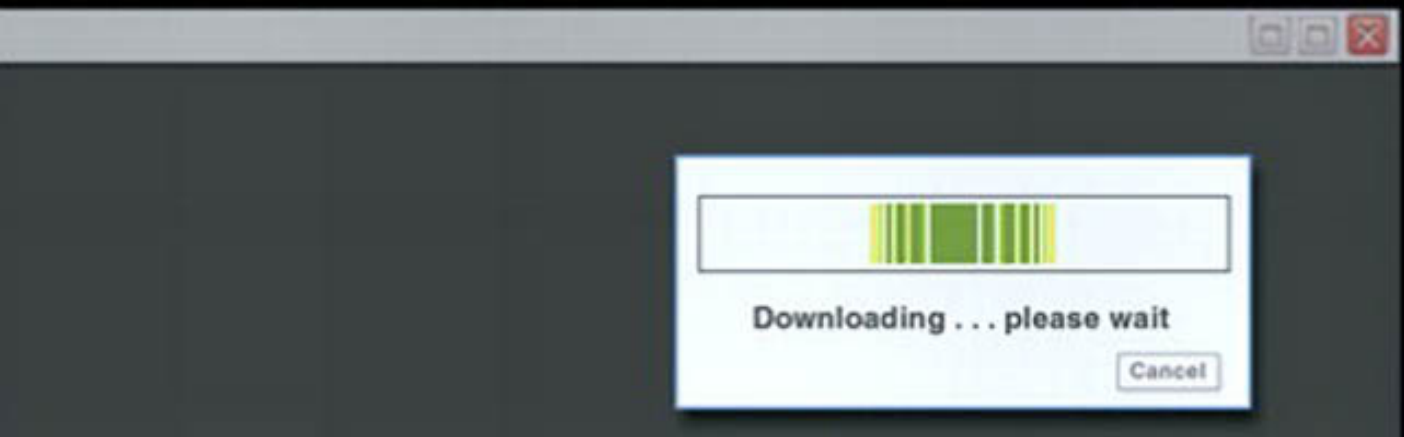
Designing and Engineering Time

The Psychology of Time Perception in Software



Steven C. Seow, Ph.D.

Praise for *Designing and Engineering Time*

"Seow has written the definitive book about understanding and engineering the perception of time in user experience. It is clear, engaging, and thorough. This is a must-read for designers, developers, or anyone else who makes decisions regarding the interaction of humans and computers."

—Susan Hodges Ramlet, Interaction Design Engineer
Member, Usability Professionals' Association

"The first comprehensive guide to this very important aspect of software usability. Chock-full of tangible examples and great techniques. Accessible for all members of the software development team and business sponsors too."

—Terrence Michael Gardiner, theTEAMcompany.com
Owner and Principal User-Centered Design Consultant

"If you're browsing for a book that explains why users are so frustrated with your software, this is it. If you're looking for ways to eliminate those frustrations, then buy this book."

—Tim Patrick, author of *Programming Visual Basic 2008*

"Response time is one of the most important contributors to user satisfaction with a system. The slow system seems recalcitrant to the point of defiance. It provokes multiple clicking, and if too slow, the user abandons it. Beyond just making performance better, engineers, system architects, and usability practitioners need to understand how users perceive time and how a well-designed system will exploit that understanding. In *Designing and Engineering Time,* Steve presents a scholarly yet very readable book on the perception of time and its design implications. This book is destined to become a classic."

—Dennis Wixon, Ph.D., User Research Manager, Microsoft Games Studios

TAFIM

The *Technical Architecture Framework for Information Management* (TAFIM) is an eight-volume documentation also developed by the Department of Defense (DoD) in 1996 to "provide guidance for the evolution of the DoD technical infrastructure, defining the services, standards, design concepts, components, and configurations that can be used to guide the development of technical architectures that meet specific mission requirements." Specific guidelines on human-computer interface are found in the last volume, and timing-specific guidelines are shown in Table 3.4.

Table 3.4 Subset of Guidelines in TAFIM

Section	Topic/Action	Timing (sec)	Guidance
6.6.2	Work-in-progress window	5 sec	For simple requests that can be processed under this time, provide simple visual feedback via a brief message. If the request response exceeds this time, the application should provide a window to indicate work in progress.
8.3.1.14	Control	5 to 200 ms	System response time.
8.3.1.15	Feedback	15 sec	If the user waits more than this time, provide a periodic indication of normal operation.

Summary

Human-computer interaction is conversational in nature, and therefore timing in both user response time and system response time is critical. For user response time, it is important to remember that when users have to focus on speed, accuracy is compromised, and vice versa. For system response times, several industry standards are available that provide guidance on the maximum acceptable response time. Although these guidelines offer concrete metrics to work with, they are based on the performance of the hardware and software available at the time when the guidelines were published. Therefore, take care when following these guidelines. In the next chapter, we consider an alternate, user-centric approach to system response times.

Rabbit Hole

Human Response Times

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Ulrich, R. and M. Giray (1989). Time resolution of clocks: Effects on reaction time measurement—Good news for bad clocks. *British Journal of Mathematical & Statistical Psychology,* 42, 1–12.

System Response Time

Beringer, J. (1992). Timing accuracy of mouse response registration on the IBM microcomputer family. *Behavior Research Methods, Instruments, & Computers,* 24, 486–490.

Miller, R. B. (1968). Response time in man-computer conversational transaction. Fall Joint Comp. Conf. U.S.A., 267–277.

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Shneiderman, B. (1984). Response time and display rate in human performance with computers. *Computing Survey,* 16, 265–285.

Speed-Accuracy Tradeoff

Fitts, P. M. (1966). Cognitive aspects of information processing: III. Set for speed versus accuracy. *Journal of Experimental Psychology,* 71, 849–857.

Pachella, R. G. and R. W. Pew (1968). Speed-accuracy tradeoff in reaction time: Effect of discrete criterion time. *Journal of Experimental Psychology,* 76, 19–24.

Hick-Hyman Law and Fitts' Law

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Hick, W. E. (1952). On the rate of gain of information. *Quarterly Journal of Experimental Psychology,* 4, 11–26.

Hyman, R. (1953). Stimulus information as a determinant of reaction time. *Journal of Experimental Psychology,* 45, 188–196.

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Industry Standards

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Responsiveness

Responsiveness is typically used to describe a characteristic of a solution, but if the solution is used by humans, it cannot be properly defined without the user. Whereas hardware and software will continually improve, human perceptual abilities will remain unchanged. This chapter introduces a way to classify responsiveness according to the general perception of what is instantaneous, immediate, continuous, and captive.

What Is Responsiveness?

The definition of *responsiveness* in the context of computing can sometimes be as elusive as the definition of beauty in poetry or style in fashion—you know it when you see it. You are going to need more formal metrics to design responsive computer systems. In the preceding chapter, human-computer interaction is related to human-human interaction because both are conversational in nature. If this analogy is accurate, it should be possible to define software responsiveness in the same way as human conversation responsiveness. Three important characteristics of responsiveness are that it is *relative* to the type of interaction in question, *subjective* in that users may have different levels of tolerance and interpretation of it, and *nonexclusive* in its form so that any indirect indication can also serve as a gauge of responsiveness.

Responsiveness Is Relative to the Interaction

Is five seconds too long for a response? Well, it really depends on what is being asked. Suppose you spot a familiar face at a party, decide to approach the individual, and ask, "John Sperling, right?" In all likelihood, a five-second delay before a response from the individual will be odd indeed. However, suppose the individual is caught off-guard by a stranger with an unexpected question (for example, "You handled the Mitsubishi account six years ago with Mike, right?"); a five-second delay before a response might not be that unreasonable because it would be normal to take some time to recollect.

The same applies in the human-computer interaction context. Different forms of interactions will have different windows of acceptable response times. For example, the time between pressing a key and having the character appear after the insertion point (the blinking vertical line) should be much shorter than when clicking a button to reach a website and having the browser load the Web page fully. Therefore, evaluating all forms of responsiveness against one scale (very fast to very slow) or setting a cut-off (< 20 milliseconds = fast) is not taking the *relative* nature of responsiveness into consideration.

A Delay Is Subjectively Perceived

Back to the familiar face at the party: Suppose you have asked the individual if he was someone you knew, but he has been remained silent for well over five seconds. What would take him so long to respond to you? Perhaps he has a hearing problem and didn't even hear the question. Maybe he heard your question but is trying in vain to remember who you are. It could also be possible that he is not John Sperling or does not even understand English. It may even be possible, especially considering the technological

trends these days, that John Sperling is unable to respond because he is actually having a cell phone conversation using an inconspicuous Bluetooth headpiece.

Likewise in the human-computer interaction context, there may be many reasons why a system is not responding as promptly as it should. Consider the typical example of attempting to reach a website (see Figure 4.1). To begin with, the Internet connection might not be established at all. The URL entered might be incorrect. The website might be receiving a lot of traffic during that particular time. Perhaps the Internet service provider (ISP) has disconnected service for some reason. For typical users, especially those who might not be technologically savvy, the interpretation is generally limited to a few usual suspects, such as the website or the browser.

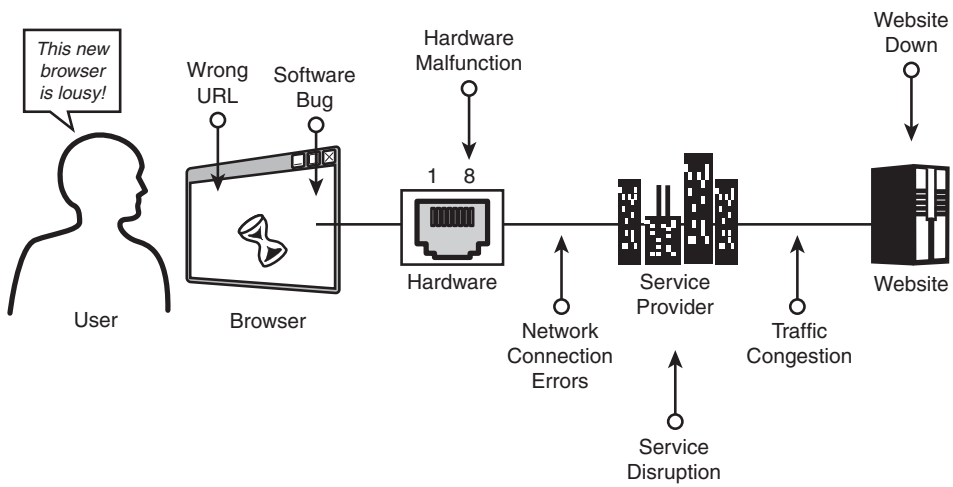

FIGURE 4.1

There might be several reasons why a particular Web page is not loading in a browser, but to the average user there will probably be just a few subjective interpretations of what is causing the failure.

Leaving users to guess why the system is not responding is the same as leaving a person to guess why a verbal response is not forthcoming in a conversation. When the user interface (UI) does not adequately communicate to the user its progress, users will likely want to quickly assign the blame to something. Occam's Razor—the simplest explanation is the best one—seems to hold true when it comes to pointing fingers: The newly installed browser is to blame for the slow connection, the management information