How does website design in the e-banking sector affect consumer attitudes and behaviour?

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Abstract

This thesis researches the interface between ebanks and their customers. An industry traditionally based upon personal contact, the rise of ebanking has changed this relationship such that transactions are now mainly conducted via website interfaces. The resultant loss of personal contact between bank and customer has removed many of the cues available to customers upon which judgments of service, reliability and trust were made. The question raised by this change is: what factors influence consumer choice when viewing bank websites? The arguments of this thesis are that user evaluation of websites and their willingness to use those websites is based not only on user centred factors such as motivation, experience and knowledge but also upon their appraisal of website structure and content.

A series of studies was conducted to examine user factors and webpage design and content factors that may affect user evaluations of ebank portal webpages and their willingness to use those ebanks. The experimental studies all used the same methodologies of eye-tracking to determine webpage viewing strategies and questionnaires to examine participant evaluation ratings and willingness to use displayed webpages. The first study examined ebank webpage layout by surveying 100 UK financial websites. The results of this survey were used to create accurate representative of e-bank webpages for the later studies.

Study 2 was designed to investigate the effect of user familiarity with banks and conventionality of webpage layout upon user evaluation of ebank home pages. A sample of 73 participants was tested and the results showed that user familiarity with a bank was a strong determinant of their evaluation rating and willingness to use it. Conventionality of layout had no effect upon webpage evaluation but was found to have an effect upon webpage viewing strategy. Study 3 examined conventionality of webpage layout and user involvement. The results from a sample of 100 participants again found no effect of webpage layout upon participant webpage evaluation or webpage viewing strategy. High user involvement lowered webpage evaluation ratings but had no effect upon recall of webpage information.

Study 3 examined the role of ebank website graphics by surveying 1300 worldwide ebank websites. The findings enabled a simple categorization of websites graphics and showed their usage was worldwide and extensive. On the basis of this survey, study 4 examined user involvement and textual and graphics modes of information presentation. The results from 72 participants found no differences in viewing strategies between high and low involvement groups or graphics or textual information presentation mode groups. Similarly no differences were found in webpage evaluations or willingness to use the websites between the involvement level groups or the information presentation mode groups.

The final study investigated the effect of the presence of webpage security indicators and different levels of user involvement. A sample of 100 participants was tested whose results showed no differences in viewing strategies between either high and low involvement groups or security indicator present or absent groups. Similarly no differences in evaluation or willingness to use the displayed webpages were found between the test groups.

On the basis of these results and the literature review this thesis provides a series of recommendations for website designers which will enable them to attract higher user ratings and increase user willingness to use those websites

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Preface

This thesis marks my return to the field of psychology after a break of 30 years spent designing and programming large computer systems in the Civil Service. A substantial part of this time was occupied undertaking technical computing and system design courses the culmination of which was a Diploma in Computer Studies and professional membership of the British Computer Society. During the latter part of this period I began to regret not finishing my PhD studies started 30 years ago. Fortunately the opportunity re-presented itself when I took early retirement from the Civil Service. Following a year at Sunderland University where I took a PGCE in ICT Education I decided to take the plunge and enquire about the possibility of restarting my PhD studies anew. A discussion with Prof Pam Briggs relieved any fears I had about being 30 years out of date and I started my long, and occasionally interrupted, studies at Northumbria University and after seven years have reached the point of submitting my thesis.

During the course of these studies I have received a considerable amount of help from a variety of sources. Firstly I would like to thank my wife Lesley for her unstinting support and tolerance in the face of my moods and dark periods. Secondly, I would like to thank my two supervisors, Dr. Chris Dracup and Prof. Pam Briggs for their advice and support. Prof Pam Briggs provided me not only with her excellent advice but also supported me during my periods of self-doubt and depression.

Finally I would like to thank the technical support that I received: Mike Caine for his help with the eye-tracking equipment, Philip Johnson and Rob Steele for other technical and computer issues and Rob Steel for his programming help.

Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work.

Name: Philip Raymond Walker

Signature:

Date

CHAPTER 1

The E-banking Context

This chapter examines the growth of Electronic Commerce (ecommerce) and Online Banking (ebanking). They are considered against a background of developing digital technology and the introduction of mobile technologies. Future developments in ebanking are suggested and some of the problems which affect this area are identified. It reviews information drawn from multiple areas of theory and research relevant to ebanking. The problem of customer resistance is examined and its precursors of website credibility and consumer trust discussed.

1.1 Growth of E-commerce

The introduction of the internet infrastructure and World Wide Web (WWW) has caused significant changes to the way business and commerce is conducted. This is manifested not only by changes to the way many business functions are carried out but also by the development of e-commerce (electronic commerce) which Zwass (1994) defines as the "conducting of business transactions by means of internet based technology". This new commercial medium has enabled what Baldock (1997) terms "virtualization" describing transactions which obviate the need for a physical contact and so are not limited by geographical location, time or the requirement for personal presence. In addition to its novelty and convenience attractions, e-commerce offers a range of other benefits for both business and customer. Poon & Swatman (1999) categorized the advantages of e-commerce into direct, quantifiable benefits and indirect benefits. Their direct benefits include the widening of their customer base, worldwide access to markets as well as providing businesses with instant contact with suppliers and customers, immediate fund transfers and the opportunity for cost savings. Their indirect benefits are less quantifiable but no less important covering customer goodwill

and reputation. For customers, it offers up to date information, round the clock availability, variety, anonymity, price savings and instant satisfaction.

1.2 Development of Ebanking

Businesses in the retail and financial sectors were quick to identify the benefits of a presence on the WWW. Prominent amongst these were retail banks whose traditional banking methods were largely paper based and usually required customer attendance at banks to conduct transactions. It required advances in digital technology and the introduction of passwords, personal identity numbers (PINs) and other security measures to enable financial transactions that could be carried out remotely.

The origin of personal ebanking (sometimes called virtual banking) was based around the introduction of the personal computer and its subsequent networking. Although networks had been in use since the 1960's they were limited in scope and were almost exclusively used by Governments, large industrial concerns and academic groups. As personal computers became widely available in the 1980's they were primarily used as stand-alone machines. It wasn't until a publicly accessible networking infrastructure was set up in the 1980's that a generally accessible internet permitted the implementation of a completely online banking system. This was the first system that allowed for a truly remote banking service with the ability to complete the full range of transactions without requiring either personal contact with banking staff or attendance at banks. It also provided for an expansion to the online facilities offered by banks. These now extend beyond those traditionally offered by local banks and include additional financial products such as the full range of insurance and travel products, ticket sales, share dealing, pensions and legal services.

Recent growth in ebanking has centred on mobile computing devices. Use of these devices enables customers conduct their business on the move obviating the need for

the use of remote standalone computers. The new mobile technology enables bank customers conduct business from any location subject only to presence of a WI-FI or mobile phone connections and appropriate security measures.

Personal banking > Internet Banking > Mobile Banking >

Mobile Banking Application

Once you've registered for Limit Alerts and/or High and Low Balance Alerts you can download the Mobile Banking Application to your phone.

- See your up-to-date account balance.
- Transfer money between your eligible* Lloyds TSB accounts.
- See your last 6 transactions to keep track of your spending.
- Top-up up to 5 prepay mobiles straight from your current account, so you (or your family and friends) never run out of credit.

Mobile Banking demo Frequently Asked questions

Fig. 1 – Lloyds-TSB Mobile Banking Advertisement

Fig. 1 above is an advertisement on the Lloyds TSB website advertising their mobile banking service together with a very brief summary of facilities offered. A further section on this webpage directs customer to a hierarchical series of animations detailing the use and further details of facilities. (URL's in reference section). However the vast majority of ebanking transactions are carried out over the internet. According to the UK payments Administration (2010) in the 12 years since online banking started it usage has grown to 22 million adult users in the UK which represents over 50% of all internet users. This figure continues to grow and is mirrored in all other countries with growth figures even higher in the developing countries.

Ebanking offers banks the opportunity to reach out to both existing and prospective customers and provide them not only with information about the services they provide available but also to offer them the 24/7 banking all year around (Aladwani, 2001). Many of these benefits including convenience and functionality are also described by Johnson et al (1995). The majority of bank customers see the benefits of ebanking and from the mid 1990's it expanded rapidly. This expansion has been exceptional with a growth rate in the US of 27% for 2005 (Ensor et al, 2007) with a further predicted growth of 55% by 2011. A consequence of this growth is the creation of internet only banks that operate without a branch networks. Introduced in the late 1990's, dealings are carried out primarily by internet and phone; necessary paper transactions are conducted through fax, postal or courier services.

1.3 The future of Ebanking

Predicting future trends for ebanking is difficult. This depends on many of the factors previously highlighted, including the national, social, legal and advancing technology issues. Improved education and increasing computer experience and sophistication will serve to increase internet usage and access to ebanking amongst the general populace. Improved online security will lead to closer integration between internet and the bank's internal applications. Amongst technological changes predicted are Web 2.0 changes involving new web design innovation leading to increased human and machine interactivity, better social interaction and collaboration and improved sharing and access to information. The Pew Internet and American Life Project Report on the internet (2008) forecast several changes to the future internet and its usage. Amongst these are increased transparency for users, increased information availability, greater use of mobile devices for access and greater integration between digital channels including the internet, digital TV, satellite links and other human and technological

systems. IBM describes the next generation internet banking system as “people oriented”.

Web 2.0 Internet Banking

> The next generation of Internet banking based on Web 2.0 fully exhibits the idea of "people-orientation". For different customers, different personalized Internet banking transaction and marketing platforms are displayed. Customers can freely customize the information and financial services that interest them. According to a customer's personalized Internet banking layout, banks can know clearly the potential demands to achieve cross-channel selling and realize target marketing and customer-oriented marketing. Figure 2 shows the next-generation Internet banking based on Web 2.0:

Fig. 2 IBM vision of Web 2.0 internet banking

See http://www.ibm.com/developerworks/web/library/wa-banking/

Fig. 2 above illustrates IBM’s vision of the impact Web 2.0 changes will have upon ebanking. As far as the banking customer is concerned he will have considerable scope in configuring his interface with the bank. The controls will be more intuitive and he will be to run several bank sessions concurrently whilst bringing other software interfaces on the screen at the same time. Below (Fig. 3) is shown a mocked up ebanking interface produced by IBM:

Fig. 3 Mocked up copy of Web 2.0 Internet bank Interface

See http://www.ibm.com/developerworks/web/library/wa-banking/

Daniel (1999) foresaw additional changes to ebanking with possible deregulation and the provision of ebanking by software and telephone companies. This provision of ebanking by non-banking organizations is already taking place with supermarket chains already offering these services. The profit benefits of this are likely to attract similar large organizations to offer similar services. This type of market expansion is likely to have knock-on effects including increased competition, improved service and pressure to ensure consumer loyalty.

Despite these technological advances it is likely that demographic changes will predominate and have a greater impact on online bank usage. The online shopping report by the Pew Internet and American Life Project Report (2008) points out that majority of online bank users are adults over the age of 30. This is predicted to change with younger users in the 18 to 30 years range beginning to predominate as today's children progress to opening bank accounts. Similarly, most ebanking is conducted amongst developed western and oriental nations. This will change as both international and local banks compete in less developed countries to establish ebanking facilities in those areas. This can be seen by changes in the former soviet satellite countries where

both the number and influence of online banks is growing rapidly alongside their developing economies.

1.4 Problems with Inline Technologies

Cultural difficulties were investigated by Rotchanakitumnuai & Speece (2003) who highlighted the lack of personal contact in online transactions. They pointed to Asian cultures where personal relationships are highly valued and that this, together with the transaction context, is often of critical importance in ensuring the successful completion of financial deals. Similar cultural effects for e-commerce were found by Doney et al (1998), Park & Jun (2003), So & Speece (2000), Harris, Van Hoye and Lievens (2003) and Markus & Soh (2003).

The effect of national and political differences were investigated by Storrosten (1998) and Farhoomand, Tuunainen and Yee (2000). They point to differing Government attitudes to internet usage which in turn give rise to disparate approaches to legal and regulatory control. This is particularly true when vested interests lobby for the enactment of particular legislation. Pressure from the Recording Industry Association of America (RIAA) and the imposition of digital rights legislation is a case in point. It is also true that some governments dislike online transactions because of their inability to maintain control over information availability and financial manipulations. Conversely, other Governments exercise little supervision or control over their internet financial institutions often resulting in financial collapses, misappropriation, fraud and other criminal conduct which serve to undermine public confidence. Other national barriers to e-commerce occur because of differing levels of internet availability, public levels of educational attainment and personal levels of computer sophistication.

Problems also arise from the interfaces through which transactions are conducted. These interfaces between customer and bank have the same basic structure – a screen

for reading the details and a keyboard, keypad or touch-screen for inputting information and selecting screen options. These interfaces make several assumptions concerning the user and operation being undertaken and transaction failures may arise as a result of them. Firstly, it is taken for granted that the user understands and is able to use the equipment by which the bank website is being accessed. Secondly, it assumes that the information required by the customer is either displayed on screen or can be accessed by interacting with options on the screen. Thirdly it is presumed that the user is prepared to use the technology in order to conduct the transaction. Finally, it is assumed that the transaction can be safely completed and will not be jeopardized by hardware and software breakdowns or by malicious interferences.

A more recent hurdle for online banks has been the Disability and Discrimination legislation requiring banks to ensure their services are equally accessible to disabled customers. Many banks have adopted Codes of Practice to address these issues but the nature of their disabilities means some customers are unable to use online services. However, such legal barriers are being overcome by International agreements and the passing of laws such as the US Uniform Electronic Signatures – Removing Barriers to e-commerce Act.

The most pressing problem for banks is online fraud. The APWG survey for the quarter 3 of 2009 identifies the financial services industry as being the most targeted online business (54% of attacks). This survey also highlighted the fact that of 23 million computers scanned, over 48% were infected with malware of which 16% are infected with specific banking Trojan and password software.

The introduction of new technology into the banking system was not seamless. Even though the introduction of ebanking was carried out concurrently with a contraction of the bank branch organization, traditional banking methods were still used, not least

because of resistance to the introduction of new methods from many customers. Various causes for this resistance have been reported; perceived risk, attitude to technology and the possibility of transaction errors (Laukkanen et al, nd; Kuisma et al, 2007); household income, customer age, education (Mattila Harjaluoto & Pento, 2003); perceived risk, gender and computer and technological skills (Akinchi Aksoy & Atilgan, 2004; Laforet & Li, 2005); lack of awareness and security concerns (Sathye, 1999); gender, cost and difficulties in understanding its use (Katz & Aspden, 1997), perceived usefulness and perceived control (Jaruwachirathanakul & Fink, 2005), risk to personal data (Hoffman et al, 1999). However, the reason most cited in research is that of customer's perceived risk, a lack of trust of online transactions and website credibility issues (Bauer & Hein, 2006; Kim & Prabhakar, 2000; Rotchanakitumnuai & Speece, 2003; Sathey, 1999; Tan & Teo, 2000; Yiu Grant & Edgar, 2007). Universal usage of ebanking depends on the resolution of many of these outstanding issues not least being the perceived risk, trust and credibility problems.

Risk, trust and credibility are three of the areas of concern highlighted in the social category of problems identified by Bingi, Mir and Kharmala (2000) that adversely affect the growth of e-commerce. Customer perceptions of these issues, together with the unfavorable publicity they attract, undermine customer confidence and are perceived as potential hazards to the adoption of online banking. Resolving these adverse customer perceptions remains an ongoing challenge for all the parties involved which include banks, customers, hardware/software suppliers, banking organizations, regulatory authorities and the Government. Regulatory control is not the complete answer to these problems as evidenced by the recent bank problems which occurred despite banks being one of the most closely regulated industries. Hardware and software suppliers will only supply products that their customers (the banks and their

customers) are prepared to pay for. Therefore, ameliorating the trust, credibility and risk problems lies with the banks and customers. As these problems are customer centred their solution must rest initially with the banks. What is required is an investigation of how customers view ebank websites, which elements within those websites serve to engender perceptions of riskiness, which promote perceptions of credibility and how these perceptions subsequently create customer trust. Accordingly, it is these problems that will be examined in this dissertation which will look at the role of ebank websites in influencing customer perceptions of risk, credibility and trust.

1.5 Aims of Thesis

Barriers to the universal market acceptance of ebanking continue to adversely affect customer take up these facilities. The challenge for banks wishing to achieve wider market acceptance is to identify the nature and origins of these barriers and to seek their removal or diminish their effects. Of these barriers, one of the more significant is customer resistance (Yousafzai et al, 2003). This has its origin in factors both intrinsic to the customer as well as to external environmental influences. Unfortunately for the banks some of these influences are beyond their control. However previous research has highlighted customer concerns over perceived risk, credibility, security and privacy as being significant precursors for customer resistance. Accordingly, banks have the opportunity to address these issues by creating a transaction environment where credibility is established and customer trust is created. The aim of this thesis is to investigate factors influencing customer perception of online banking. This will be accomplished by the study of the role of ebank website structure and contents, together with the subjective factors of familiarity and involvement, in the formation of website credibility. Specifically the thesis describes how these factors impact customer decision making and trust assessments. With this aim in sight the specific objectives are to:

- Determine whether users adopt regular webpage scanning strategies;
- Identify which webpage elements attract user attention;
- Map how users read website contents;
- Understand the role of webpage graphics;
- Understand the effect of mode of information presentation on decision making;
- Identify the factors influencing user selection of bank websites to use;
- Differentiate between decision mechanisms used by users;
- Understand the role of webpage characteristics in user decision making;
- Demonstrate the role of user involvement in decision making;
- Utilize the results to understand which webpage layout and elements optimize credibility and trust assessments.

1.6 Methodology

A dual methodology was used in most studies described in this thesis. This allowed for examination of both user viewing strategies and viewer assessment of webpage contents. Eyetracking techniques were used to investigate how users viewed banking webpages and to provide insight into the cognitive processes underlying user decision making processes. The tracking information gained included webpage scanpaths; user fixations, user areas of interest, orders of viewing of webpage elements, text reading strategies and pupillary diameters.

To support the eyetracking data, questionnaires were administered to confirm that all participants had the same internet experience and objectives and to determine the webpage characteristics they used in webpage assessment; assess the effects of different information presentation modes on rating of webpage contents and to determine how participants prioritize the screen information viewed.

CHAPTER 2

Determinants of Trust and Decision Making

This chapter examines the determinants of consumer trust and website credibility together with an overview of previous trust and credibility research. The Prominence-Interpretation theory is introduced and linked to the cognitive processes in the dual process theories of attitude formation through the role of user involvement.

2.0 Introduction

It has been recognized from the early days of the World Wide Web (WWW) that online transactions, particularly those involving finance or sensitive information, involve risks unique to the online environment. According to Cheskins (2000):

> "a sense of anarchy permeates attitudes about the web".

The nature of these risks vary dependent upon factors both intrinsic to the trustor (consumer) and extrinsic to them encompassing the trustee (retailer), online environment and factors derived from the legal, religious, cultural and political contexts. A consequence of this risk is that online consumers need to exhibit greater trust conducting business online than when carrying out such transactions using traditional methods (Komiak & Benbaset, 2004; Grabner-Krauter & Kaluscha, 2003). Considerable research has been conducted from varying theoretical standpoints to determine the nature of trust and its precursors. The result, according to Papadopoulou et al (2001), is the finding that "trust is highly complex, multi-dimensional and context specific".

2.1 Online Trust

2.1.1 What is Trust?

The question "What is trust?" is one that has been posed in many trust research papers. Several cite the Oxford English Dictionary (OED) definition as a basis for their discussions (Araujo & Araujo, 2003; Grandison & Sloman, 2000; Wang & Emurian, 2005). However, definitions given in the OED are not constant and vary between reprints (Oxford English Dictionary, 1971; The Concise Oxford English Dictionary, 1964). Other dictionaries also give different definitions (Merriam-Websters Collergiate, 2003; The Chambers Dictionary,) whilst the Collins Dictionary & Thesaurus (2000) provides both general and fiduciary definitions. For many researchers the definition of trust is determined by the context and experimental paradigm being considered. Consequently, as acknowledged by Grabner-Krauter & Kaluscha (2003), Grandison & Sloman (2000) and Bhattacharya et al (1998), there is only limited agreement between researchers which has resulted in numerous trust definitions with different characteristics and precursors.

Where there is agreement is that trust is only required where there is an element of risk (Eggar ,2001; Furnell et al, 2007; Mayer et al, 1995), uncertainty (Abdul-Rahman & Hailes, 1997; Bauer & Hein, 2006) and consumer vulnerability (Wang & Emurian, 2004); the degree of trust being contingent upon the degree of risk (Koller, 1988; Yousafzai et al, 2003. Suh and Han, 2002) define trust in terms of its characteristics of ability, benevolence and integrity. Shankar et al (2002) when explaining business perception of trust describe it as a complex construct mediating between consumer and website incorporating dimensions of credibility, reliability, emotional comfort, privacy and quality; Grabner-Krauter & Kaluscha (2003) describe the definition by Luhmann (1989) who calls it a mechanism to reduce the complexity of human behaviour in uncertain situations; Eggar (2001) describes trust as "a type of belief superior to faith

and inferior to confidence". Other trust definitions have been produced by Abdul-Rahman & Hailes (1997), Araujo & Araujo (2003), Boon & Holmes (1991); Currell & Judge (1995); Gambetta (2000); Doney & Cannon (1997); Grandison & Sloman (2002); Jones et al (2000); Kini & Choobineh (1998).

This situation is clouded further by the description of different types and dimensions of trust: cognitive trust and emotional trust (Komiak & Benbasat, 2004); disposition to trust, situation-based trust, trusting belief, and trusting intention (McKnight & Chervany, 2002; McKnight, Cummings & Chervany, 1998); initial trust and subsequent experiential trust (Eggar, 2001); trust viewed as an individual characteristic, the characteristic of an interpersonal transaction or an institutional phenomenon (Battacharya et al (1998) description of the suggestion by Lewicki and Bunker (1995)); calculus based trust, knowledge based trust and identification based trust (Lewicki and Bunker, 1996); online and offline trust (Shankar Sultan Urban, 2002). Further detailed discussions of trust and its various definitions are given by Wang & Emurian (2004) and Reigelsberger et al (2003). This variability in trust definitions and types support the conclusion of Papadopoulou et al (2001) who describe trust as "highly complex, multi-dimensional and context specific".

2.1.2 Online Trust Determinants

Shankar Sultan & Urban (2002) describe online trust from differing perspectives. Their stakeholder analysis views trust building from the perspective of the relevant stakeholders. This includes consumers, employees, partners, distributors, suppliers, stockholders and regulators with economic efficiency being the primary issue. A problem with this approach is individual trust factors operating for each stakeholder may have differing priorities and so be in conflict with each other. Similarly, individual trust building factors are not identified and it is difficult to predict how such varying

views may impact the trust building process. Shankar et al (2002) conclude that the identification of trust building processes requires the perspective of multiple stakeholders and they suggest a broader model based on previous research. The input side of this trust model categorizes the determinants of trust into 3 categories: website characteristics; user characteristics; and online characteristics. Each category contains a number of related factors based around trustor (consumer) perceptions, predispositions, experience and knowledge. Three additional categories appear on the output side comprising intent to act: satisfaction and loyalty and firm performance. These categories contain information about firm (trustee) trading details (prices, profitability), website performance (ease of use, privacy, security) and responsiveness together with consumer attitudes, satisfaction ratings and willingness to trade. Unfortunately, other additional trust determinants, both trustor and trustee related, are missing from their list; the most prominent of these being social, political, cultural, religious and regulatory factors. Walczuch & Lundgren (2004) examined five categories of antecedents to online trust: personality based, attitude base, perception based, experienced based and knowledge based. They found that perception based factors were the main determinants of online consumer trust.

An alternative approach is suggested by examination of the online loan application process and extraction of the possible factors impacting this process. It is apparent from this that the trust building factors operating can be categorized as either consumer or environmentally related. Reigelsberger et al (2005) adopt this view and describe these categories as being contextual and actor's intrinsic properties. By way of explanation the contextual properties are identified as comprising motivation based on temporal, social and institutional embeddedness; actor's intrinsic properties as based on ability and motivation centred on internalized norms and benevolence. These properties have not been expanded to identify the individual factors operating as precursors to the

creation of these motivational states. Accordingly, Fig. 4 below gives a brief functional breakdown of two categories of trust determinants. The first intrinsic category is for consumer related factors (Reigelsberger's actor's category); the second extrinsic category for the entity being trusted and environmental and contextual factors (Reigelsberger's contextual category). Factors in the intrinsic category can be further broken down into three groups whilst that for the extrinsic category contains five groups (this is in contrast to the 6 group models proposed by Shankar et al, 2002). For intrinsic factors the categories are consumer knowledge, consumer motivation and consumer perceptions, each containing several broad factors. For the extrinsic category the groups are website design, website functionality, website owner knowledge, online environment and social factors.

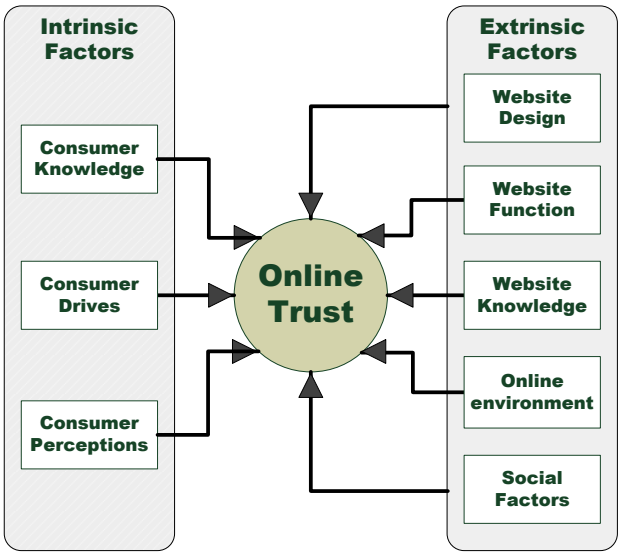

Fig. 4 – Online Trust Determinants

Tables 1 and 2 below provide details of the individual elements contained within each of the intrinsic and extrinsic categories. Appendices 1 and 2 takes this breakdown one stage further identifying the individual trust building antecedents to the elements identified within tables 1 and 2.

Table 1 – Intrinsic Trust Determinants

Intrinsic Factors		
Consumer knowledge	**Consumer Drives**	**Consumer Perceptions**
Computer sophistication and knowledge	*Motivation of consumer*	*Perceived risk/uncertainty*
Experience of online transactions	*Willingness to accept risk*	*Perceived value of benefits*
Knowledge of trustees	*Consumer need*	*Perceived trustworthiness*
	Consumer attitude	*Perceived Usability*
	Consumer expectations	*Perceived Security and privacy*
	Consumer Mood	*Perceived quality and appeal*

Table 2 – Extrinsic Trust Determinants

Extrinsic factors				
Website Design	**Website Function**	**Website Knowledge**	**Social Factors**	**Online Environment**
Aesthetics	*Usability*	*Internet Presence*	*Legal/Regulatory Control*	*Reliable equipment*
Professionalism	*Security*	*Reputation*	*Transaction context*	*Reliable software*
		Familiarity	*Cultural context*	*Reliable connection*
			Political context	*Secure connection*
			Religious context	

The effect of the antecedents identified in appendices 1 and 2 and the personal weighting given to each, in terms of their trust building effect, varies dependent upon the technology considerations, transaction context, the personal experience and motivational state of the consumer and their perception of the various aspects and characteristics of website content.

The described determinants can all be assigned to the intrinsic and extrinsic categories described earlier; although for some this is more difficult than for others. The main problem is their nature which often renders them difficult to define and delimit or to assess the strength of their trust building effect. Two examples are technical trustworthiness and professionalism of design. Technical trustworthiness can be both an absolute attribute of a website based upon the implementation of trustee website security measures such as passwords and encryption; an assessment of the reliability and security of the website and online infrastructure e.g. links to other secure sites and reliability in connections; a perception of the consumer based upon other website attributes such as security seals, policy statements and regulatory control information. Similarly, professionalism in design may be intuitively apparent to a consumer viewing a website. However, what is a professional design to one consumer may be judged differently by another who bases their assessment on different website characteristics or attributes. In such circumstances individual differences prevail and choices are based on personal preferences, aesthetics, transaction outcome or alternative heuristics. Despite these difficulties the role of such factors in the creation and maintenance of trust needs to be recognized and their effects accounted for in website design.

Examination of the categories of determinants shows that many are dependent upon website contents or consumer perception of those contents. Within the list of intrinsic determinants, all those within the consumer perceptions group are directly attributable to website structure and content. Within the extrinsic determinants category all those in the website design, function and knowledge groups, and to a lesser extent those in the social factors group, are also directly attributable to website structure and content. An inference that may be drawn therefore is that the structure, design and implementation of websites significantly impact the creation of user trust.

2.2 Website Credibility

2.2.1 What is Credibility?

E-banking is probably unique amongst online businesses in the high degree of trust that is required by its customers. The nature of their business requires e-banks to store and process sensitive private, commercial and financial data; they are entrusted with customer cash and valuables and must also be seen to provide information that is accurate, understandable and up to date. Above all they must be seen to have integrity and to be fair and honest in their dealings. Consequently it is crucial that e-banks establish relations with their customers that engender and maintain this customer trust. Cheskins-Sapient (2000) also point out that customer trust is also essential in the promotion of their branding for the purpose of attracting new custom.

The previous section 2.1.2 identified many precursors and determinant to online trust and highlighted the conclusion that many are dependent upon consumer perceptions. With this in mind it was also noted that one of the more commonly stated trust determinants in the survey of trust research is that of trustworthiness. Unfortunately trustworthiness, either as a consumer perception or third party opinion, is a rather vague concept which raises questions about its characteristics and antecedents. In terms of the creation of consumer trust, what is it about websites that conveys trustworthiness to consumers and establishes credibility?

If we look at trustworthiness in traditional transactions, Chadwick (2001) describes such transactions as a series of economic and functional messages. These messages describe the processes of attracting consumers to business premises; promoting positive purchasing decisions; making the sale; confirming warranty and follow up service terms and establishing a relationship for future dealings. Each of these stages provides opportunities for building customer perceptions of trustworthiness. Transferring this

scenario to the online environment, parts of this process also take place in e-commerce transactions. However, online communications are restricted to those allowed by the online dialogues without the ability to clarify, question or extend them. Online transactions also lack the advantages of co-locating the consumer and trader where physical presence supports trust building by providing a wealth of additional social and visual information (Chadwick, 2001; Reigelsberger, 2003; Reigeslseberger & Sasse, 2002; Reigelsberger et al, 2003; Siau & Shen, 2003). Such information enables the use of social cues between participants. This allows for discourse and involvement with the trader in the decision making process and promotes the development of personal relationships, dialogues and intimacy which are lacking with online transactions. Without these advantages, customers need to seek alternatives in determining trustworthiness and researchers and web site designers need to identify those website attributes and characteristics that convey trustworthiness to customers.

What is trustworthiness and what are its effects? Gefen (2002) describes it as that part of the multidimensional construct that is trust which describes a set of beliefs that influence behavioural intentions. In his view, trustworthiness comprises three dimensions of integrity, benevolence and ability. Ganesan (1994) combines two of these attributes (ability and integrity) to describe credibility. Fogg and Tseng (1999) adopt the view that trustworthiness is a key component of credibility and that credibility is a perceived multi-dimensional concept. In contrast Corritore et al (2003) assert that credibility is a cue for trustworthiness. In their study of online credibility, Stanford et al (2002) use trustworthiness alongside expertise as being the two dimensions of credibility and individuals combine their assessments of these two dimensions to arrive at a credibility perception. The terms they use when referring to trustworthiness are goodness and morality which are described as indicating benevolence, lack of bias or truthfulness. The term used for expertise is perceived

knowledge of the source described indicating superior knowledge, positive reputation or competence. Following from Fogg and Tseng (1999) they also define credibility as corresponding to believability and highlight the point that trust and credibility are distinct but related concepts. Burgoon et al (2000) describe credibility as being a "constellation of judgments related to perceived competence, character, composure, dynamism, and sociability". In their review of the determinants of internet banking Wang et al (2003) point out that the Technology Acceptance Model (TAM) constructs of "perceived ease of use" and "perceived usefulness" should be extended by the addition of a further construct "perceived credibility"; its function being to reflect the security and privacy concerns of consumers in the adoption of internet banking.

For the purposes of this dissertation the views of Standford et al (2002), Fogg and Tseng (1999) and the Collins Dictionary and Thesaurus (2000) will be used where credibility is regarded as being equivalent to believability and comprises the two components of trustworthiness and expertise. Since researchers accept the close relationship between credibility and trustworthiness it can be reasonably argued that credibility is dependent upon trustworthiness and that creating credible websites requires the incorporation of cues for trustworthiness.

2.2.2 Creating Website Credibility

Robins & Holmes (2003) point out that for many organizations their website provides the first impression for potential customers and that their opinions are often made during the first few seconds of exposure. For organizations that trade solely over the internet, their website provides the sole means by which they represent themselves to their potential consumers. Creating credible websites and establishing trustworthiness are of the utmost importance in ensuring their trading success. To achieve this requires the identification of credibility determinants and their incorporation into websites.

Fogg and Tseng (1999) and Stanford et al (2002) describe credibility as a solely perceived quality of websites rather than one of their objective qualities; the inference being that credibility is created solely by visual cues from websites. Previous research on website credibility has proposed a wide range of credibility enhancing factors and a survey of this provides the list credibility enhancing factors shown in Appendix 3. It might be expected, bearing in mind the close relationship between trust and credibility, that many factors would be common to both trust and credibility. The survey findings found several common factors (e.g. perceived trustworthiness, professionalism, perceived security). However, differences were found in that the majority of credibility determining factors derived directly from website design and content or user perceptions of them. This observation has to be qualified concerning user assessments of credibility. Although based on website structure and contents, many are influenced by prior user knowledge or opinions of website owners, user expectations of content and their assumed utility, the origins of information displayed, seals, logos and other sources of information concerning the website and its owner.

Commonly occurring credibility determinants found by the survey include reliable information sources (Fogg & Tseng, 1999; Fox & Rainie, 2002; Fritch & Cromwell, 2001; Metzger, 2007; O'Keefe, 2002; Walthen & Burkell, 2002), professional design and aesthetics (Burgoon et al, 2000; Collins, 2006; Fox & Rainie, 2002; Kim & Moon, 1998); Metzger, 2007; Robins & Holmes, 2008) and interface properties (Cheskin Research, 2000; Fogg et al, 2001; Fogg & Tseng, 1999; Kim & Moon, 1998; Metzger, 2007;Shelat & Egger, 2000). The two most commonly stated sets of determinants were website contents and quality and user perceptions of risk, security and privacy. Much of the research surveyed concerned user credibility assessments of informational websites where one would expect that information qualities (source, currency, accuracy, relevance, completeness etc.) would be important. What is less clear is the

effect of these determining factors upon other types of websites such as retail or service websites or whether other determinants would be identified as having greater impact. Further research in this area is required to determine whether different types of determinants, the relative importance of the different types of credibility determinants and the role of user intent and prior knowledge.

For individuals and organizations wishing to create credible websites there is a wealth of research and advice available on the internet concerning website design and production (e.g. Borchers et al, 1996; Burke et al, 2005; Cheng & Patterson, 2006; Dulas et al, 2000; Hall & Hanna, 2004; Hong et al, 2004a; Mardiros, 2010; McCarthey et al, 2003; Skaalid, 1998; Toucher Website Design, 2001; Zimmerman, 1997). Unfortunately, not all of it is necessarily helpful or constructive. It should also be remembered that website designers are often constrained by organizational restrictions on many of the design elements and content of their websites. This is understandable when organizations wish to ensure that symbols of their branding (logos, graphics, animations, colour schemes, dialogues), which may be the product of expensive marketing, are clearly evident in their websites and serve to distinguish them from competitors.

2.2.3 Assessment of Website Credibility

Fogg and Tseng (1999) describe computers as facing a credibility crisis stating that should this view persist and become widespread then computers could join the list of other least credible sources such as TV infomercials and tabloid newspapers. In the previous section 2.2.2 it was indicated that credibility may be primarily created by website structure and contents. However, this was qualified by the observation that perception of these will be affected by consumer knowledge and opinions. Support for

this is described by Fogg and Tseng (1999) who describe four types of credibility described in table 3 below:

Table 3 - Fogg and Tseng's Types of Credibility

Credibility Types	
Presumed Credibility	● Extent of consumer beliefs in Something or Somebody based on prior assumptions.
Reputed Credibility	● Extent of consumer beliefs in Something or Somebody based on 3rd party opinions.
Surface Credibility	● Extent of consumer beliefs in Something or Somebody based on simple inspection.
Experienced Credibility	● Extent of consumer beliefs in Something or Somebody based on personal experience.

According to Fogg and Tseng's (1999) analysis of different credibility types, credibility assessments based solely on website structure and contents (surface credibility) alone are unlikely as all such assessments are moderated by previously held assumptions, 3rd party opinions or personal experience. The conclusion from this is that the establishment of website credibility is not usually determined solely by website attributes. Accordingly when researching the credibility effect of particular website attributes the influential effects of these personal factors need to be controlled.

2.3 Prominence Interpretation Theory

Whilst a large number of credibility determinants have been described and categorized there has been little research work concerning the impact of these determinants in varying circumstances or how they affect the credibility assessment process. Similarly there have been few models proposed describing the credibility assessment process (Chew & Kim, 1994; Herbig & Milewicz, 1996; Lafferty et al, 2002) none of which have been applied to website credibility. Fogg (2003) addressed this issue by proposing

his Prominence Interpretation (PI) theory. His theory identifies two processes underlying user assessment of website credibility: Prominence, whereby a user notices something within the webpage and Interpretation where the user makes a judgement about what has been seen. Both processes are obligatory as without either no assessment is made. The actual method of assessing website credibility is an iterative process where the consumer "notices" a webpage element and "interprets" it to create an initial credibility assessment. This process is repeated until the consumer is either satisfied with an overall assessment of website credibility or is constrained by time or other limitation. A general expression for the model is:

$$(\text{PROMINENCE} \times \text{INTERPRETATION})^{n} = \text{OVERALL CREDIBILITY IMPACT})$$

Where ^{n} represents the number of website elements noticed and interpreted

When describing the prominence process Fogg describes it as the likelihood that a particular webpage element will be noticed. The mechanism he describes, by which user involvement operates, is to increase user motivation when seeking required information. The consequence of this is to increase the amount of information crossing the cognitive "notice-not noticed" threshold thereby increasing the probability that required information from the website will be found. He ranks five categories of affecting factors in order of importance: user involvement; website content; task of the user; user experience; individual differences. The most dominant factor, user involvement, is explained as being the motivation and ability to scrutinise web content.

The interpretation process describes the consideration and judgment of what has been noticed by the user. Fogg describes four categories of factors influencing the interpretation process: user assumptions; user skill/knowledge; context; user goals. In his clarification of interpretation, the point is made that different people will interpret what they have seen in different ways and that diverse influences such as culture,

education will come into play. He also points out that the same individual may interpret the same information differently when carrying out credibility assessments in different contexts. Relating his ideas back to his earlier breakdown of credibility types Fogg (2003) relates surface credibility to the prominence process and reputed and presumed credibility to the interpretation process. Experienced or earned credibility is not applied to either stage but described as credibility assessments over time.

On initial examination the PI theory appears to be intuitively obvious and Fogg agrees with this observation. However, whilst the model of appears to provide a valid description of the credibility assessment process it has several weaknesses. Firstly his description of the contributory factors to the two processes is vague and deficient and is descriptive rather than analytical. Looking at the prominence process, his statement (Fogg, 2003) that at least five categories of factors affect the prominence process appears incomplete. Firstly, it fails to give any indication of the extent of their impact other than to rank them in order of importance with no reason given for the ranking, Secondly, he states that other factors impact prominence but gives no indication what they may be. Finally, he offers little by way of explanation to the underlying mechanisms by which their effects are mediated. Similar criticisms can also be directed at his description of the interpretation process with only brief descriptions of the probable effects of culture and user expectations. Despite this, the theory provide a basis for further research by affording an alternative means by which the determinants of credibility, described previously, may be categorized and their effects investigated.

If we consider the PI theory in terms of online banking it gives some insight into the processes by which consumers perceive and then process the information viewed. Banking websites are not usually visited by internet surfers but by consumers with specific goals in mind. The achievement of specific goals will satisfy Fogg's first two

categories of Prominence factors - user involvement and the completion of a user task. Consequently it is expected that these will raise the level of consumer motivation. Under such circumstances it would also be expected that the level of consumer concentration will be higher and greater attention paid to searching the website for required information. The attainment of specific goals also satisfies two of the factors of the Interpretation process i.e. user goals and context and will result in more detailed consideration of the information found when forming opinions concerning credibility.

2.4 User Involvement

In view of the importance assigned to user involvement by Fogg, his description of it requires some scrutiny. Although identified as a dominant factor by Fogg (2003), he simply describes it as the motivation and ability to process and makes reference to the applicability of the Elaboration-Likelihood Model of Petty and Cacioppo (1979a, 1979b) to this process. Alternative involvement definitions have been provided by; Andrews, Durvasula and Akhter, 1990; Greenwald and Leavitt, 1984; Johnson and Eagly, 1989; Petty and Cacioppo 1979(a); Santosa, Wei & Chan; 2005). These authors extend Fogg's explanation by explaining that involvement describes the degree of personal importance or relevance of a task to the individual. As such, it impacts upon the level of motivation and attention the individual gives to that task and consequently degree of cognitive effort expended.

Other researchers have differentiated between different types of involvement. Maio and Olsen (2004) describe Johnson and Eagly's model of two types of involvement: outcome relevant and value relevant involvement. Petty and Cacioppo (1979b) differentiate between high and low involvement as being the extent to which either an issue or response is of personal importance. Greenwald and Leavitt (1984) cite Krugman as identifying two levels of involvement; one high and one low which give

rise to differing levels of information processing. Greenwald and Leavitt (1984) identify four levels of involvement dependent upon levels of attention and degree of symbolic constructs required to process information. Their levels correspond to data driven and concept driven processing, and competence and capacity limitation processing. In their review of involvement constructs Andrews, Durvasula and Akhter (1990) describe involvement as being:

> *"an individual state of arousal with intensity, direction and persistence properties*".

They highlight differences between levels of involvement and draw attention to the effect on these differences resulting from related antecedents, situational factors and decision consequences. As user involvement is identified in both Fogg's (2003) PI theory and the dual process theories of attitude formation as a significant factor in perception of information and its subsequent processing, it will be regarded as a single type of involvement being the degree of personal relevance giving rise to a complementary level of motivation to seek and consider relevant information.

2.5 Dual Process Theories

Fogg's (2003) statement of the importance of user involvement in the assessment of website credibility is reflected in its stated importance in the dual process models of attitude formation. These models, Elaboration-Likelihood Model (ELM) and Heuristic-Systematic Model (HSM), identify user involvement as having a significant role in message processing and attitude formation (Chaiken, 1987; Chaiken, Liberman and Eagly, 1989; Petty & Cacioppo, 1984; Petty, Cacioppo & Schumann, 1983). Both Elaboration-Likelihood Model (Petty, 1994; Petty and Ciacoppo, 1979(a), 1979(b), 1984) and Heuristic-Systematic Model (Chaiken 1980; Eagly and Chaiken, 1993), have at their basic level, a continuum of thinking with two routes to attitude formation; each

route describing differing levels of information processing. Chaiken, Liberman and Eagly (1989) describe systematic processing as being:

> "*a comprehensive analytic orientation in which perceivers access and scrutinize all informational input for its relevance and importance to their judgment task and integrate all useful information in forming their judgments".*

Their explanation of heuristic processing describes it as:

> *"a more limited processing mode that demands much less cognitive effort and capacity than systematic processing".*

Systematic (or central - ELM) processing comprises a deeper, considerative level of processing involving greater amounts of information and requiring more cognitive effort and which uses additional factors such as prior attitudes, strength of arguments, personal motivation and source credibility. In contrast, heuristic (or peripheral – ELM) processing operates at a superficial level requiring less information. Here judgments may then be based either on the use of simple inferential rules applied to the information gathered or on peripheral cues such as information attributes (e.g. colour, size, font, sound) or other non-issue relevant cues. Differences between the ELM and HSM models are minor, one difference being the processing of mixed message types. In practice both models describe routes that are multi-process involving several sequential logical steps.

When considering message content of a webpage an individual may adopt either the "heuristic" route or a "systematic" route, or a balance of the two working concurrently at some point along the continuum of thought between the two extremes of solely systematic (central) or heuristic (peripheral) message processing. Points along this

continuum, at which message processing occurs, are determined by the user level of motivation and determine the balance of heuristic and systematic processing that occurs. Both models predict that manipulating variables such as personal relevance or level of motivation can influence whether information is processed centrally or peripherally or by combination of the two at some point along thought continuum.

Comparison between Fogg's PI theory and the dual process models reveals a common judgement process with similarities in the descriptions of cognitive processing that take place. In his description of the interpretation process Fogg identifies user assumptions, user skill/knowledge, context and user goals as factors impacting the processing and expands these to include user culture, expectations, knowledge of website topic, experiences and heuristics. Similarly, the dual process theories identify factors including user knowledge/ability, argument strength, source attributes, issue relevance, user goals as impacting the assessment of message content. The links between the PI and dual process theories appear clear. Fogg's assessment of website credibility reflects a stage in the dual process theories where the credibility of the message source is evaluated before going on to detailed consideration of message content. The PI theory does not differentiate between systematic or heuristic processing but describes a process of varying complexity dependent upon the website cues taken into account and the assumptions, competencies, experience and prior attitudes of the user. This approximates Petty and Wegener's (1999) account of the ELM which describes the processing that occurs may involve elements of both peripheral and central processing.

One area of difference that does occur between the dual process models and the PI theory is that of the role of user involvement. Fogg describes its effect solely upon the perception processes of the Prominence stage where it determines the level of detail "noticed". In contrast the dual process theories highlight its role as a motivational factor

in the consideration process. With this in mind it would appear that as far as the PI theory is concerned, user involvement impacts upon both the prominence and interpretation stages: in the prominence stage by varying the cognitive threshold by which information is "noticed" and in the interpretation stage by promoting a more detailed consideration of information "noticed".

The dual process theories have formed the basis of considerable research effort. In spite of this, criticisms have been directed towards them. Eagly and Chaiken (1993) levelled a criticism towards the ELM model similar to that levelled at the PI theory. They described it as descriptive rather than analytic concentrating on describing the mechanism of attitude change rather than providing an explanation of the underlying psychological processes. O'Keefe (2002) cites Mongeau & Stiff who made as similar observation stating that a lack of clarity allowed for a number of alternative causal models that could be drawn from the theory. Cook, Moore & Steel (2005) identify similar criticisms raised by Hamilton, Hunter and Boster and criticisms of the continuum concept by Kruglanski and Thompson. Despite these criticisms the dual process theories provide a useful framework for examining attitude change and the underlying decision making processes.

CHAPTER 3

Overview of Background Psychology

This chapter examines some of the background psychological theory relevant to the online search for information and the subsequent cognitive progression leading up to the decision making process. It examines the requirements for a visual search of ebank websites and introduces two influential models of visual search. Following is a discussion of the mechanics of locating visual targets and how the search for website information may be optimised by both website owners and visitors. The associated problems of visual screen complexity and information overload of the website visitor are examined and suggestions made for their effects to be reduced.

3 Introduction

According to the BBC report "Turning into Digital Goldfish" (2002) the addictive nature of web browsing can: "leave you with the attention span of nine seconds – the same as a goldfish". Visual search and attention comprise an integral part of the web browsing process and this report highlights one of the problems associated with this activity. Accordingly in this chapter I will introduce some psychological theories of visual search and attention and some of the underlying research and discuss them in the context of a consumer searching ebank websites for information.

The BBC report attributes poor attention to the manner in which we spend our online time, flitting from one thing to another thereby getting into a habit of not concentrating. Other reasons cited for poor attention include the rapid onset of consumer boredom and the sheer number of websites available which results in the shortening of viewings in order to visit as many as possible. The consequence of these and related issues such as fatigue and poor web design is that the average online user spends less than 60 seconds visiting the average website. To overcome or accommodate the problems ebanks either

need to communicate their message during the limited time that consumers spend viewing their website or to grab and hold consumer attention – a process described as creating "stickiness" (Davenport & Beck, 2000).

In terms of the dual process models discussed in the previous chapter what we're trying to do is to understand the processes underlying heuristic search. Bearing in mind the limited time consumers spend visiting websites, there is a temptation for consumers to resist passing the website portal webpage to view pages within the website. In order to overcome this ebanks may opt to incorporate as much information as possible into their portal webpage. However, the consequence of doing this will be to create a visually complex webpage risking both information overload for the consumer (Chen et al, 2009; Lin, 2006; Saade & Otrakji, 2007) and the likelihood that information sought by the consumer is lost in the background "clutter" (Verghese & McKee, 2004). In information theory terms the search and information overload problems are down to the limited bandwidth possessed by human operators to take in and process information. In many practical situations this bandwidth is usually exceeded and the human operator has to focus his attention to locate, perceive and assimilate the required information. Clearly, the task for ebanks is to identify and prioritize website content that attracts most consumer business for insertion into their portal webpage and to structure these webpages in a manner that presents such content clearly and unambiguously.

3.1 Visual Attention and Search

3.1.1 Visual Search Requirements

Whether surfing the internet for pleasure or using it for particular personal or business reasons, webpages have to be searched in order to retrieve information. This process equates to Fogg's (2002) prominence stage within his Prominence-Interpretation model whereby information is gleaned from a viewed webpage prior to its interpretation

(consideration). If we return to our previous example of the consumer seeking a loan from an ebank, his search for loan information will be conducted on a visual display containing a heterogeneous mix of text, graphics, animation and colour elements. For many banks, website portal webpages contain minimal loan information usually as a "taster" to attract consumer attention. Specific loan details and application forms are usually located within the website and have to be reached via links in the portal webpage or via website menu system. Therefore, in the first instance the consumer will search the website portal page for "taster" or loan information which may supply him with the loan information he requires and obviates the need to explore the website for further information. This target information may be in the format of a text entry, animation, part of an advertising graphic or may not be present at all. These screen elements and target information may be located anywhere within the on screen visual field separated by areas of "white space" (blank areas between screen elements). Accordingly, during the search the consumer will experience both "positional uncertainty" concerning the target information location within the webpage and "availability uncertainty" as to whether the webpage contains the required information. Resolving the effects of these factors will involve the consumer searching the whole webpage or searching until the required information is found. In the event that the required information is not found either the website menus have to be examined for the correct links to the required loan information within the website or the consumer accesses the portal webpage of the next ebank found by the browser.

For the consumer searching for loan information in an ebank webpage, his task is made more complicated by the nature of the target information. As outlined above, this may be in the form of a graphic element or as straightforward text, it may comprise a single word ("loan", "borrow", "mortgage", "credit", "finance") or a combination of words ("car loan", "bank loan", "credit card", "personal loan" "secured loan", unsecured

loan", "personal finance"). These elements may be located anywhere on the page and may be duplicated (e.g. the words "personal loans" may be present as a "taster on the webpage but is also likely to be repeated in both graphics and the website menu system). As these target words comprise both single word and word combinations and may contain other features differentiating them from other webpage elements (e.g. background, size, colour, and font) they require a conjunction search to cater for the multiple differentiating features. Consequently the search for loan information is unlikely to involve searching for a single specific target having a single feature but for several possible alternative targets with a variety of attributes and which may be located anywhere within the webpage.

3.1.2 Visual Search Models

In order to understand more about what gives "prominence" (as in Fogg's Prominence Interpretation theory) we need to know a little about the processes of visual search. Much of the early research examined low level visual processes and comprised reaction time studies of time take to locate targets amongst a series of background visual elements or distractors (these are discussed by Yang et al, 2002). As a result of this and subsequent research various theories of visual search have been forwarded. Of these, the Feature Integration Theory (Treisman and Gelade, 1980) and Guided Search Theory (Wolfe, Cave & Franzel, 1989; Wolfe, 1994, 2007) have been among the most influential. Both describe a visual search model that comprise two search processes i.e. a parallel search and serial search.

The parallel search is described as one where all elements within the visual scene are viewed and processed in parallel (i.e. concurrently). Under these circumstances only targets which are sufficiently distinctive can be discriminated from the rest of the visual scene. In situations where the target is not sufficiently distinctive and is not easily

discriminated from other elements within the visual scene a serial search is adopted. This involves the sequential examination of each visual element and a decision made as to whether it matches the target before examining the next object. By its nature, each step of a serial search is restricted to a limited region of the visual scene – a shifting of the focus of attention from one visual element to the next (Neisser, 1967; Triesman & Gelade, 1980; Wolfe et al, 1990). The rationale underpinning this distinction is that where the time taken to locate a target among a number of distractor items is found to be short and unaffected by the number of distractors then the target appears to have been located using a simultaneous parallel search of all items in the visual field. This is characterized by rapid location of targets and a level reaction time versus number of distractors graph. Serial searches take longer and search times are dependent not only upon the number of distractor items but also on whether the target may be distinguished on single attribute (feature search) or on several attributes (conjunction search). Here, the reaction time versus number of distractors graph shows an increasing slope which is greater for conjunction searches than for single feature searches. A characteristic of parallel searches is the "Pop-Out" phenomenon where the target pops-out from the visual background and draws the viewer's attention to that area of the visual scene (Maljkovic & Nakayama, 1994; Treisman and Gelade, 1980).

In terms of the Prominence-Interpretation theory the Prominence stage of webpage search is akin to the parallel visual search process described previously in the Guided Search Theory. Both processes describe a state whereby specific information in the visual scene is perceptually highlighted for further consideration by the viewer. Returning again to the consumer seeking an online loan, when a webpage opens the consumer would be expected to rapidly scan for the target word or graphic. The Guided Search Model would describe the consumer as performing a rapid parallel search of the webpage to create a feature map of the webpage where screen elements identical or

related to the loan keywords were located. This would be equivalent to the P-I theory Prominence stage whereby areas of interest are "noticed" prior to further consideration by the consumer. "Noticed" areas would then form the basis for the subsequent serial search and examination of targeted areas.

3.1.3 Detection of the Visual Target

Basic research into visual search such as that conducted by Luck and Vogel (1997), Palmer (1994, 1995) and Wolfe (1998) has shown that search times increase with the number of distractors in the visual scene (Wolfe, 2001). This suggests that the effectiveness of visual search of ebank webpages for information is contingent upon the number and type of distracting visual elements in the webpages. Similarly, other visual research has indicated the ease with which targets are detected may be dependent upon factors such as the discriminability of the target from the distractors (Bravo & Farid, 2004; Verghese & McKee, 2004; Wolfe, 2001), the level of viewer attention and expectancy (Downing, 2002), grouping or ordering of visual elements (Weller, 2004; Pomplun et al, 2001) and target – background similarity (Neider and Zelinsky, 2006). Where all elements in the visual scene are similar in terms of their basic characteristics, differentiating target from distractor is clearly more difficult than when they have different characteristics (Treisman & Gormican, 1988; Wolfe, 2001). In such cases they will not be "noticed" and require extended serial search of individual elements to locate the target.

The exception to this relationship between search time and set size is the "Pop-Out" phenomenon. This occurs during parallel search when the target element is sufficiently distinctive from other visual scene elements that it "pops out" i.e. It becomes immediately distinguishable from other from other distractor elements in the visual scene. Location by pop-out is dependent upon the target having increased salience as a

result of a unique feature or features by which it can be distinguished from distractors. In pop-out situations, target location time is largely independent of the number of distractors (Julesz, 1981, 1984; Treisman and Gelade; 1990) The rapid locating of the target is accompanied by a shift of viewer attention to the target location. This shift of attention is automatic and it has been demonstrated that it is difficult for viewers not to direct their attention to a visual element with unique characteristics (Jonides and Yantis, 1988; Pashler, 1988).

So what visual characteristics serve to assist visual search by distinguishing between elements in the visual scene and serve to get them noticed? A variety of different contributory factors has been found some which relate to the visual scene whilst others pertain to the viewer. Visual scene related factors identified in the research include: size, position and orientation (Ahissar & Hochstein, 1996); visual density (Bravo & Farid, 2004); Intensity, contrast, flicker, motion and saliency (Carmi & Itti, 2006); colour (Duncan & Humphreys, 1989); colour combinations, figure/background area ratio (Huang, 2008); text alignment, line spacing (Ling & Van Schaik, 2007); design and colour (Liu et al, 2002); contrast and luminance (Pamer, 1995); colour, motion and orientation (Treisman and Gelade, 1980); layout (Van Schaik & Ling, 2001); stimulus salience (colour, contrast, saturation, shape, spatial separation, set size and orientation (Wolfe et al, 1989). Viewer related factors include: visual memory (Duncan & Humphreys, 1989; Pomplun et al, 2001), expectation (Bernard, 2001), visual attention (Yantis, 1998). Other factors that may be expected to affect viewer detection of target would be personal relevance, motivation, knowledge, beliefs, experience and accuracy of the viewer's internal representation of the target to be detected.

A difficulty in applying the results of these previous studies on visual search studies to webpage searches is the nature of the visual search tasks used. Many of the visual

search studies previously described have been conducted using visual elements against a homogenous background of letters or shapes where a single feature is sufficient to distinguish a single target from distractors. Webpage searches are often significantly different in terms of their context, complexity and operating constraints. Webpage searches often comprise a search for more than one target amongst a heterogeneous mix of visual elements, often against varying backgrounds of colour, texture and resolution. The information to be located may be in textual, graphic or animated format and the search conducted under time or other constraints. To categorize the data being sought by the viewer Gilden et al (2010) proposed three classes of visual search data: easy (feature contrast), hard (conjunction of features and some spatial configuration contrasts and quite difficult (rotation direction and the most demanding spatial configuration contrasts). Returning again to our loan seeking consumer, the information being sought comes under the hard category as it comprises a conjunction of features (see section 3.1.1). Often contained within a heterogeneous mix of visual elements and backgrounds, "noticing" the target information may present a challenge to the consumer. Attention may be drawn to particular webpage elements by applying one or more of the visual characteristics described above to selected webpage areas. However, the overuse of these characteristics to draw consumer attention to multiple webpage elements runs the risk losing their effect in what could become a cluttered visual scene containing too many disparate elements.

3.1.4 Optimizing Visual Search

The usual purpose of searching website is to provide the information required for consideration and judgment (as per Fogg's Interpretation stage within his PI Theory). As any judgments made are dependent upon the accuracy and relevance of the information used, it is important for both website owner and visitor that correct information is found and used. Unfortunately this cannot always be guaranteed. Visual

search is modulated by both attentional and computational demands and consequently is an error prone process where visitors are susceptible to their perceptual and cognitive limitations and complications such as viewer inattentional and change blindness (Cartwright-Finch & Lavie, 2007; Mack, 2003; Simons, 2000). To overcome these problems and optimize the search process heuristic rules may be applied either consciously or unconsciously by the viewer. There are several reasons to justify the employment of such rules including that they: a. reduce the attentional and computational demands of visual search by streamlining the visual process; b. optimize the chances of success of finding the correct information e.g. reduce the risk of difficulties like inattention and change blindness; c. speed up the search process. Four principles for heuristic search were suggested by Gigerenzer and Todd (1999). These were that:

1. Search for information cues may be random;
2. Search for information cues may be following a preconceived criterion to their usefulness (validity/value etc);
3. Search based on recollection about alternatives/cues that worked previously.
4. Search may be based on alternatives or cues (for alternatives search, all the cues for each alternative are examined before moving on. For cues search, all the values associated with each cue are examined before moving on to the next cue).

These rules could be applied to ebank searches. In the context of a search for investment information the first rule may involve a random search of website pages for the word “investment”. The second rule could be implemented by searching for single words which may be related to investments such as “investment”, “interest” “rate”

"deposit" "return". The third search may be accomplished by searching for alternative cues such as visual cues such as "%" signs or graphics images showing investment growth. The last rule could involve a hierarchy of searches beginning with an initial search of specific webpage areas then a general search for relevant graphics before moving on to searches for specific text entries. All of these search rules offer possible means of bypassing serial searches of all webpage elements although with a concomitant risk of failure.

Clearly, the optimization of visual search must be approached from two directions. From the website owner's perspective, searching for information by website visitors should be supported by designing websites that support efficient and effective searching. For website visitors, they should adopt search strategies that also achieve these same ends.

In selecting their search strategies website visitors often base select those founded on previous search experience and expectations. This selection may be accomplished consciously or unconsciously but is usually based on the principle that strategies that work continue to be used. Where they are found to be lacking, improved or more appropriate alternatives may be substituted. A wide variety of heuristic rules have been described based on different aspects of webpage structure and content to drive the search. Probably the most basic is that of conformance to viewer expectations. This does not necessarily require consideration of information content but may be applied to overall website qualities such as its layout, colour scheme, balance of text and graphics, its' aesthetics or simply its novelty and entertainment value. Hoffman et al (2005) described the use of graphics operating as visual signposts; Bernard (2001) and Kovacevic et al (2001) suggested restricting search to specific areas of webpages which normally contain the information sought. Scholl (2001) suggested two possible

heuristic strategies to aid visual search. Firstly by the focusing of viewer attention to specific visual features, reference frames perceptual groups or surfaces within the visual scene or b. the focusing of viewer attention to specific spatial regions and parts of the visual scene. Using eyetracking methods, Pomplun et al (2001) describe three strategies: 1. the travelling salesman method of stimulus-wise scanning to reduce scanpath length; 2. the searchlight strategy of scanning objects in fixed-size areas; 3. the clustering strategy of scanning groups of visual elements based on their density and heterogeneity. Other heuristic rules that may be applied include ignoring specific webpage elements such as photographs, logos, animations, menus and links; terminate search as soon as the first possible target is located without searching for additional targets; ranking or weighting specific items of information in terms of relevance to the nature of the task to reduce the load of searching for multiple targets. Although these heuristic search strategies have clear benefits in terms of increased search speed and reduced cognitive effort there are risks associated with their use in that there is usually a trade-off in with decreasing search accuracy when selected webpage elements are ignored or fewer areas of the website searched.

For website owners, they can assist website search and improve usability by ensuring that website viewers are able locate required information. This can be achieved by anticipating viewer's requirements and expectations and using these to assist website navigation by organizing website structure and layout to accommodate them. This can be complemented by the use of colour, fonts, graphics and backgrounds to draw visitor attention to specific website elements. Casner (1989) points to Larkin and Simon's theoretical analysis that graphical displays often allow users to substitute quick and easy perceptual judgements in place of more cognitively demanding non-visual comparisons that comprise visual search. Here, visual characteristics such size, spatial positioning, and colour differences can give users the same information as more

demanding feature comparison or textual consideration. Reductions in search can also be accomplished by grouping related information into one location or by employing techniques similar to those described above to draw website visitor's attention towards relevant information. Carmi and Itti (2006) suggested this by identifying several visual causes for selective attention which they stated could be used for attracting viewer attention to particular areas. These visual cues, such as contrasts of color, intensity, flicker, motion and orientation and variations in intensity, could provide fast heuristics for focusing limited viewer cognitive resources on targeted information. Other alternative strategies include the adoption of common webpage layout so that consumers would be able to locate particular information without the need for extensive searches, the use of information coding using colour or font sizing for particular items of information or the use of commonly agreed graphical signposts for particular products or services. The use of these and similar techniques may also have the advantage widening access across cultures and helping to ensure website compliance with legislation such as the Disability Discrimination Act. Unfortunately such approaches are not always practical as they may impact website aesthetics, restrict information that may be included or fail to comply with the website owning organization standards concerning the use of fonts, graphics, colours and logos. Website owners need to be careful when making assumptions concerning modes of presenting information as they may not necessarily be correct. Casner (1989) highlights research that rebuts the commonly held view that graphical presentation is intrinsically better than text or tabular information displays and states that:

> "*It is a false assumption that graphical displays are inherently better than other representations, or that perceptual inferences are in general are made more efficiently or accurately than non-perceptual inferences".*

He states that the usefulness of a graphical display is a function of the task being undertaken by the website visitor rather than a quality of the website. The conclusion from this is that the adoption of particular website design should not be based on false assumptions or the aesthetic and entertainment characteristics considered appropriate but should needs to reflect proven design standards and its purpose.

3.1.5 Visual Attention

This section will look at some of the basic theory and research underpinning attentional processes and apply them to the practical process of web browsing. The portal webpage is viewed as being a significant component to a website. Being the first webpage to be seen by a visitor it is critical to the gaining and holding of a website visitor's attention (D'Angelo & Little, 1998; Singh & Dalal, 2005). Work on change and inattentional blindness have shown that successful visual search and the ability to perceive the details of a visual scene is contingent upon the viewer attending to that scene. In a practical setting, it is essential that a loan seeking consumer not only locates a competitive loan but also that he is able to discriminate and understand the conditions under which any loan is made. This requires close attention to any information displayed and consideration of those details to ensure complete understanding. This basic attentional process is described by Neisser (1967) as being a special allocation of cognitive resources and "that some processes occur pre-attentively". This latter statement can be taken to describe the pre-attentive stage preceding the closer attentive stage in the Feature Integration and Guided Search models. This dichotomy between pre-attentive and attentive processes is one of the major differentiating factors between the two perceptual stages. The parallel stage is defined by the viewer attention being directed towards the whole of the visual scene whereas the serial stage is characterized by the viewer attention shifting between the various screen elements.

The purpose of sensory attention is to overcome previously described limitations to information processing. For sensory information this is achieved by the viewer selecting subsets of perceived information for further processing. For visual attention it is the method by which a viewer's higher visual and cognitive processes break up and select specific areas of a perceived visual scene for further examination; a process described by Neisser as "focal attention". Without this selective focusing of visual attention visual search is less likely to result in information being "noticed". This process of selective attention therefore equates to part of Fogg's prominence process whereby webpage information is perceived and crosses the cognitive threshold in preparation for its "interpretation". From a theoretical standpoint, Verghese and Pelli (1992) speculate that this is accomplished by an attentive processor capable of a wide range of perceptual decisions but with a limited information processing capacity or span of attention. Pointing to the Feature Integration and Guided Search theories they also suggest that for attentive processes, the level of attention is mainly dependent upon the task being undertaken.

The mechanism of visual attention is an integral part of the visual process. The ability to glean information from a visual scene in a pre-attentional visual stage indicates that part of the attentional mechanism operates at an early stage of the perceptual process and before the considerative cognitive processes. In the case of our ebank loan seeking customer, his attention to the task is critical. Lack of attention may lead to inattention blindness and the risk that required information goes unnoticed or that he fails to see and understand the full terms and conditions of any agreements. There is also the risk that as time passes the degree of attention begins to falter – possibly as a result of visual fatigue (see Dillon and Emurian, 1996; Mocci, Serra & Corrias, 2001) or boredom and cognitive fatigue (Pattyn et al, 2008). Such visual fatigue would manifest itself as irritation and reddening of the eyes, headaches, double vision and reduced

speed of perception (Strickland Pioro and Ntuen, 1996). These symptoms would also impact visual search. However the precise relationship between fatigue and attention or the rate at which any attention decrement occurs is unknown but is likely to be dependent upon the nature of the task, and the levels of visitor motivation and arousal.

3.1.6 Visual Scene Complexity

In any study of visual search it is necessary to consider the question of complexity of the visual scene. It has been shown not only to impact visual search but also webpage aesthetics (Michailidou et al, 2008), communication effectiveness (Geissler et al, 2001; O'Guinn, Allen & Semenik,, 2000; Zinkhan & Blair, 1984) and psychophysiological and emotional states (Tuch et al, 2009). In our webpage search example, the consumer seeking loan information would regard any information unrelated to loans as a distractor. The effects of such distractors vary, but would impact serial search times by increasing the number of items to be examined (Tuch et al, 2009). Does this mean that complexity is a function of the number and type of elements present in the webpage and can be defined on that basis? This is suggested by Geissler et al (2001) and Michailidou et al (2008) who identify structural elements such as links, images, words and sections and dissimilarity between them as determinants of visual complexity. Similarly, Oliva et al (2004) found that visual complexity is a multi-dimensional concept involving factors such as object quantity, clutter, openness, symmetry, organization and colour variety. They highlight the definition by Heaps and Handel who describe it as being "the degree of difficulty in providing a verbal description of an image". In contrast Guo and Hall (2009) state that it is not clear what constitutes visual complexity or how it is measured and perceived. They point to a definition by Berlyne who simply describes it as the amount of variety or diversity in a stimulus which again implies that it is primarily a physical quality of the visual scene. Although there is some agreement concerning some of the determinants of visual complexity there is a general

lack of agreement as to its definition or the contribution made by the identified determinants.

The issue of webpage complexity has to be considered against the varying organizational and cultural standards of website construction, the requirements or purpose of the website and the experience and expectations of the website visitor. Almost inevitability searches take place in webpages where the target is located in a background of distracting elements whose number and level of detail vary. Research in this area has shown that webpage complexity may be viewed both as an objective characteristic and perceived quality of the webpage. These aspects of webpage content are clearly related and will have different effects for different individuals insofar as views of webpage contents will be influenced by the perceptual and cognitive processes of the viewer. This split between actual webpage content and perception of that content is acknowledged by both Guo and Hall (2009) and Germonprez and Zigurs (2005). Guo and Hall discriminate between objective complexity (how varied the website is) and subjective website complexity (viewers perception of website complexity). According to Guo and Hall objective complexity is based around the two website qualities of structure and content whereas subjective complexity is assessed on the visual density and dissimilarity between information cues. Germonprez and Zigurs state that it is determined by 3 factors: human cognition and its influence on the retrieval and usage of website information, the content of the website in terms of its type and amount of information and the website structure with respect to interface, navigation and structure.

At a basic level it might be assumed that webpage complexity may be defined simply in terms of the number of discrete elements present, their organization and visual qualities. Measurement of complexity would be as simple as seeing the file size of a

bitmapped image of the webpage and weighting it for organizational complexity. Tuch et al (2009) suggests measurement of the visual scene physical properties (number and dissimilarity of elements and the degree to which they are related). Other suggestions have included HTML code size and signal to noise ratio (number of bytes taken by page content versus total number of bytes on page and colour content). This view of physically sizing website complexity is incompatible with the subjective-objective breakdown for webpage complexity and ignores several important aspects. Firstly it fails to take fully into account that fact that each discrete visual element will comprise several characteristics which it may either share or differ from other elements. Secondly it ignores the spatial characteristics in terms of layout and element grouping which impacts viewer's search and perception of each element. Finally it does not account for the semantic component of each element insofar as it relates to the viewer consideration of that element. It is apparent that webpage complexity is not a simple, physically measured quality of a website. Neither is webpage content and structural complexity a consistently accurate indicator of perceived complexity. Ultimately perceived complexity is a subjective impression of the website viewer taking into account webpage content, its semantic component for the viewer and their experience, ability and motivation. This view is supported by the finding of Comber and Maltby (1996) who found a significant correlation between viewer rankings of perceived webpage "goodness of design" and webpage complexity ratings which indicated that viewers dislike "simple" screens and often prefer more complex ones.

Earlier it was stated that webpage viewers searching for information will suffer from both availability and positional uncertainty concerning the presence and location of any target. Webpage complexity will serve to increase overall viewer doubts by increasing the difficulty in establishing both the presence and location of a target. From this it would be expected that the relationship between complexity and uncertainty is

relatively straightforward and that simplicity of layout and content would be conducive to ease of use and a reduction in perceived complexity. However, the previously described finding by Comber and Maltby (1996) concerning users dislike of simple screens appears to contradict this statement and lends support to the view that for perceptual purposes, webpage complexity is a quality largely determined by the viewer.

Suggestions for minimizing webpage complexity have been forwarded by various researchers. Yi, Lui and Li (2003) point to irrelevant or vaguely relevant information blocks which they categorize as noise. Under this heading they include links or headings that appear elsewhere on the webpage. Similar findings by Bravo and Farid (2004), Tuch et al (2009) and Oliva et al (2004) suggest simplification by reducing the number of background visual elements. Comber and Maltby (1995) suggest that webpage elements should be of a similar size and aligned to a grid. Burke et al (2005) suggest the removal of static and animated commercial banners. Geissler et al (2001), found that perceived complexity increased with the number of links and, the home page length and any animation. A general conclusion that may be drawn is that visual complexity may be achieved by a reduction in the number of unnecessary visual elements and the organization of the remainder into aligned groups containing related elements is the key to reducing visual complexity.

3.1.7 Visual Overload

Commercial websites including those for ebanks are required to simultaneously inform, advise and sell the products and services offered. As a consequence they tend to be both information rich and volatile in order to cater for changing business, marketing and legislative requirements. The result of this is often a complex website, both in terms of content and layout, whose complexity website visitors have to negotiate in order to find the information, product or services they require. Unfortunately, as

identified earlier, website visitors may be confronted with more information than they can handle. This problem of information overload is widely recognized (Edmonds and Morris, 2000; Nelson, 1994; Shapiro and Varian, 199; Yang et al, 2003) and according Edmonds and Morris the increasing use of information technology has exacerbated this problem. Shapiro and Varian (1999) illustrate this by pointing to the economist Herbert Simon who commented that:

"*a wealth of information creates a poverty of attention"*.

An example of this is the rapid development of on-line shopping together with its ever increasing range of products on sale. These are accompanied by online descriptions and reviews of each product which the customer would rarely see when visiting conventional retail outlets. This increase in the information load for the online shopper is not well researched (Huang, 2000) but has been shown to affect decision quality.

The information processing capacity of individuals has already been described as extremely limited and any information that exceeds this limit may be defined as an information overload. To clarify the concept of information overload Edmonds and Morris highlight previous definitions of information glut or infoglut (Computer Dictionary), data smog (Schenk, 1997), analysis paralysis (Stanley and Clipsam, 1997) and information fatigue syndrome (Oppenheim, 1997). All of which describe a state where individuals are confronted with more information than can be processed or assimilated and an inability to effectively use it. Despite these descriptions information overload seems to mean different concepts to different people and be dependent upon personal factors such as the task, training, experience, personal motivation, constraints and the ability to develop strategies to process large amounts of information. This view is supported by the differential effects that information overload has upon individuals

as demonstrated in research by Nicholas et al (1997) who found that individuals used to handling large amount of data were not bothered about information overload.

The consequences of information overload vary between individuals but are typical of the problem experienced by individuals under stress. For internet users this may be manifested as avoidance behavior (Huang, 2000); distraction, stress and errors (Klapp cited by Edmonds & Morris, 2000; Owen, 1997), disorientation (Ahuja & Webster); deleterious effects upon decision making (Swink & Speier, 1999); cognitive overload, disorientation and distress leading to mistakes (Chalmer, 2003) and learning and assimilation problems (Saadie & Otrakji, 2004; Umanath, 1994).

The information rich and volatile nature of commercial websites is often demonstrated in their website portal pages whose function is to attract and advertise the range of products and services on offer. The information density of these webpages often comprises a complex mixture of text, graphics, backgrounds and animation, usually with little white space between webpage elements. The relationship between visual complexity and information overload was recognized by Huang (2000) who identified webpage complexity and novelty as being two dimensions of information load. A conclusion that may be drawn from this relationship is that increasing website complexity leads to poorer usability and an increasing risk of viewer information overload. However, this may not be the case. The finding that some users dislike simple screens (Comber and Maltby, 1996) indicates that this view may not be valid in all circumstances. There appears to be an optimum size of webpage content above which information overload becomes increasingly likely and below which they become visually less appealing. The point at which this split occurs has not been researched but is likely to be highly dependent upon individual preferences and abilities of webpage viewers.

Other factors also come into this visual overload equation. It is known from Nicholas et al (1997) that experience ameliorates the effect of information overload. Another possible means of reducing visual overload is by improving website predictability. There are a few basic webpage layout rules. Probably the most common is that of website identity where identity information such as the owning organization logo is always located at the top of the portal webpage. Other common webpage elements such as main menus, policy statements, website maps have high probabilities of being located in particular webpage areas. Accordingly, webpage viewers may use this layout predictability to organize their searches and so avoid some of the effects of visual density and overload.

The task of reducing the risk of information overload may be accomplished by using some of the methods described above for reducing website complexity. Additionally, website visitors can make their job easier by planning their visits by visiting review sites, moderating high expectations to more pragmatic ones, learning to filter and prioritize information effectively, to distinguish between relevant and non-relevant information, selecting their internet search engines and by priming their search by inputting search parameters to locate information within websites.

CHAPTER 4

Eye Movements and the Use of eye-tracking Technologies

Eye movement analysis comprises a major methodology used in this thesis and an understanding of types of eye movements, their measurement and significance is necessary to understand some of the conclusions reached. This chapter provides a brief overview of eye movements and their role during visual search and the effect the visual scene may have upon them. Eye measurement indices of cognitive effort are introduced and discussed followed by an outline of the various methods by which eye movements are thought to be controlled including the Scanpath Theory.

The final part of the chapter provides a detailed view of eye-tracking measures and their uses together with a description of their use in usability studies.

4 Introduction

Vision is not a passive process of image reception followed by the production of a neural representation of that image within the brain. It is an active process beginning with the perception of a visual scene via a series of complex movements of both head and eyes. Images are encoded and passed through a series of neural structures which analyze, filter, and process the information before the perceptual process is complete. At its initial stage, the eyes receive stimuli from a wide visual field, not all of which can be perceived and processed. At this initial perceptual stage a filtering process begins where some stimuli are ignored and others perceived using an attentional shift accompanied by a movement of the eyes. In the context of the consumer browsing ebank webpages for information, he is confronted with a complex visual display of heterogeneous visual elements of which only a small number need to be perceived and processed. This he accomplishes with a series of attentional shifts to areas of visual interest accompanied by a sequence of eye movements to direct his gaze to those areas. The comprehensiveness of the information thus gained is dependent upon the saccadic

eye movements which move the gaze and operate to fix it upon selected visual targets and ensure foveation of that target image (Liversedge and Findlay, 2000; Rayner & Pollatsek, 1992). Various authors have described these movements as random or chaotic driven solely by visual elements that attract fleeting attention (Myers and Gray, 2010) whereas others describe these movements as being driven by both voluntary attentional and involuntary pre-attentional mechanisms (Findlay, 1997). These processes are not well understood and research into visual behaviour has long used eye-tracking techniques to investigate and explain the mechanisms by which visual information is perceived and understand the cognitive structures by which it is processed. As the studies in this thesis use eye-tracking techniques, this chapter briefly examines the role of eye-tracking and its utility in clarifying the processes underlying web browsing behaviour.

4.1 Eye Movements

Eyes may be the windows to the soul but are they also windows to the cognitive operations underpinning visual search? Eye movement research has a long history and according to Duchowski (2002) is entering its fourth era characterized by the introduction of interactive and diagnostic applications. The first three eras are described by Rayner (1998) where the first era (1879-1920) determined basic facts concerning eye movements; the second era (1920-1958) looked at applied aspects of eye movement research; the third era coincided with rapid developments in eye tracking and recording systems covering a wide variety of applications. Rao et al (2002) point to the importance of monitoring eye movements by stating that visual cognition is critically dependent upon the gaze direction. Analysis of eye movements has been used in a wide range of studies. Duchowski (2002) provides a detailed breakdown of these research areas and includes the practical applications of research into advertising, industrial human factors, computer science and driving. Within the field of psychology

much of the effort has been directed towards visual search and attention where eye movement analysis has provided a compelling means of analysis and explanation.

Eye movement analysis comprises a major part of the methodology used in this research and as such needs to be understood. Rayner and Pollatsek (1992) identify four types of eye movement: pursuit (smooth involuntary movement that keeps moving target foveated), vergence (convergence of the eyes to a single point on a near or far object), vestibular (eye movements in response to vestibular stimulation), and saccadic (voluntary rapid eye movements to direct fovea to point of interest). To these can be added optokinetic (involuntary saw tooth movement performed by the eye when observing repeated moving patterns) and miniature (group of involuntary movements that cause the eyes to have dither effect - includes drift and micro-saccades). Yang et al (2003) describe Kahneman's broad classification of eye movements into three categories:

- **Spontaneous looking** - when the viewer observes a visual scene without a specific task in mind;
- **Task Relevant Looking** – where the viewer's visual examination of a visual scene is guided by a specific question or task in mind;
- **Orientation of Thought Looking** – takes place when the viewer is not paying attention to the visual scene but is concentrating on an inner thought.

This classification is limited in that it does not describe the mechanism of individual eye movements and fixation which will be outlined below. However, the studies in this research will be concerned with Rayner and Pollatsek's saccadic movements which come under Kahnaman's second category of task relevant looking.

4.2.1 Eye Movements during Visual Search

In the previous chapter section 3.1.2 the Feature Integration and Guided search theories were introduced as models of visual search. Pre-attentive parallel and attentive serial visual search stages were described where the serial search of elements in the visual field were determined by a parallel search that created a saliency map of areas of interest in the visual scene to be examined. The eye movements relevant to these stages comprise a series of gaze fixations separated by high speed, ballistic gaze movements across the visual field. Differences in eye movements in parallel and serial search were found by Williams et al (1997).

Performing visual search requires the encoding of a wide visual scene with eyes that have variable spatial resolution (Najemnik & Geissler, 2005). The area of highest density of visual receptors (cone cells) is located in the fovea in the centre of the retina. The purpose of eye movements is to re-orient eyes so that the image of the point of interest is focused upon this central foveal area (Gregory, 1966). Maximum visual acuity occurs with a visual angle of 1° to 2° (foveal vision) and diminishes with distance from the fovea as the density of cone cells decreases. According to Yang et al (2002) individuals searching for a target within a scene will search with eye movements alone for visual scenes between 2° and 30°, wider visual scenes require head movements to maintain foveal vision. Visual searches outside the optimum visual angle risk failure to detect the target; the risk rising with increasing image distance from the foveal area. The studies conducted in this research used PC's and the experimental visual angle was maintained within the 2° and 30° obviating the need for head movements.

Card et al (1983) state that eye movements are not continuous but consist of a series of discrete voluntary movements (saccades) between periods of fixation whose times vary

between 70 -700 msec with an average of 230 msec. Fixations show the points in the visual scene at which viewer focal attention is directed. Saccades are interrupted by short involuntary eye movements described as slow drifts, microsaccades and saccadic intrusions. The function of these latter movements is not known but suspected of being involved in the correction of drift together with fixation and attentional correction. Scanpaths comprise sequences of saccades and fixations and form the basis of visual search. They operate, when eyes scan a visual scene, to maintain foveation of areas of interest within that scene. Josephson and Holmes (2002a, 2002b) define scanpaths as repetitive sequences of fixations and saccades that occur upon re-exposure to a visual stimulus. Rao et al (2002) highlight the role of task, acuity and visual features in selecting areas of visual interest and that gaze direction is determined by the cognitive requirements of the ongoing visual task.

During visual search the optimal scanpaths are straight lines between visual targets (Goldberg & Kotval, 1999). Fixation times may reflect several visual search factors in that they reflect the time taken to view and assimilate visual information. Longer fixations may imply that more time is being taken in interpreting or comparing information with internal representations (Goldberg & Kotval, 1999); they can also be indicative of task difficulty (Gould & Dill, 1969). Shorter fixation times can show that the element fixated has simple visual feature taking less time to process; they can also indicate that the viewer is more skilled or experienced in that visual search task (Bloomfield & Modrick,1976).

Examination of recorded scanpaths can clarify the search strategy adopted by the viewer. The number of fixations reflects the number of visual elements being examined. Therefore if we consider a search for a single target, the number of fixations indicates the efficiency of the search strategy with many fixations suggesting a poor

search strategy (although this could also point to viewer attention being distracted to non-relevant visual elements). Efficiency of search can also be reflected in the percentage fixations with areas of interest against total number of fixations. Goldberg & Kotval (1999) describe several other eye movement patterns of relevance to visual search. The ratio between saccade and fixation times can show the relation whether more time was spent searching or processing and could show the degree of complexity in the visual field. Rapid changes in scanpath direction (<90°) can show several possible viewer states: amendments to the goal of the search, mismatches between the visual scene and viewer expectations and the presence of attentional distractors. Research has shown that the accuracy of detection occurs when target location coincides with the location of a saccade (Hoffman & Subramaniam, 1995) a result which suggests that spatial attention is involved in determining saccade direction.

A potential problem with the use of an eye tracking methodology is pointed out by Duchowski (2002) who states that it is visually possible to fixate on one location whilst simultaneously diverting attention to another (covert attentional shift). However Hoffman & Subramaniam (1995) obtained results suggesting that viewers are unable to move their eyes to one visual location whilst attending to another.

4.2.2 Eye Movement Indices of Cognitive Load

During execution of a task the degree of mental effort varies depends on various factors both personal and environmental. Personal factors include task context, group effects, age, experience, motivation, drugs, concomitant physiological requirements, fatigue, monotony and the perceptual and computational demands involved. Environmental influences include task ergonomics, environmental demands, noise, automation and feedback. The nature of this effort was explained by Fairclough and Houston (2004) who cited the description given by Mulder. He distinguished two types of mental effort.

The first, “task Effort”, is the response made to increased computational demands such as those presented by time pressure, working memory, inhibition of usual responses and novel or unusual stimuli. The second, “State Effort”, is that required to maintain performance effort in the face of drugs, noise, sleep deprivation and fatigue. Other descriptions of mental effort have (intrinsic cognitive load; extraneous cognitive load and germane cognitive load) resulted from work on the Cognitive Load Theory (Sweller, 1988).

Various methods of mental effort measurement have been utilized. Fairclough and Houston (2004) describe those used in previous research which have included physiological measure including muscular tension, adrenaline level, cardiovascular activity (heart rate, blood pressure, ECG), P300 event related potential, pupillary diameter and energy utilization measures such as blood glucose level, temperature. Other methods that have been employed include self-reporting, rating scales and dual task measures,

The use of pupillary diameter as a measure of mental effort has been used in many studies of mental effort. Minassion et al (2004) describe task induced pupillary dilation as being indicative of the level of attentional allocation. Beatty (1982) states that changes pupil size reflect the attentional resources or cognitive effort required during performance of a cognitive task. His review of research using pupillary diameter as an indicator of mental effort concluded that “evoked pupillary response” fulfills the criteria for measurement of within-task, between-task and between-individuals variations in computational demands.

Considerable research has been carried out using pupillary diameter measures includes differentiation of deception (Dionisio et al, 2001); simple versus complex tasks in schizophrenia patients (Minassian et al, 2004); hard-easy translations (Hyona et al,

1995); completion of mathematical problems (Nakayama & Takahashi, 2002); tracking moving targets (Takahashi et al, 2000). One significant result relevant to this research is that by Reinhard & Lachnit (2002) who found that stimuli presented with a low probability of occurrence resulted in wider pupillary diameter than those with a high frequency of occurrence.

When examining webpage contents it would be expected that similar variations in pupil diameter would occur when viewers fixate on cognitively demanding visual elements or those that are novel, interesting or task relevant and this will be examined in this research.

4.2.3 Effect of Visual Scene on Eye Movements

Eye movements have been shown to be dependent not only on the personal viewer related factors but also on visual elements within the visual scene. Different visual elements generate differing salience levels which are determined by the nature of the task and the relevant importance of those elements to completion of the task. Studies of driver behaviour found that different visual elements are given differing priority levels with greater attention and thus greater fixation time being devoted to important elements such as traffic signs. Research by Brandt and Stark (1997) and Melcher and Kowler (1999) using chequered and dot patterned stimulus images found patterns of eye movement determined by the spatial arrangement of the features in the displayed images.

Driver studies have shown that differences in visual search strategies occur under varying conditions of cognitive load imposed by different types of road (Crundall & Underwood (1998). They also found difference in the visual strategies between experienced and novice drivers. Harbluk and Noy (2002) found that increased cognitive load created by driver distractions resulted in fewer saccadic eye movements. Similar

differences in visual strategies were found by Underwood et al (2003), Victor et al (2005), Engstrom et al (2005) and Pomplun (2006).

The effect of elements within the visual scene has been shown to affect visual strategies in different ways. Pomplun (2006) demonstrated that in complex displays significant eye movement guidance was provided by local intensity, contrast, spatial frequency and orientation. However, such visually "busy" or complex scenes may also result in information overload. Peavler (1974) found a leveling of the dilation pattern during periods of information overload which he suggests indicates a momentary suspension of the processing effort. He also found a significant relationship between pupil size and subsequent recall. Stuyven et al (2000) found that cognitive load interferes with saccadic eye movements and suggested that this was due to greater executive control being directed towards the task leaving less executive capacity for the saccadic process. Goldberg and Kotval (1999) – cite Loftus and Mackworth who stated that eyes naturally fixate on areas that are surprising, salient and important based on experience. What is meant by important or salient is rather vague but is likely to include elements that are novel, unexpected, interesting or pop-out and those which are of high relevance and include elements related to safety, danger and defense. Within ebank webpages this might include security and conditions information.

4.2 Scanpath Theory

In section 3.2.1 serial search of a visual scene was described as a sequence of fixations on visual elements interspersed by a series of gaze movements between fixations. Myers and Gray (2010) state that visual search is considered by Wolf, Alvarez and Horowitz as "chaotic" and that target location requires scanning the environment. They go on to state that currently there is no general agreement on how to characterize this series of eye movements during visual search. Despite this the Feature Integration and

Guided Search theories state that guidance of the saccade-fixation sequence is governed by a saliency map produced by a parallel scan of the whole visual scene to identify areas of interest – (a conclusion supported by the findings of Foulsham & Underwood, 2008). Stark et al (2001) state these eye movements are essential in top-down control of the flow of visual information. In explanation they point to the Scanpath Theory proposed by Noton and Stark (1971a, 1971b) which proposes that an internal spatial-cognitive model controls perception and eye movements. This appears to be somewhat similar to the attentive processor suggested by Verghese and Pelli (1992).

Josephson and Holmes (2002b) describe the scanpath theory as one which defines scanpaths as repetitions of eye movement (fixations and saccades) that take place when viewers are re-exposed to a particular visual scene. The scanpath mechanism is activated when a viewer is exposed to a novel visual scene and operates by storing the sequence of fixations in memory. This spatial model of the visual scene is then re-activated if exposure to the same visual scene occurs so that the pattern of eye movements is repeated and serves to facilitate recognition of the visual scene. Previous research has shown that visual search improves in efficiency with experience. The result of this is that visual search requires fewer saccades and fixations. This observation lends some support to the scanpath theory which has formed the basis for a considerable amount of research; the results of which has supported predictions coming out of this theory (Josephson & Holmes, 2002a, 2002b; Pieters et al, 1999). Despite this support a few questions remain. Josephson and Holmes (2002b) found mixed results where similar scanpaths were found between different participants suggesting strong visual scene influences. They also suggested that some scanpaths were the result of habitually preferred paths across visual scenes rather than scanpaths being guided by previous exposure. The scanpath Theory is based around a pre-cognitive spatial model whose mechanism is supported by the experience effect described above. However the

experience effect also supports other search guidance mechanisms. A possible alternative is a voluntary attentive mechanism whereby experienced individuals develop specific search strategies for particular visual scenes. Other alternatives suggested include Vergilino-Perez and Findlay (2006) who pointed to the results of several researchers who found that scanpaths can be programmed in parallel by the saccadic system. Similarly, Ellis & Smith (1985) put forward the idea scanpaths can be generated by completely random, stratified random, or statistically dependent stochastic processes; however they did not test these speculations.

Although the scanpath theory provides an attractive explanation it appears that other voluntary and involuntary mechanisms may operate exclusively or in tandem with the mechanism described by the scanpath theory. Other models proposed include the Morrison's model cited by Rayner and Pollatsek (1992) and the computational model suggested by Chanceaux et al (2008) which states that scanpaths are determined by informational needs following both semantic (top-down) and visual (bottom-up) information. In this research participant scanpaths will be examined for evidence of repetition and whether this is elicited by visual scenes following a common layout.

4.1 Eyetracking

As the principal methodology used in these studies eyetracking has been long been used to determine and explain the psychological activity underlying visual perception and visual processing. Granholm and Steinhaur (2004) describe the eyes as a unique window on the brain by providing information on underlying psychological processes. In their summary of eyetracking research Jacob and Karn (2003) describe over a century of eye monitoring experiments but describe the 1970's as being the period when great advances were made in both eyetracking technology and theory underpinning eyetracking research. As computing technology advanced from that

decade, real time eyetracking methods were increasingly used to monitor human interaction with technology. An important concept which developed from both human interface research and the practical implementation of the technology was usability which has been officially described in ISO standard 9421-11.

Although beset by a few problems on the way (Jacob and Karn, 2003), such as its intrusive relationship with subject whose eye movements are being monitored, eyetracking technology has now advanced to the stage where it can be mobile, non-intrusive and accurate. With sampling rates varying up over one thousand per second it provides a considerable amount of data for analysis. The details recorded include:

- Point of fixation in the visual scene usually of duration between 100-250 msecs;
- Gaze duration or cumulative time spent fixating particular spatial locations;
- Scanpaths tracking eye movements across the visual scene between fixations;
- Areas on of interest identifying areas of the visual scene that have accumulated higher than average fixations;
- Eye blinks sometimes used to indicate visual fatigue;
- Pupil diameter used to indicate interest in particular parts of the visual scene or cognitive load required to process visual information from a fixated area.

When stored in decimal format rather than binary, eyetracking data can be analyzed using tools such as spreadsheets. However, data analysis is usually accomplished by specialized analysis software. In these circumstances the effectiveness of data captured is contingent upon the functionality of the analysis software. This software can usually be used to provide both numerical analyses of the eyetracking data (quantitative analysis) and visual displays of the results overlaying images of the visual scene (qualitative analysis). Eyetracking data can be interpreted in various ways and Jacob

and Karn (2003) examined 20 eyetracking usability studies to produce a variety of different measures which are summarized below (Table 4):

Table 4: Measures available from eyetracking data

Eye tracking Measure		Detail
Fixation	**Gaze rate**	**Number of gazes per minute on each AOI**
	Gaze duration mean	**Gaze mean on each AOI**
	Gaze %	**% of gaze time on each AOI**
	Total number of fixations	**Number of fixations over whole visual scene**
	AOI fixations	**Number of fixations on each area of interest**
	Fixation rate	**Number of fixations per minute**
	Average fixation time	**Average time spent for each fixation**
	Transition probability	**Probability of particular transitions between AOIs**
	Long fixation frequency	**Number of long fixations on AOIs**
	First fixation	**Time to first fixation in visual scene**
	Fixation spatial density	**Number of fixations within particular spatial locations**
	Fixation rate over time	**Number of fixations over successive time intervals**
	Voluntary fixations	**Number of fixations lasting over 320 msecs**
	Involuntary fixations	**Number of fixations lasting less than 250 msecs**
Scanpath	**Scanpath direction**	**Direction of scanpath across visual scene**
	Average Scanpath length	**Average length of all scanpaths over test period**
	Saccade speed	**Speed of saccades along scanpaths**
	Fixation-saccade ratio	**Number of saccades per fixation**
	Scanpath area	**(convex hull)**
	Saccades over time	**Number of saccades of successive time intervals**
Pupil	**Pupil Diameter**	**Average pupil diameter over time**
	AOI Pupil diameter	**Pupil diameter for particular AOI's**
	Start pupil diameter	**Pupil diameter before seeing target visual scene**
	Pupil diameter over time	**Pupil diameter over successive time periods**
Eye Blink	**Average eye blinks**	**Average number of eye blinks over test period**
	Eye blinks over time	**Eye blinks over successive time periods**

In these studies the measure to be used will be scanpath direction and length, average pupillary diameter, identification of areas of interest, number of switches of fixation point and average fixation time spent in defined areas of displayed web pages.

An overview of eyetracking studies is given by Duchowski (2002) but includes investigations into attention (Shagass et al, 1976); visual search (Gilchrist et al, 1999; Gould, 1973; Greene and Rayner, 2001; Liversedge and Findlay, 2000; Vergilino-Perez and Findlay, 2006), face exploration (Leonards & Scott-Samuel, 2005); familiarity effects (Greene and Rayner, 2001); parallel and serial processing (Maioli et al, 2001; Zelinsky and Sheinberg, 1997); memory search (Gould, 1973); reading (Holsanova ete al, 2006; scene perception (Rayner and Pollatsek, 1992); personal relevance (Salojarvi, Puolamaki, and Kaski (2005); task complexity (uncertainty and target displacement (Dickov and Morrison, 2006). One eye tracking measure that has been used in many studies is pupillary diameter. This measure has been linked to cognitive load with increased pupillary diameter indicating increased load. In this role it has been used by Beatty (1982), Beatty and Lucero-Waggoner (2000), May et al (1990), Granholm and Verney (2004), Dionisio, et al (2001), Minassian et al (2004), Backs and Walrath (1992) and Siegle et al (2003) all of whom found it to be an effective measure of cognitive load. However other studies have contradicted this finding. Lin, Zhang and Watson (2003) found no evidence to support the link between pupillary diameter and cognitive load. Similarly, Van Gerven at al (2004) found that it was not an effective indicator of memory loading in older participants.

Despite some these ambiguous results on the dependability of pupillary diameter as an indicator of the level of arousal and cognitive activity the weight of evidence supports it use in this context as a measure of cognitive load and will be used on this basis in these studies.

4.2 Eye tracking and Usability

According to Bevan and McLeod (1994) the ideal way to specify usability is in terms of the features and attributes required making a product usable. However, they state that it is often difficult to specify which features and attributes to include. The alternative is to conduct usability studies which have two requirements. Firstly, the identification of the purpose of the website, profiles of its users and scenarios for users accessing the site (Kantner and Rosenbaum, 1997). Secondly, the specification of the usability criteria for the website content and structure. Content factors to be evaluated would include accuracy, authority, reasonableness, objectivity, currency, coverage and accessibility. Structural factors would include webpage layout, website structure and navigation, content organization, content loading, font details, colours, backgrounds, graphics and animations. These factors would need to be prioritized and weightings given for their effect upon overall website usability assessment and then be considered in terms of their eye movement correlates.

The usability testing of systems and products originally comprised techniques such protocol, user performance and walk through (Goldberg and Kotval, 1999), think aloud, subjective ratings, checklists, history files and observations (Norman and Panizzi, 2006) and heuristics (Neilson, 1992, Kurniawan and Zaphiris, 2005). In their overview of usability testing Norman and Panizzi describe the importance of usability testing in both software production and the development of computer interfaces and its increasing role in the development of WWW based products and WWW usage. The extension of user testing to include eyetracking measures of usability predates computers (Jacob and Karn, 2003) but has been extended to evaluate computer interface usability by many researchers (Crowe and Narayanan, 2000; Ehmke and Wilson, 2007; Goldberg and Kotval, 1998, 1999; Goldberg et al, 2002; Jacob and Karn, 2003). For WWW usage, monitoring user interaction with viewed webpages comprises

a substantial part of the testing process. Here, eyetracking provides a proxy through which a webpage viewer's gaze can be monitored and areas of interest identified and search patterns investigated (Bachioci et al , 1997; Brunea, Sasse, NcCarthy, 2002; Cowen, Ball and Delin, 2002, Oertal et al, 2001, 2003; Pool and Ball (2005), Schmidt et al, 2009; Tzanidou, 2003.

In this research eyetracking will be used to monitor which webpage elements attract viewer attention and how these subsequently impact user assessment and recall of webpage contents. Scanpath displays will be visually examined for evidence of scanning strategies and the cognitive loading of participants will be tested to determine whether this is materially affected by website content and the task being undertaken. Any scanning strategies detected are likely to be significantly affected by both webpage layout and content. Accordingly, in the next chapter, the structure and content of ebank webpages will be investigated and a webpage template produced for the later studies in this thesis.

CHAPTER 5

Study 1: Webpage structure: An overview of 116 Ebanks

Previous research has shown that users have expectations concerning both structure and contents of websites. Failure to conform to expectations has been shown to impact not only usability evaluations but at a more basic level affects both user webpage scanning strategies and visual search times. In order to ensure that the webpages used in this study accurately reflect those used on the WWW an initial survey of 116 ebank websites was conducted to determine which common webpage elements were present and where they were usually located with these website portal pages.

5. Introduction

Website usability research has demonstrated that website design and webpage layout affect the consumer view of the contents (Bevan, 1998; Comber and Maltby, 1997; De Marsico and Lvialdi, 2004; Fogg et al, 2003; Granka et al, 2004; Schenkman and Jonsson, 2000; Tractinsky, 1997; Van Schaik and Ling, 2001, 2002, 2003a, 2003b, 2004; Van Schaik and Pearson, 2003). With this in mind, it is clear that the best website content, when inappropriately presented, can adversely affect assessment of that content. It is necessary for web owners to ensure that their design efforts create a website environment to support the website content rather than detract from it. The necessity to consider structure alongside content is a recurring theme in many of the online sources of advice for website creation (type "website structure" into any search engine). Unfortunately, not all of this advice is accurate or impartial as a substantial number of advice websites are set up by web design companies to attract customers. In other websites the advice is occasionally contradictory or reflects the personal preferences of the advice source; usually without any supporting evidence for that advice. With the recent flagging reputation of many banks, they need to create ebank websites whose structure and content satisfy the basic usability criteria but also serves

to satisfy other consumer needs such as security, privacy, performance, aesthetics and availability. Failure to satisfy these is not in the interests of either the ebanks or their potential consumers. As Bevan (1998) points out "website development should be user centred, evaluating the evolving design against user requirements".

Bevan and McLeod (1994), Cowen, Ball and Delin (2002) and Jacobsen (2004) point to the importance of using stimuli which mirror real life context and reflect the personal goals of users. Accordingly, this chapter is devoted to a survey which examined the structure and contents of 116 UK financial websites. The aim of this was to determine the most common layout for ebank website portal webpages and the most common webpage elements and their usual webpage location. This could then guide the construction of webpages to be used in the later studies.

5.1 Human Computer Interaction

Interaction with computers was initially accomplished through a variety of media, many of which are now obsolete (e.g. paper tape, machine cards, teletype machines). Developing technology replaced these by other communication media such as video, audio and wireless all of which broadened the range of interfaces available to users. As computer usage widened to encompass government, business, sport and personal use these interfaces assumed increasing importance and became the subject of a considerable amount of human-computer interaction (HCI) research. This research is not only driven by academic curiosity but also as a result of commercial, governmental, industrial, health and entertainment interests. Definitions of HCI have been provided by a variety of researchers many of which are based upon the discipline of the researcher. At its basic level it is the study of the interaction between man and computer and so is dependent upon both the user and the interface being used. As such, the design of such

interfaces needs to be multi-disciplinary and user centred to take into account the desires and needs of the user.

All computer interfaces impose restrictions on users. These may be dependent upon the technology available, the purpose for their use or the context in which they are to be used. In the case of most users, scope of action is limited not only by the hardware and software configuration of the interface but also by the user's needs and abilities. Technological restrictions include processing power, data storage and communication channels. Some of the user limitations were described earlier when the subjects of visual attention, visual search and visual overload were discussed. Others to take into account would include user understanding of the interface operation and their technical sophistication with computers.

HCI research has examined a large number of different interfaces incorporating such techniques as eye-tracking (Jacob & Karn, 2003; Hutchinson et al, 1989) hand gestures (Von Hardenberg & Berard, 2001), face locating and tracking (Hunke & Waibel, 1994), speech (Oviatt, 1995) and aromatic means (Kay, 2004). In addition to the examination of different interface modes other researchers have considered the interface design process from the aspect of user limitations. For example, cognitive limits such as memory limitations, recognition failures, conflicting task demands, lack of training and motivation (Sasse Brostoff and Weirich, 2001) and trust (Riegelsberger,Sasse &,McCarthy (2004, 2005) and sensory problems including visual limitations (Chiang et al, 2005; Jacko et al, 2009), auditory limitations (Mynatt, 1994) and sensori-motor disabilities (Brewster & Brown, 2004; Wolpaw et al, 2002). Despite the amount of HCI research much of it has been directed towards the technical aspects of interfaces, their accommodation of contextual and human factors and fitness for purpose rather the user's needs for simplicity, understanding and satisfaction.

5.2 Ebank Interface Usability

The result of technology development and research is that users now have a variety of different ways of interacting with computers. However, in the context of online banking these are limited and most transactions are accomplished either by telephone or personal computer. Transactions operating via these interfaces are controlled and limited by the options within the transaction process. The usability of these interfaces is therefore crucial in ensuring that such transactions are understood and accomplished successfully and to the satisfaction of all participants.

The needs of the user are also key to successful online transactions and usability studies have extended HCI research this to include what Neilson (2003) calls the interface usability components of learnability, efficiency, memorability, errors and satisfaction. For online banking the HCI considerations that need to be taken into account when designing for usability are those related to the visual output (VDU and telephone screen) and the input (keyboard and telephone keypad). Usability considerations must include ease of use, user understanding and satisfaction with the process. Account must also be taken of user limitations particularly the disabled following the implementation of legislation protecting their interests.

Various usability definitions have been given but in the final analysis it is determined by the user and as Feng (2004) points out:

> “From the perspective of users , a successful website, not only lies in the unusual outward appearance, or the interior advanced science and technology, but depends on the fitness usability and attainability of the information items and the content on website, which lets the user to "think useful", "feel satisfied", "be willing to come back to use again".

Much usability research has been directed at computer interfaces and has adopted a variety of techniques such as questionnaires (Lewis, 1995), heuristic evaluation, and walkthroughs (Jeffries et al (1991), workshops, panels and surveys (Rosenbaum, Rohn & Humburg, 2000) and features and standards inspections (Nielson, 1994).

The development and implementation of successful human-computer interfaces requires that the development process incorporates a usability evaluation (Greenberg & Buxton, 2008) and that usability is an important factor that must be taken into account when selecting a product (Seffah & Metzker, 2004). So what factors need to be taken into consideration when conducting usability assessments? Neilson (2003) identifies five components of learnability, efficiency, memorability, errors and satisfaction; Tractinsky 1997) also incorporates cost, likeability and aesthetics and points out a high correlation between aesthetics and usability. Ebanking replaces a system where interpersonal contact was the norm and, as described earlier, this has implications for interface credibility and trust. Therefore in the ebanking sector usability evaluations must also encompass these two qualities.

Whilst this usability factor breakdown defines the interface qualities necessary for good usability it does not prioritize them or indicate whether trade-offs can be made between them. This will depend largely on the purpose, motivation, experience and knowledge of the user which must also be borne in mind during usability

Ebanking transactions are most commonly accomplished using the internet as this offers the widest ranges of online operations. Hence the interface is centred on the ebank website and usability evaluation is based upon webpage content and its interactivity with the user. The studies in this thesis will use some of the methodologies previously outlined to examine the effects of both user motivations and website structure upon usability assessments but first we will look at website structure and

usability and survey existing ebank websites to determine what standards are adopted in the construction and layout.

5.3 Website Structure and Usability

Usability testing is an accepted part of systems development and has several aims. For work based systems, it is to ensure the elimination of operator errors, improve their training and optimize performance. As a useful derivative it should also reduce operator frustration and improve motivation. For WWW (World Wide Web) based products and services its functions are wider and encompass more personal factors of the WWW user. These include the necessity to simplify interactions and ensure usage by diverse users, provide emotional comfort, promote credibility (Kim and Moon, 1998) and incorporate novelty and entertainment.

The role of webpage structure in determining usability has been investigate by several researchers who found that different webpage design elements all affected usability. Kim and Moon (1998) found 14 design elements affecting emotional responses which could be categorized under four headings: title, menu, clipart and colour all of which impacted emotional feelings, awkwardness and elegance, trustworthiness, credibility. Goldberg and Kotval (1999) found that well organized interfaces produced shorter scanpaths over smaller areas whereas poor interfaces for software packages promoted less search behaviour. Good grouping strategies prompted efficient scanning and fewer fixations; poor grouping scattered scanpaths over whole screen with higher number of fixations. Zaphiris and Kurniawan (2001) identified accessibility as an issue for older WWW users while Tractinsky (1997) and Sutcliffe (2002) pointed to the role of perceived aesthetics in usability assessment.

In these studies the research target is user perception of ebank portal pages. In order to be able to compare results from different webpages it is necessary to consider which

common visual elements these pages should contain and their webpage location, both in terms of the results of previous research and in establishing a real life context.

Bevan's (1997) guide to usability issues in website design makes several recommendations concerning website structure and content. For website structure it is important to reflect both the requirements of the user and be easy to navigate. Similarly, the level of detail and style should be appropriate for both purpose of website and user needs and abilities. For webpage design and structure Bevan identifies three categories of requirement: effective portal webpage, efficiency of design and support for different browser software. The main points that he makes are that website identity should be clear and the necessity for page scrolling removed, the design should reduce download time by reducing colours, graphics and other impediments to fact download, textual elements should be easily read with no animations or patterned backgrounds reducing legibility. Some of these observations will be taken whilst conducting the survey.

5.3 Financial Website Survey

For the purposes of the survey 116 UK financial websites were selected. These comprised both retail banks and building societies as they offered a comparable range of products and services. The analysis grid used for the analysis was based on that used by Schroeder (1998) in his testing of websites using eyetracking study (see fig. 5 below). The analysis grid defines five areas. The top area includes the menu bar, tab line, URL and search line and the top 20% of the editable page area; the bottom area includes the status line, message line (when included) and lower 20% of the editable page area. The other three areas cover the centre of webpage divided into a left and right margins and central area. The common webpage elements included in the survey were: main menu, subsidiary menu, logo, policy/regulatory statement, website search

box, animation, security section and help section. A count was also kept of any webpage constructed using frames as a method using common elements throughout the website. For survey purposes separate areas were identified as being present if a discernible separate webpage element e.g. text entry, graphic, menu, box was contained within that area. If that webpage element covered two defined areas then the area containing the majority of that element was counted as being present. Where common webpage elements are consistently located in particular webpage areas it might be expected that website visitors develop expectation as to the locations of these elements. These may in turn serve to both direct webpage viewers scanning strategies and webpage assessments if their expectations are confirmed.

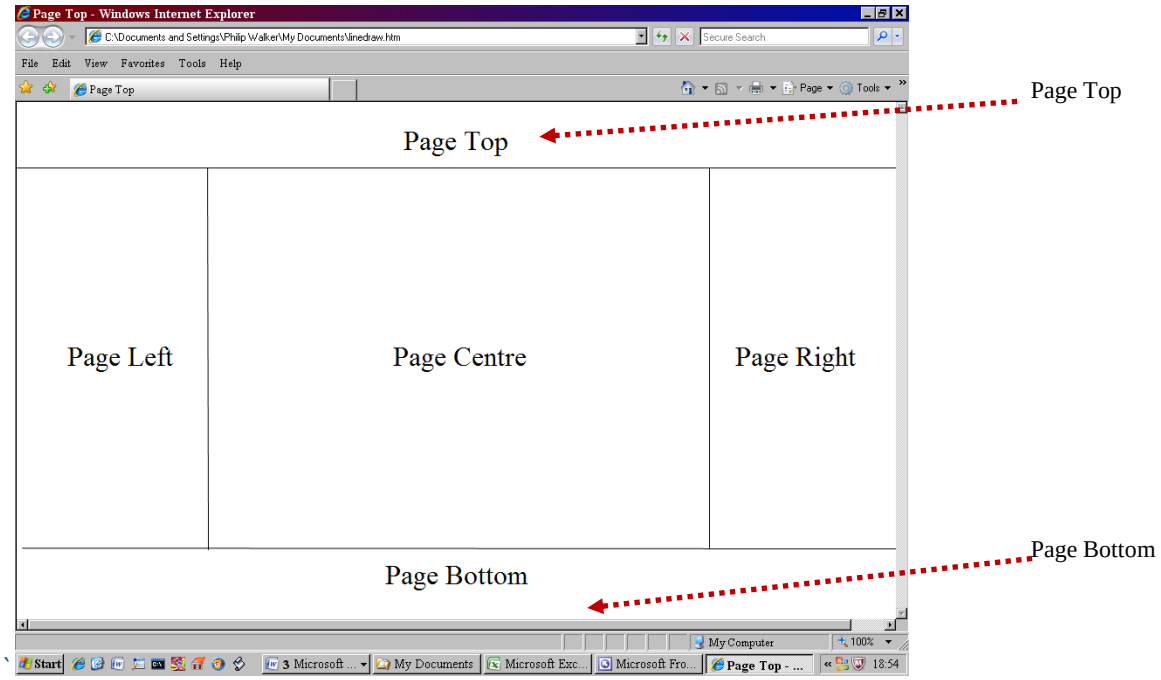

Figure 5 - Schroeder's (1998) webpage analysis grid

The tables below summarize the results of the survey. The number of websites using frames in their design was 21 representing 18% of the total.

Table 5: Website survey – Number of the Types of Discernible Areas Found

Discernible Webpage Areas (home page)	Number	% of total
Top	101	89%
Left	69	61%
Centre	112	98%
Right	47	41%
Bottom	62	62%

All webpages had top and bottom Section but only 89% of top section contained a logo and 62% of the bottom contained any information other than status details. Centre sections were almost universal. Left and right sections were present in about half of cases.

Table 6: Website Survey - Main Menu Location

Main menu location (home page)	Number	% of total
Top	54	47%
Left	47	41%
Centre	10	9%
Right	3	3%
Bottom	0	0%

Nearly 90% website menus were located in either the top or left margin of the webpage with less than 10% located in the centre.

Table 7: Website survey – logo location

Logo location (home page)	Number	% of total
Top	94	82%
Left	3	3%
Centre	13	13%
Right	2	2%
Bottom	1	1%
None	1	1%

Most logos are located in the top section of the webpages with slightly over 10% in the centre. The % logos located in the left and right margins and the bottom § averaged less than 1%.

Table 8: Website Survey - Subsidiary Menu Location

Subsidiary menu location (home page)	Number	% of total
Top	94	82%
Left	3	3%
Centre	13	13%

Where subsidiary menus are incorporated into the portal webpages the majority (82%) are located in the upper section of the central

Right	2	2%
Bottom	1	1%
None	1	1%

area whilst just over 10% are located in the

The final table details the presence or absence of common webpage elements and their locations:

Table 9: Presence & Location Of Common Webpage Elements (home page)

Object	Present	Absent	Top	Centre	Left	Right	Bottom
Logo	115	1	94	13	3	2	1
Policy Section	65	49	23	11	8	0	23
Site Map	32	82	20	2	5	0	5
Site Search	33	81	17	4	5	5	2
Contact Details	99	15	53	12	17	3	14
Security Section	17	98	4	1	2	1	9
Help Section	9	105	8	0	1	0	0
Animation	68	46	0	0	0	0	0

It would be expected that website organization would use logos to ensure their identification by visitors. Unsurprisingly, organizational logos were found in all except one webpage where identification was achieved by incorporating the organization name into the top of the webpage. All webpages contained main menu for general website navigation and were found to be equally located in the top and left web page areas. Subsidiary menus were generally less concerned with general website navigation than with direct navigation to particular products and services. When present, over 80% were in the top area and most of the remainder in the centre area. The Airdrie Savings Bank website shown below (fig. 6) is a typical example where the corporate logo is located to the top left of the webpage with the organization name to its right. The main menu is situated to the left with a product menu at the top.

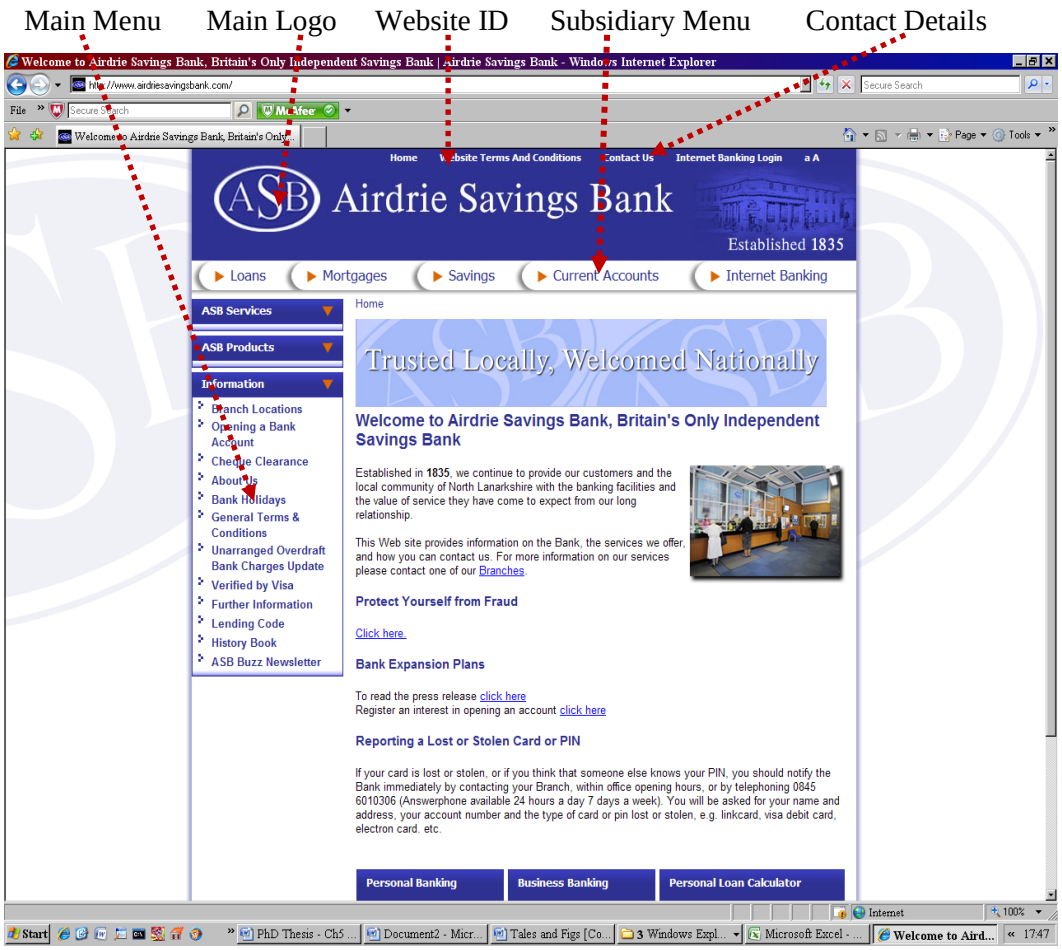

Fig. 6 - Airdrie Savings Bank Showing typical portal webpage layout

Policy statements (including regulatory and legal details) which would normally be expected in financial sites were found in just over a half of the portal webpages examined and were always located in either the top or, in most cases, the bottom areas of the webpage. This is illustrated by the Citibank website (fig. 7 below) where the regulatory information is located at the bottom in small print. The image below (fig. 8) displays the lower half of the Barclays bank website showing that the lower third of their portal webpage contains this information, but which is not visible unless the webpage is scrolled. For the other websites, it is possible that this information was located elsewhere in the website but this was not checked.

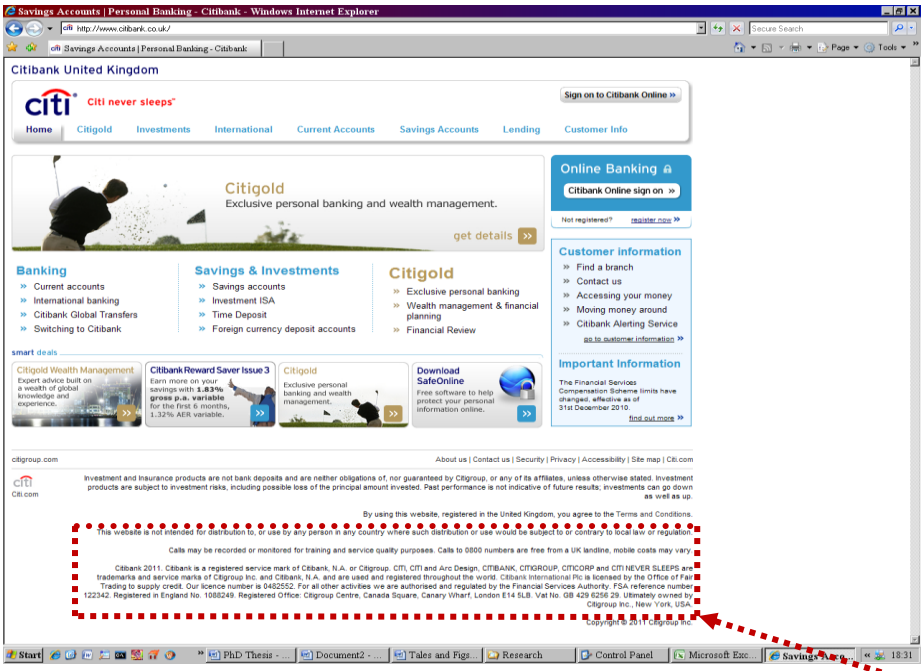

Fig.7 Citibank Webpage Showing Regulatory Information

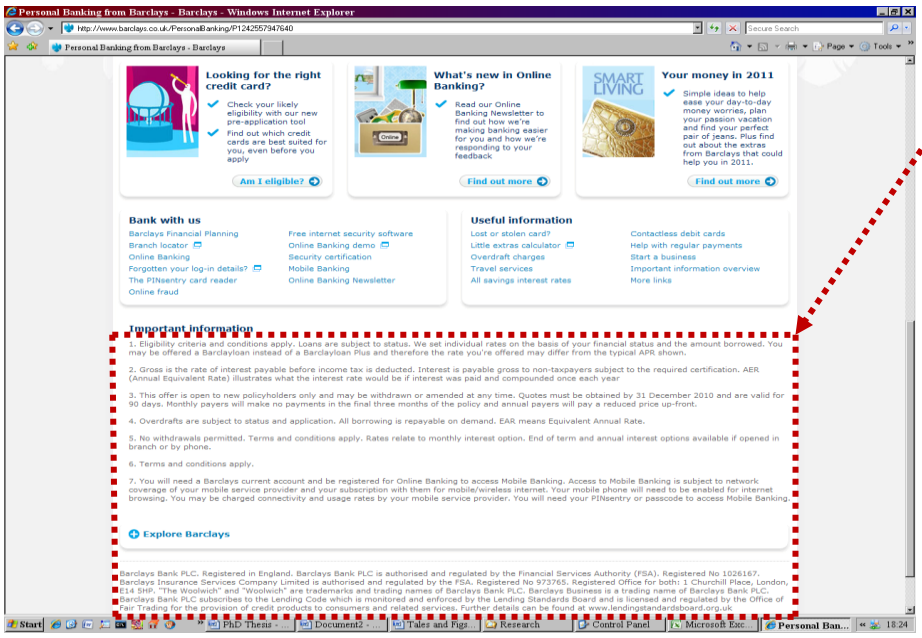

Fig. 8 – Barclays Bank Webpage Showing Regulatory & Policy Information

Over 75% of webpages did not include a website map or provide and those that did more than half usually positioned them in top area (see Chelsea Building Society fig. 9 below).

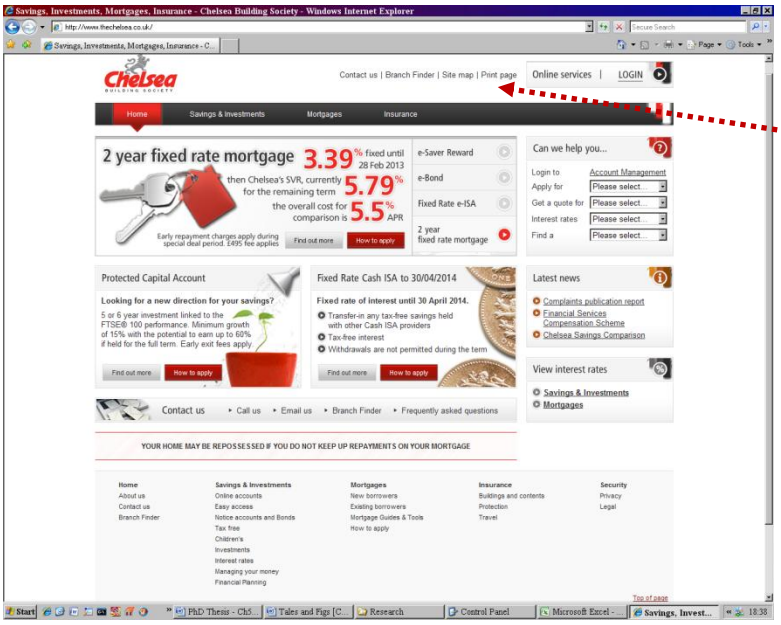

Fig. 9 – Chelsea Building Society Website Map Option

Most websites included contact details with over half situated in the top area, the remainder spread between the left, centre and bottom areas. Few of the websites included a help section (<10%) and those that did tended to put it into the top or bottom area (see fig. 10). Security sections were similarly thin on the ground and located usually in either the top or bottom areas.

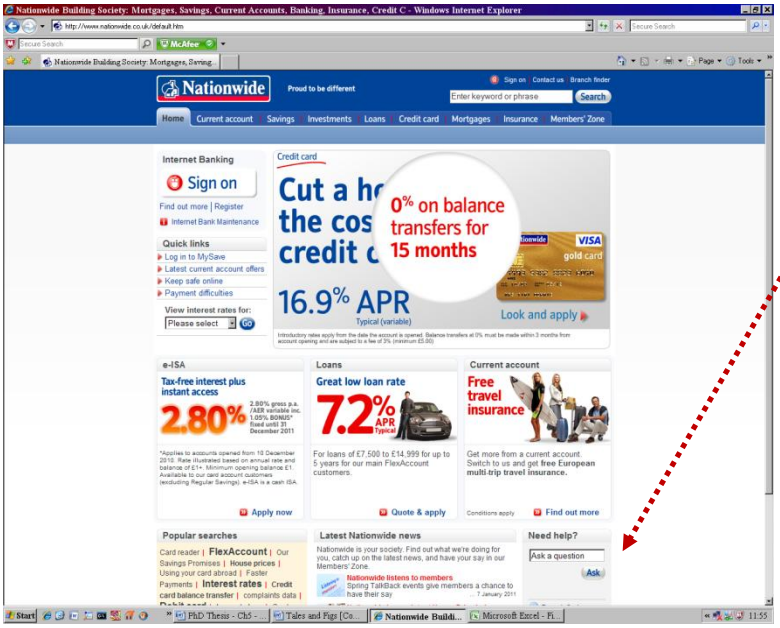

Fig. 10 – Nationwide Building Society Help facility

Security sections, when present, were generally located at the bottom of the portal webpage (see fig. 11 - West Bromwich Building Society below)

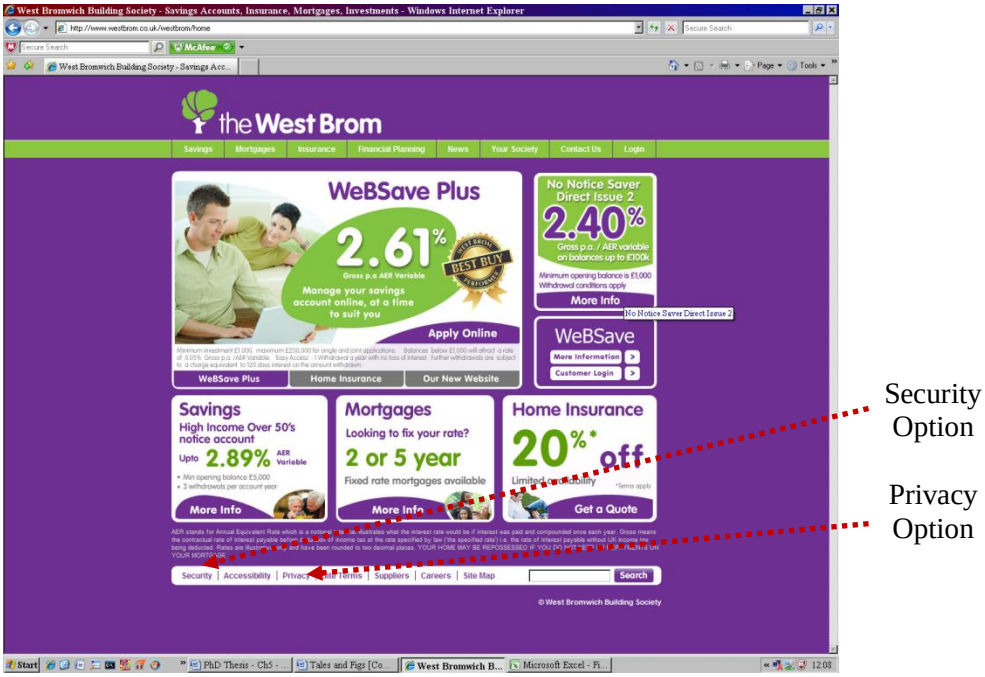

Fig. 11 – West Bromwich B.S. Security & Privacy Options

The final attribute examined on the survey differed from the others in that it was not a particular webpage element but a characteristic of them - animation. Animated areas were found in 12% of the webpages surveyed. The common webpage elements surveyed were not related to services or products and were found to be primarily located in the top and bottom areas except for main menus situated on the left. The remaining area of the webpages contained both text and graphics devoted to information concerning specific products and services. Some webpages did not contain the usual elements that would be expected for a retail bank. An example of this is the Ahli United Bank shown below (fig. 12) which displays banking awards gained but where the menus contain none of the usual service or product options that would normally be expected and the resolution used leaves the right hand side of the screen blank.

Fig. 12 - Ahli United Bank Non-Conventional Layout

Fig. 13 below shows the portal webpage of the Stafford Railway Building Society whose layout reflects the average of those financial websites surveyed

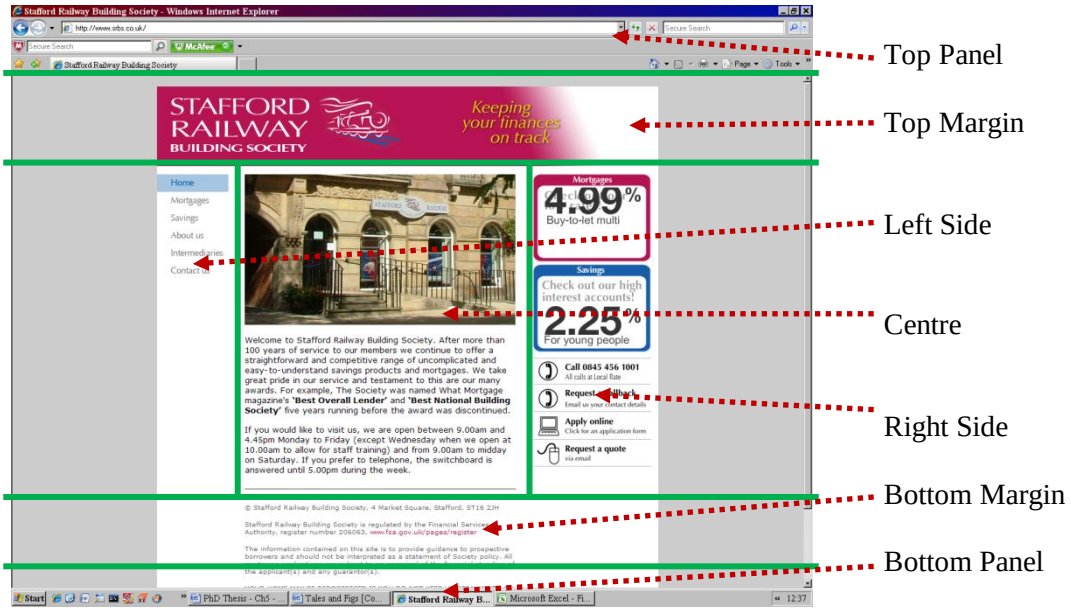

Fig. 13 – Stafford Railway B.S. Showing Standard Layout

The results of this survey are used later when constructing the test webpages and establishing participant expectations regarding the presence and location of particular webpage elements. The additional defined areas to those of Schroeder's grid are the top and bottom panels where the top and bottom panels (highlighted in red). The top panel contains the web browser menu and any additional menus and the bottom panel

contains the system tray and status bars. The graphic below (Fig. 14) shows the most common location for the webpage elements surveyed and where they will be commonly located in the test webpages.

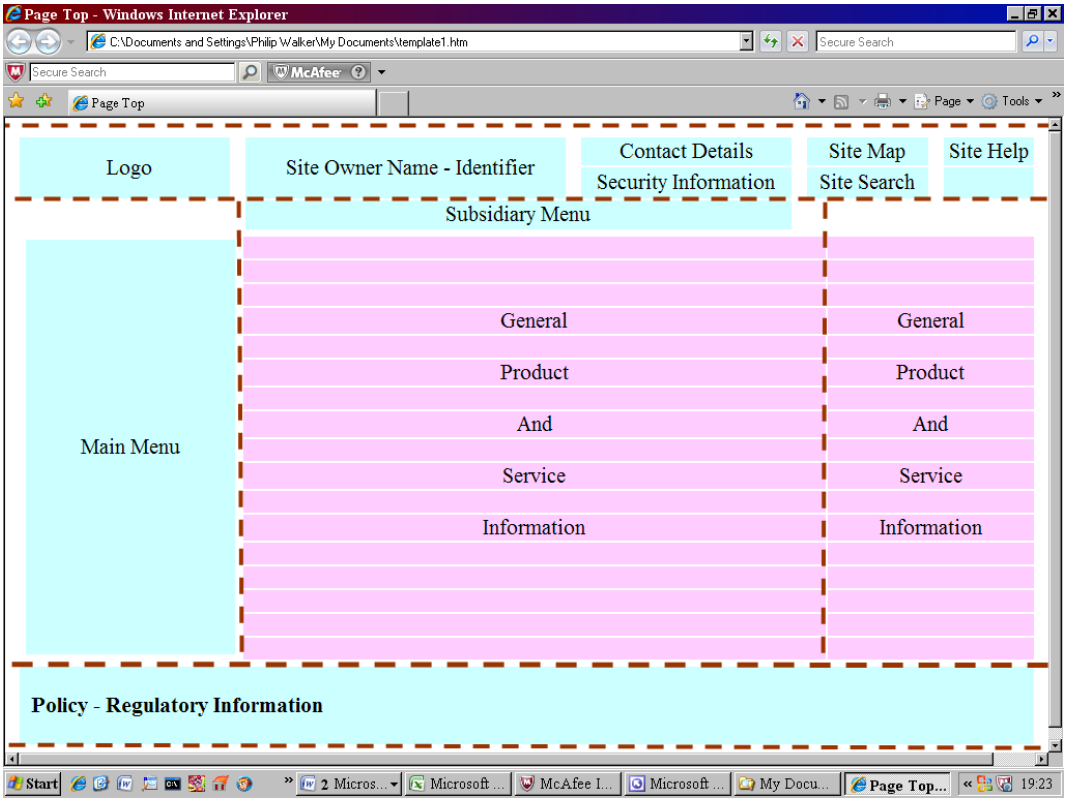

Fig. 14 - Website survey – Common webpage elements location

This layout template provides a basis against which the eye tracking data is assessed. For the gaze fixation data, it is used to locate areas of interest, determine the scanpath order in which screen areas are searched and the grid against which eye movement volatility in terms of screen are switching is measured. For the questionnaire data, this template is used to determine the usual (conventional) location of webpage elements and the variation of which is used in the usability evaluation of webpages with unconventional layout and the usual location of interest rate and security information.

In the next chapter this template will be used to create conventional and unconventional layout webpages for testing visual search and user evaluation of webpage layout.

Chapter 6

Study 2 – The Impact of Webpage Structure and Bank Familiarity upon Webpage Viewing and Assessment

This chapter describes study 2. It investigates the effect of webpage structure and bank familiarity on the manner in which webpages are viewed, which webpage characteristics were "noticed" by participants and how these subsequently impacted participant assessment of the webpages. Participants were shown six web pages, three of which were the webpages of familiar high street banks, the others lesser known or foreign banks. Half of the participants viewed webpages whose structure was conventional and half viewed unconventionally structured webpages where major webpage elements were relocated from their usual locations. The dependent variables comprised participants' webpage fixations and eye movement volatility and responses to pre and post webpage display questionnaires. The post-display questionnaire captured intention to use the bank as an important dependent measure, attention to webpage contents, subjective perceived importance of webpage characteristics and recall of contents. Results showed that conventionality of webpage layout affected participant eye movement volatility and that both bank familiarity and conventionality of webpage structure affected user assessment of webpage contents.

6. Introduction

Although Ebank websites display a variety of different formats, the website survey described previously found a few general rules that apply to their layout and content. These rules include the presence of a webpage top area where the corporate logo and identity information is shown and the left margin for main menu information. Product and service information is typically held in the central and right areas of the webpage and regulatory, policy and ownership information shown in the bottom of the webpage. When online consumers are searching for specific information to make decisions concerning the purchase of goods or services, these layout rules may be expected to direct their attention to the specific areas of webpages being viewed where this

information is likely to be held. As it is generally accepted that consumers spend less time looking at website content than is required to read and assimilate all webpage information, prior knowledge concerning the probable location of such information reduces the possibility that the information will not be found. The research reviewed in the previous chapter demonstrated that website design elements affect both the way in which online consumer views websites and the manner in which website contents are evaluated.

In chapter 2 the nature of trust and its formation was discussed and amongst the extrinsic determinants of trust was familiarity. Luhman (2000) differentiates between familiarity and trust but describes them as "Belonging to the same family of self-assurances, familiarity, confidence, and trust seem to depend on each other and are, at the same time, capable of replacing each other to a certain extent". Studies by Gefen (2000), Gefen Karahanna and Straub (2003), Gefen and Straub 2004), Huberman (2000) all highlight the importance of familiarity in trust formation and found that familiarity influenced individuals online purchasing and investment decisions. This impact of familiarity is not confined in its effects upon consumer intentions but extends to the process of visual search (Greene and Rayner, 2001; Pashler , 1988; Wang Cavanagh and Greene, 1994). Accordingly in this chapter two factors, one extrinsic consumer factor (familiarity) and one webpage design factor (layout), will be examined to determine their effect upon viewer webpage scanning strategies and their subsequent willingness to use the products and services offered. The first is consumer familiarity with the website owning organization. When visiting ebank websites, their ownership is not always immediately apparent. This is particularly so where they use different online trading names e.g. Smile (Coop Banking Group); Egg (Citi Group); Superbank (St George Bank); Netbank (Commonwealth Banking Group); 1Bank (Bank of Cyprus); WebBank (First Commonwealth Bank)). Similarly, there are many ebanks operating

whose names are not familiar to consumers. The question this raises is whether consumer inability to identify banks or a lack of familiarity impacts the manner in which these webpages are viewed and consumer assessment and willingness to use them. The second factor is webpage design related. Here the factor examined is conformity to the layout rules previously described and whether failure to conform to the rules affects consumer behaviour by altering their webpage viewing strategies or opinions concerning webpage contents.

We know from the website survey in the previous chapter and the familiarity research reviewed above that both website layout and consumer familiarity are likely to affect consumer webpage viewing strategies and evaluation of webpage contents. Accordingly the eye movement hypotheses of this study are that both deviation from conventional webpage layout and a lack of consumer familiarity will affect consumer webpage scanning strategy as they seek to identify the website owner details and service and product information which may be displaced from their usual location. For participant questionnaire responses it is predicted that familiarity and conventionality of webpage layout will increase participant willingness to use a website, their greater attention to the websites as well as reading more of their contents. In addition, familiarity and layout is expected reduce the need for alternative evaluation criteria so that fewer screen characteristics are selected as evaluation criteria.

6.1 Method

Design: A two factor mixed design was used; the independent variables were conventionality of webpage layout for the between subjects factor being and familiarity with the webpage owning banking organization for the within subjects factor. One group of participants viewed the web pages constructed with an unconventional layout where major webpage elements were moved from their usual location; the other group

viewed the web pages constructed with a conventional layout. Both groups viewed the web pages for familiar and unfamiliar banks.

For the eyetracking measures the dependent variables were screen area fixation times and eye movement volatility measure. These eye tracking measures will determine which areas of ebank websites attract participant attention; the rate of attention switching between webpage areas will indicate the level of participant search and whether recognizable webpage search strategies are used. The dependent variables for the questionnaire stage of the study were participant responses to different screen features and opinions on whether to use particular web pages for online banking. These measures aim to establish participant willingness to use a bank; the level of attention paid to webpage contents and the webpage characteristics that are used for participant evaluation.

In order to eliminate possible order effects from the sequence in which webpages were viewed participants were assigned to one of six possible webpage presentation orders using random numbers in the range 1- 6 using generated from www.random.org website.

Participants: An opportunity sample of 73 participants (age range 18 – 55, 21 males and 52 females) were recruited from staff, students and visitors to Northumbria University.

Materials: Materials comprised a set of participant instructions and questionnaire (see below) and a set of 12 web pages constructed from information gathered from the bank websites (see Appendix 4). The banks selected were three familiar high street banks (Barclays, HSBC and Lloyds-TSB) and three unfamiliar banks (ASB Bank, Bank One and Standard Life Bank). Participant familiarity with the test bank webpages was

ensured by using well-known banks with a strong high street presence that run highly visible advertising campaigns. The unfamiliar banks were selected from banks that featured very low in search engine hit lists and were therefore unlikely to have been visited by participants. The web page organization was based on the template derived from a preliminary survey on online UK banking sites and consisted of 7 distinct screen areas as displayed in figure 15 below. (see Appendix 4 for full documentation)

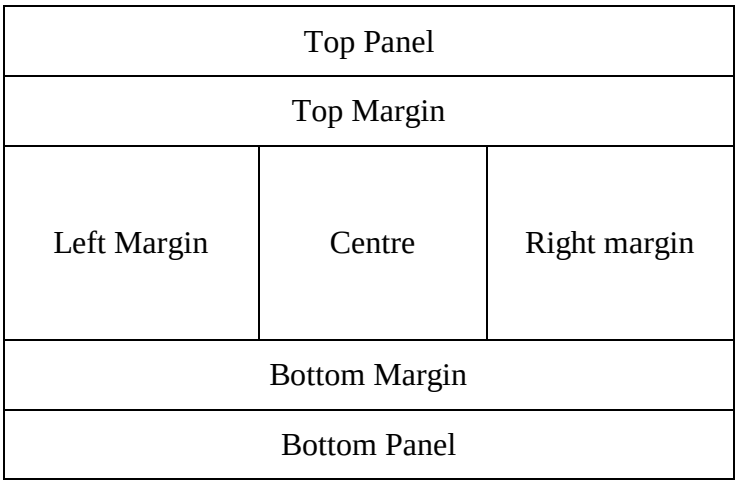

Figure 15 – Study 2 Webpage Organization

The usual contents of each of the screen areas are:

a top panel contains the web browser menu bar;

b top margin contains the website title, identity information and logos;

c left margin contains the main menu;

d centre contains product information;

e right margin contains product information and hot spot links;

f bottom margin contains privacy, policy and security statements;

g bottom panel contains the system tray status bar and windows information.

For the purposes of the experiment the conventional webpage format followed the layout described above. In the unconventional layout web pages the same information was retained but was relocated in the screen to non-usual locations. The top margin information was moved to right margin, left margin information moved to the bottom

margin and bottom margin information moved to the top margin. In order to maintain a balance in the density of the information in all screen areas small amounts of padding information were moved from the right margin into the centre area and from the centre area to the left margin of the unconventional layout web pages.

Eye-Tracking Equipment: The IviewX eye tracking systems utilizes two PC's. The first, subject PC, displayed the stimulus web pages and copied the web page images over a serial link to the second, operator PC. The operator PC was located out of the visual line of sight of the participants. A tracking camera and infra-red light source was positioned in front of and to the bottom left of the subject PC screen. The camera tracked the reflection of the infra-red source off the participant's eye and transmitted the tracking data to the operator PC. The experimenter sat at the operator PC to initiate calibration and to monitor and maintain accurate eye tracking.

Questionnaire: The questionnaire comprised 5 sections of which sections 1 was completed by participants prior to their viewing of the bank webpages whilst sections 2 to 5 were completed after the viewing of the webpages. The purpose of each section is outlined (In Italics) in the description of the questionnaire below:

Section 1 - ID section: *The purpose is to ensure compliance with ethics requirement to delete data participant data in the event of their withdrawal from the study and failure to recall participant number. Name details were removed from these questionnaires and the stored spreadsheet information following analysis of the data.*

Participant Name	**Gender: M F**	**Age:**	**Number:**

Section 2 - Ebank Usage: *Questions in this section determine participant responses to the specific webpages viewed with the aim of determining whether these views are impacted by the effects of the independent variables*

You are about to be shown 6 images displaying the initial online webpages for the following 6 banks. After you have seen these images could you rate these banks on the basis of whether you would use their online banking service?					
Rating Scale	Never	Unlikely	Possibly	Probably	Definitely

ASB Bank					
Bank One					
Barclays Bank					
HSBC					
Lloyds TSB					
Standard Life Bank					

Section 3 - Attention Levels: *Section 2 (Attention Levels): Questions in this section determine participant responses to the specific webpages viewed with the aim of determining whether participant attention levels are impacted by the effects of the independent variables.*

Please indicate how much attention you paid to the contents of each screen					
Rating Scale	**Little Attention**	**Poor Attention**	**Average Attention**	**Good Attention**	**Very Good Attention**
ASB Bank					
Bank One					
Barclays Bank					
HSBC					
Lloyds TSB					
Standard Life Bank					

Section 4 - Screen Reading: *Questions in this section determine participant responses to the specific webpages viewed with the aim of determining how much of the screen contents are read and whether this is affected by the effects of the independent variables*

Please indicate approximately how much of each screen's content you read					
Rating Scale	**0%**	**25%**	**50%**	**75%**	**100%**
ASB Bank					
Bank One					
Barclays Bank					
HSBC					
Lloyds TSB					
Standard Life Bank					

Section 5 - Screen Characteristics (tick all that apply): *in this section determine which screen attributes and contents are "noticed" by participants and which are rated by them as being important in the evaluation of webpage usability.*

Please state which of the following aspects of the displayed screens you would assess bank webpages when deciding you would use them									
	Screen Layout	Text Style	Text Content	Graphics Style	Graphics Content	Colour	Menu Choices	Knowledge of Bank	Security & Privacy
ASB Bank									
Bank One									
Barclays Bank									
HSBC									
Lloyds TSB									
Standard Life Bank									

Table 10 – Study 2 Questionnaire

Procedure:

Eye-tracking: Participants were alternately assigned to the conventional or unconventional layout groups and allocated a sequential number in the range 1 - 73. They were given the experimental instructions (Appendix 4) to read and told that at the end of the experiment they would be asked to rate the web pages on the basis of whether they would use the online banking services offered by each bank. Before proceeding they were asked if they had any questions. Participants were asked to rest their chin onto a chin rest approximately 28 inches from the display monitor. An eye-tracking camera was located below and to the left of the participant eye line so as not to interfere with the participant's view of the display. Two minutes were spent locating the participant's left eye in the camera's field of view and calibrating the camera and tracking software to the participant's eye and head movements.

The webpage display was then started on the subject PC and participant eye movements recorded on the operator PC. Six different sequences of web page displays determined by a sequence generated from www. random.org were used in order to obviate any effects due to presentation order or recency effect. Each web page was displayed for twenty seconds to obviate the effects of fatigue resulting from viewing the webpages

and deciding whether they would use their services; the total display time for all screens being two minutes.

Questionnaire: Following completion of the task the participants were asked to complete all of the questions on the questionnaire for each of the banks listed and no time limit was imposed for this task. They were debriefed and thanked for their assistance.

6.2 Results

The results of 4 participants were removed due to a loss of tracking during the tests leaving 30 participants in the unconventional layout group and 39 in the conventional layout group.

Analysis of the data comprised 2 × 2 (Layout × Familiarity) ANOVAs for the numerical data and χ^2 tests for the frequency data.

Eyetracking

Screen Area Fixation Times: The eye-tracking data was recorded in terms of the total fixation times spent in each of the seven predefined screen areas and time spent off screen. For the screen area fixation times the result showed a significant result with medium effect size for familiarity [$F(1,67)=4.128$; $p=0.046$, $\eta^2= 0.058$] such that participants viewing familiar webpages spent more fixation time in the left margin containing the main menu whereas more time was spent fixating in the right and top margins of unfamiliar webpages containing bank identity and product information webpages (Fig. 24). A significant result was also found for layout [$F(1,67)=133.03$; $p=<0.001$, $\eta^2=0.056$]. Here participants viewing webpages with the conventional layout spent more time fixating the right and top margins containing bank identity and product information and more time fixating the left margin of webpages with an unconventional layout containing bank services and interest rate information (Fig. 16).

No interaction between layout and familiarity was found [$F(1,67)=0.031$; $p=0.862$, $\eta^2=0.000$]. These results were expected in the first hypothesis which predicted that both a deviation from conventional webpage content and unfamiliarity with webpage owner would affect webpage viewing strategy. In terms of overall fixation time the majority (30%) was spent in the central area of the webpage and 10% in the left and right margins; less than 10 % of fixation time was spent in the top and bottom areas (Fig. 17). This may indicate that participant attention is determined as much by position within a webpage as by content.

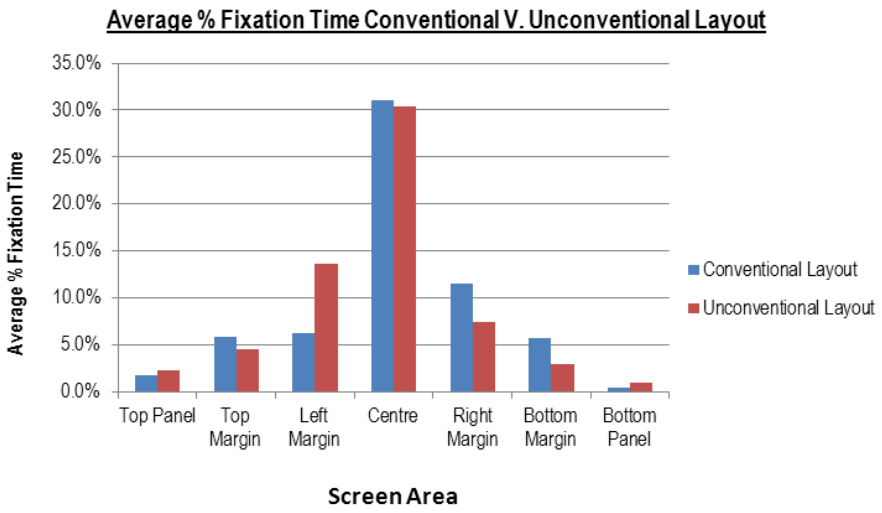

Fig 16 Screen area fixations for layout condition

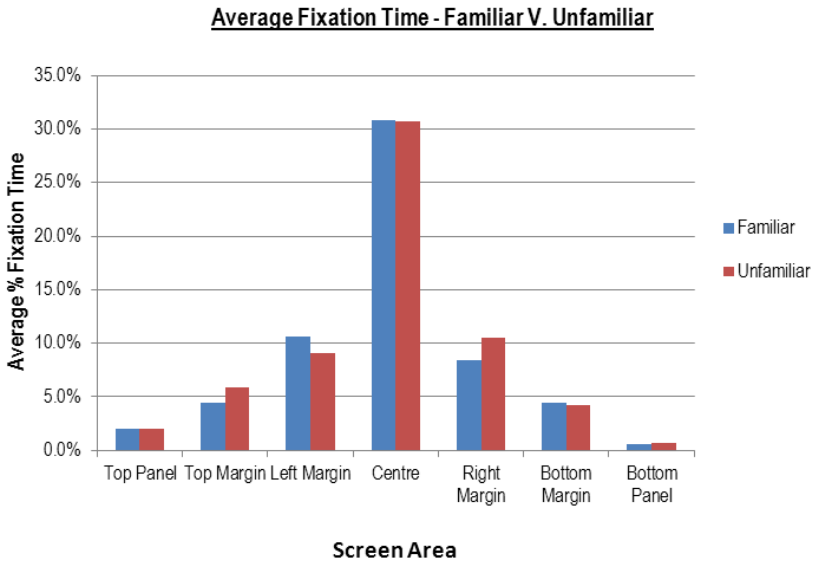

Fig 17 Screen area fixations for familiarity condition

Screen Area Fixation Switching: This was recorded in terms of the number of changes of fixation point between screen areas. Analysis showed no effect for familiarity [$F(1,134)=0.276$; $p=0.6$, $\eta^2=0.002$], A significant effect of medium size was found for layout [$F(1,134)=7.439$; $p=0.007$, $\eta^2=0.053$]. No familiarity-layout interaction [$F(1,134)=1.82$; $p=<0.18$, $\eta^2=0.013$].

Participants demonstrated a higher rate of fixation changes between screen areas when viewing the unconventionally laid out webpages. This is predictable as the higher switching rate may indicate increased search behaviour as participants look for the relocated webpage elements. Plots of screen switching rate over time (Fig. 18) shows a general slowing down which one would expect as participants familiarize themselves with the layout and location of webpage elements.

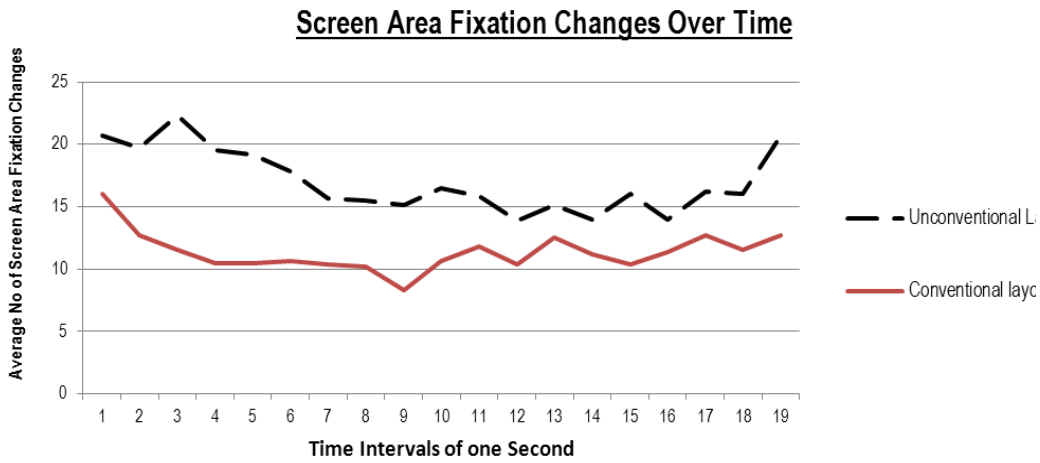

Fig. 18 Screen Area Fixation Changes over Time

Questionnaire: Completed questionnaires were obtained for 73 participants 35 of whom viewed conventional layout web pages and 38 who viewed unconventional layout web pages. The questionnaire scores were calculated in a similar way for each of the questions on the questionnaire. For the question "are you likely to use this banks' online banking services?" responses were scored on a scale of 1 to 5 with 1 for the response "never use" response to 5 for the "definitely use" response. For the "how

much attention?" question responses were scored on the scale 1 to 5 with 1 for the "little attention" response to 5 for the "very good attention" response. For the "percentage of screen content read" question the actual percentage score ticked was used as the response score. For numerical data 2 × 2 (Layout × Familiarity) repeated measures ANOVAs were carried outand $\chi 2$ tests for the frequency data.

Section 2 (willingness to use displayed banks): Significant result and medium effect size found for the effect of familiarity [$F(1,141)=12.801;p<0.001$, $\eta^2=0.083$] (see Fig 19) where participants showed greater willingness to use familiar banks. No main effect found for layout [$F(1,141)=0.231;p=0.794$, $\eta^2=0.003$] was found or evidence of any familiarity-layout interaction [$F(1,141)=0.212;p=0.646$, $\eta^2=0.001$].

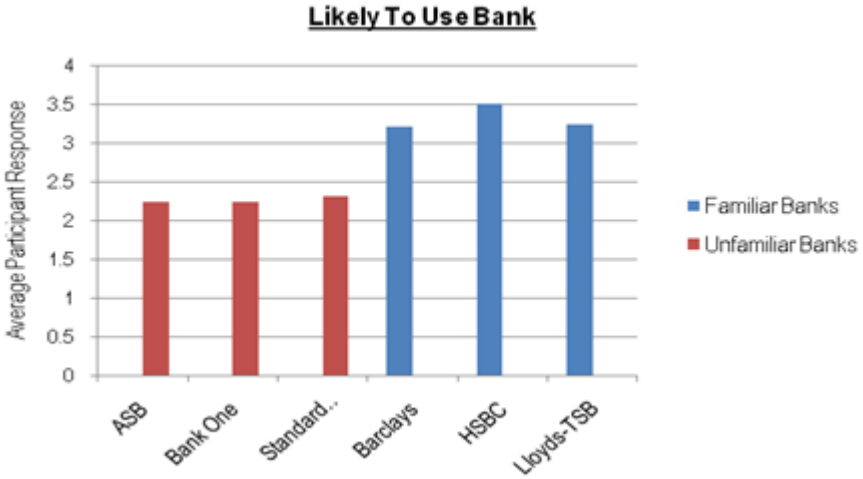

Fig 19. Effect of familiarity upon willingness to use ebank

Section 3 (Attention Level): As suggested in the second hypothesis a significant result and large effect size found for the effect of familiarity [$F(1,217)=191.238;p<0.001$, $\eta^2=0.335$] where participants paid more attention to familiar rather than unfamiliar banks (See Fig. 20). No effect found for layout [$F(1,217)=0.016;p=0.9$, $\eta^2=0.000$] which failed to support the conjecture in the second hypothesis concerning the effect of webpage layout on participant willingness to use a website. No familiarity-layout interaction [$F(1,217)=0.366;p=0.546$, $\eta^2=0.002$].

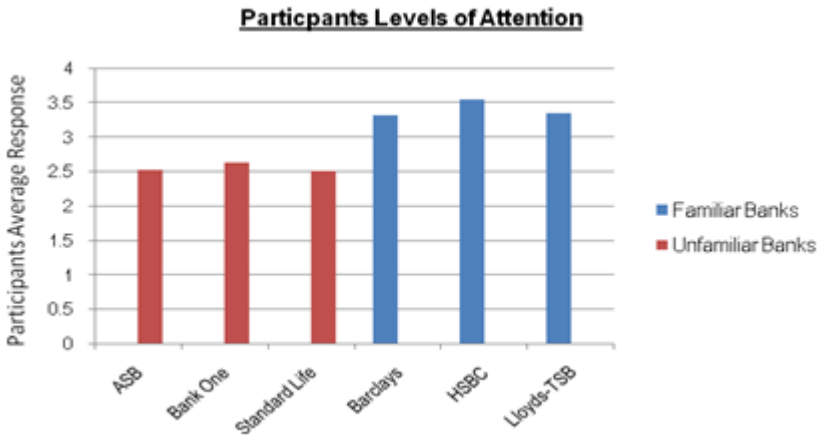

Fig 20: Reported Attention Levels for Familiar-unfamiliar Banks

Section 4 (% of webpage read): Again predicted in the second hypothesis, a significant result and large effect size found for the effect of familiarity [$F(1,217)=64.01;p<0.001$, $\eta^2=0.228$] (See Fig. 21) where participants reported reading more of the contents of webpages of familiar banks. However, as with attention levels no effect found for layout [$F(1,217)=0.455;p=0.501$, $\eta^2=0.002$] or any familiarity-layout interaction [$F(1,217)=0.1.241;p=0.267$, $\eta^2=0.006$].

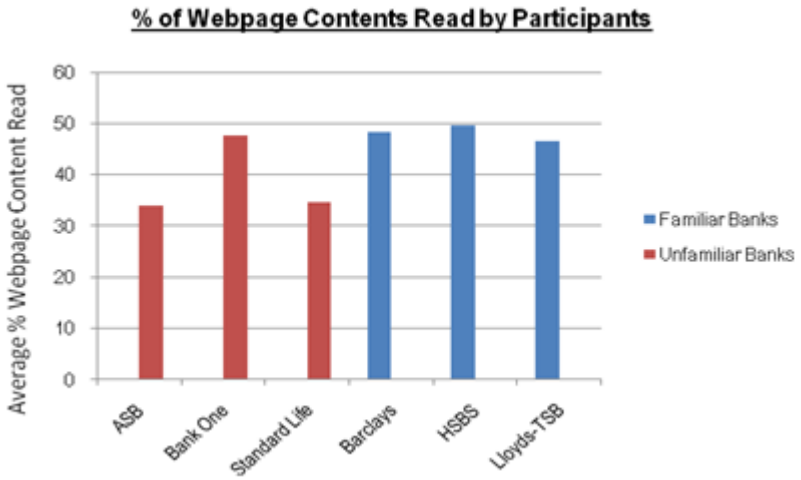

Fig. 21: Reported percentage of Webpage Contents Read for Familiar-Unfamiliar Banks

Section 5 (screen Characteristics): Contrary to expectations, the use of screen characteristics for webpage evaluation was not affected by webpage layout [$\chi^2(8)=7.357;p=0.499$, $\varphi^2=0.00563$]. However, familiarity did affect the use of screen

characteristics for evaluation purposes as a significant effect was found between the two familiarity conditions where participants viewing the unfamiliar ebank webpages reported increased use of these characteristics although the effect size was small [$\chi^2(8)=31.552;p<0.001, \varphi 2=0.027$] (Fig. 22).

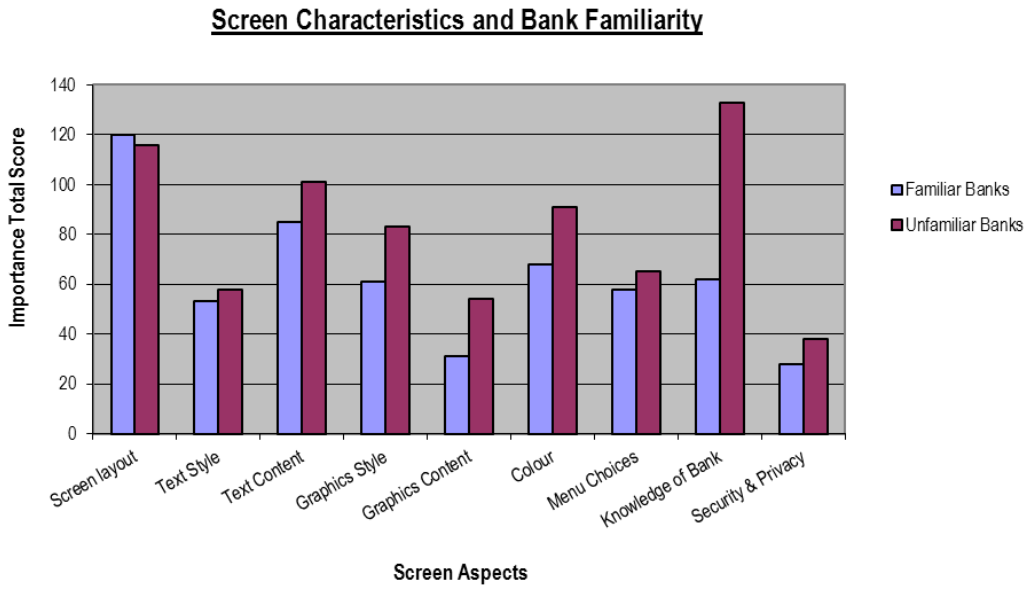

Fig. 22 Total No. Screen Characteristics selected by Bank Familiarity

6.3 Discussion

Eye tracking: As predicted participants spent more time viewing webpages of unfamiliar banks and those with conventional formats supporting the initial hypothesis concerning the effect of familiarity and layout upon fixation times. Departures from usual webpage layouts were found to result in increased eye movement volatility as indicated by the higher switching rates between screen areas. These findings indicate that participants adjusted to the re-location of common webpage elements using the increased eye movements. The slowdown in switching rates over time and the interaction with the layout variable also supports this as it would be expected that the switching rate would slow down as the re-located webpage elements were located. Further support comes from the increased on screen fixation times for unconventionally

laid out webpages as increased time would be required to adjust to the alternative layout. These findings support those of previous researchers (Ahissar & Hochstein, 1996; Van Schaik and Ling, 2001; Wolfe et al, 1989) who found that visual characteristics and spatial layout affect the process of visual search. They provide guidance for website designers who need to consider layout and content when anticipating viewer's requirements and expectations and to assist website navigation by organizing website structure and layout to accommodate them.

Previous work on visual search and familiarity has been mainly confined to search using target and distractor familiarity and positional familiarity (Greene and Rayner, 2001; Pashler, 1988; Wang Cavanagh and Greene, 1994). This study found that familiarity can also affect the amount of onscreen fixation times as it was found that participants spent more time fixating on screen. This was explained as the result of participants spending more time looking for bank identity information and highlights the benefits of marketing in terms of establishing familiarity amongst potential consumers.

Schroeder (1998a) reported that his users initially scanned web pages from left to right in a similar way to reading a book. As they became more experienced this changed to a centre – left – right scanning strategy. Outing and Ruel (2004) found a similar result. On examination of the participant scanpaths this study found a wide variation in the patterns of fixations and scanpaths and little evidence to support a simple left to right scanning strategy. Although participants exhibited horizontal scanpaths these were not consistent but were accompanied by both diagonal and vertical scanpaths. The scanpath trace for participant 53 (see fig. 23 below) who observed conventional layout webpages demonstrate that the majority of saccades were diagonal interspersed with occasional horizontal and vertical saccades. The diagonal saccades are long and appear to be

searching scans, the horizontal and vertical saccades are more localized and indicative of scanning webpage objects (areas of text or graphic images).

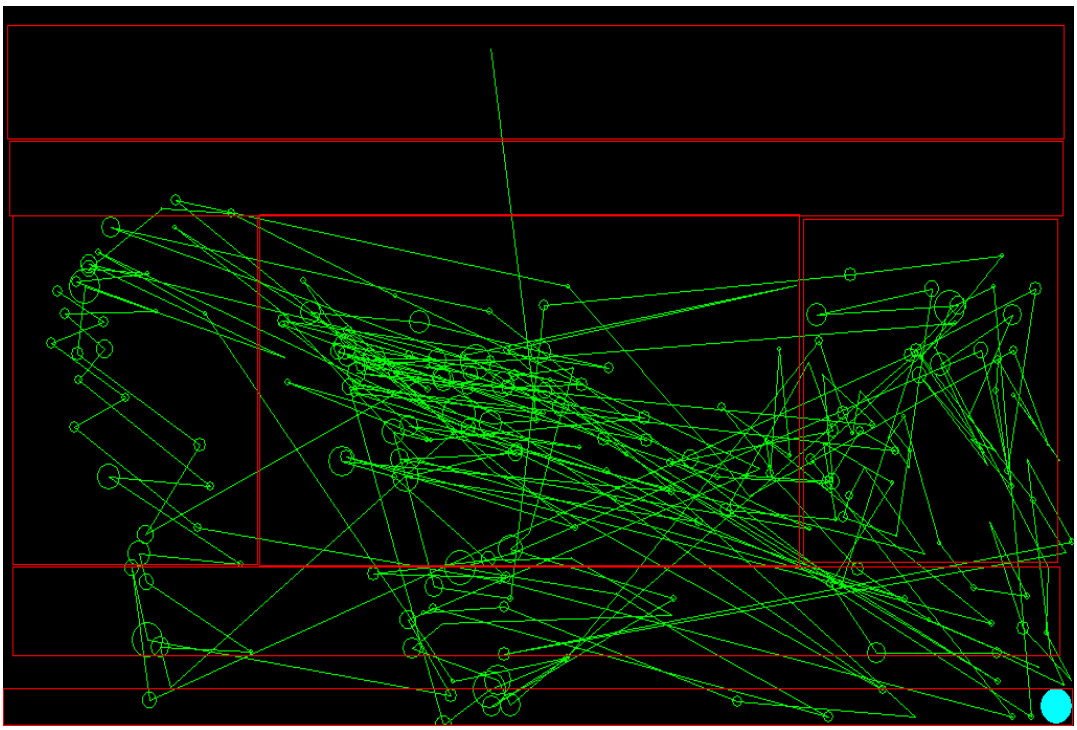

Fig 23 : Fixation and scanpath plot – conventional webpage

Many of the saccades were initially long and diagonal each followed by series of short horizontal saccades in succession down the webpage. This mixture of scanpath directions appeared to indicate that individuals were rapidly moving their gaze to wherever a web page object attracted their attention. This object was then examined before the following long saccade to the next area of interest. Initial fixations tended to begin in the left part of the screen as found by Goldberg et al (2002) but tended not to start in the top of the screen. The findings of Cowan et al (2002) and Tzanidou et al (2005) that differences in webpage content was reflected in differences in fixation patterns was found in this study where patterns for the same participants was found to be different for different webpages viewed.

One surprising result is amount of time spent looking at the privacy/security/policy statements located in the top or bottom margins. As the participants were told that the

purpose of the experiment was for them to give an opinion upon which bank's online services they would use; none appeared to take these details into account when making their decision. Fogg (2003) identifies privacy-policy statements as an important factor in determining web site credibility but also points out that if these are not noticed then they will have no impact upon credibility assessments. As financial sites almost invariably locate these objects in web page margins this has implications for such sites when trying to establish customer trust. Future work should aim to identify which web page objects attract customer attention and which properties they take into account when making such assessments.

Questionnaire: It was hypothesized that both familiarity and layout would positively impact participant's willingness to use the displayed webpages and the way that they attended to and read the webpage contents. The prediction relating to layout was not supported but a significant effect for familiarity was found showing an increased participant willingness to use websites owned by familiar organizations. Similar significant results were found for participants reported levels of attention and percentage of webpage where familiarity led to increased attention and more of the webpage contents being read. Earlier, research by Gefen (2000), Gefen Karahanna and Straub (2003), Gefen and Straub 2004), Huberman (2000) Luhman (2000) was described which highlighted the relationship between familiarity and trust. The results of this study reinforce those findings that increased familiarity led to increased trust. This study also shows that alongside this link, familiarity also led to both increased participants attention to webpage contents and greater amounts of the webpages read.

The inference from these results is that familiarity served to increase participant motivation to read webpage contents. An inference also supported by the predicted findings showing the increased use of webpage characteristics for evaluating webpages

of unfamiliar banks. They show that participants viewing both familiar and unfamiliar ebank webpages used more characteristics such as colour, content organization and menu choices in their evaluation. The difference between the two familiarity groups lies in the extent to which they are used. Participants viewing the webpages of familiar banks relied less on these webpage characteristics for evaluation than those viewing webpages of unfamiliar ebanks. The inference is that where stronger evaluation criteria such as familiarity and reputation are not available, alternative criteria such as webpage characteristics are substituted. A possible confound to these familiarity results was the possibility that webpages produced by smaller banks would be inferior to those produced by larger, more familiar banks employing better designers. For the purpose of this study this problem was removed by using lesser known banks in this country who otherwise have a major presence (ASB Bank is a major New Zealand Bank, Bank One was a major US bank and Standard Life was a major insurance group which opened its own bank which was then sold on to Barclays bank). In the real world of banking it is highly unlikely that the website designers of major banks have any advantage over those of smaller banks. The technologies involved and web design skills used are widely available as are the web design consultancy firms that major corporations use.

Conclusions: Consumers visiting ebank websites for the purpose of conducting business need to examine the contents of that website in order to make decisions concerning the use of the facilities and products on offer. The findings of this study have shown the different effects of familiarity and webpage layout upon consumer perception and consideration of those contents. Webpage layout was found to affect the time spent fixating on different areas of the webpage. Departures from the normal layout resulted in increased eye movement volatility indicating increased search activity whilst participants adjusted to the alternative layout. Familiarity was found to have minor effects upon fixation times but more significant effects upon consideration

of webpage contents. This result supports those of Gefen (2000) and Gefen and Straub (2004) that identify familiarity as occupying a key role in the creation of trust and subsequent determination of user intentions since participants identified familiar banks as ones that they would preferentially use. The results also identify the use of heuristics such as familiarity and layout in the evaluation of websites, a factor raised by Sillence et al. (2004) who found that users having low involvement with web sites accessed tend to use affect, attractiveness or other simple heuristics to assess their contents.

Examination of the eyetracking movements revealed no evidence of an organized visual search strategy although the diagonal saccades noted were found by Najemnik and Geisler (2004) to be the ideal search patterns for ensuring optimized visual search

There are some issues with this study. Although the basic screen layout was the same for each of the test web pages, differing levels of screen complexity in terms of the ratio of text to graphics were apparent between individual bank web pages. This was considered acceptable as it balanced out for the purpose of comparing overall conventional and unconventional web page layouts as conventional-unconventional layouts had the same content. It could also be justified in terms of establishing an accurate real-life context in which to carry out the study. A further question arises concerning the mental workload imposed by different web pages. Pan et al (2004) point out that visual scan path is determined by the structural and visual complexity of web page contents but that this is also dependent upon the mental workload imposed when viewing the web page. Determination of "mental workload" is problematic in that it depends on many factors including the overall screen layout, textual and graphical content, aesthetic properties and the semantic content or what the content means to the user. Granholm et al (1996) and Dionisio (2001) suggest that measurement of mental or cognitive load can be accomplished using pupillary dilation and this offers a way in

which further research can accommodate this factor. More important are the criticisms that have been directed at the use of eye-tracking technology as questions have been raised concerning its validity and utility. Schroeder (1998b) point out that eye-tracking cannot identify whether participants actually ”see” something they fixate on or determine why they fixate on particular screen objects. Similarly, eye-tracking does not give any measure on information which may be gained by participants from peripheral vision on screen areas outside the fixation area or why a participant fixates on a particular point. Despite this, eye-tracking has the benefits that it enables direct comparison of participant scanning strategies both on and off screen and identifies areas of visual interest to participants.

In this chapter we found only a limited relationship between the participant factor of familiarity and webpage factor of layout. In next chapter we will again examine the role of webpage layout in participant perception of webpage contents together with the additional participant factor of involvement. According to predictions from Fogg’s (2003) PI Theory and the Dual Process theories of attitude formation involvement has been described as exerting significant effects upon user perception and consideration of webpage contents. The aim of this study will be to determine the extent of this effect and whether it interacts with participant webpage viewing strategies.

Chapter 7

Study 3 - The Effect of User Involvement Level and Webpage Layout on Observer Eye Movements and Website Assessments

This study described in this chapter examines the role of involvement in user assessment of ebank websites. The hypotheses were that webpage layout and user involvement would impact both user viewing and assessment of displayed webpages. The hypotheses predicted firstly that unconventional webpage layout would result in increased volatility of eye movements, less efficient search strategies and lower webpage ratings. Secondly that high participant involvement would result in more critical consideration of webpage contents, lower ratings and poorer recall of webpage contents. Results partially supported the involvement hypothesis; although no effect on webpage viewing strategies was found increased involvement led to more critical consideration of displayed webpages and lower user evaluation ratings. However, no differences were found between evaluation ratings and webpage viewing strategies for the different webpage layout groups. User recall of webpage information was uniformly poor with no differences between groups.

7. Introduction

The previous study examined the role of webpage layout and familiarity in the viewing and evaluation of webpage contents. The results showed that familiarity with the bank and conventionality of webpage layout affect both participants viewing strategies for reading the webpage, the criteria they use to evaluate webpages contents and their willingness to use the services of the displayed bank. In this chapter this will be extended to examine the role of user involvement.

Earlier, we outlined the role of user involvement in the dual process theories of attitude formation proposed by Petty and Caccioppo (1979a, 1979b, 1984) and Eagly and Chaiken (1993). These theories together with the Prominence-Interpretation (PI) theory forwarded by Fogg (2003) highlighted user involvement as being significant in the perception and consideration of presented information. Fogg's PI theory describes user

involvement as one of the factors in the Prominence process responsible for the perception of presented information. In the dual process theories involvement is described as affecting the level at which presented information is considered. High involvement results in information being considered more deeply and low involvement results in information being given superficial consideration.

In this study we will look at the effects of both involvement and webpage layout on user perception of webpage information. Unlike the previous study, the participants were given specific tasks designed to create differing levels of involvement. This were achieved by allocating different amounts of money to participants with the higher amounts geared to create greater involvement. Their task was to examine several displayed ebank webpages and select the ebank in which they would invest the money in order to achieve the maximum return on the investment. Assessing the level of user involvement can be difficult due its dependency on subjective factors such as prior experience, level of ability, situational factors and the degree of personal relevance. Previous research has tended to measure individual responses using questionnaires, think aloud ratings or attitude scales. Pupillary diameter has been used in the past to assess cognitive effort. Studies carried out by Beatty (1982); Beatty and Lucero-Waggoner (2000); May et al (1990); Salojarvi et al, (2005); Salojarvi, Puolamaki, and Kaski (2005); Granholm and Verney (2004); Dionisio, Granholme, Hillix and Perrine (2001); Minassian, Granholm, Verney and Perry (2004); Backs and Walrath (1992) all found that pupillary diameter provided an effective measure of cognitive load. In contrast, other studies such as that by Lin, Zhang and Watson (2003) failed to find evidence to support the use of pupillary diameter in this context and Van Gerven at al (2004) found that pupillary diameter was not an effective indicator of memory loading in older participants. Despite these ambiguous results on the dependability of pupillary diameter as an indicator of level of arousal and cognitive activity there is a considerable

amount of research that provides evidence to justify its use in this context as an alternative to attitude scaling.

Using a general definition of involvement as the level of attention displayed by internet users, this study aimed to examine its effect upon both user perception of web pages information and its subsequent evaluation. Eye tracking methods were used to measure and record eye movements and pre and post webpage display questionnaires to investigate participant's evaluation and recall of presented information. The hypotheses for the eye-tracking part of the study were that participants with differing levels of involvement would adopt different webpage scanning strategies and demonstrate differences in eye movement volatility, scanpath length and pupillary diameter. Specifically it is predicted that higher involvement participants will adopt more efficient search strategies characterized by longer scanpaths and greater fixation times. They are also expected to display greater cognitive effort characterized by increased pupillary diameter. For the conventional and unconventional layout groups it is predicted that participants viewing conventionally structured webpages are expected to exhibit longer scanpaths and increased eye movement volatility looking for the required information.

Once again a questionnaire was used to determine subjective evaluations of the banking webpages displayed and their recall of the information presented. It is hypothesized that high involvement and unconventional webpage layout will result in lower willingness to use ratings for those webpages as participants in those groups are likely to be more critical of the webpage and its contents. It is also expected that as a consequence of lower willingness to use assessment, participants in the high involvement and unconventional layout groups will demonstrate poorer recall of interest rate details.

7.1 Method

Design: For this study a two factor between subjects experimental design was used. The independent variables were conventionality of webpage layout and high-low levels of participant involvement. One group of participants viewed the web pages constructed with an unconventional layout where major webpage elements were moved from their usual location; the other group viewed the web pages constructed with a conventional layout. Within these two layout groups a set of participants was assigned to a high level of involvement group and another to a low involvement group. The dependent variables for the eye tracking component were: pupillary dilation, scanpath length, screen area fixation times and eye movement volatility measure (the number of fixation switches between designated screen areas/objects). For the questionnaire component, the dependent variables were participant responses captured included use of internet banking websites; online purchase of goods and services; recall of webpage contents and willingness to use assessment of individual bank webpages.

Participants were allocated to the four experimental conditions detailed in table 11 below using random numbers generated from the www.random.org website. To eliminate webpage presentation order effects participants were assigned to one of six possible webpage presentation orders using random numbers in the range 1- 6 using generated from www.random.org website Documentation comprised ethics form, participant instructions; consent form and debriefing document (Appendix 5),

Group	Between Subject Factor 1	Between Subject Factor 2
Group 1	High Involvement	Conventional Layout
Group 2	High Involvement	Unconventional Layout
Group 3	Low Involvement	Conventional Layout
Group 4	Low Involvement	Unconventional Layout

Table 11: Study 3 Experimental Conditions

Participants: An opportunity sample of 100 participants of both sexes (age range 18 – 30) was recruited from staff, students and visitors to Northumbria University.

Materials: Materials comprised 6 constructed web pages for non-existent internet banks using information trawled from existing internet banks. Documentation comprised ethics form, participant instructions, consent form and debriefing document (Appendix 5), a set of 6 web pages constructed from information gathered from the bank web sites (Appendix 5), the pre and post display questionnaires (Appendix 5) and a table of web page presentation orders. Text within the web pages used the same font and font size. Additionally the ratio of text to graphics areas was the same for all displayed web pages. The participant instructions varied for the two involvement groups by having two different amounts of money to invest into the displayed internet banks. The amount of money available for investment was £50,000 for the high involvement group and £100 for the low involvement group, the higher amount being geared to engender greater participant involvement. The bank web pages displayed were three constructed unfamiliar banks (DBS –Digital Banking Services, IBS – Internet banking Services and WBS – Web Banking Services). The web page organization was based on the template derived from a preliminary survey on online UK banking sites and followed that described for study 2 with the exception that the central webpage area was divided into two parts – a centre left and a centre right area.

The same information was included for both conventional and unconventional layouts but was relocated within each web page: the top margin information was moved to right margin, left margin information moved to the bottom margin and bottom margin information moved to the top margin; graphical and textual information in the centre

left and centre right areas were swapped in order to monitor fixation times on the textual and graphical information and determine whether it is location specific.

A Visual Basic program was written which opened the internet browser and loaded the web pages using a parameter file and displayed them in random order for the required 30 seconds display time.

Eye-Tracking: Eye-tracking was accomplished using the IviewX eye tracking system as in study 2.

Questionnaire: The questionnaire differed from that used in study 2 in that it comprised 5 sections of which sections 1 to 4 were completed by participants prior to their viewing of the bank webpages whilst sections 5 and 6 were completed after the viewing of the webpages. The additional two pre-webpage display sections captured participant's responses concerning their general internet usage and views on internet banking. The post-webpage display sections examined participant's willingness to use ratings for the displayed webpages and their recall of interest rate and security information (Appendix 5).

Procedure: Participants were allocated a number made up from their sequence number together with codes indicating their allocation to the two involvement and two layout groups. This code was used to label the data files in the event of participant withdrawal from the study. Allocation to the high/low involvement and conventional /unconventional layout groups and the determination of bank web page presentation order was accomplished by generating a random sequence of numbers in the range 1-12 using the www.random.org website and allocating the participants sequentially a number in this random sequence. Each number corresponded to one the 3 possible bank presentation orders for the four condition alternatives displayed in the table above. This

order is shown in appendix 5. Participants were given the appropriate set of instructions (appendix 5). The low involvement group was told that they have £100 to open a deposit account; the high involvement group was told that they have £50000 to open a deposit. The effect of the differential amount aimed to increase the level of personal relevance and hence the motivation participants have to read web page contents. They were to view the web pages and on the basis of the information viewed to assess their suitability for investing the money.

Participants were given the questionnaire and asked to complete the pre-webpage display questions in questionnaire sections internet usage to internet banking and allowed unlimited time to complete the questions. The participants were asked to rest their chin onto a chin rest approximately 28 inches from the display monitor. The eye tracking camera was located below and to the left of the participant eye line so as not to interfere with the participant's view of the display. The participants left eye was tracked and no participant had any visual defect which may have affected results. Following calibration of the equipment for each participant each bank web page was displayed for 30 seconds each during which time their eye movements were tracked and recorded for later analysis on the operator PC.

At the end of the display period each participant was immediately given the post webpage display questionnaire for completion (bank webpages and interest rate and security details sections) and again allowed unlimited time for completion; any questions they were unable to answer were to be left blank. Following completion participants were given an end of experiment explanatory sheet and debriefed to explain the purpose of the study and to give them the opportunity to comment.

7.2 Results

The results of six participants were not used due to corruption of the data files or failure of the tracking camera to maintain lock onto participants' eyes.

Eye-Tracking: The eye-tracking equipment recorded the fixation points for each of the 50 values per second sampling rate (average 4500 samples per web page) and was given in terms of pixel coordinates for the 1078 x 768 screen display. Pupillary diameter was given in terms of the vertical and horizontal pixel values of a bounding box of pupil size for each recorded sample. These were averaged to give an average value for each 30 second display period. The eyetracking fixation data was analyzed using the iViewX analysis software which provided percentage fixation times for each defined screen area. Screen area switching rates were calculated by counting the number of switches of fixation between screen areas for each one second period over the 30 second display period. The binary data for scanpath lengths comprised a series of fixation points which was converted into decimal format. The distance between successive fixation points was then used to calculate average scanpath lengths. Scanpaths starting or finishing off screen were discarded as the eye-tracking system was unable to extrapolate accurately fixation points outside of the calibrated screen area. Both fixation data and scanpath and pupillary data were entered into an eyetrack spreadsheet.

Analysis of the data comprised 2 × 2 (Layout × Familiarity) ANOVAs for the numerical data and χ^2 tests for the frequency data.

Screen Areas Fixation Times: Analysis revealed no main effects due to either involvement level [$F(1,90)=0.071$; $p=0.791$, $\eta^2=0.001$] or layout [$F(1,90)=0.159$; $p=0.691$, $\eta^2=0.002$]. An interaction of large effect size was found between involvement level and layout [$F(1,90)=4.317$; $p=0.0.041$, $\eta^2=0.045$] (see Fig. 36).

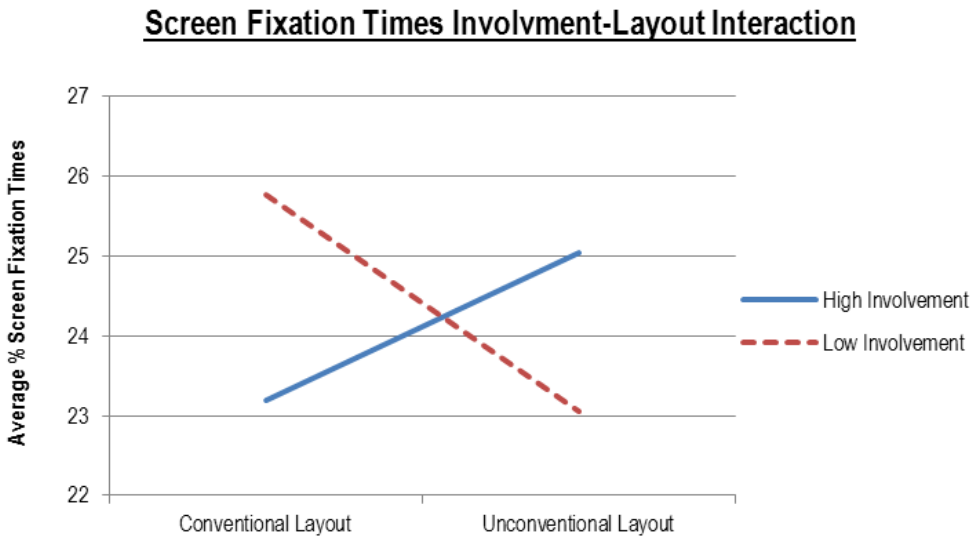

Fig 36 – Screen Fixation Time Involvement-Layout Interaction

For those participants in the high involvement group, average on screen fixation time was lower when viewing conventional layout webpages (23% of time) than when viewing unconventional layout webpages (25% of time). In contrast, the average on-screen fixation times for participants in the low involvement group was higher when viewing conventional layout pages (26% of time) and lower when viewing unconventional layout webpages (23% of time).

Differences in fixation times between individual screen areas were noted (see Fig. 37) where fixations were located primarily in the top margin (10.4% viewing time), left margin (13.9% viewing time) and centre left are (16.7% viewing time). Participants spent less than 8% viewing time in each of the other screen areas.

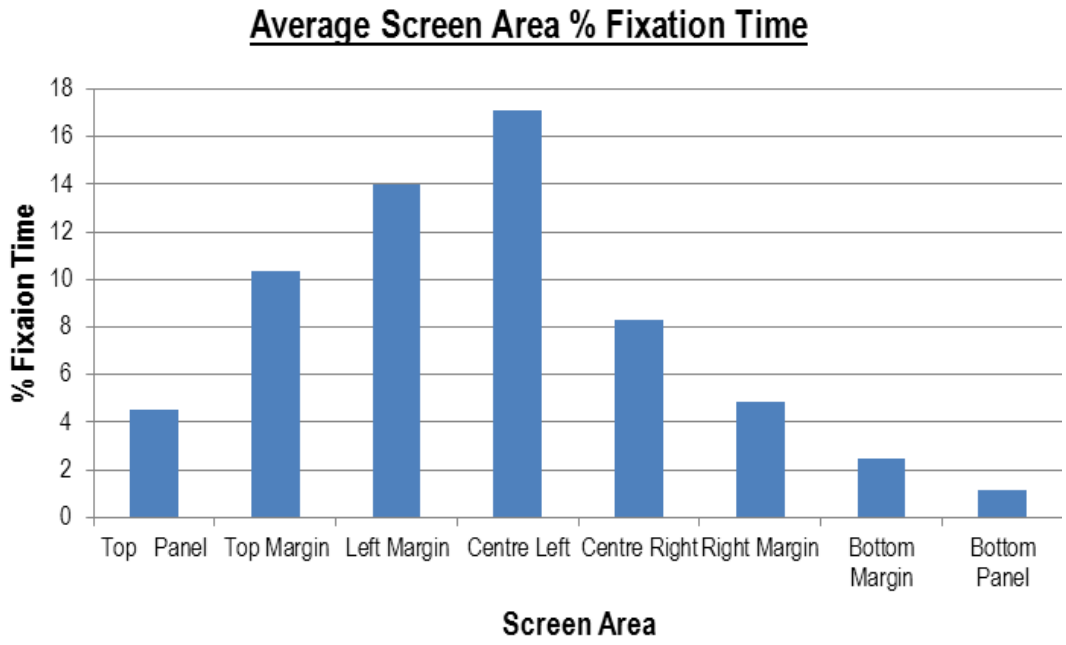

Fig. 37: Average screen area % fixation times

Graphics Area Analysis: Analysis of time spent viewing the graphic areas within webpages showed no effect of involvement [$F(1,90)=2.726;p=0.102$, $\eta^2=0.029$ or layout [$F(1,90)=0.654;p=0.321$, $\eta^2=0.007$] and no interactions were present [$F(1,90)=0.098;p=0.755$, $\eta^2=0.001$].

Eye Movement Volatility: For the screen area fixation switching rates no significant effects were found for the involvement [$F(1,90)=0.419;p=0.519$, $\eta^2=0.005$]or layout [$F(1,90)=1.242;p=0.268$, $\eta^2=0.014$] conditions, no interaction was found [$F(1,90)=0.119;p=0.731$, $\eta^2= 0.001$].

Scan Path Length Analysis: No main effects were found for either involvement [$F(1,90)=0.197;p=0658$, $\eta^2=0.002$] or layout [$F(1,90)=0.66;p=0.419$, $\eta^2=0.007$] and no layout-involvement interaction was found [$F(1,90)=0.012;p=0.912$, $\eta^2=0.000$].

Pupillary Diameter Analysis: No significant effects were found for involvement [$F(1,90)=0.071;p=0.791$, $\eta^2=0.001$] or layout [$F(1,90)=0.159;p=0691$, $\eta^2=0.002$]. An

interaction with large effect size was found between involvement and layout [F(1,90)=4.371;p=0.041, η^2=0.045 (Fig. 38).

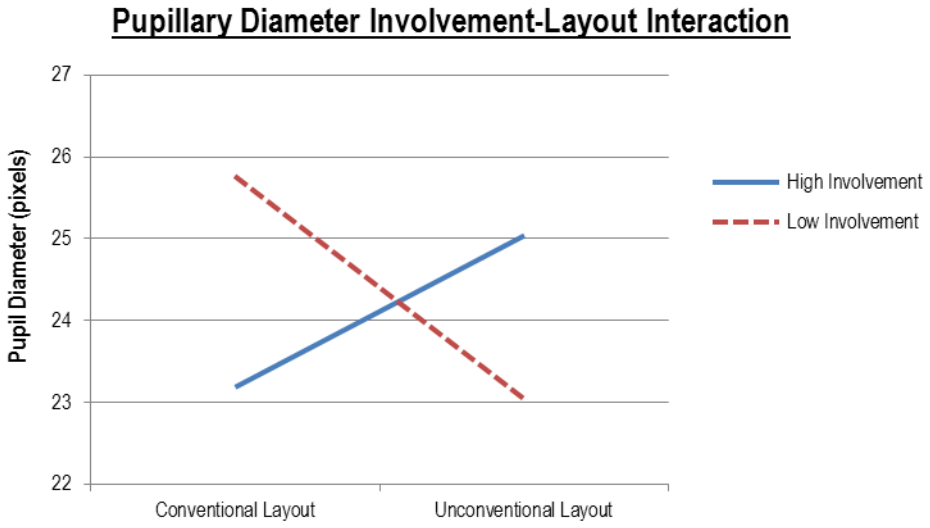

Fig. 38: Average pupillary diameter for Involvement conditions

For participants in the high involvement group, average pupillary diameters were smaller when viewing conventional webpages and larger when viewing unconventional webpages whereas participants in the low involvement group had larger pupillary diameters when viewing conventional webpages than when viewing unconventional webpages. Explaining this result is difficult but may be due to high involvement participants expending more cognitive effort searching for information in unconventional layout webpages. Those in the low involvement condition spent less effort searching the unconventional layout webpages as they had made an initial evaluation to discount information on these webpages. Overall, these results failed to support the hypothesis that pupillary diameter would be larger for the high involvement group.

Scanning Strategy Analysis: The scanning strategy analysis is purely descriptive. The results are mixed as participants displayed a wide variability in the way in which the web pages were scanned. In order to determine whether any common strategies were

detectable the scanpaths of each participant were examined over time and a print taken of the overall scan paths for each 30 sec interval over which the web pages were viewed. Despite a wide variability in scanning strategies an examination revealed that many of the participants displayed diagonal scanpaths from the top left of the screen towards the bottom right in a zigzag pattern. A typical example is shown below:

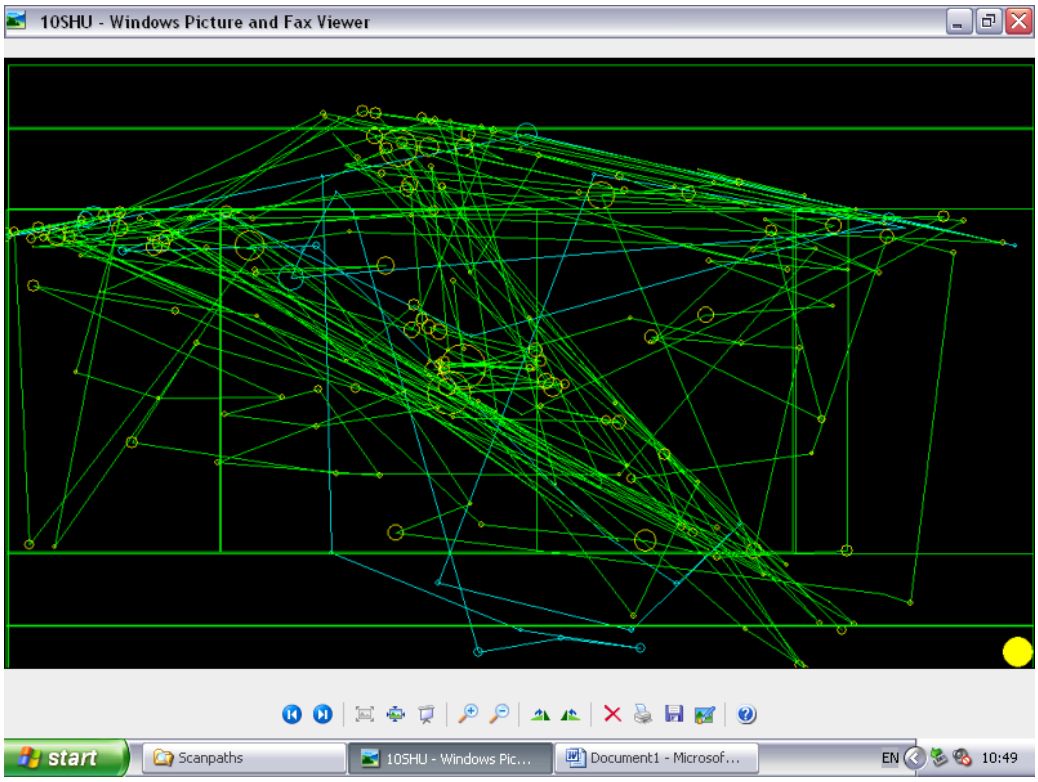

Fig. 39 – Representative scanpath plot

Counts of scanning strategies adopted are shown below in table 12 shows that 70% of participants showed evidence of diagonal scanpaths whilst 60 % adopted it as their main scanning strategy.

Table 12 – No of Participants showing specified scanpath directions

	No. of Participants Showing Scanpath Directions					
	Vertical	Horizontal	Diagonal	Half vertical Half Diagonal	Half Horizontal Half Diagonal	Half Horizontal Half vertical
Participant Counts:	4	8	53	1	10	13
% of total	4.5	9.0	59.6	1.1	11.2	14.6

Questionnaire: The pre and post display scores for each participant were entered into a questionnaire results spreadsheet. For the questionnaire data scores were calculated within the ranges 1 to 5 corresponding to the scores given by the participants on the questionnaire with a mid-point score of 3. A score of 1 showed strong disagreement with the statement posed by the question and a score of 5 showing strong agreement. Many participants failed to complete all parts of both questionnaires because they were unsure of the answer and these were treated as not known responses. The questions concerning recognition of the banks in the Bank Webpages section were not included in the analysis of that section as they were not relevant to the credibility and trust effects being measured. The average scores in the result tables and charts took account of these omissions.

Willingness to Use: No effect was found for layout [$F(1,93)=0.059;p=0.808$, $\eta^2=0.001$] or any involvement-layout interaction [$F(1,93)=0.15;p=0.699$, $\eta^2=0.002$]. A significant effect of medium size was found for involvement [$F(1,93)=6.45;p=0.013$, $\eta^2=0.065$] where participants in the low involvement group showed greater willingness to use the displayed ebanks.

Willingness to Invest: No effect was found for layout [$F(1,93)=0.605$; $p=0.439$, $\eta^2=0.006$] or any involvement-layout interaction [$F(1,93)=0.016;p=0.9$, $\eta^2=0.000$]. a significant effect of medium size was found for involvement [$F(1,93)=4.665;p=0.033$, $\eta^2=0.048$]. Again, participants in the low involvement group showed greater willingness to invest in the displayed ebanks.

Willingness to Borrow: No effect was found for layout [$F(1,93)=0.169;p=0.682$, $\eta^2=0.002$] any layout-involvement interaction [$F(1,93)=0.426$; $p=0.516$, $\eta^2=0.005$]. Again a significant effect of medium size for involvement was found

[F(1,93)=4.424;p=0.038, η^2=0.045] see Fig 40. As with the previous 2 questions low involvement participants showed greater willingness to invest in the displayed ebanks.

For all the willingness to use questions it was found that members of the low involvement group showed higher scores than those in the high involvement group (see Fig. 40). The reason for this appears to be that members of the high involvement group were more critical in their evaluation of the displayed webpages resulting in less willingness to use the services of the displayed banks.

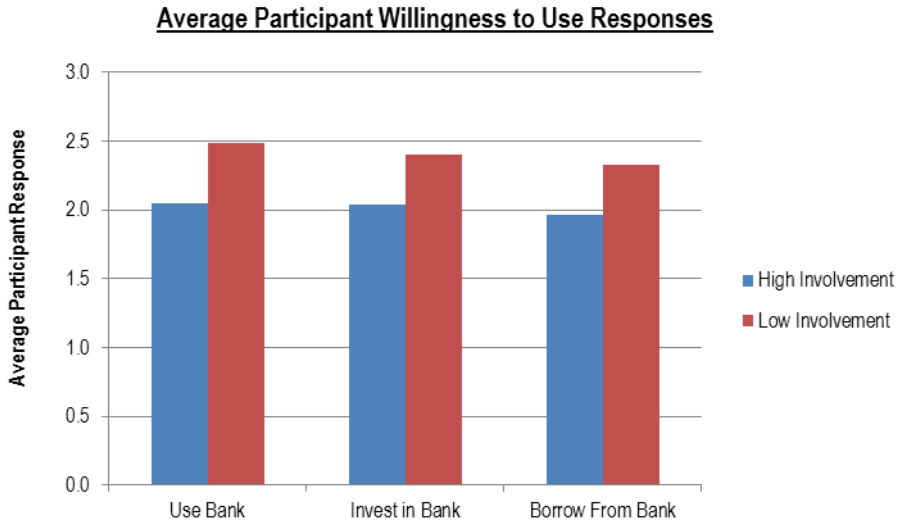

Fig. 40 – Average participant willingness to use responses

Interest Rate and Security Recall: X^2 analysis found no significant results for the lowest interest rate questions between the involvement [X^2(1)=0.066;p=0.797, Φ^2=0.64] or layout groups [X^2(1)=0.353;p=0.552, Φ^2=0.31].

For the highest interest rate question no effect was found for involvement [X^2(1)=2.203;p=0.138, Φ^2=0.81]. A significant relationship of small effect size was found for layout [X^2(1)=4.905;p=0.027, Φ^2=0.018] where participants viewing the conventional webpages were more accurate (conventional layout - 29% accuracy; unconventional – 24.5% accuracy) in their recall of which bank offered the lowest interest rate.

For the security information question no effect was found for involvement [$X^2(1)=0.04;p=0.841$, $\Phi^2=0.000$] or layout [$X^2(1)=0.892;p=0.345$, $\Phi^2=0.003$].

Participant recall of the information contained within the webpages was uniformly poor with recall accuracy rates for interest rates below 30%. The recall accuracy rate for webpage security was higher but still below 50% (sees Fig 44 below). X^2 analysis showed that layout had no effect whereas high involvement resulted in a significantly improved recall rate although the involvement effect size was small.

Post Experimental Verbal Comments: Although no participants entered explanatory comments for their responses onto the questionnaire sheets, just over half of them passed verbal comments on the displayed webpages following completion of the post-display questionnaire. These were noted and although their nature varied they could be categorized into 8 general areas of which a summary is outline in table 13 below

Table 13 – Participants verbal comments made post testing

Comment	Positive Comment	Negative Comment
Bank Recognition	5 reported recognizing Banks	29 reported not recognizing banks
Webpage Design	19 considered them professional	19 considered them unprofessional
Layout & contents	10 reported good layout and contents	5 reported poor layout
Information content	21 reported webpages contained too much information	
Trust and Security	15 positive trust and security related comments	11 negative trust and security related comments
Graphics		1 negative comment
Too commercial		1 negative comment
Information clarity	3 positive comments	2 negative comment

The most common comment was that none of the banks were recognized and this was often given as a reason for not using the bank. This finding adds additional support to the results in the second study which found that participant familiarity with a bank was a significant factor in their decisions to use that bank. The next most common comment was on the "professionalism" of the webpage which was associated with their views on website design. When asked to clarify, many participants were unsure but felt that they meant the realism or what they expected an ebank website to look like and as such many of the comments were associated with additional comments such as good layout and ease of reading contents. It is interesting to note that all webpages used received approximately the same number of professional-non-professional descriptions. Although most participants were happy with the contents and layout 20% of participants felt that there was too much by way of informational and graphic content. The next most common comment referred to participant's view of the website security and whether they would trust it. All displayed webpages contained security information and logos this failed to convince all participants of the security of the website and few reported that they would trust or use any of the banks displayed.

7.3 Discussion

Eye tracking: One of the hypotheses of this study was that increased participant involvement would lead to increased pupillary diameter reflecting the increased cognitive load upon participants. This would be accompanied by longer scanpaths and greater fixation times as participants sought and concentrated on the webpage information appropriate to the task they had been given. Conversely, low participant involvement would be expected to spend less time looking for pertinent information, less consideration of webpage contents and greater use of webpage characteristics for evaluation purposes. The effect of this upon participant eye movements would be to

display less search behaviour characterized by shorter scanpaths, increased eye movement volatility, smaller pupillary diameters and shorter fixation times. Although no direct effects were found for involvement level or layout on these measures, interactions were found between involvement level and layout for both screen area fixation times and pupillary diameter.

For the screen area fixation times, those participants in the high involvement group demonstrated higher onscreen fixation times when viewing conventional layout webpages than when viewing unconventional layout webpages. Conversely, participants in the low involvement group demonstrated higher onscreen fixation times when viewing unconventional layout webpages than when viewing conventional layout webpages. A possible explanation for this effect is that participants in the high involvement were better motivated to search for information in the unconventional layout webpages and accordingly spent more time viewing them. On the other hand, participants in the low involvement group were less motivated and spent less time viewing the unconventional layout webpages for the required information.

The pupillary diameter interaction finding was the result of participants in the high involvement group showing smaller average pupillary diameters when viewing conventional webpages and larger than when viewing unconventional webpages. Participants in the low involvement group had larger pupillary diameters when viewing conventional webpages than when viewing unconventional webpages. Explaining this result is difficult but may be due to high involvement participants expending more cognitive effort searching for information in unconventional layout webpages. For both interaction results further study is required to determine whether they are due to overall changes to the standard website layout, a consequence of the relocation of specific items

of information i.e. interest rate details or differing levels of motivation amongst participants.

The lack of definitive results between the on-screen fixation times and pupillary diameter due to involvement or layout may have several possible explanations. Firstly, any differences in fixation times may only be detectable when comparing relevant screen objects, particularly those containing deposit interest rate information. Secondly, the level of involvement condition failed to increase participant motivation and consequently their involvement. Thirdly, the nature of the task did not incur a sufficiently high level of cognitive load in the high involvement group to be detectable by eye-tracking measures. Finally, that confounds may have been operating that reduced any effect due to level of involvement. Possible confounds to the pupillary diameter measures were identified by Goldwater (1972) in his discussion on the psychological significance of pupillary movements. He pointed that pupillary responses are affected by factors other than illumination levels such as aesthetic qualities of stimulus images, affective images or words, pre-stimulus images and autonomic variables such as cardiac and respiratory rate. Many previous studies appear not to control for these factors as most are participant specific and as such are difficult control. One possible way to minimize the effects of these factors would be to present affectively neutral images to obtain a "resting" value for pupillary diameter against which later values can be compared. Accordingly, future studies to test pupillary diameter against involvement should not only aim to control for these confounds but also ensure that the experimental paradigm is sufficiently credible to invoke a measurable level of involvement.

The finding that scanpath length was unaffected by both layout and involvement conditions may be due to three factors. Firstly, the differing number and length of

fixations for different participants; secondly, the variability in scanpath distance between fixations and finally, the differing amount of time participants spent fixating off screen. These factors are difficult to control as they are a result of individual differences between participants. Despite this some common scanpath strategies were observed. The majority of participants displayed either mainly diagonal strategy starting from the top left of the screen and moving to bottom right or elements of diagonal scanning in between horizontal and vertical scans. This echoes the findings of Najemnik and Geisler (2004) on optimal search patterns and lends support to the Scanpath Theory (Noton and Stark (1971a, 1971b), which predicts that participants build cognitive representation of pre-viewed images such as web pages which direct future scanning of those or similar images.

The eye movement volatility analysis gave results similar to that found for study 2 although no significant effect for layout was found. Switches of gaze between screen areas slowed over time which was expected as participants familiarized themselves with the webpage layout and content and extracted the in interest rate information they were looking for. The lack of a significant effect for layout may be explained by the fact that the two studies used many of the same participants who rapidly adjusted to the unconventional layout having experienced it before.

Participant attention, in terms of their fixation times in individual screen areas, indicated that their attention varied between screen areas. Comparison of the two experimental conditions showed that the high involvement and conventional layout groups both spent significantly more time viewing all of the defined screen areas supporting the view that conventionality of layout and increased involvement has a positive effect on the overall viewing of pages. Those areas attracting most attention were the top margin, left margin and centre left areas. The results for these areas were common to both layout and

involvement conditions indicating that for these areas location is more important than content.

The main graphics areas were located in the centre right area for the conventional layout webpages and were switched to the centre left area for the alternate condition. Participants in the unconventional layout group did spend more time viewing the graphics areas, however as previous measures showed that participant interest tends to be directed towards the left side of webpages this would account for this result.

Questionnaire: It was predicted that high user involvement would result in a more critical approach to webpage assessment resulting in lower willingness to use the banks displayed and improved recall of interest rate information. The questionnaire data confirmed expectations concerning participant willingness to use the websites as the low involvement participants gave higher willingness to use ratings than high involvement participants. This result was also reflected in the willingness to invest or take a loan from the displayed websites where participants in the high involvement group score lower than those in the low involvement group. Accordingly, it may be concluded that the involvement factor led to more critical evaluations which led to lower willingness to use ratings to the displayed webpages. Unfortunately this gives no indication as to the assessment criteria used or what differences in webpage characteristics or contents were perceived by members of the two involvement groups and further research is required to clarify this matter.

The results for the recall questions showed that many participants performed poorly at this task. The only significant difference was found for recall of the highest interest rate between the two layout groups where those viewing the conventional layout webpages scored higher than the unconventional layout group. This result is probably attributable to participants viewing the conventional layout webpages finding the required

information more easily than those having to search an unfamiliar layout webpage. Overall recall accuracy was poor. That for highest interest rate was less than 25%; for the lowest interest rate it was than 30% and for security information was under 45%. The reason for these results is not clear. Possible causes may be the total amount of information on the webpage causing overload, difficulty in locating the interest rate information, information from other webpage elements distracting viewer attention from interest rate information or viewer memory limitations. A clue to this is contained in participant post experimental comments where 21 of the participants reported that they felt the webpages contained too much information to be read in the time allowed. This highlights problems confronted by all internet users who have to locate web sites containing relevant information and then evaluate that information and differentiate between good and poor quality information.

The question of viewer website evaluation criteria was addressed in the pre-display questionnaire where participants were asked for their views on their internet usage and internet banking. The results show that their primary internet usage is for email and information seeking purposes rather than the purchase of goods and services, although most would be prepared to give financial details and make purchases online. Their responses highlight two possible reasons for this lack of online purchasing. Firstly there is the problem of internet security as most participants reported that they are careful which sites they visit and that they would only make purchases from known companies; a response reflected in their later post experimental comments. Similarly, they also have credibility issues concerning the accuracy and clarity of information obtained from such web sites. Surprisingly, despite these misgivings, the majority report that they tend not to seek advice on which sites to visit and more than half fail to regularly check web site security and web site policy statements or read all web page contents. When asked which web page qualities affect their overall assessment of web sites most participants

identify layout, text style and amount of information displayed as being important; web site policy statements, web page graphics and animations being less important for web page assessment. The post experimental comments also highlight participant views concerning webpage layout and contents as 53 comments were made on website design, content and "professionalism". These were split almost 50:50 between positive and negative comments and it is interesting to note that all the webpages attracted both positive and negative "professionalism" judgments. These responses show clearly that the way website information is presented is as important as its content.

Participant responses to the internet banking questions highlighted some interesting views on the personal acceptability to online banking. Although most participants were generally positive about using online banking the majority showed there is reluctance to bank with organizations that they do not recognize. This question of trust is demonstrated by a survey by security specialist RSA Security (Hoffman, 2007). This revealed the extent of distrust shown by members of the general public to internet banking with over 50% stating that they would not sign up for internet banking and 44% of account holders expressing concern about their continued use of the service. This question of trust is important for any organization conducting online financial transactions as trust seems to be directly related to familiarity. The conclusion appears to be that unknown banks are less trustworthy than known banks despite the fact that all are governed by the same legislative constraints. This is not helped by the widespread publicity that online fraud generates. Accordingly it is rather odd that the majority of participants agreed that they do not read all web page contents and only a third of participants recognized that all the web pages had policy statements and security logos advertising the fact that they operated secure web sites using current security protocols.

Conclusion: The results of this study have shown that both participant involvement and layout can affect the webpage viewing strategies of observers. However the relationship between these two factors and viewing strategies is not straightforward and requires further study and clarification. The questionnaire results clearly showed that level of participant involvement affects their willingness to use ebank services in that higher involvement raises the evaluation standard against which participant assessments are made. The recall scores demonstrate that participant recall of information viewed is uniformly poor and little affected by either layout or level of involvement. The reason for this is not clear and may be due to a variety of factors including total amount of webpage content and the presence of distractors. Again further study is required to investigate the nature of the information load contained within webpages, the nature and extent of distracting elements and their effect upon participant storage and recall of displayed information.

The participant post experimental responses do raise two further questions. Graphics are identified as being less important elements than text and layout yet most web sites incorporate graphics into their web pages and are included for a variety of reasons. Secondly, if graphics are inserted for information purposes are there any differences in the user assessment and retention of information displayed graphically and textually? Zang (2000) also questioned the effect of animation upon user performance and concluded that graphics and animations act as sources of visual interference that affect individual information seeking performance. The conclusion appears to be that unless graphics have a specific role in illustrating products or services then they may well have a detrimental effect upon user performance and assessment of web pages. The next chapter looks at the use of website graphics by conducting a global survey into their usage, with the aim of defining the type of graphics used, their purpose and the role of national, cultural and religious factors in determining their use. The following chapter

will then examine some of the issues raised above concerning the use of graphics by investigating the use of graphics for information presentation purposes and whether the use of graphics affects webpage viewer strategies and the subsequent recall of displayed information.

Chapter 8

Study 4 - Survey of the Types and Functions of Ebank Website Graphics and Their Role in Consumer Decision Making

In this chapter we assess the use of graphics in ebank websites and consider the role of graphics in consumer decision making. A worldwide survey of 1302 retail banking websites revealed that graphics are used in all of those examined. The functions of these graphics can be categorized under four headings: informational graphics, illustrative graphics, aesthetic graphics and a miscellaneous category for others not categorized under the other headings. The underlying research and internet advice on webpage graphics is considered together with a discussion of the survey results.

The results support the image categories suggested. Examination of their frequency of use amount of webpage space occupied showed that illustrative graphics occupy and average of 30% webpage space, informational graphics - 7%, animated graphics - 13% and textual graphics - 20%. Usage among banks is informational graphics – 100%, illustrative graphics – 93%, textual graphics – 83% and animated graphics – 59%. The implications of these figures are discussed as are other findings concerning the use of colour and white space.

8. Website Survey Graphics

8.1. Background: Previous chapters have concerned themselves with webpage layout but in this chapter we consider another ubiquitous design issue: the use of graphics. Banks have been described as rather staid institutions whose early websites often reflected this observation by being dull, boring and uninteresting. If one looks at some of the current investment and private bank websites such as those for LloydsTSB – private-banking; Brown Brother Harrimans – private banking and Bank of Scotland private-banking (Private-Investment bank websites, 2010) it is possible to gain an impression of the format under which many ebanking websites were first designed. As investment and private banks cater primarily for business and wealthy clientele their

content was focused upon commercial and investment services and products, often with little consideration to other aspects of webpage design such as aesthetics, colour, balance (logical layout) and size (creating the need to use browser scroll bars). For their portal webpages, the majority of the content was textual whose sole graphic was the corporate logo with the occasional photograph included of the main headquarters or the chief executive. Little marketing or product information was included and the bulk of the text content often comprises information such as the bank's wonderful service, performance reports, accolades awarded and press releases. Knight et al (1999) describe four levels for the provision of information, the most basic being the provision of information about the institution with little possibility for interaction with the customer. This provides an accurate description of much of the early ebanks website content where information provision is the primary function with little or no capacity for conducting online transactions other than email, or website navigation. Other bad design features often included in these early ebank websites can be found by visiting websites that list poor website design features (e.g. www.ratz.com/ featuresbad .html).

8.2 Types of Webpage Graphics: Before deciding the role of website graphics it is necessary to define what we mean by graphics and what their function is within the website. Static graphics includes photographs, cartoons, drawings and graphical text and images created using vector or bitmapped graphics programmes. They come in a variety of formats such as GIF, TIFF. BMP, PNG, JPEG for bitmapped (raster) formats; CGM, SVG, CDR and VML for vector formats (although only SVG - Scalable Vector Graphics format are supported by some web browsers). Animated graphics and movies can be incorporated into webpages in various ways but the most common methods are the incorporation of flash and shockwave animations, animated GIFs or by the use of Java, Jscript and Javascript programs and applets. Animations, including scrolling text (also known as marquees), within webpages are readily apparent as graphical elements

as are many static images. However, many websites include other elements which are not readily identifiable as graphic elements. These include some hypertext links, text boxes and text created or manipulated using graphics programmes. The easiest way to distinguish these as graphic elements is to right mouse click them and see if you are given the option to save them as a picture file.

8.3. Categorization of Website Graphics Graphic elements are incorporated into webpages to serve a variety of purposes. A simple categorization of webpage graphics initially identifies three groups. illustrative, informational and emotional images.

Illustrative Graphics: Using the aphorism "a picture paints a thousand words "illustrative graphics illuminate, describe or enhance other elements, usually text, within the webpage. Examples include images of expensive cars used when describing car loans and images of houses when describing home mortgages,. An example of this is shown in Fig. 24 below:

Make a statement. Go paperless

Register for Online Statements today and take one small step to a cleaner, simpler way to organise your finances.

Fig 24 Example of Illustrative Graphics

By themselves illustrative images convey little to a webpage viewer. However, as shown above the image complements the associated text and in many cases aids identification and purpose of the text.

Informational Graphics: Second comes informational graphics whose purpose is to supply information to the webpage viewer; typical examples include graphs, charts, logos and graphical text (this latter format is often used when describing interest rates). These may or may not have associated text but their message can usually be inferred by

a quick glance at the image without reading any associated or incorporated text. The most common informational graphic is the logo. Used by all large businesses, they usually feature strongly in their marketing activities to ensure that they are readily identifiable in the marketplace – See Fig. 25 below. A random search amongst ebanks reveals that all use logos which are prominently situated in the top (banner) strip of their portal webpages, usually at the left hand edge.

LloydsTSB

Barclays

Fig 25 Readily Identifiable Bank Logos

The most common information image used is that related to interest rate information, both for deposits and for loans. Other information images are used to chart investment rates, branch location details, service and product advertisements and contact details. A common element in many of these is the inclusion of textual elements although these have all been manipulated to give them greater impact. Examples of those found are shown in Fig. 26 below:

Fig. 26 General Information Images

In addition to the general information images are those used solely for signposting purposes such as page printing, email, help, contact details or links to other parts of the

website. Many of these are recognizable as such and generally do not require additional text. A few of these are shown below in Fig. 27:

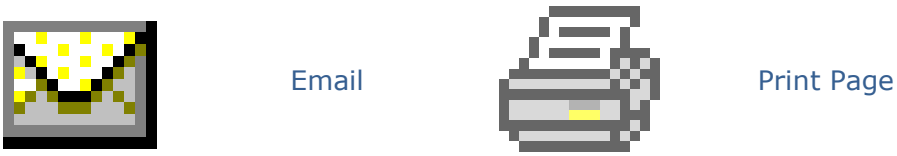

Fig. 27 Common Function Images

The third common type of informative image is the security seal and logo. Security images comprise two main types. Firstly there are the professional logos of the security companies offering internet security protection (Fig. 28) and this includes many of the major commercial internet security firms that supply hardware and software products for firewalls, data encryption, antivirus, antimalware, anti crimeware and prevention of Trojan, key loggers and rootkits.

Fig. 28 Online Security Company Seals

Other common security seals comprise simple images depicting security images such as network symbols with locks, padlocks, shields and keys (see Fig. 29). For example, lock icons located in the bottom right hand corner of a screen indicate that the webpage viewer is protected by an SSL protocol. By themselves, most of these images are meaningless and do not necessarily indicate the use of security products or procedures by the website owner or administrator. However, their presence is to be taken as indicative of the organization's commitment to safe, secure banking.

Fig. 29 Common Webpage Security Images

Other commonly encountered informative images are awards and accolades that banks appear so fond of awarding to each other. These aim to reflect good performance and service and also serve to assist potential customers in selecting which bank to use. A few banks devote an entire webpage to their awards (see Standard Chartered Bank). A few of the accolades found during the survey are shown below in Fig. 30:

Fig.30 Examples of Banking Awards

Emotional Graphics: A third category is the emotional "feelgood"/emotional graphics which are described by Diaper and Welland (2000) as aesthetic graphics. These are particularly prevalent in ebank websites and appear to serve no other function than to create a "feelgood" factor or generate an emotional response for webpage viewers in order to establish a positive emotional response to the rest of the webpage contents. The most common of these appear to be floating clouds, happy families, snowy mountains, flowers, trees, fruit, fields and tropical beaches and some of which are displayed as part of rolling flash animations. When present, many of these aesthetic images are prominently displayed; often they are located in the top part of the screen as part of the banner or as a faded background image covering a significant percentage of the

webpage screen. A few of the images found by the survey in ebank websites are highlighted in Fig. 31.

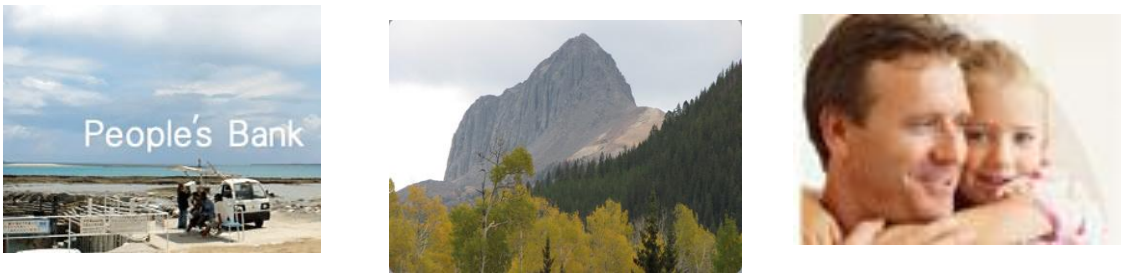

Fig.31 Examples of Aesthetic "Feelgood" Images

Miscellaneous Graphics: There is a fourth category for other images which do not fit into the three categories described above. Unlike the aesthetic-feelgood images which are there to generate a favourable emotional response, it would be difficult to categorize these in the same way. Examples of this are shown below in Fig. 32 and include pictures of bank frontages, bank officials and other images (e.g. chess pieces) which appear to have no relevance to banks, banking operations or their customers.

UMB CEO

Martha Washington Inn
Abingdon

Cranberry Festival

2

Fig. 32 Miscellaneous Images

An explanation for the incorporation of employee images is supplied by Eggar (2001), Fogg et al (2001) and Steinbrucke et al (2002). They found that webpage photographs engendered a "real world feel" about a website owning organization which in turn improved credibility and increased trust. This effect could also be strengthened by pictures of bank facades, pillars etc as reflecting themselves as solid, reliable physical

organizations rather than cyber or virtual entities. The incorporation of other images of local landmarks and festivals could be used to establish the connections of the bank to the local community. Eggar's (2001) model of relationship management highlights first impressions of graphic design in the assessment of trust and Steinbrucke et al (2002) found that employee photographs on portal webpages significantly improved user trust. Reigelsberger et al (2003) explain this by suggesting that the presence of photographs serve to create a virtual personal relationship between customer and bank in the absence of normal interpersonal relations.

The other class of images which spans the other four categories discussed above are textual graphics. This class comprises textual elements which have either been integrated into graphic images or manipulated using software packages to give them features and fonts not recognizable by standard web browsers (most web browsers only recognize the standard fonts that come with Windows or the other common operating systems). The purpose of these manipulations is to give the manipulated text greater visual impact to draw viewer attention. Textual images are normally used to advertise products and services and are commonly used on ebank websites to highlight favourable interest rates. Examples of these are shown below in Fig. 33:

Fig. 33 Examples of graphically manipulated text

8.4. The Role of Webpage Graphics Ebanks now view graphics as occupying a more important role as evidenced by their increasing use in ebank websites. This policy of retails banks appears to follow the marketing approach of other online retail enterprises

and involves the creation of websites that are not only functional but are intended to be visually interesting and appealing to customers. For some (e.g. LloydsTSB) their website graphics are the same as those used in their marketing and advertising campaigns creating a readily recognizable website design which follows on from their advertisements. As described in the previous section, the three categories of illustrative, informative and aesthetic images have defined roles and functions within the website and in some cases the images may satisfy the conditions for more than one category (e.g. a chart illustrating share dealing services whilst also showing ebank performance with customer investments). In addition to these category roles there are those pinpointed by the PAAplace website. From this list the informative category would include the additional information; condensed information, object relationships, simplification of complex information, identity creation and addition of extra information. The illustrative category would include drawing of attention and the aesthetic category would cover the breakup of text, addition of colour and addition of interest. The other suggested function of being entertaining and improving appeal and interest (Waite and Harrison, 2002) are somewhat more ephemeral functions and largely dependent upon the individual tastes, experience and motivations of the website customers.

8.5. Graphics – Good or Bad? Clearly ebanks view the incorporation of graphics into their websites as a positive development and that they provide benefits to both ebanks and customer. However, it is not always clear what benefits are attracted by these graphic additions to websites. Previously highlighted research has shown that it creates credibility and establishes trust as well as being used to promote positive emotional responses to other website contents. According to Waite and Harrison (2002) one of the results of incorporating graphics is that ebank customers now have expectations for

website contents one of which is that they contain some degree of graphical content. According to them:

> *"The use of colourful graphics and animation give financial institutions the ability to present information in a stimulating and appealing way. These methods have been shown to increase the likeablity of television advertising and this could have a similar effect in relation to financial services' websites*".

They go on to say that colourful graphics also serve to provide a measure of fun and entertainment to website visitors. The inference from these comments is that the incorporation of graphics into a website is a positive development pleasing to website visitors. Further positive support for the incorporation of webpage graphics comes from Cao et al (2005) who describe graphics as enhancing customers' preference for a website by satisfying customer information needs, facilitate learning and create trust. Hong et al (2004a) showed that image-text presentation of information is superior to text only presentation. Ivory and Hearst (2002) describe graphics as one of the major building blocks of good websites whilst Huizingh (2000) describes graphics as being elements in making websites more attractive. However does this mean that the absence of graphics and resultant failure to match expectations impact user satisfaction and result in negative customer assessments? Lindgaard and Dudek (2003) found that user expectation affected their performance of a browsing task; Bonito et al (1999) found that conformance with expectations are associated with positive assessment. However the extent that individuals hold such expectations and the extent of any impact that disconfirmation of those expectations has upon their assessments appears to be unanswered and requires further research to clarify.

Other research has shown that the use of webpage photographs serve to establish "real world" feel and community presence and to promote trust through the creation of virtual personal relations. One of the current legislative requirements of online banking is that

of catering for customer diversity and inclusion. This covers a wide range of customer requirements for which the use of graphics provides the answer. The obvious example for this is cross cultural and language diversity for which graphic symbols and icons can provide information more easily than text alone. As far as the effect of graphics on other webpage elements is concerned the results of Diaper and Welland (2000) found that experienced users are not distracted by surrounding graphics. Other suggestions have been made that the use of graphics creates clutter and impedes visual search (Bravo and Farid, 2004; Drury and Clement, 1978; Rosenholtzet al, 2005; Rosenholtz et al, 2007). In contrast to these findings, Spool (1999) points to some of the effects of webpage graphics and states that graphic design has little impact, either positive or negative, upon visitor ability to locate information and the best that can be said is that graphics do not harm. However, he qualifies this by stating that his research did not examine the role of graphics for their decorative, marketing or contribution to webpage appeal.

Despite these positive benefits there is also a downside. Reigelsburger Sasse & McCarthy (2003) found that certain groups of users had negative responses to the presence of webpage photos. These include low trusting customers (non-shoppers) who considered photographs as trust manipulators; online shoppers requiring efficient transactions saw them as webpage clutter without functionality and other variable, sometimes negative, reactions to different employee roles and employee faces. Using anecdotal evidence Nielsen et al (2005) stated that too many graphics make screen too complex and that visual design elements should be used wisely to help communicate and create order and that they should have a function other than to decorate the screen. Bevan (1998) points to the fact that graphics may add interest but this has to be weighed against the consequent reduction in webpage loading speed and possible adverse effects to website navigation. The issue of reduced loading speed is also raised by Gehrke and Turban (1999. Diaper and Welland (2000) suggest that graphics are not always

beneficial as they may be in conflict with the user's goals causing them to be distracted form the purpose of their task. However their research indicated that this does not apply to experience internet users who are able to ignore any distraction effects due to the presence of graphical elements. These conflicting findings and opinions leave the question of "webpage graphics – good or bad" unanswered. It appears likely that there are both pro and cons and that the benefits accruing from incorporation of graphics are dependent upon many disparate factors such as context, purpose, technical considerations and viewer individual differences.

The situation concerning animated graphics in webpages appears clearer. Although it is still the subject of conflicting conclusions, its use has generated the greatest amount of criticism. The most commonly cited problem is its distraction effects and the adverse effect it has on visual search performance. On the plus side, Sundar & Kalyanaraman (2004) found that animation is psychologically significant with results showing that animations increase arousal and that animated advertisements are more attention grabbing and effective than static advertisements. This result was also found by Yoo et al (2004) whose results also showed that animated advertising has better attention-grabbing capabilities, and generates higher recall and higher click-through intention than do static advertisements. Burke (2001) found no adverse effects upon search time by animated banners although her later research (Burke, Hornoff, Nilsen and Gorman 2005) reported that animation caused greater workload, increased frustration and mental demands upon webpage viewers. According to Hong et al (2007) previous research into animated banner headlines appears to indicate that users are able to ignore animation during online tasks.

In contrast to these positive results for animations, other studies have highlighted its the negative consequences. Hong (2004b) found that although animation attracted attention

and aided location of animated object it didn't improve recall of animation content, probably decreased recall of other information and worsened user focused attention and attitude. The results of a study by Hong et al (2007), who examined non banner animations, found that whilst animations attract user attention and likely to be viewed and clicked first, they also adversely affect performance and perceptions. Bayles (2002) found that animation did not improve recall of displayed information and Zhang (2000) found that animation deteriorates information seeking performance although this diminishes with increasing task complexity and animation that is relevant to the task. Similarly, Zhang (2001) and Zang and Massad (2003) points out that although the majority of animations contain no informational content they interfere with visual search and adversely affect performance but that the degree of performance deterioration depends upon the screen location of the animation.

In summary, the evidence for the overall use of graphics is mixed. Whilst they undoubtedly improve the visual appeal of webpages and grab viewer attention there are outstanding issues concerning the presentation of information in graphics mode and whether graphics serve to operate as clutter impeding visual search and distracting webpage users. There is also the possible effect they have upon recall of viewed information and whether any possible benefits are outweighed by use of internet bandwidth and increased webpage loading times. Animated graphics appear to attract most criticism in this respect of these problems but there the other factors such as the interest, fun and entertainment aspects which, as yet, have not been fully researched and whose possible benefits may well justify the ignoring the other problems highlighted.

8.6 Graphics Survey The purpose of this survey was to examine the use of graphics in the portal webpages of online banks. A total of 1302 online banking websites were visited, stretching across all continental areas and encompassing different cultural and

language types. For the purpose of this survey the following points need to be borne in mind. Ebank portal webpages tend to be volatile as changes to the markets, organization, products and services available, special offers, security advisories, hyperlinks etc are constantly changing and usually need to be reflected in the website. This volatility leads to constant changing in website structure, layout and contents and may be reflected by changes in the estimates made at the time the survey was conducted. The banks selected were high street retails banks rather than private or merchant banks; for foreign banks, local banks were the ones visited rather than regional branches of multinational banks. Percentage values for the graphic content were obtained by visual estimates. Where the nature of the webpage object was uncertain (i.e. graphic or text) its nature was determined by the right mouse click identification method (this did not apply to backgrounds where the right mouse click method does not work). Areas of scrolling text were counted as animations. For websites where the text was displayed in non-Latin alphabetic characters (e.g. those using Han characters such as Chinese and Japanese Kanji) these characters were still regarded as text.

The survey categories are shown below and the summarized data is detailed in Appendix 6.

1. Graphics used on website;
2. Informational graphics present and % of screen occupied;
3. Illustrative graphics present and % of screen occupied;
4. Aesthetic graphics present and % of screen occupied;
5. Textual graphics present and % of screen occupied;
6. Animated graphics present and % of screen occupied;
7. % white space in screen;
8. % of banks using coloured background;
8. % of screen with coloured background;
9. Number with strong colour;
10. Number with weak colour.

8.7. Graphic Survey Findings

Before examination of the summarized figures there are a few observations arising from the survey. The first, most noticeable finding is that out of the 1302 websites visited none were found that contained no graphic elements of any description. This finding supports the view expressed earlier that online banks view graphical content as a necessity in their websites. Where foreign banks have both English language and national language versions of their websites they tended to be markedly different in both terms of graphics-text balance and screen layout. It is difficult to fully account for this other than to suggest that differences in culture, nationality and language between banking website visitors are reflected in terms of different expectations for website contents and structure. If this is correct, it emphasizes the point that cross cultural-national-language testing may result in significant differences between groups and that participant's expectations for website content have to be taken into account when considering any experimental findings. It was also noticeable that many of the illustrative graphics had strong aesthetic or emotional content. For example, images for deposits or investments showed individuals portrayed as young, good looking and successful; for loans, subjects like foreign tourism or desirable cars were used; for pensions, healthy beaming pensioners were used, often engaged in some sport or other fun activity. All websites were viewed in standard 1024×768 screen resolution. Webpages were not scrolled when they extended over standard screen size.

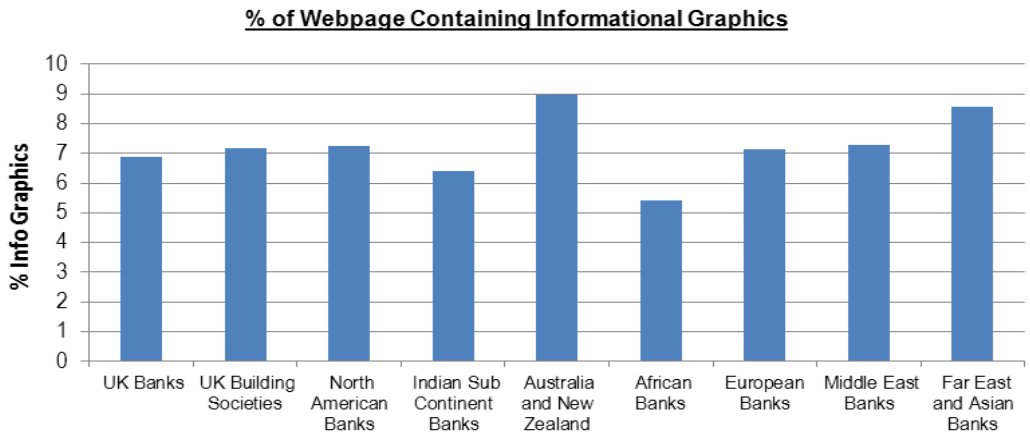

Fig. 34 - Information Graphics - % Screen Area Occupied

Individual bank screen occupancy of informational graphics varied between 1% and 90% of total screen area. Looking at the spread of informational graphics (Fig. 34), only 0.1% of websites did not use them in any form. Of the remaining 99.9%, informational graphics occupied between 5% and 9% of the screen area. African banks used the least informational graphics whereas Australasian, Indian Sub-Continent and Far Eastern bank used almost twice as much. Informational graphic usage for European, Middle Eastern and American online banks came in between these two extremes. Average overall screen occupancy for informational graphics all areas was 7.9%. The overall results indicate that the use of informational graphics is small and that text is the primary mode of online information provision. Across both nationally and culturally different banks the differences in the role of information graphics is small. The reason for this is not clear as the overall level of use of webpage graphics for aesthetic and illustrative purposes is much higher. A possible reason may be that website designers consider graphical information provision is inferior to textual provision or may be more likely to misinterpretation.

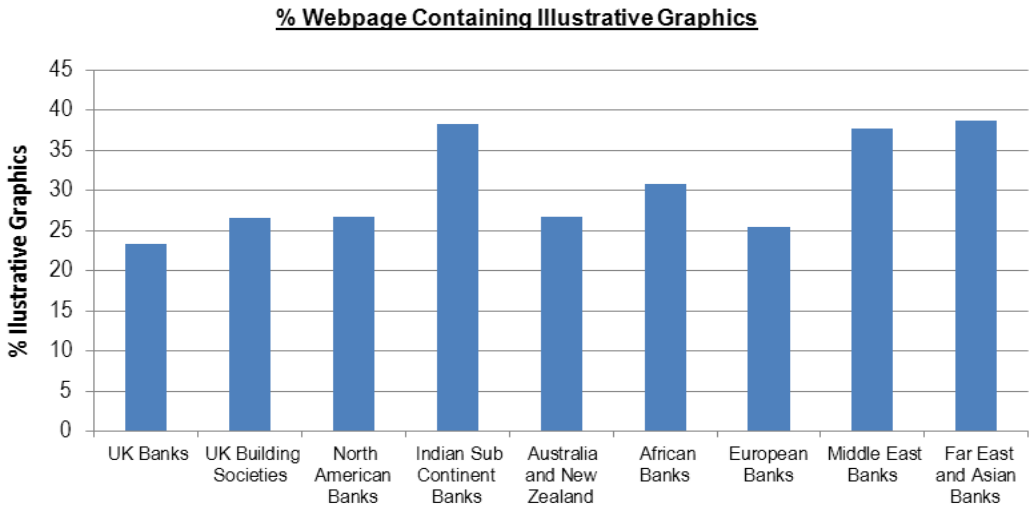

Fig. 35 Illustrative graphics - % screen area

% Screen occupancy of illustrative graphics for all areas stretched from 0% to 90% with an overall average for all areas of 31% (see Fig 35). Averages for the Indian Sub Continent, Middle East and Far East Banks approached 40% of webpage area; African Banks averaged at 30%; those for North America, Australasia and Europe hovered at around 25%. These figures represent an increase of 40% for Asian banks over European/American banks and indicate a striking difference in expectation of graphics content between occidental and oriental banks. This lends support to observation that national and cultural distinctions result in noteworthy differences in webpage layout and structure. These differences are probably best demonstrated by many Japanese bank websites where much of the text is graphical in nature and a great number of cartoon and anime characters are depicted on webpages.

Differences between geographical areas are much greater for illustrative graphics than informational graphics indicating that illustrative graphics have a greater role in the promotion of ebanks products and that this importance is higher in Asian banks.

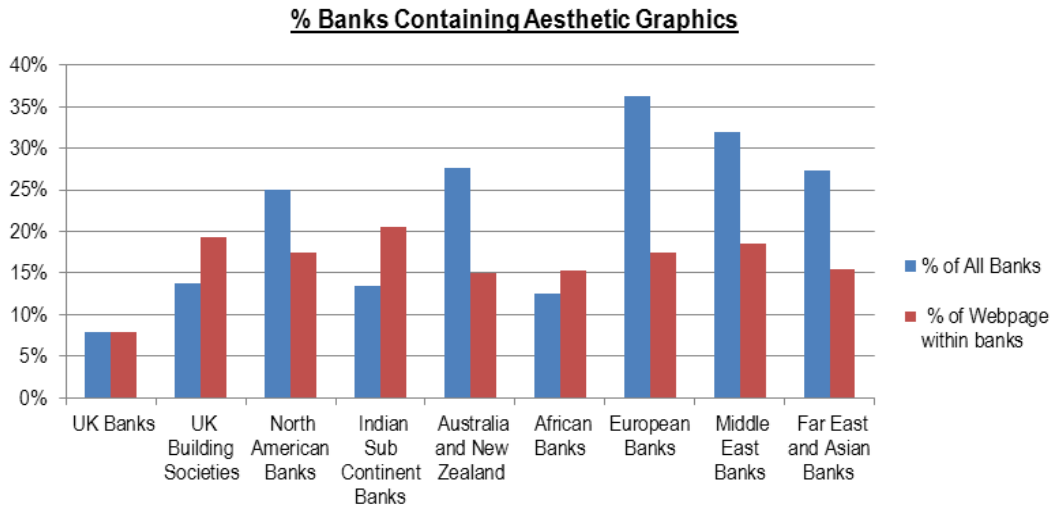

Fig. 36 Aesthetic graphics - % of all banks and % of screen area

Overall usage of aesthetic images was found to be 28% with an average screen occupancy rate of 17% (see Fig 36). National averages varied between 8 and 35% with a range for individual banks of 0 – 80% screen occupancy. UK banks use them the least

with only 7% of banks using them and a screen occupancy rate of only 8%; a surprising result in view of the fact that their usage in European banks is the highest where their use is five times greater than that of the UK, although their average screen occupancy rate is only 16%. UK building society usage was also greater than that for UK banks – a difference that can probably be attributed to the different business market being catered for. African and Indian bank usage of aesthetic images was low although where used by Indian banks they had the highest screen occupancy rate. Middle East banks were the next highest users followed by Far Easter, Australasian and North American Banks. The percentage of screen occupied by these images was similar for all these areas.

Their degree of usage and webpage screen occupancy rate show that aesthetic-feelgood images are regarded as fulfilling and important role in creating positive feelings in their website visitors. The extent to which they are successful in achieving this goal is less certain and would require further research in order to further categorize them into smaller groups (e.g. family groups, pleasant visual scenes, natural scenes etc.) and to individually measure their effects across different national and cultural groups.

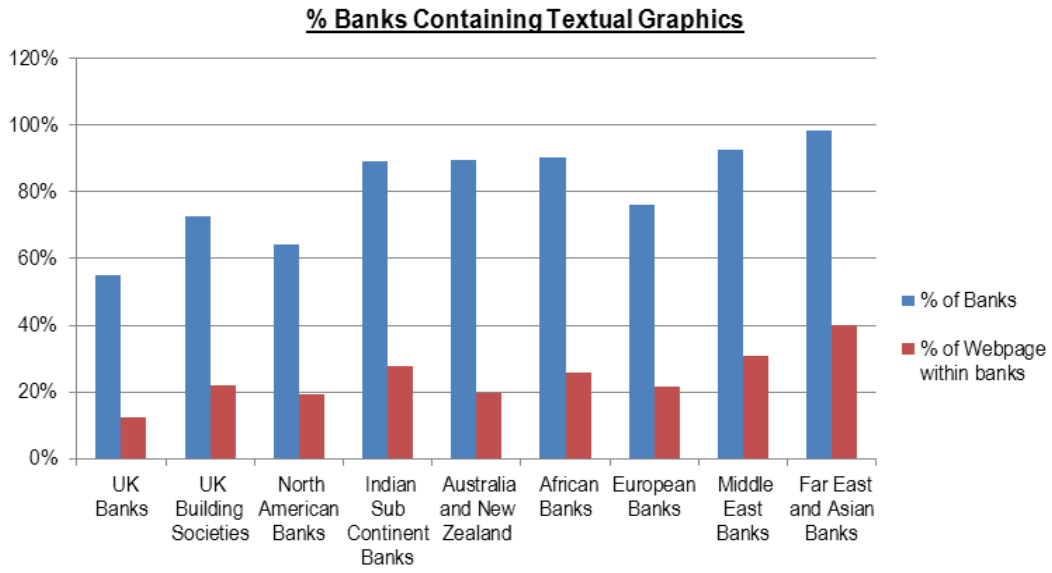

Fig. 37 Textual graphics - % of all banks and % of screen area

The overall usage of textual graphics is high with 80% of all banks visited using them (see Fig 38). As with the aesthetic images, the UK banks used them least whilst the Indian, Middle and Far East banks used them the most. In most cases observed where graphical text was used traditional large font text could have been used instead. The major differences were that graphical text tended to use unusual font styles, colour, orientation and surrounds that were not available in traditional available font styles (varying font style from those used on standard PCs would require the loading of additional font styles to each individual PC when it was switched on). These differences meant that graphical fonts could be made more distinctive and have greater visual impact than traditional fonts. Therefore, their use can be justified on the basis of their increased attention grabbing potential. The only proviso to this is that their overuse within a webpage would diminish their visual impact and reason for their use.

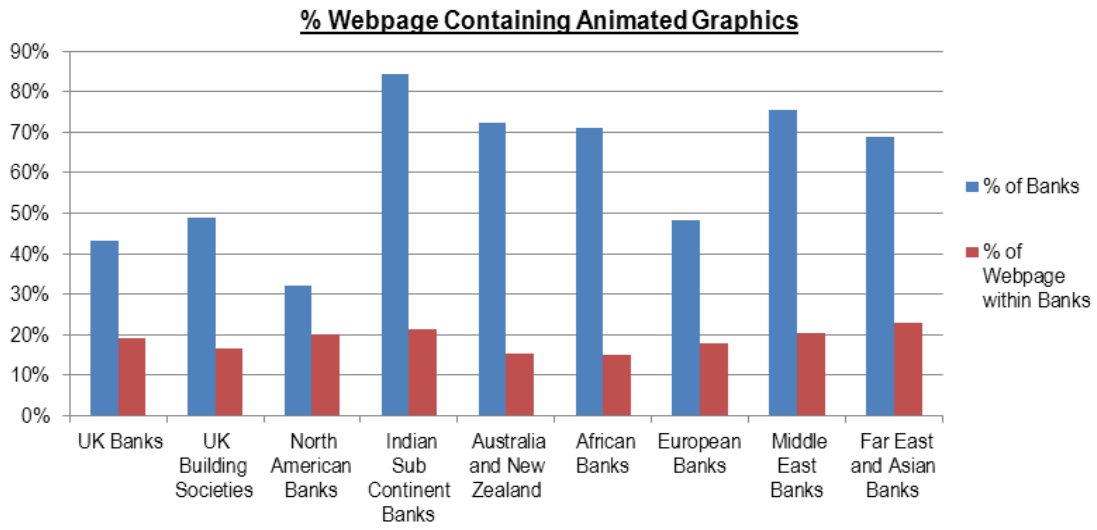

Fig. 38 Animated graphics - % of all banks and % of screen area

The use of animated graphics has grown with the increased availability and use of techniques for scrolling text and applets for animating text and images. Overall usage in all banks averages at 65% with a screen occupancy rate of 19%; screen occupancy rate extends from 0% to 75% (see Fig. 37). Their use is extremely high in Indian, African, Australasian, Middle and Far Eastern banks where usage exceeds 70% and over 80% of

banks use them in the Indian Sub-Continent. Although their usage varies the average amount of screen space they occupy remains the same for all areas. Functionally, the majority of animations were informative with the bulk of the remainder being illustrative.

The degree of their usage indicates their popularity to website designers despite the equivocal research findings concerning their use. In view of their popularity their use needs to be researched and the views of website users obtained to see whether website designer's positive view of aesthetics is reflected by the users. This research should also investigate the variable effect of different animation types (e.g. scrolling text, animated banners, service and product advertisements) upon the user assessments of animated graphics and their overall assessment of the animation containing webpage.

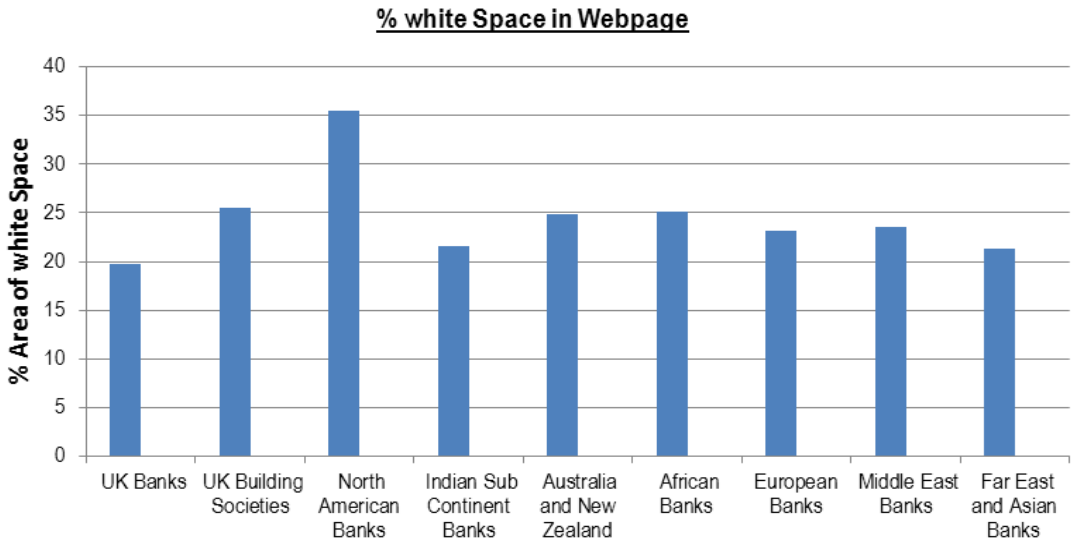

Fig. 39 % of white space available in webpage

With a range of values from 0 – 90% the white space availability for all banking website averaged 25% with most national area values occurring around this figure (see Fig. 39). The major exception is the North American banks where the average screen percentage of white space was 35%. With an average of a quarter of all webpages being empty space this represent a significant amount of possible information provision and

advertising opportunities lost to the banks. This indicates the importance that banks place on not filling every available location in their webpages.

It is generally accepted that too much visual clutter impedes both visual search and user assessments so that the effect of filling a webpage with information would achieve the opposite of what the website designer's intent. However, the wide range of white space found raises the question of what is the optimum level of free space that should be left within webpages, how should it be organized and what is the relationship between this, usability and visitor assessments of webpage contents.

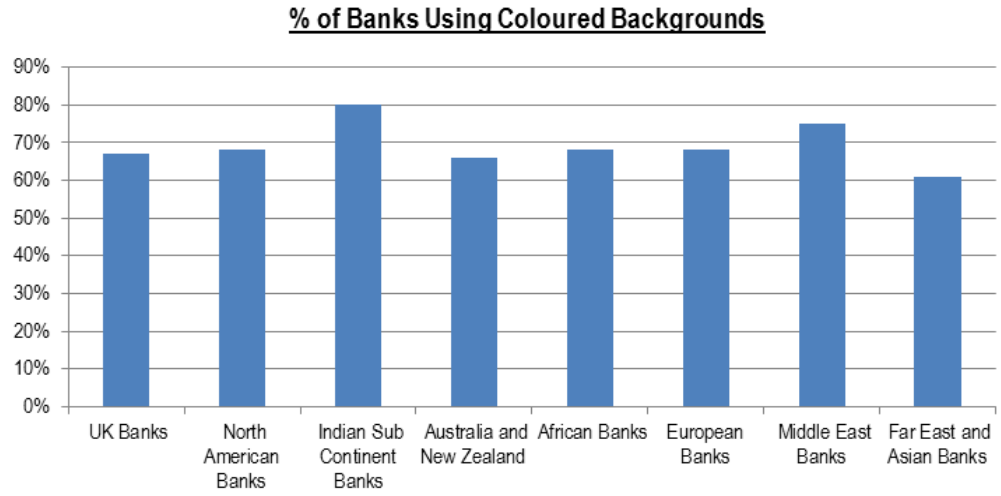

Fig. 40 % of Banks Using Coloured Backgrounds

Examination of the figures for the use of coloured backgrounds shows that they are used by 69% of all Banks and of those that use them the percentage of screen that is coloured varied from 10 to 100% (see Fig. 40). The use of colour is highest in the Indian Sub-Continent banks where there is also a tendency to use strong colours.

The use of coloured backgrounds varies both within and between national and cultural boundaries as does the strength (saturation) of the colours used and the amount of screen area coloured. Some banks were encountered which used black or very dark blues over the whole screen with light coloured lettering (see First Direct Bank). This

has implications for both the discriminability of the information being presented and user assessments of the possible overpowering use of colour. As with many visual attributes the impact of colour upon users is variable and dependent upon many factors (e.g. user experience, purpose, context). However, further research into its use and effects would be required before accurate assessments of its possible benefits could be made.

8.8. Summary The findings of this survey are unequivocal. Graphics comprise a significant proportion of ebank website contents and their roles within those websites satisfy a variety of different functions. Notwithstanding the fact that some graphics appear to serve a variety of functions (see PAA place website) and in some cases more than one function, the grouping into four functional categories provides a simple means of describing both them and their usage. The survey findings are surprising not only for the extent of graphics usage but also for the amount of website space they occupy. This is particularly the case since a significant number of these images are not necessary for business purposes but are present for aesthetic or trust building purposes. Pralle (2010) points to the fact that most websites up to the 1990's had had little by way of graphical content but that this changed with the introduction of clipart. Graphics now come in several varieties and formats and feature as an integral part of the websites of all online retail banks. They also serve a range of functions within these websites and in addition to those identified earlier in the PAA place website can be added:

- provision of information;
- illustration and advertisement of products and services;
- creation of feelgood emotional responses in website visitors;
- improvements to the aesthetics of the website;
- creation of interest for website visitors;
- attention grabbing to elements within the website
- increase arousal in website visitors;

- for entertainment and novelty.

The extent to which these aims are achieved is unresolved. Online website design advice is mixed. Pralle (2010) asks why graphics are important and goes on to answer by pointing out that graphics add interest and can make a website memorable. According to her the most important images are the logo and background. Hargay (nd) states that graphics are more appealing than text, communicate better, improve the selling power of websites, bring brand recognition and are better at providing links than text. According to HDGraphicsonline, graphical elements increase website credibility, improve company image and save money. Research has indicated that they improve credibility and trust, facilitate learning, are superior to text only presentation and make websites more attractive. Counter-arguments to the use of graphics point to their distraction effects, increased bandwidth usage and their negative effect upon visual search. Neilsen and Loranger (2006) highlight the overuse of graphics resulting in overcomplicated webpages and that improper use of graphics is counter-productive and that they should not be used to simply decorate the screen.

The well-established use of website graphics on ebank websites has been found by the survey to be subject to not only wide variance between individual banks and across national boundaries but also across cultural and language divides. All websites visited used graphics to varying extent and that a wide range of different images were used. The function of some images encountered was not always clear and categorizing them as illustrative or aesthetic may not always have been accurate. The use of aesthetic images to establish an emotional response appears to be growing. Although images of clouds, fields, shoreline, mountains, trees and flowers have universal appeal some aesthetic images were encountered which are culturally and nationally specific or whose appreciation was a matter of personal taste. Probably the best examples of this are use of anime characters in Japanese banks and the incorporation of images of the Hajj

(annual Muslim pilgrimage to Mecca) incorporated into the web-pages of Sharia and Arab ebanks. Such images are unlikely to appear in European or American bank websites.

Some of the webpages viewed could only be described as "busy" where the sheer number of different elements, both text and graphic, and their proximity to each other make the webpage visually overpowering. An obvious consequence of this is that the location of information is made more difficult and the information density may also exacerbate any problems of visual fatigue. Other websites adopt a more "minimalist" approach where the number of separate elements on the webpage are kept to a bare minimum and are separated by wide areas of white space. Some websites have adopted website graphic features that can only be described as irritating. Examples of these are the floating window that tracks when the webpage is scrolled and websites that display webpages where visitors have wait through a lengthy flash animation before they get to see the portal webpage.

Webpage graphics undoubtedly serve a useful function but their purpose and effects need close examination. Website owners would not insert pointless or meaningless text into their websites so the incorporation of graphics which are neither useful nor decorative appears puzzling. Research described in this thesis will try to clarify some of these points from the point of view of the website visitor.

In the next chapter we will continue the examination of graphics usage by examining the use of informational graphics and compare its effectiveness against textual presentation of information.

Chapter 9

Study 5 Part A - The effect of Information Graphics on Webpage Viewing Strategies

It is a popular conception that website graphics promote user interest and improve visual appeal and impact; however in an analysis of subjective responses to text versus graphics information presentation we found no difference in either recall of information presented or in evaluation of webpage contents. A similar result was found for the effect of participant involvement. In this study we assess whether any behavioural differences exist using eye tracking technology to determine whether scanning strategies are affected by presentation mode and whether graphic information is located more quickly than textual information.

9. Introduction

Graphics are generally accepted as being an important element in website design and considerable effort is often directed to their development and incorporation into websites. The global website graphics survey described in the previous chapter reinforces this view with its finding that for ebanks graphics elements often occupy more than 50% of available webpage space. Despite this, participant questionnaire responses in studies 2 and 3 highlight concerns regarding the utility and benefits of these graphics. Specifically, the participant responses identified website graphics as being of low importance contributing little by way of their influence to visitor's evaluation of websites.

Previous research has highlighted the positive aspects of website graphics in terms of their creating user satisfaction and pleasure (Hall & Hanna, 2004; Lavie and Tractinsky, 2004; Schmit, Yili and Srinhard, 2009) and perceived credibility and trustworthiness (Basso et al (2001), Hu, Lin and Zhang (2001), Karvonen and Parkkinen (2001), Kim and Moon (1998), Riegelsberger & Sasse (2001, 2002),

Steinbruck, Schaumburg, Duda & Kruger (2002), Wang & Emurian (2005). In contrast to these positive reports other research has highlighted their undesirable properties. Zhang et al (1999), Zang (2000) and Neilsen and Loranger (2006) pointed out that overusing or incorporating meaningless graphics for decorative reasons often leads to user dissatisfaction and act as sources of interference for webpage viewers seeking information. Clearly, the benefits of webpage graphics remain equivocal and opinions concerning their use remain divided between those who perceive the positive benefits and those who recognize their limitations and drawbacks.

The survey of ebank website graphics described in the previous chapter found that their usage is global and that they perform a number of different tasks which may be grouped into four different functional categories. Primary amongst these is the passing of information to the website visitor using graphical elements such as logos, security seals, signposts, charts and performance awards. All of these elements convey information and figure prominently on website portal webpages. However, one area where the use of graphics is used but untested is the use of informational graphics for communicating data other than for the identification, certification or signpost information. Some of the questions raised by this use of webpage graphics concern the possible benefits of using graphical over textual modes of information presentation. In terms of viewer webpage scanning strategies, what is their effect upon information search times and the rate at which graphical information is assimilated and processed compared to that required for equivalent textual information.

Using Fogg's (2003) definition of involvement, this study explored the effect of both textual and graphic modes of information presentation and user involvement upon webpage viewing strategies. To accomplish this, eyetracking techniques were used to examine and compare user perception of graphical and textual information in high and

low user involvement conditions. The eyetracking data demonstrates whether users adopt identifiable scanning strategies to locate required information and determine user priorities for fixating on informational webpage objects. This data determines whether user involvement and textual or graphical information affect user scanning strategies; whether graphical or textual information attract different fixation times and whether webpage graphical content affect fixation times off screen?

It was predicted that textual information would require a more regular scanning strategy in order to locate and read the required information; graphical information would attract less fixation time as the required information will be more quickly assimilated; the use of graphical information would result in more time spent fixating off screen as less time is required to view screen contents. In terms of eye movement volatility it was expected that the graphical information would be more easily located than the textual information and that this would be reflected in the lower number of eye movements between screen areas.

9.1 Method

Design: A two factor between subjects experimental design was used. The independent variables were graphic or textual interest rate information and high or low levels of participant involvement. One group of participants viewed webpages containing interest rate information in textual format, the other in graphical format. Within the two information presentation mode groups were one set of participants assigned to a high involvement group, the others to a low involvement group. The dependent variables were webpage area fixations times, eye movement volatility (number of fixation switches between webpage areas) and analysis of participant viewing scanpaths.

Participants were allocated to the four experimental conditions detailed in table 10 below using random numbers generated from the www.random.org website.

Table 10 – Study 5 Experimental Conditions

Group	Between Subject Factor 1	Between Subject Factor 2
Group 1	High Involvement	Graphical Information
Group 2	High Involvement	Textual Information
Group 3	Low Involvement	Graphical Information
Group 4	Low Involvement	Textual Information

To eliminate presentation order effects the six possible presentation orders were set up in parameter files to be implemented using a visual basic program. A parameter file (presentation order) was allocated to participants on the basis of random numbers generated from www.random.org to produce a counterbalanced order of presentation. Similarly, Participants were also allocated to the 4 experimental conditions using numbers generated by www.random.org (see table 11).

Table 11 – Study 5 – Webpage Presentation Orders

Presentation Order	Connect	Digibank	Speedbank
Order 1	1	2	3
Order 2	3	1	2
Order 3	3	2	1
Order 4	1	3	2
Order 5	3	2	1
Order 6	2	1	3

Participants: An opportunity sample of 72 mixed sex participants (age range 18 – 30) were recruited from students and visitors to Northumbria University.

Materials: Materials comprised 6 constructed web pages for fictitious internet banks using information and graphics trawled from existing internet banks. Each bank had two pages constructed which differed in that one contained interest rate information in graphical format (Speedbank – bar chart in bottom centre left area; Digibank – Venn chart in top of centre right area; Connect Bank – Circle measures in middle of centre

right area) and the other contained the same information and size in text format in the same location. The web page organization was based on the template derived from a preliminary survey on online UK banking sites and was similar to that used in study 2. The only difference in layout being the central area which was subdivided into a further three sections which occupied the same space as the original central area. A Visual Basic program was written which opened the internet browser and loaded the web pages and displayed them in the appropriate participant order for 30 seconds each.

Documentation comprised an ethics submission form and checklist, participant information sheet, participant instructions, informed consent form and debriefing document, risk assessment proforma, pre and post display questionnaires and a table of web page presentation orders. Text within the web pages used the same font and font size but in different colours to assist participants discriminate between banks after display. Additionally the ratio of text to graphics areas was the same for all displayed web pages. The instructions for all participants requested that they examine the information in the three banking webpages and decide on the basis of the information they contain in which bank they would choose to invest money. These instructions varied for the two involvement groups by having a larger amount of money for the high involvement group (£50,000) and a smaller amount for the low involvement group (£100). Eye tracking was accomplished using the IviewX eye tracking system as in study 2

Procedure: Participants were allocated a participant number which was used to label the data files in the event of participant withdrawal from the study. They were given the participant information sheet giving general information about the study (appendix 7) and then the informed consent form for them to read and sign. The participant numbers allocated were used to assigned participants to the high-low involvement and

graphic-text groups and determined which presentation order for the webpages was used. Participants were first asked to complete the pre-display questionnaire; they were not timed for this task.

Subsequently, the participants were given the appropriate set of instructions (appendix 7). These informed members of the low involvement group that they have £100 to open a deposit account and were asked to view three banking webpages and on the basis of the interest rate information seen to decide in which bank they would invest this money. Participants in the high involvement group were told that they have £50000 and were given similar instructions. The effect of the differential amount aimed to increase the level of personal relevance and hence the motivation participants have to read web page contents.

Participants then sat in front of the display computer and the eyetracking camera calibrated for their eyes viewing the display screen. Using a visual basic program the three banking webpages were automatically displayed for 30 seconds each using internet explorer and the participant's eye movements recorded. This length of time was judged to be sufficient for participants to locate the required information whilst reducing any effects of visual fatigue. Interaction between the participants and the web pages was not required.

At the end of the display period each participant was immediately given the post-display questionnaire and again allowed unlimited time for completion; any questions they were unable to answer were to be left blank. Following completion participants were given an end of experiment explanatory sheet and debriefed to explain the purpose of the study and to give them the opportunity to comment.

9.2 Results

The data recorded comprised fixation times for each screen area and time spent fixating off screen, order of screen areas viewed and number of changes of screen fixations between defined screen areas. All data was entered in a spreadsheet and organized into high-low involvement groups and graphic-textual information groups. Analysis of fixation times in all screen areas comprised a 2 × 2 (Layout × Involvement) ANOVAs.

Screen Area Fixation Times: This revealed no main effects due to either involvement level [$F(1,66)=1.263;p=0.265$, $\eta^2=0.019$] or mode of information presentation [$F(1,66)=1.793$; $p=0.185$, $\eta^2=0.026$] and no involvement – presentation mode interaction [$F(1,66)=2.302;p=0.134$, $\eta^2=0.03$].

Interest Rate Information Fixation Time: Examination of the fixation times in the screen area holding the interest rate information revealed no significant differences resulting from involvement [$F(1,66)=3.23;p=0.077$, $\eta^2=0.047$] or presentation mode [$F(1,66)=1.038;p=0.312$, $\eta^2=0.015$]. However a presentation mode – involvement interaction was found [$F(1,66)=4.794;p=0.032$, $\eta^2=0.068$] (Fig. 41). For high involvement participants, on-screen fixation time for webpages containing graphical interest rate information was twice that for webpages containing textual interest rate information. Low involvement participants spent less time fixating on webpages containing graphical interest rate information than for those containing textual information, although the difference was marginal. Fixation times for both level of involvement groups for webpages containing graphical interest rate information was about the same. Two possible reasons for this finding are; that for graphical presentation it is harder for observers to extract interest rate information; alternatively it could be that graphical entries are more “interesting” that textual ones. Further research is required to clarify the nature of this interaction and determine its causes.

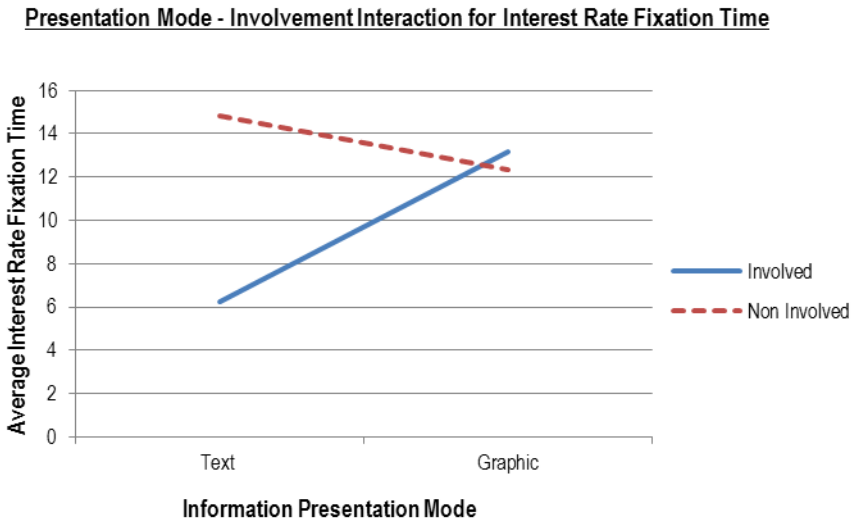

Fig. 41 Presentation Mode-Involvement Interaction

Differences in fixation times between individual screen areas were noted. Less than 1% of time was spent viewing the top and bottom margin areas containing browser status and menu information and about 5% time spent viewing the top panel containing bank identity details and bottom panel containing security and regulatory information. Less than 20% of time was spent in each of the side margins and between 25 and 40% of on screen time spent fixating in the central areas (Fig. 42 below).

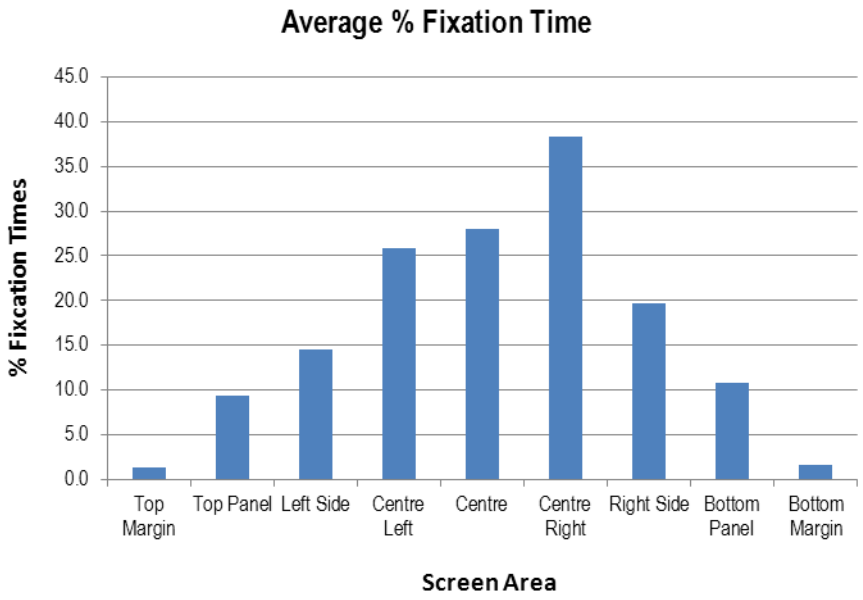

Fig. 42 – Screen Area Average Fixation Times

Screen Area Fixation Switches: A 2 × 2 (Layout × Involvement) ANOVA found no significant effect for involvement [$F(1,66)=1.709;p=0.196$, $\eta^2=0.026$] or presentation mode [$F(1,66)=1.442;p=0.234$, $\eta^2=0.022$] and no involvement – presentation mode interaction was found [$F(1,66)=0.205;p=0.652$, $\eta^2=0.003$].

Scanpath Analysis: Examination of scanpath traces revealed no evidence of regular scanning pattern for any of the groups with scanpaths followed being idiosyncratic to each participant. Few vertical paths were observed but more horizontal paths were noted. The most common scanpaths observed were diagonal, the majority being from upper left to lower right. These were not indicative of text being read but more of searching for areas of interest which drew the attention before fixating on them. This data did not support the hypothesis of a regular scanning strategy for the textual information group.

9.3 Discussion

For all participants, examination of fixation times showed that they were primarily located in the central section of the screen followed, in order, by fixations to the right hand side, left hand side, top and bottom areas. No differences were detected in overall on-screen fixation times between the two involvement level or text and graphics information presentation modes. This finding failed to support the hypothesis predicting that graphical information would attract less fixation time. It is difficult to explain this result other than to suggest that text and graphical information take equal amounts of time to perceive and process. However the presentation mode-involvement interaction for on-screen fixation times suggests that this may not be the case. The differences found between the two levels of involvement groups were confined to the fixation time for textual interest rate information. These differences were primarily attributable to the short amount of time spent fixating on the textual interest rate

information by the low involvement group. This is the opposite of what was expected as it was hypothesized that high levels of involvement would result in longer fixation times and consequently is again difficult to explain. Similarly, high involvement participants spent more time fixating off screen (27%) than those in the low involvement group (22%). Although the difference is marginal, it is again the opposite of what was expected and requires further study to determine the cause.

In terms of the previous research graphical information presentation offers no advantages over textual presentation. Any advantages would have to be similar to the creation of user satisfaction and pleasure as described by Hall & Hanna (2004), Lavie and Tractinsky (2004), Schmit, Yili and Srinhard (2009) or for creating perceived credibility and trustworthiness described by Basso et al (2001), Hu, Lin and Zhang (2001), Karvonen and Parkkinen (2001), Kim and Moon (1998), Riegelsberger & Sasse (2001, 2002), Steinbruck, Schaumburg, Duda & Kruger (2002) and Wang & Emurian (2005).

Inspection of the scanpaths produced by the participants when viewing the test webpages revealed no evidence of organized scanning strategies which fails to support the hypothesis concerning the adoption of identifiable scanning strategies by either the involved or textual presentation groups of participants. Scanpaths observed comprised a mixture of vertical, horizontal and diagonal saccades of which the majority was diagonal in the direction of upper left to lower right hand sides of the screen. This has been previously described as indicative of search behaviour. Although the majority of initial saccades began in either the top panel (23%) or left hand side of the screen (38%) the extent to which this supports the conjecture that users view webpages in the way that they would view ordinary pages of text is questionable. Many of the subsequent saccades varied as to which direction they went but the number that

followed a horizontal (reading) pattern were minimal. Where interesting information was found, evidence of rapid zigzag eye movements around the local area was apparent and could account for longer fixation times in those screen areas. The proposition that webpage scanning mimics the reading of ordinary pages of test could perhaps be tested using cultures whose text reads right to left to see if their majority of initial fixations were located to the top and right of webpages. The scanpaths did not indicate that graphical information was located any faster than textual information or that level of involvement impacted search times as the time taken to fixate the interest rate information varied little between the experimental conditions.

The suggestion that the use of graphical information is more easily located than textual information which will be reflected in participants search patterns with a consequent reduction in the number of gaze switches between screen areas was not found. Although this switching rate diminished for all groups over time indicating growing familiarity with the location of webpage elements, there were no significant differences in screen area switching rates found between either the involvement or presentation mode groups.

The eye tracking results failed to support the use of graphics for the purpose of presenting information to webpage viewers. It neither affected the way in which viewers scanned the page, speeded up information location or improved processing time as indicated by the amount of time spent fixated the interest rate information. A possible explanation for the contrary results for the differing level of involvement groups could be attributed to differing levels of motivation generated by the participant's instructions. To clarify this point, an improved experimental paradigm should be created in which clearly differing levels of participant involvement are produced.

This eye-tracking study found no effects for participant involvement or varying mode of information presentation upon eye movements or fixation times upon across webpage areas. The next chapter extends this study by examining the effect of these two factors upon various aspects of participant's opinions concerning the webpages presented. Specifically, it will look at their willingness to use these banks and determine the level of attention paid to their contents. It will also test their recall of the interest rate presented and the criteria they have used in their evaluation of these webpages.

In the next chapter the second questionnaire part of this study will examine the extent to which the two factors investigated here affect user evaluation of the webpage contents and whether textual ad graphical modes of information presentation affect recall of webpage contents.

Chapter 10

Study 5 Part B – The Impact of Graphics on Subjective Assessments of Ebank Websites

In the previous chapter user involvement and textual and graphical modes of information presentation were investigate. The results showed no significant differences in viewing strategies between the different involvement level groups or between the groups viewing textual and graphical information. This study continues that investigation by investigating possible differences in user webpage evaluation and recall of webpage information resulting from these factors.

10. Introduction

In the previous chapter it was noted that participant responses in the earlier studies raised questions concerning the incorporation of graphics into webpages. Graphics were identified as being of lower importance to webpage evaluation than webpage layout and text. This finding is inconsistent with the results of the graphics survey which showed that if webspace occupancy is used as a measure of importance, then graphics should be regarded at least as important as text content and other webpage characteristics such as layout and colour. This disparity between graphics usage and consumer perception is one that needs to be resolved in view of the high costs of website development and maintenance against their effectiveness in terms of consumer perception of webpage contents and transfer of information to those consumers.

In the previous chapter, the effect of user involvement and information graphics upon eye movements was examined and was found to have no effect upon perception of webpages in terms of scanpaths, overall fixation times and eye movement volatility. This indicated that search times for graphical and textual information were the same. Where a difference was found was in an interaction between information presentation

mode and participant involvement. The conclusion from these results was that the use of graphical elements to present information offers no advantages over the equivalent textual presentation. This study aims to extend this investigation by examining user involvement and graphic-textual modes of information presentation in user evaluation of webpages, their attentional levels and their efficacy in conveying information.

In this study questionnaires will be used to investigate the manner in which user view a selection of ebanks webpages containing interest rate presented graphically or textually. The questionnaire data aims to provide information as to whether the manner of information presentation impacts user views of website usability, assessment of webpage layout and contents and subsequent recall of information presented. The first hypothesis is that graphical presented information will have a greater impact upon user assessment of webpage contents leading to higher value assessments and improved recall of the interest rate information displayed. The second hypothesis is that higher level of participant involvement will result in a more critical assessment of displayed banks and lower ratings of willingness to use them.

10.1 Method

Design: See design section in part A of this study in the previous chapter. The dependent variables were participant responses including internet usage, views on ebanking, participant attention levels, webpage evaluation criteria and willingness to use assessment of a series of displayed webpages.

Participants: See participants section in part A of this study in chapter 9.

Materials: See materials section in part A of this study in chapter 9. The questionnaire design is an enhanced version of that used in study 2 (chapter 7) and comprised 11 sections. Sections 1 to 5 were completed by participants prior to their viewing of the

bank webpages and were designed to capture participant's responses on their internet usage and views on webpage contents and internet banking.

Sections 6 to 11 examined participant willingness to use the services of the displayed ebank webpages; recall of displayed information; evaluation criteria they used and specific questions concerning the webpage content and structure and their level of attention to the displayed information. Its overall aim is to examine participant opinions concerning website structure and contents with individual sections investigating specific aspects of participant behaviour.

Procedure: See procedure section in part A of this study in chapter 9.

10.2 Results

The pre and post display scores for each participant were entered into a spreadsheet. Scores were calculated within the ranges 1 to 5 with a mid-point score of 3. A score of 1 showed strong disagreement with the statement posed by the question and a score of 5 showing strong agreement. Several participants failed to complete all parts of both questionnaires because they were unsure of the answer and these were treated as not known responses and score averages in the result tables and charts took account of these omissions. The questions concerning recognition of the banks in the bank webpages section were not included in the analysis of that section as they were not relevant to the credibility and trust effects being measured.

For the numerical data from each question separate 2 × 2 (Involvement × Layout) ANOVAs were carried out. For frequency data for each question within the section χ^2 analyses were carried out.

Willingness to Use Bank: For the willingness to use the banks no effect was found for presentation mode [$F(1,67)=1.813; p=0.182, \eta^2=0.026$], involvement [$F(1,67)=0.539;$

p=0.466, η^2= 0.008] or any involvement-presentation mode interaction [F(1,67)=0.011; p=0.918, η^2=0.000].

Willingness to Invest in Bank: For this question no effect was found for presentation mode [F(1,67)=0.811;p=0.371, η^2=0.012], involvement [F(1,67)=0.357; p=0.552, η^2= 0.005] or any involvement-presentation mode interaction [F(1,67)=0.008; p=0.929, η^2=0.000].

Willingness to borrow from Bank: No effect was found for presentation mode [F(1,67)=1.421; p=0.237, η^2=0.021], involvement [F(1,67)=0.107; p=0.745, η^2= 0.002] or any involvement-presentation mode interaction [F(1,67)=0.057; p=0.813, η^2=0.001].

Trust in Displayed Banks: For involvement a significant association was found with trust [χ^2(2)=8.397;p=0.015, φ^2 =0.04] and for presentation mode a similar association was found [χ^2(2)=11.657;p=0.003, φ^2 =0.055].

Participants Attention Level: No significant effects found for Involvement [F(1,67)=1.081; p=0.302, η^2=0.016, mode of presentation [F(1,67)=0.284; p=0.596, η^2=0.004] or any interaction [F(1,67)=3.012; p=0.087, η^2=0.043].

Percentage Webpage Contents Read by Participants: No significant effects found for Involvement [F(1,67)=1.463; p=0.231, η^2=0.021, mode of presentation [F(1,67)=0.288; p=0.593, η^2=0.004] or any interaction [F(1,67)=1.519; p=0.222, η^2=0.022].

Participants Recall of Webpage Information: No significant effects for involvement on highest interest rate recall [X^2(1)=0.033; p=0.97, Φ^2=0.011] or mode of presentation X^2(2)=0.21; p=0.885, Φ^2=0.000].

No significant effects found for involvement on lowest interest rate recall [$X^2(2)=0.39$; $p=0.532$, $\Phi^2=0.001$] or mode of presentation $X^2(1)=0.339$; $p=0.56$, $\Phi^2=0.001$].

No significant effects found for involvement on security information recall [$X^2(2)=2.196$; $p=0.138$, $\Phi^2=0.008$] or mode of presentation $X^2(1)=1.234$; $p=0.267$ $\Phi^2=0.004$].

Use of Screen Characteristics for Evaluation: No significant effects for involvement on the use of screen characteristics for webpage evaluation purposes [$X^2(18)=17.899$; $p=0.462$, $\Phi^2=0.252$] or mode of presentation $X^2(18)=17.55$; $p=0.486$ $\Phi^2=0.2474$].

Importance of Interest Rate in Decision Making: No significant effects found for Involvement [$F(1,67)=1.127$; $p=0.292$, $\eta^2=0.017$, mode of presentation [$F(1,67)=0.307$; $p=0.581$, $\eta^2=0.005$] or any interaction [$F(1,67)=2.952$; $p=0.09$, $\eta^2=0.042$].

Average results showed that rated levels of attention were around average with only about 25% of the contents of each webpage were read; interest rate levels were regarded as being quite important. Fig. 43 below shows the total responses to the screen characteristics questions. These reflected the pre-display questionnaire responses and screen layout was regarded as being most important followed by the menu choices and colour scheme used. The other characteristics were selected less often except for graphics content which was regarded as the least important for evaluation purposes.

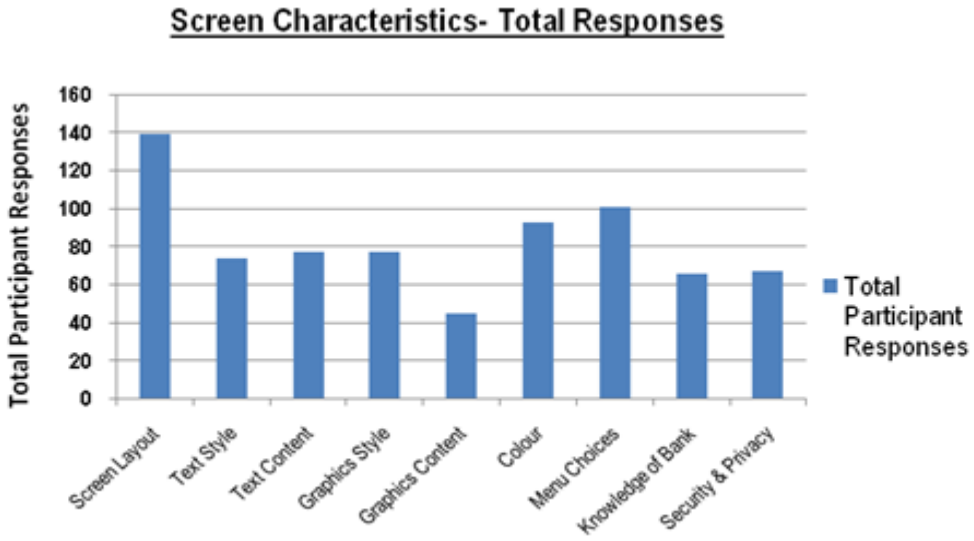

Fig. 43 – Screen Characteristics - Total Participant Responses

Although no difference was found between test groups participant recall of interest rate information was uniformly poor across all three banks with 12-13% of participants admitting they could not recall any of the interest rates. Of the remainder 33% correctly identified that Connect bank offered the highest interest rate and 23% correctly identified that Speedbank offered the lowest interest rate. When asked for the actual interest rates 10% were correct for Digibank, 6% for Connect Bank and 13% for Speedbank . These results offer only patchy support for the hypothesis that graphical presentation of information improves recall rate. They do not support the hypotheses that graphical information presentation or increasing level of involvement would improve participant improve recall.

Post Questionnaire Verbal Comments: The unprompted comments passed by participants after completion of the post display questionnaire and before debriefing were noted for examination following their departure. They were broadly categorized into the groups shown in table 12 below:

Table 12 – Participants verbal comments made post testing

Comment	Positive Comment	Negative Comment
Bank Recognition	6 reported recognizing Banks	45 reported not recognizing banks
Webpage Design	19 considered them professional	31 considered them unprofessional
Information Clarity	6 reported clear accessible information	6 reported unclear inaccessible information
Information content	41 reported webpages contained too much information	4 reported easy access to information
Trust and Security	14 positive trust and security related comments	21 negative trust and security related comments
Genuine website	2 positive comments	
Website trust	4 reported would trust websites	17 reported would not trust websites

The most notable comment was that the displayed banks were unfamiliar and that was the primary influence on their decisions on whether they trusted or would use the banks. Security was next most commented webpage aspect followed by the layout and "professionalism" of the webpage construction. When asked to clarify the "professionalism" aspect they pointed to a mixture of characteristics such as layout, font, graphics, colour, and ease of reading. Amount of content was another issue raised as some of the participants felt that there was too much content making it difficult to read and locate information. Comments related to security were the next most frequent. These primarily referred to the presence of security information or logos.

10.3 Discussion

Previous research has found that graphics increase perceived credibility and trustworthiness (Basso et al, 2001; Hu, Lin and Zhang, 2001; Karvonen and Parkkinen, 2001; Kim and Moon, 1998; Riegelsberger & Sasse, 2001, 2002; Steinbruck, Schaumburg, Duda & Kruger, 2002; Wang & Emurian (2005). If the results of this

study were to be consistent with these findings then participants viewing the graphically presented information would be expected to demonstrate greater willingness to use the displayed ebanks. The results of this study showed no effect of graphically presented information upon their willingness to use any of the services of the displayed ebanks or that graphical information would raise participants recall rates. Similarly, involvement was expected to raise participants recall rates but lower participant evaluations of the webpages. The results supported neither of these hypotheses as no differences were found in participant webpage evaluations or information recall rates. In this case higher participant involvement did not lead to a more critical approach to evaluation and this result varies from that found in chapter 7 where involvement was found to affect participant's responses to the internet banks usage questions.

Neither the recall of which ebanks offered the lowest or highest interest rates nor the recall of actual interest rates figures was affected by level of involvement or mode of information presentation. This is surprising as the predictions based on Fogg's (2003) PI theory and Dual Process theories suggested that both of these factors would significantly improve interest rate recall. The lack of effect of the involvement factor may be due to a failure to increase the participant level of involvement by the experimental paradigm of investing different amounts of money. This hypothesis needs to be re-examined with another experimental model creating greater participant involvement. Analysis of the text and graphic presentation recall rates showed that the graphic presentation group produced greater number responses whereas those in the text presentation group were less confident about their recall and failed to enter responses into the questionnaire. Despite the increased response rate for the graphics presentation group, no differences in accuracy rate were found pointing to there being no detectable difference between these different modes of information presentation.

Like the interest rate questions, responses for the security information were higher for the graphic presentation group than the text group. Similarly they were also higher for the low-involvement group than the high-involvement group. These results again support the suggestion that graphical presentation raises the confidence of the participants whereas lower participant involvement lowers it.

Examination of the recall of interest rate information shows a large number of participants (13%) admitted that they could recall none of the interest rate displayed. Less than a third correctly identified the Connect Bank webpage as offering the highest rate and only a quarter identified that the Speedbank webpage offered the lowest. The rates for the recall of the interest rate figures were worse than those for identifying which ebanks offered the highest and lowest interest rates. These differences are noteworthy in that they indicate that the identification of banks with the highest and lowest rates is not dependent upon recall of the interest rates as their recall accuracy was lower. The conclusion is that the information concerning highest and lowest interest rates appears to be processed and coded separately from the actual interest rate figures. The task given to the participants required them to locate and memorize the interest rate for three banks and identify that which offered the highest rate. Recall of this information was successfully carried out by only a small number of the participants. Why they failed to successfully accomplish this simple task is not clear. Further research is required to investigate whether this poor recall rate is an experimental phenomenon or whether it is a characteristic of internet usage.

Although several participants reported recognizing the fictional banks used in the study the majority responded that they did not recognize them – the average score being below 2. Following from this, their responses to “use bank”, “invest in bank” and “borrow from bank” were also low with average scores of 2. This result reflects the

majority response from the pre-questionnaire concerning dealing with familiar organizations and the earlier highest scoring question from the post-test questions that participants would only bank with a known familiar bank.

The first banking website assessment questions were the subjective levels of attention question. A third of the participants reported having poor or little attention and this may go some way to account for the poor interest rate recall scores. The remaining participants rated their attention level at average or good. A question that derives from this is how long during the display periods were they able to maintain these levels of attention and how much time was spent actually looking at the webpage screen? Involvement level and graphics presentation mode made no significant difference to attention level although differences between the groups were observed which tended to suggest that improved involvement would raise attention levels.

Reported reading levels were lower than the level of attention scores. Nearly half of the participants reported reading only 25% of the webpage; a third read half of the webpage and a sixth read 75% of the webpage. The remainder read none of the webpage. It was expected that more of the webpage was read but this low reading score could be attributed to shortness in the exposure time of 30 seconds per webpage and lower than expected attention levels. However it could also indicate that more time was spent looking for other webpage elements or those participants were being highly selective over which text elements they read. Again no significant effects were found due to involvement levels or information presentation mode.

The participants selection of which webpage characteristics they considered important to their assessment of webpage usability were similar for both pre and post-test questionnaire. The most significant feature from both was screen layout which was selected by the majority of participants. Second in the list of important screen feature

was the menu and the choices followed by colour. Text style and content followed by graphics were the next features listed. It is notable that screen features are primarily used for webpage assessment over the content. This finding lends support to the suggestion that webpage usability is determined by simple heuristics rather than consideration of webpage contents. It is also interesting to note that the security questions of bank familiarity and security and privacy appear near the bottom of the list although it reappeared in the post experimental comments. This result echoes the earlier finding that few of the participants recalled which banks were secure which was indicated by the presence of security seals and text on the webpage. A probable reason for participants failing to note the presence of this information is that of poor attention. Again, this may have been due to task as it was described to the participants where they were not asked specifically to verify that the banks were secure. However in view of the participant's poor rating of the importance of security it would be interesting find out whether a similar result is obtained from a real-life task using participants conducting a similar task online.

Responses to the interest rate question clearly shows that interest rate falls below some of the screen features for the assessment of webpages and that low involvement participants consider it more important than the high involvement group. There is no apparent reason for this other than it could be a result of the artificial nature of the task and that a real life situation where actual money is involved would produce a different result.

Conclusion: In these last two chapters a comparison has been made between textual and graphical modes of presenting interest rate information which found no significant effects on webpage evaluation or recall of presented information for either mode of presentation or participant's involvement. In the next chapter the role of graphics will

again be examined but in the context of ebank security. Earlier, website security was identified as an issue of concern to users conducting transactions over the WWW. However the questionnaire results from the previous studies suggest that such security is of lower importance to ebank users than other webpage characteristics and that the presence of security information is of marginal importance to ebanks users. In the next study the use of graphical security indicators will be examined and their effects upon eye movements and user willingness to use ebanking facilities identified.

CHAPTER 11

Study 6 Part A The effect of Security Information and User Involvement on Webpage Viewing strategies

UK Banks have long identified internet banking as a cost effective option for providing retail banking services and have actively followed a policy of promoting their online services. Ensor, Lussanet, Van Tongeren & Camus (2007) predict that from 2007 to 2012, online banking will increase from 15 million users (31% of adults) to 22 million users (44% of adults). The only blip on the horizon for this growth is the problem of online fraud, its perceived risk by users and the subsequent effect upon their trust and confidence in online banking. This chapter examines the role of user involvement and security information in ebanking websites and questions if the presence of security information affects the way in which users view webpages and whether security information attracts user attention.

11. Introduction

The role of website graphics is the subject of both research and debate in which the evidence points there being both positive and negative aspects to their website presence. In the two previous chapters we looked at the role of graphics as a mode of presenting information. We examined its possible benefits in term of its attention grabbing properties and whether information presented graphically was more easily recalled than textually presented information. The studies showed that graphical presentation of information was not superior to textual information either in terms of gaining user attention or improved recall of information. In this study we will again look at graphics but in the context of a mode common function of security indication.

The BBC (2006) report "Net Crime Big Fear for Britons" highlights the fact that more Britons fear internet crime than they do burglary. Using the figures from a Government "Get Safe Online" study they found that 21% of respondents felt at risk from net crime whilst only 16% felt at risk from burglary. Similar results are reported by Ensor et al

(2005) and Furnall and Karweni (1999). One of the sources of this fear is the continual news revelations of various forms of online criminal activities notably those involving counterfeiting, keystroke logging, spoofing, phishing, hacking, pharming, scalping and identify theft. A question raised by this problem is who is responsible for countering these criminal activities and ensuring online security. Unfortunately for ebanks it is widely perceived by the public and authorities that it is their responsibility. This is exemplified by the Monetary Authority of Singapore (MAS) who wrote to their Banking Auditor in Chief attaching security liabilities to the banks (2001) and the UK Financial Services Authority (out-law.com, 2006) who similarly warned banks they had to provide security support to their customers. Herein lies the problem for ebanks. Responsibility for online security has been consigned to them and as a consequence existing and potential ebank customers have expectations concerning the ebanks adoption and implementation of online security procedures. The task for ebanks is not only to implement online security measures but to be seen to be doing this by both their customers and other interested parties.

The purpose behind ebanking is the distancing of the ebank from the customer and by the provision of banking services through the ebank website. Accordingly, not only do security measures need to be implemented through these websites but customers must be made aware of these measures via the same route, thereby allaying customer fears and projecting an image of a secure ebanking environment. Methods of accomplishing this included the use of comfort graphics, provision of internet security software, the use of usernames, security questions, passwords, data encryption, security certificates, policy statements, seals, pop-ups and financial regulatory information. Most of these are visual indicators of security or what Egwali & Oghenerukevbe (2008) call SI's or Security Indicators and it could reasonably be argued that their presence would be a significant factor in the creation of website credibility and user trust.

Incorporating such security devices into their websites is intended to indicate that ebanks are fulfilling their security obligations to their customers, regulatory authorities and themselves. However the question remains as to whether these measures are recognized by customers and satisfy their expectations concerning online security and have a significant role in the creation of website credibility. In order to be effective they need to be "noticed" by customers using ebank websites and their purpose understood. Fogg's PI Theory (2003) predicts, that as an important customer issue, website security indicators would cross the cognitive threshold to be "noticed" before their presence was "interpreted" and used for website security evaluations. The theory describes user involvement as significant factor in the prominence stage of website evaluation through its effect of lowering the cognitive threshold for particular webpage elements to be noticed. However, despite the intuitive appeal of these views there has been little empirical work carried out to support them. Some evidence to support these views comes from work carried out in support of the dual process theories which also identify personal involvement as playing an active role in the perception and consideration of information. Research by Andrews, Durvasula and Akhter (1990), Brickner et al (1986), Bumkrant and Unnava, (1989) and Greenwald and Leavitt (1984) have also supported the role of involvement in user evaluation and credibility rating of website information. Nevertheless, earlier studies described in this thesis have found only limited effects for involvement on webpage viewing strategies. This experiment continues these studies by investigating the effect of involvement and the presence of security indicators on webpage viewing strategies.

In this chapter we will use eye-tracking methods to examine the role of user involvement and the presence of security indicators on user webpage viewing strategies. Constructed ebank webpages will be displayed to participants where some webpages contain security indicators; other will contain neutral graphic images in the

same location. To generate user involvement two groups of participants were given notional amounts of money to invest; one a large amount to stimulate high involvement the other a small amount to generate low involvement. It is hypothesized that, in relation to the security manipulation participants tasked with carrying a security assessment will spend more time fixating on screen and they will seek out security indicators with a more organized scanning strategy. This will be demonstrated by evidence of regular longer saccades between selected visual targets and longer fixations between saccades as information viewed is processed. Similarly, in relation to the involvement manipulation, we would expect that participants with a higher level of involvement would be expected to show similar scanning and fixation patterns as those seeking security information as they look for interest rate information. The hypothesis is these participants will spend more time fixating on screen; seek out interest rate information with a more organized scanning strategy with evidence of regular longer saccades between selected visual targets and longer fixations between saccades as information viewed is processed.

11.1 Method

Design: A two factor between subjects experimental design was used. The independent variables were high-low levels of participant involvement and presence-absence of security information. The dependent variables were webpage area fixations times, eye movement volatility (number of fixation switches between webpage areas) and analysis of participant viewing scanpaths.

Participants were assigned to one of the experimental groups outlined in table 13 using random number in the range 1 – 4 generated from www.random.org website.

Table 13 Experimental Conditions

Group	Between Subject Factor 1	Between Subject Factor 2
Group 1 (condition 1)	High Involvement	Security Information
Group 2 (condition 2)	High Involvement	No Security Information
Group 3 (Condition 3)	Low Involvement	Security Information
Group 4 (Condition 4)	Low Involvement	No Security Information

To eliminate possible order effects from the sequence in which webpages were viewed participants were assigned to one of six possible webpage presentation orders to provide a counterbalanced order of presentation (shown in table 14) below using random numbers in the range 1- 6 using generated from www.random.org website.

Table 14 – Webpage Presentation Order

Presentation Order	DBS Banking	IBF Banking	Web Banking
Order 1	1	2	3
Order 2	3	1	2
Order 3	3	2	1
Order 4	1	3	2
Order 5	3	2	1
Order 6	2	1	3

Participants: An opportunity sample of 72 mixed sex participants (age range 18 – 30) were recruited from students and visitors to Northumbria University.

Materials: Materials comprised 6 constructed web pages for non-existent constructed internet banks using information and graphics trawled from existing internet banks (see below and Appendix 8). Documentation comprised an ethics submission form and

checklist, participant information sheet, participant instructions, informed consent and debriefing document, risk assessment proforma, pre and post webpage display questionnaires and a table of webpage presentation orders – see appendix 8.

Text used on each webpage used the same font and font size but in different colours to aid participants discriminate between webpages**.** The ratio of text to graphics was the same in all webpages. Each bank had two pages constructed which differed in that one contained security information (Digital Banking Service (DBS) - VeriSign Secure site seal– bottom of left margin; Internet Banking Service (IBS) -VeriSign Secure site seal – Bottom right margin; Web Banking Service (WBS) - Trustpoint secure site seal - top right margin), whereas the other contained general information (DBS - DBS Annual Report; IBS – IBS Annual Report; WBS - child account) in the same location. The web page organization was based on the template derived from a preliminary survey on online UK banking sites and was similar to that used in study 3 where the central area was subdivided into two sections which occupied the same space as the original central area. A Visual Basic program was written which opened the internet browser and loaded the web pages and displayed them in the appropriate participant order for 30 seconds each.

The instructions for all participants requested that they examine the information in the three banking webpages and decide on the basis of the information they contain in which bank they would choose to invest money. These instructions varied for the two involvement groups by having a larger amount of money for the high involvement group (£50000) and a smaller amount for the low involvement group (£100). In addition the instructions for the high involvement group were asked to take bank security into account when making their decision.

Procedure: Participants were allocated the next participant number from the order of participant testing which was used to label the data files in the event of participant withdrawal from the study. Assignment to the involvement level and security/no security information group and webpage display order was achieved using random numbers in the range 1 – 12 obtained from www.random.org and allocated to the participants sequentially.

Participants were given the information sheet giving general information about the study and then the informed consent form for them to read and sign (see appendix 8). Participants then completed the pre-display questionnaire asking them background questions concerning their internet experience, preferences concerning web site contents and their usual purposes for their internet access. They were not timed for this task.

Participants were given the appropriate set of instructions (see appendix 13). These informed the low involvement group were told that they have £100 to open a deposit account and were asked to view three banking webpages and on the basis of the interest rate information seen to decide in which bank they would invest this money. The high involvement group was told that they have £50000 and given similar instructions. The effect of the differential amount aimed to increase the level of personal relevance and hence the motivation participants have to read web page contents. The requirement to also take security information into account was geared to prompt participants to seek security and regulatory information on the webpages.

Participants then sat in front of the display computer and the eyetracking camera calibrated for their eyes viewing the display screen. Using a visual basic program the three banking webpages were automatically displayed for 30 seconds each using internet explorer and the participant's eye movements recorded. There was no

interaction between the participants and the web pages. At the end of the display period each participant was immediately given the post-display questionnaire and again allowed unlimited time for completion; any questions they were unable to answer were to be left blank. Following completion participants were given an end of experiment explanatory sheet and debriefed to explain the purpose of the study and to give them the opportunity to comment.

11.2 Results

The score of one participant was discarded as eye-tracking was lost during the experiment. The data recorded comprised fixation times for each screen area and time spent fixating off screen, order of screen areas viewed and number of changes of screen fixations between defined screen areas. All data was entered in a spreadsheet and organized into high-low involvement groups and graphic-textual information groups. Analysis comprised 2 × 2 (Layout × Involvement) ANOVAs.

Screen Area Fixation times: For all screen areas no significant differences were found between the high-low involvement groups [$F(1,67)=1.739$; $p=0.192$, $\eta^2=0.025$]. A significant difference with medium effect size for all screen areas was found for the presence of security information [$F(1,67)=6.087$;$p=0.016$, $\eta^2=0.083$]. No interaction effect was found [$F(1,67)=1.459$;$p=0.231$, $\eta^2=0.021$]. Fig. 44 below shows that higher onscreen fixation time was found for participants viewing webpages containing security indicators.

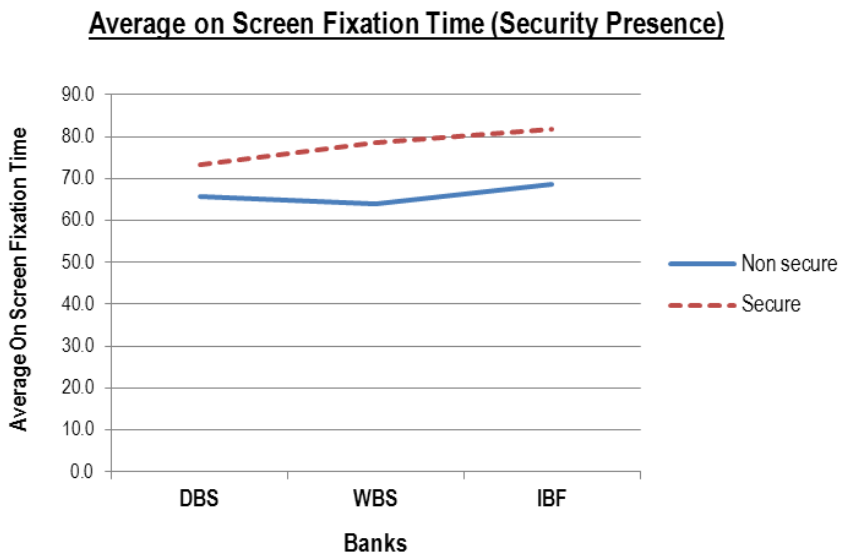

Fig. 44 - Average On-Screen Fixation time (security presence)

Security Indicator Area Fixation Times: for the screen area containing security indicators no significant effect was found for involvement [$F(1,67)=2.205$; $p=0.159$, $\eta^2=0.029$] nor any interaction effect [$F(1,67)=0.783$; $p=0.379$, $\eta^2=0.012$]. A significant effect of medium size was found for the presence of security information [$F(1,67)=15.23$; $p<0.001$, $\eta^2=0.185$] where time spent fixating security indicators was twice that of the neutral images.

Interest Rate Area Fixation Times: Fixation times for the screen areas containing interest rate information showed no significant differences due to involvement level [$F(1,67)=0.181$;$p=0.672$, $\eta^2=0.003$] or security information presence [$F(1,67)=2.137$; $p=0.148$, $\eta^2=0.031$]. No effects due to interaction were found [$F(1,67)=2.045$;$p=0.157$, $\eta^2=0.03$].

Differences in fixation times between individual screen areas were evident. Time spent in the top and bottom margins was under 1% of total fixation time. About 5% of the time was spent viewing the top panel and less than 20% of time was spent in each of the side margins. The majority of fixation time (between 25 and 40% of total on screen time) was spent fixating in the central areas (Fig. 45 below).

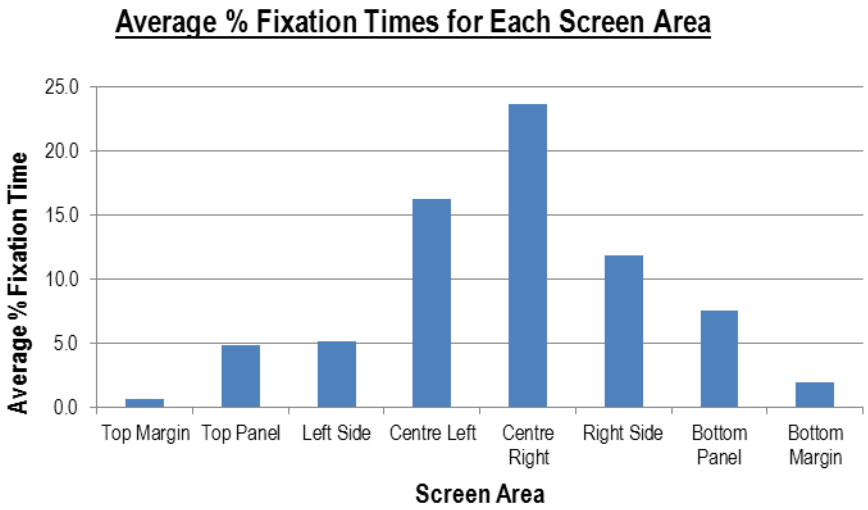

Fig. 45 Average % Fixation Times for Each Screen Area

Screen Area Switching: For screen area switching no significant effects were found for involvement [$F(1,66)=0.004;p=0.953$, $\eta^2=0.000$] security presence [$F(1,66)=0.441;p=0.449$, $\eta^2=0.007$] or any interaction effects [$F(1,66)=1.256p=0.266$, $\eta^2=0.019$].

Scanpaths: Examination of scanpaths revealed no evidence of organized scanning strategies. Scanpaths primarily comprised diagonal saccades with a lower percentage of horizontal saccades and few vertical saccades. Scanpaths were idiosyncratic to each participant with saccade length varying widely with no pattern of early movements towards security or interest rate information. A typical scanpath is shown below in fig. 46.

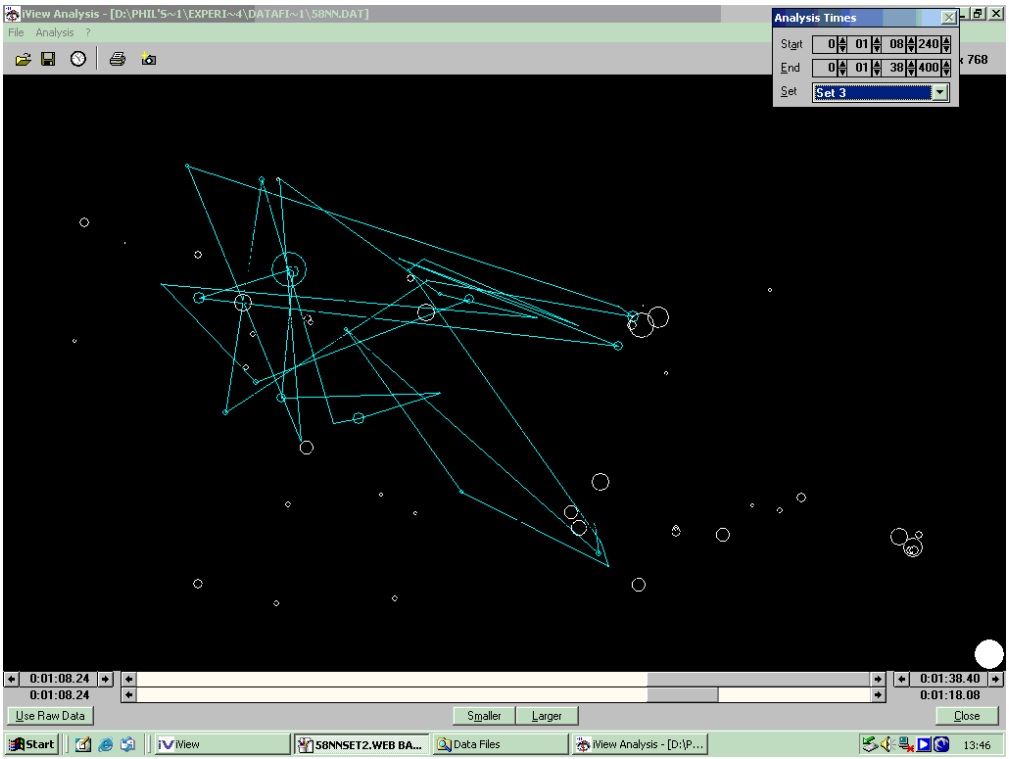

Fig 46 - Typical Scanpath

11.3 Discussion

The total fixation times for all screen areas were higher when security information was included on the webpage. This result supports the first hypothesis which predicted that the presence of security information would affect viewer webpage scanning strategies so that that participants viewing security information containing webpages spent more time fixating on screen. This difference in on-screen fixation times was mainly spent looking at the screen area containing the security information where a significant difference was found between the security information and neutral images contained in these areas. The conclusion may be drawn that security indicators attracted more attention than neutral images. The presence or absence of security information had no effect upon fixation times upon interest rate information.

Analysis of the results for the two involvement levels groups found no differences either for the total fixation time on-screen , fixations upon security information or fixation time on the screen areas containing interest rate information. This result was

contrary to expectation and fails to support the second part of the hypothesis. It indicates that either involvement does not affect participant on screen fixation times and is contrary to what would be predicted by Fogg's PI theory or the dual process theories. However it is possible that the experimental paradigm creating participant involvement was insufficiently relevant to participants to engage their interest thereby not generating a difference in involvement levels. In addition, no differences were found between the security present/absent groups for this area. The rate of switches of visual attention between screen areas was not affected by either involvement level or the presence of security level and no difference was found between banks.

For the two hypotheses no supporting evidence was provided by examination of scanpaths. Scanpaths for each participant and bank were examined but revealed no evidence of regular scanning strategies between involvement, security present/absent groups or banks. Saccades to and across the security information and interest rate screen areas were present but did not take place for all participants at the beginning of each bank webpage exposure period but at varying intervals during the display periods. This lack of early saccades to screen areas containing security information or interest indicates that these areas were either were not identified early during each display period or were not prioritized above other areas of visual interest. Generally scanpaths were idiosyncratic varying not only across individuals and groups but also across banks for each participant. Scanpath tracks over time showed that they comprised primarily of diagonal saccades interspersed with occasional horizontal scans. Few vertical saccades were noted. The apparently haphazard pattern of saccades indicates that participants did not plan their view strategy or follow a simple left to right scan as though reading a page. The conclusion that may be reached is that participants were "noticing" particular webpage elements and redirecting their attention to the elements as they were noticed.

There is no evidence of a prioritization targets or of any obvious spatial or temporal sequences.

Overall examination of the fixation times over all screen areas show that a general preference for fixating in the central screen area. For all participants less than 5% of fixation time was spent in the top and bottom screen margins as these contained no relevant information other than identification and policy information. The top and bottom panels attracted between 4% and 8% fixation times. The two central screen areas attracted most fixation time (> 40 %) with the centre right attracting more attention than centre left as this area contained the interest rate information for all three banks. The sides of the screen attracted less than 12% of fixation time with the right side attracting more than double that of the left hand side. These fixation period across individual screen areas are similar to those found in the previous eye-tracking results and shows a general preference by all participants to direct their attention towards the central and side area of the screen.

The requirement for banks to engage both existing and prospective customers into the consideration and implementation of online security is an imperative both for their success as an effective online business and to satisfy their legal obligations. Their need to improve customer security awareness has been addressed in a variety of ways including security awareness drives, free internet security, security advice webpages and the use of security seals and security software. The question initially raised is that of the value of devices such as seals and logos and are they interpreted by customers as indicating online security thereby helping to establish trust?

From an ebank's perspective the presence of security seals on their website portal webpages, when noticed, operate to quickly establish their security credentials with their customers. The results of this study show that when asked to evaluate webpage

usability the presence of such seals not only to directs attention to their presence but also raises customer interest by increasing the total on-screen fixation time.

Ebank security information is not solely confined to the incorporation of security seals, data encryption and security software logos into portal webpages. Security advice is often contained deep within websites and requires navigation through the website to reach it. Customers wishing to quickly locate interest rate or other information appear unlikely to take the time to locate, visit and assimilate security information not immediately available. Support for this conjecture is supplied by the results of this study. Ebanks often include security, regulatory and policy statements containing security information at the bottom of their portal webpage. The area fixations show that this is an area of the webpage that is rarely visited and attracts little customer fixation time. A question raised by this is whether this indicates unwillingness by customers to read this small print albeit with important information or is the bottom segment of all webpages similar to the top segment in that both appear to attract little viewer attention. To clarify this point users need to be questioned and their reasons for not fixating on these areas determined.

Despite the conjecture of Fogg (2203) and earlier research indicating the important role played by user involvement in perception and consideration of webpage contents the result of this study clearly indicate that this factor has no impact upon the webpage viewing strategies of users. Screen area fixation times were not affected by user involvement and no discernible differences in webpage scanning strategies were found. This result is similar to that of previous studies in this thesis and it may be concluded that all these results accurately reflect the low impact of user involvement on webpage scanning strategies. However, in view of the positive results of other researchers concerning user involvement the results of these studies may be the result of a weaker

experimental paradigm than that used by other researchers. Accordingly, the study should be revisited with a stronger involvement scenario in order to validate the studies described in this thesis.

Overall the picture of online banking security is confused. Whilst there are genuine concerns amongst a proportion of internet users, other research has found a degree of complacency regarding it as a minor issue which is the responsibility of someone else. Ensor et al (2005) reported in a survey of over 11000 UK net that whilst most were aware of online security threats many consumers were complacent about online security and expect their banks to deal with the problem. They also found that a large minority of consumers have given up online banking as a result of security fears, a similar result to the BBC (2006) report "Net Crime Big Fear for Britons" and Penn Doyle and Sage (2005). The results of this research support the view that users are aware of the online security issue and that it influences the manner in which they view webpage contents. However, the relative value of security seals to other security measures is another area of interest. Cook and Luo (2003) describe the importance of third party seal programs acting as intermediaries between customers and online vendors. Berlanger Hiller and Smith (2002) examined the role of privacy, security and site attributes and found that consumers value security features more highly than third party security and privacy seals or privacy statements. This finding may give some insight as to the reason that security, regulatory and policy statements at the foot of portal webpages attract little attention and appear to be rarely considered in usability evaluations. However, the findings do raise questions concerning the relative values of different security measure and in their perception by online customers and how they impact the manner in which users scan and perceived webpage information.

Conclusion: In this chapter we have reviewed some of the background and research related to ebank security issues. It has been noted that although online security is an important issue for users many of them appear ambivalent about their security responsibilities and leave it to the ebanks to establish appropriate security procedures. The study investigated the effect user involvement and security indicators upon user webpage viewing strategies and found that involvement had no effect upon user viewing strategies but that the presence of security indicators attracted viewer attention and increased overall on-screen fixation times. In the next chapter this study will be continued by examining both the effect of user involvement and the presence of security indicators to user webpage evaluations and their effect upon user willingness to use ebanks.

CHAPTER 12

Study 6 Part B The effect of Security Information on User Assessment of Webpages

In the previous chapter we examined the effect of security indicators upon user webpage viewing strategies. The findings were that the presence of security indicators attracted viewer attention and led to more attention to webpage contents in terms of increased on-screen fixation time. This chapter examines the role of security information in ebanking websites and questions whether the presence of such information impacts the manner in which users view those websites..

12. Introduction

In the previous chapter we looked at the effect of security indicators and user involvement upon the way in they might impact user webpage viewing strategies. It was found that security indicators attracted viewer attention and increases the amount of time users spent viewing webpages. However, user involvement was again found to have no effect upon user webpage viewing strategies. In this chapter we continue to examine the role of user involvement and the presence of security indicators upon user willingness to use ebanks websites and their effect upon user evaluation of those websites..

Consumer usage of ebank website facilities is dependent upon multiple factors. Previous research in this thesis found that user familiarity with the bank, the webpage layout and involvement can all affect both user perception of the website facilities and their willingness to use their facilities. Other factors have been found to exert similar effects and primary amongst these is security (Liao & Cheung, 2002; Law, 2007; Agarwal, Rastogi & Mehrotra, 2009). User willingness to use ebank services is often contingent upon perceived security and without it website credibility and user trust cannot be established. Banks have adopted a variety of means to establish their security

credentials by addressing what Penn, Doyle & Sage (2005) call the Four Pillars of Security: Identity Assurance - Protecting Accounts; Usage Assurance - Ensuring Proper Use of Personal Information; Service Assurance - Validating Authenticity Of The Business; Privacy Assurance - Controlling Access To and Use Of Personal Data. For existing customers this involves the use of usernames, passwords, data encryption and security questions to allow access to accounts and complete transactions. In addition, to improve customer security awareness, banks often include areas within their websites providing security information and links to external advice sites such as www.banksafeonline.co.uk.

Unfortunately for the banks, much of this security information and many of the links are buried within their websites and as customers rarely venture past the portal page those security messages not on this page are lost. Accordingly they need to establish their security credentials at this first contact which Wang et Al (2003) describes as creating ”perceived credibility”. Occasionally banks use “Comfort Graphics” containing messages such as “Peace of mind when you bank with us” or “Helping Hands” but in most cases they use what Egwali & Oghenerukevbe (2008) call SI’s or Security Indicators to give users a visual indication of online security. These usually comprise security warnings, privacy and security seals, financial regulatory information, policy statements and pop-ups. However, all these bank initiatives tend to address the problem from the perspective of their own banking systems and there are three difficulties with this approach. Firstly, the security message often erroneously assumes a level of computer knowledge which is not held by customers (e.g. information containing details such as 128 bit encryption and Rapport Software). Secondly, the existing procedures are often geared towards existing customers rather than prospective customers (e.g. the supply of free security software by Barclays bank to its customers). Finally, as Leydon (2005) points out, most attacks such as Trojans,

key logging and phishing are initially directed towards users and their PC's rather than directly at the Bank's own systems.

As a result of these perceived security issues banks are losing business and a survey by Ensor et al (2005) concluded that over half a million users had abandoned online banking because of these security fears. They also found that continuing customers had somewhat ambivalent attitudes to online fraud with many being unsure what to do and the remainder expecting the banks to handle it. This pattern of responses raises questions about user assessment of online banking security, its implementation and subsequent role establishing bank credibility and user trust. Fogg's (2003) PI theory predicts website credibility assessments are based on prominence ("information noticed") and specifies five factors affecting prominence of which only webpage content is not user related. In view of the often expressed security concerns by user it would be reasonable to assume that the presence of security information would be webpage content that is "noticed" and subsequently impact user consideration of the webpage contents.

In previous chapters we have investigated the role of participant involvement as a factor in determining their willingness to use ebanking facilities. Those studies used Fogg's (2003) I Theory and the Dual Process Theories describe the role of user involvement in the formation of website credibility. The findings, like those of Andrews, Andrews, Durvasula and Akhter (1990); Brickner et al (1986); Bumkrant and Unnava (1989); Greenwald and Leavitt (1984), demonstrated that user involvement impacted user perception and evaluation of website contents. These studies indicated that both user involvement and perceived security affect the establishment of website credibility. Earlier research (Cunningham et al, 2005; Flavian & Guinaliu, 2006; Liao & Cheung, 2002; Nielsen, Adams & Herd, 2007) has highlighted the importance that users place on

perceived security. However, earlier studies described in this thesis found that security, when not specifically asked to consider it, was rated below colour, menu and text style in importance when assessing websites. Clearly there is an inconsistency between the value users assign to security information when assessing website and their stated concern as to the risks associated with online financial transactions. What is also not clear is the effect user involvement upon user perception of website security and how it affects assessment of website usability.

Accordingly, this study will provide a more specific test of the role of security and involvement in webpage assessment. It will use conditions of high-low user involvement and security information present-absent and a general definition of involvement as being the level of motivation to seek out required information to investigate the effect of these factors upon webpage assessment. Specifically, the study aims are to investigate the relationship between user involvement and user perception of security information in establishing website credibility; determine what priorities were selected as being the most important when assessing usability and assess whether participant involvement affects information recall and whether interest rate information impacts participants assessment. From the results in previous chapters it is expected that increased involvement will result in a more critical approach to website evaluation resulting in lower usability ratings and reduced willingness to use the displayed websites; that the presence of security information will give rise to a more considered approach to webpage contents which will be reflected in greater accuracy in recalling webpage details and increased willingness to use a website; that the increased participant consideration of webpage contents resulting from both involvement and the presence of security information will result in improved recall for interest rate information.

12.1 Method

Design: See design section in part A of this study in the previous chapter. The dependent variables were participant responses including internet usage, views on ebanking, participant attention levels, webpage evaluation criteria and willingness to use assessment of a series of displayed webpages.

Participants: See participants section in part A of this study in chapter 11.

Materials: See materials section in part A of this study in chapter 11. The questionnaire design is the same as that used in study 5 in chapter 10 and the timing for its completion was also the same.

Procedure: See procedure section in part A of this study in chapter 11.

12.2 Results

The pre and post display scores for each participant were entered into a spreadsheet. Scores were calculated within the ranges 1 to 5 with a mid-point score of 3. A score of 1 showed strong disagreement with the statement posed by the question and a score of 5 showing strong agreement. Several participants failed to complete all parts of both questionnaires because they were unsure of the answer and these were treated as not known responses and score averages in the result tables and charts took account of these omissions. The questions concerning recognition of the banks in the bank webpages section were not included in the analysis of that section as they were not relevant to the credibility and trust effects being measured. During analysis individual scores for each participant was used.

For the numerical data from each question separate 2 × 2 (Involvement × Layout) ANOVAs were carried out. For frequency data for each question within the section χ^2 analyses were carried out.

Willingness to Use the Banks: No main effects due to involvement [F(1,67)=0.768;p=0.384, $\acute{\eta}^2$=0.011], Security presence [F(1,67)=0.035; p=0.852, $\acute{\eta}^2$=0.011] or any interaction [F(1,67)=0.007; p=0.932, $\acute{\eta}^2$=0.000].

Willing to Invest in Bank: No main effects due to involvement [F(1,67)=0.873; p=0.354, $\acute{\eta}^2$=0.013], Security presence [F(1,67)=0.006; p=0.938, $\acute{\eta}^2$=0.000] or any interaction [F(1,67)=0.064; p=0.801, $\acute{\eta}^2$=0.001].

Willing to Borrow from Bank: No main effects due to involvement [F(1,67)=0.011; p=0.918, $\acute{\eta}^2$=0.011], Security presence [F(1,67)=0.019; p=0.891, $\acute{\eta}^2$=0.000] or any interaction [F(1,67)=0.082; p=0.776, $\acute{\eta}^2$=0.001].

Site Secure: No main effects due to involvement [F(1,67)=0.132; p=0.717, $\acute{\eta}^2$=0.002], Security presence [F(1,67)=0.874; p=0.353, $\acute{\eta}^2$=0.013] or any interaction [F(1,67)=0.01; p=0.921, $\acute{\eta}^2$=0.000].

Trust in Displayed Banks: For involvement no significant association were found with trust [χ^2(2)=4.055; p=0.132, φ^2 =0.017] but a significant relationship was found for security presence [χ^2(2)=9.624; p=0.008, φ^2 =0.045] however the effect size was small.

Participant's Attention Level: No significant effects found for Involvement [F(1,67)=0.991; p=0.323, η^2=0.015, security presence [F(1,67)=0.099; p=0.755, η^2=0.001] or any interaction [F(1,67)=0.62; p=0.434, η^2=0.009].

Percentage Webpage Contents Read by Participants: No significant effects found for Involvement [F(1,67)=0.001; p=0.98, η^2=0.000, security presence [F(1,67)=0.00; p=0.99, η^2=0.000] or any interaction [F(1,67)=2.455; p=0.122, η^2=0.035].

Participants Recall of Webpage Information:

Highest Interest Rate recall: A significant effect of medium size was found for involvement [$X^2(2)=192.938$; $p<0.001$, $\Phi^2=0.24$] where low involvement participants were showed higher recall accuracy the high involvement participants. A significant effect of medium size was found for security presence $X^2(2)=192.356$; $p<0.001$, $\Phi^2=0.24$] where participants in the security present group showed higher accuracy then those in the security absent group.

Lowest Interest Rate recall: A significant effect of small size was found for involvement [$X^2(2)=180.01$; $p<0.001$, $\Phi^2=0.19$] where low involvement participants were showed higher recall accuracy the high involvement participants and one of medium size for security presence $X^2(2)=179.769$; $p<0.001$, $\Phi^2=0.22$] where participants in the security absent group showed higher accuracy then those in the security present group.

Security Indicator Recall: A significant effects of large size was found for involvement [$X^2(2)=371.31$; $p<0.001$, $\Phi^2=0.46$] where low involvement participants were showed higher recall accuracy the high involvement participants and one of large size for security presence $X^2(2)=415.868$; $p<0.001$, $\Phi^2=0.52$] where participants in the security present group showed higher accuracy then those in the security absent group.

Use of Screen Characteristics for Evaluation: No significant effects for involvement on the use of screen characteristics for webpage evaluation purposes [$X^2(16)=10.889$; $p=0.816$, $\Phi^2=0.15$] or mode of presentation $X^2(16)=11.127$; $p=0.802$ $\Phi^2=0.164$].

Importance of Interest Rate in Decision Making: No significant effects found for Involvement [$F(1,67)=0.001$; $p=0.977$, $\eta^2=0.000$, but a significant effect of medium size found for security presence [$F(1,67)=7.002$; $p=0.01$, $\eta^2=0.095$] where participants in the no security present group thought that interest rate figures were more important

for evaluation purposes than those in the security present group. No interaction effect found [$F(1,67)=0.039$; $p=0.844$, $\eta^2=0.001$].

Average results show that rated levels of attention were around average with only about 25% - 50% of the contents of each webpage were read. interest rate levels were regarded as being quite important. Fig. 46 below shows the total responses to the screen characteristics questions. These reflected the pre-display questionnaire responses and screen layout was regarded as being most important followed by security and privacy and the menu choices. Text content and knowledge of ebank came next with the graphics options again being regarded as the least important when evaluating webpages.

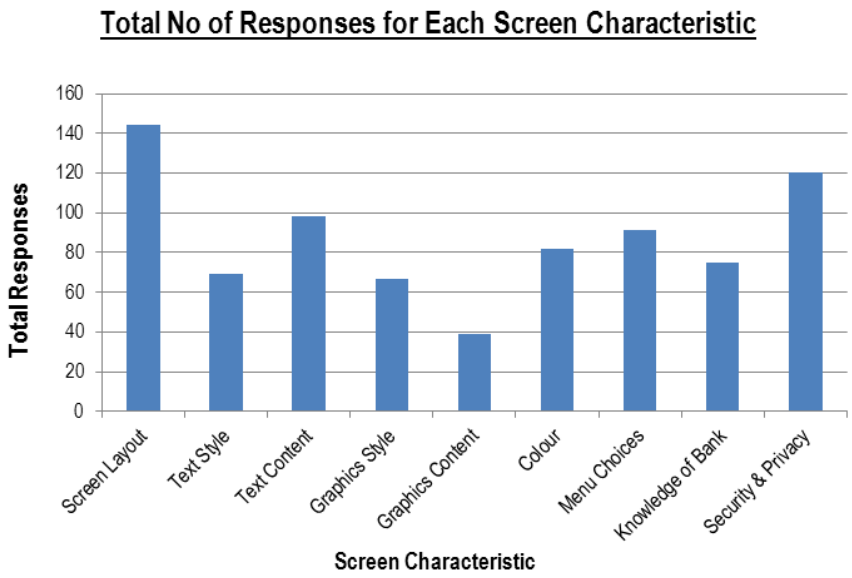

Fig. 46 – Screen Characteristics Selected for Webpage Evaluation

Although significant differences were found between test groups participant recall of interest rate information was uniformly poor across all three banks with an average accuracy rate of 15%-20%. When asked for the actual interest rates only one participant accurately recalled the interest rates. These results offer only patchy support for the

hypothesis that the presence of security information or involvement improves recall rate.

Post Questionnaire Verbal Comments: The unprompted comments passed by participants after completion of the post display questionnaire and before debriefing were noted for examination following their departure. They were broadly categorized into the groups shown in table 16 below:

Table 16 – Participants verbal comments made post testing

Comment	Positive Comment	Negative Comment
Bank Recognition	1 reported recognizing Banks	16 reported not recognizing banks
Webpage Design	7 considered them professional	2 considered them unprofessional
Information Clarity	3 reported clear accessible information	3 reported unclear inaccessible information
Information content	3 reported webpages contained too much information	1 reported easy access to information
Trust and Security	14 positive trust and security related comments	6 negative trust and security related comments
Genuine website	2 positive comments	
Website trust	4 reported would trust websites	2 reported would not trust websites

The most notable comment was that the displayed banks were unfamiliar and that was the primary influence on their decisions on whether they trusted or would use the banks. As in the previous questionnaire study, security was next most commented webpage aspect followed by the layout and "professionalism" of the webpage construction. This "professionalism" aspect pointed to an assortment of characteristics including organization and layout, font style, consumer options, graphics, colour, and ease of reading. Too much information was another issue raised as some of the participants felt that there was it made the webpages complex and difficult to find and

rad information. Comments relating to the presence of security logos, signs and policies were the next most frequently made observation.

12.3 Discussion

Studies by Salisbury et al (2001) and Turner (2002) found significant relationships between consumer's willingness to trade with a website and the presence of security within that website. Similar results were reported by Liao & Cheung (2002), Cheng et al (2006), and Agarwal Rastogi & Mehrotra (2009). The results of this study failed to support these findings. In particular, the hypothesis which predicted an increased willingness by participants to use banks whose website contained security information. An explanation for this result is provided by results of Ackerman, Cranor and Reagle (1999) and Belanger, Hillier and Smith (2002) who found that users were often placed little value in privacy seals. Similarly, Belanger, Hillier and Smith (2002) found in their study of website security that the presence of third party security seals was a less effective index of website security than security features. In this context, they define security features as being the application of specific security technologies which includes features such as password and encryption protections. The security information for the webpages used in this study comprised solely of third party security seals which were intended to convey website security to the participants. In this they failed to increase the perceived security of these webpages thus lending support to the results of Ackerman et al (1999) and Berlanger et al (2002).

These results show that the question of perceived website security is a complex issue which is not simply contingent upon the presence of security or privacy seals. Instead it appears based upon user perception of websites based upon multiple factors which may or may not be directly security or privacy related. An example of this is provided by the study of Cheskin and Studio Archetype (1999) which identified six features of Web

sites that enhance consumer perceptions of the website's trustworthiness. These features were: safeguard assurances; website owner's reputation; ease of navigation; robust order fulfilment; professionalism of the Website and the use of state-of-the-art Webpage design technology. It is worth noting that several participants in this study remarked on the "professionalism" of some of the webpages following their completion of the questionnaires. However, some of the participants ascribed these comments to webpages that other participants considered were perceptually not "good" webpages. These comments raise another subject concerning the question of professionalism. If the professionalism of a site is one of a number of characteristics used in security evaluations then it is necessary to define what this term means and how it can be assessed.

The presence of security information did impact two areas of responses within the questionnaire. These were the recall of which webpages contained security information and the rating of the importance of interest rate information when evaluating willingness to use websites. Participant recall of webpages containing security information by those who viewed webpages containing security seals was not surprising; although it played no part in their intention to use the website evaluation. Of interest in this respect is the result showing that 38% of the group viewing the webpages with no security information responded positively to this question. Whether this was due to them mistakenly recalling the presence of security information or using other cues as security indicators is not clear.

The importance of interest rate information result when evaluating intention to use a website was due the "no security information" participants preferentially selecting the interest rate quite important and very important responses. The reason for this is not

clear but may have been due interest rate being substituted for security information as an evaluation criterion.

The hypothesis predicting improved interest rate recall from the presence of security information and increased user involvement was not supported. There were no main effects due to these factors and participant recall of interest rate information was uniformly poor with only a 30% accuracy rate. It is unclear why this occurred although several alternative explanations are possible. The task only required participants to recall where the highest and lowest interest occurred and not the actual interest rate figures. Presentation order and recency effects were eliminated by varying the presentation order so other possible reasons include information overload from the amount of data displayed on the webpages, visual fatigue, lack of motivation to recall information, "overwriting" of stored information when successive webpages are displayed. This is an area that requires re-examination, particularly as several participants asked if they could see earlier displayed webpages as they could not remember the interest information required for the task. These comments seem to imply that the interest rate information stored in memory from the viewing of one webpage is displaced by information read for the next one displayed. However, if this was the situation then one would expect that information presented in the last webpage would be recalled and this was not the case. Participants failed to recall the information whether it was presented first or last.

The effect of involvement was unequivocal. The first hypothesis was not supported and the level of participant involvement had no impact on any of the areas examined in the questionnaire. This result reflects earlier studies in this thesis which failed to support Fogg's (2003) contention on the importance of involvement in the credibility assessment process of websites. The validity of this conclusion may be questioned on

the basis of the involvement level scenario. Involvement has been clearly shown to play a role in attitude formation by previous studies and this result may have been a consequence of the experimental paradigm failing to increase levels of participant involvement.

Examination of other questions in the questionnaire give some further information concerning the reasons participants use when evaluating webpages. The responses to the security related questions revealed mixed results revealing ambivalent tendencies amongst participants in their security related views with some participants rating it lower than text style and menu choices whilst with others it was rated much higher. Over all participants screen layout was the most often selected attribute followed by security/privacy, text content, menu choices and knowledge of bank. Text style and graphics were adjudged to be the least important evaluation characteristics.

These questionnaire results show that the incorporation of security and privacy seals or user involvement fail to significantly affect user intention to use websites or the way in which the contents are viewed and read. In the next chapter eye-tracking will be used to determine the manner in which these webpages are viewed and whether these two factors affect the eye movements of webpage viewers.

Chapter 13

Summary and Conclusions

In this final chapter the work described in this thesis is reviewed and considered. A brief summary of the introductory chapters is given followed by a review of the empirical studies, the factors investigated and their findings. Other issues arising from the questionnaire studies are revisited and conclusions reached from the studies are restated. The chapter concludes with a brief list practical recommendations arising from the studies together with discussion of the theoretical implications of the experimental results.

13. Thesis Summary and Conclusions

The aim of this thesis was to investigate behavioural and webpage factors that influence consumer usage of online banking websites and to determine their impact upon consumer selection of which ebanks they would use. This was achieved with positive results showing that a number of the consumer and webpage related factors investigated affect user perception and consideration of webpage content and user willingness to use that website. Consumer related factors examined included perceived security, familiarity with the bank, and user level of involvement with the purpose for visiting a website. Webpage related factors examined comprised webpage layout, mode of information presentation and presence of webpage security. Two discrete investigatory techniques were adopted. The first method examined objectively the manner in which user viewed webpage contents. The second investigated subjectively which of the contents were used for webpage evaluation and how they impacted user willingness to use an ebank.

Both investigation methods produced results which provide greater insight into the way in which users view and consider webpage contents. It was found that the way in which webpages are viewed by observers is idiosyncratic and unpredictable making it difficult to draw specific conclusions concerning webpage scanning strategies. However it was noted most webpage searches comprised diagonal scans from upper left to lower right of the webpage, that variations from conventional webpage layout resulted in increased webpage search behaviour and that particular webpage areas and objects attract more user attention than others.

The subjective data obtained improved our understanding of the way in which webpage contents and characteristics were perceived and evaluated and how they impacted user willingness to use a website. The user related factors of involvement level and familiarity with a website owning organization were found to affect webpage evaluation and user willingness to use a website. Familiarity with a website owner was shown to be a powerful determinant of user willingness to use a website and also increased participant attention and the amount of webpage content read. Increased user involvement was found to affect webpage evaluation by raising the standards against they were judged. It also reduced the number screen characteristics used as assessment criteria when evaluating webpages.

It is possible from the review of previous research and the results of these studies to provide some specific guidance concerning webpage layout, its characteristics and where to locate webpage elements where observer attention is usually focused. If the rules outlined in tables 17 and 18 are followed they will increase the likelihood that specific webpage elements are “noticed” and considered to create positive attitudes toward the website contents. Later in the summary the experimental studies and

methodology will be examined and suggestions made concerning additional studies that may be carried out and improvements made to the methodologies used.

Table 17 – Improving Webpage Scanning

Owner Identification.	To ensure rapid recognition of website owner identification details should be located at the top of the webpage. The use of logos simplifies identification and should be backed up with appropriate marketing to establish a market presence and increase familiarity to potential users.
Webpage Search.	Information should be organized into discrete areas separated by white space; Information you wish to be "noticed" should be located in the central area of the webpage or at the webpage sides; Important information should be easily distinguishable from other webpage elements using simple characteristics; The use of easily recognizable graphic signposts aids location specific webpage elements;
Webpage Organization	Where there are usability conventions for webpage layout these should be followed; Main menus should be clearly identifiable and located at left of the webpage or the top of the central area; None service or product related information such as site map, contact details, service login is normally located at the right hand side or top of the webpage;
User Involvement	When viewing conventional layout webpage high involvement users spend less time viewing webpages with a conventional layout than low involvement users. This situation is reversed when viewing unconventional layout webpages.

Table 18 - Improving user evaluation of webpage contents

User involvement	This increase the evaluation standards users apply to webpage contents. Highly involved users are more critical of webpage contents than those with low involvement and so are less likely to use a website.
User familiarity	A powerful determinant of webpage usage. Website owner logos should be used and backed by marketing to establish their presence and familiarity
Important webpage characteristics	Usability evaluation criteria in order of importance: Good Layout; Clear menu and choices; Familiar ownership; Security and privacy indicators; Webpage colour scheme; Text content and style.
Graphical information	Graphical presentation of information offers no advantages over textual presentation and might adversely affect evaluation of webpage contents.
Website contents to be avoided	Unnecessary and pointless graphics; Too much information; Animation; Text and background colour combinations that diminish text legibility;

13.1 Research Question and Context

The work in this thesis arises from the inexorable rise in online banking services which is often accomplished to the detriment of local banking services. This use of information technology has highlighted one of the main differences between these two alternative banking services, which is the increasing distance between bank staff and customer and the resultant reduction in personal contact. The consequence of this change to online banking has been to eliminate the interpersonal, service and contextual cues customers used when using bank services. A conclusion of this thesis has been that these interpersonal cues have been partially replaced by customer perception and evaluation of the banking interfaces.

Evaluating customer – bank interfaces is a dynamic process that changes with the way online banks and their customers interact. In the early chapters we looked at banking and technology and pointed to the changes that have occurred since the early introduction of information technology. This was related to the changes of the interface between customer and bank that have occurred and the nature of which will continue to evolve with developing technologies. Such evaluations will continue to be based upon both user knowledge and user perceptions of website contents. The theoretical framework against which these studies were conducted is Fogg's (2003) Prominence Interpretation theory. Although this theory is descriptive rather than predictive, it identifies factors affecting both the way webpage elements are "noticed" and the manner in which they are considered in the formation of user attitudes to websites. This two stage process reflects the methodologies used for these studies whereby the eye-tracking reflects the prominence stage and the questionnaire the subsequent consideration process.

The point was made earlier that customers using these early interfaces had few cues with which to make usability assessments and choices concerning which services to use. Initially, service characteristics such as availability and cost provided a basis for such customer judgment. However, with the increasing sophistication of the interfaces more cues became available such as service and product choices, availability, ease of use, interface design and characteristics and visual appeal offered alternative criteria upon which evaluations could be made. It is expected that the introduction of configurable interfaces and additional communication modes such as speech will provide more interface characteristics that may be used as evaluation criteria.

One of the most important decisions that had to be made by online bank customers before using a bank's online service is that of credibility and trust in their service and in

chapter three this topic was discussed. As was pointed earlier, normal interpersonal trust signals used for creating credibility and establishing trust are not available to online customers who must use alternative means of making credibility and trust judgments. With online fraud becoming a significant public issue, this aspect of online banking has become a central factor in online bank owner's quest to both attract more customers and retain existing ones. The question was asked "which online factors can provide the foundation for credibility and trust judgments"? Two separate sets of credibility and trust determinants were described; one originating with the user and the other with the user interface. The user determinants were based around the user's motivations, knowledge and perceptions of the interface. Some of these factors were examined in the studies described in this thesis where user familiarity and involvement together with user perceptions of website design and content were found to affect user evaluations and willingness to use websites. The non-user determinants included legislative and social factors together with online environment factors, website design and function. In the studies carried out website and design and function were also found to affect user website evaluation and willingness to use a website. This relationship is described in fig. 1 below. What is not clear at this stage is the relative importance of these factors and to what extent they interact to create user judgments of banking interfaces and subsequent decisions to use them. The studies described in this thesis provide additional information on both user and interface factors which go some way into answering this question.

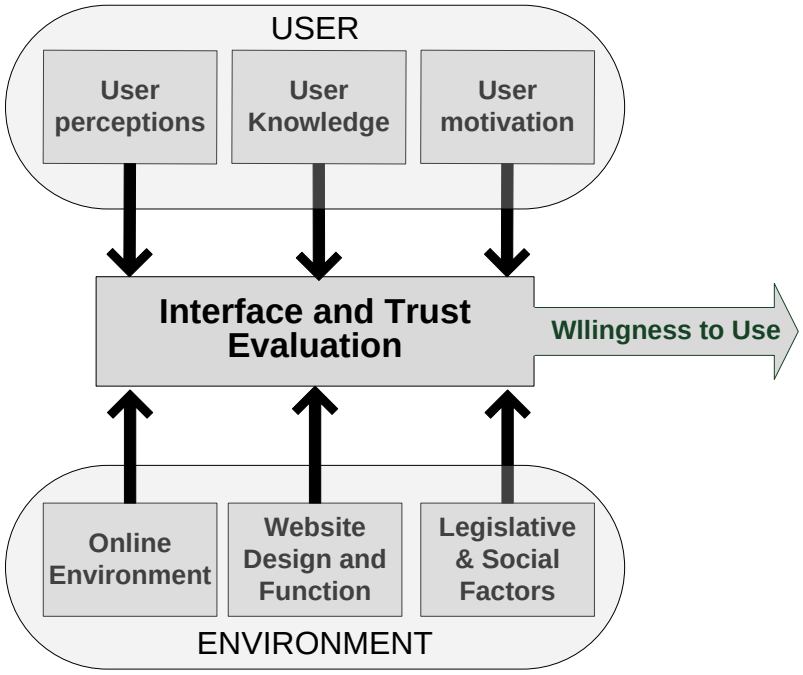

Fig. 48 – Trust Making Process

13.2 A Summary of Findings and Their Relationship to The existing Literature

General Eye-Tracking Results: If we focus on the general conclusions from the eye-tracking data we can discount the observations by Schroeder (1985a) and Outing and Ruel (2004) that user viewing webpages scanned from left to right like reading a book, which subsequent experience changed to a centre-left-right scanning strategy. All the studies found a wide variation in scanpaths which were idiosyncratic and unpredictable. The majority of saccadic movements were diagonal from top left to bottom right which are described as optimal search paths by Najemnik and Geisler (2004) and overall scanpath patterns support Noton and Stark's (1971a, 1971b) scanpath theory in that scanpaths followed by individual participants showed similarities when they viewed the different webpages. Between the diagonal saccades are interspersed horizontal and a few vertical saccades. Those horizontal saccades that were short and slow appeared to indicate that participants were reading webpage contents, the remainder was more indicative of horizontal searches.

In terms of webpage areas of interest, most participant attention in terms of fixation time was focused primarily to the central webpage area and less so to the sides. Participant fixations to the top and bottom areas were extremely short averaging less than 5% of total fixation time. A conclusion that may be drawn from these results is that visual attention across webpages is not attracted not only by webpage elements but is primarily determined by screen location. The advice from this is that webpage designers wishing to draw viewer attention to particular webpage elements should locate them in the central and side areas to ensure they are "noticed".

Bank Familiarity: Familiarity was found to have a significant effect upon bank evaluation and user willingness to use them. This result supports those of McKnight et al. (2002] and Teo and Liu (2007) that the positive reputation of an e-vendor and word-of-mouth significantly affect online trust in organizations. Similarly, Corritore et al (2000), Gefen and Strawb (2004) and Luhman (2000) and Beldad et al (2011) identified the role of familiarity in the creation of trust. The extent of this "familiarity" effect is that users are almost twice as likely to use familiar rather than unfamiliar banks. Further supporting evidence for this came from an analysis of post experimental comments. "Do not recognize the bank" and "do not know the bank" were the most common comments made and normally preceded a decision that they would not use the services of unrecognized banks. These comments by users also The clear inference being that the presence of other cues such as security logos and advice were outweighed by familiarity as a means of evaluating and assigning credibility to websites.

This "familiarity effect" extended to participants stated levels of attention and percentage of webpage contents read where familiar banks received greater attention and had more of their contents read. These findings show that participant willingness to use familiar banks is higher than that for unfamiliar banks and that on the basis of this

choice a decision is made whether to continue viewing the webpage contents and consider them. It reinforces the marketing axiom that publicity and branding provide positive benefits to commercial organizations. It was also demonstrated that that webpage design and use of screen characteristics such as graphics, colour and menu choice for evaluation purposes is also higher for the unfamiliar banks. This finding is compatible with the other results (Araujo & Araujo (2003); Lohse & Spiller, 1990; Kim & Moon, 1998) and indicates that when familiarity is not available as a cue other physical and display characteristics are substituted. One further conclusion from the familiarity findings is that familiarity or knowledge of an organization functions as a primary heuristic for evaluating that organization even in the presence of more informative cues.

Webpage Layout: The webpage survey showed that there are no rigid rules that apply to webpage layout and content. For many banks they tend to be volatile to reflect the website purpose, products and services available and changing legislative and marketing requirements. However a few general rules do apply. Identification details are almost universally located at the top of the webpage; main menus are situated either down the left hand side or less frequently at the top of the central areas; legal, regulatory and policy information is in small print at the bottom of the webpage. Deviations from these "rules" cause users to display increased search behaviour whilst they adapt to the novel layout. It is clear from this finding that users with preconceptions concerning webpage layout and content but rapidly adapt to deviations from these preconceptions. However these changes were found to have no effect upon user consideration of webpage contents, a result that contrasts to the finding of Comber and Maltby (1997) and Schenkman & Jonsson (2000) who found that user webpage evaluations were affected by their perception of webpage layout.

User Involvement: The effect of user involvement would be expected a significant factor for those visiting banking websites. Although many users use the WWW for pleasure and entertainment, banking websites would normally be visited only by users seeking information or to carry out banking transactions. As such they would normally be expected to have a higher than normal level of involvement in the task. This involvement is identified by Fogg's PI (2003) theory and the Dual Process theories (Chaiken, 1987, Petty & Cacioppo, 1984) as being a significant factor in both users noticing information on webpages, the consideration of what they had seen and in the formation of their attitudes towards websites. Previous studies (Petty, Harkins and Williams, 1980; Brickner, Harkins, and Ostrom, 1986; Bumkrant and Unnava, 1989; Leippe and Elkin, 1987) would lead us to expect that involvement would affect both the manner in which webpages were viewed and upon user's consideration of webpage contents. The final three experimental studies investigated this with mixed results. User involvement was found to have no effect upon on-screen scanning, pupillary diameter or fixation patterns. Similarly it appeared to have only limited effects upon user consideration of the webpage contents and user willingness to use evaluations. What does this mean for Fogg's PI theory? One inference is that Fogg's assertion that involvement affects users' noticing webpage information is incorrect. Unfortunately there is no previous research to support Fogg's assertion that involvement affects the prominence process so this question remains open. However, an alternative explanation is that the user "information noticing" process is not dependent upon scanning strategies or fixation patterns. The fact that no positive eye tracking results were found in three studies tends to favour this latter explanation as task involvement giving rise to increased motivation would have been expected to impact user scanning of webpage contents.

The questionnaire data provided only limited support for the dual process theories predictions. Involvement was found in the third study to raise the evaluation standards against which user made their willingness to use the website assessments resulting in low bank ratings and increased unwillingness to use them. This was accompanied by greater use of webpage characteristics (layout, colour, font style) for assessment purposes. The reason for this latter result is not clear. One possible explanation may be that increasing evaluation standards required more evidence for assessment. As this effect was not found in later studies further research using an experimental paradigm capable of creating a greater sense of user involvement is required for a more reasoned explanation. It was also predicted that high involvement would give rise to deeper consideration of what had been seen and this appears to be supported by the increased use of webpage characteristics. However this was not accompanied by a concomitant increase in pupillary diameter that previous research suggests would accompany the increased cognitive effort. Possible reasons for this include deficiencies in the technology recording the pupillary diameter data, pupillary diameter fails to reflect cognitive loading or insufficient cognitive effort being engendered within participants to affect pupillary diameter. The second reason is unlikely as there is strong research evidence supporting the idea that cognitive effort affects pupillary diameter. Additional studies using more sensitive equipment would be required to clarify this situation.

A further factor which may explain these mixed results is the experimental paradigm used. Although sufficient involvement was generated to affect some of the questionnaire data it was possibly insufficient to generate a high enough level of involvement to affect the other measures. In order to test the predictions further would be required using an experimental paradigm which guaranteed high participant level of involvement.

Website Graphics: Previous research has shown that graphical elements do not always improve user assessments of webpages (Gehrke & Turban, 1999; Neilsen & Loranger, 2006; Sinha et al, 2001). Wilson (1998) describes excessive graphics as "image inflammation". In contrast other studies (Hall & Hanna, 2004; Lavie and Tractinsky, 2004; Schmit, Yili and Srinhard, 2009; Basso et al, 2001; Karvonen and Parkkinen, 2001; Kim and Moon, 1998; Regelsberger & Sasse, 2001, 2002; Steinbruck, Schaumburg, Duda & Kruger, 2002) have highlighted the positive benefits of website graphics. As the fifth study examined the role of website graphics it was felt that their use needed to be surveyed and accurately defined. The results of a worldwide survey of online bank websites revealed that their use is ubiquitous. Categorization of those found enabled them to initially be put into three groups: informational, illustrative and emotional graphics. Their use was plotted and found to vary across both national and cultural boundaries. This showed that their usage was considered by the banks to be essential and their importance indicated by the extent of their large screen occupancy. This use of webpage graphics raised several issues: their function, their effect upon user behavioural responses, their benefits, and their effect upon performance.

Graphics Purpose: In chapter 8 the three graphic categories are described in greater detail and their functions outlined. In comparison to private banks, commercial bank usage of graphics can only be described as profligate. Their screen occupancy is high in contrast to their low functional importance. Examination of their function forces the conclusion that graphics which are purely illustrative serve little useful purpose other than to supplement textual information already contained in the webpage. As most visitors to banking websites have a specific purpose in mind, illustrative graphics occupy webspace that could be used productively for information purposes. Emotional graphics are, like illustrative graphics, apparently functionally redundant. However, research has shown some benefits in that they can engender positive emotional

(feelgood) moods within website users (Eggar, 2001; Steinbrucke et al, 2002). Such positive feelings leading to increased take-up of products and services offered (Hall & Hanna, 2004; Lavie and Tractinsky, 2004). The third category, informational graphics, is functionally useful and serves several different purposes such as navigation (Hinesley et al, 2008), identification and trust (Chen, 2006; McKnight et al, 2002; Teo and Liu, 2007; Corritore et al, 2000; Gefen and Strawb, 2004; Luhman, 2000 and Beldad et al, 2011). When used for signposting purpose they aid visual search and improve customer performance; they can also be used for supplying product and service information. However their utility for this last function is unclear or whether it provides any benefits over textual information presentation. It is this function which is examined in study 5.

Information Graphics Usage: The question raised above concerning informative graphics is "what are their benefits in comparison to the costs of their production and transmission"? The Stanford Poynter study Lewenstein et al (2000) found that textual presentation attracted more user attention than graphic presentation; Ellis et al (1990) showed that text descriptions were more efficiently processed than those containing graphics. The results of the fifth study supported these findings and confirm doubts as to the efficacy of using graphics for conveying service and product information. They were found to have no effect on eye movements or fixations so they did not appear to assist location of assimilation of information. Similarly, they exerted no influence over user evaluation of webpages or their willingness to use them and they had no effect upon the consideration and recall of the displayed webpage information. As such, they offered no benefits over textual presentation of information.

Graphics Benefits: In chapter 8 we highlighted graphics benefits for engendering positive moods (Diaper and Welland, 2000), signposting for navigation (Karanam et al,

2010; Hinesley et al, 2008) and creating website credibility and establishing trust (Chen, 2006; McKnight et al, 2002; Teo and Liu, 2007; Corritore et al, 2000; Gefen and Strawb, 2004; Luhman, 2000 and Beldad et al, 2011). However their use for other purposes is difficult to justify in terms of their production costs and bandwidth utilization. Particularly as textual content carrying the same information utilizes internet bandwidth far more efficiently. Their use may possibly be defensible if they could be described as "eye candy" or enhance webpage content and layout but this aspect of their function requires further study. Their use may be continued for no other reason than that advanced by Waite and Harrison (2002) that ebank customers have expectations that ebank websites should have graphical content. In general, the advice to website designers should be that graphics should only be included if they serve a function which has been shown to be beneficial. Their incorporation for functionless purposes such as filling blank spaces, demonstrating the designer's artistic flair or illustrating products with which users are already familiar should be resisted.

Website Security: It is widely accepted that consumers using online banking facilities view online fraud as an ongoing problem requiring rigorous online security procedures (Sathye, 1999). As customers perceive this to be the bank's problem, any failure to adopt security procedures would be expected to suffer consequences in terms of their website credibility and customer trust (Ensor et al, 2005; Furnall and Karweni, 1999). It may be assumed from this that customer actively seek such security indications within banking websites and that their absence of would impact adversely consumer perception and willingness to use unsecured online banks (Liao & Cheung, 2002; Cheng et al, 2006; Agarwal, Rastogi & Mehrotra, 2009; Lee, 2009. The final study set out to test this assumption and the security information used comprised security logos which may be seen on most bank websites. The study found that the presence of security indicators positively affected the way users viewed the webpage in that more time was spent

viewing webpage contents when they were present. However, this additional time spent viewing webpage did not improve their recall of the contents other than the presence of the security indicators or the user's willingness to use the websites. One unexpected finding was that saving interest rates were more important for websites evaluation for those containing security indicators than for those without.

The conflicting results regarding the presence of security indicators make it difficult to offer any advice concerning their presence in bank websites. Previous research (Cunningham et al, 2005; Flavian & Guinaliu, 2006;) would suggest that their presence is necessary to establish credibility and create user trust. In contrast the results of this study showed that they had no effect upon recall or willingness to use a website. Also responses to questionnaires in the earlier studies showed that security was often rated below other webpage characteristics such as layout, test style and menu choices when evaluating banking websites. This finding appears to reinforce the view that users consider security to be bank problem which they do not need to consider (Monetary Authority of Singapore, 2001; UK Financial Services Authority, 2006). There is one further observation that is worthy of note. For those banks where the security indicators were not present, participants still made judgments concerning website security when deciding whether to use them. This was apparent from the post-experimental comments where banks without security indicators were still considered secure by the participants. What is not clear is which webpage information was used by participants to make these judgments. One possibility comes from the fact that webpages that were adjudged to be "professional" were also often considered to be secure. As stated earlier, what is meant by a "professional" webpage is not certain and additional study is required for clarification.

Website security is a complex issue and the current state of affairs leaves open to question what security information is required within banking websites. Some research strongly supports the incorporation of security information in order to establish credibility and trust and increase user willingness to use the website. On the other hand other research has shown that it has little effect and is usually considered to be a bank problem. The results of these studies also indicate users consider it to be of lower priority than other webpage characteristics and that security logos and security policies placed at the bottom of website portal webpage attract little attention and are routinely ignored by website visitors. On balance it is probably better to advise that security information be included for no other reason than the accusation cannot then be leveled at banks that they are not proactively taking steps to reduce the incidence of online fraud.

13.3 Practical Recommendations The findings highlight several issues that need to be considered by webpage designers. The eye tracking results indicate the benefits provided by the use of webpage templates that utilize standard layouts and locate common webpage elements in the same position. Their use assists website visitors locate common information quickly and reduces the number of locations to be searched for non-standard information. The eye-tracking results also show that webpage viewer attention is primarily focused on the central webpage area and to a lesser extent the side margins, little attention being directed towards the top and bottom webpage areas. The advice from this would be that information that designers wish to be seen is best located in these central and side areas and that the top and bottom areas are used for less critical information. The scanpaths observed that webpage viewers shift their gaze between webpage objects that attract their attention. Several inferences may be drawn from this. Firstly, designers wishing to draw attention to specific webpage objects need to assign attention grabbing characteristics to those webpage objects to differentiate them from

other objects (pop-out). Secondly, they should avoid complex layouts and incorporating too many webpage objects. Either of these may cause visual overload and fatigue and reduce the efficiency of visual search by lowering the visibility of individual objects in addition to their requiring complex scanpaths between objects.

The results demonstrate that graphics offer no advantage over text in terms of conveying information and the questionnaire results indicated that graphics in general and animation in particular feature low in users list of website evaluation criteria. Despite this it is apparent from the graphics survey that there is widespread acceptance of the incorporation of graphics into ebank webpages. Accordingly, in order to satisfy user expectations on website content, graphics should continue to be used. However this should be with the proviso that the graphics serve a clear function rather than be purely decorative and that a reasonable balance between text and graphics be achieved. Under this guidance, graphics content of over 50% and the use of animation would be difficult to justify.

The questionnaire results show willingness to use an online bank is closely linked to prospective user's knowledge of that bank. The extent of this influence is the degree to which it affects not only the level of attention paid to the bank but also how much of a webpage contents is read. From this it is clear that the establishment of an online presence and reputation should figure prominently in the marketing and promotion of online banking facilities. Responses to the questions concerning the evaluation criteria used by users show that the characteristics of webpage content are as important as the content itself. It is also significant that characteristics such colour, font style, graphics style and menu choices are classed as more important than text content. These qualities need to be considered when decisions are made concerning the characteristics are assigned to the content.

Website security issues and consumer attitudes to them still remain clouded. Despite continuing reports of online fraud and expressions of concern by some users, the results of the questionnaires in these studies show that users have ambivalent thoughts concerning their resolution. The advice that can be offered is that website security remains an important issue that ebanks need to take the lead on. Accordingly, they need to continue incorporating security elements into their website which should be highly visible to users. Not only would this serve to enhance the ebank security credentials but also ensure that the online security remains in the forefront of user considerations.

Reflections on the Framework: In presenting his Prominence Interpretation theory Fogg provides few detailed explanations as to the manner in which the two theoretical of prominence and interpretation processes operate in establishing credibility or how they relate to other theories concerning attitude formation. He simply states that he believes that certain factors affect the two processes without any direct research evidence. As such it is difficult to make any firm predictions and as such the theory should be simply used as guide to further research.

The dual process theories define two routes to attitude formation one being a detailed considerative approach requiring a degree of cognitive effort (central processing) and the other a fast heuristic route using simple rules and minimizing cognitive overheads (peripheral processing). It was suggested that differentiating between these two processing routes could be achieved by using pupillary dilation as a measure of mental effort. The results failed to support this view. Possible reasons for this may be a result of the two alternative routes not being used during the running of these studies or that pupillary diameter is not an effective cognitive load measure. As the two routes do not occur entirely separately but operate concurrently somewhere along a continuum of decision making, any decision would utilize a combination of the two routes in which

case differentiating the extent of each route used would be impossible. This issue remains open and further research is required to clarify the position.

Relating visual search to eye movements remains problematic. Whilst eye movements show where the gaze is directed it does not necessarily indicate the focus of the observer's attention. Therefore interpreting search behaviour based solely on eye movements is arguable and they should be regarded more as guides rather than definitive indicators. The strength of eye-tracking lies is in the use of fixations to locate areas of interest within websites. These can then be used to identify those website elements that attract user attention and which impact subsequent user behaviour.

The framework used to underpin this research had some success in predicting the behavioural effects of the factors investigated. Predictions based upon Fogg's prominence process failed to be supported by the finding that involvement and task purpose had no effect upon webpage viewing strategies and the "noticing" of webpage elements. However support for Fogg's interpretation process and the dual process theories were found. Here, results showed that involvement did affect user consideration of webpage contents and their decisions concerning user willingness to use websites.

13.5 Final Conclusion and Future Work The work described in this thesis has gone some way to clarify the way in which user perceive and consider webpage contents and how these and consumer knowledge affect user willingness to use a website. The thesis demonstrates that this is a complex area of research involving theories of perception, visual search, attention and attitude formation which has a considerable foundation of relevant research. It has also shown that sections of this research have produced conflicting results which sometimes make it difficult to give positive advice concerning webpage layout and contents. Those offered within this thesis are the best that can be

given based on the previous research reviewed and the studies described in the thesis. Future work should be targeted at conducting research that not only looks at optimizing interfaces but also examines the interaction between interface design and content and users perception of those webpages. This should help clarify user consideration and evaluation of those webpages and their subsequent decision making.