Technical Report

The Effects of Standard Typing Experience and Split Keyboard Experience on Split Keyboard Experimental Outcomes: Evidence from the Split Keyboard Literature

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ABSTRACT

A recent literature review of human factors studies of split keyboards from 1926 to 1993 (Lewis, 1994) indicated very little consistency in outcomes among the experiments. Analyses of the outcomes suggested a significant relationship between split keyboard inventorship and participants' unqualified preference for split keyboards. There appeared to be no relationship between experimental control of chair height or keyboard height and preference for split keyboards. The review, however, did not address two other experimental variables that could have systematically affected the outcomes of the split keyboard experiments: (1) the amount of prior standard typing experience of the participants in the experiments and (2) the amount of experience the participants had with the split keyboards during the experiment. The purpose of this report is to document the evidence from the split keyboard literature that addresses the apparent influence of these two variables. Examination of the literature revealed no systematic influence of standard typing experience on either preference or comfort outcomes across the split keyboard literature. The only experiment that directly compared the preference of both experienced and inexperienced typists (Kroemer, 1972) found unanimous preference for the split keyboard among the experienced typists, but inconsistent preferences for the split keyboard among the inexperienced typists. Point-biserial correlations of neck-shoulder comfort, forearm-wrist comfort and preference for split keyboards with split-keyboard experience during the experiment were all nonsignificant and of low magnitude (indicating no relationship). These results fail to support the hypothesis that prior standard typing experience biases the outcome of an experiment in favor of either standard or split keyboards. They also fail to support the hypothesis that more split-keyboard experience leads to greater split-keyboard preference, at least within the limits of the current split-keyboard literature.

Introduction

A recent literature review of human factors studies of split keyboards from 1926 to 1993 (Lewis, 1994) indicated very little consistency in outcomes among the experiments. Analyses of the variant outcomes suggested a significant relationship between split-keyboard inventorship and participants' unqualified preference for split keyboards. There appeared to be no relationship between experimental control of chair height or keyboard height and preference for split keyboards.

The review, however, did not address two other experimental variables that could have systematically affected the outcomes of the split keyboard experiments: (1) the amount of prior standard typing experience of the participants in the experiments and (2) the amount of experience the participants had with the split keyboards during the experiment. The purpose of this report is to document evidence from the split keyboard literature that addresses the apparent influence of these two variables.

Method

Nine papers from the split keyboard literature covered the appropriate dependent variables and provided enough detail for evaluation in the current study (Brigham and Clark, 1986; Douglas and Happ, 1993; Jahns, Litewka, Lunde, Farrand, and Hargreaves, 1991; Kroemer, 1972, Experiment 3; Lopez, 1993; Marek, Noworol, Wos, Karwowski, and Hamiga, 1992; Nakaseko, Grandjean, Hünting, and Gierer, 1985; Smith and Cronin, 1993; Thompson, Thomas, Cone, Daponte, and Markison, 1990). From each paper's methods section, I listed the standard typing experience level of the participants (experienced or inexperienced, as defined by the experimenters) and the amount of experience (practice and test time) that participants had with the experimental split keyboard in each study. Table 1 summarizes the key results of these experiments, and shows, for each experiment, the participants' standard and split keyboard experience. Because Lopez (1993) studied two different types of split keyboards (Kinesis** and Comfort**), the outcomes for these split keyboards appear on separate lines of the table.

Kroemer (1972, Experiment 2) is the only study that directly compared experienced and inexperienced typists preferences for standard and split keyboards. Although these data might not be accurate (Lewis, 1994) and received no statistical analysis in Kroemer (1972), they are the only data available from a single study for examining the effect of standard typing experience on participant preference for split keyboards, and receive separate treatment in the Results section.

Results

Summary of Results

Table 1 shows the key results of the split keyboard experiments and the participants' standard and split keyboard experience for each study.

Table 1. Summary of Key Results Reported in Split-Keyboard Experiments, Matched with Participants' Standard Typing Experience and Split Keyboard Experience

Study	Neck-Shoulders Comfort+	Neck-Shoulders EMG	Forearms-Wrist Comfort+	Forearms-Wrist EMG	Unqualified Preference#	Standard Typing Experience	Split Keyboard Experience (min)
Kroemer (1972, Exp. 3)	Same	NA	Split better	NA	Split better	Inexperienced	200
Nakaseko et al. (1985)	Same	NA	Split better*	NA	Split better	Experienced	30
Brigham and Clark (1986)	Same	NA	Split worse	NA	Split worse*	Experienced	160
Thompson et al. (1990)	NA	NA	Split better	Split better*	Split better	Experienced	30
Jahns et al. (1991)	NA	NA	NA	NA	Split better	Experienced	480
Marek et al. (1992)	Split better*	Split better*	Same	Same	NA	Inexperienced	15
Douglas and Happ (1993)	Same	NA	Same	NA	Split worse*	Experienced	180
Smith and Cronin (1993)	NA	Same	NA	Split better*	NA	Experienced	540
Lopez (1993) (Kinesis)	Same	NA	Split better*	NA	Split worse*	Experienced	50
Lopez (1993) (Comfort)	Same	NA	Split worse*	NA	Split worse*	Experienced	50

+ = comfort can include reports of pains/discomfort or subjective ratings of relaxation/comfort, depending on the experiment.

* = an appropriate statistical test supports the result.

# = participants in the study selected their preferred keyboard without qualifications such as "best for comfort" or "best for speed".
NA = the experimenters did not measure this variable (not available).

Simple Meta-Analyses of the Effect of Standard Typing Experience

Only two of the studies (Kroemer, 1972, Experiment 3; Marek et al., 1992) used inexperienced typists. The other seven studies used experienced typists. The inexperienced typists in Kroemer (1972, Experiment 3) found both standard and split keyboards to be about equally comfortable in the neck and shoulders, but the inexperienced typists in Marek et al. (1992) found the split keyboard to be more comfortable. The experienced typists in Nakeseko et al. (1985), Brigham and Clark (1986), Douglas and Happ (1993), Smith and Cronin (1993), and Lopez (1993, both Kinesis and Comfort) found no split keyboard advantage. A Fisher test on these data showed no relationship between standard typing experience and neck-shoulders comfort (p=0.25).

The inexperienced typists in Kroemer (1972, Experiment 3) found the split keyboard to be more comfortable in the forearm-wrist area than the standard keyboard, but the inexperienced typists in Marek et al. (1992) found both keyboards to be the same. Among the experienced typists, participants in Nakaseko et al. (1985), Thompson et al. (1990), Smith and Cronin (1993), and Lopez (1993, Kinesis) found the split keyboard to be more comfortable (as assessed with either comfort ratings or EMG measurements) in the forearms-wrists, while the experienced typists in Brigham and Clark (1986) and Douglas and Happ (1993) found no advantage for the split keyboard. A Fisher test on these data showed no relationship between standard typing experience and forearm-wrist comfort (p=.83).

The inexperienced typists in Kroemer (1972, Experiment 3) generally preferred the split keyboard. The experienced typists in Nakaseko et al. (1985), Thompson et al. (1990), and Jahns et al. (1993) expressed an unqualified preference for the split keyboard. The experienced typists in Brigham and Clark (1986), Douglas and Happ (1993), and Lopez (1993, both Comfort and Kinesis) expressed an unqualified preference for the standard keyboard. A Fisher test on these data showed no relationship between standard typing experience and unqualified preference (p=.5).

Simple Meta-Analyses of the Effect of Split-Keyboard Experience

Because the amount of split-keyboard experience for each study is available in minutes (a continuous variable), these meta-analyses used point-biserial product-moment correlations rather than Fisher tests. For the analysis of the relationship between split-keyboard experience and forearm-wrist comfort, experimental outcomes in favor of the split keyboard received a code of "1" and outcomes in favor of the standard keyboard received a code of "0". The same code was used to classify the unqualified preference outcomes. The correlation between neck-shoulders comfort and split keyboard experience was -.32 (p=.43, n=8), the correlation between forearm-wrist comfort and split-keyboard experience was .12 (p=.78, n=8), and the correlation between unqualified preference and split-keyboard experience was .26 (p=.53, n=8). These data strongly suggest no relationship between the amount of split-keyboard experience and experimental outcome (at least within the range of experience available in the literature).

Results from Kroemer (1972), Experiment 2

Kroemer (1972, Experiment 2) had groups of both experienced typists and non-typists type with both horizontal (standard geometry) keyboards and split keyboards with a 60-degree declination for a total of 200 minutes per keyboard. He reported that 12 of 12 experienced typists preferred the split to the standard keyboards. Two non-typists preferred the standard keyboard, five preferred the split keyboard, and six had no preference.

Because the measurement of preference was not forced-choice, the results are not compatible with a standard Fisher test. One approach to analysis is to drop the "no preference" data, and another is to divide the "no preference" data evenly between the two types of keyboard. A Fisher test on the "dropped no preference" data just misses marginal statistical significance ($p=.12$). A Fisher test on the "divided no preference" data is statistically significant ($p=.02$).

Discussion

It appears that the amount of standard typing experience cannot account for the differences in the outcomes of the split-keyboard experiments reviewed in this study. Therefore, it is not reasonable to claim that the use of experienced typists as participants in split keyboard experiments biases the outcome of the experiment in favor of either standard or split keyboards. The data from Kroemer (1972, Experiment 2), in which he reported that 12 of 12 experienced typists stated that they preferred the split keyboard, stands as evidence that typing experience is not likely to bias a participant against preferring a split keyboard to a standard keyboard.

The correlations between the amount of split-keyboard experience and the experimental outcomes were low. Thus, this data shows that variance in the amount of split-keyboard experience does not seem to affect the outcomes of split-keyboard experiments, at least not in the range of experience represented in the literature. In some cases (Nakaseko et al., 1985; Thompson et al., 1990) participants with as little as 30 minutes of split-keyboard experience preferred the split keyboard. In another case (Douglas & Happ, 1993), participants with 180 minutes of experience preferred the standard keyboard.

Conclusions

The analyses in this study show that neither the amount of standard typing experience nor the amount of split-keyboard experience seem to have any detectable effect across the experimental outcomes in the split keyboard literature.

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