Quality Features of Wearable Technology Embedded Products Using the Kano Model

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Introduction. In our current society, wearable technologies are being used in many different sectors, namely in the fields of health and medical care, fitness and sports, emergency responses, and defense. The wearable market of these sectors has been projected to increase from U.S. $20 billion in 2015 to U.S. $70 billion by 2025 (Raj & Ha-Brookshire, 2016). Though having a bright future in the market, studies (e.g., Fortmann, Heuten, & Boll, 2015) show that after the first purchase, one third of the consumers stop using wearable technology embedded products, referring smart products integrating with information technologies, electronic gadgets, or wearable computing devices that are suitably worn on the body (Biscontini, 2018). Thus, the overall purpose of this study is to identify the major quality features of wearable technology embedded products that have the greatest impact on consumer satisfaction, using the Kano model, an organized approach to specify consumer requirements and expectation through a preference classification technique (Kano, 1984). Two specific research objectives are to: (a) classify the quality features of wearable technology embedded products and (b) examine the consumer satisfaction and dissatisfaction indices for the quality features of these products.

Background. Within the Kano model (1984), each quality feature of a product can be classified into the following five categories: (a) one-dimensional quality (O); (b) attractive quality (A); (c) must-be quality (M); (d) indifferent quality (I); and (e) reverse quality (R). This model provides mathematical formulas to determine the consumer satisfaction index (SI) and dissatisfaction index (DSI) in order to specify the degree to which satisfaction increases if the performance level of a quality feature increases and the extent to which satisfaction decreases if the performance level of a quality feature decreases (Berger, 1993). This method has numerous applications in diverse industry sectors (e.g., automotive, software product, healthcare); but little research has been conducted about its application on examining the quality features of wearable technology embedded products in the fashion discipline, which makes our study be unique.

Methods. An online survey consisted of three sections: (a) an open-ended question asking participants' level of understanding on wearable technology; (b) 22 close-ended questions about their satisfaction level on the 11 quality features of wearable technology embedded products, which include comfortability, durability, long battery life, nice product design, privacy and personal data security, product functionality, product safety, reasonable price, sustainability, usability, and wash-ability (Arnow, 2016; Baig, Gholamhosseini, & Connolly, 2013; Marakhimov & Joo, 2017; Sultan, 2015); and (c) demographic information. The 5-point Likert-type scale, ranging from "strongly disagree" (1) to "strongly agree" (5), was used to measure each of the 11 quality features. Data from the open-ended question was analyzed using content

analysis approach. For the demographics and close-ended questions, SPSS software was used to run basic descriptive statistics, frequencies, and correlations. To examine the 11 quality features to develop the consumer satisfaction and dissatisfaction indices, Microsoft Excel was used for coding the quality features and then the following Kano mathematical formulas, SI = (A+O)/ (A+O+M+I) and DSI = (O+M)/ (A+O+M+I), were used to develop SI and DSI, ranging from 0 to 1. For SI, the greater the value is, the heavier the impact on consumer satisfaction is when the performance level of quality features increases. For DSI, the greater the value is, the heavier the impact on consumer dissatisfaction is when the performance level of quality features decreases.

Results and Discussion. A total of 471 usable study participants' ages ranged from 19 to 72 years old with a mean age of 35. Around 61.35% had education higher than some college degree. Around 55% were males and the rest were females. The majority was Caucasian/ European American (74.3%), followed by African American (9.98%), Asian (7.22%), Hispanic American/Latino (5.52%), and others (2.98%). They were employed in various fields (e.g., software developer, engineer, teacher, student). The most participants (97%) identified themselves as the users of wearable devices (e.g., Apple or Samsung smart watch, Fitbit), but they had limited experiences to use wearable apparel (e.g., smart shoes, smart clothing). The participants generally connected the word phrase "wearable technology" with 'fitness tracker' (20.76%), 'smart watch' (15.67%), 'easy to use' (14.31%), and 'innovative technology' (6.52%). These selected phrases convey that the participants perceive wearable technology as a compact, handy, or functional device to wear on the upper body (e.g., arm, wrist).

Results of the consumer SI greater than 0.8 indicated that the increased performance level of durability (0.901), long battery life (0.894), privacy and personal data security (0.891), usability (0.884), reasonable price (0.884), product safety (0.875), comfortability (0.872), and product functionality (0.816) would increase consumer satisfaction, comparing to that of nice product design (0.794), wash-ability (0.762), and sustainability (0.681). As per the consumer DSI greater than 0.8, the decreased performance level of durability (0.881), long battery life (0.865), product safety (0.853), usability (0.842), comfortability (0.842), and reasonable price (0.805) would decrease consumer satisfaction, comparing to that of privacy and personal data security (0.772), product functionality (0.765), nice product design (0.720), wash-ability (0.603), and sustainability (0.597). Among the 11 quality features, the following six quality features obtained the value greater than 0.8 for both consumer SI and DSI: durability, long battery life, usability, product safety, comfortability, and reasonable price, which means these quality features play a significant role to the level of consumers' satisfaction or dissatisfaction.

Conclusion: Using the Kano model, we have found that the performance level of durability, long battery life, usability, product safety, comfortability, and reasonable price have the greatest impact on consumer satisfaction of wearable technology embedded products. However, the quality features (e.g., nice product design, sustainability, wash-ability) which might be highly related to wearable technology embedded apparel (e.g., smart shoes, smart clothing), showed less significant impact on consumer satisfaction in this particular study. Since 97% of the study participants identified themselves as the users of wearable devices, their

experiences of using these devices might influence to the results of this study, which limits to fully capture the important quality features of smart apparel. Future research is recommended using users of smart apparel as study participants to evaluate the unique quality features needed.

Furthermore, in wearable technology embedded products, tracking activities (e.g., fitness, physical wellness, mental health) are the key function that further supported by the content analysis of this study, where the participants generally connected the word phrase "wearable technology" with 'fitness tracker'. However, the absence of this tracking dimension in this study based on the Kano model limits to fully understand the main features of consumers' satisfaction of wearable products. Examining the tracking feature of wearable products is one of the suggestions for future research. In spite of having some limitations, the findings of this study may help designer, developers, and producers of wearable products to prioritize the quality features during the product design, development, and manufacturing process. This study also has implications for future research by introducing the Kano model to the apparel design and product development area, which can be integrated with other design and product development related theoretical models when designing, developing, and evaluating various apparel products.

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