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From liking to not liking: A proposed experiment design to explore consumer perceptions of health wearable notifications

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Abstract

Despite the increase in the adoption of health-wearables, most studies have focused on intentions to use the wearables, with less focus on perceptions related to their use, particularly how consumers perceive the interruptiveness of notifications the wearables provide to alert consumers or state that requires their attention. Based on the argument that wearable notifications influence consumer perceptions, we propose an experiment to develop and test a hybrid model anchored in mere exposure theory that suggests an inverted-U-shaped distribution for notification liking, where familiarity with the notifications through repeated exposure drives increased liking, while habituation, fatigue, and notification satiation drive a simultaneous decrease in liking. We propose to test this model using a vignette-based factorial survey approach. Highlighting changes in consumers' perceptions related to the interruptiveness of wearable notifications, we expect to contribute to IS research by adapting mere exposure effect and the literature that are currently focused on adoption decisions.

Keywords Consumers perceptions, health wearable notifications, mere exposure effect, vignette-based factorial survey

1 Introduction

Consumer health wearables, such as smartwatches and fitness trackers, are devices worn on the body that use sensor technology to measure physiological and behavioral data in real-time (Mettler and Wulf 2019; Rieder et al. 2021) in order to change human behavior (Oinas-Kukkonen 2013; Rieder et al. 2021) and to increase healthy outcomes. While the prevalence of these wearables has increased rapidly in recent years, as well as the variety of devices and features embedded within them (e.g., step counting, blood-pressure monitoring, stress alerts, etc.) (Rieder et al. 2021; Shin et al. 2019), so too has the interest of scholars in the adoption patterns and effectiveness of the technology (Shih et al. 2015) as well as security and privacy concerns related to smartwatches uses (Shah et al. 2020).

Gartner's 2016 consumer survey (Gartner Inc. 2017. Gartner report over 394 million wearable electronic devices will be sold in 2017) reported user's boredom with their wearables and smartwatches resulting in an abandonment rate of 29-30%. Nevertheless, there is no longitudinal assessment of this attrition over time. While, outside healthcare, some papers have examined the adverse effects of the interruptiveness of smartphone notifications (Elhai et al. 2021), research is still lacking on the wearables' effectiveness over time, in relation with the possible boredom or the fatigue generated by the notifications burden. For most of these studies, the focus has been on a consumer's intention to use the technology, based on underlying adoption theories such as the Technology Acceptance Model (TAM) (Canhoto and Arp 2017; Nasir and Yurder 2015) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Aksoy et al. 2020; Wang et al. 2020).

Before we learn about how these notifications influence any behavior or attitude, we need to know how consumers perceive these notifications. Interestingly, only a few studies have explored the impact that the notifications provided by the wearables have on consumer perceptions, decisions and emotions concerning the technology (Hadi and Valenzuela 2020). Notifications serve as interventions that alert a consumer of a certain condition or state that requires their attention. Notifications serve to interrupt a user's static condition - as active rather than passive features of consumer health wearables. While there is some research that has examined the interruptiveness of smartphone notifications (Elhai et al. 2019; Pielot et al. 2015) and the adverse effects they have on consumers, research has yet to fully explore the impact of notifications among health wearable consumers; a seemingly important focus of research given the scholarly interest in understanding adoption decisions and effectiveness of consumer health wearables.

To date, perhaps the most informative study as it relates to consumer health wearable notifications is a meta-analysis by Ringeval et al. (2020) in which they found that interventions provided by a Fitbit device were effective for healthy lifestyle outcomes, especially those related to daily step count and weight. But even with this understanding, we are still left without a complete picture of how consumer health wearable notifications influence consumer perceptions and decisions concerning the technology. What consumer perceptions are most affected by these notifications, and how are they affected?

Toward answering these questions, we look to the body of research on the mere exposure effect and an *a priori* set of affective variables espoused in that literature to describe a nomological network of interruptiveness. Specifically, we develop a hybrid model that describes a multi-stage relationship among factors salient to how consumers perceive consumer health wearable interruptions. We then propose a test of this model using the factorial survey method and a sample of health wearable consumers. The rest of the paper is structured as follows. Section 2 describes the theory chosen to answer both questions. Section 3 presents the model proposed and the experimental methodology.

2 Mere Exposure Effect

To meet the aims of this research, we consider the effects of consumer health wearable (here forth referred to as wearable(s)) notifications from the perspective of the mere exposure effect. First espoused by Zajonc (Zajonc 1968; Zajonc and Rajecki 1969), the mere exposure effect describes an increasing sense of liking of a stimulus when repeatedly exposed to the stimulus. This effect has since been modeled in numerous ways, for many different stimuli and contexts (Bornstein 1989; Montoya et al. 2017) such as the two-factor model (Berlyne 1970; Stang 1973), and the processing fluency model (Jacoby and Kelley 1987; Jacoby et al. 1992). The general consensus derived from these studies is that the mere exposure effect does persist for different stimuli, but that the two-factor model proposed by Berlyne (1970) and Stang (1973) may be the most accurate in its depiction of the evaluation patterns associated with repeated exposure (Montoya et al. 2017, p. 460). The two-factor model suggests an inverted-U shaped distribution for liking, where familiarity with the stimulus through repeated exposure drives increased liking, while habituation, fatigue, and stimulus satiation drive a simultaneous decrease in liking of the stimulus (see figure 1). Other factors included as potential antecedents and moderators of this effect include the type of stimulus, recognition of the stimulus, the time delay between stimulus and evaluation of the stimulus, the age of the participant, and the manner in which the stimuli are presented. The two-factor model explains that stimuli with little arousal potential—those that are too simple or too familiar—get relatively low evaluations, as do stimuli with too much arousal potential, those that are too complex or too unfamiliar.

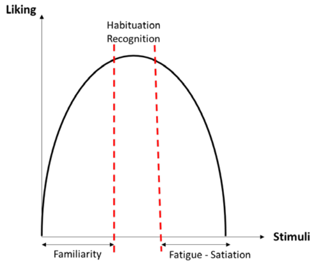

Figure 1: Inverted-U shaped distribution for liking

3 Research Model and Hypotheses

Based on previous theoretical discussion, we propose the research model presented in Figure 2. In the first stage of the model (stage 1), we assess the impact of familiarity with a notification (interruption) on habituation, recognition and liking. In stage 2, we test the influence of habituation and recognition on fatigue and satiation, while habituation drives an increase in liking of the notification and recognition creates a decrease in liking. In stage 3 of this study, we assess the proposed relationships between notification fatigue and satiation which drive a simultaneous decrease in liking of the wearable notifications. Four control variables (i.e., age, delay, stimulus presentation and personality trait) are also included in the research model.

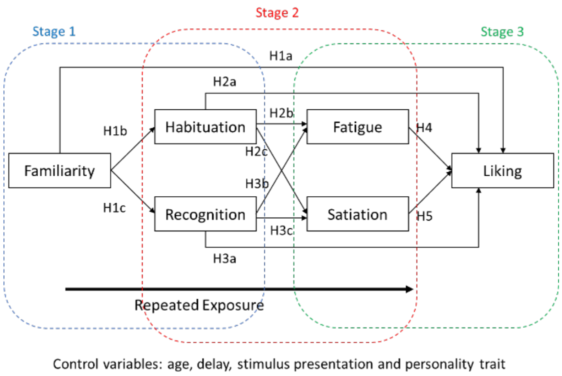

Figure 2: Proposed research model

Familiarity refers to an automatic, unconscious process that reflects the strength of individuals' memory (Yonelinas 1997). Processing fluency researchers claim that repeated exposure to a stimulus has various influences on liking. Previous exposure creates stronger memory and more familiarity. Therefore, notifications related to strong memories and familiarity are associated with greater fluency, which results in greater liking. Some fluency researchers believe that there is reason to fear the unknown (Winkielman et al. 2003), and argue that fluency shows that a stimulus is not dangerous because fluency creates a sense of familiarity that drives positive feeling and signifies that an individual has the ability to successfully process that stimulus (Carver and Scheier 1990).

The two-factor model argues the role of habituation in relation to the repeated exposure and familiarity (Berlyne 1970). Berlyne's approach postulates that people fear the unknown. On repeated exposure, there is a positive effect that is made by the greater familiarity and reduced uncertainty, which refers to stimulus habituation (e.g., Berlyne 1966). When individuals first see novel stimuli, the novelty may result in tension and uncertainty. However, repeated exposure (familiarity), can help in the elimination of this uncertainty and eventually turn it into habituation to that stimulus (Tellis 1997). On the other hand, processing fluency proposes that exposure not only increases fluency but also recognition. Recognition is based on specific details of a stimulus, and it can only be increased through repeated exposures (familiarity). Recognition is not a prerequisite for exposure effects to happen, and liking can result without the direct impact of recognition (Moreland and Zajonc 1977).

In the context of wearable notifications, in order to be merely exposed to the notification, individuals have to perceive it first. It creates a sense of liking in individuals when they notice the notifications, even if the noticing is brief. These fleeting can create a tendency towards the notifications. Familiarity with these notifications can become more effective in terms of making recognition towards the notifications. However, even when there is no strong sign of effectiveness (e.g., recognition), the notifications may still influence individuals' sense of liking towards the wearable notification. At first, individuals' exposure to wearable notifications may create a sense of uncertainty and sometimes tension, but through the repeated exposure to these notifications, it can reduce the uncertainty and create a sense of habituation to the notifications. Therefore, we hypothesize the followings for stage 1:

H1a: Familiarity with the wearable notifications increases the individuals' sense of liking of the wearable notifications.

H1b: Familiarity combined with repeated exposure to the wearable notifications increases the sense of habituation to the wearable notifications.

H1c: Familiarity combined with repeated exposure to the wearable notifications increases the sense of recognition with regards to the wearable notifications.

The repeated exposure and familiarity as the first step of habituation has already been surpassed. Through habituation, the experience of familiarity with an object can add to the object consistency, where individuals may interpret the familiar object more favorably (liking). In the habituation phase, the amount of conscious recognition lessens uncertainty and tension, and results in greater positive influence (i.e., liking) (Stang 1975). Fatigue or tedium refers to repetitive exposure leading to a decreased liking of a specific object/stimulus (Sawyer 1981). Sawyer's (Sawyer 1981) habituation-tedium theory discusses how habituation to stimuli is usually strong in the early stage of introducing an object, while tedium or fatigue gets stronger later on due to the repetitions. At a certain point in time, further repeated exposure would have no positive influence. Repeated exposure in a short period of time (not enough delay) may cause fatigue (Tellis 1997). The habituation via fatigue approach is consistent with other neuropsychological frameworks of habituation, including decremented responses (Xiang and Brown 1998). Habituation to a stimulus creates less rest and more fatigue for individuals' neural systems.

Stimulus satiation is another fundamental component of the two-factor model. When habituation to a stimulus reaches the decline point of the inverted-U shape of liking, stimulus satiation will increase, which in turn produces a negative liking affect. Bornstein (Bornstein 1989) stated that stimulus habituation and satiation have evolutionary roots, and this process can be applied to both unconscious and conscious stimuli. Referring back to the habituation via fatigue approach, wearable notifications can get worn out and have a negative affect causing fatigue. In the same vein, habituation to the wearable notifications can get to the state of satiation (maximum capacity) towards the notifications. Hence, we hypothesize:

H2a: Habituation toward the wearable notifications increases individuals' sense of liking of the wearable notifications.

H2b: Habituation combined with repeated exposure to the wearable notifications increases individuals' feelings of fatigue in relation to the wearable notifications.

H2c: Habituation combined with repeated exposure to the wearable notifications increases individuals' sense of satiation in relation to the wearable notifications.

Recognition is based on specific attributes of a stimulus. Recognition does not happen based on a brief exposure that is not sufficient to generate affective judgment (Montoya et al. 2017). Recognition can only be increased through repeated exposures. A strong and stable recognition encourages individuals to investigate novel stimuli and avoid well-known stimuli (Stang 1975). According to the two-factor model, conscious recognition is not required to create the sense of liking, but also the existence of recognition cause liking reduction through accelerating the influences of satiation and boredom (Ye and van Raaij 1997). For example, when individuals become consciously aware of a repeated wearable notification (conscious recognition of the notification stimuli), it leads to a reduction in liking of that notification.

According to the two-factor model, with a large number of repeated exposures, recognition also produces the experience of satiation. In the inverted-U shaped distribution of liking, recognition decrease liking through hastening the effects of satiation (Ye and van Raaij 1997). If an individual becomes consciously aware of the source of the positive affect of repeated notifications (recognition of the notifications), it can create the feelings of fatigue and saturation towards those notifications. Therefore, we propose:

H3a: Recognition toward the wearable notifications decreases individuals' sense of liking of the wearable notifications.

H3b: Recognition combined with repeated exposure to the wearable notifications increases individuals' feelings of fatigue in relation to the wearable notifications.

H3c: Recognition combined with repeated exposure to the wearable notifications increases individuals' sense of satiation in relation to the wearable notifications.

On the other hand, the mere exposure effect can diminish returns (backfire). This will happen when the stimulus gets stale or saturated. Based on the two-factor model, the combination of stimulus satiation and habituation produces an inverted-U shaped distribution of liking. The decline side of the inverted-U shows the increase of boredom and satiation caused by habituation and recognition. This model posits that when there is not enough delay between stimulus exposure and individuals' assessment, the mere exposure satiation leads to the degradation in liking (Montoya et al. 2017). Simple stimuli (compared to the complex stimuli), and homogeneous exposure (compared to the heterogeneous exposure) are more prone to fatigue and satiation, which creates a reduction in the sense of liking after a small number of exposures (Berlyne 1970). Therefore, the relationships between habituation, recognition, and liking are mediated by the feelings of stimulus fatigue and satiation. Sometimes, the effect of wearable notifications plateaus and comes back down, which is because of the feelings of fatigue and saturation towards those notifications. If individuals keep seeing the same wearable notifications over and over again, they will eventually get bored or sated. Thus, we hypothesize:

H4: Feelings of fatigue toward the wearable notifications decreases individuals' sense of liking of the wearable notifications/devices.

H5: Feelings of satiation toward the wearable notifications decreases individuals' sense of liking of the wearable notifications.

4 Research Method

We will apply a vignette-based factorial survey approach to test the proposed hypotheses and provide answer to the research questions (Rossi and Anderson 1982). The factorial survey method is a variant of the vignette approach that provides contextual detail for decision-making situations and simultaneously disseminates the details to all participants. The factorial survey method aims to "uncover the social and individual structures of human judgments of social objects" (Wallander 2009, p. 505). Similar to the traditional survey, factorial survey design also applies the technique of statistical random sampling. This method has been widely used by IS researchers to study IS use/abuse and others investigating deviant behaviors (e.g., Johnston et al. 2016; Vance et al. 2015). Therefore, the factorial survey design is appropriate for this study as well.

A random sample of vignettes is designed, and each participant in the study receives her/his own pack of vignettes to which to respond. We will ask participants to read their own pack of vignettes and place themselves in the context and position of each vignette's primary actor. This way, a reliable and valid measure of participants' perceptions about the actor's experience will be found, which then be reverted against a dependent variable (Jasso 2006). The survey participants will not report their personal perceptions and intentions, but rather place themselves in the fictional vignette characters and report how they may respond if presented with similar situations (Trevino and Victor 1992).

We will embed various manipulations within the sentences of the short-story vignette that will appear in a fixed order with the sentences about the manipulated factors across the vignettes (Taylor 2006). Each vignette will be a version of the base vignette. To ensure that each factor has an equal probability of assignment and the manipulated factors are not correlated with each other, each factor will be randomly assigned, which are approximately orthogonal (Lyons 2008; Rossi and Anderson 1982). For our study, five variables will be manipulated, namely familiarity, habituation, fatigue, satiation, and recognition. At each stage of testing, depending on the stage, there will be one or more independent variables manipulated in the vignette and one or more dependent variables measured via survey as responses to the vignette. Liking will be measured as a survey response to the vignettes in all stages of testing. For example, in stage 1, familiarity with a notification (interruption) is manipulated in the vignette and habituation, recognition and liking are assessed via survey responses to the vignette.

We will collect the data using Qualtrics data collection platform with an online sample of around 500 participants who can meet both of the following criteria: 1) use an Apple Watch regularly, and 2) are interested in personal health management through the use of the watch. Based on the random design factorial survey (Rossi and Anderson 1982), we will ask each participant to read and respond to an online survey that includes randomly assigned vignettes, with the number of variables of the baseline designed vignette dependent upon the stage of the model being tested and the number of independent variables being manipulated. Each vignette will describe an Apple Watch user, Casey, who regularly uses her Apple Watch and receives health-related notification messages (e.g., breathe, stand). After reading each of the assigned vignettes, participants will be asked to respond to a series of survey questions, including a realism check and a three-item manipulation check to test if the participants understand the vignette condition. As shown in the proposed research model, the dependent variable in this study is the participant's self-reported liking of the received notification (interruptiveness); a precursor to their use and/or attrition of the technology. In addition, after reading each vignette, participants will be asked to estimate the probability that they would mirror Casey's actions under similar conditions. We will be using a seven-point Likert scale (from strongly disagree to strongly agree) for the response options.

5 Expected Theoretical and Practical Contributions

By developing and testing a hybrid model for health wearable notification liking, we expect to contribute to research by presenting an explanation for wearable notification perceptions missing from a body of literature currently fixated on adoption decision in general, not specific to the interruptiveness of wearables. We also expect to contribute to practice by understanding the salient perceptions that drive user perceptions and how users of wearables move through stages of perceptions – forming both good and bad opinions of the technology, which ultimately influence continuance and attrition behaviors.

6 Conclusions

Because of the increased prevalence of health wearable technology and the notifications they provide to the consumers, in this research-in-progress, we seek to explore how consumers perceive the interruptiveness of those notifications, specifically the liking of them and the factors that influence liking. Toward this goal, this paper develops and proposes tests of a hybrid model anchored in mere exposure theory. This three-stage hybrid model suggests an inverted-U shaped distribution for liking: familiarity with the notifications through repeated exposure drives increased liking, whereas habituation, fatigue, and notification satiation drive a simultaneous decrease in liking. We propose to test a set of hypotheses using a vignette-based factorial survey approach. Our work is a first step in the assessment of consumers' perceptions related to the interruptiveness of wearables and we expect to contribute to the literature which is currently focused on wearable adoption decisions.

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