

Creation of operating feeling of rotary switches in consideration of the combination of tactile sensation and operating sound

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Rotary switches are used as control elements for various in-vehicle products such as car audio devices and air conditioning systems because of their high usability. It is known that the operating feeling of switch products influences our impression of the vehicle as a whole. Thus, the operating feeling needs to be designed appropriately by understanding the correspondence with the relevant physical characteristics.

In this study, we conducted two subjective evaluation experiments to understand the correspondence between the operating feeling of rotary switches and physical characteristics. In experiment 1, the participants responded to their impressions during the switch operation with an onomatopoeic free-answer. In Experiment 2, the participants responded to their impressions of the same stimuli as in Experiment 1 with adjective pairs using the semantic differential method. For the experiment, twenty types of stimuli were used, which consisted of a combination of tactile stimuli (five different click torques) and operating sounds (two volume levels and two sharpness conditions). For the presentation of the stimuli to participants, we used a simulator that can simulate the operating feeling of rotary switches

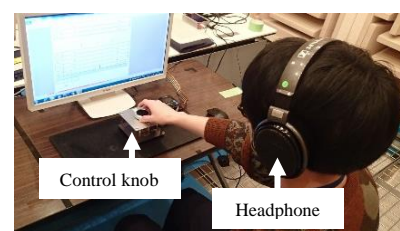


Fig. 1 Experimental setup

(Fig. 1). The simulator was designed to present the tactile sensation by turning the knob, and play the operating sound through headphones.

Experiment 1: The results of the correspondence analysis showed that the onomatopoeia used by the participants differed depending on the magnitude of the physical characteristics (Fig. 2). Focusing on the phonology of the onomatopoeia, the vowel /i/ and vowel /o/ tended to appear in the high sharpness operating sound and the low sharpness one, respectively. In addition, the larger the click torque and the operating sound volume, the more voiced consonant tended to be expressed.

Experiment 2: Factor analysis was performed on the experimental results, and the correspondence between the factor scores and the physical characteristics was examined.

From the correspondence between the experimental results and physical characteristics in Experiments 1 and 2, we found a relationship between onomatopoeia and adjectival expressions associated with impressions during rotary switch operation (Fig. 3). These findings are useful for creating quantitative feeling of switch operations.

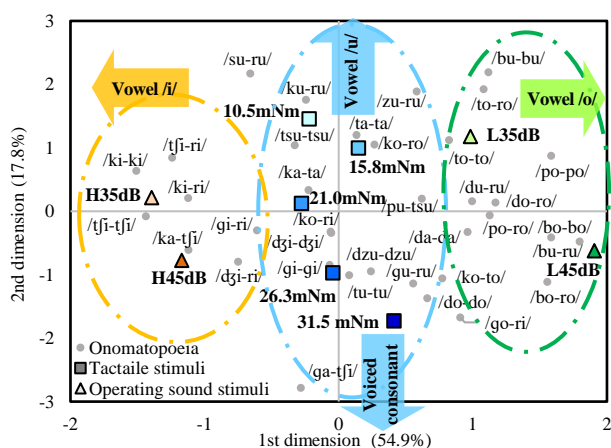


Fig. 2 Correspondence analysis results of 1st experiment

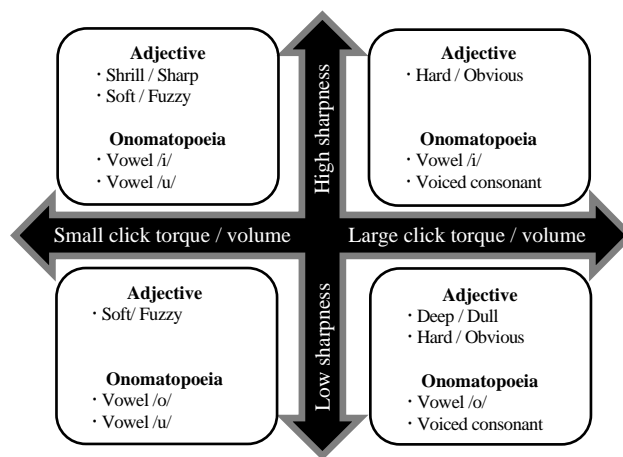


Fig. 3 Relationship between adjectives and onomatopoeias