

## Chapter 8

# Information Technology Progress Indicators: Research Employing Psychological Frameworks

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### **ABSTRACT**

*Users of information technology often encounter “progress indicators” during their interactions. These graphics (e.g., progress bars) appear on computing screens as users wait for a task to complete to inform them of the progress being made toward completing the task. This study employed theoretical models from psychological research on human waiting to develop specific hypotheses related to the design of progress indicators. Three experiments tested these hypotheses. Experiment 1 revealed that participants preferred a linear progress bar to a cycling progress bar. Experiment 2 revealed that participants preferred a video progress indicator to a cycling progress bar, and they judged process duration to be shorter with the video progress indicator. Experiment 3 revealed that the video progress indicator yielded the best user experience. Systems designers can use these results to develop more effective user interfaces.*

### **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 to complete a task, such as downloading a file, saving a file, or updating software. The purpose of progress indicators is to inform the user of the progress that is being made as the task moves toward completion. Progress indicators can take different forms, such as a spinning disk, a bar that moves across the screen, or a textual message (for example, “26% completed”) (Amer & Johnson, in press; Conrad, Couper, Tourangeau,

DOI: 10.4018/978-1-5225-1868-6.ch008

## **Information Technology Progress Indicators**

& Peytchev, 2010; Cooper & Reiman, 2003; Galitz, 2007; Shneiderman, Plaisant, Cohen, & Jacobs, 2009). Because progress indicators are common features in IT environments, it is not only important to understand which form, content, and movement patterns maximize the quality of the user experience but also to understand the problems users experience in such interactions (Galitz, 2007; Ghafurian & Reitter, 2016; Hohenstein et al., 2016; Shneiderman et al., 2009; Villar, Callegaro, & Yang, 2013).

Systems designers program progress indicators for display when time consuming operations interrupt the user interface for longer than a few seconds. In such circumstances users can become impatient if the interface provides no indication that some underlying process is functioning. Therefore, a progress indicator informs the user that the system is still operating and is not waiting for a response from the user before processing continues. Progress indicators often move in a manner that is directly proportional (linear) to the amount of work that has been completed. However, factors such as varying speeds of disk and memory access, processor speed, and bandwidth may alter the time and rate of movement. Consequently, progress indicators often exhibit non-linear behaviors, such as:

- Acceleration,
- Deceleration, and
- Stalls.

Regardless of the movement pattern of the progress indicator, the user must wait while the underlying computing process completes. Waiting is, therefore, a common aspect of the user experience when encountering progress indicators.

This paper applies theoretical models from psychological research on human waiting and perception to develop specific hypotheses related to the design of progress indicators, and it reports the results of several experiments that were carried out to test those hypotheses. These findings can be used to better understand the impact of a progress-indicator design on the user experience.

## **RELATED LITERATURE**

Prior research has investigated the design features of progress indicators in different contexts to determine appropriate parameters and user perceptions. These efforts have largely been experimental in nature and examined participants' perceptions of preference, process duration, and other factors (Amer & Johnson, in press). One area of concentrated work investigated the use of progress indicators in online surveys (Villar et al., 2013; Conrad et al., 2010; Matzat, Snijders, & van der Horst, 2009; Sarraf & Tukibayeva, 2014). The emphasis of that research was to study the effect of alternative progress-indicator designs to reduce "drop-off rates"—that is, to minimize the probability that a respondent will not complete a survey after starting. 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.

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