: a complex research method (Ethnological methods). *Library Trends, 55*(1), 171-189.

Bailey, W., Tendulkar, J., Narayanan, S., Daley, R., Wilson, K., & Pliske, D. (1998). Modeling Information Seeking in a Corporate Environment. *4th Symposium on Human Interaction with Complex Systems, March 1998*, pp.200-204.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behaviuoral change. *Psychological Review, 84*, 191-215.

Bandura, A. (1982). Self-Efficacy Mechanism in Human Agency. *American Psychologist, 37*(2), 122-147.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Barkhi, R. (2002). Cognitive Style may Mitigate the Impact the Communication Mode. *Information & Management, 39*(8), 677-688.

Barnett, A. (1999). A survey of Internet searches and their results. *Reference & user Services Quarterly, 39*(2), 177-182.

Bates, M. J. (1989). The design of browsing and berrypicking techniques for the on-line search interface. *on-line Review, 13*(5), pp.407-431.

Bates, M. J. (1990). Where should the person stop and the information search interface start? *Information Processing & Management, Vol.26*(Iss.5), pp.575-591.

Bates, M. J. (1998). Indexing and Access for Digital Libraries and the Internet: Human, Database, and Domain Factors. *Journal of the American Society for Information Science, 49*(13), pp.1185 - 1205.

Bates, M. J. (2002a). The Cascade of Interactions in the Digital Library Interface. *Information Processing and Management, 38*, pp.381-400.

Bates, M. J. (2002b). Toward an Integrated Model of Information Seeking and Searching. 4th Conference on Information Needs, seeking & Use in Different Contexts, Lisbon, Portugal.

Ballou, D. P., Wang, R., Pazer, H.L., & Tayi G.K. (1998) Modelling Information Manufacturing Systems to Determine Information Product Quality. *Management Science, 44*(4).

Bawden, D. (2006). Users, user studies and human information behaviour: A three-decade perspective on Tom Wilson's “On user studies and information needs”. *Journal of Documentation, 62*(6), 671 - 679.

Beaulieu, M. (2000). Interaction in information searching and retrieval. *Journal of Documentation, 56*(4), 431 - 439.

Beck, S. (1997). Evaluation criteria: the good, the bad & the ugly; or why it's a good idea to evaluate Web sources. http://lib.nmsu.edu/instruction/evalcrit.html

Belkin, N. J., Oddy, R. N., & H.M., B. (1982). ASK for information retrieval: Part I: Background and Theory. *Journal of Documentation, 38*(2), pp.61-71.

Bem, D. J. (1972). Self-perception theory. In L. Berkowitz (Ed.), Advances in experimental social psychology, 6, 1-62.

Benbasat, I., & Taylor, R. N. (1978). The Impact of Cognitive Styles on Information System Design. *MIS Quarterly, 2*(2), p.43.

Benbasat, I., & Zmud, R. W. (2003). The identity crisis within the IS discipline: Defining and communicating the discipline's core properties. *MIS Quarterly*, *29*(2), 183-194.

Benbasat, I., & Barki, H. (2007). Quo vadis, TAM? *Journal of the Association of Information Systems*, *8*(4), 211-218.

Berners-Lee, T., Cailliau, R., Luotonen, A., Nielsen, H., & Secret, A. (1994). The World Wide Web. *Communications of the ACM, 37*(8), pp.76-82.

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The semantic Web. *Scientific American, 284*(5), p.34.

Bhattacherjee, A. (2001). Understanding Information Systems Continuance: An Expectation-Confirmation Model. *MIS Quarterly, 25*(3), 351-370.

Bhattacherjee, A., & Premkumar, G. (2004). Understanding Changes In Belief And Attitude Toward Information Technology Usage: A Theoretical Model And Longitudinal Test. *MIS Quarterly, 28*(2), 229-254.

Bilal, D., & Kirby, J. (2002). Differences and similarities in information seeking: children and adults as Web users. *Information Processing & Management, 38*(5), p.649-670.

Bilal, D. (2002). Children's use of the Yahooligans! Web search engine. III. Cognitive and physical behaviors on fully self-generated search tasks. *Journal of the American Society for Information Science and Technology, 53*(13), 1170-1183.

Blackmon, M. H., Polson, P. G., Kitajima, M., & Lewis, C. (2002). Cognitive Walkthrough for the Web. *Conference on Human Factors in Computing Systems '02 (CHI'02), Minneapolis, Minnesota, USA.*, pp.463-470.

Blustein, J., Webber, R. E., & Tague-Sutcliffe, J. (1997). Methods for evaluating the quality of hypertext links. *Information Processing & Management, 33*(2), p.255-271.

Bodner, R. C., Chignell, M. H., Charoenkitkarn, N., Golovchinsky, G., & Kopak, R. W. (2001). The impact of text browsing on text retrieval performance. *Information Processing & Management, 37*(3), p.507-520.

Borgman, C. (1987a). Individual Differences in the Use of information retrieval Systems: Some Issues and Some Data. *Proc. of the 10th ACM SIGIR conference on Research and development in information retrieval,*, p.61.

Borgman, C. L. (1987b). The study of user behavior on information retrieval systems. *ACM SIGCUE Outlook, 19*(3-4).

Borlund, P. (2003). The IIR evaluation model: a framework for evaluation of interactive information retrieval systems. *Information Research, 8*(3).

Bovee, M., Srivastava, R. P., & Mak, B. (2003). A conceptual framework and belief-function approach to assessing overall information quality. *International Journal of Intelligent Systems, 18*(1), 51-74.

Bradley, J. (1998). Applied information quality: A framework for thinking about the quality of specific information. *Journal of Urban Health, 75*(4), 864-877.

Breen, G.-M., & Zhang, N. J. (2008). Introducing Ehealth to Nursing Homes: Theoretical Analysis of Improving Resident Care *Journal of Medical Systems, 32*(2), 187-192.

Brennan, M., Rae, N., & Parackal, M. (1999). Survey-Based Experimental Research via the Web: Some Observations. *Marketing Bulletin, 10*, pp.83-92.

Brewington, B. E., & Gybenko, G. (2000). How dynamic is the Web? Proc. 9th International World Wide Web Conference,, Amsterdam May 15-19, 2000, p.264.

Bridge, D. J., Provyn, J. P., Zhang, Y., & Howard, M. W. (2006). Memory processes and gender influences: A matter of context. *Acta Psychologica, October, 2006*, http://memory.syr.edu/papers/BridgeEtal-doc.pdf [April, 2008].

Broder, A. (2002). A taxonomy of web search. *ACM SIGIR Forum, 36*(2), 3 - 10.

Brooks, T. A. (2001). Where is meaning when form is gone? Knowledge representation on the Web. *Information Research, 6*(2), p.93.

Brooks, T. A. (2003). Web search: how the Web has changed information retrieval. *Information Research, 8*(3).

Brown, S. A., Massey, A. P., Montoya-Weiss, M. M., & Burkman, J. R. (2002). Do I really have to? user acceptance of mandated technology. *European Journal of Information Systems, 11*(4), 283.

Brown, S. A., Venkatesh, V., & Goyal, S. (2007). Expectation Confirmation in Technology Adoption: An Examination of Six Competing Theoretical Models. *Under Review, at: http://misrc.umn.edu/workshops/2007/spring/Susan.pdf*

Bruner, J. (1986). *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press Cited by Schwandt, T.A. (1998). Constructivist, interpretivist approaches to human inquiry. In Denzin, N.K., & Lincoln, Y.S. (eds.). *The Landscape of Qualitative Research*. London: Sage Publications, 221-259.

Bruner, G. C., & Kumar, A. (2005). Explaining consumer acceptance of handheld Internet devices. *Journal of Business Research, 58*(5), 553-558.

Bruce, H. (2005). Personal, anticipated information need. *Information Research, 10*(3), paper 232.

Bryant, S. L. (2000). The information needs and information seeking behaviour of family doctors: a selective literature review. *Health Libraries Review, 17*(2), 83-90.

Bryant, S. L. (2004). The information needs and information seeking behaviour of family doctors. *Health Information and Libraries Journal, 21*(2), 84-93.

Buckley, J.W., Buckley, M.H. & Ching, H.F. (1975). Research Methodology and Business Decisions. *National Association of Accountants and the Society of Industrial Accountants of Canada*, 26

Budd, J. M. (2005). Phenomenology and information studies. *Journal of Documentation, 61*(1), 44-59.

Burdick, T. A. (1996). Success and diversity in information seeking: gender and the information search styles model. *School Library Media Quarterly, 25*(1), 19-26.

Burgess, M. S. E., Gray, W. A., & Fiddian, N. J. (2003). A Flexible Quality Framework for Use within information retrieval. *Proc. of the 8th International Conference on information quality,, (MIT IQ Conference) 2003*, p.97-313.

Burgess, M. S. E., Gray, W. A., & Fiddian, N. J. (2004). Quality Measures and the Information Consumer. *9th International Conference on Information Quality, (MIT IQ Conference) 2004*, 373-388.

Burton-Jones, A., & Hubona, G. S. (2005). Individual differences and usage behaviour: revisiting a technology acceptance model assumption *ACM SIGMIS Database, 36*(2), 58 - 77.

Burton-Jones, A., & Hubona, G. S. (2006). The mediation of external variables in the technology acceptance model. *Information & Management, 43*(6), 706-717.

Byström, K. (2000). The effects of task complexity on the relationship between information types acquired and information sources used. In L. Höglund & T. Wilson (Eds.). The New Review of Information Behaviour Research. Vol. 1. Cambridge: Taylor Graham.

Catledge, L. D., & Pitkow, J. E. (1994). Characterizing browsing strategies in the World Wide Web. *Proc. 3rd WWW Conference.*

Chalmers, P. A. (2003). The role of cognitive theory in human-computer interface. *Computers in Human Behaviour, 19*(5).

Case, D. O., Johnson, J. D., Andrews, J. E., Allard, S. L., & Kelly, K. M. (2004). From two-step flow to the Internet: The changing array of sources for genetics information seeking. *Journal of the American Society for Information Science and Technology, 55*(8), p.660-669.

Castañeda, J. A., Muñoz-Leiva, F., & Luque, T. (2007). Web Acceptance Model (WAM): Moderating effects of user experience. *Information & Management, 44*(4), 384-396.

Ceaparu, I., Lazar, J., Bessiere, K., Robinson, J., & Shneiderman, B. (2004). Determining Causes and Severity of End-User Frustration. *International Journal of Human-Computer Interaction, 17*(3), 333 - 356.

Cecez-Kecmanovic, D. (2001). Doing Critical IS Research: The Question of Methodology. Qualitative Research in IS: Issues and Trends. *(ed. Trauth, E.), pp. 141 - 162, ,* Hershey: Idea Group Publishing.

Charmaz, K. (1995). Grounded theory. *In J. A. Smith, R. Harre and L. V. Langenhove. (Eds.) Rethinking methods in psychology, London: Sage*, 29-49.

Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. Denzin & Y. Lincoln (Eds.), Handbook of qualitative research (2nd ed., pp. 509-535), Thousand Oaks, CA: Sage.

Chang, S.-J., & Lee, Y. (2001). Conceptualizing context and its relationship to the information behaviour in dissertation research process. *New Review of Information Behaviour Research, 2*(29-46).

Chang, I. C., Li, Y.-C., Hung, W.-F., & Hwang, H.-G. (2005). An empirical study on the impact of quality antecedents on tax payers' acceptance of Internet tax-filing systems. *Government Information Quarterly, 22*(3), 389-410.

Chau, P. Y. K. (1996). An empirical assessment of a modified technology acceptance model. *Journal of Management Information Systems, 13*(2), 185.

Chau, P. Y. K. (2001). Influence of computer attitude and self-efficacy on IT usage behavior. *Journal of End user Computing, 13*(1), 26.

Chen, H., Fan, H., Chau, M., & Zeng, D. (2001). MetaSpider: Meta-searching and categorization on the Web. *Journal of the American Society for Information Science and Technology, 52*(13), p.1134.

Chen, S. Y., Magoulas, G. D., & Macredie, R. D. (2004). Cognitive styles and users' responses to structured information representation. *International Journal on Digital Libraries, 4*(2), 93-107.

Chen, W., & Hirschheim, R. (2004). A Paradigmatic and Methodological Examination of IS Research from 1991-2001. *Information Systems Journal, 14*(3), 197-235.

Chen, Y., & Lou, H. (2002). Toward an understanding of the behavioral intention to use a groupware application. *Journal of End User Computing, 14*(4), 1.

Cheon, M., Grover, V., & Sabherwal, R. (1993). The evolution of empirical research in IS: a study in IS maturity. *Information and Management, 24*(1), 107-109.

Chi, E. H., Pirolli, P., Chen, K., & Pitkow, J. (2001). Using information scent to model user information needs and actions and the Web. *Proc. of the SIGCHI Conference* *on Human factors in Computing Systems, Seattle, Washington, United States.*, p.490 - 497.

Chima, J. S. (2005). What's the Utility of the Case-Study Method for Social Science Research?: A Response to Critiques from the Quantitative/Statistical Perspective. *Proc of the Annual Meeting of the American Political Science Association, September 1-4, 2005*.

Choo, C. W., Detlor, B., & Turnbull, D. (2000). Information Seeking on the Web: An Integrated Model of Browsing and Searching. *First Monday, 5*(2).

Choo, C. W., & Marton, C. (2003). Information seeking on the Web by women in IT professions. *Internet Research, 13*(4), 267-280.

Choudrie, J., & Dwivedi, Y. K. (2005). Investigating the Research Approaches for Examining Technology Adoption Issues. *Journal of Research Practice, 1*(1), Article D1.

Chowdhury, G. G. (1999). The internet and information retrieval research: a brief review. *Journal of Documentation, 55*(2), 209-225.

Christie, M., Rowe, P., Perry, C., & Chamard, J. (2000). Implementation of Realism in Case Study Research Methodology. *Proc. of International Council for Small Business, Annual Conference, Brisbane, 2000.*

Chuang, Y. H., & Chuang, Y. W. (2002). Attitudes of two-year RNBSN nursing students towards computers. *The Journal of Health Science, 5*(1), 71–84.

Chung, W. Y., Fisher, C., & Wang, R. (2002). What Skills Matter in Data Quality. *Proc. of the 7th International Conference on Information Quality, (MIT IQ Conference),* 331-342.

Chung, J., & Tan, F. B. (2004). Antecedents of perceived playfulness: an exploratory study on user acceptance of general information-searching websites. *Information & Management, 41*(7), 869-881.

Cockton, G. (2004). From quality in use to value in the world. Proc. of the Conference on Human Factors in Computing Systems (SIGCHI '04), Vienna, Austria, pp.1287 - 1290.

Cole, C. A., & Balasubramanian, S. K. (1993). Age Differences in Consumers' Search for Information: Public Policy Implications. *Journal of Consumer Research, 20*(2), 157-169.

Collier, A. (1994). Critical realism: an introduction to the philosophy of Roy Bhaskar. *London: Verso*.

Compeau, D. R., & Higgins, C. A. (1995). Computer Self- Efficacy: Development of a Measure and Initial Test. *MIS Quarterly, 19*(2), p.189-211.

Compeau, D., Higgins, C. A., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *MIS Quarterly, 23*(2), 145.

Cooper, J., Lewis, R., & Urquhart, C. (2004). Using participant or non-participant observation to explain information behaviour. *Information Research, 9*(4), 184.

Cosijn, E., & Ingwersen, P. (2000). Dimensions of relevance. *Information Processing & Management, 36*(4), pp.533-550.

Croft, D. R., & Peterson, M. W. (2002). An evaluation of the quality and contents of asthma education on the world wide web. *Chest [NLM - MEDLINE], 121*(4), 1301.

Cunningham, S. J., & Connaway, L. S. (1996). Information Searching Preferences and Practices of Computer Science Researchers. *6th Australian Conference on Computer-Human Interaction (OZCHI '96), Hamilton, NEW ZEALAND.*, 294

Dadayan, L., & Ferro, E. (2005). When Technology Meets the Mind: A Comparative Study of the Technology Acceptance Model. *in M.A. Wimmer et al. (Eds.): Electronic Government 2005, , LNCS 3591*(Springer-Verlag Berlin Heidelberg 2005), 137-144.

D'Ambra, J., & Rice, R. E. (2001). Emerging factors in user evaluation of the World Wide Web. *Information & Management, 38*(6), 373-384.

D'Ambra, J., & Wilson, C. S. (2004a). Use Of The World Wide Web For International Travel: Integrating The Construct of Uncertainty in Information Seeking and the Task-Technology Fit (TTF) Model. *Journal of the American Society For Information Science & Technology, 55*(8), 731–742.

D'Ambra, J., & Wilson, C. S. (2004b). Explaining perceived performance of the World Wide Web: uncertainty and the task-technology fit model. *Internet Research, 14*(4), 294-310.

Das, T. H. (1983). Qualitative research in organisational behaviour. *Journal of Management Studies, 20*(3), 311.

Davidov, E. (2007). Explaining Habits in a New Context the Case of Travel-Mode Choice. *Rationality and Society, 19*(3), 315-334.

Davies, K. (2007). The information-seeking behaviour of doctors: a review of the evidence. *Health Information and Libraries Journal, 24*(2), 78-94.

Davis, F.D. (1986) A Technology Acceptance Model for Empirically Testing New End-user Information Systems: Theory and Results, MIT Sloan School of Management, Cambridge, MA, 1986. *(doctoral dissertation)*

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), p319.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). user Acceptance Of Computer Technology: A Comparison Of Two Theoretical Models. *Management Science, 35*(8), 982.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and Intrinsic Motivation to Use Computers in the Workplace. *Journal of Applied Social Psychology, 22*(14), 1111-1132.

Davis, L. D., & Davis, F. D. (1990). The effect of training techniques and personal characteristics on training end users of information systems. *Journal of Management Information Systems, 7*(2), 93-110.

Davis, P. M. (2004). Information-seeking behavior of chemists: A transaction log analysis of referral URLs. *Journal of the American Society for Information Science & Technology, 55*(4), p.326-332.

DeLone, W. H. & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research, 3* (1), 60-95.

Dedeke, A. (2000). A Conceptual Framework for Developing Quality Measures for Information Systems. *Proc. of 5th International Conference on information quality*, 126-128.

Dedeke, A., & Kahn, B. (2002). Model-Based Quality Evaluation: A Comparison of Internet Classifieds Operated by Newspapers and Non-Newspaper Firms. *Proc. of the 7th International Conference on Information Quality, MIT IQ Conference, 2002*, 142-154.

Denzin, N. K. (1970). The Research Act: A Theoretical Introduction to Sociological Methods. *Aldine, Hawthorne, NY.*

Denzin, N. K. (1978). The research act: A theoretical introduction to sociological methods. *New York: McGraw-Hill.*

Denzin, N. K., & Lincoln, Y. S. (1998). The Landscape of Qualitative Research. *Thousand Oaks, CA: Sage Publishing.*

Dervin, B. (1983) An overview of sense-making research: Concepts, methods and results to date. *Seattle: School of Communications, University of Washington.*

DeSanctis, G. (1983). Expectancy theory as an explanation of voluntary use of a Decision Support System. *Psychological Reports, 52*, 247–260.

Despont-Gros, C., Fabry, P., Muller, H., Geissbuhler, A., & Lovis, C. (2004). User acceptance of Clinical Information Systems: A methodological approach to identify the key dimensions allowing a reliable evaluation framework. *MEDINFO 2004*, 1038-1042.

Detlor, B. (2003). Internet-based information systems use in organizations: an information studies perspective. *Information Systems Journal, 13*(2), 113-132.

Dey, C. (2002). Methodological issues The use of critical ethnography as an active research methodology. *Accounting, Auditing & Accountability Journal, 15*(1), 106-121.

Dillman, D. A., & Bowker, D. K. (2001). The Web Questionnaire Challenge to Survey Methodologists. in Dimensions of Internet Science, Ulf-Dietrich Reips and Michael Bosnjak (Eds), Pabst Science Publishers, Lengerich, Germany, 159-178.

Dillon, A. (1987). Knowledge acquisition and conceptual models: a cognitive analysis of the interface. *In, D. Diaper & R. Winder (Eds.) People and computers III, Cambridge: Cambridge University Press.*

Dishaw, M. T., & Strong, D. M. (1998). Extending the technology acceptance model with Task-technology fit constructs. *Information & Management, 36*(1), p.9-21.

Dobson, P. J. (2002). Critical Realism and information systems research: why bother with philosophy? *Information Research, 7*(2), http://informationr.net/ir/7-2/paper124.html.

Doctorow, C. (2001). Metacrap: putting the torch to seven straw-men of the meta-utopia. *http://www.well.com/~doctorow/metacrap.htm*

Dong, X. (2003). Searching Information and Evaluation of Internet: A Chinese Academic User Survey. *International Information & Library Review, 35*(2), 163-187.

Dooley, L. M. (2002). Case Study Research and Theory Building. *Advances in Developing Human Resources, 4*(3), 335-354.

Dotsika, F., & Patrick, K. (2006). Towards the new generation of web knowledge. *VINE: The journal of information and knowledge management systems*, *36*(4), 406-422.

Dziadosz, S., & Chandrasekar, R. (2002). Do Thumbnail Previews Help users Make Better Relevance Decisions about Web Search Results? *Proc. of the 25th Annual International ACM SIGIR Conference on Research and Development in information retrieval, Tampere, Finland*, p.365 - 366.

Edwards, S. L. (2004). Web-based information searching: Understanding student experiences to enhance the development of this critical graduate attribute. *Proc of 3rd International Lifelong Learning Conference, 13th-16th June, Central Queensland University, Rydges Capricorn International Resort*(Eds, Appleton, K., Macpherson, C. and Orr, D.), 106-115.

Ellis, David (1989a). A Behavioural Model for information retrieval System Design, *Journal of Information Science, 15* (4/5) pp.237-247.

Ellis, David (1989b) A Behavioural Approach to information retrieval System Design, *Journal of Documentation, 45* (3), pp.171-212.

Ellis, David, Cox, D. & Hall, K. (1993) A Comparison of the Information Seeking Patterns of Researchers in the Physical and Social Sciences, *Journal of Documentation, 49*(4), pp.356-369.

Ellis, D., & Haugan, M. (1997). Modeling the Information Seeking Patterns of Engineers and Research Scientists in an Industrial Environment. *Journal of Documentation, 53*(4), pp.384-403.

Ellis, D., & Oldman, H. (2005). The English literature researcher in the age of the Internet. *Journal of Information Science, 31*(1), 29-36.

Eppler, M., & Muenzenmayer, P. (2002). Measuring information quality in the Web Context: A Survey of State-of-the-Art Instruments and an Application Methodology. *Proc. of 7th International Conference on information quality*, 187-196.

Eppler, M. J., & Wittig, D. (2000). Conceptualizing information quality: A Review of information quality Frameworks from the Last Ten Years. *Proc. of 5th International Conference on information quality*, p.83-96.

Eisenhardt, E. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532-550.

Even, A., & Shankaranarayanan, G. (2005). Value-Driven Data Quality Assessment. *Proc. of 10th International Conference on Information Quality*.

Farber, M., & Shoham, S. (2002). Users, end-users, and end-user searchers of online information: a historical overview. *On-line Information Review, Vol.26*(No.2), p.92 - 100.

Fellows, R., & Liu, A. (1997). Research Methods for Construction. *Blackwell Science Limited, Oxford*.

Fescemyer, K. (2000). Information-seeking behavior of undergraduate geography students. *Research Strategies, 17*(4), 307-317.

Festinger, L. A. (1957). Theory of Cognitive Dissonance. *London, UK, Travistock Publications*.

Festinger, L. & Carlsmith, J.M. (1959). Cognitive Consquences of Forced Compliance. Journal of Abnormal and Social Psychology, 58, 203-210. (available at http://psychclassics.yorku.ca/Festinger/]

Fidel, R. (1993). Qualitative methods in information retrieval research. *Library and Information Science Research, 15*(3), pp.219-247.

Fidel, R., Pejtersen, A. M., Cleal, B., & Bruce, H. (2004). A Multidimensional Approach to the Study of Human-Information Interaction: A Case Study of Collaborative Information Retrieval. *Journal of the American Society for Information Science & Technology, 55*(11), 939–953.

Fielden, K. (2003). Fact or Fiction: Qualitative Research Results in Information Systems. *Proc of Informing Science InSITE '03 - "Where Parallels Intersect" June 2003.*

Fink, A. (1995). The Survey Handbook. *Thousand Oaks, London and New Delhi, Sage Publications.*

Fishbein, M., & Ajzen, I. (1975). Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. *Addison-Wesley, Reading, MA.*

Fishbein, M. (1967). Readings in Attitude Theory and Measurement. *NY, Wiley.*

Ford, N., & Miller, D. (1996). Gender differences in Internet perceptions and use. *Aslib Proceedings, 48*, 183-192.

Ford, N. (2000). Cognitive styles and virtual environments. *Journal of the American Society for Information Science, 51*(6), pp.543-557.

Ford, N., Miller, D., & Moss, N. (2001). The role of individual differences in Internet searching: an empirical study. *Journal of the American Society for Information Science and Technology, 52*(12).

Ford, N., Miller, D., & Moss, N. (2002). Web search strategies and retrieval effectiveness: an empirical study. *Journal of Documentation, 58*(1), 30-48.

Ford, N., Miller, D., & Moss, N. (2005). Web search strategies and human individual differences: Cognitive and demographic factors, Internet attitudes, and approaches. *Journal of the American Society for Information Science and Technology, 56*(7), 741-756.

Ford, N. (2004). Modeling cognitive processes in information seeking: From Popper to Pask. *Journal of the American Society for Information Science and Technology, 55*(9), p.769-782.

Forslund, H. (2007). Measuring information quality in the order fulfilment process. *International Journal of Quality & Reliability Management, 24*(5), 515-524.

Foster, A. (2004). A nonlinear model of information-seeking behavior. *Journal of the American Society for Information Science and Technology, 55*(3), p.228-237.

Fugmann, R. (1973), "On the role of subjectivity in establishing, using, operating and evaluating information retrieval systems" Information Storage and Retrieval, Vol.9 No.7, p353-72.

Fourie, I. (2006). Learning from web information seeking studies: some suggestions for LIS practitioners. *The Electronic Library, 24*(1), 20-37.

Fox, E. A. (1987). Development of the CODER system: a testbed for artificial intelligence methods in information retrieval. *Information Processing & management, 23*(4), 341-366.

Freudenthal, D. (2001). Age differences in the performance of information retrieval tasks. *Behaviour & Information Technology, 20*(1), 9-22.

Frias-Martinez, E., Chen, S. Y., & Liu, X. (2007). Automatic cognitive style identification of digital library users for personalization. *Journal of the American Society for Information Science and Technology, 58*(2), 237-251.

Fusilier, M., & Durlabhji, S. (2005). An exploration of student internet use in India: the technology acceptance model and the theory of planned behaviour. *Campus-Wide Information Systems, 22*(4), 233-246.

Gaizauskas, R. & Robertson, A. (1997). Coupling information retrieval & Information Extraction: A New Text Technology for Gathering Information from the Web. *Proc. of RIAO 97: Computer-Assisted Information Searching on the Internet,, Montreal, Canada*, 356-370.

Galliers, R. D. (1992). Choosing information systems research approaches. In R. D. Galliers (ed.), Information Systems Research: Issues, Methods and Practical Guidelines, Oxford: Blackwell Scientific., 144.

Gardiner, D., McMenemy, D., & Chowdhury, G. (2006). A snapshot of information use patterns of academics in British universities. *Online Information Review, 30*(4), 341-359.

Gecas, V. (1989). The Social Psychology of Self-Efficacy. *Annual Review of Sociology, 15*, 291-316.

Gefen, D., & Straub, D. W. (1997). Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model. *MIS Quarterly, 21*(4), p.389-400.

Gefen, D. (2003). TAM or just plain habit: A look at experienced online shoppers. *Journal of End User Computing, 15*(3), 1.

Gendron, M., & D'Onofrio, M. (2002). Formulation of a Decision Support Model Using Quality Attributes. *Proc. of the 7th International Conference on Information Quality, MIT IQ Conference, 2002*, 305-316.

Gendron, M., Shanks, G., & Alampi, J. (2004). Next Steps in Understanding Information Quality and Its Effect on Decision Making and Organizational Effectiveness. *Proc. of DSS 2004 Conference*, 283 - 294.

Geoffrey, K. (2003). Understanding Web Information Search Behaviour: an exploratory model. *Journal of End User Computing, October 2003.*

Gerrard, P., Cunningham, J. B., & Devlin, J. F. (2006). Why consumers are not using internet banking. A qualitative study. *Journal of Services Marketing, 20*(3), 160–168.

Gist, M. E., & Mitchell, T. R. (1992). Self-Efficacy: A Theoretical Analysis of Its Determinants and Malleability. *The Academy of Management Review, 17*(2), 183-211.

Gittins, R. (1999). Qualitative Research: An investigation into methods and concepts in qualitative research.

Given, L. M. (2002). The academic and the everyday: Investigating the overlap in mature undergraduates' information–seeking behaviors. *Library & Information Science Research, 24*(1), 17–29.

Glaser, B., & Strauss, A. (1967). The discovery of grounded theory: Strategies of qualitative research. *London: Wiedenfeld and Nicholson*.

Glaser, B. G. (2002). Constructivist Grounded Theory? *Qualitative Social Research, 3*(3).

Glass, R. L., Ramesh, V., & Vessey, I. (2004). An analysis of research in computing disciplines. *Communications of the ACM, 47*(6), 89-94.

Graff, M. (2003). Learning from web-based instructional systems and cognitive style. *British Journal of Educational Technology, 34*(4), 407-418.

Green, D. (2000). The evolution of Web searching. *on-line Information Review, Vol24*(No.2), p124-137.

Greene, J. C. & Caracelli, V.J. (2003). Making paradigmatic sense of mixed methods practice. In A. Tashakkori & C. Teddue (Eds.), Handbook of mixed methods in social and behavioral research (91-110). Thousand Oaks, CA: Sage Publications.

Griffiths, J. R., Hartley, R. J., & Willson, J. P. (2002). An improved method of studying user-system interaction by combining transaction log analysis and protocol analysis. *Information Research, 7*(4), paper139.

Grim, B. J., Harmon, A. H., & Gromis, J. C. (2006). Focused Group Interviews as an Innovative Quanti-Qualitative Methodology (QQM): Integrating Quantitative Elements into a Qualitative Methodology. *The Qualitative Report, 11*(3), 516-537.

Goodhue, D.L. (1995) Understanding user evaluations of information systems, *Management Science 41*(12), 1827–1844.

Goodhue, D.L. & Thompson, R.L. (1995) Task– technology fit and individual performance, MIS Quarterly 19(2), 1995, pp.213-236.

Goodman, A. (2003). Introduction to Data Collection and Analysis. available online at: http://www.deakin.edu.au/~agoodman/sci101/index.php

GoogleArchive001, (2003) "keyword 'the' shows 5.2 billon results" (at: www.webmasterworld.com) http://www.webmasterworld.com/forum3/16779.htm

GoogleSchSearch001, (2007) "Davis, F_ D_ (1989)_ Perceived usefulness, perceived ease of use, and user acceptance of information technology" (at http://scholar.google.com/)

Goulding, C. (2005). Grounded theory, ethnography and phenomenology: A comparative analysis of three qualitative strategies for marketing research. *European Journal of Marketing*, *39*(3-4), 294 - 308.

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal*, *29*(1), 75–91.

Ha, I., Yoon, Y., & Choi, M. (2007). Determinants of adoption of mobile games under mobile broadband wireless access environment. *Information & Management, 44*(3), 276-286.

Hackbarth, G., Grover, V., & Yi, M. Y. (2003). Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use. *Information & Management*, *40*(3), 221–232.

Hale, G & Moss, N. (1999b). So tell me about it! A qualitative investigation of Internet search strategies. Paper presented at the European Conference on Educational Research. (ECER '99). Lahti, Finland, 22-25 September, 1999. http://www.leeds.ac.uk/educol/documents/000001188.htm on 22 August, 2004.

Halttunen, K. (2003). Students'conceptions of information retrieval: Implications for the design of learning environments. *Library and Information Science Research*, *25*(3), 307-332.

Hargittai, E., & Shafer, S. (2006). Differences in Actual and Perceived Online Skills: The Role of Gender. *Social Science Quarterly*, *87*(2), 432-448.

Harris, R. (1997). Evaluating Internet Research Sources. Virtual Salt - http://www.virtualsalt.com/evalu8it.htm, Viewed: Feb 2005.

Harris, R. W. (2003). Schools of Thought in Research into End-User Computing Success. *Journal of End User Computing*, *12*(1).

Hasan, B. (2006). Delineating the effects of general and system-specific computer self-efficacy beliefs on IS acceptance. *Information & Management*, *43*(5), 565-571.

Hawking, D., Craswell, N., Bailey, P., & Griffihs, K. (2001). Measuring Search Engine Quality. *Information Retrieval (Kluwer), 4*(1), 33–59.

Hawkins, D. T. (1999). What is Credible Information? *on-line, 23*(5), pp.86-89

Hayslett, M. M., & Wildemuth, B. M. (2004). Pixels or pencils? The relative effectiveness of Web-based versus paper surveys. *Library & Information Science Research*, *26*(f1), 73-93.

Hektor, A. (2003). Information activities on the Internet in everyday life. *New Review of Information Behaviour Research, 4*(1), 127-138.

Heinström, J. (2000). The impact of personality and approaches to learning on information behaviour. *Information Research, 5*(3), Paper78.

Heinström, J. (2002). Fast surfers, broad scanners and deep divers - personality and information seeking behaviour. *2002, Åbo (Turku): Åbo Akademi University Press. (Doctoral dissertation)*.

Heinström, J. (2003). Five personality dimensions and their influence on information behaviour. *Information Research, 9*(1).

Herman, E. (2001). End-users in academia: meeting the information needs of university researchers in an electronic age. *Aslib Proceedings*, *53*(9), 387-401.

Hess, T. M., Germain, C. M., Rosenberg, D. C., Leclerc, C. M., & Hodges, E. A. (2005). Aging-Related Selectivity and Susceptibility to Irrelevant Affective Information in the Construction of Attitudes. *Aging, Neuropsychology & Cognition, 12*(2), 149–174.

Hinson, R. (2006). The internet for academics: towards a holistic adoption model. *Online Information Review 30*(5), 542 - 554.

Hjørland, B. (1998). Theory and metatheory of information science: a new interpretation. *Journal of Documentation, 54*(5), 606-621.

Hjørland, B. (2002). Epistemology and the socio-cognitive perspective in information science. *Journal of the American Society for Information Science & Technology, 53*(4), 257-270.

Hölscher, C., & Strube, G. (2000). Web search behaviour of Internet experts and Newbies. *Proc. of the 9th conference on World Wide Web*, pp.81 - 101.

Hong, W., Thong, J. Y. L., Wong, W.-M., & Tam, K.-Y. (2001). Determinants of user acceptance of digital libraries: An empirical examination of individual differences and systems characteristics. *Journal of Management Information Systems, 18*(3), 97.

Hong, S.-J., Thong, J. Y. L., & Tam, K. Y. (2006). Understanding continued information usage behaviour: A comparison of three models in the context of mobile internet. *Decision Support Systems, 42,* 1819-1834.

Hsieh-Yee, I. (1993). Effects of search experience and subject knowledge on the search tactics of novice and experienced searchers. *Journal of the American Society for Information Science, 44*(3), pp.161-174.

Hsieh-Yee, I. (2001) Research on Web search behavior. *Library & Information Science Research*, 23, pp.167-85.

Hsu, C.-L., & Lu, H.-P. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & Management, 41*(7), 853–868.

Huang, A. H. (2003). Effects of multimedia on document browsing and navigation: an exploratory empirical investigation. *Information & Management, 41*(2), 189–198.

Huang, H.-T., Lee, Y. W., & Wang, R. Y. (1999). Quality information and knowledge. *Prentice Hall PTR*.

Huang, H.-M. (2006). Do print and Web surveys provide the same results? *Computers in Human Behaviour, 22*(3), 334-350.

Huberman, B., Pirolli, P., Pitkow, J., & Lukose, R. (1998). Strong regularities in world wide web surfing. *Science, No.280*(5360), pp.94-97.

Hyldegaard, J., & Seiden, P. (2004). My e-journal - exploring the usefulness of personalized access to scholarly articles and services. *Information Research, 9*(3).

Hysell, D. (1999). ISO 9001: traditions before and after. *Proc. of the 17th annual international conference on Computer Documentation, New Orleans, Louisiana, United States*, p.99 - 104.

Igbaria, M., & Iivari, J. (1995). The effects of self-efficacy on computer usage. *OMEGA: International Journal of Management Science, 23*(6), 587-605.

Igbaria, M., Parasuraman, S., & Baroudi, J. (1996). A motivational model of microcomputer usage. *Journal of Management Information Systems, 13*(2), 127-143.

Iivonen, M. (1995). Searchers and searchers: differences between the most and least consistent searches. Proc. of the 18th ACM SIGIR Conference on Research and Development in information retrieval, Seattle, Washington, United States, 149.

Ilieva, J., Baron, S., & Healey, N. M. (2002). Online surveys in marketing research: Pros and cons. *International Journal of Market Research, 44*(3), 361–382.

Ingwersen, P. (1992). Information retrieval interaction. London: Taylor Graham.

Ingwersen, P. (1996). Cognitive perspectives of information retrieval interaction. Elements of a cognitive IR theory. Journal of Documentation, 52, (1), 3-50.

Ingwersen, P. (2000). Users in Context. Proc. of ESSIR 2000, M. Agosti, F. Crestani, and G. Pasi (Eds.), 157-178.

Ip, B., Jones, S., & Jacobs, G. (2007). Retention and application of information technology skills among nursing and midwifery students. *Innovations in Education and Teaching International, 44*(2), 199-210.

Jacobs, I. (2002). Architectural principles of the World Wide Web, W3C working draft. *World Wide Web Consortium (W3C.org)* http://www.w3.org/TR/2002/WD-Webarch-20020830/ (20 March 2003)

Janesick, V. (2000). The Choreography of Qualitative Research Design: Minuets, Improvisations, and Crystallization. *In N. K. Denzin & Y. S. Lincoln (Eds.), The Handbook of Qualitative Research, Thousand Oaks, California, Sage Pub*, 379-400.

Jansen, B. J., & Pooch, U. (2001). A Review of Web Searching Studies and a Framework for Future Research. *Journal of the American Society for Information Science and Technology, 52*(3), 235 - 246.

Jelinek, R., Ahearne, M., Mathieu, J., & Schillewaert, N. (2006). A Longitudinal Examination of Individual, Organizational, and Contextual Factors on Sales

Technology Adoption and Job Performance. *The Journal of Marketing Theory & Practice, 14*(1), 7 - 23.

Jeong, M., & Lambert, C. U. (2001). Adaption of an information quality framework to measure customers' behavioural intentions to use lodging Web sites. *Hospitality Management, 20*(129-146).

Jiao, Q. G., & Onwuegbuzie, A. J. (2003). Reading ability as a predictor of library anxiety. *Library Review, 52*(4), 159 - 169.

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly, 24*, 602-611.

Johnson, J. D., & Meischke, H. (1991). Women's preferences for cancer information from specific communication channels. American Behavioural Scientist, Vol.34, pp.742-755.

Johnson, J. D. & Meischke, H. (1993) A comprehensive model of cancer-related information seeking applied to magazines. Human Communications Research, vol.19, p.343-367.

Johnson, J. D. (2003). "On Context of Information Seeking". *Information Processing and Management*, *39*(5), pp.735-760

Johnson, F. C., Griffiths, J. R., & Hartley, R. J. (2003). Task dimensions of user evaluations of information retrieval systems. *Information Research, 8*(4).

Johnson, R. B. (1997). Examining the validity structure of qualitative research. *Education*, *118*(2), 282-292.

Johnson, R. D., Marakas, G. M., & Palmer, J. W. (2006). Differential social attributions toward computing technology: An empirical investigation. *International Journal of Human-Computer Studies, 64*(5), 446-460.

Joughin, G. (1992). Cognitive style and adult learning principles. *International Journal of Lifelong Education, 11*(1), 3-14.

Julien, H., & Michels, D. (2000). Source Selection Among Information Seekers: Ideals and Realities. *Proc. of Canadian Association for Information Science (CAIS) Conference, 2000*.

Julien, H., & Michels, D. (2004). Intra-individual information behaviour in daily life. *Information Processing & Management, 40*(3), 547-562.

Kahn, B. K., Strong, D. M., & Wang, R. Y. (2002). Information quality benchmarks: product and service performance. *Communications of the ACM, 45*(4), 184 - 192.

Kaplan, B., & Duchon, D. (1988). Combining Qualitative And Quantitative Methods In Information. *MIS Quarterly, 12*(4), 571.

Kari, J., & Savolainen, R. (2002). Web Searching in the Context of Information Seeking in Everyday Life. A Synopsis of Research Proposal, April 2002. *Proc. of 4th Information Search in Context conference, University of Tampere Finland, 2002.*

Kari, J. (2004). Web information seeking by pages. World Wide Web, Information seeking, Personal development, Navigation. *Information Research, 9*(4), paper 183.

Karahanna, E., & Straub, D. W. (1999). The psychological origins of perceived usefulness and ease-of-use. *Information & Management, 35*(4), 237-250.

Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs. *MIS Quarterly, 23*(2), 183-213.

Katerattanakul, P., & Siau, K. (1999). Measuring information quality of web sites: development of an instrument. *Proc. of the 20th International Conference on Information Systems (ICIS'99), Charlotte, North Carolina, United States*, 279-285.

Keast, G., Toms, E. G., & Cherry, J. (2001). Measuring the Reputation of Web Sites: A Preliminary Exploration. *Joint Conference on Digital Libraries (JCDL'01), June 24 - 28, 2001. Roanoke, Virginia, United States*, pp.77-78.

Kellar, M., Watters, C., & Shepherd, M. (2007). A field study characterizing Web-based information-seeking tasks. *Journal of the American Society for Information Science and Technology, 58*(7), 999-1018.

Kelly, G.A. (1963) A theory of personality: the psychology of personal constructs. New York: Norton. 1963

Khalifa, M. (2004). The State of Research on Information System Satisfaction. Journal of Information Technology Theory and Application, (online: http://www.findarticles.com/p/articles/mi_qa4008/is_200401/ai_n9384759/print).

Khan, K., & Locatis, C. (1998). Searching through cyberspace: The effects of link display and link density on information retrieval from hypertext on the World Wide Web. Journal of the American Society for Information Science, 49, 176–182.

Khazanchi, D., & Munkvold, B. E. (2003). On the Rhetoric and Relevance of IS Research Paradigms: A Conceptual Framework and Some Propositions. *36th Annual Hawaii International Conference on System Sciences (HICSS'03), Track 8*, pp. 252b.

Kim, H.-W., Chan, H. C., & Chan, Y. P. (2007). A balanced thinking-feelings model of information systems continuance. *International Journal of Human-Computer Studies, 65*(6), 511-525.

Kim, K.-S. (1999). Searching the Web: effects of problem-solving style on information-seeking behaviour. *Proc of ED-MEDIA 99: World conference on educational multimedia, hypermedia & telecommunications,* 1541-1542.

Kim, K.S. (2000). Individual Differences and Information Retrieval: Implications on Web Design. *Proceeds of RIAO 2000.*

Kim, K.-S. (2001). Information seeking on the Web: Effects of user and task variables. *Library & Information Science Research, 23*(2), 233–255.

Kim, K., & Allen, B. (2002). Cognitive and task influences on Web searching behavior. *Journal of the American Society for Information Science and Technology, 53*(2), p.109 - 119.

Kim, S. S., & Malhotra, N. K. (2005). A Longitudinal Model of Continued IS Use: An Integrative View of Four Mechanisms Underlying Postadoption Phenomena. *Management Science, 51*(5), 741 - 755.

King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management, 43*(6), 740-755.

Kimura, D. (2004). Human sex differences in cognition: fact, not predicament. *Sexualities, Evolution & Gender, 6*, 45-53.

Kitchenham, B. A., & Pfleeger, S. L. (2001). Principles of Survey Research Part 1: Turning Lemons into Lemonade. *ACM Software Engineering Notes (SIGSOFT), 26*(6), 16-18.

Kitchenham, B. A., & Pfleeger, S. L. (2002a). Principles of Survey Research Part 2: Designing a Survey. *ACM Software Engineering Notes (SIGSOFT), 27*(1), 18-20.

Kitchenham, B. A., & Pfleeger, S. L. (2002b). Principles of Survey Research Part 3: Constructing a Survey Instrument. *ACM Software Engineering Notes (SIGSOFT), 27*(2), 20-24.

Kitchenham, B. A., & Pfleeger, S. L. (2002c). Principles of Survey Research Part 4: Questionnaire Evaluation. *ACM Software Engineering Notes (SIGSOFT), 27*(3), 20-23.

Kitchenham, B. A., & Pfleeger, S. L. (2002d). Principles of Survey Research Part 5: Populations and Samples. *ACM Software Engineering Notes (SIGSOFT), 27*(5), 17-20.

Klein, B. D. (2001). user perceptions of data quality: Internet and traditional text sources. *Journal of Computer Information Systems*, *41*(4), 9-18.

Klein, B. D. (2002a). When Do users Detect information quality Problems On The World Wide Web? *8th Americas Conference on Information Systems,* 1101-1103.

Klein, B. D. (2002b). Internet data quality: Perceptions of graduate and undergraduate business students. *Journal of Business and Management*, *8*(3).

Knapp, H., & Kirk, S. A. (2003b). Using pencil and paper, Internet and touch-tone phones for self-administered surveys: does methodology matter? *Computers in Human Behavior*, *19*(1), 117-134.

Knight, S. A., & Burn, J. M. (2005). Developing a Framework for Assessing Information Quality on the World Wide Web. *Informing Science, 8*, 159-172.

Knight, S.A. & Spink, A. (2008) Toward a Web Search Information Behavior Model. in Spink, A & M. Zimmer (Eds.) Web Search: Multidisciplinary Perspectives. Series: Information Science and Knowledge Management. 209-234. Springer

Komlodi, A. (2004) Task management support in information seeking: a case for search histories. *Computers in Human Behaviour*, *20*(2) March 2004. p163-184

Kopcso, D., Pipino, L., & Rybolt, W. (2000). The Assessment of Website Quality. *Proc of the 5th International Conference on Information Quality, (MIT IQ Conference, 2000),* 97-108.

Kopcso, D., Pipino, L., & Rybolt, W. (2001). Factors Affecting The Assessment of Web Site Quality. *Proc of 9th European Conference on Information Systems Bled, Slovenia, June 27-29, Global Co-Operation in the New Millennium*

Korjonen-Close, H. (2005). The information needs and behaviour of clinical researchers: a user-needs analysis. *Health Information & Libraries Journal, 22*(2), 96-106.

Kovac, R., & Weickert, C. (2002). Starting with Quality: Using TDQM in a Start-Up Organization. *Proc. of the 7th International Conference on Information Quality, MIT IQ Conference, 2002*, 69-78.

Krauss, S. E. (2005). Research Paradigms and Meaning Making: A Primer. *The Qualitative Report, 10*(4), 758-770.

Kreymer, O. (2002). An evaluation of help mechanisms in natural language information retrieval systems. *Online Information Review, 26*(1), 30 - 39.

Krieger, S. (1991). Social Science and the Self: Personal Essays on an Art Form. *New Brunswick, Rutgers University Press*.

Kuhlthau, C. C. (1991). Inside the Search Process: Information Seeking from the user's Perspective. *Journal of the American Society for Information Science and Technology, 42*(5), 361-371.

Kuhlthau, C. C. (1999). Accommodating the user's Information Search Process: challenges for Information retrieval System Designers. *Bulletin of the American Society for Information Science, 25*(3).

Kuhlthau, C. C., & Tama, S. L. (2001). Information Search Process Of Lawyers: A Call For 'Just For Me' Information Services. *Journal of Documentation, 57*(1).

Kumar, R. L., Smith, M. A., & Bannerjee, S. (2004). User interface features influencing overall ease of use and personalization. *Information & Management, 41*(3), 289–302.

Kwon, O., Choi, K., & Kim, M. (2006). User acceptance of context-aware services: self-efficacy, user innovativeness and perceived sensitivity on contextual pressure. *Behaviour & Information Technology, 25*(1), 1 - 16.

Lai, J., & Soh, B. (2004). Using Element and Document Profile for Information Clustering. *Proc of 2004 IEEE International Conference on e-Technology, e-Commerce and e-Service, EEE'04*(March 2004), 503-506.

Landry, M., & Banville, C. (1992). A Disciplined Methodological Pluralism for MIS Research. *Accounting, Management and Information Technology, 2*(2), 77-97.

Lawrence, S. & Giles, C. (1998) "Searching the world wide web". Science, No.280, p98–100.

Lazonder, A.W., Biemans, J.A. & Wopereis, I.G. (2000). Differences between novice and experienced users in searching information on the World Wide Web. Journal of the American Society for Information Science, 51(6), 576-581.

Lederer, A. L., Maupin, D. J., Sena, M. P., & Zhuang, Y. (1998). The role of ease of use, usefulness and attitude in the prediction of World Wide Web usage. *Proc. of the 1998 ACM SIGCPR conference on Computer personnel research, Boston, Massachusetts(United States),* p.195 - 204.

Lederer, A. L., Maupin, D. J., Sena, M. P., & Zhuang, Y. (2000). The technology acceptance model and the World Wide Web. *Decision Support Systems, 29*(3), 269-282.

Lee, A. S. (1991). Integrating Positivist and Interpretive Approaches to Organizational Research. *Organization Science, 2*(4), 342-365.

Lee, H. Y., Qu, H., & Kim, Y. S. (2007). A study of the impact of personal innovativeness on online travel shopping behavior—A case study of Korean travelers. *Tourism Management, 28*(3), 886-897.

Lee, K. C., Kang, I., & Kim, J. S. (2007). Exploring the user interface of negotiation support systems from the user acceptance perspective. *Computers in Human Behaviour, 23*(1), 220-239.

Lee, S. M., Kim, I., Rhee, S., & Trimi, S. (2006). The role of exogenous factors in technology acceptance: The case of object-oriented technology. *Information & Management, 43*(4), 469-480.

Lee, Shu-Shing; Theng, Yin-Leng & Goh, Dion Hoe-Lian (2003) Creativity in Digital Libraries and Information Retrieval Environments. *In T.M.T. Sembok et al. (Eds.) ICADL 2003*, 398–410

Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The Technology Acceptance Model: Past, Present, and Future. *Communications of the AIS, 12*(50).

Lee, Y. W., Strong, D. M., Kahn, B. K., & Wang, R. Y. (2002). AIMQ: a methodology for information quality assessment. *Information & Management, 40*(2), p133.

Lee, Y. W., & Strong, D. M. (2003). Process Knowledge and Data Quality Outcomes. *Proc. of the 8th International Conference on Information Quality, (MIT IQ Conference) 2003*, 96-106.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*(3), p.191-204.

Leonard, N. H., Scholl, R. W., & Kowalski, K. B. (1999). Information processing style and decision making. *Journal of Organizational Behavior, 20*(3), p.407-420.

Leung, H. K. N. (2001). Quality metrics for intranet applications. *Information & Management, 38*(3), 137-152.

Lewis, W., Agarwal, R., & Sambamurthy, V. (2003). Sources of Influence on Beliefs about Information Technology Use: An Empirical Study of Knowledge Workers. *MIS Quarterly, 27*(4), p.657-678.

Li, S., & Lin, B. (2006). Accessing information sharing and information quality in supply chain management. *Decision Support Systems, 42*(3), 1641-1656.

Liao, Z., & Cheung, M. T. (2001). Internet based e-shopping and consumer attitudes: An empirical study. *Information & Management, 38*(5), 299-306.

Liaw, S.-S., & Huang, H.-M. (2003). An investigation of user attitudes toward search engines as an information retrieval tool. *Computers in Human Behaviour, 19*(6).

Liaw, S.-S. (2002a). Understanding user perceptions of World Wide Web environments. *Journal of Computer Assisted Learning,, 18*(2), p.137-148.

Liaw, S.-S. (2002b). An Internet survey for perceptions of computers and the World Wide Web: relationship, prediction, and difference. *Computers in Human Behaviour, 18*(1), 17-35.

Liaw, S.-S. (2004). The theory of planned behaviour applied to search engines as a learning tool. *Journal of Computer Assisted Learning, 20*(4), 283-292.

Liaw, S.-S. (2005). Developing a Web assisted knowledge construction system based on the approach of constructivist knowledge analysis of tasks. *Computers in Human Behavior, 21*(1), 29-44.

Liaw, S.-S., Chang, W.-C., Hung, W.-H., & Huang, H.-M. (2006). Attitudes toward search engines as a learning assisted tool: approach of Liaw and Huang's research model. *Computers in Human Behaviour, 22*(2), 177-190.

Liew, C. L., & Ng, S. N. (2006). Beyond the Notes: A Qualitative Study of the Information-Seeking Behavior of Ethnomusicologists. *The Journal of Academic Librarianship, 32*(1), 60–68.

Lim, L., Wang, M., Padmanabhan, S., Vitter, J. S., & Agarwal, R. (2001). Characterizing Web Document Change. *Proc. 2nd International Web-Age Information Management (WAIM 2001), Xi'an, China*, 133.

Limayem, M., Hirt, S. G., & Chin, W. W. (2001). *Intention does not always Matter: The Contingent Role of Habit in IT Usage Behaviour.* Paper presented at the Proceedings of the Ninth European Conference on Information Systems, Bled, Slovenia.

Limayem, M., Hirt, S. G., & Cheung, C. M. K. (2003). *Habit in the Context of IS Continuance: Theory Extension and Scale Development.* Paper presented at the European Conference on Information Systems.

Lin, A. (2006). The acceptance and use of a business-to-business information system. *International Journal of Information Management, 26*(5), 386-400.

Lin, C. C. J., & Lu, H. (2000). Towards an understanding of the behavioural intention to use a web site. *International Journal of Information Management, 20*(3), 197-208.

Lin, S. J. (2001). Understanding successive searches across multiple sessions over the Web. *Proc. of 22nd International Conference on Information Systems*.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. *London: Sage*.

Lindgaard, G., & Dudek, C. (2003). What is this evasive beast we call user satisfaction? *Interacting with Computers, 15*(3), 429-452.

Liu, J. E., Pothiban, L., Lu, Z., & Khamphonsiri, T. (2000). Computer knowledge, attitudes, and skills of nurses in People's Hospital of Beijing Medical University. *Computers in Nursing, 18*(4), 197–206.

Liu, L., & Chi, L. (2002). Evolutional Data Quality: A Theory-Specific View. *Proc. of the 7th International Conference on Information Quality, (MIT IQ Conference) 2002*, 292-304.

Liu, L., & Ma, Q. (2005). The impact of service level on the acceptance of application service oriented medical records. *Information & Management, 42*(8), 1121-1135.

Liu, L., & Ma, Q. (2006). Perceived system performance: a test of an extended technology acceptance model. *ACM SIGMIS Database, 37*(2-3), 51 - 59.

Lu, J., Yu, C.-s., & Liu, C. (2006). Gender and Age Differences in Individual Decisions about Wireless Mobile Data Services: A Report from China. *China Mobile Value-Added Services Analysis Report, January 2006*.

Lucas Jr, H. C., & Spitler, V. K. (1999). Technology Use and Performance: A Field Study of Broker Workstations. *Decision Sciences, 30*(2), 1-21.

Lyytinen, K., & Rose, G. M. (2003). The Disruptive Nature of Information Technology Innovations: The Case of Internet Computing in Systems Development Organizations. *MIS Quarterly, 27*(4), p558 - 595.

Ma, Q., & Liu, L. (2004). The Technology Acceptance Model: A Meta-Analysis of Empirical Findings. *Journal of Organizational and End User Computing, Vol.16*(Iss. 1), pg. 59.

MacDermid, S. M., Roy, K., & Zvonkovic, A. (2005). Don't Stop At The Borders: Dynamic and Contextual Approaches to Theorizing About Work and Family. *In Vern L. Bengtson (ed) Sourcebook of Family Theory & Research. Sage London.*

M[ac]Gregor, G. (2005). The nature of information in the twenty-first century: Conundrums for the informatics community? *Library Review, 54*(1), 10-23.

MacPherson, K. (2004). An information processing model of undergraduate electronic database information retrieval. *Journal of the American Society for Information Science and Technology, 55*(4), p.333-347.

Madden, A. D., Ford, N. J., Miller, D., & Levy, P. (2006). Children's use of the internet for information-seeking: What strategies do they use, and what factors affect their performance? . *Journal of Documentation, 62*(6), 744 - 761.

Madge, C. & O'Connor, H. (2003) Exploring the Internet as a medium for research: web-based questionnaires and online sychronous interviews. ESRC Research Methods Programme Working Paper No.9

Majid, S., & Anwar, M. A. (2000). Information Needs and Information Seeking Behavior of Agricultural Scientists in Malaysia. *Library & Information Science Research, 22*(2), 145–163.

Mansourian, Y. (2004). Similarities and differences between Web search procedure and searching in the pre-web information retrieval systems. *Webology, 1*(1).

Mansourian, Y., & Madden, A. D. (2007). Methodological approaches in web search research. *The Electronic Library, 25*(1), 90-101.

Marchionini, G. (1995). Information Seeking in Electronic Environments. Cambridge Series on human computer interaction, Cambridge: Cambridge University Press. 1995.

Marchionini, G. (2000). Evaluating digital libraries: a longitudinal and multifaceted view. *Library Trends, 49*(2), 304-333.

Marghescu, D., Rajanen, M., & Back, B. (2004). Evaluating the Quality of Use of Visual Data-Mining Tools. *In proceedings of 11th European Conference on Information Technology Evaluation (ECITE 2004),* Amsterdam, Netherlands.

Mari, L. (1999). Notes towards a qualitative analysis of information in measurement results. *Measurement, 25*(3), 183-192.

Markey, K. (2007). Twenty-five years of end-user searching, Part 2: Future research directions. *Journal of the American Society for Information Science and Technology, 58*(8), 1123-1130.

Martin, C. L., & Nagao, D. H. (1989). Some effects of computerized interviewing on job application responses. *Journal of Applied Psychology, 74*, 72–80.

Marton, C. (2003). Quality of health information on the Web: user perceptions of relevance and reliability. *New Review of Information Behaviour Research, 4*(1), 195-206.

Martzoukou, K. (2005). A review of Web information seeking research: considerations of method and foci of interest. *Information Research, 10*(2), p215..

Mastaglia, B., & Kristjanson, L. J. (2001). Factors influencing women's decisions for choice of surgery for Stage I and Stage II breast cancer in Western Australia. *Journal of Advanced Nursing, 35*(6), 836-847.

Mat-Hassan, M., & Levene, M. (2001). Can Navigational Assistance Improve Search Experience? *First Monday, 6*(9).

Matheus, A. (2004). Web Design Quality versus Web Information Quality. *Proc of 9th International Conference on Information Quality,* 89-98.

Mathieson, K. (1991). Predicting user Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research, 2,* p173-191.

Mathieson, K., Peacock, E., & Chin, W. W. (2001). Extending the technology acceptance model: the influence of perceived user resources. *ACM SIGMIS Database, 32*(3), p.86 - 112.

Mathison, S. (1988). Why Triangulate? *Educational Researcher, 17*(2), 13-17.

McClintock, C. C., Brannon, D., & Maynard-Moody, S. (1979). Applying the Logic of Sample Surveys to Qualitative Case Studies: The Case Cluster Method. *Administrative Science Quarterly, 24*(4), 612-629.

McFarland, D. J., & Hamilton, D. (2006). Adding contextual specificity to the technology acceptance model. *Computers in Human Behaviour, 22*(3), 427-447.

McKinney, V., Yoon, K., & Zahedi, F. M. (2002). The measurement of webcustomer satisfaction: An expectation and disconfirmation approach. *Information Systems Research, 13*(3), 296-315.

Meho, L. I., & Hass, S. W. (2001). Information-seeking behavior and use of social science faculty studying stateless nations: a case study. *Library & Information Science Research, 23*(1), 5-25.

Melucci, M. (2004). Making digital libraries effective: Automatic generation of links for similarity search across hypertextbooks. *Journal of the American Society for Information Science and Technology, 55*(5), p.414-430.

Michnik, J., & Lo, M.-C. (2007). The assessment of the information quality with the aid of multiple criteria analysis. *European Journal of Operational Research, Article in Press, Corrected Proof, November 2007.*

Miller, H. (1996). The Multiple Dimensions Of Information Quality. *Information Systems Management, 13*(2), 79 - 82.

Miller, S. (2002). Information-Seeking Behaviour of Academic Scientists in the Electronic Age. available online: http://www.researchknowledge.ca/initiatives/evaluation/LitReview-SusanMiller.pdf.

Mills, J., Bonner, A., & Francis, K. (2006a). Adopting a constructivist approach to grounded theory: Implications for research design. *International Journal of Nursing Practice, 12*, 8–13.

Mills, J., Bonner, A., & Francis, K. (2006b). The Development of Constructivist Grounded Theory. *International Journal of Qualitative Methods, 5*(1).

Mingers, J. (2001a). Embodying information systems: the contribution of phenomenology. *Information and Organization, 11*(2), 103-128.

Mingers, J. (2001b). Combining IS research methods: Towards a pluralist methodology. *Information Systems Research, 12*(3), 240-259.

Mingers, J. (2003). The paucity of multi-method research: a review of the information systems literature. *Information Systems Journal, 13*, 233-249.

Mitchell, J Clyde (1983) Case and Situation Analysis. *The Sociological Review, 31*, 187-211.

Mizzaro, S. (1997). Relevance: The Whole History. *Journal of the American Society for Information Science and Technology, 48*(9), p.810-832.

Mizzaro, S. (1998). How many relevances in information retrieval? *Interacting with Computers, 10*(2), 303-320.

Modell, S. (2005). Triangulation between case study and survey methods in management accounting research: An assessment of validity implications. *Management Accounting Research, 16*(2), 231-254.

Moffat, S. D., Zonderman, A. B., & Resnick, S. M. (2001). Age differences in spatial memory in a virtual environment navigation task. *Neurobiology of Aging, 22*(5), 787-796.

Moon, J.-W., & Kim, Y.-G. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management, 38*(4), p.217-230.

Moraga, Á., Calero, C., & Piattini, M. (2006). Comparing different quality models for portals. *Online Information Review, 30*(5), 555 - 568.

Morrel-Samuels, P. (2003). Web surveys' hidden hazards. *Harvard Business Review, 81*(7), 16–18.

Morris, M. G., & Venkatesh, V. (2000). Age differences in technology adoption decisions: implications for a changing work force. *Personnel Psychology, 53*(2), 375-403.

Moss, N., & Hale, G. (1999). Cognitive style and its effect on Internet searching: a quantitative investigation. *European Conference on Educational Research (ECER '99)*, 1189.

Murray, L. (2000). Mindfulness, Meta-cognition and Interpersonal Communication Skills Training. *Proc of International Conference on Self-Concept Theory, Research & Practice: , Advances for the New Millennium, 2000, 337-343.*

Muylle, S., Moenaert, R., & Despontin, M. (2004). The conceptualization and empirical validation of web site user satisfaction. *Information & Management, 41*(5), 543–560.

Myers, M. D. (1997). Qualitative Research in Information Systems. *MIS Quarterly, 21*(2), pp.241-242.

Nachmias, R., & Gilad, A. (2002). Needle in a hyperstack: Searching for information on the World Wide Web. *Journal of Research on Technology in Education,, 34*(4), p.475.

Nahl, D., & Tenopir, C. (1996). Affective and cognitive searching behaviour of novice end-users of a full text database. *Journal of the American Society for Information Science, 47*, pp. 276-286.

Naumann, F., & Rolker, C. (2000). Assessment Methods for information quality Criteria. *Proc. of 5th International Conference on information quality*, 148-162.

Navarro-Prieto, R., Scaife, M., & Rogers, Y. (1999). Cognitive Strategies in Web Searching. *Conference on Human Factors & the Web (HFWEB '99), July 5, 1999, Washington*.

Neely, M. P. (2005). The Product Approach to Data Quality and Fitness for Use: A Framework for Analysis. *Proc. of 10th International Conference on Information Quality*.

Neus, A. (2000). The Quality of Online Registration Information. *Proc of the 2000 Conference on Information Quality,* 215-227.

Neus, A. (2003). Evolving Knowledge: Empowering Information Users. *Proc. of the 8th International Conference on Information Quality*, 41-50.

Ng, K. B. (2002). Toward a theoretical framework for understanding the relationship between situated action and planned action models of behavior in information retrieval contexts: contributions from phenomenology. *Information Processing and Management, 38*(5), 613–626.

Nicholas, D., Huntington, P., & Watkinson, A. (2003). Digital journals, Big Deals and online searching behaviour: a pilot study. *Aslib Proceedings, 55*(1/2), 84-109.

Nicholas, D., Huntington, P., Williams, P., & Dobrowolski, T. (2004). Re-appraising information seeking behaviour in a digital environment: Bouncers, checkers, returnees and the like. *Journal of Documentation, 60*(1), p.24-43.

Nicholas, D., Paul, H., Jamali, H. R., & Dobrowolski, T. (2007). Characterising and evaluating information seeking behaviour in a digital environment: Spotlight on the ‘bouncer’. *Information Processing & Management, 43*(4), 1085-1102.

Nielsen, J. (1999). User Interface Directions for the Web. *Communications of the ACM, 42*(1), pp,65-72.

Niglas, K. (2000). Combining quantitative and qualitative approaches. *Proc. European Conference on Educational Research, Edinburgh, 20-23 September 2000*.

Ocholla, D. N. (1996). Information-seeking Behaviour by Academics: A Preliminary Study. *International Information & Library Review, 28*(4), 345-358.

Ocholla, D. N. (1999). Insights into Information-seeking and Communicating Behaviour of Academics. *International Information & Library Review, 31*(3), 119-143.

Ojala, M. (1986). Views on end-user searching. *Journal of the American Society for Information Science, 37*(4), pp.197-203.

Olesen, V. L. (2000). Feminisms and Qualitative Research At and Into the Millennium. In N. K. Denzin & Y. S. Lincoln (Eds.), The Handbook of Qualitative Research, Thousand Oaks, California: Sage Pub, 215-256.

Oliver, R. L. (1980). A Cognitive Model for the Antecedents and Consequences of Satisfaction. *Journal of Marketing Research, 1*(7), 460-469.

Oliver, R. (1996). Satisfaction; A Behavioural Perspective on the Consumer. *McGraw-Hill, New York.*

Olson, H. (1995). Quantitative 'versus' Qualitative Research: The Wrong Question. *http://www.ualberta.ca/dept/slis/cais/olson.htm* (av. Feb 2005)

Olsson, M. (2005). Meaning and authority: the social construction of an 'author' among information behaviour researchers. *Information Research, 10*(2), p219.

Ondrusek, A. L. (2004). The attributes of research on end-user online searching behavior: A retrospective review and analysis. *Library & Information Science Research, 26*(2), 221–265.

Ong, C.-S., Lai, J.-Y., & Wang, Y.-S. (2004). Factors affecting engineers’ acceptance of asynchronous e-learning systems in high-tech companies. *Information & Management, 41*(6), 795-804.

Ong, C.-S., & Lai, J.-Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behaviour, 22*(5), 816-829.

Onwuegbuzie, A. J., & Teddlie, C. (2003). A framework for analysing data in mixed methods research. *In: A. Tashakkori and C. Teddlie (eds.), Handbook of Mixed Methods in Social and Behavioural Research*(Thousand Oaks, CA: Sage), 351–383.

Onwuegbuzie, A. J., & Leech, N. L. (2005). Taking the "Q" out of research: Teaching research methodology courses without the divide between quantitative and qualitative paradigms. *Quality & Quantity: International Journal of Methodology, 39*, 267-296.

Onwuegbuzie, A. J., & Leech, N. L. (2007). Sampling Designs in Qualitative Research: Making the Sampling Process More Public. *The Qualitative Report, 12*(2), 238-254.

Oppenheim, A. N. (1992). Questionnaire Design, Interviewing and Attitude Measurement, New York: Pinter Publishers.

Orlikowski, W. J., & Baroudi, J. J. (1991). Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research, 2,* 1-28.

Orr, S. K. (2005). New Technology and Research: An Analysis of Internet Survey Methodology in Political Science. *Political Science & Politics,, 38*(2), 263-267.

Pace, S. (2004). The Roles of Challenge and Skill in the Flow Experiences of Web Users. *Proc. of Informing Science and Information Technology Education Joint Conference 2004*(InSITE '04), pp.341-358.

Page-Thomas, K. (2006). Measuring task-specific perceptions of the world wide web. *Behaviour & Information Technology, 25*(6), 469 - 477.

Pajares, F. (1997). Current directions in self-efficacy research. In M. L. Maehr & P. R. Pintrich (Eds.)

Palmquist, R. A. (1996). The search for an Internet metaphor: a comparison of literatures. *American Society of Information Science Conference.*

Palmquist, R. A. (2001). Cognitive style and users' metaphors for the web: an exploratory study. *The Journal of Academic Librarianship, 27*(1), 24-32.

Palmquist, R. A., & Kim, K.-S. (2000). Cognitive style and on-line database search experience as predictors of Web search performance. *Journal of the American Society for Information Science and Technology, 51*(6), p.558-566.

Palvia, P., Midha, V., & Pinjani, P. (2006). Research Models in Information Systems. *Communications of the Association for Information Systems, 17*, 1042-1063.

Pan, B., Hembrooke, H., Joachims, T., Lorigo, L., Gay, G., & Granka, L. (2007). In Google We Trust: Users Decisions on Rank, Position, and Relevance. *Journal of Computer-Mediated Communication, 12*(3), 801-823.

Pandit, N. R. (1996). The Creation of Theory: A Recent Application of the Grounded Theory Method. *The Qualitative Report, 2*(4).

Pather, S., & Remenyi, D. (2004). Some of the philosophical issues underpinning research in information systems: from positivism to critical realism. *In Proceedings of the 2004 Annual Research Conference of the South African institute of Computer Scientists and information Technologists on IT Research in Developing Countries (Stellenbosch, Western Cape, South Africa, October 04 - 06, 2004)*, 141 - 146.

Patton, M. Q. (2002). Qualitative evaluation and research methods (3rd ed.). *Thousand Oaks, CA: Sage Publications, Inc.*

Pernici, B., & Scannapieco, M. (2002). Data Quality in Web Information Systems. *Proc. of ER-2002, 21st International Conference on Conceptual Modeling, Tampere, Finland*

Persson, P. (1998). Supporting Navigation in Digital Environments: A Narrative Approach. *In Proc of the Workshop Towards a Framework for Design and Evaluation of Navigation in Electronic Spaces, SICS, Stockholm, Sweden.*

Petersen, M. G., Madsen, K. H., & Kjær, A. (2002). The Usability of Everyday Technology—Emerging and Fading Opportunities. *ACM Transactions on Computer-Human Interaction, 9*(2), pp.74–105.

Pharo, N. (2004). A new model of information behaviour based on the Search Situation Transition schema. *Information Research, 10*(1), 203.

Pharo, N., & Järvelin, K. (2004). The SST method: a tool for analysing web information search processes. *Information Processing and Management, 40*(4), 633-654.

Pinsonneault, A., & Kraemer, K. L. (1993). Survey Research Methodology In Management Information Systems: An Assessment. *Journal of Management Information Systems, 10*(1), 75-105.

Pinto, M. (2003). Abstracting/abstract adaptation to digital environments: research trends. *Journal of Documentation, 59*(5), p.581 - 608.

Pipino, L. L., Lee, Y. W., & Wang, R. Y. (2002). Data Quality Assessment. *Communications of the ACM, Vol.45*(No.4), p.211-218.

Pittenger, D. J. (2003). Internet Research: An Opportunity to Revisit Classic Ethical Problems in Behavioral Research. *Ethics & Behavior, 13*(1), pp.45-60.

Pokorný, J. (2004). Web Searching and information retrieval. *Computing in Science and Engineering*, pp.43-48.

Pors, N. O. (2006). The public library and students' information needs. *New Library World, 107*(7/8), 275-285.

Porter, C. E., & Donthu, N. (2006). Using the technology acceptance model to explain how attitudes determine Internet usage: The role of perceived access barriers and demographics. *Journal of Business Research, 59*(9), 999-1007.

Prabha, C., Connaway, L. S., Olszewski, L., & Jenkins, L. R. (2007). What is enough? Satisficing information needs. *Journal of Documentation, 63*(1), 74 - 89.

Presbury, R., & Fitzgerald, A. (2006). Using a Kaleidoscope in Research: An Example of How Triangulation is Used to Undertake Management Research. *Proc. of Social Science Methodology Conference*, University of Sydney, Australia 2006.

Price, R. and Shanks, G. (2004) A Semiotic Information Quality Framework, Proc. IFIP International Conference on Decision Support Systems (DSS2004): Decision Support in an Uncertain and Complex World, Prato, July

Price, R., & Shanks, G. (2005a). A semiotic information quality framework: development and comparative analysis. *Journal of Information Technology*, *20,* 88-102.

Price, R., & Shanks, G. (2005b). Empirical Refinement of a Semiotic Information Quality Framework. *Proc of the 38th Hawaii International Conference on System Sciences*.

Quinn, B. (2003). Overcoming psychological obstacles to optimal online search performance. *The Electronic Library, 21*(2), 142 - 153.

Raghunathan, S. (1999). Impact of information quality and decision-maker quality on decision quality: a theoretical model and simulation analysis. *Decision Support Systems*, *26*(4), 275-286.

Ramsay, J. (1998). Problems with empiricism and the philosophy of science: Implications for purchasing research. *European Journal of Purchasing and Supply, 4*(2/3), 163-173.

Rapp, D. N., Taylor, H. A., & Crane, G. R. (2003). The impact of digital libraries on cognitive processes: psychological issues of hypermedia. *Computers in Human Behaviour, 19*(5), 609–628.

Rappaport, J. (2004). An Analysis of Expectancy Theory, the Theorist, and the Application/Limitations of. *INFO 640 Theory Paper*, From: http://www.jrappaport.waynefire3.com/literature/info640/Rappaport_expectancy_theory_final_version.pdf.

Ratten, V., & Ratten, H. (2007). Social cognitive theory in technological innovations. *European Journal of Innovation Management*, *10*(1), 90 - 108.

Rawstorne, P., Jayasuriya, R., & Caputi, P. (2000). Issues in predicting and explaining usage behaviours with the technology acceptance model and the theory of planned behavior when usage is mandatory. *Proc. of the 21st International Conference on Information Systems, Brisbane (Australia)*, p.35 - 44.

Reid, J. (2000). A task-oriented non-interactive evaluation methodology for information retrieval systems. *Information Retrieval, 2*(1), 115-129.

Remenyi, D., Williams, B., Money, A., & Swartz, E. (1998). Doing Research in Business and Management. *Sage Publications, London*.

Rieh, S. Y. (2000). Information Quality and Cognitive Authority in the World Wide Web. *Dissertation Research at Rutgers University School of Communication, Information, and Library Studies*(Advisor: Nicholas J. Belkin).

Rieh, S. Y., & Belkin, N. J. (2000). Interaction on the Web: Scholars' judgment of information quality and cognitive authority. *Proc of the 63rd ASIS Annual Meeting*(vol. 37, pp. 25–38).

Rieh, S. Y. (2002). Judgment of information quality and cognitive authority in the Web. *Journal of the American Society for Information Science and Technology, 53*(2), p.145-161.

Rieh, S. Y. (2004). On the Web at home: Information seeking and Web searching in the home environment. *Journal of the American Society for Information Science and Technology, 55*(8), p.743-753.

Rieh, S. Y., & Xie, H. (2006). Analysis of multiple query reformulations on the web: The interactive information retrieval context. *Information Processing & Management, 42*(3), 751-768.

Robertson, S. (2000). Evaluation in Information Retrieval. *Proc. of ESSIR 2000,* , M. Agosti, F. Crestani, and G. Pasi (Eds.), 81-92.

Roco, M. C. (2005). The emergence and policy implications of converging new technologies integrated from the nanoscale *Journal of Nanoparticle Research, 7*(2-3), 129-143.

Rose, D. E., & Levinson, D. (2004). Understanding user Goals in Web Search. *Proc. of the 13th World Wide Web Conference, New York, New York, USA.*, 13-19.

Rosenberg, A. (1993). Hume and the philosophy of science. In D. Norton (Ed), The Cambridge Companion to Hume Cambridge University Press, New York, 64–89.

Rossman, G. B., & Wilson, B. L. (1991). Numbers and words revisited: being 'shamelessly eclectic'. *Evaluation Review, 9*(5), 627-643.

Rowley, J. (2002). Using case studies in research. *Management Research News, 25*(1), 16 - 27.

Rubin, A., & Babbie, E. (1993). Research methods for social work *(2nd ed.) Pacific Grove, CA: Brooks/Cole Publishing Company.*

Saeed, K.A.; Hwang, Y. & Yi, M.Y. (2003) Toward an integrative framework for online consumer behavior research: a meta-analysis approach. *Journal of End User Computing; Oct 1, 2003.*

Saito, H., & Miwa, K. (2001). A cognitive study of information seeking processes in the WWW: the effects of searcher's knowledge and experience. In M.T. Özsu, H.J. Schek, K. Tanaka, Y. Zhang, and Y. Kambayashi (Eds.), *Proceedings of the 2nd International Conference on Web Information Systems Engineering, Kyoto, Japan, 2001*. (pp.321-333). Washington, DC: IEEE Computer Society

Sandhu, K., & Corbitt, B. J. (2003). Assessing web-based electronic services adoption model (E-SAM). In Proc of the 11th European Conference on Information Systems (Ciborra CU, Mercurio R, de Marco M, Martinez M, Carignani A eds.), Naples, Italy, 1683-1696.

Saracevic, T. (1995) . Evaluation of evaluation in information retrieval. Proceedings of the 18th Annual ACM SIGIR Conference on Research and Development in Information Retrieval, 138–146.

Saracevic, T. (1996). Modeling interaction in information retrieval (IR) : A review and proposal. *Proc. of the 59th Annual Meeting of the American Society for Information Science, 33,* 3-9.

Sarkis, J., & Sundarraj, R. P. (2000). Quality and Process Standards for Electronic Commerce. *Proc. of the 5th International Conference on Information Quality, MIT IQ Conference, 2000*, 283-298.

Savage-Knepshield, P. A., & Belkin, N. J. (1999). Interaction in information retrieval: Trends Over Time. *Journal of the American Society for Information Science and Technology, 50*(12), p.1067-1082.

Savolainen, R., & Kari, J. (2006). User-defined relevance criteria in web searching. *Journal of Documentation, 62*(6), 685 - 707.

Scannapieco, M., Pernici, B., & Pierce, E. (2002). IP-UML: Towards a Methodology for Quality Improvement based on the IP-MAP Framework. *Proc of the Seventh International Conference on Information Quality (ICIQ-02)*..

Schostak, J. (2002). Critiquing Critical Realism: a working paper. *Proc of ECER 2002, Portugal.*, http://www.enquirylearning.net/ELU/Issues/Research/Critical%20Realism.htm.

Schwarz, A., Junglas, I. A., Krotov, V., & Chin, W. W. (2004). Exploring the role of experience and compatibility in using mobile technologies. *Information Systems & e-Business Management, 2*(4), 337-356.

Seligman, L. (2006). Sensemaking throughout adoption and the innovation-decision process. *European Journal of Innovation Management, 9*(1), 108 – 120.

Sellen, A. J., Murphy, R., & L., S. K. (2002). How knowledge workers use the web. Proc. of the SIGCHI Conference on Human factors in Computing Systems: Changing our world, changing ourselves, Minneapolis, Minnesota, USA, p.227 - 234.

Seyal, A. H., Rahman, M. N. A., & Rahim, M. M. (2002). Determinants of academic use of the Internet: a structural equation model. *Behaviour & Information Technology, 21*(1), 71-86.

Seyal, A. H., & Rahman, N. A. (2007). The influence of external variables on the executives' use of the internet. *Business Process Management Journal, 13*(2), 263 - 278.

Schamber, L., Eisenberg, M., & Nilan, M. (1990). A re-examination of relevance: toward a dynamic, situational definition. *Information Processing & Management, 26*(6), 755–776.

Schepers, J., & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information & Management*, *44*(1), 90–103.

Schottenbauer, M. A., Rodriguez, B. F., Glass, C. R., & Arnkoff, D. B. (2004). Computers, anxiety, and gender: an analysis of reactions to the Y2K computer problem. *Computers in Human Behaviour, 20*(1), 67–83.

Shankaranarayan, G., Wang, R. Y., & Ziad, M. (2000). Modeling the Manufacture of an Information Product with IPMAP. *Proceedings of Conference on Information Quality, Massachusetts Institute of Technology,* 1-16.

Shankar, G., & Watts, S. (2003). A Relevant, Believable Approach for Data Quality Assessment. *Proc. of 8th International Conference on information quality*, 178-189.

Shanks, G., & Corbitt, B. (1999). Understanding Data Quality: Social and Cultural Aspects. *Proc. 10th Australasian Conference on Information Systems*, 785-797.

Sharma, R., Yetton, P., & Crawford, J. (2004). The Relationship between Perceived Usefulness and Use: The Effect of Common Method Bias. *Proc of the Diffusion Interest Group in Information Technology (DIGIT) Conference, Washington DC, 2004*.

Shaw, D., & Davis, C. H. (1996). The Modern Language Association: Electronic and paper surveys of computer-based tool use. *Journal of the American Society for Information Science, 47*, 932–940.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*(2), 63-75.

Shenton, A. K., & Hayter, S. (2006). Terminology deconstructed: Phenomenographic approaches to investigating the term “information” *Library & Information Science Research, 28*(4), 563-578.

Shih, H.-P. (2004). Extended technology acceptance model of Internet utilization behavior. *Information & Management, 41*(6), p.719.

Slater, S. F., & Atuahene-Gima, K. (2004). Conducting Survey Research In Strategic Management. *Research Methodology in Strategy and Management, 1*, 227-249.

Slyke, C. V., Comunale, C. L., & Belanger, F. (2002). Gender differences in perceptions of web-based shopping. *Communications of the ACM, 45*(7), 82-86.

Smith, N.C. (1989). The case study: a vital yet misunderstood research method for management, *in Mansfield, R. (Eds), Frontiers of Management*, Routledge, London, 50-64.

Song, G., & Salvendy, G. (2003). A framework for reuse of user experience in Web browsing. *Behaviour & Information Technology, 22*(2), 79-90.

Song, J., & Zahedi, F. M. (2006). Trust in health infomediaries. *Decision Support Systems, 43*(2), 390-407

Sonnenwald, D. H., & Iivonen, M. (1999). An Integrated Human Information Behavior Research Framework for Information Studies. *Library & Information Science Research, 21*(4), 429-457.

Spink, A. (1997). Study of Interactive Feedback during Mediated Information Retrieval. *Journal of the American Society for Information Science and Technology, 48*(5), p.382-394.

Spink, A. (2004). Multitasking information behavior and information task switching: an exploratory study. *Journal of Documentation*, *60*(4), 336-351.

Spink, A., & Saracevic, T. (1997). Interactive information retrieval: Sources and effectiveness of search terms during mediated online searching. Journal of the American Society for Information Science, 48(8), 741-761.

Spink, A., & Saracevic, T. (1998). Human-computer interaction in information retrieval: Nature and manifestations of feedback. *Interacting with Computers*, *10*(3), 249-267.

Spink, A., Jansen, B. J., & Ozmultu, H. C. (2000). Use of query reformulation and relevance feedback by Excite users. *Internet Research, 10*(4), 317 - 328.

Spink, A., & Cole, C. (2001). Everyday life information seeking research. *Library & Information Science Research, 23*(4), 301-304.

Spink, A., Park, M., Jansen, B. J., & Pedersen, J. (2006). Multitasking during Web search sessions. *Information Processing and Management*, *42*(1), 264-275.

Stahl, B. C. (2005). A Critical View of the Ethical Nature of Interpretive Research: Paul Ricœur and the Other. *Proc of. 13th European Conference on Information Systems*(Information Systems in a Rapidly Changing Economy), Regensburg, Germany, 26 to 28 May 2005.

Stajkovic, A. D., & Sommer, S. M. (2000). Self-Efficacy and Causal Attributions: Direct and Reciprocal Links. *Journal of Applied Social Psychology, 30*(4), 707-737.

Stake, R. E. (1978). The case study method in social inquiry. *Educational Researcher, 7*(1), 5-8.

Stake, R. (1995). The art of case study research. *Thousand Oaks, CA: Sage.*

Staw, B. M. (1976). Intrinsic and extrinsic motivation. In J.T. Spence, R.C. Carson, & J. Thibaut (Eds.), University programs modular studies., Morristown, N.J.: General Learning Press.

Steers, R. M. (1988). Introduction to Organizational Behaviour. *3rd edition. Glenview, IL: Scott, Foresman*.

Stenbacka, C. (2001). Qualitative research requires quality concepts of its own. *Management Decision, 39*(7), 551-555.

Stenmark, D. (2001). The Relationship between Information and Knowledge. *in Proceedings of IRIS 24, Ulvik, Norway*, August 11-14

Strang, K. D. (2007). Examining effective technology project leadership traits and behaviors. *Computers in Human Behavior, 23*(1), 424–462.

Staples, D. S., Wong, I., & Seddon, P. B. (2002). Having expectations of information systems benefits that match received benefits: does it really matter? *Information & Management, 40*(2), 115-131.

Straub, D. W., Gefen, D., & Boudreau, M.-C. (2005). Quantitative Research. In Research in Information Systems: A Handbook for Research Supervisors and Their Students, D. Avison and J. Pries-Heje (Ed.), Elsevier, Amsterdam, 221-238.

Straub, D., & Burton-Jones, A. (2007). Veni, Vidi, Vici: Breaking the TAM Logjam. *Journal of the Association for Information Systems, 8*(4), 223-229.

Strauss, A., & Corbin, J. (1994). Grounded theory methodology: An overview. *In N. Denzin & Y. Lincoln (Eds.), Handbook of qualitative research*, 273-285.

Strong, D. M., & Miller, S. M. (1995). Exceptions and Exception Handling in Computerised Information Processes. *ACM Transactions on Information Systems, 13(2); ; , 13*(2), 206-233.

Strong, D. M., Lee, Y. W., & Wang, R. Y. (1997a). Data quality in context. *Communications of the ACM, 40*(5), p.103 - 110.

Strong, D., Lee, Y., & Wang, R. (1997b). 10 Potholes in the Road to information quality. *IEEE Computer, 30*(8), 38-46.

Strube, G. (1999). Cognitive Modeling: Research Logic in Cognitive Science. *IESBS, 2.2*(55).

Sturges, P., & Griffin, A. (2003). The Archaeologist Undeceived: Selecting Quality Archaeological Information from the Internet. *Informing Science Journal, 6*, pp.221-232.

Stvilia, B., Twidale, M. B., Smith, L. C., & Gasser, L. (2005). Assessing Information Quality of a Community-Based Encyclopedia. 10th International Conference on Information Quality

Succi, M. J., & Walter, Z. D. (1999). Theory of User Acceptance of Information Technologies: An Examination of Health Care Professionals. *Proc. of the 32nd Hawaii International Conference on System Sciences - 1999.*

Sullivan, D. (2002) Nielsen//NetRatings search engine ratings. search engine Watch. http://www.searchenginewatch.com/reports/netratings.html (20 March 2003)

Sutcliffe, A. G., Ennis, M., & Watkinson, S. J. (2000). Empirical studies of end-user information searching. *Journal of the American Society for Information Science, 51*(13), 1211-1231. .

Talja, S. (1999). Analyzing Qualitative Interview Data: The Discourse Analytic Method. *Library & Information Science Research, 21*(4), 459–477.

Talja, S., Keso, H., & Pietiläinen, T. (1999). The production of ‘context’ in information seeking research: a metatheoretical view. *Information Processing & Management, 35*(6), 751-763.

Talja, S., Tuominen, K., & Savolainen, R. (2005). "Isms" in information science: constructivism, collectivism & constructionism. *Journal of Documentation, 61*(1), 79-101.

Tayi, G. K., & Ballou, D. P. (1998). Examining data quality. *Communications of the ACM, 41*(2), 54 - 57.

Taylor, S., & Todd, P. (1995). Assessing IT Usage: The Role of Prior Experience. *MIS Quarterly, Vol.19*(Iss.4), p.561-570.

Taylor, A. R., Cool, C., Belkin, N. J., & Amadio, W. J. (2007). Relationships between categories of relevance criteria and stage in task completion. *Information Processing & Management, 43*(4), 1071-1084.

Teo, T. S. H., Lim, V. K. G., & Lai, R. Y. C. (1999). Intrinsic and extrinsic motivation in internet usage. *OMEGA: International Journal of Management Science, 27*(1), p.25-37.

Tesch, D., Miller, R., Jiang, J. J., & Klein, G. (2005). Perception and expectation gaps of information systems provider skills: the impact on user satisfaction. *Information Systems Journal, 15*(4), 343-355.

Thelwall, M. (2003). What is this link doing here? Beginning a fine-grained process of identifying reasons for academic hyperlink creation. *Information Research, 8*(3).

Thompson, R., Higgins, C., & Howell, J. (1994). Influence of experience on personal computer utiliation: testing a conceptual model. *Journal of Management Information Systems, 11*(1), 167–188.

Thong, J. Y. L., Hong, W., & Tam, K.-Y. (2002). Understanding user acceptance of digital libraries: what are the roles of interface characteristics, organizational context, and individual differences? *International Journal of Human-Computer Studies, 57*(3), 215-242.

Thurmond, V. A. (2001). The Point of Triangulation. *Journal of Nursing Scholarship, 33*(3), 253-258.

Tombros, A., Ruthven, I., & Jose, J. M. (2003). Searchers' criteria For assessing web pages. Proc. 26th annual International ACM SIGIR Conference on Research and Development in Information Retrieval, Toronto, Canada, July 28 - Aug 01, 2003, p.385-386.

Toms, E. G. (1997). Information Interaction: Providing a Framework for Information Architecture. *Journal of the American Society for Information Science & Technology, 53*(10), 855-862.

Toms, E. G., Freund, L., Kopak, R., & Bartlett, J. C. (2003). The Effect of Task Domain on Search. *Proc. of CASCON 2003.*

Toms, E. G., Dufour, C., & Hesemeier, S. (2004). Measuring the User's Experience with Digital Libraries. *Joint Conference on Digital Libraries, 2004 (JCDL'04)*, 51-52.

Toms, E. G., O'Brien, H. L., Kopak, R., & Freund, L. (2005). *Searching for Relevance in the Relevance of Search*: In F. Crestani & I. Ruthven (Eds.): CoLIS 2005, LNCS 3507, pp.59–78.

Torkzadeh, G., & Lee, J. (2003). Measures of perceived end-user computing skills. *Information & Management, 40*(7), 607-615.

Tourangeau, R., Couper, M. P., & Steiger, D. M. (2003). Humanizing self-administered surveys: Experiments on social presence in web and IVR surveys. *Computers in Human Behaviour, 19*(1), 1–24.

Trauth, E. (2001). The choice of Qualitative Methods in IS research. (chap 1) in Trauth, E. Qualitative Research in IS: Issues and Trends, Idea Group Publishing.

Trauth, E. M. (2002). Odd girl out: An individual differences perspective on women in the IT profession. *Information Technology & People, 15*(2), 98-118.

Triandis, H. C. (1980). Values, attitudes, and interpersonal behavior. In H. E. Howe (Ed.), *Nebraska Symposium on Motivation 1979: Beliefs, Attitudes and Values* (pp. 195-259): Lincoln: University of Nebraska Press.

Trochim, W. (2000). The Research Methods Knowledge Base, 2nd Edition. Atomic Dog Publishing, Cincinnati, OH.

Trochim, W. M. (2002). The Research Methods Knowledge Base, 2nd Edition. Internet WWW page, at URL: <http://trochim.human.cornell.edu/kb/index.htm>, (August 16, 2004).

Tsikriktsis, N. (2002). Does Culture Influence Web Site QualityExpectations?: An Empirical Study. *Journal of Service Research, 5*(2), 101-112.

Tsoi, A.C, Forsali, D., Gori, M., Hagenbuchner, M. & Scarselli, F. (2003a) "A Novel Focused Crawler". Proc. of the 12th World Wide Web Conference, 20-24 May 2003, Budapest, Hungary

Tsoi, A.C., Morini, G., Scarselli, F., Hagenbuchner, M. & Maggini, M. (2003b) "Adaptive Ranking of Web Pages" *Proc. of the 12th World Wide Web Conference, 20-24 May 2003, Budapest, Hungary*

Tsoi, A., Burn, J. & Gori, M. (2003c) Building a Prototype for Quality information retrieval from the Internet. Australian Research Council Discovery Application, Proj ID: DP0452862.

Turk-Charles, S., Meyerowitz, B. E., & Gatz, M. (1997). Age differences in information-seeking among cancer patients. *International Journal of Aging Human Development, 45*(1), 85-98.

Vakkari, P. (2001). Changes in Search Tactics and Relevance Judgements when Preparing a Research Proposal A Summary of the Findings of a Longitudinal Study. *Information Retrieval, 4*(3/4), 295-310.

Vakkari, P. (2003). Task-Based Information Searching. *Annual Review of Information Science and Technology (ARIST), 37*, p413-464.

Vakkari, P., & Sormunen, E. (2004). The influence of relevance levels on the effectiveness of interactive information retrieval. *Journal of the American Society for Information Science and Technology, 55*(11), 963-969.

Vandenbosch, B., & Huff, S. L. (1997). Searching and Scanning: How Executives Obtain Information from Executive Information Systems. *MIS Quarterly, 21*(1), p.81-107.

Van Rijsbergen, C. J. (1997). information retrieval. *London: Butterworths, 1979.*

Varlander, S. (2007). Online information quality in experiential consumption: An exploratory study. *Journal of Retailing and Consumer Services, 14*(5), 328-338.

Venkatesh, V. (1999). Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation. *MIS Quarterly, 23*(2), p239-260.

Venkatesh, V., & Davis, F. D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science, 46*(2), pp.186 -204.

Venkatesh, V., & Morris, M. G. (2000). Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior. *MIS Quarterly, 24*(1), p115-139.

Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A Longitudinal Field Investigation of Gender Differences in Individual Technology Adoption Decision-

Making Processes. *Organizational Behavior and Human Decision Processes, 83*(1), 33-60.

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). user Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), p425 - 478.

Venkatesh, V., Morris, M. G., Sykes, T. A., & Ackerman, P. L. (2004). Individual Reactions to New Technologies in the Workplace: The Role of Gender as a Psychological Construct. *Journal of Applied Social Psychology, 34*(3), 445-467.

Verplanken, B., Aarts, H., Van Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *British Journal of Social Psychology, 37,* 111-128.

Vessey, I., Ramesh, V. & Glass, R.L. (2004) Research in Information Systems: An Empirical Study of Diversity in the Discipline and Its Journals…

Vigil, P.J. (1983) "The psychology of online searching", Journal of the American Society of Information Science, Vol.34 No.4, p281-7.

Vroom, V. H. (1964). *Work and motivation.* (New York: Wiley)

Waddington, D. (1994). Participant Observation. in Cassell, C. & Symon, G., (Eds.), Qualitative Methods in Organizational Research, Sage, London, 107-122.

Wall, D., & Kristjanson, L. (2005). Men, culture and hegemonic masculinity: understanding the experience of prostate cancer. *Nursing Inquiry, 12*(2), 87-97.

Wallace, D. (1998). Qualitative Research and the Editorial Tradition: A Mixed Metaphor - Qualitative Research. *Library Trends, Spring 1998*.

Walsham, G. (1995). The Emergence of Interpretivism in IS Research. *Information Systems Research, 6*(4), 376-394.

Wang, R. Y., Reddy, M. P., & Kon, H. B. (1995). Toward quality data: An attribute-based approach. *Decision Support Systems, 13*, 349-372.

Wang, R. Y., & Strong, D. M. (1996). Beyond Accuracy: What Data Quality Means to Data Consumers. *Journal of Management Information Systems, 12*(4), 5-34. 27

Wang, R. Y. (1998). A Product Perspective on Total Quality Management. *Communications of the ACM, 41*(2), p.58.

Wang, P., Hawk, W.B, & Tenopir, C. (2000). Users' interaction with World Wide web resources: an exploratory study using a holistic approach. *Information Processing & Management, 36*(2), 229-251.

Wang, P., Berry, M. W., & Yang, Y. (2003). Mining longitudinal web queries: trends and patterns. *Journal of the American Society for Information Science and Technology, 54*(8), p.743 - 758. .

Wang, Y.-S., Lin, H.-H., & Luarn, P. (2006). Predicting consumer intention to use mobile service. *Information Systems Journal, 16*, 157–179.

Wang, Y.-S., Wu, M.-C., & Wang, H.-Y. (2008). Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British Journal of Educational Technology, In Press:* (Published article online: 27-Feb-2008).

Wang, Y., & Kitsuregawa, M. (2001). Link Based Clustering of Web Search Results. *Proc. of 2nd Web-Age Information Management (WAIM) Conference. Xi'an, China,* 225-236.

Watt, D. (2007). On Becoming a Qualitative Researcher: The Value of Reflexivity. *The Qualitative Report, 12*(1), 82-101.

Webster, J., & Watson, R. T. (2002). Analyzing The Past To Prepare For The Future: Writing A Literature Review. *MIS Quarterly, 26*(2), xiii-xxiii.

Weiler, A. (2005). Information-Seeking Behavior in Generation Y Students: Motivation, Critical Thinking, and Learning Theory. *The Journal of Academic Librarianship, 31*(1), 46–53.

Weiner, B. (1974) Achievement motivation and attribution theory. Morristown, N.J.: General Learning Press.

Weiner, B. (1980). Human Motivation. *NY: Holt, Rinehart & Winston.*

Weiner, B. (1986). An attributional theory of motivation and emotion. *New York: Springer-Verla.*

White, A. (2007). Understanding hypertext cognition: Developing mental models to aid users' comprehension. *First Monday, 12*(1), http://firstmonday.org/issues/issue12_11/white/index.html.

White, R. W., & Marchionini, G. (2007). Examining the effectiveness of real-time query expansion. *Information Processing & Management, 43*(3), 685-704.

Whitmire, E. (2004). The relationship between undergraduates' epistemological beliefs, reflective judgment, and their information-seeking behavior. *Information Processing & Management, 40*(1), 97–111.

Whitworth, B., Bañuls, V., Sylla, C., & Mahinda, E. (2007). Expanding the Criteria for Evaluating Socio-Technical Software. *Proc of IEEE - SMC '07, 29 Aug 2007.*

Wildemuth, B. M. (2002). Effective methods for studying information seeking and use. *Journal of the American Society for Information Science & Technology, 53*(14), 1218.

Williamson, K. (2006). Research in Constructivist Frameworks Using Ethnographic Techniques. *Library Trends, 55*(1), 83-101.

Wikipedia: The Free Encyclopedia, Most Visited Websites. http://en.wikipedia.org/wiki/Most_visited_websites

Wilson, T. D. (1981a). On user studies and information needs. *Journal of Documentation, 37*(1), pp.3-15.

Wilson, T. D. (1981b). A case study in qualitative research? *Social Science Information Studies, 1*, pp.241-146.

Wilson, T. D. (1984). The cognitive approach to information-seeking behaviour and information use. *Available from: http://informationr.net/tdw/publ/papers/cogapp84.html*.

Wilson, T. D. (1994). Information needs and uses: fifty years of progress? In B. C. Vickery (Ed.), Fifty years of information progress, a Journal of Documentation review, London, Aslib, pp. 15-51.

Wilson, T. D. (1997). Information behavior: An interdisciplinary approach. *Information Processing and Management, 33*(4), pp.551-572.

Wilson, T. (1999). Exploring models of information behaviour: the 'uncertainty' project. *Information Processing & Management, 35*(6), 839-849.

Wilson, T. D. (1999a). Models in information behaviour research. *Journal of Documentation*, *55*(3), pp.249-270.

Wilson, T. D. (2000). Human Information Behavior. *Informing Science*, *3*(2), pp.49-56.

Wilson, T. D. (2003). Philosophical foundations and research relevance: issues for information research. *Journal of Information Science, 29*(6), 445-452.

Wirth, W., Böcking, T., Karnowski, V., & von Pape, T. (2007). Heuristic and Systematic Use of Search Engines *Journal of Computer-Mediated Communication, 12*(3), 778-800.

Wood, A. (2000). Hume: The Problem of Induction. Stanford University. August 31, 2002. URL: http://www.stanford.edu/~allenw/Phil102/Hume - Induction.doc

Workman, M. (2004). Performance and perceived effectiveness in computer-based and computer-aided education: do cognitive styles make a difference? *Computers in Human Behaviour, 20*(4), 517–534.

Worsley, Peter (1970) Introducing Sociology. *Peter Worsley (Ed.), Harmondsworth, Penguin.* 112

Wu, J.-H., Chen, Y.-C., & Lin, L.-M. (2007). Empirical evaluation of the revised end user computing acceptance model. *Computers in Human Behavior, 23*(1), 162-174.

Wu, M., Fuller, M., & Wilkinson, R. (2001). Using clustering and classification approaches in interactive retrieval. *Information Processing & Management, 37*(3), 459-484.

Xu, Y., & Liu, C. (2007). The dynamics of interactive information retrieval, Part II: An empirical study from the activity theory perspective. *Journal of the American Society for Information Science and Technology, 58*(7), 987-998.

Yee, P. L., Hsieh-Yee, I., Pierce, G. R., Grome, R., & Schantz, L. (2004). Self-evaluative intrusive thoughts impede successful searching on the Internet. *Computers in Human Behaviour, 20*(1), 85-101.

Yi, M. Y., Jackson, J. D., Park, J. S., & Probst, J. C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & Management, 43*(3), 350-363.

Yi, Y. (1990). A Critical Review of Consumer Satisfaction. in V. A. Zeithmal (Ed.), Review of Marketing (4), American Marketing Association, Chicago, IL, 68-123.

Yin, R. K. (1981). The case study as a serious research strategy. *Knowledge: Creation, Diffusion, Utilization, 3*(1), 97-114.

Yin, R.K. (1984) Case Study Research. Design and Methods. *Sage, Newbury Park.*

Yin, R. (1994). Case study research: Design and methods (2nd ed.). *Beverly Hills, CA: Sage Publishing*.

Zach, L. (2006). Using a Multiple-Case Studies Design to Investigate the Information-Seeking Behaviour of Arts Administrators. *Library Trends, 55*(1), 4-21.

Zeist, R. H. J., & Hendriks, P. R. H. (1996). Specifying software quality with the extended ISO model. *Software Quality Management IV - – Improving Quality,* pp.145-160.

Zhang, P., & von Dran, G. M. (2000). Satisfiers and Dissatisfiers: A Two-Factor Model for Website Design and Evaluation. *Journal of the American Society for Information Science & Technology, 51*(14), 1253–1268.

Zhang, P., & von Dran, G. (2001). Expectations and Rankings of Website Quality Features: Results of Two Studies on User Perceptions. *Proceedings of the Hawaii International Conference on Systems Science (HICSS 34), Hawaii, January 2001*.

Zhang, X. (2002). Collaborative Relevance Judgment: A Group Consensus Method for Evaluating User Search Performance. *Journal of the American Society for Information Science & Technology, 53*(3), 220–231.

Zhang, P., & Li, N. (2004). An assessment of human–computer interaction research in management information systems: topics and methods. *Computers in Human Behaviour*, *20*(1), 125–147.

Zhu, X., & Gauch, S. (2000). Incorporating quality metrics in centralized/distributed information retrieval on the World Wide Web. *Proc. 23rd annual International*

ACM SIGIR Conference on Research and Development in Informaion Retrieval, Athens, Greece, 288-295.