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DESIGN OF SMART BRACELETS: CURRENT TRENDS

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The paper analyzes modern trends in the design of smart bracelets. The impact of the design-ergonomic properties of materials for the manufacture of a smart bracelet on its tactile perception by the consumer has been revealed. The most common design and ergonomic characteristics of materials corresponding to modern trends in the development of smart straps are listed.

Key words: *design, modern trends, tactile perception, smart bracelet.*

INTRODUCTION

The application of smart devices, in particular smart bracelets, has led to large-scale research on the relationship between the design and ergonomic characteristics of materials for their manufacture and tactile feedback. The smart strap is designed for tactile contact with sensitive parts of the body, so it is usually used to wear on the wrist not only as an accessory, but also to provide the most effective feedback when transmitting spatial tactile information. Therefore, the need for an in-depth analysis of modern trends in the application of materials for the manufacture of smart bracelets and the impact of their design-ergonomic characteristics on the user's tactile perception is obvious.

PURPOSE

The purpose of this study is to explore the modern trends in the application of design-ergonomic characteristics of materials used in the manufacture of smart bracelets to improve the effectiveness of their tactile feedback.

RESULTS AND DISCUSSION

Today, as a result of the rapid development of smart technologies, samples of new products appear, and as a result, the list of tasks for their design is also expanding. In particular, smart bracelets used for tactile contact are widely distributed, since the tactile sense organs of the skin can detect various stimuli, such as touch, vibration and temperature [1]. Recent research has suggested a variety of haptic modes used to provide feedback specifically on the wrist. Material texture and human computer interaction (HCI) are interconnected and span disciplines such as tactile perception, computer vision, and haptic sensing. The integration of information from touch, proprioception, and kinesthesia is crucial in the complex process of material texture perception [2]. It is not enough for us to passively experience the properties of an object when it is placed in our hands; we rely on proprioceptive information from our hands to accurately perceive its shape. It is important to understand the difference between touch and tactile sensations.

Tactile perception involves active touch that allows us to gather information about objects and surfaces.

An experiment was conducted specifically to explore the neural correlates of pleasure judgements and information perception brought about by different materials in contact with the wrist and fingers. For this purpose, multiple custom-built materials stimuli with either a smooth or a rough surface, and in form of a decontextualized, flat sample were used [3]. Decision for these materials and the stimulus manipulation was based on the intention to portray a lifelike depiction of aesthetic processing, which includes the usage of actual, physical materials as well as the exploration of these using common hand gestures [4].

This study demonstrates that material properties play a significant role in human tactile cognition during complex information transfer. The experiment reveals that different stimulus materials can elicit distinct tactile sensations when actively touched. The behavioural results align with previous research, indicating that the participants found smooth materials to be more comfortable than rough materials [5]. This was observed for both textiles and hard objects, with smooth wood rated slightly higher than smooth textiles. The results showed that not only was the primary somatosensory cortex region of the brain activated when touching materials, but the PFC region was also activated during the touching process, which is related to the behaviours of pleasure perception, response execution, memory retrieval and emotion evaluation.

The integration of haptics into design, as evidenced by the activation of parietal and prefrontal brain regions during active touch experiences, also plays a critical role in shaping user experience. This underscores the importance of material design and tactile interactions in influencing neural responses and, ultimately, in shaping how users perceive and interact with products and interfaces. Haptic technology has been shown to activate areas traditionally associated with visual processing, suggesting a cross-modal effect on brain activation. In material design, the fusion of haptic technology with virtual environments has been investigated, enabling the rendering of haptic forces in response to user interactions.

The smart wristband consists of a wristband body and a wristband (fig. 1). The main body of the bracelet is a functional area for various indicators monitoring, information viewing, and vibration and tactile feedback with the skin. The wrist strap is worn and needs to be in long-term contact with the skin, so it is necessary to pay attention to material comfort and durability.

Thermoplastic polyurethane (TPU) has high strength, high toughness, wear resistance, oil resistance and other excellent comprehensive properties, suitable for a wide range of fields, such as footwear, medicine, automotive and so on. For smart bracelet varieties, the advantages of TPU material include softness and comfort, wear resistance, waterproof, ingress resistance, environmental protection and non-toxicity. Currently, TPU is one of the main materials for smart bracelets.

It is worth noting that when choosing materials for the manufacture of the body part of the smart bracelet, the aesthetic perception of the textured solution should also be taken into account. Plastic with a matte surface is most often used today. In addition, matte plastic has advantages such as corrosion resistance, low production cost, durability, waterproof, light weight, easy molding, etc. Because matte plastic surfaces are harder, vibration can provide stronger tactile feedback to the user.

Fig. 1. Smart bracelet (from the official website of Xiaomi smart bracelet)

CONCLUSIONS

This study responds to the need for HCI. It is based on the block paradigm and uses near infrared spectroscopy to study the effects of active touching of different materials on users' brain activation. The main purpose is to explore the difference in the perception of users when touching different materials, and provide theoretical support for the blind operation of smart bracelet functions and wearing comfort in daily life. The cognitive arousal response after active touching of materials was also investigated using the fNIRS technique. The results showed that not only was the primary somatosensory cortex region of the brain activated when touching materials, but the PFC region was also activated during the touching process, which is related to the behaviours of pleasure perception, response execution, memory retrieval and emotion evaluation. The primary somatosensory cortex region of the brain was more strongly activated when touching rough materials. Different materials can affect HCI. Therefore, in interaction design, it is necessary to design different tactile feedback and material textures for smart bracelets. Therefore, it is recommended to use smooth and soft materials, such as TPU wristbands, to ensure wearing comfort, and rough and hard materials, such as frosted plastic, to provide strong and timely feedback in the functional module area.

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