



## A Wearable System Design for Outdoor Activities and Tourism

Helen S. Koo, and Kristy A. Janigo, University of Minnesota, USA

Keywords: wearability, design, product development

**Introduction.** As outdoor and tourism activities are increasing in popularity, specialized luggage and bag markets are emerging to fulfill these niches. A portable wearable system, or a wearable bag, can carry personal items and provide mobility and freedom for both hands. When designing accessories, it is necessary to deeply understand the users, context of usage, and existing products (Moen, 2007). The purpose of this study was to gather perceptions of potential consumers and to identify crucial factors to guide future wearable bag design and development.

**Literature Review.** A literature review was conducted to determine what aspects must be considered for wearable bag design. Gemperle, Kasabach, Stivoric, Bauer, and Martin (1998) researched wearability. They found eight general unobtrusive parts of human body suitable for attachment or placement of wearable objects. These included the collar area, backs of upper arms, forearms, rear, the sides, front ribcage, waist, hips, thighs, shins, and tops of feet. Dunne and Smyth (2007) studied psychological comfort of wearable objects and found the body schema and peripersonal space must be carefully considered. Tamura, Yoshimura, Sekine, Uchida, and Tanaka (2009) proposed that wearable bags be small, lightweight, and simple to wear.

**Theoretical Framework.** LaBat and Sokolowski's (1999) three-stage design process consists of the following steps: 1. problem definition and research, 2. creative exploration and development, and 3. implementation. We will follow this framework for development of wearable bags. Our research fits into the first stage. We have sought to understand how people perceived wearable bags and how they felt when using them. Another goal of our research was to understand what people expect and value when purchasing and using wearable bags. Lamb and Kallal's (1992) Functional-Expressive-Aesthetic (FEA) model guided our development of questionnaires to explore participants' wants and needs for wearable bags.

**Methods.** Guided by previous researchers' findings (Tamura et al., 2009; Dunne and Smyth, 2007; Gemperle et al., 1998), measurement questions were developed to understand consumers' perceptions and feelings on wearable bags and the value of various design factors. The questionnaire was uploaded to Mechanical Turk, a website where volunteers can choose to participate ([www.mturk.com](http://www.mturk.com)). A total of 122 participants responded (age:  $m=31.2$ ,  $SD=10.3$ , range 21-67), 71 men and 41 women who enjoy outdoor activities and traveling. The questionnaire contained 34 questions: three questions about demographics; eight about outdoor activity behavior; seven about traveling behavior; five about fashion behavior; and 11 about wearable bag buying intentions. The questions were a mix of open-ended questions and close-ended questions (multiple choice and nine-level Likert scales from 1 strongly disagree to 9 strongly agree).

**Results and Discussions.** The data were analyzed with descriptive, one-way ANOVA, and Duncan test using SPSS 19.0. First, more than 80% of the participants responded that they need wearable bags when travel, and about 65% participants need the wearable bags during

outdoor activities as to carry important things (48%), handy (38.4%), safe (14.7%), increase mobility (5.9%), and even as look trendy (3%). Second, personal belongings carried in such bags included cell phones (20.5%), keys (16%), money and checks (14.5%), ID cards (13.4%), credit cards (11.5%), music players (10.7%), and other things (13.4%) such as maps, cosmetics, a passport, a camera, tissues, water bottles, and snacks. Thus, the size needs to be big enough to include those items. Participants carried personal belongings in their pockets (29.9%), wallets/purses (23.8%), waist bags (16.5%), shoulder bags (13.4%), bag packs (12.4%), and other locations (4%). Third, regarding functional needs for these wearable bags according to the FEA model, people wanted the bags to be waterproof, conveniently fitted to the body, lightweight, spacious, lockable, have multiple pockets, easy to use, durable, size adjustable, and easy to wash. In expressive aspects, they preferred not to attract others' attentions to the bag but to make the wearer look trendy. In aesthetic aspects, people (37%) wanted simple and modern styles with dull colors such as black and natural, rather than bright colors. Fourth, in the image survey on consumers' purchasing intentions for nine different wearable bag types in the market, there were significant differences among bag types after ANOVA analysis ( $p \leq .05$ ). The most wanted bag type was a simple, black, size adjustable bag. The next group with five bags had a colorful and noticeable design, and the least wanted group consisted of three bags in black color with too big or small sizes. Further insight was collected from the open-ended questions.

**Conclusions.** In this study, we gathered potential consumers' perceptions on wearable bags for outdoor activities and travel to define how existing products in the market fell short of meeting their needs and to enable us to move to the next two stages in the design process (creative exploration and development, and implementation). This study was conducted online, so it will be beneficial to create wearable bag prototypes and interview actual users in person.

### References

- Gemperle, F., Kasabach, C., Stivorcic, J., Bauer, M., & Martin, R., (1998). Design for wearability. ISWC '98 Proceedings of the 2nd IEEE International Symposium on Wearable Computers, 19-20 Oct 1998, Pittsburgh, PA.
- LaBat, K., & Sokolowski, S., (1999). A three-stage design process applied to an industry-university textile product design project. *Clothing and Textiles Research Journal*, 17(1): 11-20.
- Lamb, J., & Kallal, M., (1992). A conceptual framework for apparel design, *Clothing and Textile Research Journal*, 10 (2), 42-47.
- Moen, J., (2007). From hand-held to body-worn: embodied experiences of the design and use of a wearable movement-based interaction concept. *Proceedings of the 1st international conference on tangible embedded and embodied interaction TEI'07*, 15-17 Feb 2007, Baton Rouge, LA.
- Tamura, T., Yoshimura, T., Sekine, M., Uchida, M., & Tanaka, O., (2009). A wearable airbag to prevent fall injuries. *IEEE Transactions on Information Technology in Biomedicine*, 13(6): 910-914.