Information Technology Progress Indicators: Temporal Expectancy, User Preference, and the Perception of Process Duration

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ABSTRACT

Users of information technology (IT) often encounter “progress indicators” during their interactions. These graphics appear on screen as a user waits for a task to complete and are designed to inform the user of the progress made as the task moves toward completion. This study employs theoretical models from research on human experiences in waiting to develop hypotheses related to the design of one type of progress indicator: the “stalling progress bar.” That is, a progress bar that moves consistently during most of the computing process but then stalls for an indeterminate period before completing. Data from one experiment indicates that participants preferred a progress bar that moves consistently to a stalling progress bar, and judged the process duration to be shorter with the linear progress bar. Data from a second experiment indicates that displaying an explanatory message with a stalling progress bar enhances participant’s perception about the stalling bar.

KEYWORDS
Information Technology, Progress Bars, Progress Indicators, Temporal Expectancy, Waiting

INTRODUCTION

Users of information technology (IT) often encounter “progress indicators” during their interactions. Progress indicators are graphics that appear on the computer screen as a user waits for a task, such as down loading a file, saving a file, or updating software, to complete. Their purpose is to inform the user of the progress that is made as the task is in process and moves toward completion. Although progress indicators can take different forms such as a spinning disk, an extremely common progress indicator takes the form of a bar that moves across the screen as the task completes. As such, these indicators are referred to as “progress bars” (Amer & Johnson, 2014; Conrad, Couper, Tourangeau, & Peytchev, 2010; Cooper & Reiman, 2003; Galitz, 2007; Shniederman, Plaisant, Cohen, & Jacobs, 2009). As a common feature in IT environments it is important to understand the form, content, and movement patterns of progress bars that are appropriate to maximize the quality of the user experience.

This study draws upon theoretical models from psychological research on human experiences in waiting to develop specific hypotheses related to the design of progress bars. The idea is that progress bars appear on screen during a period of waiting as an underlying computing task completes. Accordingly, psychological models of waiting which have been applied to human waiting scenarios in physical lines and in telephone queues should relate in this context. For example, Amer and Johnson (2014) applied theoretical models of waiting to the design of progress bars that move in a consistent
fashion across the computing screen during the duration of the computing process. Specifically, they applied a “sense of progress framework” of waiting and a “subjective sense of time framework” of waiting to investigate the alternative design attributes of consistently moving progress bars. This study extends this prior work through the application of additional psychological theories. Most notably, the “temporal expectancy framework” of waiting. The progress bar of interest in this study is the so-called “stalling progress bar.” That is, a progress bar that moves consistently for most of the computing process but then stalls for an indeterminate period before resuming and completing. Such a progress bar occurs rather frequently during IT interactions.

Two experiments were carried out to examine the stalling progress bar. The results of the first experiment indicate that participants preferred a linear progress bar (a progress bar that moves consistently) over a stalling progress bar and judged process duration to be shorter with the linear progress bar. The second experiment investigated an approach to mitigate the relatively negative perceptions of the stalling progress bar by displaying an explanatory message to participants when the progress bar stalled. Data from the second experiment revealed that including the explanatory message improved participant’s perceptions about the stalling progress bar. These results have implications for both researchers and systems designers. This paper not only illustrates to researchers the effectiveness of applying psychological models for hypothesis testing and experimental design, but also extends the understanding of the impact of alternative types of progress indicators on users. Systems designers can use these results to guide their development of more effective user interfaces.

The rest of this manuscript is organized as follows: The next section provides background information about prior research on progress indicators, including progress bars, and explains the temporal expectancy framework of waiting. The section ends with a statement of testable hypotheses. The two sections that follow describe the research methodology and experimental design employed to examine the hypotheses and the results of statistical analysis. The fifth section describes a second experiment carried out, and a final section provides a summary and conclusions.

BACKGROUND AND HYPOTHESIS DEVELOPMENT

Research efforts that examine the design parameters of progress indicators has largely been experimental in nature and examined participants’ perceptions of preference, process duration, and other factors. One area of concentrated work investigated the use of progress indicators in online surveys (Villar, Callegaro, & Yang, 2013. Also see Conrad, Couper, Tourangeau, & Peytchev, 2010; Matzat, Snijders, and van der Horst 2009; and Sarraf and Tukibayeva, 2014). The emphasis was on the effect of alternative progress-indicator design to reduce “drop-off rates” – that is, to minimize the probability that a respondent fails to complete a survey after starting it. Villar et al. (2013) used meta-analytics of 32 published manuscripts that examined three types of progress indicators: constant (moving linearly), fast-to-slow, and slow-to-fast. Their results indicated that using a constant-moving progress indicator does not significantly reduce drop-offs and that effectiveness of the progress indicator varies depending on the speed of the indicator: Fast-to-slow indicators reduced drop-offs, whereas slow-to-fast indicators increased drop-offs. These results may be explained by a sense-of-progress psychological framework of waiting (to be discussed below): A progress indicator that moves quickly at the beginning of the task may give users the impression that there is a greater movement toward task completion (a sense of progress), which improves satisfaction.

Some additional research has examined other progress-indicator design features in contexts other than participants completing online surveys. Crease and Brewster (1998) found that adding sounds to progress bars improved usability and increased user preference over progress bars without sound cues. Conrad et al. (2010) varied the speed of progress bars in a manner to set user expectations regarding the task completion. Participants in the study were more likely to “break-off” from (i.e., abandon) completing a task if the progress indicator began moving slowing at the beginning of the task rather than one that began moving quickly at the beginning of the task. Matzat et al. (2009) also examined the
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