Visual Quotes and Physical Activity Tracking: Can Aesthetic Pleasure Motivate Our Short-term Exercise Motivation?

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Abstract. Empirical studies of activity tracking in HCI research have paid little attention to the impact of the visual presentation of motivational text messages on exercise motivation, even though, these days, motivational texts are often embedded in a visual presentation (such as visual quotes). Herein, we report the results of an online experiment with a total of 368 participants. Contrary to expectations, perceived aesthetic pleasure did not strengthen the motivating capability of perceived positive or neutral motivational text messages on the type of exercise motivation linked to the short-term (on the extrinsic-identified behavior regulation). Findings are discussed in the context of physical activity tracking services.

Keywords: Motivational text messages · Aesthetic pleasure · Exercise motivation

1 Introduction

In recent years, HCI researchers have questioned the feasibility of activity trackers as tools for creating behavioral changes [1–3]. One of the issues they have pointed out is the low impact of feedback strategies centered on displaying numerical measurements [1]. Individuals do not seem to perceive their past numerical data as meaningful [2, 4], and numerical feedback can actually have a detrimental effect on the type of motivation more predictive of long-term exercise adherence (intrinsic motivation) [1]. A possible alternative to showing numerical feedback would be to transform the quantitative data into personalized informative and motivational text messages.

In the short-term, motivational text messages can increase physical activity levels [5–7]. This likely happens due to their capacity to activate the extrinsic identified behavior regulation, which is linked to short-term exercise adoption [8, 9]. However, the HCI field has paid little attention to the current phenomenon of people sharing and accessing motivational text messages on image-sharing social media platforms, where these types of text messages are relatively and commonly embedded in a visual

presentation [10, 11] – designated commonly as visual quotes. For these people, motivational text messages may not only be about textual content, but also how the text is presented visually. In this paper, we describe the results of an experiment we conducted where the motivating levels of motivational text messages and the aesthetic pleasure levels of visual presentations were manipulated. We measured whether there was a difference in short-term exercise motivation when we perceived the visual presentations of positive or neutral motivational text messages as beautiful or ugly. Our results show that aesthetic pleasure levels did not influence the motivating capability of motivational text messages on the type of motivation linked to short-term exercise, contrary to our expectations. Implications of our findings are discussed within the context of physical activity tracking.

2   Background

2.1   Extrinsic Identified Behavior Regulation and Exercise Behavior

Self-determination theory (SDT) has been applied extensively to predicting and understanding health related-behaviors, including exercise adoption and exercise adherence among adults [8, 12]. In the context of this paper, the extrinsic identified behavior regulation that predicts exercise behavior in the short-term is considered next [8]. Identified behavior regulation is relatively self-determined and refers to behaviors that derive from the conscious valuing of an activity (the outcomes of the behavior are highly valued). An exerciser who volitionally participates in jogging gym sessions because it feels personally valuable to their health would be behaving for identified reasons [13]. By identifying with a behavior's value, individuals have more fully internalized its regulation (they have more fully accepted it as their own). However, the person's behavior is still extrinsically motivated because it is still instrumental (e.g., exercising to being healthy), rather than being guided by the activity's inherent interest [13, 14]. In sum, exercise outcomes are highly valued, and the behavior is performed with no pressure, but it is not particularly perceived as enjoyable in most cases. Studies have found that identified behavior regulation predicts better initial/short-term exercise adoption than intrinsic motivation [8].

2.2   Text Messages Interventions and Exercise Motivation

Several studies [9, 15] and systematic reviews [5, 6] have shown mobile text messaging interventions can promote physical activity among adults, with the majority of the studies being conducted over a period of 15 weeks or less [6]. Message content characteristics, such as gain versus loss frames [16], can influence the persuasive appeal of a message. Moreover, a recent early-stage work [9] suggests text messages can instigate autonomous motivation to do physical exercise, which in turn, is linked to positive behavioral exercise outcomes [8]. The study [9] which lasted one month and a half, found motivational text messages can instigate identified behavior regulation. In other words, the study found motivational text messages might help in promoting a

conscious valuing of physical exercise. Nonetheless, more research is needed to examine whether the findings from this early-work are confirmed.

2.3   Visual Aesthetics in HCI

Tractinsky defined visual aesthetics as the beauty or pleasing appearance of things [17]. This hedonic quality, as instrumental qualities, contributes to a positive user experience with interactive systems. The HCI community's interest in the impact of visual aesthetics on the user experience started between 1995 with the findings of Kurosu and Kashimura [18] and 1997 with Tractinsky [19], both indicating that visual aesthetics influence the perception of usability of a system. However, several recent studies did not find a correlation between aesthetics and usability [20, 21].

Today, it is not yet clear how beauty impacts the overall impression of a product or influences other product attributes [22]. Nonetheless, there is a relative agreement in the HCI community that visual aesthetics can positively influence the user experience [21, 22]. Following Hassenzahl [22], one factor that can explain some of the inconsistencies found relative to the interplay between beauty and usability are the methodological differences in studying beauty. He distinguishes three general approaches: the normative, the judgmental, and the experiential.

The present paper focuses on the experiential approach. Experiential approaches focus on all-encompassing holistic experiences characterized by an individual's altered perception of their surroundings. They tend to preserve the complexity and richness of an aesthetic experience, in the sense that they do not look for ways to explain what specific characteristics of the object cause it to be perceived as beautiful or not. Rather, they are focused on how alterations in perception of beauty impact the assessment of artifacts.

3   Method

The primary research question of this study addressed the influence of perceived aesthetic pleasure on the motivating capability of motivational text messages on short-term exercise motivation. For this purpose, it was created a 3 * 3 factorial design where it was manipulated the perceived motivating levels of the text messages and the perceived aesthetic pleasure of the visual presentation. To try to achieve the three levels of motivation of the text messages—perceived motivating, neutral, and not-motivating—we started by creating a pre-study where 26 messages were assessed regarding their motivating capability. To try to achieve the three levels of the aesthetic pleasure—perceived beautiful, neutral, ugly—we started by creating a pre-study where 18 visual presentations were assessed regarding aesthetic pleasure. From the results of these two pre-studies, we then created the pool of visual quotes used in the main experiment. After the experiment was conducted the results were classified accordingly to the perception of how motivating were messages and perceived aesthetic pleasure. Next, we report the results of both pre-studies, and then we describe the main experiment.

3.1   Pre-study: Text Messages

A list of 26 text messages was collected from the Instagram account of the activity tracker Runkeeper [23]. We reviewed the posts from last to first until 26 generic text messages that do not refer to a brand or associated services were identified. Participants were recruited through Amazon Mechanical Turk [24]. Qualification requirements were defined: the number of HITs (tasks) approved greater than 500, and a HIT approval rate greater than or equal to 99%. Each individual was compensated with $.50. 100 individuals were recruited, but due to non-US nationalities, two individuals dropped out, which left 98 valid participants. Participants was asked to assess the 26 messages following a 7-item Likert scale, ranging from extremely motivating (1) to extremely demotivating (7), and the images were presented randomly, one at a time. After, participants were asked some questions related to their personal characterization (age, gender, nationality, education, exercise habits, and habits of seeing motivational text messages).

Results. The majority of the participants were women (71%), which might have led to gender bias. The sample's median age was 38 years (minimum = 20 years and maximum = 65 years or older). All participants have at least a high school education. Most of the participants reported exercising once in a while (42%), or never exercising (29%). Lastly, participants did not encounter motivational text messages related to physical exercise often. Only 6% of the participants reported encountering messages frequently. 31% of the participants reported seeing motivational text messages sometimes, 40% rarely, and 23% declared never encountering motivational messages. None of the messages were considered demotivating considering the mean of assessments. Therefore, we picked three messages assessed as neutral (*Did you get your dose today?* Mean = 4.3, Standard Deviation = 1.2; *How did you move today?* M = 4.0, SD = 1.0; *What do you run for?* M = 3.7, SD = 1.3), three messages assessed as slightly motivating (*Find your motivation.* M = 3.4, SD = 1.3; *Embrace the road in front of you.* M = 3.0, SD = 1.2; *Find your inspiration gear up and go.* M = 2.9, SD = 1.2), and three messages assessed a moderately motivating (*Let nothing stand in your way.* M = 2.4, SD = 1.2; *There's no feeling like exceeding your own expectations.* M = 2.2, SD = 1.0; *No matter what your goals are, the first step is to start.* M = 2.1, SD = 1.1).

3.2   Pre-study: Aesthetic Pleasure

To create variation regarding the aesthetic pleasure, author 1 started by creating several visual presentations and tested them with 6 to 11 participants. Following the results of these exploratory assessments, a pool of 18 visual presentations was selected to be assessed in the pre-study, which showed potential variety regarding aesthetic pleasure levels and would present relative agreement in the results among participants. In all visual presentations was used as text the anagram: *The quick brown fox jumps over the lazy dog.* A total of 195 individuals were recruited through Amazon Mechanical Turk and had received a compensation of $.50. Some individuals did not pass the criteria of having US nationality (n = 8), which left a total of 187 valid participants. Participants were asked to assess 6 randomly selected visual presentations. Visual presentations were presented one at a time. The aesthetic pleasure was measured by applying the

validated scale Aesthetic Pleasure in Design [25]. Next, participants were asked to answer some demographic questions (age, gender, nationality, level of education). *Results.* The percentage of men and women participating in the study was relatively similar. 54% of the participants were men, and 46% were women. The sample's median age was 31 years (minimum = 19, maximum = +65). Almost half of the participants 42% reported having a bachelor's degree, and only two participants reported having less than a high school education. Each visual stimulus was assessed on average 62 times. Following the results of the aesthetic pleasure assessments, nine visual stimuli that varied regarding aesthetic pleasure levels were selected to be used in the pool of the main experiment. They were, the three visual stimuli assessed as the ugliest, three assessed as neutral, and the three assessed as more beautiful (assessed as slightly positive regarding aesthetic pleasure). Table 1 presents the means scores of aesthetic pleasure and standard deviations obtained for each of the visual stimuli selected, and Table 2 displays the correspondent visual presentations already with the text messages applied in the main experiment.

Table 1. Means and standard deviations of the aesthetic pleasure assessments of the visual stimuli selected to be used in the main experiment (scale values ranged from −3 [extremely ugly] to 3 [extremely beautiful]). The letter followed by a number corresponds to the visual presentation displayed in Table 2.

	Mean (Standard deviation)		
Ugly	**A1**	**B1**	**C1**
	−1.93 (1.48)	−1.89 (1.62)	−0.90 (1.59)
Neutral	**A2**	**B2**	**C2**
	0.06 (1.36)	0.47 (1.31)	0.48 (1.37)
Beautiful	**A3**	**B3**	**C3**
	1.14 (1.17)	1.19 (1.30)	1.19 (1.27)

4   Main Experiment

The main goal of the experiment was to understand how perceived aesthetic pleasure influences the motivating capability of motivational text messages on identified behavior regulation. *Material.* A pool of nine visual quotes was created following the results of the two pre-studies described previously. Table 2 shows the pool of visual stimuli used in the main experiment. The visual presentations were displayed to participants in the size of 600*600 pixels. *Participants.* 400 participants were recruited through Amazon Mechanical Turk and were compensated with $.40. To participate in the study individuals had to pass some qualification requirements: location equal to the US, a number of HITs (tasks) approved greater than 500, and a HIT approval rate greater than or equal to 99%. The data obtained from participants were filtered by nationality and repetition of the IP address. Data from participants with nationality different from the US (n = 9) and data entries with a repeated IP address (n = 4) were removed, which left a total of 387 valid participants. *Procedure.* One of the visual stimuli picked randomly from the pool was presented to the participant. It was asked to

the participant to assess this visual stimulus (visual quote) regarding aesthetic pleasure, using the validated scale Aesthetic Pleasure in Design [25], and its perception about how motivating or demotivating he/she found the text message presented in a 7-point item Likert scale. Next, it was measured the identified behavior regulation using the BREQ-3 scale [26], followed by some demographic questions.

Table 2. The pool of visual stimuli used in the experiment.

5   Results

60% of the participants were male, and 40% female. The sample's median age was 31 years (minimum = 18, maximum = 65), and all participants reported having at least a high school education. Most of the participants were regular exercisers. Only 21% of the participants reported exercising just once in a while, and 5% reported never exercising. Since we were interested in the effect of perception, participants were classified according to their assessment scores regarding aesthetic pleasure and motivational capability of textual messages (Table 3). As we can see in Table 3, only 19 participants classified messages as not being motivating. This result was expected because, during the pre-study of the text messages, not one of the messages were assessed as demotivating. Due to the small size of the groups within this level of messaging (Table 3, row demotivating), we decided not to conduct statistical analysis on these results and therefore discarded these results. A 2 × 3 factorial design was

therefore obtained. The independent variables are: textual content perception with two conditions (motivating, and neutral), and aesthetic pleasure perception with three conditions (beautiful, neutral, and ugly).

Table 3. The number of participants within each condition.

		Aesthetic pleasure perception			
		Beautiful	Neutral	Ugly	Total
Textual content perception	Motivating	54	27	26	107
	Neutral	50	84	127	261
	Demotivating	2	4	13	19
	Total	106	115	166	387

To determine if there is an interaction effect between the perceived motivating capability of motivational text messages and the perceived aesthetic pleasure on the continuous variable identified behavior regulation, we ran a two-way ANOVA. However, due to the non-normal distribution we decided on separate Kruskal-Wallis tests. Two Kruskal-Wallis H tests were ran instead, however these tests did not allow for the interactions effects to be examined.

Two research questions were asked. RQ1: Does aesthetically appealing visual presentations influence the motivating capability of perceived motivating messages in identified behavior regulation? RQ2: Does aesthetically appealing visual presentations influence the motivating capability of perceived neutral messages in identified behavior regulation? To answer RQ1, we focused on group differences of aesthetic pleasure within the level of motivating text messages. The independent variable was the variable aesthetic pleasure that had three conditions: beautiful, neutral, and ugly. The dependent variable was the continuous variable identified behavior regulation measured using the BREQ-3 scale [26]. Due to the nature of the project being related to perception, we were not able to control how many participants would have each condition or group. The Beautiful group had 54 individuals, the Neutral group had 27 individuals, and the Ugly group 26 individuals for a total of 107 participants (Table 3, the row of the motivating messages). Data were not normally distributed in all cells. Therefore, a non-parametric test was performed to examine the group differences in identified behavior regulation. A Kruskal-Wallis H test was run to determine if there were differences in identified behavior regulation scores between the three groups of perception of aesthetic pleasure: the "Beautiful" (n = 54), "Neutral" (n = 27), and "Ugly" (n = 26). Distributions scores were somewhat similar for all groups, as assessed by visual inspection of a boxplot. Median identified behavior regulation scores (beautiful = 4.25, neutral = 3.75, ugly = 4.25) were not statistically significantly different between the groups, $\chi2(2) = 4.166$, p = .125.

To answer RQ2 we focused on group differences of aesthetic pleasure within the level of neutral text messages. The independent variable was the variable aesthetic pleasure that had three groups: beautiful, neutral, and ugly. The dependent variable was

the continuous variable identified behavior regulation. The Beautiful group had 50 individuals, the Neutral group had 84 individuals, and the Ugly group 127 for a total of 261 participants (Table 3, the row of the neutral messages). Data were not normally distributed in all cells. Therefore, a non-parametric test was performed to examine the group differences in identified behavior regulation. A Kruskal-Wallis H test was run to determine if there were differences in identified behavior regulation scores between the three groups of perception of aesthetic pleasure. Distributions scores were similar for all groups, as assessed by visual inspection of a boxplot. Median identified behavior regulation scores (beautiful = 3.87, neutral = 3.50, ugly = 4.00) were not statistically significantly different between the groups, $\chi2(2) = 5.148$, p = .076.

6 Discussion and Limitations

Human-computer interaction literature is inconclusive regarding the impact of aesthetic pleasure (aesthetic appeal) in other factors related to user experience. While early studies found that visual aesthetics can impact the perception of the usability of interactive systems [18, 19, 27], more recent studies have questioned these findings and did not always find a correlation between aesthetics and usability [20, 21, 28]. In general, there is a relative agreement about visual aesthetics contributing positively to the overall experience with an interactive system. In this study, we were interested in exploring whether perceiving a visual presentation of a motivational text message as beautiful will strengthen the motivating capability of the message on short-term exercise motivation (in the extrinsic identified behavior regulation). Our results suggest that aesthetic pleasure does not influence the motivating capability of perceived motivating or neutral motivational text messages on identified behavior regulation. Following the literature, this does not necessarily mean that aesthetic pleasure cannot contribute to an overall positive feeling regarding the text message, but instead that aesthetic pleasure did not strengthen the motivating capability of the textual content in the type of exercise motivation linked to short-term exercise (extrinsic identified behavior regulation). For future studies, we suggest studying the interaction effects between the perceived motivating capability of the textual content and perceived aesthetic pleasure. One factor could interact with the other. In the context of activity tracking our findings mean that delivering motivational text messages as notifications (text-only) or as visual quotes (embedded in a visual presentation) can have the same impact in exercise motivation. We note, however, that we did not study the impact of using imagery in the visual presentations of motivational text messages. One of the limitations of our experiment was the amount of time we had to conduct the experiment. The experiment was conducted in a short time frame which may have affect the ability to capture the full effect of aesthetic pleasure. Future studies are needed to confirm these results. A second limitation of this study was due to their nature of studying perception. Since we did not know, although we had conducted pre-studies, how many individuals would assess the visual presentations as Beautiful, Ugly, or Neutral, we were not able to define from the beginning of the study the number of participants in each condition. This resulted in different group sizes. Finally, it can be argued that some visual presentations used did not differ much from each other. As

such, the finding that perceived beauty does not have an impact could be caused by that. However, we highlight that our results are in line with another very recent similar study [29].

7   Conclusion

Nowadays it is quite common to encountering motivational text messages embedded in a visual presentation. This paper explored whether the aesthetic pleasure perceived from these visual presentations impact the motivating capability of motivational text messages on exercise motivation. Our experiment discovered that, opposite to what may be expected, aesthetic pleasure might not strengthen the motivating capability of perceived motivating and neutral text messages on exercise motivation. Research is needed to study the influence of the visual dimension of visual quotes on exercise motivation and engagement with physical activity tracking to help and understand how they can leverage healthy behavior changes.

References

1. Etkin, J.: The hidden cost of personal quantification. J. Consum. Res. **42**, 967–984 (2016)
2. Lazar, A., Koehler, C., Tanenbaum, J., Nguyen, D.H.: Why we use and abandon smart devices. In: Proceedings of 2015 ACM International Joint Conference UbiComp 2015, pp. 635–646 (2015)
3. Kim, D., Lee, Y., Rho, S., Lim, Y.: Design opportunities in three stages of relationship development between users and self-tracking devices. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI 2016, pp. 699–703 (2016). https://doi.org/10.1145/2858036.2858148
4. Gouveia, R., Karapanos, E., Hassenzahl, M.: How do we engage with activity trackers?: A longitudinal study of Habito. In: Proceedings of the 2015 ACM International UbiComp, pp. 1305–1316 (2015)
5. Hall, A., Cole-Lewis, H., Bernhardt, J.M.: Mobile text messaging for health: a systematic review of reviews. SSRN (2015)
6. Buchholz, S.W., Wilbur, J., Ingram, D., Fogg, L.: Physical activity text messaging interventions in adults: a systematic review. World. Evid.-Bas. Nurs. **10**, 163–173 (2013)
7. Connelly, K., Mutsuddi, A.U.: Text messages for encouraging physical activity. In: PervasiveHealth, pp. 33–40 (2012). https://doi.org/10.4108/icst.pervasivehealth.2012.248715
8. Teixeira, P.J., Carraça, E.V., Markland, D., Silva, M.N., Ryan, R.M.: Exercise, physical activity, and self-determination theory: a systematic review. Int. J. Be. Nutr. Phys. Act. **9**, 78 (2012)
9. Tseng, Y.-C., Chang, H.-Y., Yen, S.-W.: The different effects of motivational messages and monetary incentives on fostering walking behavior. In: Extended Abstracts CHI Conference (2018)

10. Cocozza, P.: Read this and feel better – how inspirational guff invaded our lives (2014). https://www.theguardian.com/lifeandstyle/2014/nov/18/inspirational-quote-b(…)
11. Burnett, D.: Motivational posters: do they actually work? (2014). https://www.theguardian.com/science/brain-flapping/2014/nov/20/motivationa(…)
12. Rodgers, W.M., Hall, C.R., Duncan, L.R., Pearson, E., Milne, M.I.: Becoming a regular exerciser: examining change in behavioural regulations among exercise initiates (2010)
13. Standage, M., Ryan, R.M.: Self-determination theory and exercise motivation: facilitating self-regulatory processes to support and maintain health and well-being. In: Roberts, G.C., Treasure, D.C. (eds.) Advances in motivation in sport and exercise, 3rd edn, pp. 233–270. Human Kinetics Champaign, USA (2012)
14. Deci, E.L., Ryan, R.M.: The "what" and "why" of goal pursuits: of behavior human needs and the self-determination. Psychol. Inq. **11**, 227–268 (2000)
15. Toscos, T., Faber, A., Connelly, K., Upoma, A.M.: Encouraging physical activity in teens can technology help reduce barriers to physical activity in adolescent girls? Pervasive Computing Technologies for Healthcare 2008. PervasiveHealth 2008, pp. 218–221 (2008)
16. Latimer, A.E., Brawley, L.R., Bassett, R.L.: A systematic review of three approaches for constructing physical activity messages: what messages work and what improvements are needed? Int. J. Behav. Nutr. Phys. Act. **7**, 36 (2010). https://doi.org/10.1186/1479-5868-7-36
17. Tractinsky, N.: Visual aesthetics. https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/visual-aesthetics
18. Kurosu, M., Kashimura, K., Creativity, O.F.: Apparent usability vs. inherent usability: experimental analysis on the determinants of the apparent usability. In: Proceedings of CHI (1995)
19. Tractinsky, N.: Aesthetics and apparent usability: empirically assessing cultural and methodological issues. In: Conference on Human Factors Computing Systems, pp. 115–122 (1997)
20. Hassenzahl, M.: The interplay of beauty, goodness, and usability in interactive products. Hum. Comput. Interact. **19**, 319–349 (2004). https://doi.org/10.1207/s15327051hci1904_2
21. Hamborg, K.-C., Hülsmann, J., Kaspar, K.: The interplay between usability and aesthetics: more evidence for the "what is usable is beautiful" notion (2014)
22. Hassenzahl, M.: Aesthetics in interactive products: correlates and consequences of beauty. In: Product Experience, pp. 287–302 (2008)
23. ASICS Runkeeper™: Instagram account. https://www.instagram.com/runkeeper/?hl=pt
24. Amazon.Com: Amazon Mechanical Turk page. https://www.mturk.com/
25. Blijlevens, J., Thurgood, C., Hekkert, P., Chen, L.-L., Leder, H., Whitfield, T.W.A.: The aesthetic pleasure in design scale: the development of a scale to measure aesthetic pleasure for designed artifacts. Psychol. Aesthetics, Creat. Arts **11**, 86–98 (2017)
26. Wilson, P.M., Rodgers, W.M., Loitz, C.C., Scime, G.: "It's who I am…really!" The importance of integrated regulation in exercise contexts. J. Biobehav. Res. **11**, 104 (2006)
27. Tractinsky, N., Katz, A.S., Ikar, D.: What is beautiful is usable. Interact. Comput. **13**, 127–145 (2000)
28. Van Schaik, P., Ling, J.: The role of context in perceptions of the aesthetics of web pages over time. Int. J. Hum. Comput. Stud. **67**, 79–89 (2009)
29. Duro, L., Romão, T., Karapanos, E., Campos, P., Campos, P.: How does the visual aesthetics of positively-framed messages impact their motivational capacity? In: Proceedings of the 31st European Conference on Cognitive Ergonomics. ACM (2019)