Usability News

July 2005, *Vol. 7 Issue 2*

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Usability News is a free web newsletter that is produced by the Software Usability Research Laboratory (SURL) at Wichita State University. The SURL team specializes in software/website user interface design, usability testing, and research in human-computer interaction.
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Smooth or Textured: Does Mouse Pad Surface Impact Performance?

By Jeremy Slocum and Shelby Thompson

Summary: This study examined the effects of mouse pad usage on performance of a target acquisition task. Results indicated no performance difference between three specialized mouse pads, a traditional mouse pad and no mouse pad. In addition, no significant differences were found between each of the mousing surfaces based on kinematic data. The results suggest that manufacturer claims of increased performance cannot be supported by empirical evidence.

INTRODUCTION

With the advent of high-speed processors and video cards, sales of computer video games have skyrocketed, leading to the development of organized 'gaming' communities and events. Within the competitive computer gaming community, optimized user input performance is of uppermost importance. Most of these games rely on fast-accurate movements of the mouse for aiming at a target, or manipulating movements during competitions. Manufacturers of computer accessories have benefited from an increased desire for gamers to have a "competitive edge" with regard to control of input by demanding high-dpi optical mice, specialized input devices and specialized mouse pads. However little empirical evidence exists showing these products improve basic input control with a computer, let alone computer gaming performance.

The goal of the present research was to test the claims of specialized mouse pad manufacturers that mouse pad surfaces can increase mousing performance for competitive gamers. The present study measured the effect of three different mouse pad surfaces on cursor control performance during a simple target acquisition task. Performance was examined through movement time (MT) and error rate (ER). The kinematic variables of peak velocity (PV), gross movement time (GMT: time from initial movement to first zero crossing in the velocity profile) and fine movement time (FMT: time from end of GMT to end of movement) were also examined to determine how the mouse pad surface affects the actual movements made by a user. It was hypothesized that as the texture of the mouse pad becomes smoother users will move faster (i.e., increased PV), but make more errors and show an increase in gross movement time (GMT).

METHOD

Participants

Twenty-five college students, 16 females and 9 males (M = 24.28 years of age) were matched according to movement time with a standard optical mouse without a mouse pad and then randomly assigned to one of four different mouse-pad conditions or a control group (no pad). All were right-hand experienced mouse-users and had normal or corrected-to-normal vision with no other physical impairments being reported.

Materials

The mouse pads used are shown in Figure 1: the Corepad (www.corepad.com), the G-Pad by Maxtill (www.maxtill.com), the Thunder 9 by X-Ray (www.xraypad.com), and a traditional foam mouse pad.

The Corepad (rougher surface) was 280 x 200mm and made of glass with "fencing" branded in to create texture. The G-Pad by Maxtill (smoother surface) was 265 x 215mm and made of frictionless tempered glass. The Thunder 9 by X-Ray (moderately smooth surface) was 291 x 236mm and made of rigid ABS material. The traditional mouse pad was 270 x 215mm and made of foam with a cloth surface. The table used had a 36 X 18" desktop area made of a low-glare Formica. The experimental apparatus consisted of a PC running Linux, a 21-inch monitor running at 1400 x 1050 with a resolution of 100 DPI and a refresh rate of 85 Hz, and a Logitech® MX™300 Optical Mouse (800 DPI).

Figure 1. The Corepad (top left), the G-pad by Maxtill (bottom left), and Thunder 9 (right)

Procedure

The experiment was divided into two sessions: a pre-session where subjects completed a target acquisition task without a mouse pad and a post-session in which subjects completed the same target acquisition task with a mouse pad or without if assigned to the control group. The purpose of the pre-session was to establish an average movement time in order to match each participant in the post-session. The experiment varied display target distance (17.5, 70, and 140 mm), display target size (2, 4, and 8), and angle of approach (0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°) in a discrete pointing task. Participants were asked to acquire the target "as quickly and accurately as possible." Amplitude, target size, and angle were randomized via the software. In the post-session, subjects were randomly assigned to one of five mouse pad groups: G-pad, Corepad, Thunder 9, traditional mouse pad, or no mouse pad.

RESULTS

With the emphasis of the study being the mouse pads, the data was collapsed across all conditions for each subject (N = 25, 5 subjects per pad). Results of a one-way ANOVA to test the adequacy of the matching procedure found no difference in MT ($p = .998$), indicating that each subject was appropriately matched across all post-session conditions. Additional one-way ANOVA's found no significant difference for the remaining dependent variables (GMT, FMT, PV and ER).

With the subjects appropriately matched, a series of split plot ANOVA's using each dependent variable was completed, with session (pre and post) being the within-subjects variable and mouse pad being the between-subject variable (Table 1). A significant main effect for session was found for MT [F(1,20) = 7.939, p =.011, h2 = .284] and FMT [F(1,20) = 6.208, p =.022, h2 = .237], showing a significant decrease in MT and FMT from the pre-session to the post-session. No significant main effect for mouse pad or interaction with session and mouse pad was found.

Table 1. Performance means for pre-session and post-session.

Mouse-pad	MT (seconds)	ER (% of trials with error)	PV (mm per second)	GMT(seconds)	FMT(seconds)
G-pad					
Pre-session	0.870	5.694	103.808	0.520	0.350
Post-session	0.862	4.826	102.353	0.517	0.356
Corepad					
Pre-session	0.862	4.201	95.431	0.533	0.330
Post-session	0.848	3.785	96.087	0.542	0.305
Thunder 9					
Pre-session	0.855	11.875	98.488	0.500	0.354
Post-session	0.855	11.007	101.666	0.513	0.340
Traditional-pad					
Pre-session	0.858	7.014	105.192	0.469	0.390
Post-session	0.824	6.458	108.758	0.461	0.362
No Pad					
Pre-session	0.865	5.417	89.605	0.563	0.302
Post-session	0.840	4.688	94.469	0.559	0.286

DISCUSSION

The results showed that different mouse pad surfaces did not significantly affect performance in terms of movement time (Figure 2) or error rate. A general significant decrease in movement time and fine movement time was found from the pre-session to the post-session, which is attributed to practice. The effect cannot be generalized to any particular mouse pad surface or mouse pads because the same decrease was seen in the control group which used no mouse pad.

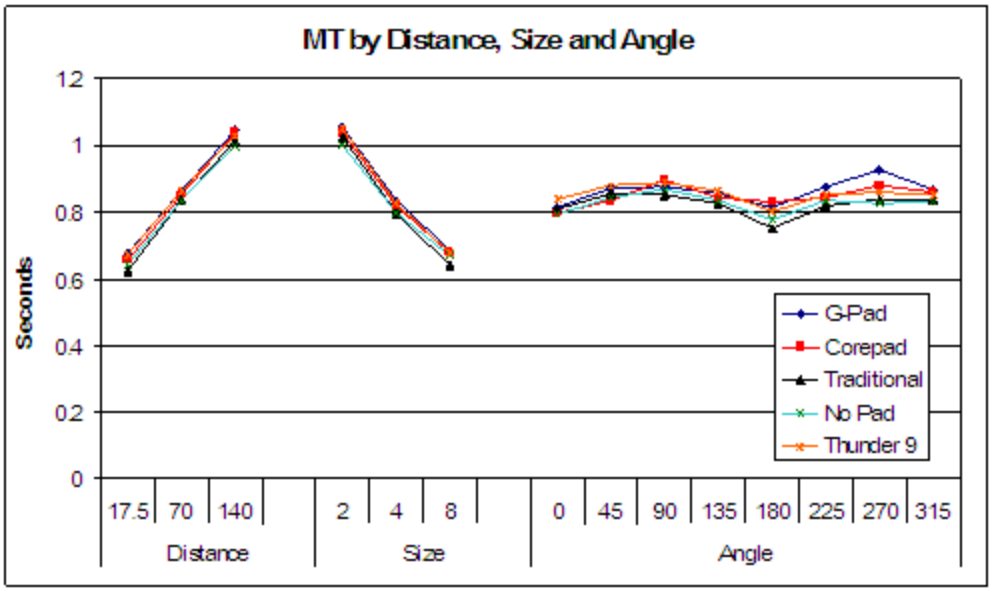

Figure 2. MT for each target condition in the post-session. This figure outlines how there is little difference between performance for each of the mouse pad conditions.

Kinematic analysis was conducted to determine if the mouse pads significantly affected the actual movements made by users. It was predicted that as mouse pads became smoother users would attain a higher velocity, but would increase fine movement time. These predictions were not supported. The mouse pad surface did not have a significant effect on gross movement time, fine movement time, or peak velocity.

These findings show no true performance benefit from specialized mouse pads, nor did it affect the user's kinematics. The claims of the manufacturers were not substantiated by these findings. However, more questions remain to be answered. This research did not specifically target experienced gamers as participants. Research should be conducted to examine the use of alternative mouse pads with this population (versus non-gamers). It could be that a certain level of skill is required to take advantage of the claimed benefits of the mouse pads. In addition gamer performance during actual play should be evaluated.

Note: For additional information on this study, please see the proceedings of the Human Factors and Ergonomics Society's 49th (2004) Annual Meeting, Orlando, FL.
