Fostering User Engagement: Improving Sense of Identity through Cosmetic Customization in Wearable Trackers

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ABSTRACT

Despite numerous health advantages wearable health trackers could offer, tracker users often abandon their devices after a short period of time. One reason for abandonment is users' lack of identification of their trackers as an accurate reflection of who and what they are (i.e., sense of identity). In this study, we examine the role of cosmetic customization (i.e., a modification of a given product's presentation) of a wearable health tracker in increasing one's sense of identity. Furthermore, we explore if one's sense of identity can explain the relationship between cosmetic customization and user engagement (assessed by attitude, exercise intention, and sense of attachment) with a wearable tracker. We conducted a between-subjects online experiment and found that individuals presented with a high level of cosmetic customization features experienced a higher sense of identity with a wearable health tracker, which in turn was associated with more favorable attitude, higher exercise intention, and greater sense of attachment towards the tracker than individuals presented with a low level of cosmetic customization features. Based on the study results, we recommend the designers of wearable health trackers to provide users with salient and recognizable cosmetic customization features so that users can establish a good "identity fit" with their tracker.

Author Keywords

Sense of identity; user engagement; customization; health tracking; personal informatics systems; self-tracking.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): User Interfaces.

INTRODUCTION

Wearable health trackers have become increasingly popular. For instance, Fitbit sold over 21.4 million of its wearable health trackers in 2015, double the number of 10.9 million that were sold in 2014 [5, 16]. Garmin, which is another technology company that makes wearable health trackers, shipped 16.2 million units in 2015 [9]. However, this rapid increase in the number of individuals who have started to use wearable health trackers has been met with increasing number of individuals who abandon their trackers shortly after a purchase. Recent consumer research reported a high dropout rate for both smartwatches (29%) and fitness trackers (30%) [10].

One of the primary reasons for user abandonment of smart devices, including wearable health trackers, is due to a mismatch between user's identity and an identity portrayed by his or her device [20]. Lazar and colleagues point out that advertisements of smart devices feature slender models who are engaged in extreme sports activities [20]. As a result, individuals do not perceive their devices as a true representation of their identities, but they perceive them as appropriate for someone who is athletic. In our study, we propose *cosmetic customization* as a potential means through which individuals can establish a good "identity fit" with one's tracker. Cosmetic customization is a modification of the presentation of a given product [11]. When a mobile phone user is switching her pink phone cover to a flower-patterned cover, she is engaging in cosmetic customization. Customization in general invites individuals to project their personality, values, and preferences onto a product. As a result, the customized product is a true reflection of who and what they are (i.e., sense of identity) [22, 32]. Furthermore, this heightened sense of identity, in turn, could lead to positive user outcomes such as favorable attitude and greater behavioral engagement with the customized product [23, 32].

Many of the existing wearable health trackers offer users with a limited number of cosmetic customization features, mainly band colors, band materials, and clock faces. One's identity can be expressed via multiple venues. A person can convey her identity as a composer through their collection of CDs, vintage purses, and cigarette lighters [1]. A video game player expresses oneself through their avatar's hairstyle, hair color, facial features, clothes, and weapon [7]. By limiting the number of cosmetic customization features that are available, some users of existing wearable health trackers may not be able to express their identity to its fullest color, subsequently resulting in a poor identity fit with their trackers.

In current study, we propose that cosmetic customization can help individuals truthfully reflect their identity onto a wear-

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able tracker. We further suggest that one's heightened sense of identity from engaging in cosmetic customization can lead to greater user engagement with a tracker. We assessed user engagement by one's attitude, exercise intention, and sense of attachment towards a wearable health tracker. Prior research has demonstrated the positive effects of customization on user outcomes in the context of health message [19], avatar [18], personal website [17], and news article [2]. Furthermore, sense of identity has been demonstrated as one of the mechanisms that underlie the relationship between customization and positive user outcomes [22, 23]. To date, no research has been done to systematically unfold the relationship between customization, sense of identity, and positive user outcomes in the context of wearable health trackers.

To empirically examine our research topic, we conducted an online experiment in which participants were presented with a fictitious advertisement, which highlighted varying levels of customization capabilities of a wearable tracker called "StayActive." We then asked participants to answer a series of questions regarding their attitude, exercise intention, and sense of attachment towards StayActive. Based on the online experiment, we unveiled the relationship between customization, sense of identity, and user engagement. In what follows, we provide background on the positive effect of customization on user psychology, including sense of identity. Next, we detail our study design and method, and report on the results. Based on our results, we suggest design considerations for creating engaging wearable health trackers.

RELATED WORK

Sense of Identity in Wearable Health Trackers

Our possessions reflect who and what we are. They are salient identity signals that convey our personality, values, ideas, and preferences to others [3, 4]. For example, people who purchase a laptop from Apple, Dell, or Microsoft respectively might be portraying different identity signals. Similarly, people might be conveying different identity signals when they are wearing a watch from Rolex (a luxury watch brand) versus Timex (an economical watch brand). People experience greater emotional attachment to a product that matches one's identity (e.g., [12]), and they become sad upon losing a product that served an identity signal because such loss comes across as a threat to one's identity [8].

But what happens when a product is a mismatch to one's identity? In the area of wearable health trackers, an identity mismatch between a user and an identity portrayed by a wearable health tracker may act as a barrier for continuous usage [13, 20, 24]. A most direct evidence for the above proposition comes from a study by Lazar and colleagues. In their study, participants were instructed to purchase up to $ 1,000 of smart devices, including wearable health trackers, to pursue their health goals, and they were reimbursed after the study [20]. After 2 months, researchers found that participants abandoned 80% of the devices they had purchased. Participants mentioned a lack of fit between their identities and the identity portrayed by the devices (i.e., athletic identity) as one of the reasons for their discontinued usage. That is, they perceived the devices as more appropriate for people with extreme fitness needs [20].

Other studies report poor aesthetics of wearable health trackers as one of the reasons contributing to user abandonment. Harrison and colleagues found that some of the participants were reluctant to use their trackers because they found them "pretty ugly" or "doesn't look cool" [13]. To get around the "ugly" appearance of the trackers, a few participants wore their trackers on "hidden" body parts (e.g., ankle) or sought out for various customization options, such as making Do-It-Yourself (DIY) alterations, and purchasing aftermarket accessories. Similarly, Shih and colleagues reported the "bulky" and "unattractive" appearance of a tracker as one of the cited reasons for discontinued usage among their participants [29]. Lastly, Meyer and colleagues found that individuals prefer trackers to be invisible to others to avoid drawing attention to their act of tracking [24]. If trackers have to be made visible to other individuals, the authors suggest the designers of the tracker to make them fashionable. Although above studies do not directly demonstrate an identity mismatch with one's tracker as a reason for user abandonment, they imply that users are reluctant to be seen with "uncool" or "ugly" trackers by others. The appearance of a product makes an "aesthetic statements about the owner" to other individuals [21, p. 2]. It is an attribute of a product that others can quickly glance upon to infer an identity of its owner [4]. When individuals wear "uncool" or "ugly" health trackers, they are presenting themselves as someone who is uncool or ugly, a portrayal of someone they are not. Such misrepresentation of oneself, as identified by Lazar and colleagues [20], can strongly demotivate continuous engagement with wearable health trackers, wearing off the benefits people can gain from sustained self-tracking.

The Effect of Customization on Sense of Identity

Based on the studies presented above, providing individuals with a greater number of cosmetic customization features to tailor their trackers could be a desirable way to foster a good identity fit with one's tracker [13, 24]. Prior research has demonstrated the positive effects of customization on one's sense of identity. Blom and Monk conducted an in-depth interview to examine the impact of appearance personalization of website, mobile phone, and PC on user outcomes [6]. Across the three technology mediums, participants reported that appearance personalization allowed them to express their personal and group identities to others, and "personalization was often compared to the use of clothes as a way to distinguish oneself from others" [6, p. 204]. Similarly, Mugge and colleagues found that cosmetic customization of one's bicycle through the use of paint afforded the bicycle owners a freedom to express their unique identity [25]. It seems that cosmetic customization allows individuals to differentiate themselves from others by projecting their unique set of traits and characteristics onto a product.

In addition to one's sense of identity, customization extends its positive effect to user outcomes with the customized product. Kalyanaraman and Sundar demonstrated that individuals who experienced a high level of customization (i.e., their

MyYahoo! landing page was programmed to completely match their interests on various topics) had more positive attitudes compared to those who experienced medium and low levels of customization [17]. Beier found that participants who read a news article that was customized to their preference perceived the news to be of a higher quality than those who read a news article that was not customized to their preference [2]. Lastly, Kim and Sundar demonstrated that participants who created their *Second Life* avatar indicated greater willingness to maintain good health than those who were assigned to a random avatar. Even a perception of customization (*versus* act) can be psychologically appealing to users. Xiao, Stasko, and Catrambone found that individuals who were given an illusion that they were assigned with Embodied Conversational Agent (ECA) based on their personal preferences liked and trusted their ECA more than individuals who were not given such illusion of customization [33]. A simple "act" of customization made individuals accept ECA's advice and change their behaviors accordingly.

According to Marathe and Sundar, one's sense of identity is one of the factors that drive the positive effects of customization on user outcomes in the form of emotional, behavioral, and cognitive responses towards the customized product [22]. People find customization psychologically appealing because being an active participant in creating and projecting one's identity onto a given product allows them to develop strong emotional connection with the customized product. In support of this view, Marathe found that individuals who engaged in cosmetic customization of a website called Netvibes experienced higher sense of identity towards the website, and this higher sense of identity, in turn, resulted in more favorable attitude and higher intrinsic motivation to revisit the website [23]. In summary, customization—both the actual act and perception—can induce people to develop positive emotional, cognitive, and behavioral responses towards the customized product via its influence on one's sense of identity.

In the context of wearable health trackers, a study by Nurkka provides qualitative evidence that customization is related to users' self-expression [27]. Their research provides valuable insight that customization can lead to increased sense of identity with a wearable device. In our study, we sought out to empirically establish the relationship between cosmetic customization, sense of identity, and user engagement with a wearable health tracker in the form of one's attitude, exercise intention, and sense of attachment towards the tracker.

HYPOTHESES AND EXPERIMENT DESIGN

Hypotheses

Providing individuals with higher levels of cosmetic customization features may allow them to express oneself onto a tracker via multiple venues. An individual who customizes a band color, font style, and interchangeable accessory of a tracker may experience higher sense of identity compared to an individual who only customizes a band color. We suspect that the positive effects of cosmetic customization on user engagement towards a given wearable health tracker would be augmented for individuals who are assigned to higher levels of cosmetic customization. Therefore, we posit Hypothesis 1 as follows:

H1: Individuals provided with a tracker equipped with higher levels of cosmetic customization features will have higher sense of identity, and greater user engagement with the wearable health tracker than individuals provided with a tracker equipped with a lower level of customization features.

Consistent with Marathe and Sundar, who found a sense of identity as one of the psychological factors that underlie the positive effects of customization on user outcomes [22], we suspect that the positive effects of cosmetic customization on user engagement will be mediated by sense of identity. Thus, we posit Hypothesis 2 as follows:

H2: The relationship between levels of cosmetic customization and user engagement with a wearable health tracker will be mediated by one's sense of identity with a given wearable health tracker.

Lastly, we conjectured that cosmetic customization may play a different role for current users and non-current users of a wearable health tracker. Sundar and Marathe demonstrated that customization has a different effect on individuals as a function of the individual difference in technology experience and one's privacy concern [31]. We therefore included one's current status of tracker usage as an exploratory factor to examine a possibility that customization may differently affect individuals with different levels of experience with a tracker. We propose the following research question:

RQ: What is the relationship between levels of cosmetic customization, one's status of tracker usage, sense's of identity, and user engagement?

Experiment Design

We employed a 2 (Status: non-user *vs.* user) x 4 (Levels of Cosmetic Customization[1]: NONE *vs.* LOW *vs.* MEDIUM *vs.* HIGH) between-subjects design.

Status had two levels: *user* was operationally defined as individuals who are currently using a wearable health tracker, and *non-user* as individuals who have no experience with a tracker, or who have previously used a tracker, but not at the time of our study.

Cosmetic customization had four levels, which were largely distinguished based on the number of available cosmetic customization features for a fictitious tracker. We further broke down the cosmetic customization features into two categories—form factor customization and interface customization. Form factor customization involves changing the physical presentation of a tracker (e.g., band color). Interface customization involves changing the presentation of the items on an interface screen of a tracker (e.g., clock face).

We reviewed the cosmetic customization features offered by 5 popular wearable health trackers (i.e., Fitbit, Apple Watch, Garmin, Xiomin, and Samsung Gear) to generate cosmetic

[1]We will use "NONE" to denote the none cosmetic customization condition, "LOW" to denote the low-level cosmetic customization condition, and so forth.

customization features for our study. As of Fall 2016, we observed that these wearable health trackers offered a subset of the following cosmetic customization features—band colors, clock face, interchangeable accessories, and customizable font size. For instance, Apple Watch offered users with customizable font size, various clock faces, and a wide selection of band colors. Fitbit Flex offered interchangeable accessories and band colors. We included two cosmetic customization features—clock face (Fig.1 left & center), band color (Fig.1 right)—in LOW and MEDIUM, and additional two cosmetic customization features—interchangeable accessories (Fig.2 right), customizable font size (Fig.2 left)—in MEDIUM. We however changed "customizable font size" to "customizable font," which we defined as an ability for individuals to customize font size, style, and color.

Figure 1. Examples of multi-faceted clock faces (left and center) and band colors (right).

Figure 2. Examples of customizable font (left) and interchangeable accessories (right).

Additionally, we reviewed an online Fitbit community forum, and examined the posts made by the current Fitbit users on what kinds of customization features they want to see in Fitbit devices. Based on our observations, we came up with two additional features—engraving capability (Fig.3 right) and customizable stat icons (Fig.3 left)—which we included in HIGH. Engraving capability was operationally defined as an ability to engrave any characters and symbols onto one's tracker bands. Engraving capability was a feature that was perceived as highly desirable by many Fitbit users, and it also matched our conceptual definition for form factor customization. With the exception to engraving capability, other features recommended by the current Fitbit users did not match our conceptual definition of interface customization. Hence, we came up with a second new feature, customizable stat icons, which was operationally defined as an ability to change an icon that represents daily stats (e.g., calories burned). In existing wearable health trackers, individuals are normally given a same icon to represent their daily stats. In Fitbit, for instance, a total number of steps is represented by the same shoe print icon for all individuals. We suspected that customizable stat icons are salient visual cues that can act as an identity signal to other individuals.

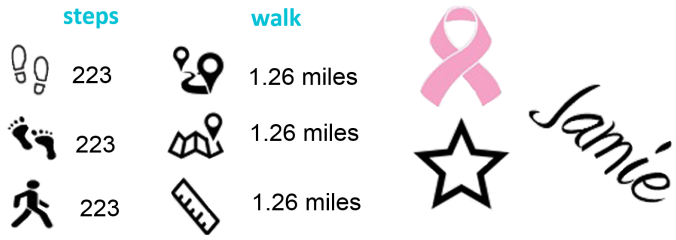


Figure 3. Examples of customizable stat icons (left) and engraving capability (right).

In total, our StayActive offered 6 cosmetic customization features—3 features for form factor (band color, interchangeable accessories, and engraving capability) and 3 features for interface (clock face, customizable font, and stat icons). We employed an added value paradigm by Sundar [30] for our study design where cosmetic customization features for a higher level of customization were added onto the cosmetic customization features presented from a previous lower level of customization. The current study added one form factor feature and one interface feature at each higher level of customization. See Table 1 for the summary of the customization manipulation.

Table 1. Summary of customization manipulation.

Level	Form Factor	Interface
NONE	No customizability	No customizability
LOW	Band colors	Clock faces
MEDIUM	Band colors + Interchangeable accessories	Clock faces + Customizable font
HIGH	Band colors + Interchangeable accessories + Engraving capability	Clock faces + Customizable font + Stat Icons

METHODS

Procedures

Participants were directed to our study's survey page by clicking a link that was posted on Amazon Mechanical Turk. As a cover story, participants were told that StayActive was in its last stage of development, and developers were trying to identify individuals' reaction to its advertisement. Furthermore, for participants who may not know what wearable health trackers do in general, they were presented with a brief description on what StayActive does. Participants were exposed to one of the four versions of the StayActive advertisement (stimulus) for one minute, and presented with a writing activity to specify their customization preference, which we describe in detail later. Afterwards, participants answered a set of questionnaires that pertained to user engagement. Upon the completion of the study, participants were debriefed and thanked.

Stimuli

We created an advertisement for StayActive for each of the 4 cosmetic customization levels. We included a baseline condition (NONE), presenting a basic wearable health tracker without any customization features (i.e., a black band with no customizable interface). In the low cosmetic customization (LOW) stimulus, we presented the same device from the

baseline stimulus, but this time, participants were able to alter the band color (among 12 options) and clock faces (among 4 options), providing a total of 2 customization features—one form factor and one interface customization feature. In the medium cosmetic customization (MEDIUM) stimulus, we added interchangeable accessories and customizable font onto the features presented in the low cosmetic customization stimulus, thereby providing a total of 4 customization features—two form factor and two interface customization features. Lastly, in the high cosmetic customization (HIGH) stimulus, we added engraving capability and customizable stat icons onto features presented in the medium cosmetic customization stimulus, a total of 6 customization features. See Figure 4 for the advertisement presented in HIGH.

Measures

Qualitative Measures

After seeing the advertisement for StayActive, we instructed participants to type-in how they would customize StayActive, if they had the device, based on the cosmetic customization features provided in the advertisement. Some of cosmetic customization features were numbered (e.g., Customizable stat icons) to ease the writing process for participants. This activity was included in order to strengthen a personal relevance of StayActive to participants. Afterwards, participants were provided with a list of customization features that appeared on their respective advertisement and selected which customization feature(s) were the most important feature(s) for StayActive. For the participants in NONE, they were provided with a list of our 6 customization features and asked to indicate which customization feature(s) they would like to see in StayActive. The advertisement remained on screen throughout this portion of the study.

Quantitative Measures

Unless otherwise indicated, all measures asked participants to rate their level of agreement with the following statement on a scale of 1: Strongly disagree to 7: Strongly agree.

1. *Perceived customizability*: Two questions were included to serve as a manipulation check for cosmetic customization, "StayActive offers many customization features to its users," and "StayActive allowed me to customize the tracker in many different ways." (Cronbach's $\alpha = .94$).

2. *Sense of identity*: A measure was adapted from Marathe [23]. Sample items are "I feel StayActive reflects my personal identity," "The StayActive is now a true representation of who I am," and "The StayActive fits my image." (Cronbach's $\alpha = .96$).

3. *Attitude towards StayActive*: Participants were asked to indicate how well each adjective described StayActive. Sample adjectives are "Appealing," "Useful," "Good-looking," "Attractive," "Pleasant," and "Desirable" [17]. (Cronbach's $\alpha = .98$).

4. *Exercise intention*: Participants were asked about their intention to exercise with StayActive. Sample items include "I think I will enjoy exercising with StayActive," "I think StayActive will motivate me to exercise," and "I think I will increase my level of physical activity if I had StayActive." (Cronbach's $\alpha = .94$).

5. *Sense of attachment*: Participants indicated their sense of attachment to StayActive. Sample items are "I want to keep my StayActive for a long time," "I will continue to want to use my StayActive," and "I will not get bored with my StayActive." (Cronbach's $\alpha = .92$).

Figure 4. A fictitious advertisement shown to participants assigned to HIGH.

Participants

A total of 157 participants (Female = 103) were recruited via Amazon Mechanical Turk ($M_{age} = 36.75$, $SD_{age} = 12.16$). We recruited US-based Mechanical Turkers whose approval rating is 95% or higher. Of the total participants, 89 participants identified themselves as current users of a wearable health tracker and 68 participants identified themselves as non-current users. Forty-five of current users reported they have been using their trackers for between 6–12 months. Among the current users of wearable health trackers, Fitbit series was the most frequently mentioned ($n = 67$). Among the non-current users of wearable health trackers, 7 participants indicated they had experience with wearable health trackers and the Fitbit series was the most cited one ($n = 4$). Upon the completion of the study, participants were compensated with a monetary reward of 40 cents.

RESULTS

Manipulation Check

A 2 (Status: non-user *vs* user) x 4 (Levels of Cosmetic Customization: NONE *vs* LOW *vs* MEDIUM *vs* HIGH) ANOVA

was conducted to examine whether our study manipulation was successful. We observed a significant main effect of Cosmetic Customization, F (3, 149) = 41.44, p <.001. Using Bonferroni adjustment, participants across cosmetic customization conditions significantly differed from each other in an expected direction (NONE: M = 3.21, SE = .22; LOW: M = 4.56, SE = .20; MEDIUM: M = 5.77, SE = .21; HIGH: M = 6.27, SE = .21). However, participants in MEDIUM and HIGH did not differ significantly from each other on perceived customizability. We did not find significant main effect of Status, F (1, 149) = 1.37, p >.05, or interaction term, F (3, 149) = .02, p >.05, on perceived customizability.

Status, Cosmetic Customization, and User Engagement

A 2 (Status: non-user *vs* user) x 4 (Levels of Cosmetic Customization: NONE *vs* LOW *vs* MEDIUM *vs* HIGH) MANOVA was conducted to examine H1. This analysis revealed a significant main effect of Status, Wilks'∧ = .93, F (4, 144) = 2.91, p <.05, partial η^2 = .08, and a significant main effect of Cosmetic Customization, Wilks'∧ = .71, F (12, 381) = .4.38, p <.001, partial η^2 = .11. Interaction between Status and Cosmetic Customization was not significant, Wilks'∧ = .93, F (12, 381) = .91, p = .54, partial η^2 = .03.

A closer inspection on univariate analysis for the main effect of Status, however, indicates that p-values were greater than .10 for all outcome variables. In answer to our RQ, we did not find a unique effect of Status on outcome measures. There was a significant main effect of Cosmetic Customization on sense of identity, F (3, 147) = 11.69, p <.001, partial η^2 = .19. Post-hoc analyses with Bonferroni adjustment indicate that participants in NONE (M = 3.10, SE = .25) scored significantly lower on sense of identity than participants in LOW (M = 4.26, SE = .24), MEDIUM (M = 4.66, SE = .24), and HIGH (M = 5.04, SE = .24). Participants in three other conditions differed from each other on sense of identity in an expected direction (see Figure 5). Our H1 was partly supported—higher levels of cosmetic customization resulted in higher sense of identity. We did not find significant differences on attitude, exercise intention, and sense of attachment across cosmetic customization conditions. However, participants in four cosmetic customization conditions differed from each other in an expected direction for attitude and exercise intention, such that participants in NONE reported lowest score and participants in HIGH reported highest score on these measures. See Table 2 for a summary of mean and standard error (in parentheses) for the outcome variables.

Sense of Identity as a Mediator

We performed a mediation analysis using bootstrap techniques using Model 4 to examine our H2 [14]. Hayes and Preacher recommend estimating for relative indirect, direct, and total effects when performing mediation analysis with multicategorical independent variables [15]. Thus, indirect, direct, and total effects should be interpreted in comparison to a reference group. In our analysis, participants in LOW served as a reference group. LOW, which offers band colors and 4 clock faces, reflects cosmetic customization features offered by many existing wearable trackers. In order to examine our proposition that current cosmetic customization features offered by existing wearable health trackers may not be enough, we set LOW as a reference group.

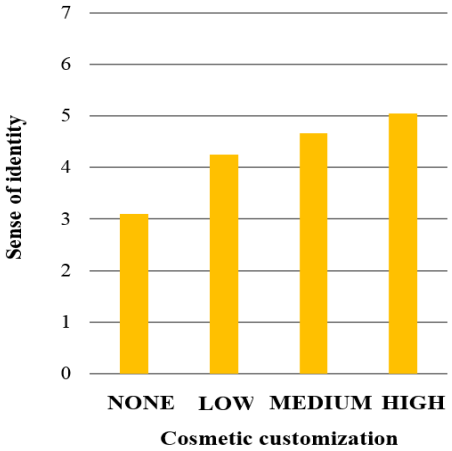


Figure 5. Main effect of Cosmetic customization on Sense of identity

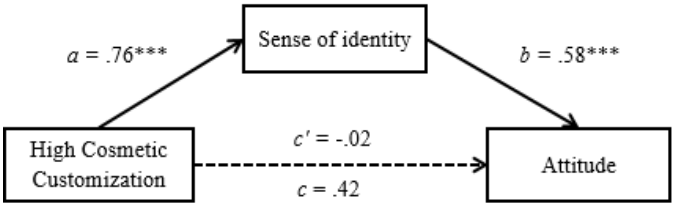
Table 2. The Effect of Cosmetic Customization on User Engagement

	F-ratio	Sig. Level	NONE	LOW	MED.	HIGH
Sense of identity	11.69 *	.00	3.10[a] (.25)	4.26[b] (.24)	4.66[b] (.24)	5.04[b] (.24)
Attitude	2.29	.08	4.74[a] (.21)	5.09[a] (.20)	5.28[a] (.20)	5.46[a] (.20)
Exercise intention	.39	.76	4.54[a] (.25)	4.80[a] (.24)	4.54[a] (.24)	4.79[a] (.24)
Sense of attachment	.55	.65	4.60[a] (.22)	4.55[a] (.21)	4.48[a] (.21)	4.85[a] (.21)

Note: Within rows, means with no subscript in common differ at p <.05 using Bonferroni post hoc comparisons.
*p <.05 **p <.01 ***p <.001.

Attitude, Exercise intention and Sense of attachment

Participants in HIGH, in comparison to participants in LOW, experienced a higher sense of identity, which in turn, was associated with more positive attitudes towards StayActive[2], ab = .44, SE = .18, CI = .0869 to .8101 (Figure 6).



* p < .05 ** p < .01 *** p < .0001

Figure 6. Mediating role of Sense of identity on Attitude towards StayActive for the HIGH cosmetic customization condition.

Similarly, participants in HIGH, in comparison to participants in LOW, experienced a higher sense of identity, which in turn, was associated with greater exercise intention with StayActive, ab = .45, SE = .19, CI = .0934 to .8451 (Figure 7).

[2] ab denotes indirect effect of sense of identity on each user engagement variable.

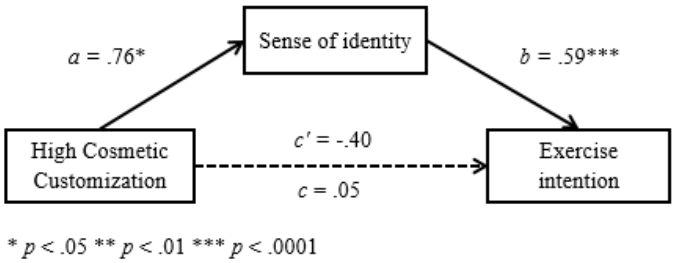


Figure 7. Mediating role of Sense of identity on Exercise intention with StayActive for the HIGH cosmetic customization condition.

As for the sense of attachment, participants in HIGH, in comparison to participants in LOW, experienced a higher sense of identity, which in turn, was associated with higher sense of attachment towards StayActive, *ab* = .45, *SE* = .18, CI = .1261 to .8295 (Figure 8).

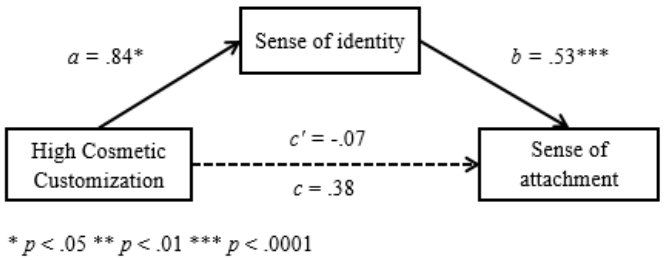


Figure 8. Mediating role of Sense of identity on Sense of attachment towards StayActive for the HIGH cosmetic customization condition.

On the contrary, we found a reverse direction for indirect effect of sense of identity for our comparison of participants in NONE and LOW. First, participants in NONE, in comparison to participants in LOW, reported a lower sense of identity, which in turn, was associated with lower positive attitude towards StayActive, *ab* = -.66, *SE* = .22, CI = -1.1267 to -.2689 (Figure 9).

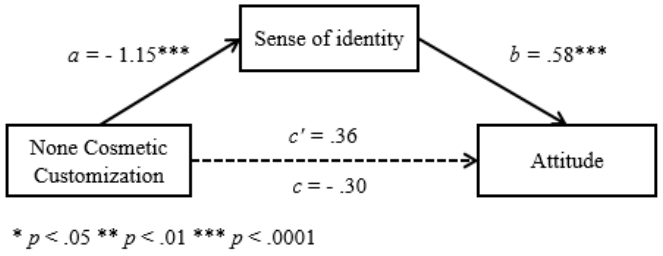


Figure 9. Mediating role of Sense of identity on Attitude towards StayActive for the NONE cosmetic customization condition.

Similarly, participants in NONE, in comparison to participants in LOW, reported a lower sense of identity, which in turn, was associated with lower exercise intention with StayActive, *ab* = -.68, *SE* = .23, CI = -1.1764 to -.2731. (Figure 10).

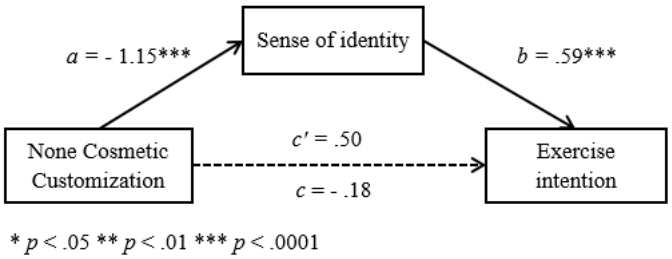


Figure 10. Mediating role of Sense of identity on Exercise intention with StayActive for the NONE cosmetic customization condition.

Lastly, participants in NONE, in comparison to participants in LOW, reported a lower sense of identity, which in turn, was associated with lower sense of attachment towards StayActive, *ab* = -.61, *SE* = .21, CI = -1.0404 to -.2090 (Figure 11).

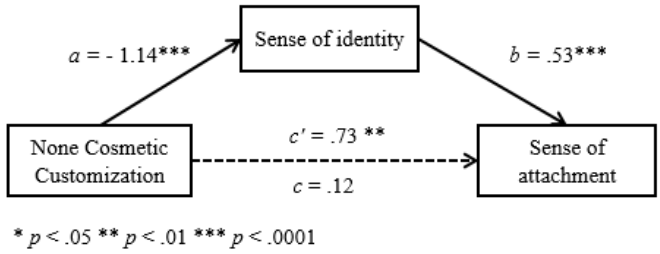


Figure 11. Mediating role of Sense of identity on Sense of attachment towards StayActive for the NONE cosmetic customization condition.

As for participants in MEDIUM, in comparison to participants in LOW, a sense of identity was not a significant mediator for attitude towards StayActive, (*ab* = .25, *SE* = .19, CI = -.1319 to .6162), exercise intention with StayActive (*ab* = .26, *SE* = .20, CI = -.1353 to .6448) and lastly, sense of attachment towards StayActive (*ab* = .24, *SE* = .18, CI = -.0998 to .6066).

Perceived Importance of Customization Features

We examined responses provided by participants in HIGH and NONE with respect to perceived importance of cosmetic customization features for StayActive. Participants assigned to these two conditions were the only ones whom we asked about perceived importance of all 6 cosmetic customization features. Participants in HIGH saw images of these features from the advertisement whereas participants in NONE were simply provided with a list of features in text. For participants in HIGH (N_{high} = 39), we found that clock face (*n* = 16), customizable font (*n* = 15), band color (*n* = 13), and interchangeable accessories (*n* = 12) were rated more desirable than customizable stat icons (*n* = 9) and engraving capability (*n* = 5). For participants in NONE (N_{none} = 36), we found that band color (*n* = 27), customizable stat icons (*n* = 18), clock face (*n* = 17), customizable font (*n* = 10), and interchangeable accessories (*n* = 10) were perceived as more desirable than engraving capability (*n* = 4).

Summary of Results

We found that a high level of cosmetic customization capability encourages user engagement with a wearable health tracker via enhanced sense of identity whereas a zero cosmetic customization capability discourages user engagement with a tracker via lowered sense of identity. Surprisingly, the direction of the relative direct effect of the high cosmetic customization on all three user engagement variables was negative, albeit not significant (see values for *c'* in Figure 6, 7, 8). This means that, in the absence of sense of identity, a high level of cosmetic customization may *decrease* user engagement variables compared to a low level of cosmetic customization. Moreover, the direction of the relative direct effect of a zero level of cosmetic customization on user engagement variables was positive. The relative direct effect on attitude and exercise intention was not significant, but it was significant for sense of attachment. This means that a zero level of cosmetic customization may *increase* attitude and exercise intention towards a tracker, and it can *significantly increase* one's sense of attachment towards a tracker compared to a low level of cosmetic customization in the absence of sense of identity. Such results suggest that providing a high level of cosmetic customization capability independently may nega-tively impact user engagement compared to providing a low level of cosmetic customization capability. Similarly, pro-viding a zero level of cosmetic customization independently may lead to greater user engagement, especially for sense of attachment, than providing a low level of cosmetic customization capability. Also, we did not find any significant effects of one's current status of tracker usage on main variables. Lastly, based on our open-ended question regarding perceived importance of cosmetic customization features, we found that clock face, band color, customizable font, and interchangeable accessories were seen as more important than engraving capability in both HIGH and NONE conditions. Interestingly, participants in NONE perceived customizable stat icons as important whereas participants in HIGH did not. Participants in HIGH differed from those in NONE in a sense that the former saw the visuals of three icons for each daily stat (e.g., steps walked). It is possible the stat icons we have chosen were not appealing for participants in HIGH, although they found the idea of customizable stat icons desirable.

DISCUSSION

Reflection on the Study Results

Lazar and colleagues identified an identity mismatch between a user and a smart device as one of the reasons for user abandonment [20]. In our study, we proposed cosmetic customization as a way for users to establish a good identity fit with a wearable health tracker. We further posited that sense of identity will mediate the relationship between cosmetic customization and user engagement, and found support for our hypotheses. Our finding on rather counter-intuitive direction of the relative direct effect of high and zero levels of cosmetic customization on user engagement variables could be attributed to the nature of wearable health trackers. People purchase wearable health trackers to adopt healthy lifestyle (e.g., [20, 28]). Cosmetic customization, by definition, does not serve utilitarian function to help individuals directly achieve their health-related goals. Furthermore, in our cover story, we told participants that StayActive tracks daily physical activities, including total steps walked and distance traveled. This instruction may have reinforced a perception of using a tracker to promote one's health, subjecting some participants to view cosmetic customization features as non-essential in achieving health goal. Such perception may have evoked negative user responses.

There was no significant main effect of one's current status of tracker usage on sense of identity and user engagement variables. This result makes sense as one's current status of tracker usage alone would not have any meaningful effect on user psychology. On a similar note, our non-significant interaction between one's current status of tracker usage and cosmetic customization could be due to a uniformly, positive effect of cosmetic customization on individuals. In our data, we observed that current and non-current users, within each level of cosmetic customization, reported similarly on sense of identity and other user engagement variables. This indicates that cosmetic customization had a similar value to both current and non-current users. At the same time, this non-significant interaction could also be attributed to how we designed the body of StayActive. We created StayActive's body based on Fitbit Blaze [5]. Majority of our current users reported that they use one of the Fitbit models. Some of these current users may have recognized the body of StayActive as Fitbit Blaze. This familiarity of a brand may have led them to react positively to StayActive, thereby reporting comparably high scores on sense of identity and user engagement variables as the non-current users.

Design Implications

Several decades of research has shown that keeping track of a target behavior (i.e., self-tracking) leads to the change in the frequency of the target behavior, usually in a desired direction [26]. However, this change is effective as long as the person keeps track of the behavior; when they stop self-tracking, the behavior returns to the original state. As such, if we can make people "want" to continuously wear and engage with health trackers by providing more cosmetic customization options, this design choice essentially contributes to enhance the tracker's efficacy, thereby indirectly promoting utilitarian function.

Designers of wearable health trackers should provide individuals with a greater number of cosmetic customization features for their trackers. Our StayActive provided individuals with 12 possible band colors to customize with. In reality, many of the trackers offer under 5 colors (with an exception of Apple Watch) and limited options for interchangeable accessories. As for the customizable font, existing trackers only offer font size customization. Some of these customization have to be decided at the time of purchase (e.g., band color) while others can easily be changed without additional costs at any time (e.g., icons and fonts). In any case, we argue that it is important for people to have a chance to invest their time in

customizing and configuring their device as an opportunity to develop a sense of identity with their device.

In addition to the number of available customization features, we also believe that the nature of a customization feature can influence how users and people around them perceive a given product. We found that participants perceived customization features that are salient and easily recognizable (i.e., clock face, band colors, customizable font, customizable stat icons, and interchangeable accessories) more desirable than customization features that are less salient and recognizable (i.e., engraving capability). We suspect that although the engraving capability can help users develop a sense of identity with a given product, the engraved symbol is not the best outlet to portray identity signals because it can easily be dismissed by others. For instance, if a person engraves a symbol to support a particular cause (e.g., breast cancer), other individuals may not easily recognize the meaning of the symbol. Therefore, although we acknowledge the value of the engraving capability, users who wish to express their unique identity may benefit more from cosmetic customization features that are salient and easily recognizable by others.

Limitations and Future Work

The research reported in this paper has some limitations. First, in our fictitious advertisement, we grouped a set of 2 cosmetic customization features together based on their shared atypicality in the current market. For instance, we grouped customizable stat icons and engraving capability together because both features are not currently offered by existing wearable health trackers. This arbitrary grouping decision may have caused our 4 fictitious advertisement to vary not only at the level of cosmetic customization, but also vary at the level of other factors, such as attractiveness and novelty. Second, we asked participants to imagine as if they had StayActive and customize "their" StayActive accordingly. However, our writing activity may have not been strong enough to increase personal relevance of StayActive to participants. A lack of personal relevance with StayActive could explain why participants across cosmetic customization conditions did not differ on user engagement variables. Some participants may have not treated StayActive as their own tracker, thereby negating any potential effects of higher customizability. Therefore, it would be important to establish a strong connection between a tracker and participants in order to examine meaningful effect of customization on user psychology. For instance, researchers can make the customization as an interactive experience whereby participants can see a vivid image of their customized end-product.

Additionally, we invite and encourage researchers to examine other factors that can interact with cosmetic customization to ensure that cosmetic customization steers users to develop a strong sense of identity with a tracker. For example, in this study, we have not yet explored *functional customization*, which is defined as a modification of task-oriented features of a product [32]. With wearable health trackers, functional customization would involve capturing a new exercise module or adding a particular daily stat to the main screen. From a user's perspective, functional customization can be perceived as more helpful in achieving one's health goal. Therefore, future research remains to understand what unique combinations of cosmetic and functional customization can positively influence one's sense of identity and user engagement with a wearable health tracker. Lastly, the effect of cosmetic customization on long-term adoption of a wearable tracker has yet to be explored. Although an online experiment using fictitious advertisement was a good first step, allowing us to explore many cosmetic customization features with a large number of participants at relatively low cost, we call for designers and researchers to consider our design implications to create effective wearable health trackers, which could then be deployed in the real-world environment.

CONCLUSION

The current study is one of the few studies that offer systematic examination of the effect of cosmetic customization in fostering user engagement with a wearable health tracker via enhanced sense of identity. We identified the importance of providing a greater number of cosmetic customization features as an outlet to express users' sense of identity. In addition to cosmetic customization features, we encourage the users of wearable health trackers to actively search for other creative means that would allow for a colorful projection of themselves onto a tracker. By doing so, users will be able to form an enhanced sense of identity with their tracker, which will help them have sustained engagement with the tracker.

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