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The Online Waiting Experience: Using Temporal Information and Distractors to Make Online Waits Feel Shorter

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Abstract:

Research on how to manage the online waiting experience has begun to emerge but has primarily focused on the use of distracting cues for online wait management (e.g., text and images that distract the user from the wait). The use of temporal information in waiting webpages (e.g., text and images that convey the duration of the wait) has received little attention from the information systems literature, and we have limited understanding about how the two types of cues (temporal information and distractors) affect wait time estimation. We address this gap by developing a theoretical model of how these cues affect the waiting experience and perceived waiting time. We tested the model with a 2 x 2 x 2 x 2 controlled lab experiment and 1025 participants using progress bar treatments that included temporal information (spatial and text description of the wait time duration) and distractors (progress bar animation and accelerated filling of the progress bar) with both short and long wait conditions. We found that the two types of cues reduced perceived waiting time through different nomological paths. Temporal cues reduced perceived uncertainty about the wait, while distractor cues directed attention away from the wait, increasing perceived enjoyment and wait time distortion. Further, the enhanced waiting experience reduced the perceived waiting time. Further, these cues were effective in managing the online waiting experience with both short and long waits.

Keywords: Online Wait, Wait Management, Progress Bar, Attentional Gate Model, Temporal Information, Distractor, Perceived Waiting Time, Uncertainty, Attention, Distortion.

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1 Introduction

Despite sizable investments in Internet connectivity, online customers continue to wait during information searches, page transitions, file uploads/downloads, and login authentication (Mulpuru, Johnson, & Hult, 2007; Mcguire, Kimes, Lynn, Pullman, & Lloyd, 2010; Mital, 2014). In most contexts, waiting remains a pervasive and inseparable component of an e-commerce experience that results in stress and dissatisfaction toward services, products, and online stores[1] (Rose, Meuter, & Curran, 2005; Zhou & Soman, 2008). Even short waits can result in website abandonment and loss of revenue (Brutlag, 2009); thus, websites should be designed to make the wait feel shorter and even enjoyable.

In general, human time perception remains an elusive object of study (Grondin, 2010) because both external, context-specific factors such as cues and individual differences, including emotion and attention, affect it. Although some research exists for managing perceptions of wait time in traditional environments, including banks and restaurants (see Lambert & Lee, 2008, for a review), research on managing perceptions of wait time in online environments has just started to emerge. Recent studies have examined how one can include distracting cues (e.g., text and images that distract the user from the wait) on a waiting page to improve the waiting experience (e.g., Hong, Hess, & Hardin, 2013; Lee, Chen, & Ilie, 2012). However, little research has examined the use of temporal information (e.g., displays related to the duration of the wait) for managing an online wait. Further, we have limited understanding of the nomological network for online wait time estimation and how the combination of temporal information and distractors influence perceptions of the waiting experience. Finally, little research has examined how the effects of such cues change with short and long wait situations.

In this study, we address the above mentioned gaps in the literature with the following research questions:

> **RQ1-3**: How do 1) temporal information, 2) distractor cues, and 3) the synergy of using both types of cues influence the online wait experience?
>
> **RQ4**: How do these perceptions of the waiting experience ultimately influence perceived waiting time and online behavior?

We propose a comprehensive model based on time perception research (Block & Zakay, 1996; Zakay & Block, 1997, 2004) in which perceptions of the online waiting experience *(*perceived uncertainty, focused attention on the wait, perceived enjoyment, and perceived time distortion*)* and perceived waiting time (PWT) represent the key constructs and the process for understanding the online waiting phenomenon. Our model depicts how different interface cues may influence the online waiting experience and, ultimately, affect the PWT.

This study provides contributions at several levels. First, this research provides insight by operationalizing perceptions of the waiting experience as key mediating variables through which two types of cues, temporal information and distractors, influence PWT. We conducted a 2 x 2 x 2 x 2 lab experiment to assess the different effects of these types of cues on key mediating variables and, ultimately, on PWT. Second, this research builds off of and extends two recent IS studies in this area (i.e., Hong et al., 2013; Lee et al., 2012) by examining how both types of cues influence the time-estimation process with short and long waits. Third, this research examines how one can design temporal information and distractor cues to reduce PWT independently and in a complementary manner. Further contributions include providing insight on how one can use specific progress bar features to manage the online waiting experience and identifying new research opportunities. Spatial and text wait duration information are the temporal elements examined, while progress bar animations and accelerated filling of the progress bar (referred to as exaggeration) are novel, distractor elements examined in the study.

This paper proceeds as follows. In Section 2, we review the wait management literature and time perception research to develop a theoretical model of how temporal information and distractor cues affect the waiting experience. In Section 3, we present our theoretical model and hypotheses. In Section 4, we present the research methods. In Section 5, we present our results and, in Section 6, discuss them. Finally, in Section 7, we describe the theoretical and practical implications of our results and future research opportunities.

[1] In some online waiting contexts, waiting is necessary and expected by users. While these online waits may not be as displeasing to users as others, these waiting experiences may still be improved.

2 Literature Review and Theoretical Background

2.1 Environmental Cues in the Wait Management Literature

Customers' waiting for service is one of the primary challenges facing both traditional and online businesses (Rose, Devilliers, & Straub, 2009; Rose et al., 2005), and research on managing customers' waiting experiences often focuses on how providing environmental cues during the wait can influence PWT. In general, the literature has examined two types of environmental cues used for wait management (i.e., temporal information vs. distractors) but often without theoretical explanation and with inconsistent results.

Temporal information provides information about the time that has passed and/or the time that remains in a waiting context to objectively inform the user about the wait without manipulating or distorting perceptions of time. Examples of temporal information in an online environment include a progress bar showing the amount of progress, a percent-completed indicator, a clock, and countdown seconds. Conceptual research on wait management has assumed that PWT will seem shorter when individuals are provided with temporal information about the wait (Maister, 1985; Osuna, 1985) because this temporal information should reduce the uncertainty associated with the wait (Osuna, 1985). When people are less uncertain about the wait, they should direct fewer cognitive resources toward the estimation of time, resulting in shorter PWT. Similarly, when people are provided with information about the wait time, they should be released from tracking time, resulting in shorter PWT (Zakay, 1989).

On the other hand, distractors are believed to direct attention away from the wait, which leaves one with fewer cognitive resources available for time estimation and results in a shorter PWT (McGrath & Kelly, 1986; Taylor, 1994). Research often refers to such distractors as fillers because the cues are designed to distract people and fill their thoughts with topics other than the passage of time. Distractors examined in the literature include television (Pruyn & Smidts, 1998), mirrors in elevators (Maister, 1985), and newsstands (Katz, Larson, & Larson, 1991). Hedonic fillers have the potential to further distract attention away from time as hedonic cues provide enjoyment to users and are believed to make the wait feel shorter (Hornik, 1993). Hedonic fillers include famous characters in a theme park (Dawes & Rowley, 1996) and a live music performance while waiting in a restaurant or a hospital (Chebat, Gelinas-Chebat, & Filiatraut, 1993).

Empirical studies of wait time management have produced inconsistent findings on how environmental cues influence the waiting experience. For example, some studies have found that temporal information reduces waiting-related perceptions and behavior (Antonides, Verhoef, & Van Alas, 2002; Fornell & Larcker, 1981; Litman, 2011), while others produce no effects or negative effects (e.g., Hornik, 1984; Whiting & Donthu, 2006). Similarly, inconsistent results have been reported with distractor cues: some studies have reported positive effects (e.g., Cameron, Baker, Peterson, & Braunsberger, 2003; Katz et al., 1991) and others have reported no effect or negative effects (e.g., Antonides et al., 2002; Pruyn & Smidts, 1998). We conjecture that several possible reasons exist for these inconsistent findings with both types of cues, including conceptualization and measurement of mediating and outcomes variables, as we describe below.

First, prior studies have examined different outcome variables and measures, including PWT, satisfaction with the wait, perceptions of the waiting experience, estimates of the actual time elapsed, and satisfaction with the service. Often, these prior studies have examined only a single outcome variable or compared different studies with different outcome variables, which has resulted in inconsistent findings and the field's limited advancement. Second, existing research has examined a variety of different cues without considering how cues could influence the waiting experience and behavior through different mechanisms. Third, previous studies have not investigated the synergistic effect of employing temporal information and distractors simultaneously in an interface to manage wait time perceptions. A recent commentary on mediation has noted how the absence of a relevant mediator, or multiple mediators (as proposed in this study), can result in insignificant direct effects or positive/negative direct effects between independent and dependent variables (Zhao, Lynch, & Chen, 2010). In this study, we address these inconsistencies by measuring several perceptions of the waiting experience and PWT and by integrating these variables into a comprehensive, nomological network.

2.2 Theoretical Model of Time Perception

Time perception is a cognitive process heavily influenced by extraneous information other than the actual time that has elapsed. Thus, many time-related experiences are based on subjective time such as perception, memory, estimation of duration, and speed of events (Killeen & Fetterman, 1988). Research shows that individuals estimate time "differently depending on the amount of information presented or processed during the time period" (Block & Zakay, 1997 p. 12). Thus, perceived time is sensitive to the conditions under which one measures it (Zakay, 1990), including the external "cues" in the environment. The resources one allocates to estimating time also influences how individuals estimate it (Zakay, 1989). Attentional resources are limited such that, if one directs their attention to external cues, then one has fewer resources for time estimation. The attentional gate model (Block & Zakay, 1996; Zakay & Block, 1997, 2004) is a widely accepted time perception theory that explains how humans estimate time with limited resources (see Figure 1).

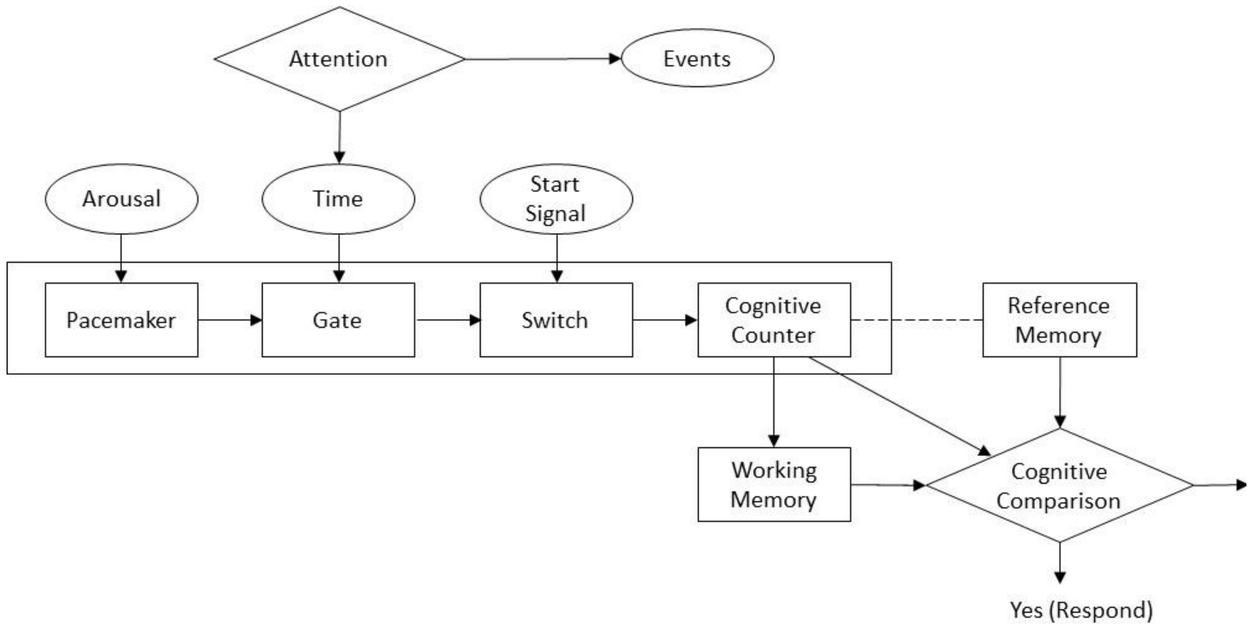

Figure 1. Attentional Gate Model

2.2.1 Attentional Gate Model

Researchers have proposed a series of models to explain the effects of various cues on time perception; in fact, the attentional gate model (Block & Zakay, 1996; Zakay & Block, 1997, 2004) combines features of many earlier models, including the internal clock model (Treisman, 1963), scalar-timing model (Gibbon, Church, & Meck, 1984), and the attentional model (Thomas & Weaver, 1975). The model is an attentional resource-allocation model (Block, Hancock, & Zakay, 2010) that explains how attention and other cognitive components affect how individuals estimate time's passing. In general, a "pacemaker" in the human brain produces pulses at a steady rate, and "arousal" causes variations in this rate. When a person attends to time, an attentional "gate" is opened and the stream of pulses from the pacemaker is sent to a form of cognitive counter. The pulses recorded by the cognitive counter can be transferred to working memory when attention is directed toward time. As working memory records the pulses that have been counted during the current period, reference memory stores the average number of pulses that have been counted with past, similar waiting experiences. The final step of the time-estimation process occurs when an individual compares the pulse count stored in working memory with the average count stored in reference memory and then estimates the time that has passed based on this comparison.

The attentional gate model suggests that the time-estimation process requires both human attention and memory. As Zakah (1990, p. 61) notes: "Attention to time is manifested by an individual being aware of time and by intentionally seeking information about objective time". An individual who is uncertain about the wait duration may seek information about time and pay more attention to time, leading to increased PWT (Osuna, 1985). However, if individuals focus their attentional resources on external events, such as environmental cues, they may attend less to time (Block & Zakay, 1996). The attentional gate may be closed, opened a little, or opened widely depending on the resources focused on time. For example, the estimates of time duration are the lowest when individuals focus their resources on external events as the attentional gate is closed. If individuals directs their attention toward an external event or cue, then they will count fewer or no pulses, they may disrupt the transfer of pulses from the cognitive counter to working memory, and they may distort the comparison between working memory and reference memory, which will result in reduced PWT. For example, when a person waits in a line at Disney World and sees Mickey Mouse (a distractor cue) and observes that the line is moving (temporal information), the person may direct cognitive resources toward Mickey Mouse and may not feel the need to attend to time because they have alleviated the uncertainty of the wait. From an attentional gate perspective, the redirection of cognitive resources away from the tracking of time means that the attentional gate closes, which results in fewer pulses in the cognitive counter. Further, this redirection disrupts the transfer of pulses from the cognitive counter to working memory, and the individual's working memory stores fewer pulses, which results in a distorted time estimation.

Although the attentional gate model describes the mechanics of the time-estimation process, researchers cannot measure the opening of the gate or the count in working memory. Psychology studies that apply this model (see Block et al., 2010, for a recent meta-analysis) focus on inputs (task and load differences) and outcomes (time estimates and task performance) without considering the intermediate steps or the waiting experience, which may provide insight into how one can manage wait time. Therefore, in this research, we focus on identifying perceptions of the waiting experience that reflect changes to the pacemaker, gate, and the count of pulses in memory that, in turn, influence the PWT.

2.2.2 Perceptions of Waiting Experience

Time perception research suggests that individuals will experience considerable uncertainty while waiting if they do not have information about the duration of the wait, and this uncertainty builds as the wait increases (Osuna, 1985). Perceived uncertainty *(PU)* represents ambiguity or lack of confidence in the likelihood that an event will occur (Dellaert & Kahn, 1999; Maister, 1985; Taylor, 1994). Osuna (1985) suggests that providing temporal (wait duration) information can reduce the uncertainty associated with waiting, which enables an individual to focus less on the wait (i.e., a closing of the attentional gate). For example, individual may feel uncertain while waiting for a delayed flight if the airline provides them without any information about the delay (Taylor, 1994), but providing information about the wait duration (e.g., the expected arrival time of the delayed flight) may reduce their uncertainty and the need to obtain information about the wait time (Hui & Tse, 1996).

The attentional gate model suggests that attention to the wait is a critical component in each step of the time-estimation process. Thus focused attention on the wait *(*FA*)* is also an important indicator of the time-estimation process. The waiting time literature suggests that individuals pay less attention to the wait if other stimuli distract them. When external cues disrupt the time-estimation process, perceived time distortion (PTD), one's inability to register the passage of time (Agarwal & Karahanna, 2000) can occur. An individual can experience PTD as losing track of time or being unaware of time's passing. In addition, a positive, affective experience or cue may attract more attention and make the time go by more quickly. The affect infusion model (Forgas, 1995) suggests that people in a good mood tend to initiate processing of targeted cues, which requires more attention and memory resources. Psychology studies have found that an affective experience that causes perceived enjoyment (PE) can attract individuals' attention by directing more resources toward the distracting cues and away from time estimation (Gable & Poole, 2012; Gupta & Khosla, 2006; Zakay & Block, 2004).

In summary, the time perception literature suggests that PU, PTD, PE, and FA are important perceptions of the waiting experience. These measures of the waiting experience influence the PWT and may provide insight into how one can manage wait time.

2.3 Using Progress Bars to Manage Online Waits Heading for Level Three

A progress bar is a graphical element that fills as a task progresses and that many online waiting webpages include. Websites most commonly implement it as a rectangle that fills with color as a wait progresses, but it can also take on other shapes, including filling dots and images that appear to move across the screen. Research often refers to such interface elements as time affordances because they provide information or feedback to users during a wait (Conn, 1995; Norman, 2002) and can reduce the uncertainty of the wait. Research on wait time feedback generally refers to textual feedback information as progress indicators and to graphical feedback information as progress bars. A progress indicator might display the percentage of wait time that has passed and remains (e.g., 40% and 60%) (e.g., Myers, 1985).

Several types of progress bar features hold promise for managing waits but have received limited attention in an online context. Text that shows the percent completed (e.g., actual percentage of wait time remaining) is a temporal feature that may influence perceptions of the wait experience. Distractor features of progress bars that may be helpful in managing online waits include the early arrival of results (exaggeration) and hedonic features. In summary, empirical research on progress bars has not adequately addressed these wait-management tools. Research gaps include 1) limited examination of progress bar features, 2) a lack of theoretical foundation, 3) and no nomological network that explains the effects of temporal information and distractor progress bar features on the waiting experience.

3 Research Model and Hypotheses Development

Based on the attentional gate model and the waiting time literature, we hypothesize the effects of temporal information and distractors on perceptions of the waiting experience, PWT, and use intention as depicted in our research model (see Figure 2). The model proposes that 1) temporal information reduces the perceived uncertainty surrounding a wait (PU); 2) distractors in the form of hedonic cues reduce focused attention on the wait (FA), increase perceived enjoyment of the wait (PE), and distort time estimation (PTD); and 3) distractors in the form of the early arrival of search results (exaggeration) also distort time estimation (PTD). In developing the hypotheses, we focused on these intermediate variables (namely PU, FA, PE, and PTD) as perceptions of the online waiting experience. We propose these variables to mediate[2] the influence of online cues on PWT, which subsequently influences online use intention.

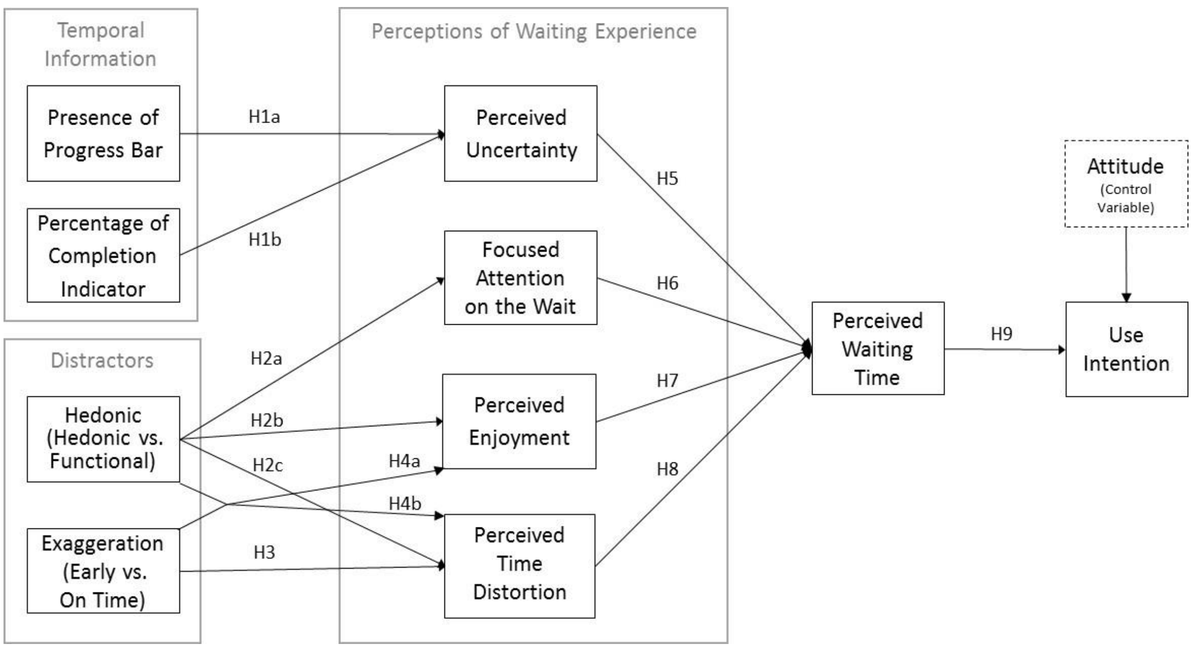

Figure 2. Research Model

3.1 Temporal Information: Progress Bars and Percent-completed Indicator

In the context of an online wait, a *progress bar* that appears in a waiting screen represents the first type of temporal information. It provides temporal information in a graphical format about how much of the wait has passed and how much remains. Prior research on progress bars has produced inconsistent results: some studies have found they had no effect on perceived wait duration and satisfaction with the wait (e.g., Branaghan & Sanchez, 2009; Culwin & Faulkner, 2001), and others have found a significant effect of progress bars (e.g., Myers, 1985). Rather than propose a direct relationship between a progress bar and the final outcome variable PWT, we address these inconsistencies by specifying how progress bars change the waiting experience such that they may reduce PWT. Time perception research suggests that information on the status of the wait may reduce users' PU during the wait (Chebat et al., 1993; Maister, 1985; Nah, 2004; Osuna, 1985). For example, individuals may feel uncertain while waiting for a delayed flight if the airline provides no information about the delay (Taylor, 1994). Providing wait duration information (e.g., the expected arrival time of the delayed flight) may reduce individuals' uncertainty and the need to obtain information about the wait time (Hui & Tse, 1996). With this reduction in PU, the attentional gate model suggests that the gate can close because the user no longer needs to attend to time's passing. Therefore,

[2] While some studies have investigated one or two of these variables in a waiting context (e.g., Taylor, 1994; Lee et al., 2012), we know of no studies that examine PU, FA, PE, and PTD together or examine these variables with progress bars or the two types of cues (i.e., temporal information and distractors).

a progress bar that provides temporal information in an online waiting screen should enhance the waiting experience by reducing the PU of the wait as compared to a waiting screen with no temporal information. Thus, we hypothesize that:

> **H1a:** During an online wait, users perceive less uncertainty when viewing a waiting screen with a progress bar as compared to one without a progress bar.

Progress bars can provide additional temporal information with a text indicator such as a percent-completed indicator that displays the exact percentage of the wait completed (Gibbon et al., 1984). When a waiting screen displays this more precise information along with a progress bar, the resulting design element provides two pieces of temporal information (a graphical progress bar and text percentage of wait remaining). Time perception research suggests that more precise information about the wait should further reduce uncertainty (Maister, 1985; Osuna, 1985). Similarly, HCI research on time affordances recommends that waiting screens should provide users with all available information about the wait because more information should further reduce users' uncertainty (Conn, 1995; Norman, 2002).

However, we have limited empirical evidence on the effects of using progress indictors or a progress bar with a text progress indicator included. Further, researchers have found mixed results for websites that use a text indicator on its own: some report positive effects on PWT (Cham, Darido, Jackson, Laver, & Schneck, 2006; Hui, Tse, & Zhou, 2006) and others report negative or mixed effects from using some form of a text progress indicator (Conrad, Couper, Tourangeau, & Peytechev, 2010; Hui & Tse, 1996). Negative effects from text progress indicators could occur if these indicators inadvertently draw users' attention to the wait. In this research, we consider the compounding effect of how a text indicator in combination with a progress bar affects PU and expect that, when users view two forms of temporal information, they will report less PU during the wait as compared to just viewing a progress bar. Thus, we hypothesize that:

> **H1b:** During an online wait, users perceive less uncertainty when viewing a progress bar that includes a percent-completed indicator as compared to one without a percent-completed indicator.

3.2 Distractor: Hedonic Progress Bars

A distractor is an external event or cue that attracts the user's attention in a waiting context (Lee et al., 2012). Distractors attempt to disrupt users' focused attention on the wait and the tracking of time to reduce their perception of the wait time. Distractors focus an individual's attention on external events and away from the internal process of time estimation. The attentional gate model supports this distraction effect because, when individuals direct their resources toward a distracting cue, they have fewer resources available for estimating time. Because they focus their resources elsewhere, the attentional gate is closed or less open, and fewer pulses get through the gate to the cognitive counter (Block & Zakay, 1996).

People are intrinsically attracted to beautiful objects and enjoy aesthetic displays. In the HCI field, researchers suggest that it is important to incorporate aesthetics to attract people's attention and provide them with an enjoyable interactive experience (Cai & Xu, 2011; Tractinsky & Lowengart, 2007). Another progress bar feature that has received little research attention is a progress bar with hedonic graphics. One can classify progress bars into hedonic and functional based on whether they use different shapes or symbols. For example, hedonic progress bars might use symbols such as a bear's footprints or a cartoon character to invoke fun and enjoyment, while functional bars use functional symbols such as plain dots or rectangular bars. Research has shown that visually attractive objects that spur individuals' emotions draw more attention than those that offer only functional value (Norman, 2002). Similarly, cues that are emotionally interesting and imagery-provoking are likely to excite the imagination and attract our attention (Nisbett & Ross, 1980). Thus, when individuals focus their attention on a hedonic progress bar (i.e., a plane moving across the screen or images of city nightlife), they have fewer resources available and the attentional gate closes, which reduces or stops the counting of pulses. Therefore, we hypothesize:

> **H2a:** During an online wait, users experience lower focused attention on the wait when viewing a hedonic progress bar than a functional progress bar.

Research has also shown that visually attractive objects in an interface that spur individuals' emotions can provide greater fun, excitement, and enjoyment than those that offer only functional value (Norman, 2002). Recent IS research on affective cues suggests that using such cues in information and communication technologies (ICT) can influence a person's affective reactions during an interaction with ICT (Zhang, 2013). Specifically, Parboteeah, Valacich, and Wells (2009) found that the visual appeal of a website influenced individuals' perceived enjoyment of using the website. Further, the wait time literature suggests that affective cues such as music can improve customers' mood and perceptions of the wait (Cameron et al., 2003; McGrath & Kelly, 1986). In the context of a hedonic progress bar, we expect that the hedonic image will act as an affective cue and will increase the user's enjoyment of the waiting experience as compared to a functional progress bar. Thus, we hypothesize:

> **H2b:** During an online wait, users perceive more enjoyment when viewing a hedonic progress bar than a functional progress bar.

As we describe above, a hedonic progress bar is a type of aesthetic attraction in the environment. Aesthetic components on webpages can influence users' affect and emotion (Kim, Lee, & Choi, 2003). At the same time, aesthetic interfaces can draw users' attention and make them more engaged and immersed in an activity (Jennings, 2000). The attentional gate model (Block et al., 2010; Block & Zakay, 1996) suggests that an attention-grabbing element (i.e., a hedonic progress bar that appeals to one's emotions) will reduce the resources available for estimating time. That is, when one consumes more resources to process distracting cues, one has less resources available for counting pulses, transferring counts to working memory, or comparing working memory to reference memory, which results in a distorted estimate of time. Because a hedonic progress bar may attract more attention than a functional stimulus, users are more likely to lose track of time (PTD) with a hedonic progress bar. Thus, we hypothesize:

> **H2c:** During an online wait, users experience more perceived time distortion when viewing a hedonic progress bar than a functional progress bar.

3.3 Distractor: Progress Bars with Exaggeration (Early Completion)

We further investigate the effect of progress bars that use exaggeration, a unique type of distractor that provides results sooner than expected. In service encounters, businesses often provide an exaggerated wait time to people who are waiting for service (Maister, 1985), and, when they provide service sooner than expected, customers are surprised and pleased. Theme parks, theaters, and clubs use this exaggeration technique, and one can implement it in an online waiting context with a progress bar. With exaggeration, online results would appear early when, for example, the percentage fills to 80 percent rather than 100 percent. By providing exaggerated (overestimated) waiting time information, e-businesses can manipulate customers' online waiting perceptions (Weinberg, 2000).

An exaggerated design with a progress bar would result in a shift from the waiting webpage to the results webpage before the end of the anticipated wait time based on how the progress bar fills up. This unexpected change in webpages acts as a distractor because the user feels surprise at seeing the results page sooner than anticipated and allocates less resources to estimating time. Based on the attentional gate model, the distraction closes the attentional gate and can interfere with the transfer of counted pulses to working memory and the comparison process between working memory and reference memory. When users reflect on the waiting experience with an exaggerated progress bar, they may feel that they have lost track of time and have experienced perceived time distortion (PTD). Therefore, we hypothesize that:

> **H3:** During an online wait, users experience more perceived time distortion when viewing a progress bar that uses exaggeration than one that does not use exaggeration.

3.4 Combination of Distractors

We now consider how the combination of two distractors (i.e., a hedonic, exaggerated progress bar) can further influence PE and PTD. We propose that high-affect hedonic features will increase enjoyment and help distort time during a wait. Exaggeration provides results to users sooner than expected, which disrupts them from tracking time. Both distractors assist in closing the attentional gate and can also interfere with the transfer of counted pulses to working memory and the comparison process between working memory and reference memory. For example, a restaurant would greatly enhance customers' waiting experience when, as they wait for service, they could watch a live piano performance and also have their name called earlier than they were originally informed. We expect the customer to feel greater enjoyment and greater time distortion when one provides them with both a live piano performance and earlier-than-expected service as compared to when one provides them with just one distractor. Similarly, we expect users to feel greater enjoyment and time distortion when viewing a hedonic progress bar that transitions to the search results sooner than expected as compared to a progress bar that provides just one of these wait time-management features. Brown and Boltz (2002) found that two task factors (distractor task and either music or narrative) in combination exerted a greater decrement in timing performance than either one alone. Given the expected positive influence of each of these two distractors on PE and PTD, one can anticipate greater effects when a progress bar design includes both. Therefore, we hypothesize that:

H4a: During an online wait, the positive influence of a hedonic progress bar on PE is greater with exaggeration than without exaggeration

H4b: During an online wait, the positive influence of a hedonic progress bar on PTD is greater with exaggeration than without exaggeration

3.5 Antecedents and Consequences of PWT

Having hypothesized how progress bar design elements (temporal information and distractors) can influence perceptions of waiting experience, we now turn our attention to the mediating role of the waiting experience. In our research model, PU, FA, TD, and PE represent perceptions of the waiting experience that influence PWT, and PWT influences use intention.

The PU of an online wait is likely related to PWT because waiting is a stressful situation, and, if people are uncertain about the duration of a wait, they attend to the estimation of time. When users attend to time, the attentional gate opens and pulses pass through to be counted and compared with prior waits (Block & Zakay, 1986). Maister (1985) propose that uncertain waits are longer than certain waits, and Osuna (1985) states that, by merely informing the individual about the expected delay (reducing uncertainty), one can perceive reduced waiting time. Time-estimation research has largely examined the direct relationship between temporal cues and PWT rather than the relationships between temporal cues and PU and between PU and PWT. We propose that a progress bar can reduce PU and that the reduction in PU decreases PWT. In other words, PU is positively related to PWT. Thus, we hypothesize that:

H5: Users' perception of lower uncertainty while viewing a progress bar in a waiting screen is related to shorter PWT during an online wait.

Focused attention is also related to PWT because attending to time can make a wait seem longer and attending to an external event or cue can make the wait seem shorter. The attentional gate model suggests that duration judgment is a direct function of the attention allocated to the passage of time. When humans focus their attention on external cues, fewer pulses pass through the gate to the cognitive counter. Thus, the pulse count that is transferred to working memory is lower and the time estimate will be lower. Although attentional models provide theoretical support for the relationship between focused attention and PWT, few empirical studies have examined this relationship (e.g., Baker & Cameron, 1996). We conjecture that a progress bar with hedonic features will distract users, which will lower their focused attention on the wait and, thus, reduce PWT. In other words, there is a positive relationship between FA and PWT. Therefore, we hypothesize that:

H6: Users' lower focused attention on the wait while viewing a progress bar in a waiting screen is related to shorter PWT during an online wait.

Perceived enjoyment is another aspect of the waiting experience that can affect PWT. The attentional gate model's basic premise supports the common sentiment that "time flies when you're having fun" (Block et al., 2010; Zakay, 1989) because, when one has fun, one does not think about time's passing, the gate closes, and PWT seems shorter. Further, research has shown that an individual's positive state causes assessments of elapsed time to be shorter (Angrilli, Cherubini, Pavese, & Manfredini, 1997; Droit-Volet, Brunot, & Niedenthal, 2004; Hornik, 1993; Lee et al., 2012). An affective state can serve as a heuristic based on the notion of affect-as-information, and, thus, a positive affective state may automatically result in one's positively evaluating a target object (Clore & Parrott, 1991). Similarly, a heightened state of enjoyment during a wait may prompt an individual to recall similar positive waiting experiences in that individual's referent memory, which may make the wait seem shorter. This heightened state of enjoyment may also create a halo effect such that perceptions of the wait time are more positive and shorter. Given this, we expect that the enjoyment that results from a hedonic progress bar will also result in a shorter PWT. That is, PE is negatively related to PWT. Thus, we hypothesize that:

H7: Users' perception of higher enjoyment while viewing a progress bar in a waiting screen is related to shorter PWT during an online wait.

Last, the PTD during a wait may also influence PWT. According to the attentional gate model (Block et al., 2010; Zakay, 1989), when people are distracted, the gate closes and time's passing does not enter into their consciousness, which makes the PWT seem shorter. Research suggests that, while people are engaged in an interaction, they may be unable to register the passage of time and may perceive that time flies by quickly (Agarwal & Karahanna, 2000; Csikszentmihalyi, 1990; Skadberg & Kimmel, 2004). Little work has empirically examined this relationship (i.e., Lee et al., 2012) and none have done so in the context of progress bars. For example, Kellaris and Mantel (1994) describe how music can distort the listener's internal timing mechanism and, thus, result in reduced PWT, but they did not measure PTD or not test any relationship. We address this gap in the literature and propose that an exaggerated or hedonic progress bar can induce PTD, which should reduce PWT. That is, we propose that a negative relationship between PTD and PWT exists. Thus, we hypothesize that:

H8: Users' experience of higher perceived time distortion while viewing a waiting screen with a progress bar is related to shorter PWT during an online wait.

Finally, researchers in traditional and online waits have examined and found support for a direct relationship between PWT and use intention (Galletta, Henry, Mccoy, & Polak, 2006; Hoxmeier & Dicesare, 2000). Further, Lee et al. (2012) found that longer PWT negatively affected online consumers' attitude toward a website, which resulted in lower intention to use it. Similarly, we expect that, when PWT is shorter, users will have greater intentions to use or revisit the site. Thus, we hypothesize that:

H9: Users' shorter PWT increases their intention to use the website.

Research on online wait time management suggests that providing temporal and distractor cues may have different effects depending on the length of the wait. For example, Hong et al. (2013) found that more multimedia content (i.e., a series of images) in an online waiting webpage decreased PWT in longer waits but increased PWT in shorter waits. Other research has found that temporal and distractor cues are less effective with shorter waits (e.g., Hui & Tse, 1996). Given the moderate level of multimedia content[3] in the cues we examined in our study (i.e., progress bars with hedonic graphics and early arrival of results), we further investigate whether the proposed, positive effects of temporal and distractor cues are supported with both short and long waits and whether these effects differ.

4 Research Methods

We conducted a large-scale, controlled experimental study to examine the effects of progress bar designs on PU, PE, PTD, and FA and to test the nomological network for these variables, including PWT and use intention. We used simulated online travel website and a 2 x 2 x 2 x 2 design with 1) the presence/absence of a percent-completed indicator, 2) hedonic/functional progress bar graphics, 3) early/on-time (exaggeration) completion of the progress bar, and 4) a long (16 seconds) or short (5 seconds) wait. We used two control treatments (one with a short wait and one with a long wait) that used a waiting screen but no progress bar. As a result, we developed eighteen treatments in total that featured eight different progress bar designs with two different wait times, and two control treatments.

Table 1. Experimental Design (2 x 2 x 2 x 2): Number of Participants in Each Treatment

	Hedonic				**Functional**				**Control**
	Percent-completed indicator		No percent-completed indicator		Percent-completed indicator		No percent-completed indicator		No progress bar: waiting screen only
	Early	On time	Early	On time	Early	On time	Early	On time	
Long wait	88	86	88	80	80	75	74	85	81
Short wait	33	30	31	31	35	33	34	31	30

4.1 Experimental Website

As Figures A1 to A4 show, we created an experimental online travel website by mimicking major online travel sites such as Travelocity.com. We designed all experimental treatments to include three webpages: an input screen, a waiting screen, and an output screen. Input and output screens were identical across the

[3] The multimedia content in Hong et al. (2013) was greater than the current study, with a flash series of images providing new content throughout the wait, as compared to a single progress bar.

different treatments. All screens had a blue background color since research has established that blue provides the highest relaxation in physical and online environments (Gorn, Chattopadhyay, Sengupta, & Tripathi, 2004). The only differences among treatments were the progress bar designs included in the waiting screen and the length of the wait. The input screen comprised several input (dropdown) boxes, commercial ads, security seals, and option buttons. We asked subjects to make selections from five input boxes, including departure, destination, leave/return date, and number of travelers. We controlled the content of the drop down boxes to include specific departure (e.g., Kansas City and Seattle) and destination cities (i.e., Las Vegas) that were relevant to the subject pool. The output screen presented multiple flight options, including airline information, departure time/date, total duration, non-stop/stop, and price, in addition to promotion ads, acceptable credit card types, and security seals. We provide more details on the experimental design, procedures, and manipulation checks in the sections below.

4.2 Participants

We recruited participants by distributing invitational fliers and making class announcements to undergraduate business students at two large U.S. universities. We initially conducted a large-scale experiment with a longer wait time given our emphasis on managing online waiting. Subsequently, we conducted a smaller, second study with a shorter wait time to assess whether the proposed effects would apply to shorter waits as we further describe below. We recruited a total of 1386 subjects and randomly assigned them to the sixteen treatments and two control conditions to investigate the effect of different progress bar designs. After some participants did not show up and after we removed incomplete responses, 1025 usable responses (73.9% response rate) remained to analyze. According to a power analysis for between-subject design, 1025 subjects provide sufficient statistical power (0.8) and are also sufficient for running a structural equation model. On average, subjects were 20.8 years' old and 56.4 percent were female. They had purchased products or services from online travel websites last year an average of 1.94 times. We tested the samples from the two academic institutions for differences in demographics, including gender, age, and travel purchases. Except for gender ($F = 5.637$, $p < 0.05$), we found no significant differences between the samples and, therefore, pooled the data[4]. Participation was voluntary, but we incentivized participation by providing both class credit and an opportunity to win a small gift card or cash reward.

4.3 Experimental Procedure

We conducted the experiments in a controlled lab environment. We installed the eighteen different websites onto the lab computers in order to precisely control the wait that the subjects experienced. We randomly assigned the subjects to one of the experimental conditions. We told them that they would be searching for flights on a new travel website and asked them to evaluate the website when they had completed the search task. We asked each subject to fill in the requested information on the input screen, click on the "find flights" button, and then select one option from the search results provided on the output screen. All subjects waited while viewing the waiting screen for either 5 seconds or 16 seconds before the website displayed the results. After selecting their preferred travel option, they completed an online survey. It took less than thirty minutes for each subject to complete the experiment.

4.4 Experimental Treatment

4.4.1 Hedonic/Functional Progress Bars

We created both hedonic and functional progress bars after pre-testing several designs[5]. The hedonic treatment used an airplane symbol that moved across the screen from left-to-right as time passed and reached the other side when the wait had elapsed. Similarly, the functional treatment used a blue rectangular progress bar that filled from left to right as the wait elapsed.

[4] Since there were significantly more female subjects, we tested its effect by including gender as a covariate, but did not find any significant differences.

[5] We conducted a pretest for the hedonic and functional treatments using six different progress bars with varying hedonic levels. College-age subjects, with at least one year of online travel purchasing experience, viewed the treatments and picked the most hedonic and functional progress bars. We selected the progress bars with the highest hedonic and functional scores (airplane and blue rectangle).

4.4.2 Percent-completed Indicator

We developed progress bar designs with and without a percent-completed indicator for both the hedonic and functional progress bars. The website displayed the percentage of time elapsed below the progress bar in the percent-completed treatment (see Appendix A1c-d) but did not provide it in the no percent-completed treatment.

4.4.3 Exaggeration

We developed progress bar treatments with exaggerated time (early completion of a progress bar) in which the search results appeared when the progress bar filled to 80 percent. To determine an appropriate exaggeration percentage for the experimental website, we conducted a pretest with 32 college-age participants. We preselected four exaggeration conditions (60%, 70%, 80%, and 90%) and a no exaggeration condition (100%). Employing a within-subject design, we asked participants to answer the question “the requested results were delivered quicker than what I expected” after completing a flight search task. Each subject viewed the four exaggeration conditions and a no-exaggeration condition randomized based on a five by five Latin square design. The subjects perceived all of the 60, 70, and 80 percent exaggeration conditions to be quicker than expected. We selected the 80 percent condition for this experiment because, with this percept, the results appeared quicker than expected while also providing a realistic treatment (i.e., the results did not appear too soon). In the progress bar treatments with no exaggeration, the search results appeared when the progress bar filled completely. The wait time for the on-time and the early completion treatments was the same and the results appeared after the specified wait was over. We implemented exaggeration with both hedonic/functional treatments and both (with/without) percent-completed indicator treatments.

4.4.4 Length of Wait (LOW)

We used the short (5 seconds) and long (16 seconds) waiting times because people perceive and respond differently to different wait times (Hong et al., 2013). We chose five seconds for the short wait time based on Zakay (1989) and Fraisse (1984), who suggest that time estimation begins with durations greater than four seconds because times of four seconds or less do not have two distinct events (past and present) for which to estimate duration. We chose 16 seconds for the long wait time based on Lee et al. (2012), who sampled the wait times of different airline ticket search scenarios and found that a 16 second wait was relatively long. We conducted a pretest with 60 subjects to assess the perceived length of the wait. We randomly assigned participants to one of the two waiting treatments and asked them about the perceived length of the wait (e.g., I feel that waiting to see the search results was: very short….very long) and about the wait time they perceive as short and long for online airline ticket purchases (e.g., How many seconds of waiting would you consider to be a short wait?). Results showed that the subjects perceived 16 seconds as significantly longer than 5 seconds ($F = 31.576$, $p < 0.001$), and participants specified 3.59 seconds as a short wait and 13.52 seconds as a long wait for online airline ticket purchasing, which verified our short and long wait times (5 and 16 seconds) as appropriate.

4.4.5 Dependent Variables

We developed the scales used to measure all model constructs by following a formal instrument-development procedure (Straub, 1989). An extensive literature review yielded items for perceived uncertainty (Gorn et al., 2004), focused attention (Lee et al., 2012), perceived enjoyment (Koufaris, 2002), perceived time distortion (Skadberg & Kimmel, 2004), perceived waiting time (Gorn et al., 2004), attitude (Fishbein & Ajzen, 1975)[6] and use intention (Palmer, 2002). We then conducted a pre-test was with seven experts that included faculty members, IS doctoral students, and users who have frequented diverse online travel websites. We modified the scales’ wording and format based on the experts’ suggestions in order to improve content validity. Then, we conducted a pilot test (n = 81) to examine the psychometric properties of the instrument. We performed an exploratory factor analysis (EFA), and the final set of items produced factor loadings greater than 0.7 and cross-loadings less than 0.4, which suggests good convergent and discriminant validity. All constructs exhibited Cronbach’s alphas > 0.8, which indicates high reliability. Through this process, we identified four items for PU, four items for FA, four items for PE, three items for

[6] Attitude is the degree to which a person has a (un)favorable feeling about a behavior (or action), and IS studies have found that it significantly influences behavioral intention (BI) (e.g., Fishbein & Ajzen, 1975). We included attitude as a control variable to better examine the effect of PWT on use intention.

PTD, three items for PWT, three items for ATT, and three items for UI. We measured all items on a seven-point Likert-type scales (strongly disagree to strongly agree) (see Table 2).

Table 2. Measurement Items

Construct	Items	Description	Sources
Perceived uncertainty (PU)	PU1	I was uneasy while I was waiting for the requested results.	Gorn et al. (2004)
	PU2	I was anxious while I was waiting for the requested results.	
	PU3	I was uncertain while I was waiting for the requested results.	
	PU4	I was unsettled while I was waiting for the requested results.	
Focused attention (FA)	FA1	I was absorbed intensely in the amount of time I waited while waiting to see the results.	Lee et al. (2012)
	FA2	My attention was focused on the wait while I was waiting to see the results.	
	FA3	I concentrated fully on the wait while waiting to see the results.	
	FA4	I was deeply engrossed in the wait while waiting to see the results.	
Perceived enjoyment (PE)	PE1	Waiting for the requested results in the waiting screen was: pleasant	Koufaris (2002)
	PE2	Enjoyable	
	PE3	Fun	
	PE4	Exciting	
Perceived time distortion (PTD)	PTD1	I lost track of time while waiting to see the results.	Skadberg & Kimmel (2004)
	PTD2	I was unconscious of the passage of time while waiting to see the results.	
	PTD3	While waiting to see the results, I would forget the passage of time.	
Perceived waiting time (PWT)	PWT1	Your online waiting to see the requested results was: fast	Gorn et al. (2004)
	PWT2	Speedy	
	PWT3	Quick	
Attitude (ATT)	ATT1	My overall experience with the website was: contented	Fishbein & Ajzen (1975)
	ATT2	Happy	
	ATT3	Satisfied	
Use intention (UI)	UI1	If I needed this service in the future, I would probably revisit this website.	Palmer (2002)
	UI2	I would recommend this Web site to others who are interested in this service.	
	UI3	If I needed this service in the future, I would probably try this website again.	
Note: *PWT items were reverse coded to help readers better understand the hypothesized relationships.			

5 Results

We first present the results for our manipulation checks and then the results from our MANOVA, ANOVA, structural equation modelling analysis, mediation and common method bias tests. We used SPSS 21.0 and AMOS 20.0 to analyze the data.

5.1 Manipulation Check Results

We conducted manipulation checks on the control, hedonic/functional, percent-completed, and exaggeration progress bar treatments. We successfully manipulated the control treatment (i.e., the presence of a progress bar) as 93.1 percent of the subjects correctly identified this element in their assigned waiting screens. We also found significant differences between the hedonic and functional progress bars based on a three-item, seven-point affect scale (Ajzen, 1985) (e.g., "It was fun to watch the progress bar shown in the waiting screen") ($F = 52.276$, $p < 0.001$) with means of 4.49 (high) and 3.70 (low). Subjects correctly identified the type of progress bar that appeared: 82.1 percent selecting the correct combination of features (e.g. airplane with percentage of time displayed). Further, we found significant differences between short and long waiting time for PU, FA, PE, and PTD (see Table 3). Finally, a single item of wait expectation ("The requested results were delivered quicker than what I expected") showed significant differences between the exaggeration and no-exaggeration groups ($F = 4.124$, $p < 0.001$). Thus, we successfully manipulated the independent variables. We calculated the effect sizes on all treatments using the manipulation check items. Using Cohen's D, we found small and medium effects (ranged from .07 to .38) for all treatments, which affirms the practical significance of our manipulations.

Table 3. Mean Statistics by Waiting Screen Treatments: Total/Combined, Long, and Short Wait

Variables	Hedonic				Functional				Control
	Percent-completed indicator		No percent-completed indicator		Percent-completed indicator		No percent-completed indicator		No progress bar
	Early	On time	Early	On time	Early	On time	Early	On time	
PU-Total	2.310	2.660	2.521	2.635	2.820	2.560	2.655	2.787	3.369
PU-Long	2.355	2.791	2.699	2.903	3.009	2.643	2.834	2.929	3.475
PU-Short	2.189	2.283	2.016	1.944	2.386	2.371	2.265	2.395	3.083
FA-Total	3.229	3.205	2.922	3.072	3.680	3.519	3.447	3.394	3.622
FA-Long	3.412	3.320	3.082	3.197	3.872	3.617	3.581	3.471	3.540
FA-Short	2.742	2.875	2.468	2.750	3.243	3.295	3.154	3.185	3.833
PE-Total	4.256	3.989	4.271	3.768	3.457	3.581	3.609	3.410	3.342
PE-Long	4.403	4.073	4.375	3.762	3.468	3.710	3.638	3.420	3.317
PE-Short	3.864	3.750	3.976	3.782	3.429	3.280	3.544	3.379	3.408
PTD-Total	4.033	3.569	4.252	3.577	3.597	3.522	3.509	3.477	3.348
PTD-Long	3.958	3.496	4.189	3.442	3.442	3.520	3.275	3.431	3.032
PTD-Short	4.232	3.778	4.430	3.925	3.952	3.525	4.020	3.602	4.200
PWT-Total	3.325	3.235	3.345	3.378	3.420	3.327	3.213	3.480	3.920
PWT-Long	3.667	3.353	3.769	3.650	3.704	3.453	3.572	3.753	4.200
PWT-Short	2.414	2.900	2.140	2.677	2.771	3.040	2.431	2.731	3.144
UI-Total	4.884	4.934	4.787	4.889	4.736	4.633	4.959	4.707	3.766
UI-Long	4.708	4.899	4.523	4.763	4.517	4.516	4.766	4.533	3.580
UI-Short	5.354	5.033	5.538	5.215	5.238	4.899	5.382	5.183	4.267

* Total: long and short wait combined, Long: long wait only, Short: short wait only, PU: perceived uncertainty, FA: focused attention, PE: perceived enjoyment, PTD: perceived time distortion, PWT: perceived waiting time, and UI: use intention.

5.2 MANOVA and ANOVA Tests

In testing H1a, we tested PU for the different waiting screens with a progress bar and the two without progress bars (control treatments) using ANOVA. PU was significantly less ($F = 6.044$, $p < 0.001$) when the waiting screen included a progress bar as compared to one that did not. We conducted a post hoc analysis and every waiting screen with a progress bar had a significantly reduced PU compared to one without a progress bar, which supports H1a.

Next, we conducted a MANOVA test to examine H1b-H4 using the four progress bar design elements (2 x 2 x 2 x 2), hedonic, percent-completed indicator, exaggeration, and length of wait on PU, FA, PE, and PTD. We found significant effects (Wilks' λ) for hedonic ($F = 14.202$, $p < 0.001$), exaggeration ($F = 4.216$ $p < 0.01$), and length of wait ($F = 21.428$, $p < 0.001$). We then conducted ANOVA tests (see Table 4), and the percent-completed indicator did not have a significant effect on PU ($F = 0.004$, $p > 0.05$), which does not support H1b. The hedonic progress bar had a significant effect on FA ($F = 36.812$, $p<0.001$), PE ($F = 48.777$, $p < 0.001$), and PTD ($F = 20.769$, $p < 0.001$), which supports H2a-c. Exaggeration had a significant effect on PTD (H3, $F = 14.477$, $p < 0.001$), and the interaction between hedonic and exaggeration had a significant effect on PTD ($F = 4.561$, $p < 0.05$, H4b) but not PE ($F = 2.045$, $p > 0.05$, H4a) (see Figures 3 and 4).

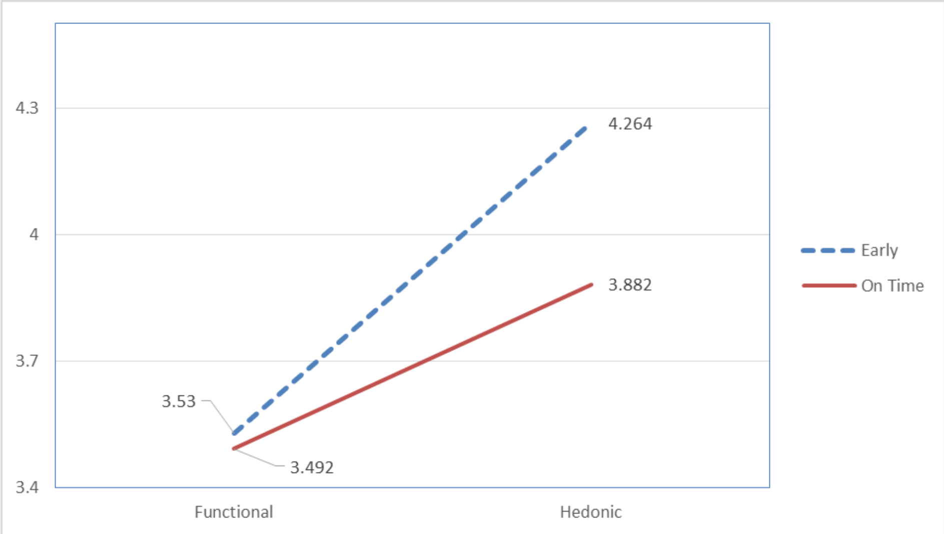

Figure 3. Interaction Effect of Hedonic and Exaggeration Progress Bar Features for PE

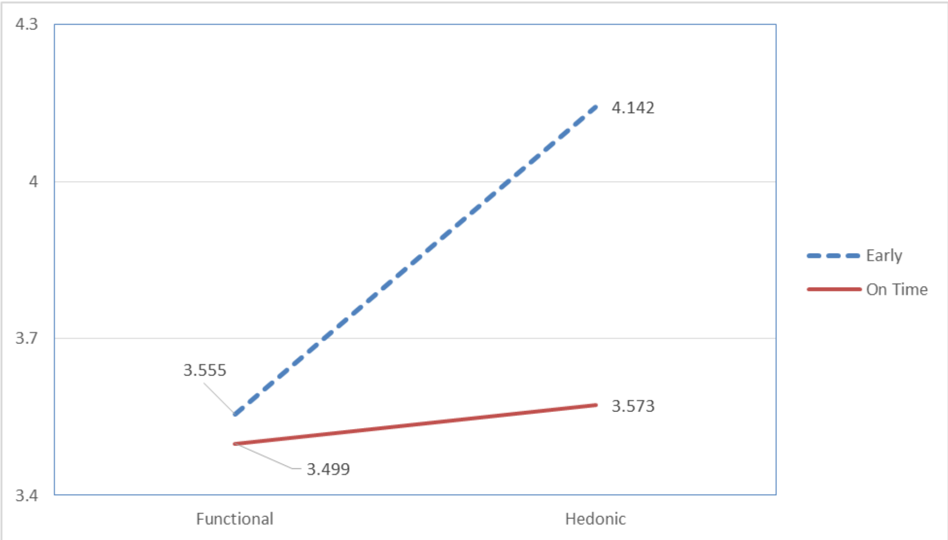

Figure 4. Interaction Effect of Hedonic and Exaggeration Progress Bar Features for PTD

Table 4. Test of Between Subject Effects

	Combined long & short wait				Long wait				Short wait			
DV / IV	PU	FA	PE	PTD	PU	FA	PE	PTD	PU	FA	PE	PTD

Hedonic (HED)	F	5.268	24.000	37.233	13.489	2.592	13.819	42.283	12.973	4.818	16.264	10.279	4.499
	Sig.	0.022	0.000	0.000	0.000	0.108	0.000	0.000	0.000	0.029	0.000	0.002	0.035
Exaggeration (EXA)	F	0.494	0.045	5.203	14.477	0.788	0.697	6.311	6.138	0.094	0.968	1.308	9.148
	Sig.	0.482	0.832	0.023	0.000	0.375	0.404	0.012	0.013	0.760	0.326	0.254	0.003
Percent completed (PERC)	F	0.004	4.161	0.023	0.315	1.865	4.673	1.601	0.040	1.851	1.394	0.437	0.671
	Sig.	0.953	0.042	0.879	0.575	0.173	0.031	0.206	0.841	0.175	0.239	0.509	0.413
Length of wait (LOW)	F	35.895	27.700	7.545	13.768	N/A				N/A			
	Sig.	0.000	0.000	0.006	0.000								
HED * EXA	F	1.285	0.973	2.045	4.561	4.808	0.890	7.067	13.475	0.044	0.427	0.000	0.037
	Sig.	0.257	0.324	0.153	0.033	0.029	0.346	0.008	0.000	0.833	0.514	0.991	0.847
HED * PERC	F	0.010	0.088	0.179	0.750	0.690	0.001	0.349	1.204	0.860	0.158	0.017	0.113
	Sig.	0.922	0.766	0.672	0.387	0.407	0.970	0.555	0.273	0.355	0.691	0.898	0.737
HED * LOW	F	0.192	0.496	0.882	0.043	N/A				N/A			
	Sig.	0.661	0.481	0.348	0.835								
EXA * PERC	F	0.083	0.432	1.557	0.116	0.306	0.730	4.162	0.277	0.002	0.064	0.032	0.005
	Sig.	0.773	0.511	0.212	0.734	0.581	0.393	0.042	0.599	0.962	0.800	0.859	0.945
EXA * LOW	F	0.103	1.333	0.193	1.289	N/A				N/A			
	Sig.	0.748	0.249	0.661	0.257								
PERC * LOW	F	2.673	0.159	1.482	0.604	N/A				N/A			
	Sig.	0.102	0.690	0.224	0.437								
HED * EXA * PERC	F	1.942	0.102	0.030	0.337	2.777	0.023	0.245	0.854	0.482	0.114	0.014	0.010
	Sig.	0.164	0.749	0.861	0.562	0.096	0.880	0.620	0.356	0.488	0.736	0.908	0.919
HED * PERC * LOW	F	1.116	0.065	0.047	0.100	N/A				N/A			
	Sig.	0.291	0.799	0.829	0.752								
HED * EXA * LOW	F	1.949	0.006	2.098	3.312	N/A				N/A			
	Sig.	0.163	0.938	0.148	0.069								
PERD * EXA * LOW	F	0.122	0.094	0.923	0.052	N/A				N/A			
	Sig.	0.727	0.760	0.337	0.820								
HED * EXA* PERC * LOW	F	0.280	0.022	0.131	0.172	N/A				N/A			
	Sig.	0.597	0.881	0.718	0.678								

PU: perceived uncertainty, FA: focused attention, PE: perceived enjoyment, PTD: perceived time distortion, N/A: not applicable when wait time is a treatment.

The hedonic and exaggeration interaction results for H4a-b were examined in more detail in Table 5, Figures 3-4, and in separate analysis of short and long wait times in Table 4.[7] While the interaction was significant for PTD and not for PE in the overall study results, post hoc analysis shows that the interaction was significant for both PTD and PE when considering the long wait time only, and both were insignificant when considering the short wait time only, as shown in Table 4. These findings are consistent with the marginally significant three-way interaction between hedonic, exaggeration, and length of wait ($F = 3.312$, $p = 0.069$) (see Figures 5 and 6). Further, a hedonic progress bar showed significantly greater PE than a functional one for both the exaggeration and no exaggeration treatments, with the effect being greater for exaggeration. For PTD, a hedonic progress bar showed significantly more time distortion than a functional one only when exaggeration was present. The combination of hedonic and exaggeration features (both distractor cues) improved PE and PTD over the use of just one distractor cue alone.

Table 5. Interaction Effect Between Hedonic and Exaggeration on PE and PTD

						95% confidence interval	
	Hedonic	**Functional**	**Mean difference**	**Std. dev**	**Sig.**	**Lower bound**	**Upper bound**
Perceived enjoyment (PE)							
Exaggeration	4.264	3.530	0.734	0.054	0.000	3.791	4.003
No exaggeration	3.882	3.492	0.390	0.053	0.000	3.582	3.792
Perceived time distortion (PTD)							
Exaggeration	4.142	3.555	0.587	0.054	0.000	3.734	3.962
No exaggeration	3.573	3.499	0.074	0.059	0.529	3.422	3.651

Other interesting but unhypothesized effects include the significant effect of length of wait on PU ($F = 35.895$, $p < 0.001$), FA ($F = 27.700$, $p < 0.001$), PE ($F = 7.545$, $p < 0.01$), and PTD ($F = 13.768$, $p < 0.001$). In addition, the hedonic progress bar had a significant effect on PU ($F = 5.268$, $p < 0.05$), and the percent-completed indicator had a significant effect on FA ($F = 4.161$, $p < 0.05$). We address these results in Section 6.

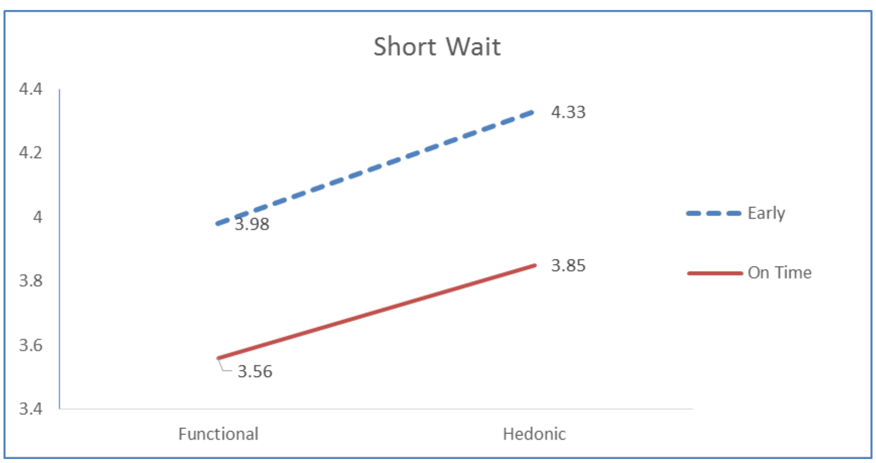

Figure 5. Interaction Effect between Hedonic and Exaggeration for Short Wait

[7] Given that the significant interactions were all ordinal (i.e., simple main effects which are in the same direction), we can still interpret the main effects and, thus, we should discuss them (Rosnow & Rosenthal 1991; Jaccard, 1998).

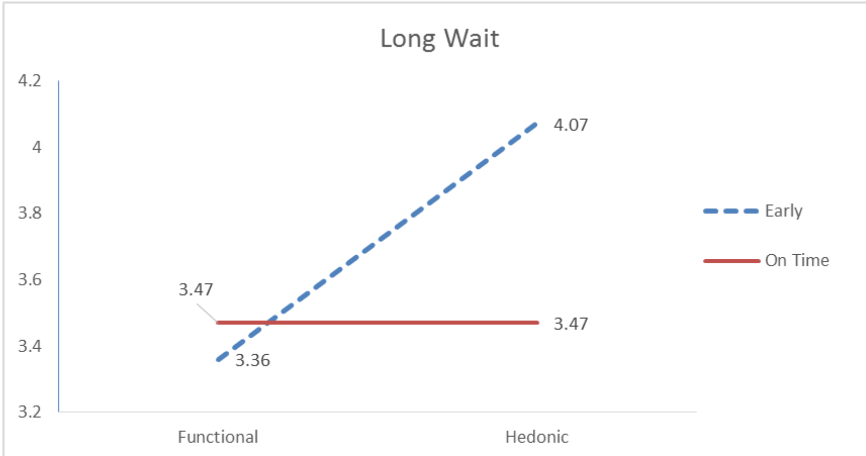

Figure 6. Interaction Effect between Hedonic and Exaggeration for Long Wait

5.3 Structural Equation Modeling Analysis

5.3.1 Measurement Model Analysis

We conducted a confirmatory factor analysis to assess construct validity. It included 1) examining measurement model fit and 2) assessing unidimensionality, convergent and discriminant validity, and reliability. Following established guidelines (Hair, Black, Babin, Anderson, & Tatham, 2006), we found that X^2/df was < 3.0 (2.177), RMSEA was < .08 (0.036), and NFI (0.971), GFI (0.956) and CFI (0.984) were all greater than the cut-off value of 0.90, which suggests that the measurement model adequately fitted the data. We evaluated convergent validity using three criteria (Fornell & Larcker, 1981): 1) all indicator factor loadings (λ) were greater than 0.7 and significant at $p < 0.05$, 2) reliabilities were greater than 0.7, and 3) average variance extracted (AVE) for each construct were greater than 0.5 (see Table 6). Composite reliabilities ranged from 0.867 and 0.950, and the Cronbach's α value for all constructs were > 0.865, which indicates high reliability. Last, AVE values were well above the cut-off value of 0.50 and so met all conditions for convergent validity. We assessed discriminant validity by constraining the estimated correlation parameters (Φ_{ij}) between constructs to 1.0 and performing a chi-square difference test on the values obtained for the constrained and unconstrained models. The chi-square differences were significant at $p < 0.05$, which demonstrates discriminant validity. In addition, we examined inter-construct correlations and all were < 0.7 and were less than the square root of the AVE for each construct, which demonstrates appropriate discriminant validity (see Table 7).

5.3.2 Mediation Tests

We conducted mediation tests following the Preacher and Hayes' (2008) mediation test procedure because this method has strong statistical power and does not assume normality. The results showed that PU (β = -0.133, t = -4.136, p < 0.001), FA (β = -0.093, t = -2.897, p < 0.01), PE (β = 0.257, t = 7.540, p < 0.001), and PTD (β = 0.156, t = 4.927, p < 0.001) were significantly associated with UI. Further, PU (β = 0.198, t = 5.685, p < 0.001), FA (β = 0.180, t = 5.171, p < 0.001), PE (β = -0.268, t = -7.232, p < 0.001), and PTD (β = -0.187, t = -5.451, p < 0.001) were significantly associated with PWT. Last, the results indicate that the proposed mediator, PWT, was positively associated with UI (β=-0.404, t = -14.717, p < 0.001). Because both the a-path and b-path were significant, we tested mediation using the bootstrapping method with bias-corrected confidence estimates (Preacher & Hayes, 2008), a 95% confidence interval for the indirect effects, and 5000 bootstrap samples (Preacher & Hayes, 2008). Results support the mediating role of PWT in the relationships between PU (CI = -0.116 to -0.049), FA (CI = -0.106 to -0.043), PE (CI = 0.072 to 0.155), PTD (CI = 0.045 to 0.108) and UI. In addition, the results show that the direct effect of PU (β = -0.053, t = -1.793, p = 0.073 > 0.05) and FA (β = -0.021, t = -0.688, p = 0.492 > 0.05) was not significant on UI when controlling for PWT, while those of PE (β = 0.149, t = 4.723, p < 0.001) and PTD (β = 0.080, t = 2.775, p < 0.01) on UI remained significant, which suggests partial mediation for these constructs.

Table 6. Results of Measurement Model Analysis

Construct	Items	Loadings	Cronbach's α	CR	AVE
Perceived uncertainty	PU1	0.933	0.911	0.915	0.729
	PU2	0.828			
	PU3	0.782			
	PU4	0.866			
Perceived time distortion	PTD1	0.784	0.865	0.867	0.685
	PTD2	0.826			
	PTD3	0.870			
Perceived enjoyment	PE1	0.898	0.924	0.924	0.753
	PE2	0.850			
	PE3	0.808			
	PE4	0.912			
Focused attention	FA1	0.839	0.913	0.914	0.726
	FA2	0.843			
	FA3	0.868			
	FA4	0.858			
Perceived waiting time	PWT1	0.913	0.948	0.950	0.864
	PWT2	0.976			
	PWT3	0.898			
Attitude	ATT1	0.906	0.905	0.908	0.767
	ATT2	0.920			
	ATT3	0.797			
Use intention	UI1	0.898	0.914	0.917	0.786
	UI2	0.926			
	UI3	0.834			

Table 7. Inter-Construct Correlation Matrix

	PU	PTD	PE	FA	PWT	ATT
PU	0.854					
PTD	-0.085	0.827				
PE	-0.151	0.260	0.868			
FA	0.266	-0.160	-0.176	0.852		
PWT	0.266	-0.267	-0.323	0.274	0.930	
ATT	-0.161	0.206	0.426	-0.222	-0.405	0.876
UI	-0.206	0.245	0.318	-0.195	-0.538	0.549

*Values in diagonal represents square root of AVE

5.3.3 Structural Model Analysis

Figure 7 shows the result of the structural model analysis, including the R^2 and path loadings for all hypothesized relationships. The model was successful in explaining a large amount of variance in PWT and UI. As with the measurement model, the structural equation model exhibited good fit with $X^2/df = 2.400$, NFI = 0.968, GFI = 0.951, CFI = 0.981, and RMSEA = 0.039. The structural model provided support for the relationships between the four waiting experience variables and PWT with PU (H5: $\lambda = 0.171$, $p < 0.001$), FA (H6: $\lambda = 0.169$, $p < 0.001$), PE (H7: $\lambda = -0.230$, $p < 0.001$), and PTD (H8: $\lambda = - 0.181$, $p < 0.001$) all significantly influencing PWT ($R^2 = 0.226$). In addition, PWT (H9: $\lambda = -0.395$, $p < 0.001$) and attitude (control variable: $\lambda = 0.463$, $p < 0.001$) all significantly affected UI, explaining its substantial variance ($R^2 = 0.449$).

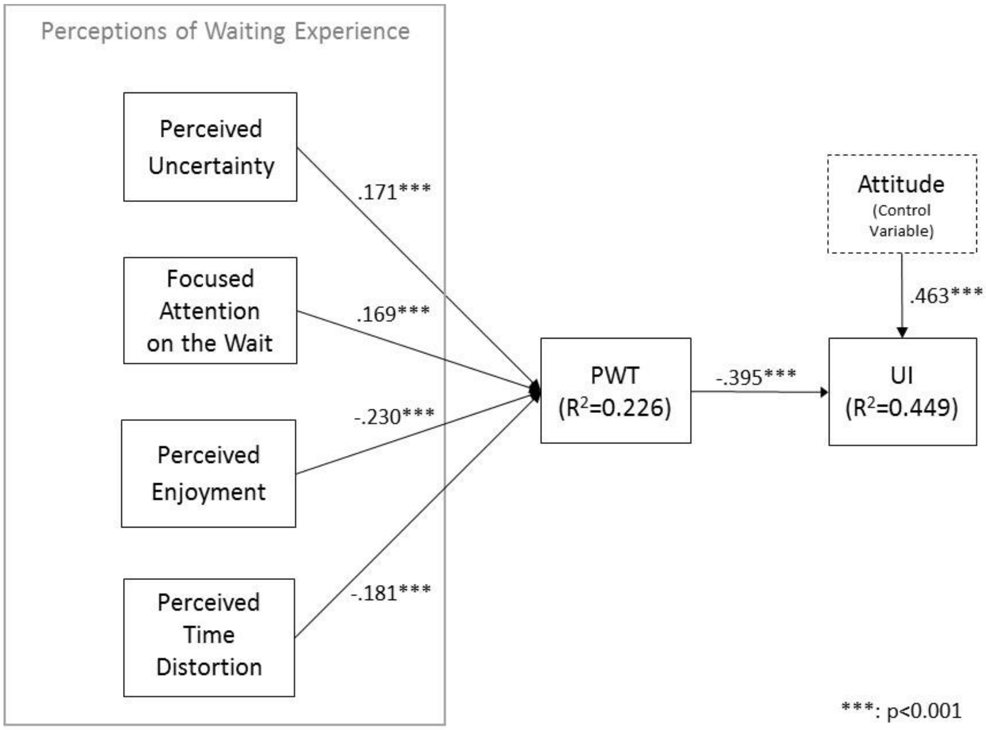

Figure 7. Structural Equation Model

5.3.4 Common Method Bias (CMB) Test

We conducted the marker variable (MV) test (e.g., Malhotra, Sung, & Patil, 2006) to assess common method bias. In running the MV test, we found that none of the original correlations were significantly different from their CMV-adjusted counterparts, which implies that CMB had a minimal effect on the results (Appendix B).

6 Discussion

Our proposed model explained substantial variance in PWT (23%) and use intention (45%), which indicates that progress bars as temporal information and distractors are important cues for manipulating online users' waiting experience. Table 8 summarizes our results from testing the hypotheses.

First, we found that the presence of even a plain progress bar on a waiting screen (temporal information) can significantly reduce users' PU, which supports the value of providing a progress bar when online users may have to wait (H1a). Further, users who viewed any of the eight progress bar designs used in the study had lower PU than viewing a waiting screen without one. Note that we found that temporal information had a significant effect on PU (i.e., a reduction in PU) as compared to other wait time studies, which have found inconsistent results for temporal information's direct effect on PWT. However, the progress bar with a percent-completed indicator (as compared to no indicator) did not significantly decrease PU (H1b). This unexpected finding contradicts the conventional HCI guideline that disclosing more information about the wait is better. One interpretation of these findings is that adding a percent-completed indicator did not provide any further reduction in PU beyond that contributed by the basic progress bar. Instead, the additional temporal information increased attention to the wait. As Hong et al. (2013) discuss, temporal information may inadvertently direct attention to the wait (e.g., a countdown clock) and make it more salient (Diclemente & Hantula, 2003). Another explanation for this finding is that users are experienced with purchasing airline tickets online, so the task is not a highly uncertain one, which limits the upper boundary for the value of PU.

Table 8. Summary of Hypothesis Testing Results

Hypothesis	Result
H1a: During an online wait, users perceive less uncertainty when viewing a waiting screen with a progress bar as compared to one without a progress bar.	Supported
H1b: During an online wait, users perceive less uncertainty when viewing a progress bar that includes a percent-completed indicator as compared to one without a percent-completed indicator.	Not supported
H2a: During an online wait, users experience lower focused attention on the wait when viewing a hedonic progress bar than a functional progress bar.	Supported
H2b: During an online wait, users perceive more enjoyment when viewing a hedonic progress bar than a functional progress bar.	Supported
H2c: During an online wait, users experience more perceived time distortion when viewing a hedonic progress bar than a functional progress bar.	Supported
H3: During an online wait, users experience more perceived time distortion when viewing a progress bar with exaggeration than one without exaggeration.	Supported
H4a: During an online wait, the positive influence of a hedonic progress bar on PE will be greater with exaggeration than without exaggeration.	Supported for long waits
H4b: During an online wait, the positive influence of a hedonic progress bar on PTD is greater with exaggeration than without exaggeration.	Supported for long waits
H5: Users' perception of lower uncertainty while viewing a progress bar in a waiting screen is related to shorter PWT during an online wait.	Supported
H6: Users' lower focused attention on the wait while viewing a progress bar in a waiting screen is related to shorter PWT during an online wait.	Supported
H7: Users' perception of higher enjoyment while viewing a progress bar in a waiting screen is related to shorter PWT during an online wait.	Supported
H8: Users' experience of higher time distortion while viewing a waiting screen with a progress bar is related to shorter PWT during an online wait.	Supported
H9: Users' shorter PWT increases their intention to use the website.	Supported

Second, hedonic progress bars (a distractor cue), significantly decreased FA (H2a), increased PE (H2b), and increased PTD (H2c). That is, hedonic progress bars attracted more attention, aroused more fun and excitement, and distorted the time-estimation process. Further, an exaggerated progress bar (a distractor cue) significantly increased PTD (H3). This study is the first to consider how exaggeration (early completion of a search) can disrupt online users from estimating time and distort time. Our findings suggest that websites distort users' estimation of waiting and make them lose track of time when they present search results to them before the progress bar reaches completion. Further, they suggest that exaggeration's positive effect applies in both short and long wait conditions.

Third, our results indicate an interaction effect with the two distractor cues, a hedonic progress bar and exaggeration, in that the hedonic-exaggeration interaction further enhanced PE (H4a) and PTD (H4b) with longer waits. That is, when users viewed a progress bar with an animated airplane symbol and the results appeared earlier than expected, the combination of distractor cues further increased PE and PTD in the long wait condition. Interestingly, these interaction results are not supported if we only consider the short wait condition. A possible explanation is that users might not have enough time to absorb and benefit from multiple distractors. However, with temporal cues, our results suggest no interaction effect. We found that users perceive less uncertainty when viewing a progress bar (H1a) but do not perceive a greater reduction in uncertainty when viewing a progress bar that includes a percent-completed indicator (H1b). Further, the inclusion of a percent-completed indicator increased focused attention to the wait. Therefore, it seems that showing the combination of two temporal cues (i.e., progress bar and completion indicator) does not further reduce users' perceived uncertainty when waiting and may have negative results. Although we need to validate these results further, these interaction findings suggest that website designers should consider including multiple distractor cues together on a waiting screen, especially in a long wait situation, but not multiple temporal cues.

Fourth, results from the structural equation modeling analysis validated the hypothesized nomological network between perceptions of the waiting experience (i.e., PU, FA, PE, and PTD), PWT, and website UI. Our results suggest that different types of cues affect time estimation and waiting perceptions differently. Temporal information reduces negative perceptions about the wait (PU). When PU falls, PWT does, too. On the other hand, distractors can increase positive perceptions about the waiting experience by increasing PE or PTD and by decreasing FA. These results show that cues can positively influence (i.e., reduce) PWT through different nomological paths and that the four waiting experience variables play a critical role in time estimation. Last, we found that a shorter PWT triggered more use intention. These results show that, even with a positive attitude toward a travel website (a control variable), PWT significantly affects online consumers' intention to use the website, which indicates PWT's crucial role in website use intention.

Last, we found that the model largely held for both short and long wait times. Exceptions include the significance of the two-way interactions between hedonic cues and exaggeration on PE and PTD, which held with the long wait time but was insignificant with the short wait time. The results for the two-way interactions in the short wait were generally in the same direction as the long wait but just failed to reach significance, which suggests that the full time-estimation process and related effects may not have occurred in the shorter wait. Other differences between short and long wait times included the unexpected influence of the percent-completed indicator on FA. This temporal cue increased the attention directed toward the wait in the long wait condition likely because there was more time to observe this temporal cue and direct more attention toward it.

7 Implications and Conclusions

Previous studies of wait time management have produced inconsistent findings about how environmental cues influence PWT. For example, some studies have found that temporal information reduces waiting-related perceptions and behavior (Antonides, Verhoef, & Van Alas, 2002; Fornell & Larcker, 1981; Litman, 2011) but that others produce no effects or negative effects (e.g., Hornik, 1984; Whiting & Donthu, 2006). Similarly, research has reported inconsistent results with distractor cues: some studies report positive effects (e.g., Cameron, Baker, Peterson, & Braunsberger, 2003; Katz et al., 1991) and others report no effect or negative effects (e.g., Antonides et al., 2002; Pruyn & Smidts, 1998). In this paper, we conjecture that several possible reasons exist for these inconsistent findings with both types of cues and we address these inconsistencies by proposing a comprehensive model of online waiting.

First, prior studies have examined a variety of different outcome variables and measures separately, including PWT, satisfaction with waiting, perceptions of the waiting experience, estimates of the actual time elapsed, and satisfaction with the service, which could obviously influence study findings and comparison of results across studies. Second, prior studies have examined a variety of different cues without considering how cues could influence the waiting experience and behavior through different mechanisms. A recent commentary on mediation has noted how the absence of a relevant mediator, or multiple mediators (as proposed in this study), can result in insignificant direct effects or positive/negative direct effects between independent and dependent variables (Zhao et al., 2010).Third, previous studies have not investigated the synergistic effect of employing temporal information and distractors simultaneously in an interface to manage wait time perceptions. In this study, we specifically model the PWT as the dependent variable and constructs of perceptions of the waiting experience as mediating variables to investigate individual as well as synergistic effects of wait management mechanisms (cues) on PWT through different paths (mediators). By doing so, we attempt to build a more comprehensive picture of the type and combination of design cues that one can use to manage online waiting experiences and reduce the perceived wait time. Obviously, there are many types of temporal and distractor cues and waiting scenarios that need to be examined; however, we believe that our theoretically grounded model provides a robust foundation for future research in this area.

7.1 Theoretical Implications

This study contributes to the literature in several ways. First, our research model, based on the attentional gate model, integrates key constructs from this theory (temporal information, distractors/external events, and PWT) into a testable, comprehensive model. Specifically, this research shows how perceptions of the waiting experience, as measured by the mediating waiting experience variables (i.e., PU, FA, PE, PTD), can align with the function of the attentional gate and counting of pulses based on time perception research and empirical work. Further, we use the attentional gate model and time perception research to explain the paths through which two types of cues, temporal information and distractors, subsequently influence PWT.

Second, this research extends two important online wait time studies (Hong et al., 2013; Lee et al., 2012). The proposed research model extends Lee et al. (2012) by incorporating PU, short/long wait times, and two types of cues (temporal information and distractors) that influence time estimation and waiting perceptions through different paths. The research model also extends Hong et al. (2013) by measuring FA on the wait along with the other three perceptions of the wait experience (PU, PE, PTD) and by incorporating these important constructs as mediating variables in the nomological network. The results suggest that all four waiting experience variables explain significant variance in PWT, and they largely support the proposed research model with both shorter and longer waits.

Third, by systematically investigating the effect of progress bar designs as temporal information and distractors in a theoretically grounded framework, we expand our knowledge about how different environmental cues designed for an online context can influence users' waiting perceptions and behavior. Previous studies have investigated a variety of environmental cues but have not differentiated between temporal information and distractor types of cues or considered the different effects that these types of cues may have on the waiting experience and PWT. Further, past studies have not examined the potential synergistic effects of temporal information and distractors. In contrast, we investigated these effects simultaneously. Our results suggest that presenting some temporal information in the interface during a wait can effectively reduce PU. Even a non-numerical progress bar (graphical temporal information) is sufficient for reducing PU. At the same time, the addition (interaction) of distractor cues, such as hedonic and exaggeration features, can redirect individuals' attention away from the wait and enhance PE and PTD with the wait. Although these two types of cues (i.e., temporal information and distractors) can manage PWT individually, they complement each other and can further reduce PWT when combined.

Fourth, based on time perception research, we propose and empirically test how these different types of cues can affect PWT through different nomological paths (i.e., through different mediating variables). That is, we hypothesize that temporal information influences PWT through PU while distractors influence PWT through FA, PE and PTD, and our empirical results support this differentiation. We also note that, although distractor cues can potentially affect users' PWT, not all cues will reduce PWT, which the inconsistent results from previous studies in which potential distractor cues may or may not have affected PWT reflect. We conjecture that only distractors that can significantly distract attention and induce PE or PTD have a positive effect on PWT. For example, the results from Whiting and Donthu (2006, Study 2) show that the presence of music (a potential distractor) only influenced PWT when the valence of the music was positive. That is, the presence of music was a potential distractor cue that influenced PWT only when the user enjoyed the music.

Fifth, this study also advances the design of progress bars by examining the differential effects of existing and more novel features on online wait perceptions. As we mention above, prior studies mainly focused on functional aspects (e.g., temporal information) of progress bar designs without considering non-functional aspects (e.g., distractors such as exaggeration and hedonic features). This study provides a firm theoretical foundation and supporting empirical evidence for exploring progress bar designs (both temporal and distractors) in the future and for possible improvements in online wait management. By showing the significant influence of a hedonic progress bar, this study provides useful insights to HCI researchers. Despite the increased interest in hedonic interface design in the HCI field, interface design guidelines are still heavily rooted in functional features (e.g., simplicity, consistency), especially with progress bars. Our empirical results open the door for HCI researchers to explore the relatively uncharted territory of hedonic progress bar design and the potential benefits of the resulting emotional responses. Our findings suggest that the synergistic effect of other distractor cues (e.g., exaggeration) may further improve the benefits of these emotional responses. Exaggeration (early arrival of search results) has received limited examination in wait time research, and we operationalized exaggeration as an experimental treatment and a type of distractor cue that has a positive influence on PTD. Although we use progress bars as the design artifact for this study, the proposed model and findings apply to other types of interface designs for managing waiting perceptions.

7.2 Practical Implications

Our findings also suggest important implications for e-business practitioners and website designers in not only using but also designing effective temporal information and distracting cues that will successfully manage online waits. First, this study provides important evidence that including a variety of progress bar features in online waiting screens can favorably impact users' wait perceptions. These results should give e-businesses confidence in investing their limited resources in progress bar designs (e.g., with hedonic and exaggeration components) that are both technically and economically feasible for managing PWT and users' online behavior.

Second, our findings provide useful insight into how different progress bar features (both common and more novel) influence individuals' wait perceptions. Our study results suggest that one temporal element, a basic progress bar, may sufficiently reduce users' perceived uncertainty with an online wait. Additional temporal cues may not be necessary depending on the context of the online interaction and the wait time and could direct more attention to the wait. For example, some wait situations need less interaction such as online virus scan services (e.g., McAfee Security Scan Plus and Norton Security Scan) and software updates (e.g., Adobe and RealPlayer) because users expect to wait in these contexts. Providing additional temporal information beyond a basic progress bar without any corresponding reduction in perceived uncertainty may actually direct users' attention toward time's passing and, thus, result in more negative waiting perceptions. We need more research to enhance our understanding of the precision and quantity of temporal cues that waits of different lengths and contexts need.

Finally, providing distractor cues during an online wait can increase the perceived enjoyment of online users, and induce time distortion. Therefore, we recommend a progress bar design with hedonic features or unexpected early completion, even with long waits, because users benefit from the improved waiting experience. Existing wait screens do not commonly use these features, and they warrant additional consideration. We also found a synergistic effect (interaction) between hedonic and exaggerated progress bars for greater PTD and PE with longer waits, which indicates that Web designers should consider using both types of cues (hedonic and exaggerated) with progress bars in a waiting screen. Our finding of an interaction effect with distractors also leads to the possibility of exploring and including other appropriate distractors (in addition to these progress bar features), such as images and animations on a waiting screen to further enhance positive waiting perceptions. Further, one can generalize our findings on effective progress bar designs to manage and enhance users' wait experience in other online contexts such as trading online (e.g., eTrade and Scottrade), downloading media (e.g., iTunes and Amazon), and uploading files (e.g., Facebook and Google Drive).

7.3 Limitations and Future Research

As with all research, this study has some limitations. Although student subjects successfully represent the target users of online travel booking, one could collect additional data with actual customers of real-world travel reservation sites to further improve the validity and generalizability of our findings. We used only progress bars as design artifacts in this study, and future research should explore other forms of temporal information and distractors in an online wait environment. While we examined four features of progress bars, one should also consider other progress bar designs. Future research should also consider alternative operationalizations of the dependent variable we used in this study (i.e., the perceived wait time), such as actual waiting time and the difference between expected and actual waiting time.

We discovered several exciting avenues for future research. First, our results suggest that websites need only limited temporal information to reduce perceived uncertainty and that too much temporal information can actually focus an individual's attention on time's passing. We need work that formally manipulates and examines these effects. Further, future research should examine these effects in highly uncertain situations, such as luxury goods purchases, first time purchases from an unknown site, or funds transfer. Second, there are potential relationships between PU, FA, PE, and PTD—the mediating variables that represent users' perceptions of the waiting experience. Examining these relationships fell outside our scope given the complexity of the relationships between the four constructs, including causality which could be supported in both directions. We treated these four perceptions of the waiting experience (PU, FA, PE and PTD) as exogenous variables in the structural equation model and, thus, allowed them to correlate by default. Future research should examine any causal relationships between these constructs, in different contexts, and whether further mediation exists among the waiting perceptions. Third, we studied design cues on a waiting screen and their effects on waiting perceptions after viewing a controlled results webpage. Future studies should also investigate how using different design cues on the results screen (webpage) can further influence waiting perceptions. Fourth, other factors not considered in this study can affect potential outcomes from progress bar designs. For example, individual differences such as personality, gender, age, and cultural background can induce different responses to more advanced interface design approaches such as anthropomorphic responses (Nass, Moon, Fogg, Reeves, & Dryer, 1995; Johnson, Marakas, & Palmer, 2006). Future research on progress bar designs, including animations and anthropomorphism, should consider how individual responses to technology may differ, and not everyone may appreciate animated, interactive technology (e.g., Shneiderman, 1998). Finally, the overall research domain of online waiting is rich with future research opportunities in the areas of expected wait time, the pattern of waiting (a long initial wait or loading time, followed by shorter waits), and the context of the wait environment (e.g., routine, emergency response). The interface design for these different waiting scenarios with both temporal and distractor cues has great practical relevance for many organizations. This research provides a theoretically grounded model that supports future exploration.

In summary, we examined the effect of progress bars on the waiting experience and the theory-based nomological network associated with PWT. We discuss the critical impact of an online wait and the lack of consistent study results in online wait management. As an initial effort, we manipulated cues as temporal and distractor features of progress bars (i.e., hedonic, percent completed, and exaggeration of a progress bar) and tested the differential contributions of these cues to four perceptions of the online waiting experience and to PWT. The empirical results provide strong support for the proposed theoretical model and highlight the importance of managing online waiting perceptions and creating an overall positive experience through effective progress bar designs.

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Appendix A: Experimental Interfaces

Figure A1. Input Screen

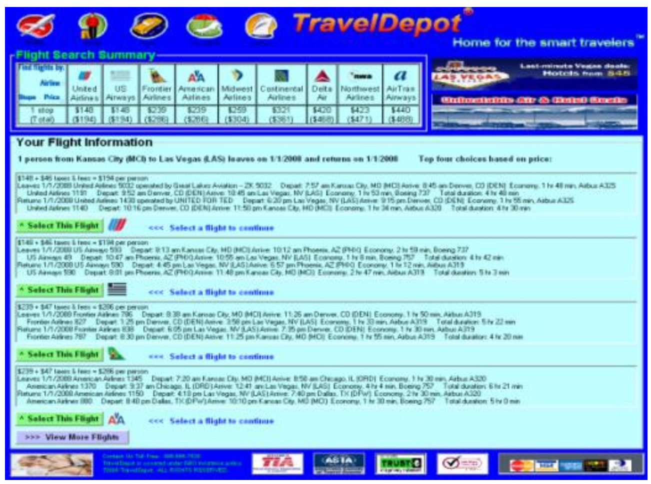

Figure A2. Output Screen

Figure A3. Hedonic Wait Screen with Percent-completed Indicator

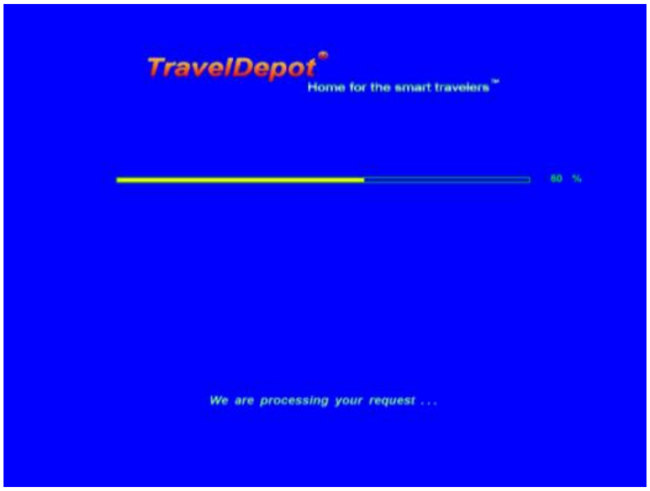

Figure A4. Functional Wait Screen with Percent-completed Indicator

Appendix B: Common Method Bias Assessment

We conducted a marker variable (MV) analysis (Malhotra et al., 2006) to assess common method bias. We used the fashion consciousness construct (i.e., the importance one attaches to being fashionably dressed) as a marker variable because it is believed to be unrelated to the other constructs in our research model. We used a three-item scale to measure fashion consciousness and exhibited high reliability (Cronbach's α= 0.842). In conducting the MV analysis, we first conducted a correlation analysis to find the second-smallest correlation between the study variables and marker variable, which was 0.052. Then, by putting it into the formula provided by Malhotra et al. (2006, p. 1868), we created adjusted correlation estimates and t-statistics. None of the original correlations were significantly different from CMV-adjusted counterparts, which suggests that common method bias was not substantial (see Table B1).

Table B1. Results of Common Method Bias Marker Variable Analysis

Unadjusted correlation estimates								
	PU	TD	PE	FA	PWT	ATT	INT	CMB
PU								
TD	-0.085							
PE	-0.151	0.260						
FA	0.266	-0.160	-0.176					
PWT	0.266	-0.267	-0.323	0.274				
ATT	-0.161	0.206	0.426	-0.222	-0.405			
INT	-0.206	0.245	0.318	-0.195	-0.538	0.549		
CMB	0.120	0.035	0.101	0.052	-0.067	0.098	0.132	
Marker variable: adjusted correlation estimates								
	PU	TD	PE	FA	PWT	ATT	INT	CMB
PU								
TD	-0.145							
PE	-0.215	0.219						
FA	0.225	-0.224	-0.241					
PWT	0.225	-0.337	-0.396	0.234				
ATT	-0.225	0.162	0.394	-0.290	-0.483			
INT	-0.273	0.203	0.280	-0.261	-0.623	0.524		
CMB	0.119	0.043	0.129	0.058	-0.067	0.098	0.132	
Marker variable: t-statistics								
	PU	TD	PE	FA	PWT	ATT	INT	CMB
PU								
TD	-3.755							
PE	-5.630	5.750						
FA	5.925	-5.892	-6.362					
PWT	5.925	-9.171	-11.052	6.160				
ATT	-5.921	4.206	10.987	-7.750	-14.118			
INT	-7.261	5.316	7.478	-6.929	-20.405	15.759		
CMB	3.070	1.102	3.332	1.488	-1.720	2.522	3.411	

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