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Perceptions of download delays: relation to actual waits, web site abandoning, and stage of delay

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This experiment investigates how slow downloads of shopping web sites are perceived by online consumers, and how download delays relate to web site abandoning and stage of delay. Results show a complex, nonlinear relationship between actual and perceived download waiting, where perceptions level off after a threshold is reached. Furthermore, perceptions of download waiting are found to be more reliable than actual waits in predicting web site abandoning. Finally, delays near the start of the download are perceived as longer than later in the process, and time pressure worsens the effect of download waiting at earlier stages of delay.

Keywords: download delay; perceptions of waiting; nonlinear relationship; abandoning web sites; stage of delays; time pressure

Introduction

According to market analysts, delays in the downloading of shopping web sites are obstacles that hold back e-commerce (Forrester Research Report, 2007) and carry an expensive price tag. Estimated lost sales due to slow downloads were US$21 billion in 2001 (Zona Research Report, 2001). Moreover, download delays continue to result in abandoned transactions representing huge potential losses (Keynote Research Report, 2005).

Although 47% of US households now have broadband connections (Pew/Internet, 2007), this has not solved the problem. Ironically, increased bandwidth encourages the creation of more complex web pages which take longer to download (Selvidge, 2003), thus negating the strides made in technology to reduce this problem and making it an ongoing issue for online marketers.

Previous research on download delays (or download waiting) has examined how delays influence attitude towards e-retailers or web pages (e.g., Rose, Meuter, & Curran, 2005; Rose & Straub, 2001), but many studies which focused on actual download delays have failed to support their proposed hypotheses. The reason may be that subjective perceptions of waiting are more relevant for predicting consumer behaviour (e.g., Taylor & Fullerton, 2000). Furthermore, the issue of how perceptions of download waiting relate to actual download waiting, and whether there is a linear or nonlinear relationship between the two, has not been studied.

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Other studies have examined how long web users are willing to wait before abandoning a web site with delays (e.g., Nah, 2004; Otto, Najdawi, & Wagner, 2003), but have yielded contradictory findings. Many of these studies have also focused on actual download delays, whereas a focus on perceptions of waits may better predict web site abandoning.

Offline research on waiting in service contexts has examined how perceptions of waits relate to the stage of the service encounter where the delay occurs. Studies show that pre-process waits are typically perceived as longer or worse than in-process waits (e.g., Davis & Maggard, 1990; Hui, Thakor, & Gill, 1998). However, the only study which specifically examined this issue in an online context (Dellaert & Kahn, 1999) found the opposite result. In contrast, Weinberg (2000) assumed that delays on the home page of a web site would be critical, but did not test these against delays on other web pages. Thus, the timing-of-delays issue is worth exploring systematically in studying download waiting.

Finally, offline research related to shopping or restaurant contexts (e.g., Davis & Vollmann, 1990; Dubé-Rioux, Schmitt, & Leclerc, 1989; Eroglu & Machleit, 1990) has found that time pressure moderates the effects of situational influences, such as crowding or waiting time. However, the role of time pressure as a moderator has not been studied in the online context, and it is particularly worth exploring in the download waiting context.

A conceptual framework is proposed to address these gaps in the literature, and is tested with a carefully controlled experiment. First, the study examines perceptions of download waiting to determine exactly how they relate to actual download waiting. Second, it investigates whether actual or perceived waiting better predicts the abandoning of web sites with delays. Third, the study determines whether delays at an earlier stage of web site downloading are seen as longer than delays that occur later. Finally, it explores whether time pressure in the situation where the delay occurs worsens the effect of download waiting. All the issues are addressed to offer insights for online marketers in designing web sites and to provide direction for future research on download waiting as well as waiting in offline service encounters.

Conceptual framework

Actual and perceived download waiting

Actual download waiting is the actual time it takes (presumably in seconds) for a web page to download from a web site. *Perceived download waiting* is the time that a consumer perceives it takes for a web page to download from a web site. Drawing on offline research (Hui, Tse, & Zhou, 2006; Pruyn & Smidts, 1998), this is a subjective evaluation of whether the download is taking too long rather than an estimate in seconds.

Although perceptions are much more likely to determine how consumers would react to download waiting, research on perceived download waiting has been limited. Some researchers have begun to explore this angle and found that perceptions of download waiting are speeded with different presentations, such as loading web pages step-by-step versus all at once for the same total time (Bhatti, Bouch, & Kuchinsky, 2000) or by gradually increasing delays as opposed to gradually decreasing delays (Weinberg, Berger, & Hanna, 2003).

However, few researchers have investigated the direct link between actual and perceived download waiting. Only one study (Rose et al., 2005) tested and found a direct, positive link between actual download delay and estimated delay. But this study did not include a sufficient range of delay to determine if the relationship continued to be linear with longer delays.

When actual waits are not too long, a positive linear relationship between actual and perceived waiting is indeed logical. In other words, for a given individual at a particular time (i.e., holding all personality and situational factors constant), perceived waiting should be directly proportional to actual waiting. For example, an actual wait of 10 s should be perceived as shorter than an actual wait of 30 s. In addition to the logical basis, there is a wide support for the linear relationship between actual and perceived waits in the psychology literature (e.g., Allan, 1979; Fraisse, 1984) as well as in the offline waiting context for services (e.g., Baker & Cameron, 1996; Dabholkar, 1990; Pruyn & Smidts, 1998).

However, an experiment on telephone waiting (Antonides, Verhoef, & van Aalst, 2002) found a positive but nonlinear function of actual waiting on perceived waiting, whereby perceptions of waits increased at a decreasing rate beyond a threshold limit. Although no one has studied the relationship between actual and perceived waiting in the download waiting context, Selvidge, Chaparro, and Bender (2002) found that user frustration was the same for 30- and 60-s download delays, but was worse in both cases compared to a 1-s delay. This finding supports the idea that download delay has a nonlinear effect, in this case on user frustration, which levels off after a certain threshold is reached. Based on this background, the following hypothesis is proposed:

> *H1*: Actual download waiting in using a shopping web site will have a positive effect on perceived download waiting, but the effect will be nonlinear after a threshold is reached.

Abandoning of web sites

Abandoning a web site may mean that consumers are simply signing-off the web site (and the Internet) or that they are switching to a competing web site. Given the risk that they might indeed switch to competitors, the abandoning of web sites becomes an even more important concern for online marketers.

In offline research, Keaveney (1995) found that inconvenience was a major reason for consumers to switch service providers, and waiting for service was an important aspect of inconvenience. It is logical that web users would react in a similar way to download delays.

In fact, online research has begun to examine the issue of web site abandoning as a result of slow downloads. However, the bulk of this research has mainly looked at tolerance for download waiting in terms of actual delays, and has yielded inconsistent findings. Some researchers have found that very short delays make consumers abandon the web site (e.g., 2 s; Nah, 2004). In contrast, others have found that consumers have a much greater tolerance for download waits (e.g., 90 s; Otto et al., 2003) before they abandon the site.

Although these studies make a good start towards examining an issue of great importance to online marketers, the contradictory findings suggest that it may be worthwhile investigating whether perceived download waiting, rather than actual download waiting, is the driver for the abandoning of web sites. For example, Rajamma (2006) found a positive effect of perceived waiting time on the abandoning of shopping carts. Even in offline research, in a study comparing technology-based self-service with full service, greater perceptions of waiting for a particular option decreased the choice of that option in favour of the alternative option (Dabholkar, 1996), which supports a positive effect of perceived waiting on abandoning and switching behaviour. Moreover, subjective perceptions of waits are more germane to consumer intentions and behaviour than objective waits (e.g., Hornick, 1984; Maister, 1985; Taylor & Fullerton, 2000).

The above discussion suggests that perceptions of download delays would be a better predictor of inclination to abandon the web site than actual delays. Therefore, the following is proposed:

H2: Perceived download waiting will better predict consumer inclination to abandon a shopping web site with delays than actual download waiting.

Timing of delays

Researchers (e.g., Carmon, Shanthikumar, & Carmon, 1995) have suggested that waits are perceived differently by customers at different stages of service delivery and therefore the issue of timing of delays needs careful study. Earlier, Maister (1985) had specifically proposed that in service delivery contexts, pre-process waits seem longer to consumers than in-process waits.

Indeed, offline research on service encounters has found that typically earlier delays are less acceptable than later delays. In an experiment on computerized course registration, Hui et al. (1998) found that students reacted more negatively to pre-process waits than to in-process waits for most type of delays. Also, in an earlier experiment with students using a restaurant scenario, Dubé-Rioux et al. (1989) found that respondents were more upset with pre-process delays (in ordering food) than with in-process delays (waiting for food). Davis and Maggard (1990) corroborated this finding in an actual fast-food restaurant setting, where customers regarded waits at earlier stages (being acknowledged and taking orders) as more critical than in later stages (waiting for orders to be processed).

The only online study to address this issue was an experiment using a web site for an entertainment magazine, in which Dellaert and Kahn (1999) found the opposite effect, i.e., waiting was less acceptable in later stages. It is possible that this particular result was context-dependent. As the web site in their study included cartoons, celebrity pictures, and movie reviews, it is understandable that students were more upset when waits occurred *after* they got involved with the web site.

In contrast, Weinberg (2000) assumed that it would be critical to avoid download delays for the home page of a web site, but did not test delays on the home page against delays on other web pages. Weinberg et al. (2003) found that an ascending order of waits on subsequent web pages reduced perceptions of overall waiting time compared with a descending order. Although the authors do not draw this conclusion, their finding supports the idea that shorter waits in early stages are preferred, and that delays in earlier stages are likely to be seen as longer. Based on this background and the bulk of offline research, it is expected that download delays in earlier stages of the online shopping process will be perceived as longer than delays that occur in later stages.

H3: Download delays in earlier stages of using a shopping web site will be perceived as longer than download delays in later stages of using the web site.

Time pressure

Offline research (e.g., Park, Iyer, & Smith, 1989) has proposed and found strong effects of time pressure in shopping situations. Moreover, time pressure has been found to have moderating effects in a variety of offline studies. Eroglu and Machleit (1990) proposed a direct effect, but found that time pressure moderated (strengthened) the effect of high retail density on crowding perceptions. In their experiment on the timing of delays in a restaurant context, Dubé-Rioux et al. (1989) found that customers who were very hungry (which created a sense of extreme

time pressure) were even more upset with pre-process delays, once again suggesting a moderating effect of time pressure. Similarly, in a study on waiting at meal times, Davis and Vollmann (1990) found that time pressure (such as experienced during weekdays meals or meals in a work setting, as opposed to weekend meals or meals in a non-work setting) worsened the negative effect of waiting time on customer satisfaction.

Applying the offline evidence, it is expected that time pressure will exacerbate the effect of download waiting on consumer inclination to abandon a web site with delays. Moreover, as the offline studies found moderating effects for either actual or perceived situational effects (such as waits or crowding), the moderating effect of time pressure could take place for objective or subjective download waits, or both. Therefore, it is proposed that:

> *H4*: Time pressure will strengthen the effect of download waiting (actual or perceived) on inclination to abandon a shopping web site.

Methodology

An experimental approach was used to carefully control different levels of actual download waiting on a mock travel web site. Scenarios, given to respondents at the start of the experiment, created high and low time pressure situations for booking a flight. The experiment was followed by a short survey to measure perceptions of waiting and inclinations to abandon the web site. Other variables were also measured to address different issues related to download delays (see Dabholkar & Sheng 2008a, 2008b).

Developing a mock travel web site

The travel context was selected because online travel bookings have grown exponentially in recent years, and yet there is strong competition among the available online offerings (Wang, Chou, Su, & Tsai, 2007). A mock travel web site was developed, modelled closely on popular travel web sites such as Expedia.com and Orbitz.com (see Appendix A). After travel dates and destinations were entered on the home page, the search page displayed the message 'please wait while we search all available flights'. Next, the review page displayed the available flights from which one flight could be selected, followed by the purchase page with flight details and a simulated payment process. The last page confirmed the purchase.

The Macromedia Flash 8 program was used to control the download timing of individual web pages, in order to create different experimental treatments. By saving the program files on lab computers (e.g., Rose & Straub, 2001) and running them through Internet Explorer, a realistic online experience was created. Participants were unaware that they were simply retrieving data files from the computers, and at the same time, extraneous factors such as the Internet connection speed were controlled.

Experimental treatments

Actual download waiting was manipulated by embedding download delays on three critical web pages of the travel web site, i.e., search, review, and purchase, to create different overall combinations. A 'no delay' condition was implemented as a 3-s delay and a 'delay' condition was implemented as 30 s, based on previous research on realistic times for download waiting (e.g., Rose et al., 2005).

Table 1. Research design.

Experimental treatments (actual download waiting)	Search page (searching for flights)	Review page (review and selection)	Purchase page (making a purchase)
No. 1: Control group	No delay	No delay	No delay
No. 2: Single delay (search)	**Delay**	No delay	No delay
No. 3: Single delay (review)	No delay	**Delay**	No delay
No. 4: Single delay (purchase)	No delay	No delay	**Delay**
No. 5: Two delays (search and review)	**Delay**	**Delay**	No delay
No. 6: Two delays (search and purchase)	**Delay**	No delay	**Delay**
No. 7: Two delays (review and purchase)	No delay	**Delay**	**Delay**
No. 8: Three delays (search, review, and purchase)	**Delay**	**Delay**	**Delay**

Note: A 'delay' was approximately 30 s and a 'no delay' condition was 3 s, as explained in the text.

The manipulation consisted of eight treatment levels (see Table 1). The control group (No. 1) had no delays for all three web pages. Three groups (Nos. 2, 3, 4) had a delay on only one page, and three more groups (Nos. 5, 6, 7) had two delays each. The last group (No. 8) had a delay on all three pages. This created a complete experimental design.

Time pressure was manipulated by creating a sense of urgency (vs. no urgency) in two ways. Scenarios mentioned the purpose of the trip (job interview vs. visiting a friend) and the timing of the trip (next week vs. after two months) to create high vs. low time pressure situations for booking the flight (see Appendix B).

Sample

University students were used in the study as they represent a highly relevant population for online studies and specifically for online travel (e.g., Gefen & Straub, 2003). A total of 252 students were recruited from two universities in the USA. The students majored in diverse disciplines spanning Engineering, English, and Business Administration. The respondents were highly familiar with the Internet – 96% had five or more years of Internet experience, 86.5% used the Internet at least once a day, and 98.5% used high-speed Internet connections, such as DSL (digital subscriber line) or cable. Moreover, they had a fair amount of experience with online travel as 69.8% had booked airline tickets on the Internet. The sample was fairly evenly divided by gender (46.8% females), with an average age of 23.56 years.

Procedure

The experiment was conducted in the computer labs of the two universities, which had about 30–35 computers in each lab, making it necessary to conduct several sessions to collect the data. Students were told that a new travel web site was being tested and they voluntarily signed up for different sessions in the labs. Those who participated were given a couple of extra credit points in their courses. The eight treatments of actual download waiting were evenly assigned to the computers, and students could freely choose any computer. They were

instructed not to start until all the students signed up for that session were seated. The scenarios were randomly distributed and participants were told to read these, fully imagine themselves in the exact situation, and then use the new travel web site to book their flight. They were also told that as this was a test of the proper working of the web site, the payment process was simulated with artificially created credit card information so that they would not have to actually make payments. As they finished the booking process, the scenarios were collected and surveys were handed out. Participants were debriefed about the objectives of the research only after all the data were collected.

Measurement

Perceived download waiting was measured using three items, adapted from research on perceptions of waiting in offline service contexts (Hui et al., 2006; Pruyn & Smidts, 1998). The statements for the three modified items were: (1) the web pages on this site took much longer to download compared with a normal download time; (2) download time for each page on this web site was acceptable; (3) information on this web site was obtained quickly. The last two items were reverse-coded, and five-point, Likert scales were used for all the items.

Inclination to abandon the web site was measured with three items that asked participants whether they felt like abandoning the web site during the search, review, or purchase phases in using the web site to book a flight. This resulted in three dichotomous variables as participants responded with a 'yes' or a 'no' for each of the three web pages.

Results

Realism checks

As subjects had been told that this was a new web site being tested, asking them (after the experiment) if they thought the web site was 'realistic' would have led them to suspect that it was not a real web site, and they could pass on this information to other students before data collection was complete. Instead, they were asked to respond to two Likert statements about the web site: 'the layout of this site was easy to follow' and 'Internet links on this site were in working order'. The means of these two variables were 4.57 and 4.23 on a five-point scale, suggesting that the respondents thought that the web site worked pretty well.

Moreover, in verbal feedback after the experiment, several students said the new web site was very good and ought to do well, except that it was rather slow. As seven out of eight treatments had some level of delay, this feedback confirmed that the download delay manipulations had worked *and* that students thought that it was a real web site. Finally, during debriefing after data completion, when students were told that it was not a real web site, they were very surprised. They had taken the somewhat longer download time simply as an indication that the web site was still being perfected. Thus, there is evidence at various levels of the high realism of the experiment.

Manipulation checks

The manipulation check for download waiting asked participants to think back and respond to the question 'on average, how long did you think it took for each web page to download (in seconds)'? An ANOVA indicated that the manipulation had worked well, $F = 11.81$,

$p < 0.001$. However, a *post hoc* comparison of the means using the Scheffe test showed only three separate groups (instead of eight). The first group combined the control (or no delay) group with the three single delay groups (i.e., treatments 1, 2, 3, and 4; Table 1), explaining why past research (e.g., Rose et al., 2005; Rose & Straub, 2001) had not been able to find an effect of actual download waiting when a single delay had been used in the studies. The second group combined two groups with two delays (treatments 6 and 7) and the third group combined the third two-delay group with the three-delay group (treatments 5 and 8).

Combining the eight treatment levels into three distinct groups as indicated by the *post hoc* tests, a second ANOVA was conducted, with improved results, $F = 27.49$, $p < 0.001$. The three-way split resulted in 116 participants in the 'low download waiting' group (manipulation check M1 = 7.22 s), 69 in the 'medium download waiting' group (M2 = 18.51 s), and 67 in the 'high download waiting' group (M3 = 25.04 s). The means for all three groups were significantly different from each other (M1, M2: $p < 0.001$; M1, M3: $p < 0.001$; M2, M3: $p < 0.05$).

The manipulation check for time pressure asked respondents to think back and indicate whether the scenario they read earlier suggested an urgent situation or not. They were specifically not asked about having felt 'time pressure' to avoid clueing them as to the objective of the research. The results of a cross-tabulation with a chi-squared test showed that the manipulation had worked very well, $\chi^2 = 196.57$, $p < 0.001$. Specifically, 113 out of 117 participants correctly indicated the scenario that was 'urgent' (i.e., 96.6%), and 122 out of 132 correctly indicated the scenario that was 'not urgent' (i.e., 92.4%). Three respondents did not answer.

Hypotheses testing

An ANOVA was conducted to test the effect of actual download waiting on perceived download waiting. The effect was found to be significant, $F = 39.96$, $p < 0.001$, with the means increasing in the correct direction (i.e., M1 = 1.88 for low download waiting, M2 = 2.88 for medium download waiting, and M3 = 2.95 for high download waiting), yet tending to increase marginally with increasing actual waiting, thus providing initial support for hypothesis *H1*.

Moreover, *post hoc* tests showed that whereas the difference in means was significant for the low and medium groups (M1, M2, $p < 0.001$) as well as for the low and high groups (M1, M3, $p < 0.001$), the difference in means for the medium and high groups (M2, M3) was not statistically significant. This indicates that the relationship between the actual and the perceived download waiting is indeed nonlinear, in the specific way proposed, and strongly supports hypothesis *H1*. In other words, actual download waiting had a direct, positive effect on perceived download waiting when participants were comparing a relatively short delay (low download waiting) with a longer delay (medium or high download waiting), but the relationship levelled off as expected because participants could not differentiate between medium and high download waiting.

To test the hypothesis *H2*, two different sets of tests were run to compare the effects of actual versus perceived download waiting. First, chi-squared tests were conducted for the effect of *actual download waiting* on inclination to abandon the web site (at each stage of delay). The tests showed a significant effect of actual download waiting on inclination to abandon, but only for the search web page, $\chi^2 = 15.49$, $p < 0.05$. The other two χ^2 values (for the review and purchase web pages) were not significant. Next, binomial logistic regressions were conducted to test the effect of *perceived download waiting* on inclination to abandon the web site (at each stage of delay). Results indicated that perceived download waiting successfully predicted inclination to

abandon all three web pages: the search page ($\chi^2 = 19.35$, $p < 0.001$), review page ($\chi^2 = 26.98$, $p < 0.001$), and purchase page ($\chi^2 = 15.88$, $p < 0.001$). Beta coefficients were 0.85 ($p < 0.001$) at the search page, 0.95 ($p < 0.001$) at the review page, and 0.86 ($p < 0.001$) at the purchase page, and Nagelkerke R^2 values were 0.15, 0.19, and 0.14, respectively, for the three web pages. Thus, perceived download waiting strongly predicted inclination to abandon web site at each stage of the process, and was a better predictor overall than actual download waiting, supporting hypothesis *H2*.

The test originally planned for hypothesis *H3* was to separately view the search, review, and purchase web pages to examine whether delays seemed longer to respondents at earlier stages as proposed. The collapsing of the eight treatments into three groups made the original test infeasible. Respondents could not differentiate between delays at the search, review, and process stages if there was only one delay in the whole booking process. However, the way the eight treatments were grouped offers support for the hypothesis. Although treatments 5, 6, and 7 each had two instances of download delay, treatments 6 and 7 were grouped together and represented the medium waiting group. Treatment 5, grouped with treatment 8 (which had three delays), was the only two-delay treatment which had consecutive delays at the start of the booking process (search and review). This natural grouping of treatment 5 with 8 through analysis suggests that the wait for treatment 5 seemed much longer to respondents (than for the other treatments with two delays, i.e., 6 and 7) because the two delays for treatment 5 were concentrated at the start of the booking process. The fact that this treatment was viewed as similar to the one where delays occurred at all three stages supports hypothesis *H3*, which proposes that delays at earlier stages are seen as longer than at later stages.

In addition, the χ^2 tests conducted earlier to test hypothesis *H2* showed that actual download waiting had an effect on inclination to abandon only for the search web page, and not for the review and process web pages. As respondents were more likely to abandon a web site with delays while searching (i.e., earlier in the process rather than later), it suggests that delays at earlier stages are perceived as longer than at later stages, and offers further support for hypothesis *H3*.

Finally, to test hypothesis *H4*, the data were split into high and low time pressure situations. Then, the earlier χ^2 tests were repeated for the split sample, and the only significant effect was for the search page under the high time pressure condition, $\chi^2 = 13.35$, $p < 0.05$. This result supports the moderating effect of time pressure with actual download waiting, i.e., hypothesis *H4*, for the search page. Next, the binomial logistic regressions conducted earlier were repeated for each group. However, there was no difference in the effect of perceived download waiting on inclination to abandon the web site between the two groups (high and low time pressure), thus failing to support the moderating effect of time pressure, i.e., hypothesis *H4*, with perceived download waiting.

Discussion

Implications for theory

Past research on download waiting has typically focused on actual delays. Those studies that examined perceptions of delays, did not investigate the relationship between objective and subjective delays. By addressing the issue, this study found a positive but nonlinear effect of actual download waiting on perceived download waiting. What this implies is that at lower levels of

delay, perceptions follow objective waits closely. However, subjects could not differentiate between medium and high download waiting, indicating a nonlinear, decreasing function between actual and perceived download waiting with longer waiting times, thus extending past findings on telephone waiting to the download waiting context.

Secondly, past studies on download waiting have yielded contradictory findings with regard to the abandoning of web sites with delays. Some studies indicated that consumers were intolerant of the slightest wait (e.g., 2 s; Nah, 2004), whereas others found that consumers have a huge tolerance for download waits (e.g., 90 s; Otto et al., 2003). By comparing the actual and perceived waits, this study found that actual download waiting is not a good overall predictor of web site abandoning, which explains the variance in past results. Instead, by focusing on and capturing perceptions of download waiting, it is possible to more accurately predict if and when consumers are likely to abandon a web site with delays.

It would be useful to know the exact wait before consumers abandon a web site which is downloading slowly, but past studies suggest that actual tolerances for download waits may vary greatly for different contexts. Thus, it may be difficult to develop a general theory to predict the actual tolerance for download delays which could apply to a variety of shopping web sites, whereas a focus on perceptions of waits may be more widely applicable.

As no difference was found between single delays and the no-delay condition, this sheds light on why much of the past research (which mostly used single delays) has been unable to consistently substantiate the expected negative effects of download waiting. Apparently, it takes more than one delay (or possibly longer single delays) to find significant negative effects in a controlled, experimental study. Related to this issue, the stage of delay hypothesis could not be verified when a 'single delay' was used.

However, the study found that the stage of delay did have an effect when 'two delays' were used, with earlier delays seen as longer than later delays. This finding supports and extends the majority of past offline service research on the stage of delay by confirming that waiting at an earlier stage is perceived as worse than waiting at a later stage, even in online service delivery.

The study also found that actual download waiting could predict web site abandoning only on the search page of the travel web site. Viewing this result along with the complex relationship found between actual and perceived waits, it appears that actual download waiting is a good predictor of web site abandoning only at an earlier stage of delay because actual and perceived waiting have a linear relationship at this point of delay. At later stages of delay, when perceptions do not follow actual waits closely, it is understandable why perceptions are good predictors of the abandoning web sites, but actual waits are not.

Finally, the study extends offline research on time pressure by finding a moderating effect of time pressure in an online context. The specific moderating effect was related to the actual download waiting and inclination to abandon the web site, at an early stage of the delay. A similar effect of time pressure was not found with perceived download waiting, possibly because perceptions of waiting may already capture time pressure. In other words, given that the manipulation for time pressure had worked well, this situational effect may have been internalized by respondents.

Implications for practitioners

The study shows that download waiting does have serious negative consequences that marketers need to consider in web site design. Not only are subjective perceptions of waiting directly influenced by actual waits (below the threshold level), but perceptions in turn lead strongly to

web site abandoning. Therefore, online marketers, often focused on developing complex and visually interesting web sites, need to find a balance between streamlining web site designs for quicker downloads and managing consumer perceptions of waiting.

The finding that perceptions are generally better predictors of web site abandoning needs to be examined in conjunction with the complex relationship between actual and perceived download waits. The linear relationship between actual and perceived download waiting at low levels of delay implies that below the threshold level, minimizing actual download waits is imperative for online marketers to keep perception of waits manageable and to reduce abandoning of the web sites. However, the nonlinear relationship at higher levels of delay implies that those consumers who stay on past the threshold level of waiting may not be so concerned about additional waiting, thus making them a good audience for web sites with rich visual, and possibly audio, content.

In addition, the findings suggest that at higher levels of delay, it is better to manage consumer perceptions to prevent abandoning than to worry about the actual length of the delay. A related implication is that it may be necessary for online marketers to determine this threshold limit for their particular situation, and gauge the percentage of consumers who stay on beyond it.

Given that waits on earlier pages of a web site are seen as longer than on later pages, online marketers should ensure that the first few pages in a web site download quickly to avoid negative perceptions of excessive waiting. If online marketers wish to include complex web content, they should save it for the later pages in a web site, so consumers will not perceive them as taking too long to download.

Finally, as time pressure worsens the effect of download delays on abandoning of the web site when the delay is on earlier web pages, online marketers need to be cognizant of whether the consumers they target are likely to access their web site under time pressure (e.g., business people booking flights). If so, they should focus on making the first few web pages download especially quickly, to drastically reduce the possibility of web site abandoning.

Limitations and future research

The use of student subjects limits generalization in terms of demographics. Yet, college students do represent an important segment of online consumers and a relevant target for Internet marketers. Moreover, the fact that the respondents were very familiar with Internet use gives greater credence to the results.

The experimental design did not capture abandoning behaviour, as participants could not actually stop the booking process if they thought the wait was too long. They could only indicate their inclination to abandon. Future field studies could observe when online consumers actually abandon slow loading web sites. Despite this limitation, the experimental design allowed careful control of download waiting times and extraneous factors, as is not possible with field studies.

The hypothesis regarding time pressure was not supported for perceived download waiting, despite the fact that the manipulation for time pressure had worked very well. A possible reason mentioned earlier is that time pressure may be already incorporated into perceptions of download waiting. Another possible reason might be that as the experimental design precluded subjects from abandoning the web site, time pressure or urgency became less important. Future research using field studies could test whether time pressure consistently exacerbates the negative effects of download waiting on consumers' abandoning of web sites.

In addition, future research building on this study could take a number of different directions. For example, it would be useful to examine whether the findings apply equally well to informational web sites. In other words, are online consumers more (or less) tolerant to download waits for web sites that only offer information?

Future studies could test for the nonlinear effects of actual waiting on perceptions of waiting in other contexts, including offline service delivery. Additional research could determine the threshold where perceptions of waiting level off for different contexts, to help marketers develop different strategies for below and above the threshold.

Another aspect to investigate is what constitutes an acceptable delay at early stages versus at later stages of browsing through a web site or in an offline service delivery. Determining acceptable delays at different stages in online contexts would help in developing web designs with built-in download times for different web pages. A similar study for offline contexts would help in developing flowcharts for offline service delivery with time specifications for each stage.

Finally, it would be interesting to determine if the superiority of perceptions over actual waits in predicting web site abandoning transfers to offline contexts. For example, future research could test whether perceived waits in an offline service delivery better predict consumers' switching to a competitor, than would actual waits in those situations. Such research would have important implications for carefully managing customer perceptions, even with long actual waits.

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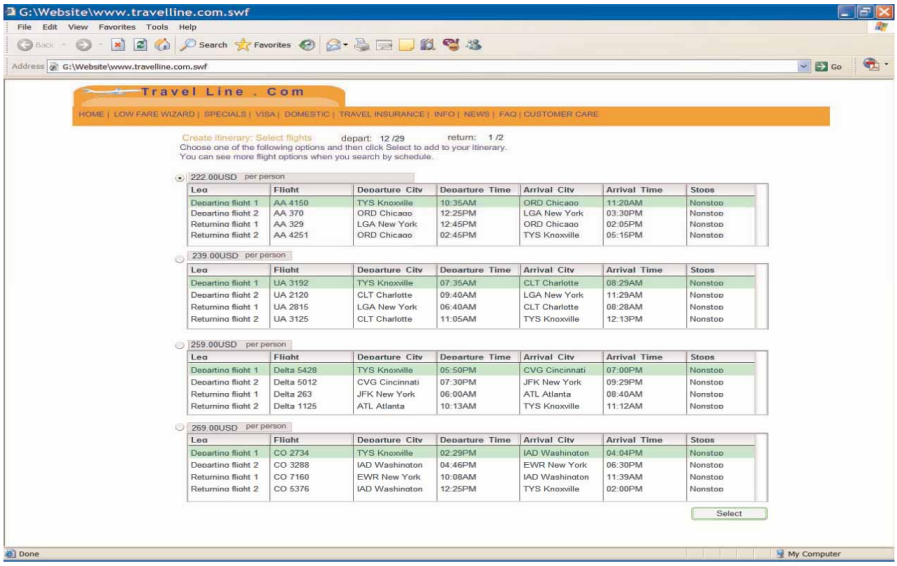
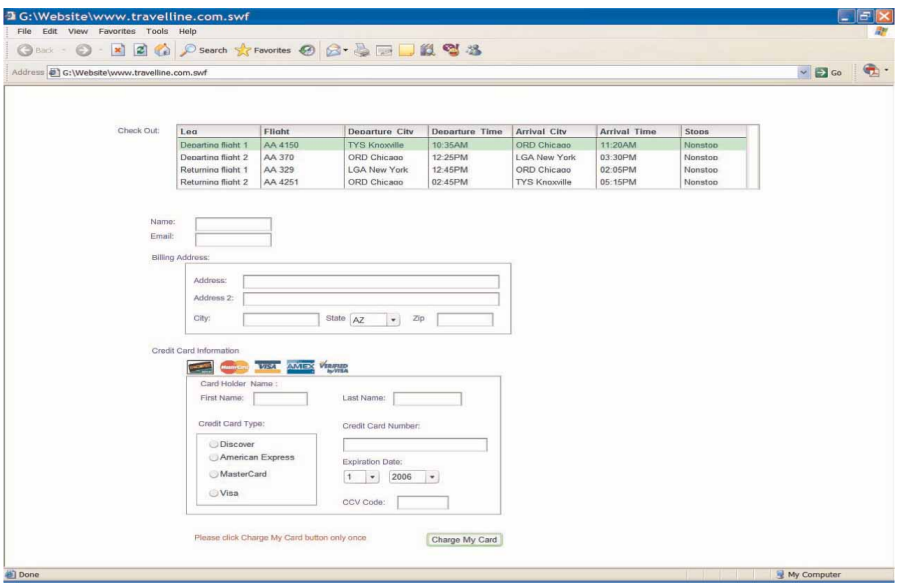
Appendix A. An illustration of the mock web site (review and purchase pages)





Appendix B. Scenarios used in the experiment

Scenario for high time pressure

You just received a letter today from a company in New York inviting you for an early on-site interview. This interview could possibly lead to a secondary interview for a job starting in May. Imagine that this is a company that you've always wanted to work for. You had written to this company a month ago telling them of your interest and of your graduation in May but you had not hoped to hear from them so early. You realize that this is a great opportunity for you. The interview is scheduled a week from today. You would like to reach New York the previous day and return the day after the interview. You are unsure whether you will find a reasonably priced flight with a convenient schedule at such short notice, and decide to book your flight right away.

Scenario for low time pressure

One of your best friends from high school works in New York and recently bought a time share in a high-rise condo overlooking the Hudson River. Your friend has invited you and other mutual friends over for the New Year's Eve weekend, which is about two months away. Imagine that you really want to go and relax over the long holiday weekend with your old friends and enjoy the scenic view. You think it would be nice to fly out to New York on December 29th and return as late as January 2nd. You know that good deals might be available closer to the time of your trip but decide you might as well start exploring possible flights right now.

Note: The scenarios were given to subjects without these identifying headings.