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A requirement-scenario-experience framework for evaluating wearable and fashionable design: Presenting underlying factors of user loss

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ABSTRACT

Owing to the inevitable trend of intellectualization and digitalization, wearable and fashionable products are popular as a new product form in the past five years. Nevertheless, these kind of smart products are not widely and continuously used in daily life. This paper analysed the design intention and cognitive interpretation form of wearable and fashionable design and reveals the connection among user motivation, behaviour and perceived value in using smart products. Then we propose an evaluation framework for a better understanding of the attributes, 5 impact factors of wearable and fashionable design using a three-dimensional impact matrix approach. The framework is applied to the evaluation of two pairs of wearable and fashionable products by five designers and proved to be effective for designers to evaluate the risk of smart and fashionable design to put on the market. We expect the framework can be used as basic design knowledge of design evaluation in the realm of wearable and fashionable product design.

1. Introduction

Taking health care, social entertainment, fashion and other typical application scenarios as the breakthrough point, different kinds of wearable and fashionable products burst into market in the past five years (Amjadi et al., 2016). Despite the emergence of a large number of wearable and fashion devices, wearable interactions are actually seldom found and popular on the street (Kobayashi et al., 2009; Shim et al., 2007). Just like Donald A. Norman pointed out: "all new technologies will take a while for us to figure out the best manner of interaction as well as the standardization that removes one source of potential confusion" (Norman, 2010). In fact, there is still a long way to go before wearable and fashionable devices and clothes can be truly integrated into our daily lives. What is currently particularly interesting is the potential in combining wearable and fashionable devices and clothes: the fashionable smart devices have vast computation capabilities and connectivity (Amjadi et al., 2016; Lumsden and Brewster, 2003), while the wearable sensors and actuators can be placed at various parts of the body to allow more direct, accurate and always accessible input/output (Yoon et al., 2016). Looking at the well-known fashionable and wearable products at the 2016 Paris fashion & Technology Exhibition whose theme is "Wearable Fashiontech Festival", such as "AWE Goosebumps" or music jacket named "Showpiece", shown in Fig. 1, it becomes apparent that these devices are actually internal sensors, battery and CPU that increase the sensing capability of the clothes (Amjadi et al., 2016; Deckers et al., 2011; Liang et al., 2013). These fashionable and wearable smart clothes mainly fulfill basic use-cases and applications, nowadays mainly in the fitness, emotion monitoring and eHealth domain (Desmet, 2015; Juhlin et al., 2013), but in a way of fashion expression (Hassenzahl et al., 2015). In fact, sophisticated computer sensing technology makes this possible that smart wearable devices utilize these sensors to expand the variety of use cases and applications to different domains (Lumsden and Brewster, 2003). However, the integration of technology and fashion into a piece of clothing is not a simple matter, and designers will face more design constraints and decision-making trade-offs than ever before.

To facilitate this transition, the integration from the wearable computing to fashionable and wearable interaction design is one of the important change for wearable devices (Kobayashi et al., 2009; Wensveen et al., 2000). This motivates to investigate a new design evaluation framework for mobile interaction that takes into account the sensing, emotion communication, usability and the context (Hallnäs and Redström, 2001). Smart wearable devices are traditionally associated with functionality and utility of needs, whereas fashionable products deal more with aesthetic, symbolic, and cultural meanings, as well as our emotional needs as individual and social beings (Kawamura, 2005). Fashion-oriented design encourages ingenuity, imagination and

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Fig. 1. The fashionable products of Paris fashion & Technology Exhibition.

innovation (Stevens and Walker, 2002). Fashion entails aesthetic values that can compete with functionality and enhance enduring value (Pan et al., 2015). As special form of fashion, wearable and fashionable products should consider all the aspects mentioned above, what makes the design and interaction hard to satisfy the needs of customers. Meanwhile, it is easy for designers to show a "wow" wearable devices to the customers in the first time they saw it, but difficult to ensure the continuous use of the product and keep stickiness (Lin and Cheng, 2014).

Nevertheless, due to the inevitable trend of intelligent, digital and continued interest in wearable technology, a large amount of smart clothes, wearable equipment is still being designed and produced on a global scale, and fashion and stylish design is becoming more important to hardware manufacturers accordingly (Chung et al., 2013). While current dealing with the limited sensing capabilities as well as limited fashion possibilities offered by the devices themselves, wearable and fashionable design can augment these possibilities (Amjadi et al., 2016; Kobayashi et al., 2009; Yoon et al., 2016).

Understanding user requirement is considered as an important aspect of interaction design of smart devices to ensure the highest level of usability (Zhou et al., 2011). Meanwhile, user experience, to some extent, determines the quality of the products or the services, having a great influence on user stickiness (Tomico et al., 2006; Wang and Yu, 2016). However, experiences with products are to be ascribed in part to the products, as the remaining part is due to the context in which the interaction occur and to the users themselves (Pucillo and Cascini, 2014). Because of its characteristics of miniaturization, close fitting, intelligent adaptation, the wearable and fashionable devices present more challenges of the way of interaction between human and wearable devices (Chung et al., 2013; Shim et al., 2007). In the same way, the ultimate goal of wearable and fashionable product design is to satisfy some requirements such as fashion needs, or to obtain some kind of services through the human-product interaction, including aspects of tangible interaction and the invisible emotional exchange, both from the objective and subjective perspectives, and internal external aspects (Gero and Kannengiesser, 2004; Woodruff, 1997).

There has been a wide range of papers about wearable computing (Chung et al., 2013; Shim and Park, 2009; Yoon et al., 2016), sensing technology, usability testing of interface and other aspects about how to design strong sensing and friendly smart devices (De Angeli et al., 2006; Khan et al., 2011; Vatrapu et al., 2008). However, few methods and little guidance can be found in design research literature about how to evaluate the wearable and fashionable design in a macroscopic perspective, not merely limited to product design, interaction usability, aesthetic evaluation and function realization etc.

In this paper we reviewed the difficulties we faced in wearable and fashionable design, and presented some cases on how to take dynamic requirement and diverse user experiences into consideration in wearable and fashionable product development. We also discussed the relevant aspects of different user scenarios of the fashionable smart devices and cognition gaps between designers and users. The focus of this article is how to evaluate the wearable and fashionable design and gain continuous usability (Han et al., 2000). We created an evaluation framework by identifying wearable and fashionable design attributes and impact factors to understand user perceived value and their design directions for the promotion of sustainable use. We then verified the framework is applicable through a case study about two pairs of wearable and fashionable product experienced by five designers. This paper is not a conflict to interaction usability or fashionable aesthetic evaluation (De Angeli et al., 2006; Leder et al., 2004), but a complement and further guidance for dealing with user loss of wearable and fashionable products around the topic of user requirement, scenario and user experience.

The paper is organized as follows. In Section 2, we present the links between design intention and user cognitive interpretation in product design, and the influence of user motivation, behaviour and perceived value on wearable product design. After describing the situation of dynamic user requirement and diverse UX in design in Section 3, we explain the behind driving factors of this situation in wearable and fashionable product design in Section 4. Then, in Sections 5, the requirement-scenario-experience framework (RSEF)of wearable and fashionable product design was constructed and applied to a case study. Discussion and further work are presented in Section 6.

2. Understanding design intention and cognitive interpretation

2.1. Design intention and cognitive interpretation

The understanding of the links between design intention and user cognitive interpretation of the product is still low, especially in a new design area, including fashionable and wearable product design. The difficulty lies in the fact that the user's feeling of a new product is a more complex cognitive process and many intricate factors contribute to the perception mechanisms (Da Silva et al., 2015). With some asymmetry in the design information, designers and users, as the two sides of information exchange, are not only the own unique cognitive subjects, but the co-creator of meaning achieved through communication. It is difficult for designer to completely obtain the design knowledge from the users, even using the method of user participation or empathy into design process (Høiseth and Keitsch, 2015; Kang et al.,