

Understanding Floor Haptics: The Effect of Soft and Hard Material on Decision of Room Exit

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I. INTRODUCTION

Flooring is an essential material in the building that supports our daily life [1], and since it is in constant physical contact with the human body, the body continuously receives subtle tactile information from the ground. From this perspective, an approach has been proposed to consider the floor as an ambient haptic interface [2]. In relation to this, research has been conducted on haptic feedback through vibration techniques on the floor surface [3] and changes in floor shape [4]. However, the effects of changes in floor tactile stimuli on human behavior have not been sufficiently explored. Preliminarily, we explored the effect of floor material on object perception and suggested an internal somatic model [5].

This study aims to examine the subtle effects of floor texture on decision-making behavior under stress, conducting an experiment with 99 participants. The experiment clarifies the subtle influence of tactile stimuli provided by flooring on people's behavior and cognition, offering a new perspective on the use of haptic feedback in spatial design. This research aims to establish a theoretical foundation for integrating haptic feedback into spatial experiences and provides insights into the potential of tactile approaches in future design practices.

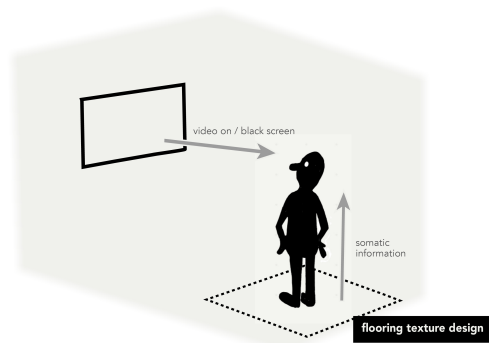


Fig. 1. Diagram explaining the effect of tactile stimuli from the floor on human behavior.

II. METHODOLOGY

Two rooms, having the exact same dimension with each other, were prepared for the experiment, one with a soft carpet floor (Hantaf Black W100% 30mm Shaggy 1800 grit) and the other with hard tiles (Sanwa NB-6000P (matte)). Each room measures approximately 12 m² (3.96 m × 2.875 m), and black was used as the base color to minimize the effect of visual impact. Upon arrival at the venue, participants provided consent for wearable sensor measurements and video recording, changed into slippers, and completed a pre-experiment questionnaire. Qualitative data were gathered through questionnaires administered before and after the experiment, while quantitative data were obtained from measurements captured by wearable sensors. These datasets were cross-checked to verify the consistency of behavioural responses, experiential reports, and physiological measures.

The experimental procedure is divided into three phases: before, during, and after (see Figure 2). Upon arrival, researchers obtain participants' consent for wearable-sensor monitoring. Participants then complete an online pre-experiment questionnaire on an iPad. After submitting the questionnaire, they change into slippers and are fitted with the wearable sensors. The area for this procedure was a wood floor with 1m x 1m sized wood planks. Following this, researchers provided a brief introduction: "Today, you will enter the experiment room. Inside the room, a video will be playing. Please feel free to spend some time at your leisure. Watch your step." Participants were not informed of the experiment's purpose until the procedure was completed, nor were they explicitly told any criteria for leaving the room. At this time, the floor in the preparation area was covered with a 3.5 mm-pile grey tile carpet—a very standard specification for tenant buildings in Japan. The experiment began when the participant enters the assigned room. A pre-recorded video, designed by the researchers, played for two minutes before the screen abruptly turned black. The black screen lasted for 8 minutes, during which no instructions were given to the participants. Then, 10 minutes after entering the room, the message "The experiment is over" appeared on the screen, and participants were instructed to exit the room. Finally, participants completed a questionnaire assessing their experience.

A total of 99 individuals participated in the experiment, with 49 participants assigned to the soft-floored room and 50 to the hard-tiled room. The sample included 45 males and 54 females, ranging in age from their 20s to 50s. Each

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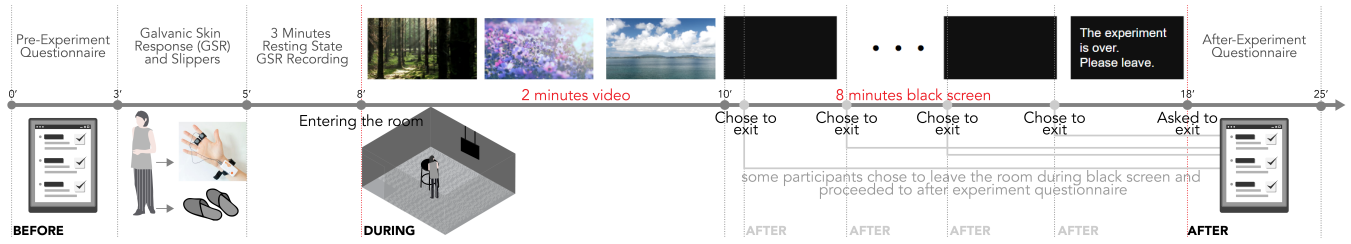


Fig. 2. Experimental procedure of before, during, and after the experiment.

participant entered only one room.

III. RESULT AND DISCUSSION

A. Result

The results of participants' exit behavior in each room are shown in Figure 3. Specifically, a statistical test was applied to assess the trends in exit behavior, using a two-step scale. The results showed a statistically significant difference between whether participants chose to exit or were asked to exit, with a higher percentage of participants choosing to exit in the room with the soft floor ($p < 0.05$).

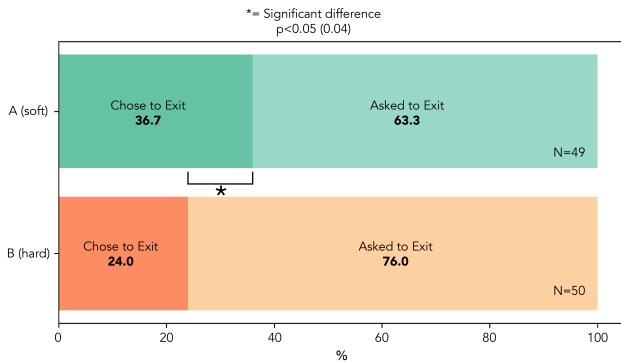


Fig. 3. Bar chart showing the exit behavior of participants in each room: Room A (soft floor) and Room B (hard floor).

B. Discussion

Here we discuss what we could summarize based on the aforementioned experimental results. At a most foundational level, these results suggest that the type of floor material measurably influenced whether participants chose to exit the room or not. The results suggest that the softness of the floor may facilitate certain behavioral tendencies. On the other hand, in the hard-floor condition, more participants remained in the room until the end of the experiment and stayed until they were asked to exit. In other words, when participants experienced a conflict between staying in the room or exiting, those in the soft-floor room were slightly more likely to choose to exit rather than simply staying.

In future research, it is important to further analyze the data while considering both cognitive and physical approaches to investigate the detailed mechanisms behind why the soft floor might facilitate exit behavior. These discussions are still fundamentally preliminary. The analyses

of the qualitative data obtained from the pre- and post-experiment questionnaires and the quantitative data collected via wearable sensors remain insufficient; therefore, an integrated analysis of all the collected data would be next steps.

IV. CONCLUSION

This study conducted a preliminary examination of how floor texture influences behavioral choices under stress. The experimental results revealed that participants in the room with the soft floor were significantly more likely to choose to exit, suggesting that the tactile properties of the floor subtly influence behavior ($p < 0.05$). These results demonstrate the influence of floor materials on people's behavior and cognition, offering new insights into the use of haptic feedback in spatial design. Specifically, this study shows that the influence of floor texture on participants' behavioral choices can be understood quantitatively in the context of spatial experience design. Additionally, the findings of this study suggest the potential to strengthen haptic approaches in spatial design, offering possibilities for creating more comfortable and effective environments. Future research should explore the detailed mechanisms behind why soft floors promote exit behavior by combining cognitive and physical approaches to further data analysis.

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