

Waiting on the internet: A review of the multi-disciplinary literature and suggestions for future research

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ABSTRACT

The slowness of the internet is one of the most common complaints cited by internet users, practitioners, academics and web designers. Online waiting is important because of the role it plays in the evolution and development of e-commerce. Although there are numerous references to the negative effects of online waiting, very little empirical research has been carried out on this topic. This paper is a review of the academic and professional literature on waiting on the internet. It draws on market research, system time response studies and quality-of-service studies. This review on the literature highlights many inconsistencies in previous research as well as a number of gaps in our knowledge about online waiting. The research methodologies employed in previous studies are examined. A future research agenda is outlined and suggestions are made as to how the definition of online waiting as well as the range of research methodologies may be extended.

KEYWORDS

Internet, download delay, online waiting, consumer behaviour, electronic commerce

SUMMARY

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Waiting on the internet: A review of the multi-disciplinary literature and suggestions for future research.

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Introduction

One of the most common complaints by internet users, practitioners, academics and web designers is the that the internet is frustratingly slow (Dellaert & Kahn, 1999; Selvidge, 1999; Weinberg, 2000; Rose *et al.*, 1999; Rose & Straub, 2001; Sears *et al.*, 1997a; Georgia Tech Research Corporation, 1998; Johnson, 1997; BBC News, 2002). Even though the world wide web doubles its speed every two years, web traffic also doubles in the same time period (Dembeck, 1999; Nua, 1999; Destounis *et al.*, 2001). In fact, delays on the internet are likely to increase in the short to medium term (Bhatti, *et al.*, 2000; Nielsen, 1999; Nua, 2001a; Dunlop & Johnson, 1998; Rose, 2000).

Waiting on the internet is important because slow downloading web pages represent one of the most important obstacles to growth in online commerce (Nielsen, 1999; Rose *et al.*, 1999; Rose & Straub, 2001; Rose *et al.*, 2001) and a major cause of e-commerce failures (Sorkin, 2000; Stockport *et al.*, 2001). Although there are numerous references to the negative effects of download delay on e-consumers, little is known of *exactly* how waiting on the internet affects e-commerce and very little empirical work has been carried out to verify the opinions of the experts and professionals (Rose *et al.*, 2001; Rose & Straub, 2001). To questions such as ‘How long are e-consumers willing to wait for web pages to download?’, ‘What factors determine e-consumers’ tolerance for delays on the internet?’, ‘What are e-consumers talking about when the complain about the slowness of the internet?’, there are very few empirically based answers. The evidence that does exist is based mainly on isolated experiments which draw from diverse bodies of knowledge.

Objectives of this ‘working paper’

It seems logical that ‘waiting on the internet’ should be the focus of a dedicated area of research with its own theoretical development and its own main reference authors. However, this is not yet the case.

There are very few academic studies devoted exclusively to this topic. However, we have found numerous press articles and practitioner reports on this subject. The academic literature which we have identified on waiting on the internet is scattered across various disciplines and draws from diverse bodies of knowledge, thus appearing in very different types of publications. As a consequence, waiting on the internet is not yet an established area of research or academic focus, but we believe that its role in the development of e-commerce merit such a position.

To establish waiting on the internet as a recognised area of research, initial efforts should concentrate on gathering together and making sense of the existing knowledge from the diverse sources on this topic. Therefore, the objective of this paper is threefold: First, to review the extant literature on waiting on the internet from various disciplines; Second, to discuss the conclusions which have emerged from empirical studies and industry reports on this topic; Third, to propose an agenda for future research in this area.

In our review of the literature, we found 21 papers exclusively on waiting on the internet in scientific journals or conference proceedings, including one PhD dissertation. Of these, 13 papers are based on separate empirical research projects (Perfetti, 2001; Borella *et al.*, 1997; Selvidge *et al.*, 2000; Ramsay *et al.*, 1998; Meyer & Hildebrandt, 2001; Bhatti *et al.*, 2000; Rose, 2000; Rose & Straub, 2001; Dellaert & Kahn, 1999; Weinberg, 2000; Proctor, 1999; Rose *et al.*, 2001; Hoxmeier & DiCesare, 2000) and a further 8 are papers by the same authors related to or based on the same or similar empirical research (Sears & Jacko, 1997; Sears & Jacko, 1998; Sears *et al.*, 1997a; Sears *et al.*, 1997b; Selvidge, 1999; Meyer & Hildebrandt, 2002; Rose *et al.*, 2000; Bouch *et al.*, 2000).

We also found numerous press articles, consultants reports and documents based on the opinions of practitioners in the trade and practitioner press which are either exclusively on the topic of 'download delay' or made reference to this topic (for example, Accounting Web, 2000; Dembeck, 1999; Nielsen, 1999; Tedeschi, 1999).

This paper will be based on our review of the academic work which we have identified. We will also make some reference, where appropriate, to other non-empirical commentaries of practitioners and professionals in the area of e-commerce. Having introduced the topic, in the first section of this paper we will proceed to identify the bodies of knowledge from which studies on waiting on the internet have drawn from. The second section will examine the existing definitions of online waiting and will briefly outline its causes. The following sections will examine the questions which have already been posed on online waiting. The final section will be a discussion of the findings and methodologies and an agenda for future research.

Bodies of Knowledge

The academic literature on online waiting is mainly found in the areas of marketing and electronic commerce, in system response time literature within human-computer interaction studies and in network QoS (Quality of Service) studies.

Delay has been studied in system response time studies within the area of computer-human interaction since the early 1980's (Weiss *et al.*, 1982). Research in this area demonstrates that delays in system response of personal computers causes uncomfortable feelings of annoyance and frustration among users (Schleifer & Amick, 1989). These findings suggest that delay caused by slow downloading web pages will provoke similar feelings among web users.

With the appearance of the world wide web in the early to mid 1990's network researchers began to research network delay on the internet (internet latency). These studies concluded that internet latency is both highly variable and unpredictable (see Sears *et al.*, 1997a for a full review). In recent years research on network 'Quality of Service' (QoS) has extended its originally system oriented focus on internet traffic

analysis, scheduling and routing, to include user-level issues. This new line of research examines how users perceive objective system quality parameters improvements such as increases in internet download speed (Bouch *et al.*, 2000).

In the marketing literature, the first widely recognised studies on waiting in traditional services were Hornik (1984) and Maister (1985). In 1999, Durrande-Moreau reviewed the literature on waiting in services marketing and identified more than 30 publications in academic journals and conference proceedings including 18 empirical studies. Research in marketing on online waiting has mostly drawn from the findings on waiting in traditional services.

Many of the papers on waiting on the internet draw on various bodies of knowledge; Marketing and waiting in traditional services (Weinberg, 2000; Rose & Straub, 2001; Dellaert & Kahn, 1999); Retail marketing and store patronage (Rose & Straub, 2001); Social psychology (time anchoring and adjustment) (Weinberg, 2000); Systems response time studies within human-computer interaction (Weinberg, 2000; Rose & Straub, 2001; Sears *et al.*, 1997a; Borella *et al.*, 1997; Sears & Jacko, 1998; Ramsay *et al.*, 1998; Selvidge, 1999); Network quality-of-service studies (Bhatti *et al.*, 2000); Web and systems design (Weinberg, 2000; Bhatti *et al.*, 2000); Economics (hedonic utility) (Dellaert & Kahn, 1999; Bouch *et al.*, 2000); Management science and decision-making (Dellaert & Kahn, 1999). These studies also draw from numerous professional, practitioner and internet consultant reports (Dembeck, 1999; Tedeschi, 1999).

Definitions and Causes of Waiting Online

Before examining the questions that the various researchers have proposed about online waiting, we will define the topic of study. Even though waiting on the internet has been referred to in a number of ways (download time, download delay, internet latency, world wide wait, internet speed) the majority of authors deal with the delay involved in waiting for web pages to download. For example, Rose & Straub (2001) based their research exclusively on download time, which they define as “the time it takes for a web client to fully receive, process and display files submitted by a web server once those files are requested.” Although Bhatti *et al.*, (2000) refer to ‘internet latency’, their

definition is similar to that of Rose & Straub. They define latency as the “delay between a request for a web page and receiving that page in its entirety.” In a later section of this paper, having examined the extant empirical research, we will return to this definition with the objective of broadening its scope to include other aspects of waiting online.

Slow downloading web pages (download delay), the most commonly studied form of waiting on the internet, is caused by a combination of four factors; the size of the web application (the size of the files of a web page), the technological configuration of the website web server(the website’s server connection to the internet); the technological configuration of the web user (e.g. the user’s internet connection speed and computer) and the infrastructure of the internet (for a complete review see Rose & Straub, 2001). Although on the side of the website the web designer can attempt to reduce the download time of his web site by reducing the number of large graphics and animation files and multimedia plug-ins and by upgrading his server technology, he has no control over the internet infrastructure nor the configuration of the web user. As mentioned already, download times may become worse in the immediate future because of various factors: the prevalence of modem-based connection to the internet; the unwillingness on the part of web users to upgrade their technology more often; the appearance of broadband access that encourages the use of larger, multimedia rich files and that in turn causes more internet congestion.

Broadband technology should in the long term go some way to reduce waiting which results from slow downloading web pages. However, broadband is not yet a reality for the majority of web users around the world. Dial-up modem connection at 56 kilobits per second is still how the vast majority of users connect to internet in the US, Europe and the developing world (Rose *et al.*, 2001). Nevertheless, there is a strong interest in broadband services, even if the percentage of users with this type of access is small compared to the total connected population.

Questions about Tolerance of Waiting on the Internet

This section examines the most commonly asked questions about waiting on the internet in the various multidisciplinary literatures. Firstly, we will examine the question of how

long web users will wait for web pages to download. Secondly, we will examine the factors that determine how long users will wait. Thirdly, we will how users react or behave when they experience delays. Finally, we will examine how waiting on the internet affects users attitudes to the web site and the companies, organisations or products associated with it.

How long are web users willing to wait for a web page to download?

One of the most commonly asked questions in both the academic and professional literatures is ‘How long are web users willing to wait for a web page to download?’ It is widely accepted in the professional literature that there is an objective limit or maximum tolerance in terms of how long users are willing to wait for a web page to download before they will decide to give up and click on another web page (possibly of a direct competitor) or disconnect from the internet. According to Zona Research, after just 8 seconds, 30% of users will exit a website (Volera, 1999), while the other 70% will leave after just a 12 seconds wait. Various professional publications suggest a maximum waiting time of between 8 and 28 seconds (8 seconds - Accounting Web, 2000; 10 seconds – Nielsen, 1996 & 1999; 28 seconds – Tedeschi, 1999; 10 seconds - Lynch & Horton, 1997).

Similarly, a review of the academic literature suggests that users’ tolerance for delays on the internet is quite limited. Accordingly, many experiments have been based on simulations of web pages with controlled levels of download time, in order to measure the effects of different lengths of download delay on users. Rose (2000) suggests that 30 seconds represents the average download time of a web page and thus varied the experimental download times from 15 to 90 seconds. Dellaert & Kahn (1999) varied the download time in their experiments between 0 and 240 seconds. Download levels ranged from 2 to 73 seconds in experiments by Bhatti et al (2000) and from 2 to 3 seconds in Meyers & Hildebrandts’ experiments (2001 & 2002).

In general, empirical results reflect the claims of practitioners, that users are willing to tolerate a certain maximum level of delay of between 8 to 30 seconds; (8.57 seconds, Bhatti *et al.*, 2000); (10 seconds, Selvidge, 1999). On the whole, the longer the wait involved before downloading fully a web page, the greater the chance the user will quit

the website. However, it is important to point out that there may be a difference between, on the one hand, *tolerable* levels of delay and on the other hand, *maximum* levels of delay before a user decides to quit. A user may find a wait of up to 10 seconds tolerable and waits of more than 10 seconds intolerable. This does not imply that after 10 seconds the user will necessarily close the web page or abandon his wait. Even though users may find that waits of 20 seconds are intolerable and waits of 30 seconds cause much frustration, many users will 'stick it out' until the end, until they complete the task they set out to achieve (Selvidge, 1999).

What factors affect how users evaluate download delay?

Time Online (Internet Experience & Single Session Cumulative Time): Research suggests that users have varying levels of tolerance for waiting, determined by a number of factors. It is possible that more experienced users will have less tolerance for or be more sensitive to download delay (Weinberg, 2000; Borella *et al.*, 1997) or that tolerance levels change within a single internet session. There is some evidence to suggest that as users spend more time in an online store during the same session they become more intolerant of delay (Johnson, 1998). However, once a user has placed a product in a shopping cart, there is an incentive to finish the transaction and less likelihood of the user actually quitting the site (Bhatti *et al.*, 2000).

Web users will expect different degrees of benefit from dedicating more time at different stages of an online search process. If the user has just begun the search process he will expect to gain substantially from dedicating an extra 5 minutes to the search. However, if the user has already been searching for a number of hours, he may not expect to gain much more for 5 extra minutes. Therefore, the user may be more tolerant of delays at the early stages of an online session than at later stages, as he may expect to benefit more by tolerating the delay early on (Johnson, 1998).

Economic Factors: Economic factors are also likely to affect the tolerance and perceptions of delay. Firstly, users with a flat rate connection speed are likely to be more tolerant of delays whereas users who pay per minute of connection are more likely to be more sensitive to delay. As Johnson (1998) puts it "File size may be a less

important determinant of successful retrieval than the details of a user's telephone bill." Secondly, the time spent online may be seen as the opportunity cost that has to be paid for the task that the users wishes to achieve (information search, make a purchase, etc.). As delays increase the value of the resource will eventually decline (Johnson, 1998).

Although, in general, the shorter the download delay the more positive the evaluation of the wait (Selvidge *et al.*, 2000), there is evidence from system response time experiments that delay should not always be reduced to zero, that zero response time leads to agitated, careless work style and low accuracy (Meyers & Hildebrandt, 2002; Martin & Corl, 1986). Obviously this will not be a concern for web designers in the near future!

The (real) length of the wait: In light of the findings on web users' tolerance for delay in terms of real time (seconds), it would seem logical that in general the longer the delay the more negative the user's evaluation of the wait. Indeed, the literature on waiting in traditional services clearly illustrates that consumers can accurately tell the real length of a delay and that the longer it lasts the more negative the perception of the wait (Durrande-Moreau, 1999). However, research on waiting on the internet is inconclusive. While evidence exists to suggest that longer delays cause greater frustration (Selvidge, 1999; Meyer & Hildebrandt, 2001) some authors suggests that longer waits are not necessarily worse than shorter waits (Dellaert & Kahn, 2000; Weinberg, 2000).

Users may not rate the speed of the web site only in terms of the time it takes to download the web pages but in terms of successfully completing the task the user sets out to achieve (Perfetti, 2001; Bhatti *et al.*, 2000; Rose *et al.*, 2001). There is evidence to suggest that slow download times make task completion more difficult and that users who cannot complete their desired task are particularly critical of page download time (Borella *et al.*, 1997; Selvidge, 1999).

The perceived length of the wait: A number of authors found no relationship between the actual download speed of the website and users' perceptions of download time (Perfetti, 2001; Weinberg, 2000). In experiments by Perfetti, many of the slowest downloading websites were actually rated among the quickest, while many fast downloading sites were rated as 'slow'. These findings question the most basic of

recommendations of internet practitioners (Nielson, 1996 & 1999), to make web sites quicker and instead suggest that efforts should be made to help the user to complete their goal or task rather than simply increasing the speed of the download. Actual download time may not be as important as some other intermediate measure of delay such as perception of delay and attitudes towards delay (Rose *et al.*, 2001).

Attitude to delay: Psychological factors associated with the individual may also play a role in determining users' tolerance for delay. Individuals with a more favourable attitude to delay (more patient individuals) are less likely to abort the download (Rose *et al.*, 2001). Impatient individuals expect relatively low returns if a web page is not accessed quickly and so are more likely to take the risk of abandoning the page and move on elsewhere. In contrast, individuals with more patience and less propensity for risk are more likely to tolerate longer delays and not risk abandon a web page in search of another (Johnson, 1998).

The position of the wait: Although Maister (1985) in his widely referenced work on waiting in services, suggested that pre-process waiting is often perceived as longer than in-process waits, Durrande-Moreau (1999) in her review of the empirical research on waiting in services found that the ideal position of the wait varied and depended on the type of service involved. Weinberg's (2000) experiments of online waiting concentrated solely on the download time of the homepage as it was felt that the impression formed in the mind of the user by the download speed of the homepage would create a halo effect (Maister 1985), which in turn could affect the perception of the rest of the website. Therefore, Weinberg emphasised the importance of a quick loading homepage so that users would not have to wait at the first page of the website that they encounter.

Nevertheless, research in system response time (Sears *et al.*, 1997a) suggests that web users actually expect that downloading the homepage will generally take longer, but once downloaded there should be no further delays in the website. Similarly, Dellaert & Kahn (1999) found that any negative impression formed by download delays could be reduced if the waiting took place before the homepage is downloaded and not afterwards. As we have already noted, users' tolerance for waiting decreases during a single session on one web site (Bhatti *et al.*, 2000), and as Weinberg's comments are

purely based on opinion, it would seem that it's better to have the user wait at the beginning (i.e. at the homepage) rather than later in the process.

Users expectations of delay: Just as in empirical research on waiting in traditional services finds that customers previous expectations of the wait affect their reaction to the wait (Durrande-Moreau, 1999), research on waiting on the internet suggests that tolerance for delay is decreased when delay is longer than expected. Web users seem to build their expectations about online waiting for various tasks in terms of how long they would expect the real version of this task to take. Internet operations which involve consulting a database, comparing prices of various products or making a calculation are expected to take longer than placing a product in the shopping cart or returning to a web page that was visited earlier in the session (Bhatti *et al.*, 2000; Bailey & Schaffer, 2001).

It seems that users form mental assumptions about how the network operates and these also inform their expectations of delay (Proctor, 1999). While some users base their assumptions on analogies with other traditional technologies ('The web is like a poor telephone connection. If you ring back you'll get a better line'), others base them on how they think the internet operates ('By reloading you get a route for the data download') or how much congestion they expect to find at specific times ('North Americans are still in bed, therefore the network should be faster') (Proctor, 1999).

Expectations of delay are also formed over time through habitual visits to a website as users form impressions of how long specific tasks should take to perform. Evidence from focus group discussions suggests that in general tolerance for delay is lower for larger, well known brands or corporate websites than for smaller less well known sites (Bhatti *et al.*, 2000). More experienced web users may even use the URL information as a guide to how long they expect a web page to take to download. Users expect large, well known institutions and companies to invest in server technology that reduces download delays (Proctor, 1999).

In fact, internet download time is extremely variable and it is difficult to form accurate expectations about delay. Indeed, the time of day and day of the week can significantly influence the download time of web sites (Borella *et al.*, 1997). Users' tolerance for

delay seems to decrease with the predictability of delay. The more difficult it is to predict waiting time (Proctor, 1999), so much so, that users will even prefer lower but more consistent or predictable download time (Bouch & Sasse, 1999). Nevertheless, when considering to download a web page, the user will often make a prior assessment of the possible content of the page as well as the likely download time based on their previous experience and the clues provided by the URL address (Proctor, 1999). The outcome of their calculation will determine whether to click on the link or wait to come back during a more favourable time.

The type of the task: Users are more tolerant of delay when the task involves information gathering or browsing rather than more concrete tasks such as making a purchase (Bhatti *et al.*, 2000; Dellaert & Kahn, 1999). This may be one of the reasons why many web sites have introduced a fast lane checkout (for example, Amazon's One Click).

Uncertainty and information about the wait: Research suggests that when users are provided with full information about the wait, in the form of countdown clocks or time anchors ("e.g. "This page will take 30 seconds to download"), their retrospective evaluation of the web site is not adversely affected by the wait (Dellaert & Kahn, 1999) and their tolerance for delay is increased significantly (Bhatti *et al.*, 2000). With this information, users can separate their frustration with the wait from their evaluation of the contents of the web site.

Earlier evidence from human computer interaction studies suggests that users require continual feedback in the form of progression indicators to show that a computer system is actually working (Myers, 1985). Although most web browsers include some form of download indicator, the information provided is not particularly accurate (Weinberg, 2000) or sufficient to satisfy users need for feedback (Bhatti *et al.*, 2000). However, at least these indicators provide the user with some information that the system is not stuck and that the page is still downloading (however slowly!).

It seems that countdown information is more effective than duration information (Dellaert & Kahn, 1999), probably because it provides the user with continual feedback information on the progress of the download, rather than merely an indication of the

total download time. However, by using time anchors that are shorter than the actual download time, the perceived download time can be reduced (Weinberg, 2000).

Users are significantly more tolerant of delay with incrementally downloading web pages than pages that begin with a delay followed by the page downloading all at once. In experiments that compared incrementally downloading and 'all-at-once' downloading web pages, users rating of poor download speed was 10 seconds for all-at-once downloads and 56 seconds for incremental downloads (Bhatti *et al.*, 2000). This is probably because the incrementally downloading page holds the users attention longer and provides him with constant feedback on the progress of the download.

Attributing the blame for delay: In traditional services, when a delay occurs, customers imagine what could be happening and form an explanation (Durrande-Moreau, 1999). Internet users also seem to construct a conceptual model of how the network works and attribute the blame for the delay accordingly (Bhatti *et al.*, 2000). Also, just as in traditional services, users are more tolerant of delay when it is not attributed to the service provider (Durrande-Moreau, 1999; Bhatti *et al.*, 2000). Users are more tolerant of delay in text only web sites as the cause of the delay is not as obvious (as would be the case of web sites rich in graphics and animations) and they may attribute the delay to network congestion (Borella *et al.*, 1997). Indeed website designers may provoke negative user reaction for the inclusion of large graphic and animation files in their websites even when these are not the cause of delay. Hence, users tend to prefer quick downloading text sites than slow downloading graphic heavy sites (Sears & Jacko, 1998).

What do users do when they experience intolerable delay?

As we have already seen in the previous paragraphs, there are a number of factors that will determine how the user will react to delays on the internet. In this section we will examine how users behave when faced with intolerable online delays. It is generally assumed that faced with long or intolerable download delays, users will eventually become frustrated (Sears *et al.*, 1997), give up and go to another web site (Selvidge *et al.*, 2000; Weinberg, 2000; Proctor, 1999) or simply abandon their task (Perfetti, 2001;

Borella *et al.*, 1997) and disconnect. The longer the delay, the more likelihood that the user will give up on the web page (Rose *et al.*, 2001). The possibility of losing prospective customers in this way could be prove potentially fatal for many commercial websites (Sorkin, 2000). According to GVU (Georgia Tech Research Corporation, 1998) almost 60% of users had left a web site to look at another vendor's web because of slow downloading web pages. What we do not know is whether these users will return to the web page at a future date or give up entirely on the web page.

Beside the 'wait/ don't wait' reaction of users to slow downloading web pages, very little reference has been made to other possible behavioural reactions to wait. Only Proctor (1999) noticed that users would often interrupt a slow downloading web page by clicking on stop and then clicking on the reload button as they felt that by re-clicking the might find a quicker connection.

Questions about how waiting on the internet affects users' attitudes to the websites, the brand and the e-retailer

Although a number of researchers have examined how download delay affects users' subsequent perceptions or evaluation of the associated website, the e-retailer or the brand and the quality of the contents or products, the results are notably inconsistent. This section examines these findings

How does waiting affect attitudes to the website? In general, a number of authors suggest that longer delays may negatively influence users evaluations of the associated web site or web page (Dellaert & Kahn, 1999; Weinberg, 2000) or the quality of the information on the web page (Borella *et al.*, 1997). However, by providing information about the (perceived or real) download time, users evaluations of the website (homepage – Weinberg, 2000; contents – Dellaert & Kahn, 1999) can be influenced and any negative effect provoked by the delay can be avoided.

In one study, slow downloading *text only* web pages were perceived more favourably than slow downloading *text & graphics* web pages, probably because the users attribute the delay to the design of the web pages (Borella *et al.*, 1997). However, in another

study, quick downloading *text only* pages were perceived less favourably than quick downloading *text plus graphics* web pages (Sears *et al.*, 1997a). In fact, the quicker the download time, the less favourable the perception of the quality of the information contained within (Sears *et al.*, 1997b; Sears *et al.*, 1997a). In a third study, all web pages, regardless of their web style, that produced longer delays, were perceived poorly and pages with longer delays were perceived as less interesting than pages with shorter delays. (Ramsay *et al.*, 1998). It may be that users prefer multimedia web (text and graphics) sites but they are not willing to wait for them to download (Sears & Jacko, 1997). As delays increase, users prefer text only web sites to graphic rich sites (Borella *et al.*, 1997).

Research also suggests that slow downloading web sites are also related to poor web site security and inferior quality products on commercial sites (Bhatti *et al.*, 2000) and are less likely to be recommended to other users if the delay is attributed to high graphic content (Borella *et al.*, 1997) and are less likely to be revisited (Hoxmeier & DiCesare, 2000).

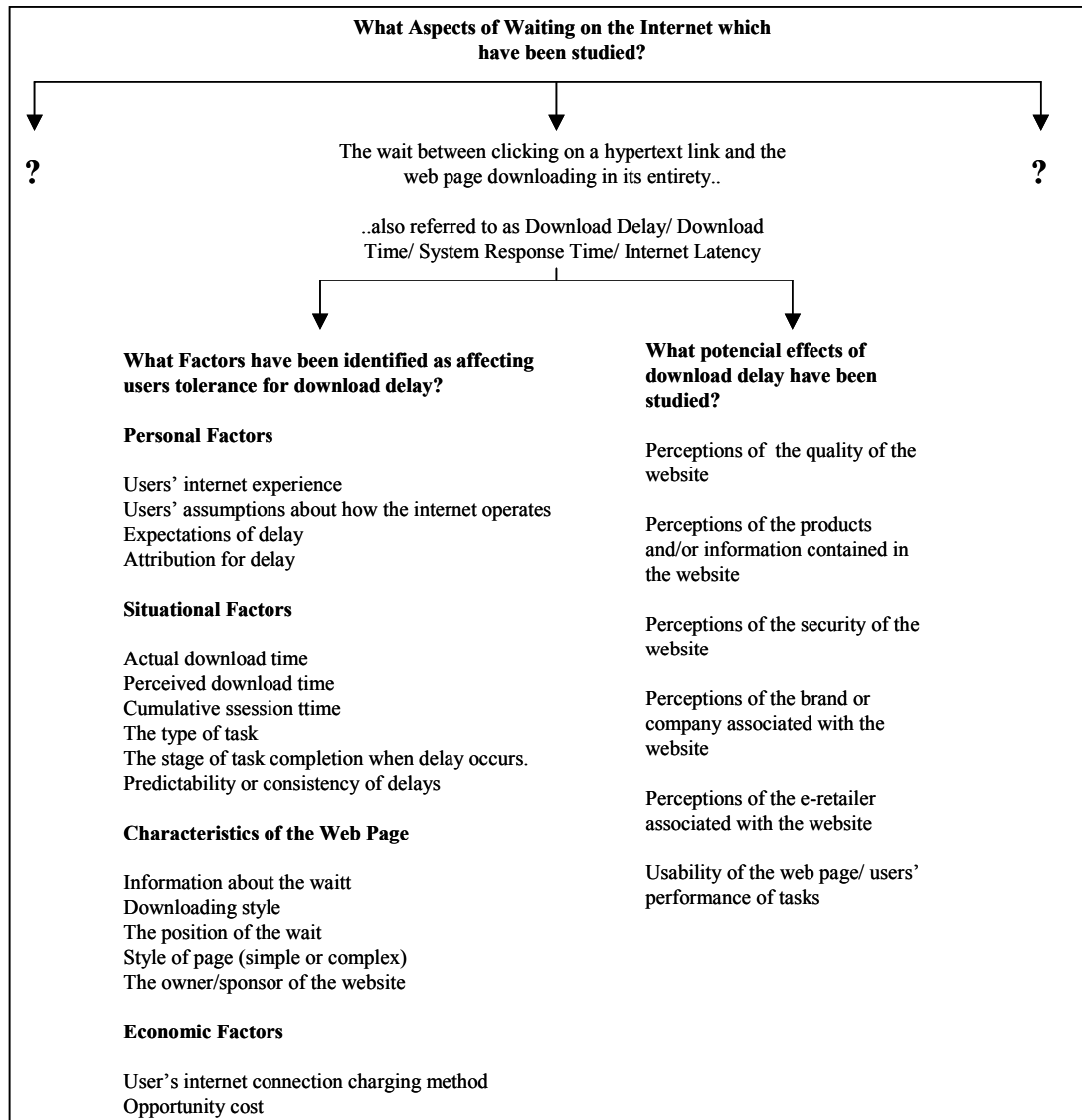
Inversely, research by Johnson (1997) and Proctor (1999) suggest that the expected quality of the web page will affect the users' tolerance for delay. If the user's prior evaluation of the probable contents of the web page is positive, there is more likelihood he will decide to endure any delays in download time.

How does waiting affect attitudes to the e-retailer, brands and products? The results of various studies on this issue are also inconsistent. While one set of experiments found that download delay leads to negative attitudes towards the associated brands (Rose, 2000), further research by the same author found no relationship between download delay and users' attitudes towards e-retailers (Rose & Straub, 2001; Rose *et al.*, 2001).

It may be that download delay only affects the decision to wait or not to for wait for a page to download, but once downloaded, the wait does not affect the subsequent evaluation of the e-retailer (Rose & Straub, 2001). This corresponds with previous research which found that users could separate the wait from the contents of the website (Dellaert & Kahn, 1999; Proctor, 1999). It may be that the impact of waiting on attitudes to brand or retailer is linked to how the user attributes blame for the delay.

Delay which is not directly attributable to the e-retailer may have no affect on users' attitudes to them.

Figure 1: A summary of the research on download delay



Discussion

In the previous section, we reviewed the 21 papers which we found on waiting on the internet. As we have seen, previous research has examined, almost exclusively, the part of waiting on the internet associated with the delay caused by slow downloading web pages. Figure 1 is based on our review of these papers. In this figure we have categorised the questions that have been asked about download delay under two

headings, ‘What factors have been identified as affecting users’ tolerance for download delay’ and ‘What potential effects of download delay have been studied?’. We have subdivided the factors that influence users’ tolerance for download delay under the headings personal, situational, characteristics of the web page and economic factors.

In this section we will discuss various aspects of the review of the papers, including the methodologies employed by researchers and the definition of waiting on the internet.

List of the Research Methods Applied to the Analysis of Waiting on the Internet		
Paper	Main Objective	Methodology
1. Borella et al 1997	How does delay affect perceptions of information content, quality and organisation web site?	Experiment
2. Ramsay et al 1998	Does delay affect user perceptions of the web page?	Experiment
3. Dellaert & Kahn 1999	How do delay affect evaluations of website contents?	Experiment
4. Proctor 1999	How do users make navigation decisions?	Experiment
5. Rose 2000	How does delay affect attitude to the brand?	Experiment
6. Bhatti et al 2000	What are users tolerance for QoS in ecommerce?	Experiment & Focus Group
7. Weinberg 2000	How does information about the wait affect the perceived waiting time and the evaluation of the web page?	Experiment
8. Hoxmeier & DiCesare 2000	How does delay affect attitudes towards web applications and intentions to revisit?	Experiment
9. Selvidge et al 2000	How does delay affect user performance?	Experiment
10. Rose & Straub 2001	How does delay affect attitudes to web e-retailers?	Experiment
11. Perfetti 2001	How does delay affect web page usability and users evaluations of the speed of web sites?	Experiment
12. Meyers & Hildebrandt 2001	How does delay affect emotional strain and web page residence time?	Experiment
13. Rose et al 2001	How does delay affect users’ attitudes to web e-retailers?	Experiment

Table 1: Research methods applied to the analysis of waiting on the internet

Methodologies: As illustrated in table 1, researchers have almost exclusively examined waiting on the internet in lab experiments. Most of these experiments used a simulated website, instead of a real (online) website so that the researchers could control the download speed of web pages (for example; Rose, 2000; Rose *et al.*, 2001; Rose & Straub, 2001; Bhatti *et al.*, 2000; Weinberg, 2000) and measure users' reactions to different levels of delay. Selvidge et al (2000) used a real website that had been fully downloaded in advance and also allowed them to control the download speed. Perfetti (2001) is the only example where users were actually connected to the internet during the experiment. They used real, but pre-selected, websites.

Under experimental conditions web users are not necessarily interested in the contents of the simulated web pages or web pages that have been pre-selected by the researchers. It is also possible that the users (subjects) may not be interested in the tasks set out for them by the researchers. It would probably be difficult (or unreasonable) for users to evaluate web pages which they might not usually visit or have any real interest in. Only one of these experiments actually got the subjects to purchase a product online (Bhatti *et al.*, 2000). Others simply asked subjects to watch two web pages download and to rate which one was quicker (Weinberg, 2000). Future research should examine web users in more natural settings, visiting their own preferred websites, carrying out the tasks they normally carry out on the internet.

Most of the experiments simply exposed subjects to different (controlled) download times and then asked them to rate the speed of the web pages. The difference between the controlled download times varied significantly among the different experiments. In Dellaert & Kahn's experiments the controlled delay levels were either zero delay or four minute delays. In light of the findings on maximum tolerated download times, it is highly unlikely that in a real life setting users would wait a full four minutes for a web page to download.

Weinberg (2000) asked users to evaluate the contents of the website based on a single exposure to web site they had never before seen, with a download time of either 5 or 10 seconds. He also asked his subjects the likelihood that they would continue to search this website given the opportunity. First, as we have seen, there is widespread agreement

that download delays of up to 10 seconds are tolerated by users (they almost expect to wait a little!). We feel that the difference in the controlled download times of 5 or 10 seconds, is simply too short to produce any significant outcome. Second, we do not know if users base their expectations on the overall quality of a website on their impressions of the homepage. Neither do we know how users evaluate the quality of a homepage and if indeed, download time is an important factor in this evaluation. Third, Weinberg recommends that web designers should avoid delay in the homepage and if necessary position the delay somewhere else on the site. However, research suggests that users often expect delay on the homepage and are willing to tolerate it if it avoids delays later on (Sears *et al.*, 1997a; Dellaert & Kahn, 1999) and that users become less tolerant of delay as cumulative session time increases (Bhatti *et al.*, 2000). Thus, we feel that asking users to evaluate the quality of two websites based on the download speed of their quickly downloading homepages (one at 5 seconds, the other at 10 seconds), does not produce conclusive findings. However, we feel that Weinberg's focus on perceived and actual download times is important and deserves further research in order to identify the factors that determine perceived download time.

Aspects of specific experiments put the conclusiveness of their conclusions into question. For example, Weinberg's (2000) conclusions are based on a users' single exposure to just one web homepage (simulated) on just one occasion. Rose & Straub's (2000) experiment found that download delay does not affect users' attitudes to the online retailer. However, just as in Weinberg's research, their experiment was also based on a single exposure to a website. As the authors themselves point out, the effects of download delay may be cumulative. If a user continues to visit an e-retailer web site and continually encounters download delay, a negative effect on attitudes towards that e-retailer could result. But, common sense would suggest that download delay encountered by users on their first and only visit to a website, is not likely to affect their attitude to that e-retailer. It is likely that initial delay be attributed to network congestion and that only after repeatedly encountering delay on separate internet sessions that users' attitudes to either the website or the e-retailer be affected. Therefore, further research is required to confirm or disconfirm Rose & Straubs' findings that delay does not affect users attitudes to e-retailers. Also, research should examine how users attribute blame for delays in commercial websites and if delay attributed to the e-retailer provokes negative attitudes towards them.

Although, these experiments represent a valid research methodology, it is almost exclusively the only methodology used. As we mentioned, the focus is almost entirely on the speed of downloading web pages. In many cases users were exposed to just one page of a website (Dellaert & Kahn, 1999), usually the homepage (Weinberg, 2000). Just one of these experiments was followed by focus group discussions in which users had the opportunity to discuss their thoughts and opinions on waiting on the internet (Bhatti *et al.*, 2000).

There is a clear need for more varied research methodologies to examine waiting on the internet in order to produce more conclusive and practical findings for e-commerce. Finally, the experiments cited almost exclusively used university students as subjects. Although we do not criticise the use of students in experiments in general, we feel that, if waiting on the internet is to be examined in an e-commerce setting, subjects should reflect the population that frequently use the internet as a commercial channel. These are more likely to be university graduates, professional employed with a regular income, between 26 and 50 years old (Georgia Tech Research Corporation, 1998).

Extending the Definition of Waiting on the Internet: We feel that the most limited aspect of existing research on waiting on the internet is that it is based almost exclusively on download delay, that is, waiting for web pages to download. As we mentioned, many of the studies are based exclusively on download delay on the homepage of the website. We feel that the definition of waiting on the internet must be expanded for two principle reasons. Firstly, besides download delay, there are likely to be other forms of waiting on the internet. Future research should attempt to identify other forms of online waiting. Secondly, we have already seen in our review that some users did not associate the speed of the website with the download time of the pages but in terms of other factors such as their success in completing the task they set out to achieve (Perfetti, 2001; Bhatti *et al.*, 2000; Rose *et al.*, 2001). Therefore, future efforts should be made to discover what elements of the internet users associate with waiting and what factors users use to determine the speed of websites.

We feel that other forms of online waiting or delay could be some of the following;

The checkout process in online retail websites: The checkout process might be considered a form of online waiting as before finally confirming the purchase the user has to pass through a number of stages, located on separate web pages. Indeed, many online retailers such as Amazon have rationalised the checkout process by reducing the number of stages the customer has to pass through before finally confirming their purchase.

Waiting for replies to email enquiries: The delay between sending an email with some product or service enquiry to e-retailer and waiting for a reply might also be considered a form of online waiting. Many e-retailers automatically send a message confirming receipt of your message but they may take some minutes, hours or even days to reply (in our experience some never reply at all!).

Waiting for the product to be delivered: The time it takes for the product to be delivered to the e-consumer's door may also represent an important aspect of waiting in online services, even though the wait takes place after the e-consumer finalises his purchase.

Time spent searching for the product: The layout of the website and the subsequent time and effort spent searching for products is likely to be important for e-consumers who shop online because of its convenience and time-saving advantages. Delays might be caused by having to search through masses of information, or a poorly organised or confusing website, or time could be wasted by not finding the required product. Many websites offer a much wider variety of products than would be available in a normal high street store. As a result, users often have to search through many sub-categories of products before they finally find the product they are searching for. In many cases this can mean searching through many separate web pages until they find their product. Just as in traditional stores have fast tracks to move quickly from one department or section to another, web sites could incorporate virtual fast tracking facilities to reduce the time required to complete an online purchase.

Website Lockouts: Delay are also sometimes caused by web site congestion lockouts. This is when e-consumers are asked to reconnect at a less busy time as there are too many e-consumers in the virtual store for the site's server technology to cope with. Similarly, e-consumers are often asked to return at another time because web sites are undergoing maintenance or regular updating of there databases. Ebay's site closes its doors every Friday for regular updating. Although this closure takes place in the middle of the night in the US, its peak time in Europe and other parts of the world.

Waiting to speak to a salesperson: Some e-retailers offer the opportunity to speak directly with a salesperson through web chat applications but there may be a waiting time for connecting with the next available clerk. There may also be other forms of online waiting that are specific to certain types of online service providers, such an in online healthcare where the patient may have to wait to chat online with a medical doctor (Chase, 1999).

Registering and waiting for a password: Increasingly, many websites require the user to enter some basic personal information in order to register as a member of this website. The user may then have to wait for his ID and password to be emailed to him before he can enter the website. Even though the personal information is usually quite basic and not intrusive, the process of filling out the application, waiting for a password, and re-entering the website, takes some time. Imagine the extra time we would need to register if we had to do so at every real store that we entered, not to mention the problems we would have recalling all our user names and passwords. It's quite possible that many users avoid the wait caused by registering and instead go directly to a similar website that doesn't require registering.

Time Outs: Time outs generally occur when the user has more than one web pages open in separate windows. If the user leaves idle a web page while he is reading other pages and then returns to the original page to continue his task, he may find that he has been timed-out or logged off. In order to continue with his task he may have to re-enter the website and begin from zero. Time outs can often occur within sort time spans in secure links or when consulting catalogues or databases.

Connection Failures: Although the quality of modem connections varies throughout the world, users in some countries still encounter connection failures, when low quality connections with service providers cause the user to be cut off. This may causes delays and frustrations especially when the user is at the closing stages of task completion and he is forced to start afresh.

Research Agenda.

One of the most salient outcomes of this review of the diverse and scattered literature on online waiting is that we have very few truly conclusive answers to the research questions. For example, in terms of the tolerance of waiting, there is substantial support for objective maximum levels of tolerance of delay (Bhatti *et al.*, 2000; Selvidge, 1999). However, researchers have identified a range of diverse factors which affect and vary tolerance levels considerably. Furthermore, while it seems that the longer the wait the greater the frustration for the user, there is evidence that provided with information, longer waits may not be necessarily more frustrating than shorter waits (Dellaert & Kahn, 1999; Weinberg, 2000). Moreover, users may not entirely associate the speed of a web site with the download time of its web pages.

There are other examples of inconclusiveness. There is evidence to suggest that as cumulative online time increases, tolerance for delay decreases. However, there is also evidence that as cumulative online time increases (Johnson, 1998), users are more strongly motivated to stay connected in order to finish their task (Selvidge *et al.*, 2000) and less likelihood of abandoning the web page (Bhatti *et al.*, 2000). If tolerance decreases but motivation increases, what do users actually do?

The lack of conclusiveness, the conflicting research outcomes and the overwhelming use of experiments, leads us to our *first recommendation* for future research, that researchers should expand their arsenal of research methodologies on the topic of waiting on the internet. In addition, we suggest that researchers speak directly to users about the topic of research and that emphasis be placed on qualitative research techniques.

Of the 21 papers reviewed, just 5 of these were written by researchers in marketing. Despite the importance of online and delays for e-commerce, marketing academics have not yet applied themselves to the study of waiting on the internet. In addition, despite many years of research on waiting in traditional services since the first publications in the mid-eighties, it is surprising that, apart from a few exceptions (Dellaert & Kahn, 1999; Rose & Straub, 2001), marketing academics have not applied this knowledge to the analysis of online waiting. Our *second recommendation* is that marketers return to the ‘waiting in traditional services cupboard’ and apply the knowledge on traditional waiting to assist in examining the very real problem of virtual waiting.

Perfetti’s (2001) findings that users didn’t really rate the speed of a website in terms of how fast the web pages downloaded led her to ask “ When users are complaining about the download speed of a site, what are they actually complaining about?”. We still do not have the answer to this basic question. Hence, our *third recommendation* is that researchers ask users what ‘online waiting’ is to them.

In our review of the empirical studies we saw that researchers on QoS have recently turned their attention to users’ subjective evaluations of improvements in objective network parameters. Our *fourth recommendation* is that this line of research be continued so we can more fully understand how improvements in download speed with broadband technologies are subjectively evaluated by web users. In addition, this line of research should be applied to commercial activities on the web such as online retail sites. It is important to understand how users evaluate improvements in web store design, layout and processes and how this affects their perceptions of online waiting.

In terms of more specific research questions, we *recommend* that emphasis should be placed on the topic of repeated delay over time. Specifically; (i) how users’ tolerance for delay changes over time; (ii) how this influences e-consumers’ attitudes to commercial websites such as e-retailers (iii) and if online waiting affect e-consumers’ attitudes to the bricks n’ mortar version of the store.

Conclusion.

This paper has reviewed the literature on waiting on the internet. Even though online waiting is widely seen as an important factor in the evolution and development of e-commerce, it is not a widespread topic of research. Previous empirical research is almost entirely based on a very narrow definition of online waiting, that is, web page download time. Furthermore, the range of research methodologies adopted is very narrow. There is a need for researchers in marketing to advance the definition of waiting on the internet by applying knowledge developed in the study of traditional services and by extending the use of a variety of different research technologies. This paper has also introduced some suggestions in terms of how the definition of waiting on the internet can be broadened to encompass other aspects of online waiting.

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