Operation Sound Influence on Tablet Device Character Input Operation

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Abstract. On the other hand, because tactile feedback from the touch interface is poor, there is a lack operation it is difficult comfort see if it is running correctly problems. To solve this problem, research to improve the operability of the touch interface through auditory feedback has been conducted. On the other hand, it is clear that auditory feedback from touch interface operation in order to accelerate work is at the center of physical factors; however, not much progress in being made for research on emotions and the psychological effects of the user. In this study, we clarify the operation sound effect on the character input operation of tablet devices. From the results, we produce a tool that can examine the impact on character input operation through various operation sounds.

Keywords: Touch device · Operation sound · Feedback · POMS

1 Introduction

In recent years, tablet devices for the general public that can be used in various applications have become available from various companies; for example, Apple iPad is widely used. According to the communication usage trends survey conducted in 2013, household holdings of tablet devices increased yearly by 21.9 % from 7.2 % over 2010–2013; it is estimated that such usage will be widespread in the future [1]. One of the features of table devices that can be mentioned is their intuitive operation by touching the screen. On the other hand, because tactile feedback from the touch interface is poor, there is a lack operation it is difficult comfort see if it is running correctly problems [2].

Because of differences in the feeling operation between software and real keyboards, the former, which are often used to input characters into tablet devices, have been reported to be inconvenient [3]. To solve this problem, research to improve the operability of the touch interface through auditory feedback has been conducted. On the other hand, it is clear that auditory feedback from touch interface operation in order to accelerate work is at the center of physical factors; however, not much progress in being made for research on emotions and the psychological effects of the user [4].

Therefore, to input characters input into tablet devices, investigating the effects of auditory feedback on user emotions is necessary [5].

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2 The Aim of Research

This study aimed to clarify the effects of operation sounds on text (character)-input operations on a tablet terminal. From the results, we created a tool that can investigate the effects of various operation sounds on text (character)-input operations.

Feedback at Text input times. In many cases, one relies on visual and auditory feedback when inputting characters on a tablet terminal. As visual feedback, in general use is a color change of the key touched on the software keyboard, or a "pop-up" of the character corresponding to the touched key, etc. This enables users to confirm whether or not the inputted character is the desired character (Fig. 1). As auditory feedback, an actual keyboard is mimicked, and a analogous sound effect is generated to give the sense that a key was pressed (below, "operation sounds").

Fig. 1. Visual feedback on a software keyboard

3 Research Method

We surveyed research regarding auditory feedback with a touch panel, and hypothesized that operation sounds had effects on the operability of the touch panel. We then investigated the effects that the presence or absence of sounds had on character-input operations on a tablet terminal.

4 Effects on Character-Input Operations of the Presence or Absence of Sounds

We had subjects input designated text using a tablet terminal, and surveyed subjects before and after the test as to what effects the presence or absence of operating sounds had on changes in feeling (mood), subjective evaluations, and working speeds (Fig. 2). As the tablet terminal, we used the iPad mini 2 made by Apple Inc.

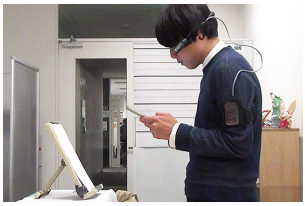

Fig. 2. Experimental Scenes of character input using a Tablet Device

4.1 Research Plan

Subjects were 12 university students familiar with keyboard operations due to daily use of a smartphone or tablet terminals, and either right-handed or ambidextrous.

1. The test was explained to the subjects.
2. Subjects performed the POMS (Profile of Mood States) survey prior to the test.
3. Subjects were asked to use a tablet terminal to input designated texts. Flick input was used as the input method. Subjects were in a standing position, and input processes were recorded by filming with video (a camera was attached to respective subject's head).
4. The POMS survey was administered to subjects after the test. Subjects were also asked to write their subjective evaluations on a questionnaire paper. Using the above-described process, for each individual subject, the test was performed twice (2 times; once in a state where operation sounds were generated on the tablet terminal ("with operation sounds" state), and once when no such operation sounds occurred ("without operation sounds" state)). As identical texts were used in the second test, to ensure that no differences occurred due to subject learning levels (proficiency), the order in which each subject had either operation sounds or no operation sounds was made random, and the second test was given after the space of three or more days from the first test. Subjects were not informed of the change in the state of operation sounds on the tablet for the second test. Two texts were used for input: the "*Iroha*" song (the Japanese "alphabet song") and the "*Torinaku*" song ("The Birds are Singing") (Fig. 3).

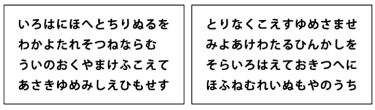

Fig. 3. Texts used left: the "*Iroha*" song, right: the "*Torinaku*" song

4.2 Research Results

1. Changes in feeling (mood). Analysis of variance was performed regarding changes in feeling (mood) pre- to post-test. The results showed that, in the "with operation sounds" state, no significant differences appeared for any of the six (6) scales

(Table 1). Meanwhile, in the "without operation sounds" state, the p value of "A feeling of vitality/energy" was 0.042 ($p < 0.5$), thus a significant decline (Table 2).

2. Subjective evaluations. Analysis of variance was performed regarding subjective evaluations of the respective "with operation sounds" and "without operation sounds" states. The results showed that the p value of "the difficulty level of inputting the texts" was 0.096 ($p < 0.1$), confirming marginal significance (Table 3). In other words, the results showed that, in regards to the difficulty level of inputted texts, the "with operation sounds" state had a trend of "feeling easier". Also, although no significant difference appeared for the other categories, a decline was seen in all scores.
3. Working speeds. In the tests, measurements were made of time taken for character input, and mean values were calculated. The results were as follows: "with operation sounds" state, 100.6 s; "without operation sounds" state, 105.3 s. The result of a t-test showed no significant difference. No significant differences occurred in the subjective evaluations of identical question categories. Thus, both quantitatively and qualitatively, the presence or absence of operation sounds had no effect on working speeds.

Table 1. Changes in feeling (mood): "With operation sounds" state

	Measurements before the Experiments	Measurements after the Experiments	Comparison of Measurements before and after the Experiments (P<0.05)
T-A	3.2	3.2	n.s.
D	2.0	1.1	n.s.
A-H	2.0	0.4	n.s.
V	4.4	4.3	n.s.
F	3.7	2.4	n.s.
C	6.0	4.8	n.s.

Table 2. Changes in feeling (mood): "Without operation sounds" state

	Measurements before the Experiments	Measurements after the Experiments	Comparison of Measurements before and after the Experiments (P<0.05)
T-A	4.2	3.6	n.s.
D	2.1	1.1	n.s.
A-H	1.5	0.1	n.s.
V	5.6	2.3	P<0.05
F	4.3	1.9	n.s.
C	6.5	5.5	n.s.

4.3 Considerations

The above-described results show how the presence or absence of operation sounds impact text-inputting operations on a tablet terminal. In a state where operation sounds

Table 3. Subjective evaluations in "with/without operation sounds" states

Question	sound	No sound	Comparison of Measurements sound and no sound the Experiments (P<0.05)
Amount of character input	2.8	3.2	n.s.
Time of character input	3.0	3.3	n.s.
Tub-flick of reaction	3.1	3.2	n.s.
Difficulty of the sentence	2.7	3.3	P<0.1
Weight of the tablet device	3.1	2.9	n.s.

are present, surely a sense of security regarding operations is obtained from the auditory feedback, helping to control any decline in the sense of vitality one has when engaging in operations. Thus, operation sounds are thought to have the effect of maintaining vitality when performing text-inputting operations. As for time required for text-inputs, the presence or absence of operation sounds had no effects. Meanwhile, in prior research, it was shown that when touch-panel devices were operated, the state where auditory feedback is provided had reduced input times [5]. Thus, further investigation is required, including by increasing the numbers of subjects, examining differing input contents, etc.

5 A Tool for Investigating the Effects of Operation Sounds on Text (Character)-Input Operations

We learned from this study that operation sounds serve to maintain the vitality/energy of users, and that with operation sounds, even large amounts of text inputting can be performed without feeling boredom. We also considered that the recent increased daily use of tablet terminals for email, uploads to social network systems (SNS), etc., entails increased character (text)-inputs, meaning that the effects of operation sound differences are important. Thus, based on the results obtained from this study, we made a tool for investigating the effects of a variety of different operation sounds on character (text)-input (Fig. 4).

Fig. 4. Prototype image of tool

6 Conclusion

To clarify the effects of operation sounds on character (text)-input operations on tablet terminals, we surveyed such effects on test subjects' changes in feeling, subjective evaluations, working speeds, and working styles. As for changes of feeling, results showed that the "with operation sounds" state served to dampen reductions of "vitality" (energy) in users. Among the subjective evaluations, in regards to "difficulty of inputting text," the "with operation sounds" state tended to be felt as easier for text inputs. As for time required for text (character)-inputs, the presence or absence of operation sounds had no effects in our study. However, in prior research, cases have been reported where the existence of operation sounds resulted in reduced input times. Thus, further investigation is required with differing test environment arrangements. A further note is that no test subjects became aware that a change had occurred in the operation sounds state during the test period. We think that this is due to the fact that although people perceive operation sounds with their senses, it is done unconsciously. From our test results, we learned that operation sounds do have an effect on character-input operations. We also believed that study is required regarding how changes in operation sounds impact character-input operations. This time, we were unable to change operation sounds for the tablet terminals used, so we searched for an application that would permit a tablet to serve as a test device having operation-sound changing functions; to our knowledge, as of the current point in time, no such application existed. We thus believed that to enable smoother testing in future surveys of effects due to operations sounds on tablet terminals, a more suitable test device was required; we therefore created a tool for investigating the effects of a variety of operation sounds on character-input operations.

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