

How do Motivational Text Messages Impact Motivation to Exercise? Implications for the Design of Activity Trackers

Lígia Duro
Madeira-ITI; NOVA
LINCS, FCT, Universidade
Nova de Lisboa, Portugal
ligiaduro@yahoo.com

Pedro F. Campos
Madeira-ITI/Larsys;
University of Madeira
Funchal, Portugal
pedro.campos.pt@gmail.com

Teresa Romão
NOVA LINCS, DI,
Faculdade de Ciências e
Tecnologia, Universidade
Nova de Lisboa, Portugal
tir@fct.unl.pt

Evangelos Karapanos
Persuasive Technologies Lab,
University of Technology,
Limassol, Cyprus
evangelos.karapanos@cut.ac.cy

ABSTRACT

We study the motives of regular and non-regular exercisers' engagement with motivational text messages and the importance individuals attribute to visual presentation. A total of 160 individuals were surveyed (80 regular exercisers and 80 non-regular exercisers). We found regular exercisers use motivational text messages in order to encourage their exercise routine. Non-regular exercisers use motivational text messages mainly to try to boost their exercise motivation. Individuals, independent of their exercise profile, prefer to see motivational text messages presented in a mixed way, sometimes as text-only and sometimes embedded in a visual presentation. Participants reported that an aesthetically appealing visual presentation helps instill a positive feeling regarding the text, and the visual presentation was considered as important as the textual content. We conclude with a number of implications for the design of activity trackers.

CCS CONCEPTS

• Human-centered computing • Human computer interaction

KEYWORDS

Motivational text messages, exercise motivation

ACM Reference format:

Lígia Duro, Pedro F. Campos, Teresa Romão, Evangelos Karapanos. 2019. How do Motivational Text Messages Impact Motivation To Exercise? Implications for the Design of Activity Trackers. In *Proceedings of ACM CHIItaly conference (CHIItaly'19)*. ACM, New York, NY, USA, 10 pages. <https://doi.org/10.1145/3351995.3352043>

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.

CHIItaly'19, September 23–25, 2019, Padova, Italy
© 2019 Association for Computing Machinery.
ACM ISBN 978-1-4503-7190-2/19/09...\$15.00
<https://doi.org/10.1145/3351995.3352043>

1 Introduction

Nowadays, motivational text messages embedded in a visual presentation are quite common on the Internet [2,5]. The site *brainyquote.com*, for example, presents motivational text messages presented as text-only as well as embedded in a visual presentation. The commercial activity tracker Runkeeper regularly shares motivational quotes on their Instagram account.

Activity trackers have the potential to leverage motivational text messages by tracking users' behavior patterns and thus helping personalize motivational text messages to the user's behavior pattern. However, in the field of human-computer interaction, little attention has been paid to the impact of motivational text messages on exercise motivation, including their visual presentation.

In this study, we explore (1) why individuals seek motivational text messages and how the messages support exercise motivation, and (2) what value individuals attribute to motivational text messages embedded in aesthetically appealing visual presentations.

We first designed an exploratory survey to explore these aspects and tested it in 20 individuals who view and seek motivational text messages regularly. We then surveyed 160 people who also see and seek motivational text messages regularly and classified them regarding their exercise habits.

In this paper we address the following: (1) An empirical description of why regular and non-regular exercisers seek motivational text messages and how the messages support their exercise motivation; (2) What main types of exercise motivation and behavior regulations are present, in each of the groups, in those who regularly exercise (EX), and in those who do not (Not EX); (3) What value individuals attribute to aesthetically appealing visual presentations, and what is their value compared to the textual content of the message.

We then discuss the broader implications of our findings for activity tracking services, considering how the development of motivational text messages features in activity trackers services can be influenced by the profile of individuals who actively seek motivational text messages.

2 Background

This study builds on prior research in textual feedback in activity trackers, as well as visual aesthetics in human-computer interaction (HCI).

2.1 Activity Trackers and Textual Feedback

Text messaging (SMS) interventions focused on encouraging physical activity have shown that text messages can help increase physical activity exercise levels [1,3,8,34,39]. Characteristics of the text content (e.g., framing [17,40], tailoring [17,23], specificity [42]) can impact the persuasive appeal of a message. However, we are not aware of any research that has investigated why individuals seek motivational text messages, as well as what is the perceived value in seeing motivational text messages embedded in aesthetically appealing visual presentations.

Exploring the impact of textual feedback in the context of physical activity tracking has received relatively limited attention [4,7,22]. Gouveia et colleagues [7] developed an activity tracker application that showed text messages to their users based on their present and past activity levels. The textual feedback was designed to support either reflection or persuasion. Messages to support reflection were designed to assist users in gaining better knowledge about their behaviors avoiding employing any form of recommendation or nudging. For example, *"You are the second most active person at work."* Persuasive messages, on the other hand, were designed to try to instigate behavior change by providing explicit recommendations. For example, *"Last week, you reached your daily walking goal 2 times, try updating it to 8km."*

Authors concluded that while persuasive messages led to greater time until re-engagement with activity trackers, users would take less time to start walking and walk for long distances. Following the authors, these findings support previous research: while persuasive messages tend to instigate action in the short-term, aversion and reactance also arise, potentially constraining long-term engagements.

Other factor authors evaluated was the novelty as opposed to the familiarity of the messages. Novel messages made users return to the application in a shorter period of time, compared to when a familiar message was presented. However, no differences were found in inspiring users to walk more. While novel content helped to intensify engagement with the tracker per se, this was not translated directly into a change of exercise behavior.

In a previous article, in 2014, Consolvo et al. [4] highlighted some of the advantages of using textual feedback to present data findings, indicating as the strongest point of textual feedback the fact that it can "provide people with information about their data that they might not have discovered themselves," and highlighting that by providing feedback in everyday language "textual feedback can also overcome the problem of giving self-monitoring feedback to users with low numeracy."

Some of the advantages of using textual feedback were also noted by Villalonga et colleagues [41] in a 2017 paper where they presented an ontology-based approach to model

personalizable motivational messages for promoting healthy physical activity. Their proposed ontology models the message intention and its components (e.g., argument, feedback or follow-up, as well it's content, such as action, place, time, action, or object required to perform the recommended activity). The goal was to find the "appropriate feedback using context information to prune irrelevant branches of the ontology." Following the authors, this model differs from others by the fact that most of these models only include information about the structure of the message or its intention.

Researchers also explored text messages as a way to remind users of their plans [13,25]. Reminding users of their exercise goals through internet or mobile phone can help them to increase their physical activity [13,25]. Findings suggest that a combined implementation intention with text message reminders is more effective than either strategy alone in terms of increasing exercise [25]. However, pairing implementation intentions with SMS was only beneficial when a participant chose to receive reminders of their plans, which implies that reminding an individual of their plans drives the effects. This effect might happen, as the authors explain because "the intervention should increase the accessibility of the environmental cue (as the individual is reminded of this cue) or cue an individual to implement their plan (as the individual is reminded of the association between the cue and their desired action), or both" [25]. However, authors do not directly test these processes and additional explanations should be considered.

2.1.1 Motivational Text Messages. Tseng et colleagues [39] developed a mobile application to deliver motivational text messages to adult office workers with sedentary jobs. They also provide monetary incentives to foster walking behavior. The creation of the motivational text messages was not detailed, although following participants' opinions, these messages helped remind them to do some physical activity. This early-work found that motivational text messages can improve people's walking behavior only when their behavior is first influenced by motivational text messages, not through money.

Participants who received the motivational text messages first, then the monetary reward, have increased identified behavior regulation levels after being intervened by motivational text messages. The extrinsic identified behavior regulation, in turn, has been linked to the initial adoption or short-term exercise adoption [33]. Motivational text messages seem to be able to impact this critical type of motivation to start exercising.

2.2 Visual Aesthetics in HCI

Visual aesthetics, in human-computer interaction, is viewed as the beauty or pleasing appearance of things [37], a non-instrumental quality, that plays a significant role in the product appeal and experience [12]. Aesthetic appeal is often perceived before any other quality characteristics of the products (e.g., usability) [11], and aesthetic judgments are similar before and after users interact with a system [20,38].

However, the positive results of studies regarding the existence of a positive correlation between visual aesthetics and

the assessment of other product characteristics (e.g. usability) [16,31,35,36], was not always confirmed [9,10,29].

For Hassenzahl [11] inconsistencies in the findings related to the impact of visual aesthetics (beauty) can partially be explained by differences in the approaches of studying beauty.

For Norman [24], the aesthetic experience seen as what is called the visceral design – the initial impact of a product, about its appearance, touch, and feel – might impact other product attributes since an aesthetic experience can lead to positive affect, and positive affect, in turn, can affect our cognitive processing [14,15].

Studies using functional magnetic resonance imaging (fMRI) support the claim that aesthetic emotions are intertwined with aesthetic judgments [18,19]. Aesthetic experiences are associated with reflective thought as well as affective responses [44], that will impact the overall impression of a product.

All in all, there is not a clear understanding of how beauty impacts the general impression of products and user experience [20,30,38], but as long “as beauty contributes to value and the overall liking of the product, this general ‘positivity’ is likely to spill over to other attributes” [11].

3 Study Design

Researchers started by creating an exploratory pilot survey constituted mainly by open-ended questions and tested it with 20 individuals from Amazon Mechanical Turk.

All individuals reported seeing motivational text messages (messages that encourage people to exercise) regularly and actively seek them. Considering the answers from this pilot survey, researchers created then a final survey, in which, they transformed the open-ended questions into closed-ended questions.

Participants. The target individuals for this study were individuals who see and seek actively motivational text messages on a regular basis. Within this general profile, we were interested in comparing similarities and differences between individuals who exercise regularly (group EX) and individuals who never exercise or do not exercise regularly (group Not EX).

To recruit the same number of individuals for each group (EX and Not EX), we created two “hits” (surveys) in Amazon Mechanical Turk, both with screening questions. Both hits had the same three screening questions. The first two screening questions asked if the individuals frequently see motivational text messages and actively seek them out. Individuals had to answer “yes” to both questions to be considered.

The third screening question required a different answer to be accepted and served the purpose to classify individuals within the general target profile (exercisers versus not-exercisers), as well to control the number of individuals recruited within each group. A total of 160 valid individuals were recruited, with 80 in each group.

The hit that had as final target audience exercisers (the group EX) rejected individuals who reported being non-exercisers. The hit that had as target audience non-exercisers

(the group Not EX) rejected individuals who reported being exercisers.

All participants were recruited from Amazon Mechanical Turk, and had to meet the qualification requirements: having location equal to the US, having a number of HITs approved greater than 500, and lastly, having a HIT approval rate greater than or equal to 99%.

Individuals started by being informed that the survey had three closed-ended qualifying questions and that they will not get paid answering these. Participants acknowledged that their participation in the study was voluntary and they agreed not being paid answering the qualifying questions. Participants were informed that they can choose to terminate their participation in the study at any time and for any reason.

Individuals who passed the screening questions were invited to complete the survey. Participants were compensated with \$1.00 and the survey took on average 5 minutes and 50 seconds to complete.

IP addresses of participants were analyzed to detect multiple submissions. There were no instances of multiple submissions.

The structure of the survey questions is as follows:

(1) Exercise Profile. If the participant had stated that they exercise regularly in the screening questions, then they were asked how often they exercised and how long they gave been exercising regularly. If the participant stated they do not exercise regularly in the screening questions, they were asked if they were thinking of starting to exercise regularly in the next three months;

(2) Messages View Habits. Participants were asked the following questions regarding their message view habits: (2.1) Participants were asked how long ago they began noticing motivational text messages, for what reasons, where and when they saw motivational text messages. (2.2) How participants saw the motivational text messages presented to them (e.g., as text-only or embedded in a visual presentation), and how they preferred to see them. (2.3) Did having the motivational text messages be presented in an aesthetically appealing presentation instill a positive feeling? (2.4) Is the visual presentation of a motivational text message as important as what the message says?

(3) Types of Exercise Motivation. BREQ3 scale [21,43];

(4) Demographics. Age, gender, nationality, education.

(5) Comments or suggestions (optional).

4 Results

The presentation of the results follows this order: demographic characterization, exercise profiles, motivational text messages - for what, where and when, motivational text messages presented as text-only or embedded in a visual presentation, and lastly, differences in the types of exercise motivation (amotivation, extrinsic identified behavior regulation, extrinsic introjected behavior regulation, extrinsic identified behavior regulation, extrinsic integrated behavior regulation, intrinsic motivation).

4.1 Demographic Characterization

Age and gender. Individuals in the EX group were slightly older (the sample's median age was 31 years [min. = 20, max. = 63]) than those in the Not EX group (the sample's median age was 29 years [min. = 19, max. = 58]).

In both groups, there were more men than women. The number of men and women in the Not EX group was relatively similar (38 female [47%], 42 male [53%]). In group EX there was a difference of 20% between the genders of participants (32 female [40%], 48 male [60%]), which might have led to gender bias within this group.

Education. None of the participants, in both groups, had less than a high school diploma. Most participants in both groups had a bachelor's degree (48% in EX group, 66% in Not EX group), followed by those who reported having some college, but no degree in the case of the EX group (20% of the EX participants), and by those who reported having an associate's degree in the case of the Not EX group (13% of the Not EX participants).

4.2 Exercise Profiles

The exercise profile of the groups EX (the regular exercisers) and Not EX (non-regular exercisers) is as follows:

4.2.1 Group EX – Regular Exercisers. This group is characterized by individuals that exercise often, at least three times a week (Figure 1, point 5 and 6). They are long-term exercisers (the majority of the participants have been exercising more than 12 months) (Figure 2) and started seeing motivational text messages accordingly to the period they started to exercise (Figure 2).

A Kendall's tau-b correlation was run to determine the relationship between how long EX participants have been exercising regularly and how long they had started seeing motivational text messages. There was a strong, positive association between how long they exercise and how long they started seeing motivational text messages, which was statistically significant, $\tau_b = .602, p = .001$.

4.2.2 Group Not EX (Non-Regular Exercisers). This group is characterized by individuals that typically only exercise occasionally (Figure 1, point 1 and 2).

Most of the individuals have the intention to start exercising within a month (Figure 3), and they started seeing motivational text messages mainly less than 6 months ago (Figure 3, points: Less than 1 month ago, between 1 month and 3 months ago, and more than 3 months ago).

There was not a pattern regarding how long they started seeing motivational text messages and their intention to start exercising (Figure 3), as confirmed by Kendall's tau-b correlation test.

A Kendall's tau-b correlation was run to determine the relationship between how long Not EX participants started seeing motivational text messages and their intention to exercise in the next three months. There was an extremely weak, negative association between both variables, which was not statistically significant, $\tau_b = -.007, p = .939$.

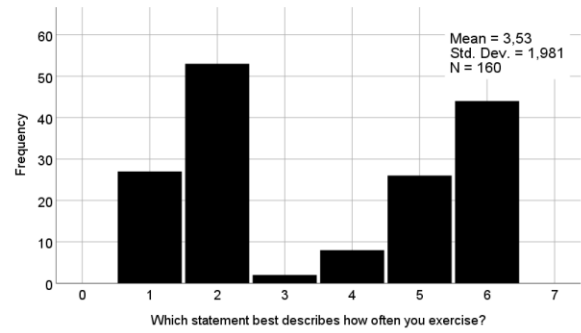


Figure 1: How often participants exercise. 1= I never exercise, 2= Once in a while, 3= Once a week, 4= Twice a week, 5= Three times a week, 6= More than three times a week. (The point 1 and 2 correspond to the participants in the Not EX group. The point 3, 4, 5, 6 and seven correspond to the participants in the EX group).

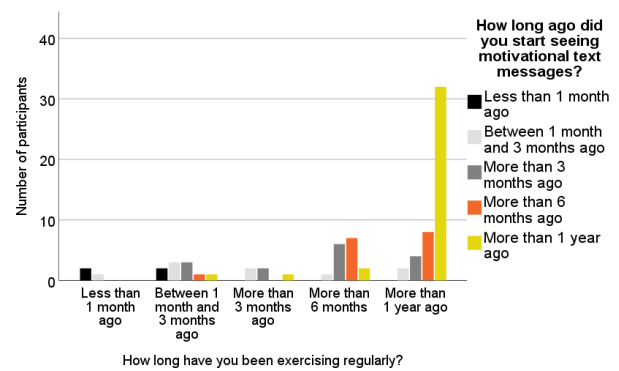


Figure 2: How long have participants in the group EX been exercising regularly clustered by how long they started seeing motivational text messages.

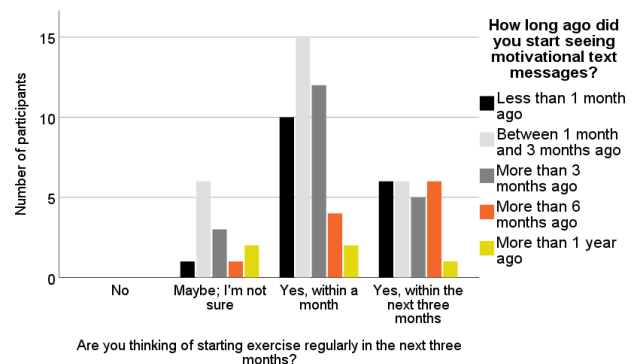


Figure 3: Whether participants in the group Not EX are planning to start exercising regularly soon clustered by how long they started seeing motivational text messages.

4.3 Motivational Text Messages – For What, Where, and When

The majority of the participants in both groups look for motivational text messages with the only purpose of trying to boost their exercise motivation (Figure 4, A). A considerable number of participants look for motivational text messages to try to boost their exercise motivation, remind them of their exercise goals and the benefits of exercising (Figure 4, ABC). However, groups differ in their third main reason to look for motivational text messages. In the Not EX group the third top reason to look for motivational text messages is to remind participants of their exercise goals. In the EX group, the third top reason to look for motivational text messages combine reasons B and A: remind participants of their exercise goals and try to boost their exercise motivation.

Therefore, while participants in the EX group look for motivational text messages to boost their exercise motivation (present in the three top reasons to look for motivational text messages), individuals in the Not EX group might only look for motivational text messages to remind them of exercise goals, and not to boost their exercise motivation.

Both groups visualize motivational text messages mainly on social media platforms and online forums (Facebook, Youtube, Instagram, Twitter, Reddit). In the case of the Not EX group, participants also reported to receive them from friends or family (Figure 5, AC). In the case of EX participants, they also reported to receive motivational text messages in apps and from friends and family (Figure 5, ABC).

In total, two participants selected option D (Figure 5, D and BD) and reported finding motivational text messages in the gym.

Individuals in the EX group, the regular exercisers, reported seeing motivational text messages primarily before working out, and when they check social media (Figure 6, AB). Individuals in the Not EX group, the non-regular exercisers, reported seeing motivational text messages mainly when they check social media.

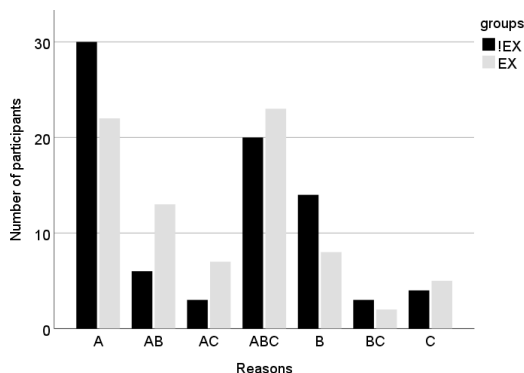


Figure 4: What are the main reasons for seeking motivational text messages in each group of participants. A= To try to boost my exercise motivation, B= Because they remind me of my exercise goals, C= Because they remind me of the benefits of exercising, D= Other.

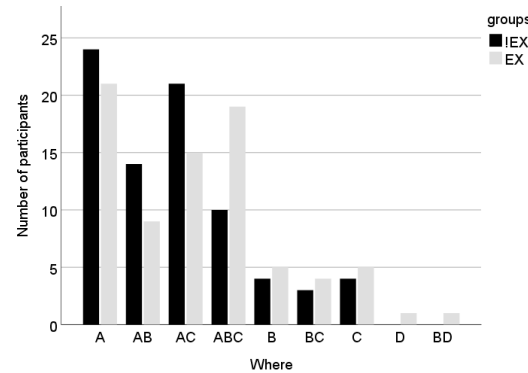


Figure 5: Where participants usually see motivational text messages. A= Social media platforms and online forums (Facebook, YouTube, Instagram, Twitter, Instagram, Reddit), B= Apps, C= Sent by friends or family, D= Other.

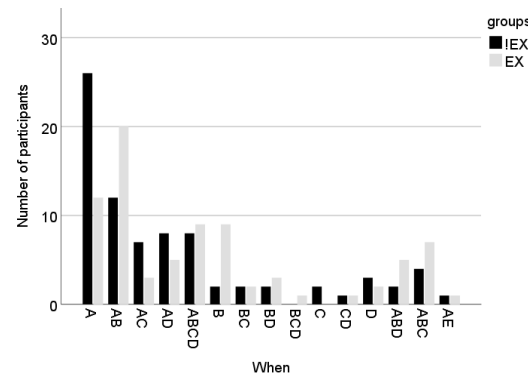


Figure 6: When do participants usually see motivational text messages. A= When I check social media, B= Before working out, C= After working out, D= When I miss the motivation to go exercising, E= Other.

4.4 Text Messages Presented as Text-Only or Embedded in a Visual Presentation?

The majority of all participants (in groups EX and Not EX) usually see motivational text messages presented as text-only, as well, as embedded in a visual presentation (Figure 7).

In both groups, individuals tend to have a preference to visualize motivational text messages presented as a "mix", sometimes as text-only and sometimes embedded in a visual presentation (Figure 8).

The vast majority of the participants indicated that an aesthetically appealing visual presentation helps to instill a positive feeling relative to the text (Figure 9).

Lastly, the visual presentation of a motivational text message was considered as being as important as the textual content in both groups (Figure 10), and only a very small part of the participants indicated that the visual presentation is more important for them than the textual content (Figure 10).

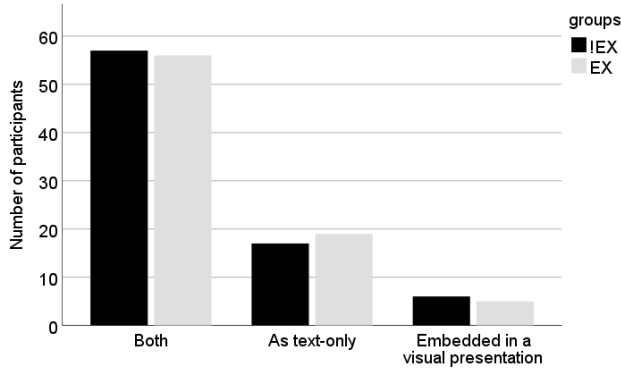


Figure 7: How participants usually see motivational text messages presented.

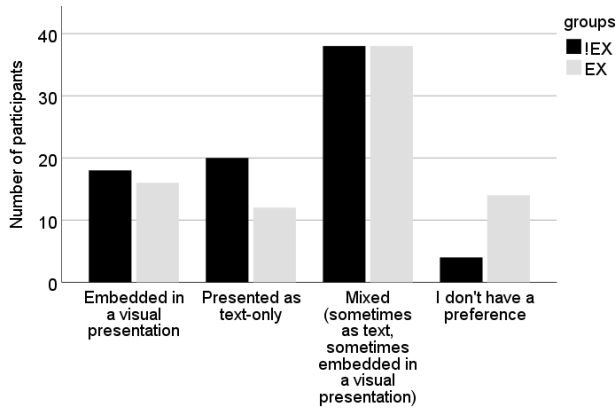


Figure 8: How participants prefer to see motivational text messages.

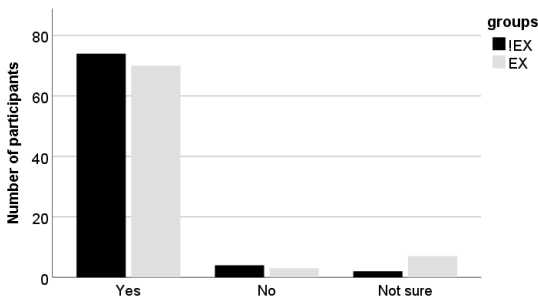


Figure 9: Would you say that visualizing a motivational text message embedded in an aesthetically appealing visual presentation helps to instill a positive feeling relative to the text?

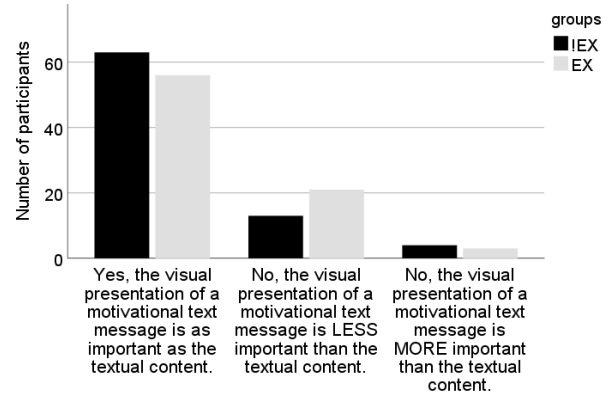


Figure 10: Would you say the visual presentation of a motivational text message is as important as the textual content?

4.5 Differences in The Types of Exercise Motivation

Following the different types of motivation individuals can have to perform a certain behavior, according to self-determination theory [6,28], as well as previous findings related to exercise motivation and predicting exercise adoption and exercise compliance among adults [26,27,32,33], we measured the participants on their different types of exercise motivation, through the BREQ-3 scale [21,43]. The types and levels of motivation of the participants were then compared to the results of published literature.

In self-determination theory [28], controlled and autonomous motivation designate the "quality" of motivation and varies from low-self-determined to self-determined.

The terms amotivation, extrinsic motivation (from external factors to the activity), and intrinsic motivation (from internal factors) designate the type of motivation present in individuals.

Some of the behavior regulatory styles of extrinsic motivation are considered controlled motivation (external and introjected regulations) while the ones close to self-determined behaviors are already within autonomous motivation (identified and integrated behavior regulations). Intrinsic motivation is the prototype of self-determined motivation.

As expected, individuals in the EX group, present high levels of intrinsic motivation (Figure 16), as well as, extrinsic and autonomous motivation (Figure 14 and Figure 15).

Moreover, these individuals also present low levels of amotivation (Figure 11), as well as between small (external regulation) and medium levels (introjected regulation) of extrinsic and controlled motivation (Table 1, Figure 12 and Figure 13). Individuals in the Not EX group tend to present medium levels of all types of exercise motivation (Table 1), as we can see on Figure 11 (levels of amotivation), Figure 12 (external regulation), Figure 13 (introjected regulation), Figure 14 (identified regulation), Figure 15 (integrated regulation), and Figure 16 (intrinsic regulation).

Table 1: The median for all types of exercise motivation (BREQ-3 scale, values from 0 to 4) in EX and Not EX groups.

	Amotivation	External	Introjected	Identified	Integrated	Intrinsic
Not EX	2.00	2.25	2.62	2.50	2.25	2.25
EX	.00	1.12	2.50	3.25	3.00	3.00

4.5.1 Comparison of Motivation Levels Between Groups. Statistical tests have confirmed that there is significant differences between the levels of all types of behavior regulation, except in the introjected regulation, between EX and Not EX groups.

The EX group present lower levels of amotivation, as well as external regulation, than the Not EX group. The EX group present higher levels of extrinsic and autonomous motivation, as well as intrinsic motivation than the Not EX group (Table 1). These results are in line with what was observed in previous research works [26,27,32,33]. Intrinsic and extrinsic as well as autonomous motivation is typically present in individuals who regularly exercise.

Next, the results of the statistical tests that compared the levels of the different types of motivation between each group are presented.

Amotivation. A Mann-Whitney U test was run to determine if there were differences in amotivation score between EX and Not EX groups. Median amotivation score was statistically significantly higher in Not EX (2.00) than in EX (0.00), $U = 1540.500$, $z = -5.789$, $p = .001$.

External Regulation. A Mann-Whitney U test was run to determine if there were differences in external regulation score between EX and Not EX groups. External regulation scores for EX (mean rank = 64.22) were statistically significantly lower than for Not EX (mean rank = 96.78), $U = 1897.500$, $z = -4.463$, $p = .001$.

Introjected Regulation. A Mann-Whitney U test was run to determine if there were differences in introjected regulation score between EX and Not EX groups. Median introjected regulation score for EX (2.63) and Not EX (2.50), was not statistically significantly different, $U = 3066.500$, $z = -.458$, $p = .647$.

Identified Regulation. A Mann-Whitney U test was run to determine if there were differences in identified regulation score between EX and Not EX groups. Identified regulation scores for EX (mean rank = 101.41) were statistically significantly higher than for Not EX (mean rank = 59.59), $U = 4872.500$, $z = 5.740$, $p = .001$.

Integrated Regulation. A Mann-Whitney U test was run to determine if there were differences in integrated regulation score between EX and Not EX groups. Integrated regulation scores for EX (mean rank = 99.83) were statistically significantly higher than for Not EX (mean rank = 61.17), $U = 4746.500$, $z = 5.300$, $p = .001$.

Intrinsic Motivation. A Mann-Whitney U test was run to determine if there were differences in integrated regulation score

between EX and Not EX groups. Intrinsic regulations scores for EX (mean rank = 97.93) were statistically significantly higher than for Not EX (mean rank = 63.07), $U = 4594.500$, $z = 4.776$, $p = .001$.

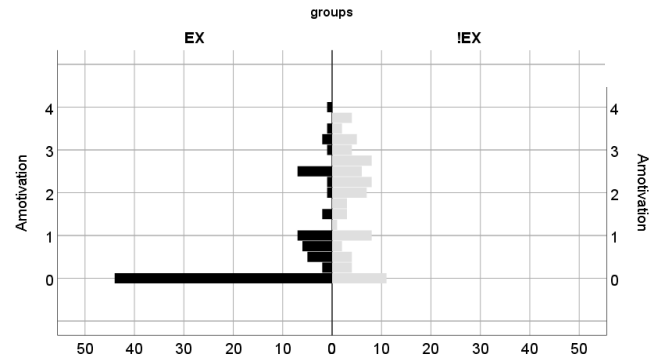


Figure 11: Histogram of amotivation scores by groups.

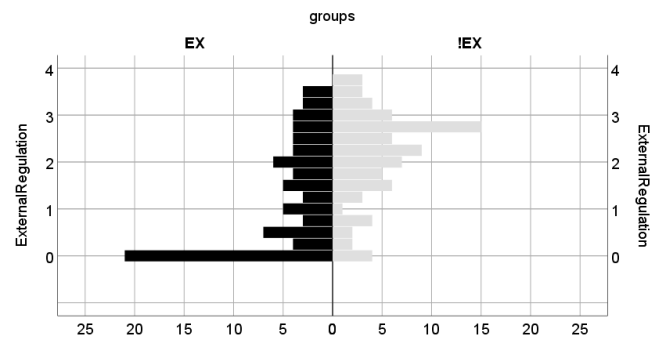


Figure 12: Histogram of external behavior regulation scores by groups

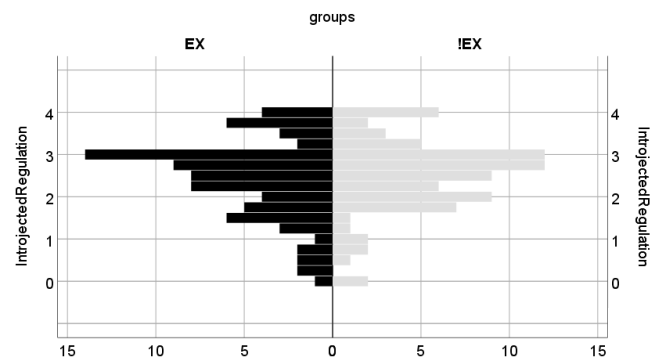


Figure 13: Histogram of introjected behavior regulation scores by groups.

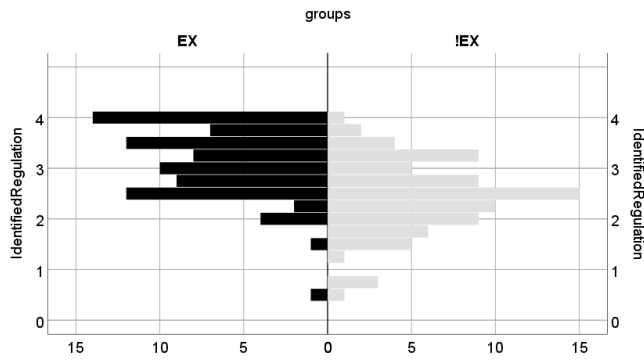


Figure 14: Histogram of identified behavior regulation scores by groups.

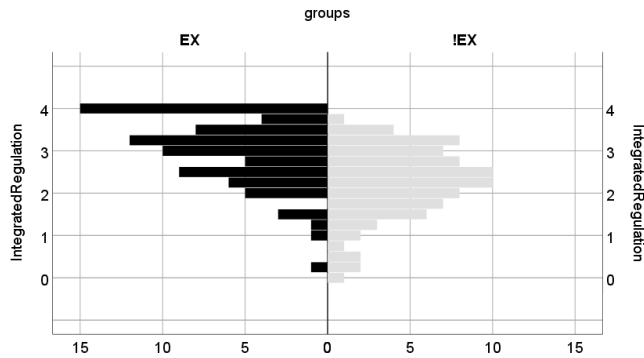


Figure 15: Histogram of integrated behavior regulation scores by groups.

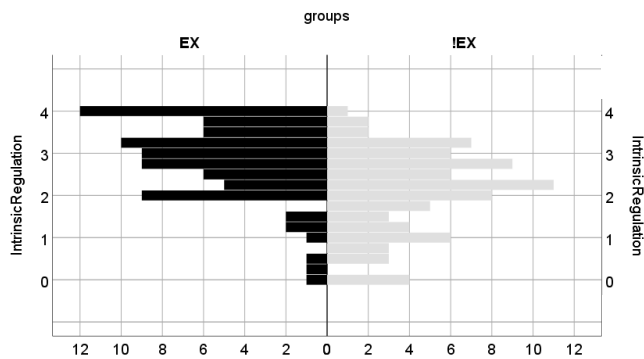


Figure 16: Histogram of intrinsic behavior regulation scores by groups.

5 Discussion

Our exploratory surveys showed that individuals who exercise regularly and see motivational text messages regularly (the EX group) use motivational text messages with the general purpose

of trying to boost their exercise motivation, as well as to remind themselves of their exercise goals, and the benefits of exercising. Goal reminders have shown to help individuals continue to pursue their goals [13,25]. Reminders can also help to consciously valuing an activity what might help to increase the identified behavior regulation [39] which is linked with the initial adoption of exercise [33].

The regular exercisers reported they started exercising and started seeing motivational text messages in a similar period of time, and statistical tests, showed a positive correlation between both. This might suggest that this type of profile of individuals (regular exercisers) have been using motivational text messages to strengthen their exercise motivation, and not that motivational text messages triggered a change of behavior. However, follow-up contact with this population would be useful to confirm this finding.

Individuals in the group Not EX, non-regular exercisers, tend to look for motivational text messages as a way to boost their exercise motivation. The assessment of the different types of exercise motivation showed that this group of individuals tend to present similar levels of self-determined and non-self determined exercise motivation, which might explain why there was no change in their behavior. These individuals tend to present relatively medium levels of all types of motivation (Table 1). They are not particularly demotivated or controlled and extrinsically motivated, as well as not particularly intrinsically motivated.

This might suggest that, in general, if the individuals do not have high levels of self-determined exercise motivation, the motivational text messages might not be enough to help individuals start having regular exercise habits. A notable number of individuals who do not exercise regularly reported seeing motivational text messages already more than three months ago and less than six months ago.

Regarding the importance of the visual presentation, and in particular, the aesthetic appeal, both groups presented the same opinions. Both tend to see motivational text messages presented as text-only, as well as embedded in a visual presentation. Both prefer to see them in a mixed way, sometimes as text and sometimes embedded in a visual presentation, and not only seeing them as text-only or solely embedded in a visual presentation. However, we do not know why they prefer to view motivational text messages presented in a mixed way. We suggest exploring this question in future work.

It was found that, in both groups, participants felt that an aesthetically appealing visual presentation helps instill a positive feeling regarding the textual content. This result can be seen as being in line with HCI literature. Non instrumental qualities, such as aesthetically appealing, can contribute to a positive user experience or general impression about a product [9,11]. Regarding the importance of the visual presentation, the majority of the participants in both groups reported that for them the visual presentation is as important as the textual content. However, in our study, we did not explore why individuals say so. We suggest as future work, an in-depth exploration about this topic.

Finally, what is a motivational text message (their characteristics) was not defined to participants. This limitation of the study may have caused differences in their judgment of what is a motivational text message.

6 Conclusions

We contribute to an initial understanding of why different profile of exercisers, regular and non-regular, look for motivational text messages, how motivational text messages support exercise motivation, and in general, what is the importance of an aesthetically appealing visual presentation. Activity trackers services should support motivational text messages presented as text-only as well as with an appealing visual presentation. Using motivational messages that remind their users of their goals, as well as the benefits of exercising, might help regular exercisers engage with their service. On the other hand, future studies are needed to conduct further research to understand how motivational text messages could match the needs of non-regular exercisers, and thus hopefully help them to become regular exercisers.

ACKNOWLEDGMENTS

This research was funded by ARDITI –Agência Regional para o Desenvolvimento da Investigação Tecnológica e Inovação, Madeira Island, Portugal, under the support of the Project M1420 -09-5369-FSE-000001 – Ph.D. scholarship;

REFERENCES

- Susan Weber Buchholz, Joellen Wilbur, Diana Ingram, and Louis Fogg. 2013. Physical activity text messaging interventions in adults: A systematic review. *Worldviews on Evidence-Based Nursing* 10, 3: 163–173. <https://doi.org/10.1111/wvn.12002>
- Paula Coccozza. 2014. Read this and feel better – how inspirational guff invaded our lives. *The Guardian*. Retrieved from https://www.theguardian.com/lifeandstyle/2014/nov/18/inspirational-quote-business-read-feel-better?CMP=twl_gu
- Kay Connelly and Aditya U. Mutsuddi. 2012. Text Messages for Encouraging Physical Activity. *PervasiveHealth*: 33–40. <https://doi.org/10.4108/icst.pervasivehealth.2012.248715>
- Sunny Consolvo. 2012. Designing for Healthy Lifestyles: Design Considerations for Mobile Technologies to Encourage Consumer Health and Wellness. *Foundations and Trends® in Human-Computer Interaction* 6, 3–4: 167–315. <https://doi.org/10.1561/11000000040>
- Dean Burnett. 2014. Motivational posters: do they actually work? *The Guardian*. Retrieved from <https://www.theguardian.com/science/brain-flapping/2014/nov/20/motivational-posters-science>
- Edward L Deci and Richard M Ryan. 2000. The “what” and “why” of Goal Pursuits: of Behavior Human Needs and the Self-determination. *Psychological Inquiry* 11, 4: 227–268. <https://doi.org/10.1207/S15327965PLI1104>
- Rúben Gouveia, Evangelos Karapanos, and Marc Hassenzahl. 2015. How do we engage with activity trackers?: a longitudinal study of Habito. *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, SEPTEMBER: 1305–1316. <https://doi.org/10.1145/2750858.2804290>
- Amanda Hall, Heather Cole-Lewis, and Jay M. Bernhardt. 2015. Mobile Text Messaging for Health: A Systematic Review of Reviews. *Ssrn*. <https://doi.org/10.1146/annurev-publhealth-031914-122855>
- Kai-Christoph Hamborg, Julia Hülsmann, and Kai Kaspar. 2014. The Interplay between Usability and Aesthetics: More Evidence for the “What Is Usable Is Beautiful” Notion. *Advances in Human-Computer Interaction*. <https://doi.org/10.1155/2014/946239>
- Marc Hassenzahl. 2004. The Interplay of Beauty, Goodness, and Usability in Interactive Products. *Human Computer Interaction* 19, 4: 319–349. https://doi.org/10.1207/s15327051hci1904_2
- Marc Hassenzahl. 2008. Aesthetics in interactive products: Correlates and consequences of beauty. In *Product Experience*. 287–302. <https://doi.org/10.1016/B978-008045089-6.50014-9>
- Marc Hassenzahl and Noam Tractinsky. 2006. User experience - A research agenda. *Behaviour and Information Technology* 25, 2: 91–97. <https://doi.org/10.1080/01449290500330331>
- Robert Hurling, Michael Catt, Marco De Boni, Bruce William Fairley, Tina Hurst, Peter Murray, Alannah Richardson, and Jaspreet Singh Sodhi. 2007. Using internet and mobile phone technology to deliver an automated physical activity program: Randomized controlled trial. *Journal of Medical Internet Research*. <https://doi.org/10.2196/jmir.9.2.e7>
- Alice M. Isen. 2001. An Influence of Positive Affect on Decision Making in Complex Situations: Theoretical Issues With Practical Implications. *Journal of Consumer Psychology* 11, 2: 75–85. https://doi.org/10.1207/S15327663JCP1102_01
- Nadine Jung, Christina Wranke, Kai Hamburger, and Markus Knauff. 2014. How emotions affect logical reasoning: evidence from experiments with mood-manipulated participants, spider phobics, and people with exam anxiety. *Frontiers in Psychology* 5. <https://doi.org/10.3389/fpsyg.2014.00570>
- Masaaki Kurosu, Kaori Kashimura, and O F Creativity. 1995. Apparent usability vs. inherent usability: experimental analysis on the determinants of the apparent usability. *Proceedings of the ACM Conference on Human Factors in Computing Systems*: 292–293. <https://doi.org/10.1145/223355.223680>
- Amy E Latimer, Lawrence R Brawley, and Rebecca L Bassett. 2010. A systematic review of three approaches for constructing physical activity messages: What messages work and what improvements are needed? *International journal of behavioral nutrition and physical activity* 7: 36. <https://doi.org/10.1186/1479-5868-7-36>
- Helmut Leder, Benno Belke, Andries Oeberst, and Dorothee Augustin. 2004. A model of aesthetic appreciation and aesthetic judgments. *British Journal of Psychology* 95: 489–508. <https://doi.org/10.1348/0007126042369811>
- Helmut Leder and Marcos Nadal. 2014. Ten years of a model of aesthetic appreciation and aesthetic judgments: The aesthetic episode - Developments and challenges in empirical aesthetics. *British Journal of Psychology* 105, 4: 443–446. <https://doi.org/10.1111/bjop.12084>
- Gitte Lindgaard, Gary Fernandes, Cathy Dudek, and J. Brown. 2006. Attention web designers: You have 50 milliseconds to make a good first impression! *Behaviour & Information Technology* 25, 2: 115–126. <https://doi.org/10.1080/01449290500330448>
- David Markland and Vanessa Tobin. 2004. A Modification to the Behavioural Regulation in Exercise Questionnaire to Include an Assessment of Amotivation. *Journal of Sport and Exercise Psychology*. <https://doi.org/10.1123/jsep.26.2.191>
- Sean Munson and Sunny Consolvo. 2012. Exploring Goal-setting, Rewards, Self-monitoring, and Sharing to Motivate Physical Activity. *Proceedings of the 6th International Conference on Pervasive Computing Technologies for Healthcare*: 25–32. <https://doi.org/10.4108/icst.pervasivehealth.2012.248691>
- Seth M. Noar, Christina N. Benac, and Melissa S. Harris. 2007. Does Tailoring Matter? Meta-Analytic Review of Tailored Print Health Behavior Change Interventions. *Psychological Bulletin* 133, 4: 673–693. <https://doi.org/10.1037/0033-2909.133.4.673>
- Donald N. Norman. 2004. *Emotional Design - Why we love (or hate) everyday things*. https://doi.org/10.1111/j.1537-4726.2004.133_10.x
- A. Prestwich, M. Perugini, and R. Hurling. 2009. Can the effects of implementation intentions on exercise be enhanced using text messages? *Psychology and Health*. <https://doi.org/10.1080/08870440802040715>
- Wendy M. Rodgers, Craig R. Hall, Lindsay R. Duncan, Erin Pearson, and Marcia I. Milne. 2010. Becoming a regular exerciser: Examining change in behavioural regulations among exercise initiators. *Psychology of Sport and Exercise* 11, 5: 378–386. <https://doi.org/10.1016/j.psychsport.2010.04.007>
- R.M. Ryan, C.M. Fredrick, D. Lepes, N. Rubio, and K.M. Sheldon. 1997. Intrinsic Motivation and Exercise Adherence. *International Journal of Sport Psychology* 28, 335–354.
- R M Ryan and E L Deci. 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist* 55, 1: 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Paul Van Schaik and Jonathan Ling. 2009. The role of context in perceptions of the aesthetics of web pages over time. *International Journal of Human-Computer Studies* 67, 1: 79–89. <https://doi.org/http://dx.doi.org/10.1016/j.ijhcs.2008.09.012>
- Bo N. Schenkman and Fredrik U. Jonsson. 2000. Aesthetics and Preferences of Web Pages. *Behaviour and Information Technology* 19, 5: 367–7.
- Andreas Sonderegger and Juergen Sauer. 2010. The influence of design aesthetics in usability testing: Effects on user performance and perceived usability., Der Einfluss von ästhetischem Design beim Usability-Testing: Auswirkungen auf Benutzerverhalten und wahrgenommene Usability. *Applied Ergonomics* 41, 3: 403–410. Retrieved from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyn&NEWS=N&AN=0227628>
- Martyn Standage and Richard M Ryan. 2012. Self-determination theory and

- exercise motivation: facilitating self-regulatory processes to support and maintain health and well-being. In *Advances in motivation in sport and exercise, 3rd edition*, Glyn C Roberts and Darren C Treasure (eds.). Human Kinetics, Champaign, U. S. A., 233–270. Retrieved from <http://opus.bath.ac.uk/30376/>
33. Pedro J. Teixeira, Eliana V. Carraça, David Markland, Marlene N. Silva, and Richard M. Ryan. 2012. Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 9, 1: 1. <https://doi.org/10.1186/1479-5868-9-78>
 34. T Toscos, A Faber, K Connelly, and A M Upoma. 2008. Encouraging physical activity in teens Can technology help reduce barriers to physical activity in adolescent girls? *Pervasive Computing Technologies for Healthcare, 2008. PervasiveHealth 2008. Second International Conference on* 3, Group 3: 218–221. <https://doi.org/10.1109/PCTHEALTH.2008.4571073>
 35. N Tractinsky. 1997. Aesthetics and apparent usability: Empirically assessing cultural and methodological issues. *Conference on Human Factors in Computing Systems*: 115–122. <https://doi.org/10.1145/258549.258626>
 36. N. Tractinsky, A. S. Katz, and D. Ikar. 2000. What is beautiful is usable. *Interacting with Computers* 13, 2: 127–145. [https://doi.org/10.1016/S0953-5438\(00\)00031-X](https://doi.org/10.1016/S0953-5438(00)00031-X)
 37. Noam Tractinsky. Visual Aesthetics. *The Encyclopedia of Human-Computer Interaction, 2nd Ed.* Retrieved from <https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/visual-aesthetics>
 38. Noam Tractinsky, Avivit Cokhavi, Moti Kirschenbaum, and Tal Sharfi. 2006. Evaluating the consistency of immediate aesthetic perceptions of web pages. *International Journal of Human Computer Studies*. <https://doi.org/10.1016/j.ijhcs.2006.06.009>
 39. Yuan-Chi Tseng, Hui-Yen Chang, and Shih-Wei Yen. 2018. The Different Effects of Motivational Messages and Monetary Incentives on Fostering Walking Behavior. *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*: LBW017:1--LBW017:6. <https://doi.org/10.1145/3170427.3188670>
 40. Jonathan Van't Riet, Robert A.C. Ruiter, Marieke Q. Werrij, and Hein De Vries. 2010. Investigating message-framing effects in the context of a tailored intervention promoting physical activity. *Health Education Research* 25, 2: 343–354. <https://doi.org/10.1093/her/cyp061>
 41. Claudia Villalonga, Hermie Hermens, Luis Javier Herrera, Hector Pomares, and Ignacio Rojas. 2017. Ontological Modeling of Motivational Messages for Physical Activity Coaching.
 42. Oliver J. Webb and Frank F. Eves. 2007. Promoting stair climbing: Effects of message specificity and validation. *Health Education Research* 22, 1: 49–57. <https://doi.org/10.1093/her/cyl045>
 43. Philip M Wilson, Wendy M Rodgers, Christina C Loitz, and Giulia Scime. 2006. "It's who I am...really!" The importance of integrated regulation in exercise contexts. *Journal of Biobehavioral Research*. <https://doi.org/10.1111/j.1751-9861.2006.tb00021.x>
 44. Yu chu Yeh, Chung Wei Lin, Wei Chin Hsu, Wen Jui Kuo, and Yu Chen Chan. 2015. Associated and dissociated neural substrates of aesthetic judgment and aesthetic emotion during the appreciation of everyday designed products. *Neuropsychologia* 73: 151–160. <https://doi.org/10.1016/j.neuropsychologia.2015.05.010>