Viewers’ Sensations: Using Skin Sensor Technology to Assess Wearable Technology

Virginia Rolling, Georgia Southern University

Karla Teel and Steph Courtney, Auburn University

Keywords: Electrodermal activity (EDA), sensory, wearable technology

Wearable technology has received incredible attention over the past decade in museum displays. Most notably, the Metropolitan Museum of Art (the Met) featured a technology-inspired gala opening for the exhibition Manus x Machina, which happened to be among the top ten most visited exhibitions of the museum (Met, 2016). This exhibition featured electronic wearable technology garments such as the Video Dress with over 15,000 LED lights (Bolton, 2016). In 2016, the Museum of Design Atlanta (MODA) featured wearable technology garments during the On You and Beautiful Users exhibition such as a dress called Pixi Interactive using over 500 LED lights to produce over 15 million different colors (Cochran et al., 2015), Imogen Heap’s Mi.Mu Gloves that produced musical sound with lit sensors from hand gestures (Said-Moorhouse et al., 2015; Warlick, 2016), and The Hood where by playing guitar sounds from lit-touch jacket sensors controlled with Bluetooth technology (Zeagler et al., 2015). These enhanced sensory experiences can be explored using physiological devices, which capture an individual's automatic responses. One example device is skin sensors which can measure several physiological responses including the wearer’s heart rate and electrodermal activity (EDA) also known as galvanic skin response (GSR) (Empatica, 2018). EDA measures the electrical conductance on the surface of the wearer’s skin which varies with their level of micro-perspiration (small changes in sweat gland activity) (Critchley, 2002). Thus, EDA can be used as an “objective measure of emotional behavior,” showing reactions to a wide variety of stimuli such as “novelty and familiarity, potential threat or reward, wins and losses, love and hate, anticipation and outcome, memory recall and cognitive work” (p. 133, Critchley, 2002). In this study, we used EDA technology to examine viewers’ sensations (S) in reaction to various sensory cues of a wearable technology garment displayed as an artwork. This study uniquely applies the sensation aspect of Shimamura’s I-SKE theory (2013) using EDA skin sensor data from viewing a wearable technology garment as an artwork. The application of skin sensor devices to conduct wearable technology research has both methodological significance as well as

being unprecedented in the areas of apparel, aesthetics, and museum research. This study concerns wearable technologies as aesthetic objects, displayed as art, which has yet to be examined according to our literature search. Arousal experiences from multisensory artworks can lead to increased sensory input. With varied sensory properties to view in wearable technology, it is uncertain which cues will instigate a pleasurable sensory experience. Since wearable technology has the additional multisensory properties of digital music and colored LED lights, the viewer’s senses may be stimulated for a pleasurable sensation. This research was conducted at MODA located in the southeastern United States. This study was set up to determine museum visitors’ aesthetic experiences from exposure to various ways to view the wearable technology examples (i.e., dress-only, music-only, lights-only, music-lights). The stimuli for the present study, the wearable technology dress, resembled a silk-painted kimono-style dress created as an artwork for display that illuminated colored LED lights in a

detachable belt while playing digital music. Electronics for the dress were encased inside the

back of the dress’s belt using Wi-Fi. The Institutional Review Board (IRB) approved this research. A flier was used to recruit millennial museum visitors at MODA between the ages of

19 to 37. In total, a purposive sample of 44 millennial museum visitors participated. Individuals that consented to and qualified for participation based on their age were asked to wear a wrist skin sensor before viewing the wearable technology in a private foyer area gallery space. They were asked to press record on the device to start the data collection and then wore the skin sensors for two minutes before entering the room with the stimulus (dress) in order to collect a baseline measurement of their electrodermal activity (EDA), and also reviewed the IRB information letter and consent information. As described above, because EDA varies greatly between individuals, a baseline measurement was needed for each person in order to analyze their EDA measured during the experimental period. Participants were escorted singularly into the room with the dress, but it was initially covered to be out of view. The participants were then asked to stand on a floor marker about six feet away from the dress. According to Short (2012), standing four to six feet away from an artwork, depending on the size, will provide a richer experience to viewing art in a gallery setting. Participants were informed that once the viewing began, they could view the garment at their leisure with no limit and could move closer to or further as desired. Each participant started out facing away and remained in this position until the researcher uncovered the dress and instructed them to turn around to view the dress. Each participant was then instructed to press the skin sensor button, turn around, and begin viewing and experiencing the dress. When the participant self-determined the end of their viewing time, they pressed the wrist skin sensor button a second time to finish recording. The researcher then quickly covered up the artwork so that future participants would not be pre-exposed to the artwork. The wrist skin sensor of the participant was then removed. Physiological measures for arousal were collected using this device (Empatica, 2018). These sensors measure EDA which indicates the participants’ arousal based upon sympathetic nervous system responses (Critchley, 2002; Ohme et al., 2011; Rajava, 2004). During Viewing 1 (dress-only), eight participants’ EDA levels are being reported. For Viewing 2 (music-only), ten participants’ EDA levels are reported. EDA levels for participants during Viewing 3 (lights-only) and Viewing 4 (music-lights) were all (11) recorded. Using Mixed ANOVA, the effect of viewing the dress-only for all participants had an increase in EDA (F=22.160, p<.001, with a large effect using a partial eta sp =.381). There was no effect on membership in the conditions (F=.391, p=.760) and no difference in the effect of the dress on EDA by condition (F=.132, p=.940, a small effect using partial eta sp., where a small effect is .01 or greater and this test has a .011). Overall, most participants experienced heightened emotional arousal when viewing the artwork, which aligns with previous research examining EDA responses to art, especially in museums (Bortz et al., 2019; Du et al., 2016; Jaimovich et al., 2013; Kalénine, 2016). Additionally, previous studies examining sensory experiences have correlated high engagement with pleasure and excitement. So while this study did not explicitly measure emotional valence, it is possible that our participants had a pleasurable experience with the piece (McCall et al., 2015; Salimpoor et al., 2009). However, some research has suggested that arousal and pleasure are not necessarily connected for unfamiliar stimuli. So this relationship requires more research to be understood (van den Bosch et al., 2013).

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