

Perception of Delay and Attitude toward Feedback Display: An Exploration into Downloaders' Demographics

Chatpong Tangmanee¹, Pawarat Nontasil²

¹Chulalongkorn Business School, Chulalongkorn University, Thailand

²National Electronics and Computer Technology Center (NECTEC), Thailand Science Park, Thailand

Abstract: *To cope with delay during an online download session, web service providers often present feedback cues to keep downloaders informed of progress. Yet, empirical work examining the downloaders' perception of delay or their attitudes toward the feedback provided is scant. Moreover, only few studies have addressed the two variables in conjunction with downloaders' demographics. This study intends to fill that void. 2,160 downloaders who downloaded online content from one content-sharing website participated in the survey. The analysis revealed that differences in perceptions of delay and attitude toward feedback provided across four major demographics including gender, age, education background and the amount of experience on the Internet were statistically significant at the 0.05 level. In addition, the correlation between downloaders' perception of delay and their attitude toward feedback is also statistically significant. In addition to extending insight into the concept of human-computer interaction regarding perception of delay, the study concludes that service providers should pay more attention to certain groups of downloaders so they perceive delay as less of a problem.*

Keyword: *Website delay, Demographics, Perception of Delay, Attitude toward Feedback Presentation, Downloaders*

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1. Introduction

Given the increase in online content and growth in the number of Internet users, it is likely that users will experience greater delays when accessing content [19], especially when they download. Consequently, researchers and practitioners have put much effort in studying these delays and how to deal with them sensibly [17].

A fair number of researchers in the field of human-computer interaction have given valuable recommendation on how web owners adjust the waiting time [11, 16, 33], offer cues to users so their attention is put away [24], or enhance attitudes toward online services [4, 29]. Yet, there is no published work covering perception of delay or attitude toward feedback cues in conjunction with online downloaders.

2. Related works

Shneiderman [31] is among the pioneers in investigating information system delay. Indeed, he and other scholars [21, 25] have stated based on their experiments that (1) if an information system displays results within 0.1 second, users would perceive no delay and be aware of the system's true interactivity, (2) if the system takes between 0.1 to about 10 seconds to display the results, users would notice the delay but their "flow of thought" has not been interrupted [24] and there is then no need to address the delay, and (3)

if the information system spends 10 seconds or longer to display results, users definitely lose focus and subsequently start making irrational decisions such as hitting ALT-CTRL-DEL buttons prematurely. As a result, users should be given sufficient feedback to indicate the system is still processing the user's request and will shortly display the results.

Although it is commonly accepted that users can tolerate up to a 10-second delay, Shneiderman [31] and Nah [24] argue that an information system should respond to users within two seconds. If it takes longer, feedback will be definitely needed. Despite the disagreement on the amount of waiting time users can tolerate, they deserve to be informed of the delay, either through the output presentation or via the feedback display.

In this study, a delay occurs "when a user clicks on a hypermedia and nothing seems to happen for several seconds [during which the user must wait]" [11]. So, the perception of download delay occurs when a downloader (1) clicks on a button to start the download and (2) must wait for its completion. In other words, it is the downloader's cognitive load tolerance in waiting for the download request to complete. Although in different terminology, this definition of perception of delay is conceptually consistent with perceived speed of website [8, 9], perceived quickness of a download [10], perceived response time [25, 31], tolerable

waiting time [24], perception of progress duration [14] and perceived delay [6, 22].

Galletta and coworkers [11] confirmed that users of an information system with no feedback cue would perceive longer delays than those using a system with a feedback cue. Similar results also were obtained by other scholars [13, 19]. In an attempt to examine the extent to which webpage background color could foster relaxation, Gorn and colleagues [10] conducted a series of experiments which suggested that the use of color may lead to greater relaxation, and subsequently users perceived less delay while doing online work. Nah [24] was interested in determining the extent to which the average online user could wait. While two seconds seemed to be the longest they could tolerate, users with feedback information concerning the wait seemed to tolerate the delay better than those with no feedback. Feedback in the form of textual or pictorial cues yielded almost the same result [24].

Instead of focusing on the actual length of delay, it may be more useful to focus on the perception of delay [6, 16]. Weinberg [33] and Nah [24] stated that dealing with perceived delay is more manageable compared to dealing with actual delay. In cases where site visitors are experiencing a long delay, they may perceive the delay as tolerable only if they lose track of time [30]. Technical implementations such as an increase in bandwidth have largely been the focus of solutions to this delay problem [10, 28]. Although these technical solutions help alleviate the problem, they may yield other more serious consequences. That is, a technical improvement in delay may draw greater numbers of users, leading to more traffic and even longer delays [7]. Therefore, researchers may wish to tackle the delay problem from a behavioral perspective [9]. Based on psychology literature, people prefer to be fully informed of a situation to avoid uncertainty. Waiting for a download to complete can be agitating unless users are fully informed of the entire download process. Two of the effective techniques to inform downloaders are presenting audio feedback and displaying feedback status.

Audio signals have been incorporated to alert users as their concentration is perhaps on other activities [32, 34]. It is typical that users could have other engagement (e.g., checking their email or looking for information) during their online sessions. Consequently, a beep when a download session is over could be helpful. Based on a qualitative approach, Merry and Orsmond [20] contend that undergraduates in England responded via interviews in favor of the audio feedback while using online tutoring software. Adding non-speech sound to a progress bar in an experiment, Crease and Brewster [4] confirmed that users in sessions with the sound perceived that they could complete tasks faster than those in sessions with no sound. Their findings were expected as any feedback given to users will often help shift their

attention from the waiting feeling to giving them the impression of being in-control [6]. Once the action is completed, a short beep could call their attention back to continue what has recently loaded or been downloaded. Users appear to appreciate this audio reminder.

In addition to presenting an audio signal as a feedback cue, a display of download status is also commonly used to keep users informed [16, 22]. The display of this status is generally visible through a progress indicator. Figure 1 illustrates some examples of formats of the status display.

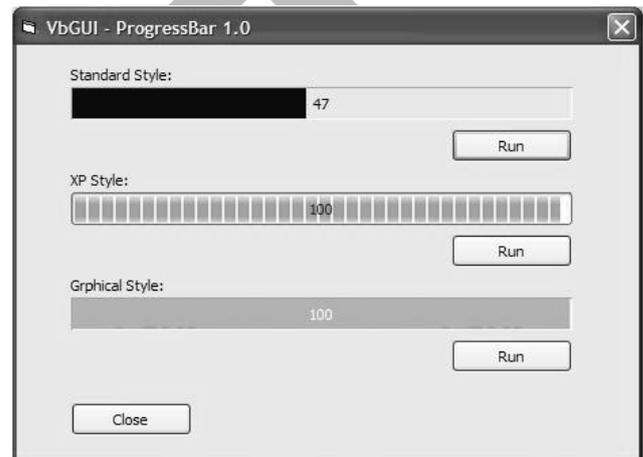


Figure 1. Examples of download status display formats.

Nah's experiment [24] confirmed that downloaders with a progress bar could tolerate a delay significantly better than those without any feedback cue. However, Nah's attempt [24] to verify whether pictures could help convey waiting time better than text failed to yield conclusive results. Dabholkar and Sheng [8] discovered that male downloaders reacted more positively to perceived delay (or perceived speed of a website using their exact term) than did female downloaders. In their attempt to ease users' frustration while waiting for system output, Harrison et al. [14] postulated that humans perceived delay as non-linear and therefore the display of the progress bar should take into account non-linear presentation. However, they failed to verify which non-linear function was the best. They could only confirm that a system designer should at least avoid linear presentation [14]. Crystal and Kalyanaraman [4] contend that presenting feedback does not only ease the user's frustration but also enhances their positive attitude toward a website, thereby increasing perceived usability. Comparing completion rates of online surveys of those with and without progress indicators, Couper et al. [5] found that the difference was not statistically significant. This insignificance was in part because it took too long to present the indicator on the screen. They thus state that the notification of download status is effective only as long as its display is swift. Yan et al. [34] discovered based on their quasi experiment that the feedback

display enhanced samples' perception, preventing their survey breakoffs.

A user's perceived delay of online service has received remarkable research attention. A number of scholars have examined ways to incorporate various types of feedback to alleviate delay problems [24, 29, 30, 34]. In addition, a large volume of empirical findings have appeared regularly in several publications [8, 11]. Although these results are useful in certain contexts, delay in downloading is still at the top of the list of complaints. This has prompted us to conduct research into downloaders' attitude toward feedback displays. In other words, we would like to explore the extent to which downloaders are still in favor of such presentation. In this study, this variable is defined as the downloaders' positive feeling toward the presence of feedback information while waiting for their download to complete. Based on downloaders' information obtained regarding feedback presentation, the researchers would then consider how to use feedback to deal more successfully with website delay. Findings on downloader attitudes would thus be one of this study's unique contributions since we could not locate any published work examining this variable.

A review of past research found no empirical publication examining attitudes in the context of downloading online content. We thus extend our review to cover related attitudes in similar contexts. Galletta and coworkers [11], for instance, contend that a delay of less than eight seconds would have no serious effect on Internet users' attitude but one of eight seconds or longer might contribute to a negative response. Dabholkar and Sheng [8] speculated that the link between the display of feedback information and a user's perceived speed of a website should be mediated by their attitude toward the extent to which they perceive control over their lives. In an academic setting, college students developed a positive attitude toward learning software only if it presented feedback information [20].

A review of previous literature has identified a research gap in which this current study hopes to fill. Although a fair number of empirical publications have covered perceived delay in various contexts [6, 8, 9, 13, 30], none has investigated whether there is any difference in perceived delay except Block and coworkers' meta review [3] or that of attitude toward feedback presentation across downloaders' demographics.

Previous research often assumes that online users are similar and their attitudes would be the same. This assumption needs empirical verification because users are indeed different [25, 26]. Moreover, virtually no research in the past has examined the perception of delay in the download context despite the fact that it is heavily correlated with delay [6]. We speculated that previous research's inconclusive findings on applying

feedback cues to handle delay problems may be a result of differences in user demographics or their attitude toward the feedback display. As a result, the objectives of this study are as follows.

- Compare differences in downloaders' perception of delay across their demographics,
- Compare differences in downloaders' attitude toward feedback presentation across their demographics,
- Examine correlation between downloaders' perception of delay and their attitude toward feedback presentation.

3. Research Methodology

Data used in the study was from a survey in which questionnaires were given to downloaders who experienced feedback presentation while waiting for their download request to complete at one content-sharing website. After the download completed, we asked the downloader to participate in this research.

3.1. Population and Samples

The population in this study consisted of those who at least once had downloaded content from the Internet. With cooperation from uploadtoday.com, a website providing virtual spaces for members to share files of up to 50 MB in size, the samples obtained were downloaders who had used this service to download content. During this period of data collection, we were able to get 2,160 samples.

3.2. Instrument to Measure Perception of Delay and Attitude Toward Feedback Presentation

The measurements were based on adaptation of scales measuring perception of delay and attitude toward feedback presentation in previous research or those measuring similar constructs. Four five-level Likert scales were used to measure perception of delay. The scales were modified from Crystal and Kalyanaraman [4]. The higher the average of these four scales, the longer delay downloaders perceived.

Scales to measure the subject's attitude toward feedback presentation were also adopted from previous literature [4]. We are aware that this variable is somewhat new. The modification was then from the most closely related variables found in past empirical research. The scales were five five-level Likert scales. The higher the average of these five scales, the more positive attitude downloaders had.

The two sets of scales were in the first two sections of the questionnaire and the final section collected a participant's demographics. To assess this questionnaire's acceptability, we performed face validity with five faculty members in fields of

information technology, management and research design. Furthermore, we pretested the questionnaire on (1) Chulalongkorn Business School's students and (2) members of uploadtoday.com. We made a few modifications based on these pretests and believe that the data from this questionnaire is of acceptable quality.

3.3. Data Collection Execution

Prior to the data collection, we had to figure out (1) what the feedback was that appeared on screen while samples were waiting for their download and (2) how to present the feedback. Based on previous literature, the feedback in this study was a message informing the downloader of (a) the requested file name and (b) the percent of remaining content waiting for transfer. Above the message was a visual representation with a series of arrows flying from left to right indicating the file transfer process. To alert the samples when a download finished, we used a beep sound similar to a bell, playing once at the end of each download. Following experts' suggestions [1], the selection of a brief and gentle audio signal was used to call the sample's attention. Figure 2 is an example of this study's feedback presentation. This presentation would disappear after the beep was played.

We are aware that a sample's perceived delay or attitude toward the feedback presentation depends on the length of its display. The display should thus be long enough for the samples to develop a perception; yet, it must be comparable for them. A check of the log files at the host website, uploadtoday.com, together with few conversations with the webmaster, revealed that download sessions of files between 3 to 15 MB in size would last approximately 10 seconds, the amount of which typically leads to frustration and feeling of delay [25, 32]. Our samples would thus be those who requested to download files in the range of 3 to 15 MB in size from the hosting website. Therefore we can assume that they would experience waiting times of 10 seconds.

With help from uploadtoday.com, we installed a small program on the website. After a visitor requested to download a file with a size in the range of 3 to 15 MB, the program would read a data package embedded in the request. In the package was (1) file details including the file name and size and (2) the sample's IP address (this is to ensure it was a unique visitor). Then, the program would send the file details to the website's main server, after which the download would start. While the requested file was being downloaded, the feedback cue would appear on the sample's screen. Once the download was completed, the program would direct the sample to a questionnaire. If the sample put off responding to the questionnaire, we would ask for their email address so we could remind them to do it within the following two weeks. After one month of

data collection, we were able to get 2,160 samples. After assessing the questionnaire responses, we adopted all of them for further analysis.



Figure 2. Example of this study's feedback presentation.

3.4. Analysis Framework and Hypothesis Testing

We presented the overall picture using descriptive statistics. To fulfill the study's first two objectives, we used (a) the independent t-test to verify the comparison of the downloaders' (1) perception of delay and (2) attitude toward feedback presentation across genders, and (b) analysis of variance (ANOVA) to do the same across educational levels, age groups and different degrees of experience with the Internet. To respond to the final objective, we used Pearson's correlation coefficient analysis.

4. Results

According to Table 1, 8 in 10 of the participating downloaders were men. About half were 20 years old or under. 58% held a vocational diploma (or lower) as their highest educational background. The largest proportion (75%) had experience on the Internet of eight years or less.

Table 1. Profiles of survey participants.

Characteristics	N	(%)	Characteristics	N	(%)
Gender			Internet Experience		
Female	375	(17)	< 2	889	(41)
Male	1,785	(83)	2-8	741	(34)
Age			>8	530	(25)
≤ 20 yrs	1,147	(53)	Highest education		
21-30	650	(30)	Vocational or lower	1,258	(58)
31-40	241	(11)	College degree	770	(36)
≥41 yrs	122	(6)	Graduate level	132	(6)

The Cronbach alphas for (1) four scales measuring downloaders' perception of delay and (2) five scales measuring their attitude toward feedback presentation were 0.876 and 0.940, respectively. This confirms the reliability of these two measurements [27].

Table 2: Descriptive statistics of downloaders' perception on delay categorized by four major demographic variables

Variables	N	Average	Standard Deviation
Age			
<= 20 yrs	1,147	3.09	.942
21-30 yrs	650	2.60	.829
31-40 yrs	241	2.52	.742
>40 yrs	122	2.58	.817
Education levels			
Vocation or less	1,258	3.05	.953
College level	770	2.56	.781
Graduate work	132	2.63	.800
Internet Experience			
< 2 yrs	889	3.28	.912
2-8 yrs	741	2.58	.799
> 8 yrs	530	2.51	.786
Gender			
Female	375	2.57	0.811
Male	1,785	2.91	.927
Total	2,160	2.85	0.917

Table 3. Descriptive statistics of downloaders' attitude toward feedback presentation categorized by four major demographic variables.

Variables	N	Average	Standard Deviation
Age			
<= 20 yrs	1,147	2.07	1.300
21-30 yrs	650	2.87	1.134
31-40 yrs	241	2.94	1.012
>40 yrs	122	2.91	1.153
Education levels			
Vocation or less	1,258	2.17	1.324
College level	770	2.87	1.103
Graduate work	132	2.72	1.066
Internet Experience			
< 2 yrs	889	1.84	1.226
2-8 yrs	741	2.92	1.124
> 8 yrs	530	2.84	1.138
Gender			
Female	375	2.88	1.111
Male	1,785	2.36	1.294
Total	2,160	2.45	1.279

Based on Tables 2 and 3, the average of downloaders' perceived delay was 2.85 in a one-to-five range and the average of their attitude toward feedback presentation was 2.45 also in the same scale range. We could thus interpret these results as participating downloaders having a neutral attitude toward feedback presentation and have perceived the download speed neither quick nor slow.

The statistics in Table 4 confirm that the differences in the participating downloaders' perception of delay across four age groups, three levels of education background and three intervals of experience on the Internet are all statistically significant. Further post-hoc analyses indicate that the perception of delay among those young downloaders (less than 20 years of age) is significantly different than those in the older categories while these perceptions among the other two older categories are about the same. Similarly, the perception of delay among those with less than a college level education is significantly different from those who are at least college graduates. Yet, those with a college degree and those with graduate work perceived about the same length of delay. Finally, the

perception of delay among those with less than two years of experience on the Internet is statistically different from those with at least two years of the experience. However, the difference in perceived delay between those with 2-3 years and those with at least eight years of the experience is not significant. Regarding gender, the t-statistics of 7.088 with a degree of freedom of 597.957 and a p-value of .000 confirms that the perceptions of delay between male and female downloaders are statistically significant.

Table 4. Results of ANOVA.

Independent variables	Statistics	P-value
Dependent variable: Perception of delay		
Age	$F_{3, 2156} = 59.0$.000
Education levels	$F_{2, 2157} = 74.7$.000
Internet Experience	$F_{2, 2157} = 193.5$.000
Dependent variable: Attitude toward feedback presentation		
Age	$F_{3, 2156} = 59.0$.000
Education levels	$F_{2, 2157} = 80.6$.000
Internet Experience	$F_{2, 2157} = 210.8$.000

Similarly, the statistics in Table 4 confirm that the differences in the participating downloaders' attitude toward feedback presentation across four age groups, three levels of education background, and three intervals of experience on the Internet are all statistically significant. Further analyses indicate that this attitude toward feedback presentation among those young downloaders (less than 20 years of age) is significantly different than those in the older categories while this attitude among the other two older categories is about the same. Likewise, the attitude toward feedback presentation among those with education below the college level is significantly different from those with at least a college degree. Yet, those with a college degree and those with graduate work hold about the same attitude toward feedback presentation. Finally, the attitude toward feedback presentation among those with less than two years of experience on the Internet is statistically different from those with at least two years of the experience. However, the difference in this attitude between those with 2-3 years and those with at least eight years of the experience is not significant. The t-statistics of -8.046 with a degree of freedom of 607.509 and a p-value of .000 confirms that the attitude toward feedback presentation between male and female downloaders is statistically significant.

The analysis of correlation between downloaders' perception of delay and their attitude toward feedback presentation revealed that a Pearson's correlation coefficient of -0.623 with the p-value of .000. This

suggests a statistically significant negative relationship between these two variables.

5. Conclusion and Discussion

5.1. Demographics of Participating Downloaders

Among the total of 2,160 subjects, the main profile was males at 20 years of age or less with 6 in 10 having education below the college level and experience on the Internet of at most six years. Given that the population in this study were those who downloaded content from a website, the findings regarding this profile seem to reflect the previously identified yet important characteristics of downloaders in Thailand. A comparison between this profile and that of Internet users in Thailand [23] reveals significant overlapping between these two profiles. As a result, the subjects are representative.

5.2. Downloaders' Perception of Delay Across Demographics

The participating downloaders' perception of delay in this study was slightly over the midpoint (the value is 2.85 in a one-to-five range). Also, the findings empirically confirm that downloaders perceived the length of delay differently across various demographic values. Based on Table 2, the downloaders at 20 years of age or lower having less than a college level education or having less than two years of online experience perceived significantly longer delays than those older with a higher education background or more experience on the Internet. These findings are in line with previous research [3, 8, 9]. Based on a meta-analytic review of research in both online and offline contexts, Block and coworkers [3] contend that older adults are likely to tolerate long delays better than younger people. In addition, Dabholkar and Sheng [8] confirmed in their survey that male online users should be more sensitive to the delay and thereby perceive longer waiting time than female users who often focus more on interpersonal communication.

5.3. Downloaders' Attitude Toward Feedback Presentation Across Demographics and Correlation with Perception of Delay

The display of feedback to deal with the delay problem would be of limited value if we examined only the perception of the delay. This inspires us to extend our examination to cover the downloaders' attitude toward feedback presentation. Indeed, those downloaders who took part in this study held an average positive attitude toward the presentation (the value was 2.45 in a one-to-five range). This means the downloaders were still in moderate favor of the feedback presentation. The feedback in this study incorporated both text messages

and audio signals to inform downloaders while waiting for their download. Nah [24] achieved similar results from the use of textual and pictorial feedback cues. Other researchers may therefore want to investigate what kind of feedback could enhance downloaders' attitude [19].

Comparisons of this variable across downloaders' four major demographics yielded results similar to the comparisons of perceived delay. Since there has been virtually no previous empirical work examining this attitude, we could offer no explanation regarding these findings; however, we did explore a correlation between downloaders' perception of delay and their positive attitude. The Pearson's r correlation coefficient of this relationship was -0.623 which is statistically significant. For the significance, it was not surprising that the comparisons of the perceived delay and those of the attitude toward feedback presentation across demographics yielded similar findings. The negative direction of this correlation could be expected as well. If downloaders perceive a long delay, they would have a less positive attitude toward the feedback presentation. In other words, their higher positive attitude would consistently point to their perception of less delay [16].

5.4. Implications and Limitations

The implications of this study's findings are at least two fold. First, it has extended theoretical insights into the concept of human-computer interaction regarding perception of delay and attitude toward feedback presentation, especially in the context of online downloads. Second, it has practical utility. The findings suggest at least two recommendations for practitioners. First, they indicate that young downloaders with less education or less experience on the Internet tend to be more impatient about download delays. As a result, practitioners may be more attentive to techniques that shift the downloader's attention so they do not perceive a long delay while waiting for their download. Second, the negative significant correlation between downloaders' perception of delay and attitude toward feedback presentation may suggest that practitioners display certain feedback cues that lead to improved attitude which could further result in perception of short delay.

This study's contribution could have been stronger if it had not had two limitations. The first limitation was the study's inclusion of a new variable: attitude toward feedback presentation. Although the measurement used was of acceptable quality, this construct still requires more development. The second limitation is that this survey gathered data from downloaders in Thailand. As such, the perceptions reported in this study are limited to this group of subjects. Since a perception of delay or attitude toward feedback presentation is sensitive to culture [3, 11, 24],

replicating similar research with other groups of downloaders should help paint a more complete picture.

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Chatpong Tangmanee is an assistant professor in the area of information application in business at Chulalongkorn University's Business School in Thailand. His research interest includes human-computer interaction in electronic commerce context. Dr. Tangmanee holds a PhD in information transfer from Syracuse University's School of Information Science and Technology in New York, USA. He published research papers in the *Australasian Journal of Information Systems*; *Journal of Business Administration Research*; *Journal of Information Technology Applications and Management*; and several academic journals in Thailand as well as presented research findings at academic conferences including ICEB or eCASE.



Pawarat Nontasil earned a M.Sc. in Business Software Development from Chulalongkorn University's Business School. Currently, she is an engineer at the National Electronics and Computer Technology Center's LEAD Technologies Inc.