Evaluating Animation as a Mechanism for Maintaining Peripheral Awareness

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Abstract

Animation is becoming increasingly used to communicate information within some limited viewing area. Little is known, however, about the effectiveness and the possible distractions of animation used in this way. This article describes an initial experiment exploring the information awareness and distraction capabilities of different styles of animation.

Keywords: Animation, awareness, empirical evaluation, information display

1 Introduction

Consider the ever-expanding pool of constantly changing information that is readily available on the Internet and World Wide Web. Stock prices climb and fall, news bulletins arrive, email queues grow, sports teams score points, and the weather changes. While people care about this information, their focus at the computer is generally on other activities such as editing, programming, and research. Users often cannot afford large visualization displays that require an explicit request for information. Rather, an alternate communication mechanism is needed—one that occupies little space on the desktop and that does not distract focus from other activities.

One solution is to use animation to cycle between pieces of information. Only a small amount of screen space is required, and changes to the information can be integrated in the next iteration. Animations are popular on Web pages, and tools that use animation are beginning to become more common [1]. While animation has potential benefits, there are drawbacks as well. Animation is often seen as distracting or annoying, yet animation on the desktop is common in accessories such as clocks and machine load monitors.

Will animation indeed distract a user from other tasks? Or can it help with this emerging awareness task? Are different animations better suited for different information types? To address these questions, we conducted an experiment that examined the awareness capabilities of three types of animation: a motion-based effect that moves or *tickers* information across the display area, an in-place *fade* effect that gradually changes information at a fixed location, and an in-place sudden *blast* that rapidly changes the visible information without the benefit of smooth animation.

2 Empirical evaluation

This experiment explored whether the presence of animations causes degradation in performance on a browsing task and examined the speed with which participants could react to changes in the animated displays. Seventy participants performed a series of information searching tasks using a simplified browsing environment. At the same time, an animation was running in a small portion of the screen, and the participants were asked to watch for certain information to appear in it.

The browsing tasks were performed using a simple browser and hypertext pages. The browser consisted of an information area containing cropped text-only versions of World Wide Web sites. The participants navigated the information space by clicking on highlighted underlined links and with forward and back buttons. The browsing tasks were non-trivial: the participants had to read and navigate through a hypertext space to find certain information in the pages, enter it, and press a button. To minimize the typing required, all solutions were numerical (for example, "In what year was Mount Rushmore carved?") Participants performed six rounds of tasks with each round consisting of four such questions.

At the same time, information was provided via a fade, ticker, or a blast animation in a small, separate window on the display. New information appeared in each type of animation at a comparable rate. Participants were asked to press a button when certain information appeared in the animation (for example, "When the temperature drops below 35, press OK1.") Each round of browsing tasks had two such accompanying awareness activities. For the first three rounds, the information was a mixture of sports scores, stock quotes, weather information, news headlines, and email sender names. The latter three rounds each focused on a single type of information: stock quotes, news headlines, and sports scores, respectively. We tried to select information that is interesting but rarely vital and informational occurrences that might spur a user to perform some activity (such as bringing in a plant that is outdoors, or selling a stock that is performing poorly).

The times for all browsing tasks and awareness activities were recorded. It was emphasized that fast performance for both was important. All participants experienced all animations, with orders based on a latin square design (browse - fade - ticker ($n = 17$), fade - ticker - browse ($n = 17$), or ticker - browse - fade ($n = 21$). A different animation was used for each of the first three rounds with the order repeated on the last three. In addition, one group ($n = 15$) did not have any animations present at any time and as such did only the browsing tasks.

The dependent variables were the completion times for the browsing tasks and awareness activities. The completion times for the browsing tasks were measured from the start of each round. For the awareness activities, we measured the time from the first appearance of the information until the information was acknowledged.

2.1 Results

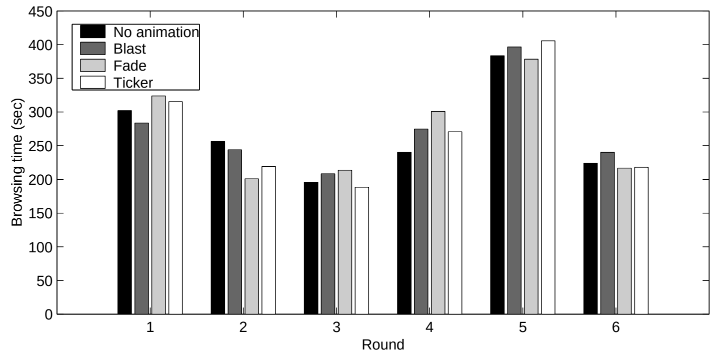

Figure 1: Average completion times for browsing tasks for each round based on the type of animation that was present. Participants performed about the same on the browsing tasks regardless of the type or even the presence of animation.

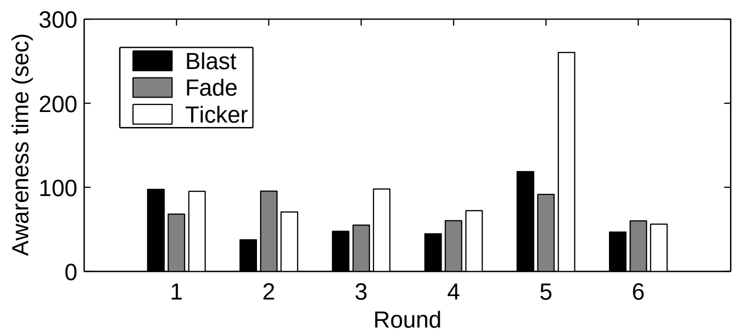

Figure 2: Cumulative completion times for the two awareness activities for each round. The participants performed significantly better with the blast and fade animations.

One might suspect that participants who are not faced with an animation and not burdened with the additional awareness activities would perform significantly faster on the browsing tasks, but our results suggest that this is not the case. There was not a significant impact of the type of animation on browsing task times ($F(2,46) = 0.62$, $MSE = 25411.63, p = 0.54$), and in fact the presence of an animation did not affect the browsing times ($F(3,58) = 0.60$, $MSE = 46277.71$, $p = 0.62$) (see Figure 1).

Does the number of tasks completed depend on the type of animation? On average, participants completed 11.3 of the 12 awareness activities, including 3.83 of 4 for blast, 3.79 of 4 for fade, and 3.71 of 4 for ticker. The number of activities completed did not differ significantly based on the type of animation that a participant used ($F(2,96) = 0.77$, $MSE = 0.25$, $p = 0.46$). That is, it does not appear that a participant is more likely to identify (or miss) a piece of information when using one type of animated display than another.

While the noting of awareness information was not affected by device type, the time to react to it was. A breakdown of the awareness activity times for each round for the activities that were completed appears in Figure 2. The times to complete the awareness activities differed significantly depending on the type of animations used ($F(2,52) = 17.24$, $MSE = 4528.75$, $p < 0.001$). Pairwise comparisons revealed the blast and fade animations resulted in significantly faster awareness times than the ticker ($F(1,26) = 34.89$, $MSE = 4190.84$,

$p < 0.001$ and $F(1,26) = 13.02$, $MSE = 5911.67$, $p = 0.01$, respectively) and there was a trend toward faster blast times than fade ($F(1,26) = 3.16$, $MSE = 3483.74$, $p = 0.087$).

We expected that certain display types would prove to be better suited for particular styles of information. As such, we expected that the change in the type of information shown in the animations in the latter three rounds would result in a change in the awareness response times for different animation types. Even though it appears that the awareness times are much higher for the fifth case (the news headlines) than in the fourth or sixth, large variance meant that there was no significant correlation (see Figure 2) with $F(2,46) = 0.37$, $MSE = 10957$, $p = 0.69$ and $F(2,46) = 0.17$, $MSE = 16484$, $p = 0.84$ and $F(2,46) = 0.27$, $MSE = 9604$, $p = 0.76$ respectively.

We suspect that the higher awareness times are due to the fact that news headlines are more informationally dense than stock quotes and sports scores, meaning more information must be processed, thus reducing the chance that a given piece of information will be identified. The ticker showed particularly poor performance because headlines that would not fit in the blast and fade were truncated while they were shown in their entirety in the ticker. As such, ticker users had to process more information, reducing their opportunities to see the desired piece of information.

3 Conclusions

This paper explored the role of animation in awareness. The results described in this paper suggest that modest uses of animation over short periods of time may assist in maintaining awareness without causing undue distraction. The type of animation used seems to impact the ability to identify information quickly. The in-place blast and fade animations resulted in faster identification than the motion-based tickering. Future work will examine more closely the impact of information type, the size of the available display area, and the speed of updates on the choice of animations.

As such, we see animation used not continually, but rather for short, well-defined periods of time, perhaps to monitor the traffic close to leaving time each day, or to track breaking news stories on hot topics, or to keep an eye on volatile stocks.

Programmers should not write applications that employ animation with the expectation that they will be used continually, but rather for short, well-defined periods of time, perhaps to monitor the traffic 5 and 6 pm every weekday, or to keep an eye on the scores of selected baseball games during the pennant drive and playoffs. If programmers do anticipate that it will be necessary to run the application at all times, alternate (non-animated) information delivery mechanims should be made available.

We have developed a toolkit that simplifies the incorporation of animation into a user interface [2] and have performed real-world user studies to examine how people react to animation on the desktop [3]. Ongoing work is focusing on identifying other uses for animation in awareness and on integrating animation into real-world applications. Experiments will test whether the size of the display space and the type of information impacts the animated device performance. In addition, we will seek to examine whether the proposed augmentations can successfully overcome some of the drawbacks to animation. Several real-world applications are currently in development for monitoring weather information, stock quotes, news, personal information, and sports scores. We are planning other user studies that presents a large variety of options to users and monitors the informational and display choices that they make.

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