

# Computers as Pacemakers: The Influence of System Response Time on Navigating Through Hypertext

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Surveys consistently report long system response times (SRT) among the major problems in World Wide Web usage. Systematic studies on the cognitive and emotional impacts of such delays, however, are rare. Approaching this problem from the perspective of cognitive psychology, and based on theories of memory and time perception, we investigated the threshold at which system response times become annoying. Participants in our study explored a Web Site consisting of 1300 fashion photographs, i.e. catwalk shots from designer shows. The users could browse freely among the various collections. To maintain control over the experimental situation, the study was conducted in the laboratory on a PC workstation. SRT was manipulated (between-subjects) in a range of 0.5 to 3.5 seconds.

Mood rating tests confirmed our hypothesis that SRT becomes annoying only at SRT of three seconds and over. We also recorded residence time for each chosen HTML file, i.e. the time the user viewed each separate page. An astonishing pattern emerged: the longer participants had to wait for delivery of a page (i.e. the longer the SRT), the longer they actually viewed the page. Apparently, longer SRT induced a slower pace of perception and navigation. However, at the critical point of three seconds SRT, this linear relation broke down and residence time dropped. This was also the time when negative emotions appeared. Above this threshold, figuratively speaking, the computer became the break block of the user dialogue. Below, it worked almost like a pacemaker. To emphasize, it is the human who keeps the computer's pace, not the other way around! A replication of this study showed the same pattern of synchronization between SRT and residence time, and also revealed cognitive correlates of this effect in an adaptive recognition test. Based on these results, we firmly advocate a cognitively sound "time design" for the development of future computer interfaces.

Key words: hypertext, system response time, emotion, cognition

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