

Master's Thesis

The role of visual aesthetics in instant physical
activity motivation: exploring how motivational
images inspire physical activity

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2024

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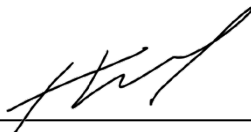
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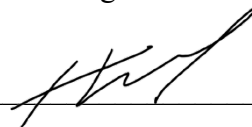
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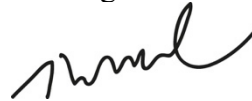
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Abstract

Digital physical activity applications employ various motivational mechanisms to encourage exercise, yet research on the complex relationship between their visual aesthetics and motivation for physical activity is still limited. The purpose of this paper is to investigate how three different visual images, such as those representing health, fitness, and social benefits, respectively, can motivate people to engage in physical activity in a digital service environment. To investigate this, 50 participants evaluated these images in the survey. The results showed that out of the three categories, fitness images had the most significant impact on motivating physical activity, suggesting that stimuli that directly evoke thoughts of physical activity help to increase motivation. In addition, motivation for physical activity and aesthetic appeal were found to be strongly related ($r = 0.65$, $p < 0.001$, $n = 50$). These findings provide new evidence that visual aesthetics in digital applications notably enhance physical activity motivation.

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Terms and Abbreviations

PA	Physical activity
HCI	Human computer interaction
SDT	Self-Determination Theory

I. INTRODUCTION

1.1. Research motivation

During my studies in visual design, I have consistently contemplated the criteria of aesthetics and the intuitive perception of beauty. While working on my undergraduate capstone project, which involved designing a concept for an application to guide fitness beginners in using exercise equipment, I conducted a competitive analysis. Through this process, I discovered that applications with similar functionalities received significantly different user reviews based on their aesthetic appeal. Observing that visual aesthetics influence purchasing decisions, I began to wonder whether visual aesthetics might also enhance motivation for physical activity. This curiosity led me to investigate the design elements that could potentially increase people's motivation to do physical activity from a designer's perspective, initiating this research.

1.2. Background

The physical, mental and social benefits of regular physical activity are widely recognized. Yet there remains a significant gap between the known benefits and how much adults are getting done. Data from the Korean National Health and Nutrition Examination Survey highlight this gap, showing an 18.8% gap in compliance with World Health Organization guidelines for physical activity and sedentary behavior. This gap suggests a critical lack of motivation to maintain recommended activity levels, highlighting the need for individuals to change their perceptions and behaviors regarding physical activity (Garber et al., 2011; Consolvo et al., 2009). In this digital age, mobile devices and smartphone applications are emerging as powerful tools to help facilitate changing health behaviors (Payne et al., 2015). Research shows that interventions rooted in behavioral theories significantly increase the effectiveness of behavior change (Noar & Zimmerman, 2005; Lopez et al., 2016; Schoeppe et al., 2016). Therefore, incorporating strategies such as feedback provision, self-monitoring, and goal setting based on behavior change theories is essential for designing effective motivational applications (Middelweerd et al., 2014).

Self-determination theory (SDT) has received attention for its relevance to physical activity interventions among several theoretical frameworks. SDT posits that the quality of motivation, ranging from intrinsic to extrinsic self-determination, significantly influences physical activity behaviors (Donnachie et al., 2017; Ryan & Deci, 2020). Central to SDT is the satisfaction of three psychological needs—autonomy, competence, and relatedness—that underlie self-determined behavior. In particular, the importance of intrinsic goals, such as improved health and social benefits, in satisfying these needs is

highlighted by the distinction between self-determined and other-determined extrinsic motivation, with the former more positively associated with autonomous choice (Ryan & Deci, 2002; Mears, 2008).

In the domain of health information and services accessible through digital platforms, the influence of visual aesthetics extends (Lazard & King, 2020). Aesthetics not only influence usability, reliability, and enjoyment, but also play a central role in motivating users (Tractinsky et al., 2000; Fogg et al., 2003; Jordan, 1998, Wang & Bowerman, 2018). There is a notable research gap regarding the effect of visual aesthetics on motivational imagery, especially in the context of physical activity promotion, although existing literature has explored the visualization of health data and the development of motivational text content (Huang, 2022; Islam et al., 2022; Meyer et al., 2016; Latimer et al., 2010; Gouveia et al., 2015; Noar et al., 2007; Duro et al., 2019).

1.3. Research question

This study aims to contribute to the field by exploring the influence of visual aesthetics on motivational outcomes related to physical activity, specifically through the lens of Self-Determination Theory (SDT). The research focuses on how images related to health, fitness, and social benefits affect the motivation of young adults aged 20-39 to engage in physical activity. The research questions include: 1) Which of the three categories of imagery tends to motivate the most? 2) How do gender and PA frequency influence in aesthetic appeal and motivation? 3) Is there a correlation between aesthetic appeal and physical activity motivation? 4) Which visual elements enhance both aesthetic appeal and motivation? This research is rooted in the theoretical foundations of SDT and prior research on visual aesthetics. It aims to provide valuable insights into the design of effective health promotion interventions.

There are three main contents in this paper. (1) Empirical investigation of SDT in digital app contexts: The study advances the understanding of SDT by examining how physical activity motivations are influenced by visual stimuli, specifically images promoting physical activity. This adds a nuanced layer to the existing body of knowledge on motivation in the context of physical health, situating SDT within the realm of digital health interventions; (2) Exploration of visual aesthetics in health motivation: By focusing on the aesthetic appeal of images categorized under health, fitness, and social benefits, the research provides insights into how visual aesthetics can be leveraged to enhance motivational outcomes. This addresses a notable gap in the literature, where the emphasis has traditionally been on textual or data visualization rather than on the motivational impact of aesthetic images; and (3) Design implication for the future digital apps: The findings are poised to offer practical guidance for the development of more effective health and fitness applications. By identifying which category of images elicits the highest level of motivation and understanding the role of aesthetic appeal, developers and

designers can create more engaging and motivating content tailored to the preferences and psychological needs of their user base.

This thesis includes content that was previously submitted to the DRS conference.

II. RELATED WORKS

2.1. Self-determination theory

The purpose of SDT intervention is to facilitate individual development within a continuum of increasingly autonomous motivation. Such intervention developments have been successfully achieved in various health management research fields such as smoking cessation, weight loss and others (Williams et al., 2006; Silva et al., 2009). Indeed, researchers who have found evidence that successful health behavior changes can result from applying SDT principles in the domain of physical activity (PA) have begun studying PA promotion interventions based on SDT (Fortier et al., 2012).

Kinnafick et al. (2016) conducted a comparison with a control group to investigate the impact of SDT-theory-based messages delivered through text message intervention on motivation and physical activity behavior. Both groups reported an increase in intrinsic motivation pre- and post-intervention. The SDT-theory-based messages demonstrated the ability to fulfill the three basic psychological needs (autonomy, competence and relatedness) through text messages, indicating their potential to activate intrinsic motivation among individuals, particularly young, healthy, and inactive women. Busch et al. (2020) investigated the impact of self-tracking and normative step goal setting through a fitness app on motivation and physical activity. The implementation of technological support for tracking and visualization was found to promote autonomy-supportive needs fulfillment and facilitate an increase in physical activity levels.

Previous studies have demonstrated that SDT-based interventions on digital devices are useful tools for promoting physical activity. However, they have not focused on the impact of SDT-based interventions when applied to visual imagery.

2.2. Visual aesthetic and motivation

Despite numerous studies on visual aesthetics in design, the correlation between visual aesthetics and motivation remains an unresolved issue. Huang (2022) investigated the impact of visual complexity on the aesthetic preferences and learning motivation in children's educational websites, exploring the correlation between children's aesthetic preferences and learning motivation. The findings indicated a correlation between aesthetic preference and learning motivation, suggesting that the more aesthetically pleasing a learning website is, the higher the children's learning motivation.

Conversely, Duro et al.(2019) explored whether aesthetic pleasure derived from visual quotes could enhance short-term exercise motivation. The results revealed that aesthetic pleasure did not have a significant impact on participants' short-term exercise motivation.

III. METHOD

3.1. Experimental Design

The experiment utilized three types of independent variables involving image sets categorized as “health,” “fitness,” and “social benefits.” To facilitate measurement in the experiment, each category was defined as depicted in Table 1. Representative images for these categories can be observed in Figure 1. The primary dependent variables included aesthetic appeal and motivation. A total of 18 images (with a 1:1 ratio, comprising color and black and white images) were delivered twice daily.

Table 1. The operational definitions of the three categories

Category	Definition
Health	Refers to a healthy lifestyle achievable through physical activity.
Fitness	Denotes the physical performance capabilities attainable through physical activity.
Social benefits	Positive interactions with others and social recognition.

3.1.1. Stimuli

According to SDT, people can be motivated to perform actions through extrinsic and intrinsic motivation. Intrinsic motivation is promoted when individuals experience the fulfillment of their psychological needs for autonomy, competence, and relatedness (Ryan et al., 2009). Three image sets were created, corresponding to health, fitness, and social benefits to stimulate three psychological needs. The images used in the experiment were selected from Google and Pinterest using keywords such as ‘Health aesthetic’ and ‘Fitness aesthetic.’ For the health category, images depicting individuals with healthy eating habits, enjoying life with a healthy body, were chosen. For the fitness category, images included individuals engaging in various types of exercises such as pilates, crossfit, basketball, volleyball, and muay thai. For the social benefits category, images depicted people engaging in positive interactions through PA or receiving attention and recognition through sports activities. All images included people of diverse races, including white and black individuals, and the age of the people in the images was similar to that of the participants.

To select images with high aesthetic satisfaction for the participants, I intuitively considered elements such as color emphasis, appropriate composition, unity, dynamism, and contrast. These elements are principles of design that make artifacts appear more attractive and have been developed over time across various cultures and academic backgrounds. Afterward, the aesthetic quality of the images was verified by the research team, including 2 of 15+ years of experienced designers. The images were presented via Google Forms and maintained a uniform 1:1 ratio.



Figure 1. Health images

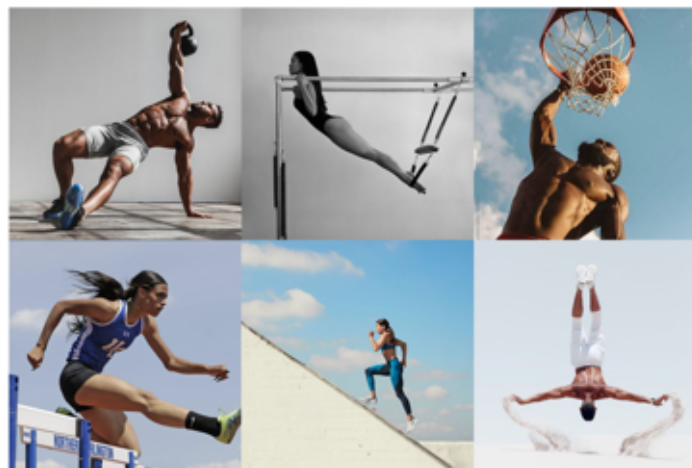


Figure 2. Fitness images



Figure 3. Social Benefits Images

3.1.2. International Physical Activity Questionnaire (IPAQ)

As a tool for measuring individuals' physical activity levels, I employed the International Physical Activity Questionnaire (IPAQ), developed by the World Health Organization (WHO). The IPAQ is a standardized self-report questionnaire designed for the assessment of health-related physical activity in populations. Due to cultural considerations, in this experiment, I used the officially recognized Korean translation version of IPAQ, as endorsed by the IPAQ research team. (Oh et al.,2007)

Questions	Response	Code	
Physical Activity			
Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.			
Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting foodstuffs, fishing or hunting for food, seeking employment. (Insert other examples if needed). In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate. 'Moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.			
Activity at work			
1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [running or sitting heavy loads, digging or construction work] for at least 10 minutes continuously? (INSERT EXAMPLES) (USE SHOWCARD)	Yes 1 No 2 # If No, go to P 4	P1
2	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days [] [] [] [] [] [] [] [] [] []	P2
3	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours: minutes [] [] [] [] [] [] [] [] [] [] hrs mins	P3 (a,b)
4	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously? (INSERT EXAMPLES) (USE SHOWCARD)	Yes 1 No 2 # If No, go to P 7	P4
5	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days [] [] [] [] [] [] [] [] [] []	P5
6	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours: minutes [] [] [] [] [] [] [] [] [] [] hrs mins	P6 (a,b)
Travel to and from places			
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. (Insert other examples if needed).			
7	Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 # If No, go to P 10	P7
8	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days [] [] [] [] [] [] [] [] [] []	P8
9	How much time do you spend walking or bicycling for travel on a typical day?	Hours: minutes [] [] [] [] [] [] [] [] [] [] Hours: minutes hrs mins	P9 (a,b)
Recreational activities			
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure). (Insert relevant terms)			
10	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously? (INSERT EXAMPLES) (USE SHOWCARD)	Yes 1 No 2 # If No, go to P 13	P10
11	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?	Number of days [] [] [] [] [] [] [] [] [] []	P11
12	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours: minutes [] [] [] [] [] [] [] [] [] [] Hours: minutes hrs mins	P12 (a,b)

Continued on next page

부록. 단문형 IPAQ

다음 질문은 사람들이 평소에 하는 신체활동에 대해 알아보고자 만들어졌습니다. 질문은 지난 7일간 귀하가 신체활동에 소모한 시간에 대해 물을 것입니다. 귀하 스스로 활동적이지 않다고 생각되더라도 각 질문에 응답해 주시기 바랍니다. 직장에서 집에서 하는 활동, 교통수단을 이용할 때 하는 활동, 여가 시간에 시행하는 활동, 운동 또는 스포츠 모두를 포함하여 생각해 주시기 바랍니다.

귀하가 지난 7일간 하신 모든 격렬한 활동을 생각해 보십시오. 격렬한 신체활동이란 힘들게 움직이는 활동으로서 평소보다 숨이 훨씬 더 차게 만드는 활동입니다. 한 번에 적어도 10분 이상 지속적인 활동을 생각하여 응답해 주시기 바랍니다.

- 지난 7일간 두꺼운 물건 나르기, 달리기, 에어로빅, 빠른 속도로 자전거 타기 등과 같은 격렬한 신체 활동을 며칠간 하였습니까?
일주일당 _____ 일
 격렬한 신체활동 없었음 ⇨ 3번으로 가세요
- 그런 날 중 하루에 격렬한 신체활동을 하면서 보낸 시간이 보통 얼마나 됩니까?
하루에 _____ 시간 _____ 분
 모르겠다/확실하지 않다
- 귀하가 지난 7일간 하신 모든 중간정도 신체활동을 생각해 보십시오. 중간정도 신체활동이란 중간정도 힘들게 움직이는 활동으로서 평소보다 숨이 조금 더 차게 만드는 활동입니다. 한 번에 적어도 10분 이상 지속적인 활동을 생각하여 응답해 주시기 바랍니다.
- 지난 7일간, 가벼운 물건 나르기, 보통 속도로 자전거 타기, 복식 테니스 등과 같은 중간정도 신체 활동을 며칠간 하였습니까? 결과는 포함시키지 마십시오.
 중간정도 신체활동 없었음 ⇨ 5번으로 가세요
- 그런 날 중 하루에 중간정도의 신체활동을 하며 보낸 시간이 보통 얼마나 됩니까?
하루에 _____ 시간 _____ 분
 모르겠다/확실하지 않다
- 지난 7일간 걸은 시간을 생각해 보십시오. 직장이나 집에서, 교통 수단을 이용할 때 걸은 것 뿐만 아니라 오락 활동, 스포츠, 운동, 여가 시간에 걸은 것도 포함됩니다.
- 지난 7일간, 한 번에 적어도 10분 이상 걸은 날이 며칠입니까?
일주일당 _____ 일
 걸지 않았음 ⇨ 7번으로 가세요.
- 그런 날 중 하루에 걸으면서 보낸 시간이 보통 얼마나 됩니까?
하루에 _____ 시간 _____ 분
 모르겠다/확실하지 않다.

다음 질문은 지난 7일간 주중에 앉아서 보낸 시간에 관한 것입니다. 여기에는 직장과 집에서 작업이나 여가시간에 앉아서 보낸 시간이 포함됩니다. 또한 책상에 앉아 있거나, 친구를 만나거나, 독서를 할 때 있거나, 텔레비전을 앉아서 또는 누워서 시청한 시간이 포함됩니다.

- 지난 7일간, 주중에 앉아서 보낸 시간이 보통 얼마나 됩니까?
하루에 _____ 시간 _____ 분
 모르겠다/확실하지 않다.

Figure 4 From left to right, IPAQ and Korean translation version of IPAQ

3.2. Participants

Participants were recruited from the Ulsan National Institute of Science and Technology campus through a posting and were selected using Google Forms, with eligibility criteria that included being between the ages of 19 and 39, and possessing a smartphone with the Kakao Talk messenger. Kakao Talk is the most widely used and representative messenger application in South Korea.

The participants consisted of individuals interested in promoting physical activity. Being interested in promoting physical activity implies a willingness to recognize and change one's behavior. Participants who were not interested in promoting physical activity, were excluded as it was assumed they would not utilize digital services related to physical activity.

In the survey, a total of 50 participants participated in the experiment, consisting of 25 males and 25 females. All participants completed a demographic questionnaire and the International Physical Activity Questionnaire (IPAQ). Among the participants, 8 individuals had low levels of physical activity, 22 had moderate levels, and 20 had high levels of physical activity. The age range of the participants was 19 to 38 years old.

3.3. Survey procedure

Eligible participants completed a survey regarding their demographic information and the Korean version of the International Physical Activity Questionnaire (IPAQ) using Google Forms. They were also asked to provide their usual physical activity times to determine message sending schedules.

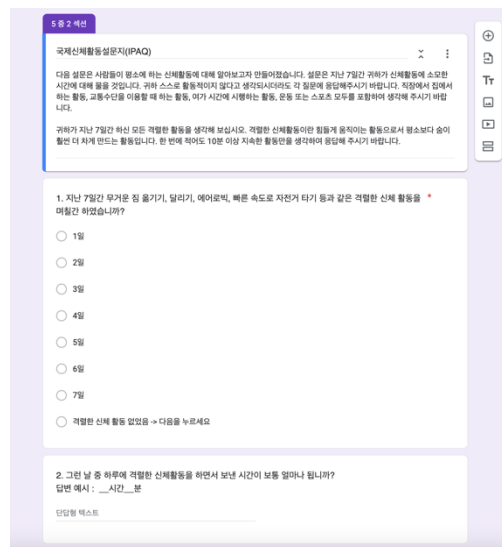


Figure 5 Korean translation version of IPAQ Transferred to Google Forms

In accordance with the World Health Organization (WHO) guidelines, adults aged 18–64 years are recommended to engage in moderate-intensity physical activity for two or more days a week. Following this guideline, the experiment was designed to span three days. After confirming the participants’ usual physical activity times, it was observed that they were mainly divided into morning and afternoon. Consequently, the image delivery times were set to twice a day.

Over a span of three days, three images per session were posted on Google Forms, and links were delivered sequentially through Kakao Talk Messenger, with the order of image presentation randomized to mitigate potential order effects. Participants were asked to evaluate images based on “aesthetic appeal” and “motivation” using a 5-point Likert scale (1=very low, 5=very high). The survey was designed to first assess the level of aesthetic appeal and subsequently evaluate the level of motivation. After that, participants were requested to provide explanations for their choices by answering three questions: ‘Why do you find this image aesthetically appealing or unappealing?’, ‘What about this image inspires motivation?’, and ‘If the “Aesthetic appeal” rating and “Motivation” rating do or do not coincide, what is the reason?’ Participants evaluated the aesthetic appeal and motivation of a total of 18 images over three days, with three images in the morning and three images in the afternoon each day. They provided their reasons for the evaluations, including ratings on a 5-point scale, on a Google Form. After the experiment, participants were compensated with an experimental participation fee of approximately \$15.

The screenshot shows a Google Form titled "설문지" (Survey). It includes a name field, a photo of a man doing a handstand with a kettlebell, and several Likert scale questions. The questions are in Korean and ask about aesthetic appeal and motivation. Below each question is a text box for the user's response.

Figure 6 Survey on Google form

3.4. Data analysis

In the experiment, a total of 1,746 results were obtained for aesthetic appeal and motivation score related to 18 images. Furthermore, 2,618 responses were collected in reference to the three questions regarding the rationales behind participants' choices. To ensure a consistent evaluation of the overall visual appeal across different categories, the top three images with the highest average aesthetic appeal scores from each category were selected. Consequently, a total of 841 responses were analyzed. All quantitative statistics were analyzed using SPSS 29.0. To ascertain which of the three categories exerts the most significant impact on motivation, a repeated measures ANOVA was conducted. And also, to investigate whether there are differences in motivation scores for health, fitness, and social benefits among genders and physical activity frequency, a MANOVA was conducted. In addition, a Pearson's correlation analysis was performed to investigate the relationship between aesthetic appeal and motivation data. For the responses to the three questions, thematic analysis was employed as the qualitative analysis approach.

IV. RESULT

4.1. The motivational differences by category, gender and activity type

I evaluated the dataset using the repeated measures ANOVA to analyze how people get influenced by the images in the three different categories: health, fitness, social benefits. There were no significant differences motivation at health, fitness and social benefits category, $F(2,48)=1.080$, $p=0.348$. Although the differences were not statistically significant, the fitness category had the highest mean motivation score among the categories. Specifically, the mean scores were 3.41 (SE = 0.13) for fitness, 3.30 (SE = 0.14) for health, and 3.26 (SE = 0.12) for social benefits.

I conducted the dataset using MANOVA to examine whether there are differences in motivation scores for health, fitness, and social benefits among genders and physical activity frequency. There were no significant differences found in motivation by gender, $F(2,43) = 1.05$, $p = 0.36$; Wilk's lambda = 0.954, partial eta squared = 0.046. Additionally, no significant differences were observed in motivation by physical activity frequency, $F(4,86) = 1.03$, $p = 0.40p$; Wilk's lambda = 0.911, partial eta squared = 0.045.

4.2. The correlation between aesthetic appeal and motivation in Gender differences

A Pearson correlation coefficient was performed to assess the relationship between aesthetic appeal and motivation. There was a significant, strong positive relationship between aesthetic appeal and motivation, $r(50) = 0.65$, $p < 0.001$. A scatterplot summarizing the results is presented in Figure 6.

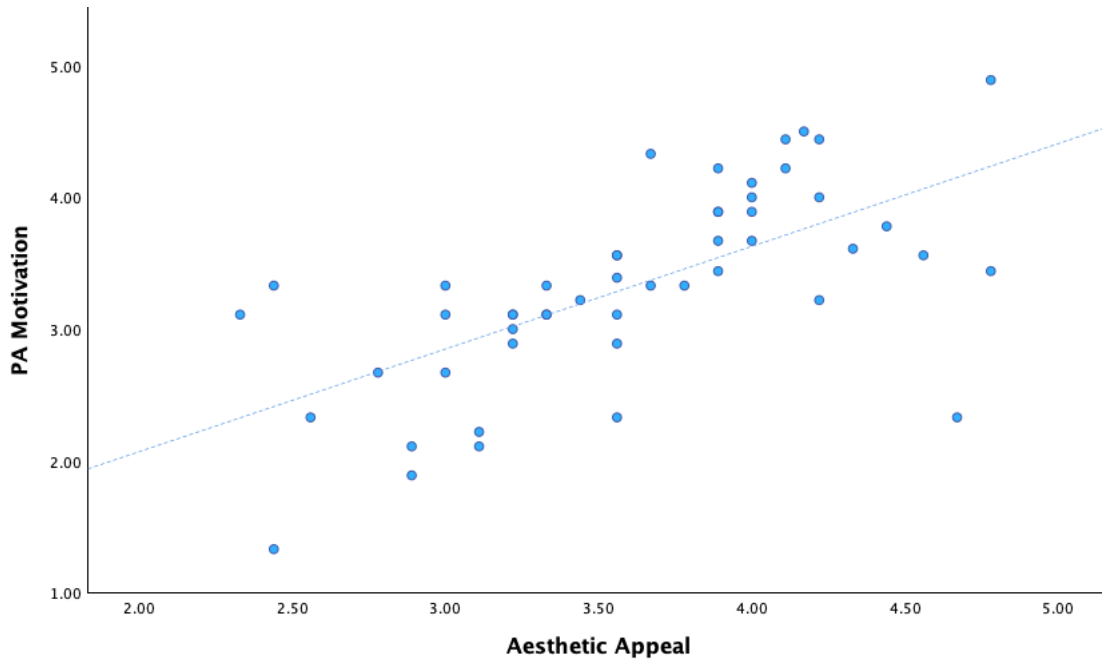


Figure 7 Correlations of aesthetic appeal and motivation

In the male group, a significant, strong positive relationship was observed between aesthetic appeal and motivation, $r(25) = 0.87$, $p < 0.001$. The corresponding scatterplot is displayed in Figure 7.

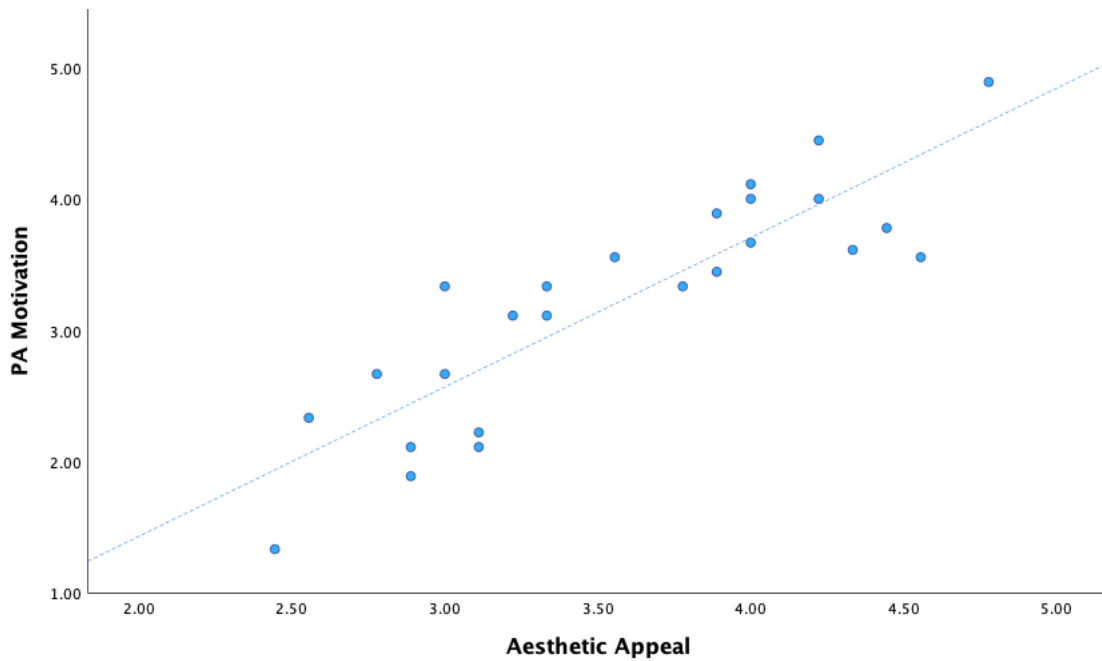


Figure 8 Correlations of aesthetic appeal and motivation in male group

Conversely, In the female group, there was a significant, weak positive relationship between aesthetic appeal and motivation, $r(25) = 0.28$, $p = 0.17$. A scatterplot illustrating the results can be found in Figure 8.

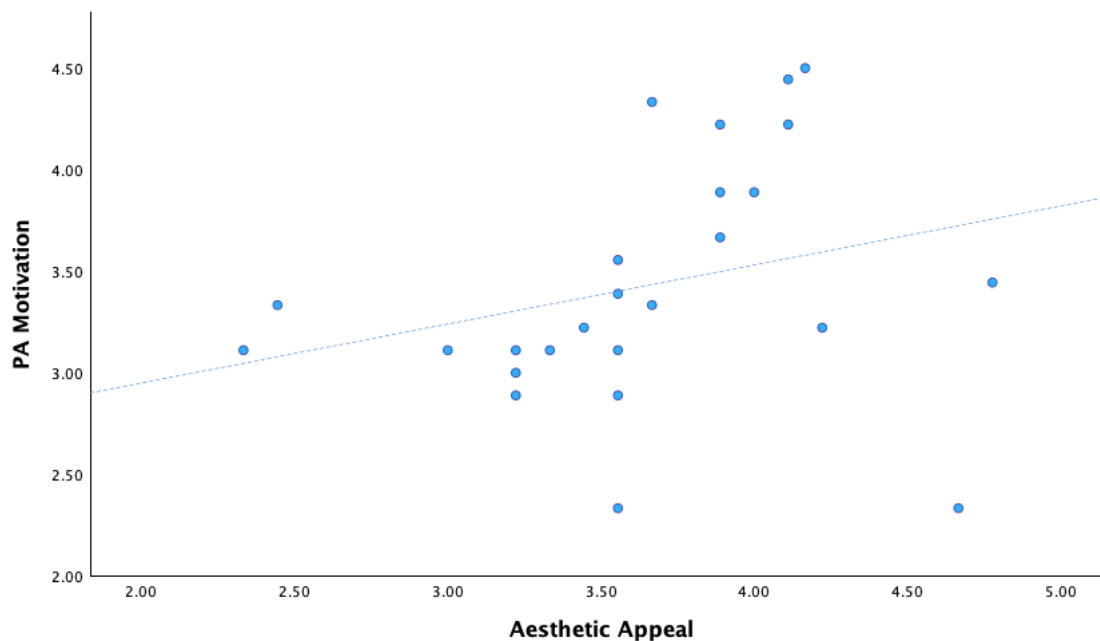


Figure 9 Correlations of aesthetic appeal and motivation in female group

4.3. Insights from participant feedback: Thematic analysis findings

To gain a qualitative understanding of the results and uncover relationships that cannot be elucidated through quantitative analysis alone, thematic analysis was employed to analyze participants' responses according to different themes. As a result, I identified aesthetic characteristics and motivational factors within imagery associated with physical motivation. I also observed differences in motivation across physical activity levels and disparities based on categories such as health, fitness, and social benefits. These discrepancies across health, fitness, and social benefit categories are summarized in Table 2.

4.3.1. Gender and activity type factors influencing motivation: participant perspectives

Regardless of gender and physical activity level, participants selected “the sight of someone engaging in physical activity” and “a physique with emphasized muscles” as the biggest motivators for physical

activity. Many participants expressed sentiments such as ‘Just seeing someone briskly engaging in physical activity is motivating in itself’ and ‘Seeing well-defined muscles makes me want to build muscles too.’ Furthermore, when the sight of physical activity and emphasized muscles were combined, participants were found to be even more motivated. Participants provided reactions like, ‘Large and defined abs are motivating for abdominal physical activities,’ ‘Seeing someone holding a kettlebell with one arm and one leg, maintaining balance and displaying strong core, motivates me because it shows great core strength,’ and ‘A balanced body and dynamic physical activity movements seem to provide motivation when combined.’ Reasons for lack of motivation often related to situations unrelated to oneself and cases where one's physical aspirations were not aligned. Participants stated, ‘It feels distant from personal experience as it's an unusual event,’ ‘As a Black person, I feel a barrier due to my different physique and body type. I think I would be more motivated if I saw someone with a similar body type, maybe a Korean or East Asian,’

There were no significant differences in motivation based on gender, but there were differences based on physical activity levels. Participants with low physical activity levels expressed sentiments such as, ‘I feel like I can do that physical activity sufficiently, and someday, I can be that kind of body too.’ indicating strong motivation when they perceive their body and posture as achievable. On the other hand, those with moderate physical activity levels mentioned experiences like, ‘I remembered when I did pilates before, and that memory motivated me.’ emphasizing preference for or past experiences with certain physical activity. Physically, they were driven by desires such as, ‘Having a visually pleasing figure without excess fat looks good, and I want to resemble or at least resemble it a little, so I am motivated.’ or ‘Seeing people with great muscles due to physical activity makes me think that I can achieve a good physique through physical activity.’ Conversely, when there were only aesthetic factors without physical activity related elements, motivations were lacking. Reasons for lack of motivation included statements like, ‘Visually appealing pictures are more motivating than aesthetic appeal,’ or ‘It doesn't motivate me as physical activity, but rather as an artistic photograph.’ The opinion that it is not their preferred body was less common among the high physical activity group compared to the other two groups.

4.3.2. Aesthetic appeal factors within motivational images

Individuals directed their attention to the dynamism and contrast within design elements when contemplating motivational images. One participant remarked, ‘It seems to offer motivation through balanced physique and dynamic physical activity movements.’ Another mentioned, ‘Dynamic motions, expression through sand, and distinct symmetry are perceived as aesthetically pleasing.’ Furthermore, one participant mentioned, ‘The contrasting colors in the photo make it easier to focus on the body,

which in turn enhances its aesthetic appeal.’ In contrast, static images were not preferred in the context of physical activity motivation. One participant stated, ‘Lack of movement diminishes aesthetic appeal and motivation, it's not dynamic.’ When it came to black and white images, there were mixed opinions, with one expressing an optimistic view, ‘I believe it's aesthetically pleasing due to the portrayal of the subject's power through the black and white treatment.’ At the same time, another held a negative perspective, ‘It appears lifeless in black and white images.’

Overall, most opinions were related to the aesthetics of the body. Among male participants, there was a significant emphasis on muscle, mentioning various muscle groups. Comments frequently centered on specific muscles, such as, ‘Well developed abs and pectorals, as well as defined obliques, are perceived as aesthetically pleasing,’ or ‘The separation of the abs and obliques is exceptionally aesthetically pleasing.’ Among female participants, the focus shifted towards the abdomen, and opinions often centered on a “toned body” or a “body without excess fat” rather than specific muscles. Comments such as ‘Wearing workout attire and seeing a toned abdomen motivates to physical activity’ and ‘The aesthetics of the body are evident. The absence of excess adipose tissue around the waist and hips makes me feel the urge to work on my waist and hips’ were common. Compared to males, females expressed more opinions about their ideal body, stating that it may differ from their own, saying, ‘I am not attracted to it because it does not match what I idealize.’ Additionally, among females, there were opinions that a body appearing excessively lean was not particularly aesthetically pleasing, with comments like ‘I do not find it aesthetically pleasing when it is too skinny’ and ‘It appears somewhat off-putting due to excessive leanness.’ Both males and females, similarly, did not find a body with an excess of muscle particularly aesthetically pleasing, as indicated by comments like ‘The excessive ratio of muscle to fat does not make it particularly aesthetically pleasing’ and ‘I prefer slim, toned muscles over overly bulky ones,’ as well as ‘Excessive muscle is somewhat repelling.’

4.3.3. Cognitive Aesthetic appeal

Individuals did not solely focus on intuitive aesthetic appeal within the human body or composition. They also experienced cognitive aesthetics appeal, which involved depicting individuals in the image and the associated thoughts and feelings it evoked. Some remarks included, ‘I find the effort made to achieve the result more appealing than a mere display of muscles,’ and ‘Thinking about taking a breath after running and drinking water immediately brings freshness, invigoration, and satisfaction. I sense these feelings indirectly while looking at this image, making it aesthetically pleasing,’ and ‘It is aesthetically pleasing because it represents a situation where effort has culminated in achievement.’ Moreover, participants found their physical activity motivation activated when the image recalled their past physical activity experiences or when the image's content was relatable or evoked empathy. One

participant expressed, ‘I thought of a scene where I took a break and drank water after sweating while running. I remembered the experience of briefly catching my breath and drinking water while running. Because that experience was quite impressive, I felt like reliving that feeling.’ Another participant added, ‘It seems like a motivating image because it is something I can actually experience.’ On the other hand, when participants did not have relevant experiences or when the context of the image did not resonate with them, their motivation declined. One participant stated, ‘I do not find it motivating because I cannot empathize with the places or environments that I would typically experience daily.’

4.3.4. Correlation between aesthetics and physical activity motivation

In the correlation between aesthetic appeal and motivation, it was observed that there were many opinions suggesting that for men, motivation and aesthetic appeal were aligned more than for women. Among men, comments such as ‘The posture, physical activity, and body shape are all motivating and aesthetically pleasing, so the scores match,’ ‘It matches. This is the direction of the ideal body I pursue, and I also engage in physical activity, so both are significant,’ and ‘Health and a fantastic physique are causes of aesthetic appeal, so motivation and aesthetic appeal scores seemed to align’ were frequent. In contrast, women expressed opinions like ‘The two scores did not align, and there appears to be little correlation,’ and ‘The difference between someone looking great and what I want to achieve through physical activity.’ to indicating a lack of strong correlation.

Table 2. The differences by health, fitness and social benefits categories

Category	Description	Quote
Health		
The Influence of a Healthy Lifestyle on Motivation	Feel the motivation simultaneously while viewing a healthy diet and a self-managed body	‘While observing others choose nutritious meals rather than consuming fast food, I’m inclined to reflect on my own life and desire a healthier lifestyle.’ ‘The sight of someone leading a healthy life and wearing a happy smile feels aesthetic appeal and motivating.’ ‘The perception that

		maintaining a balanced diet leads to an appealing body spurred my motivation.'
Scenes Unrelated to Physical Activity Lack Motivation	People are less likely to find direct motivation for physical activity in images that aren't directly related to physical activity.	'It seems that I feel less motivation or aesthetic appeal from it compared to depicting the act of exercising itself.' 'Seeing images unrelated to physical activity doesn't make me feel like I should work out.' "Just eating fruit alone isn't motivating.'
Enhancement of the Aesthetic Appeal of Color	The diversity and combination of colors in health images enhance the aesthetic appeal of the images. There is a notable emphasis on color compared to other categories.	'The red fruits gathered together create a beautiful color palette.' 'While I find it beautiful enough, the yellow color is too vibrant and doesn't let the viewer focus.' 'Beautiful. I can really feel the skin tone and the colors of the fruits, and the slightly darker screen adds to the charm.'
Fitness		
Feeling motivated by observing others engage in physical activity.	People are motivated by the act of physical activity itself portrayed in the images.	'I am motivated because the sight of people engaging in physical activity looks good.' 'Seeing people enjoy physical activity motivates me.'

<p>The Type of Physical activity Influences Motivation</p>	<p>If it's a physical activity one has experienced, wanted to try, or currently does, it receives a high score in terms of motivation. However, in the opposite case, it receives a low score.</p>	<p>'I wanted to engage in physical activity that could improve flexibility, and I had an interest in them. However, upon seeing the images, I felt an increased desire to pursue physical activity related to it.'</p> <p>'After looking at physical activity images in an uninteresting field, it seems that I neither get motivated to physical activity nor have any interest.'</p>
<p>Composition and Movement Dynamism</p>	<p>Dynamical movements as well as composition both enhance motivation and aesthetic appeal.</p>	<p>'The moment of jumping high to spike the ball just before hitting it feels incredibly dynamic and motivating.'</p> <p>'The dynamic sight of running energetically makes me want to run as well.'</p> <p>'The dynamic posture, composition, and harmonious colors are sufficient to evoke aesthetic appeal.'</p>
<p>Social benefits</p>		
<p>The positive impact of achievement</p>	<p>People find motivation from a sense of accomplishment derived from positive interactions with others in the images.</p>	<p>'It's a picture where everyone seems to be experiencing achievement together, so I want to feel that sense of achievement</p>

		too. It seems like it would bring happiness.' 'The sense of accomplishment through goal setting and achievement appears to be maximized.'
Unattainable ideals diminish motivation.	When they see something with aesthetic appeal, they want to emulate it, but the motivation diminishes when confronted with the reality that it is too perfect to catch up with.	'No matter how much I physical activity, I feel like I won't achieve that level, so it makes me want to give up.' 'The unrealistic display of muscles by someone entirely unrelated to me didn't motivate me.'

V. DISCUSSION

My study provides nuanced insights into how images from the health, fitness, and social benefits categories differentially influence motivation for physical activity. The fitness category emerged as the most powerful motivator, underscoring the critical role of direct, action-oriented stimuli in eliciting a motivational response. This finding is consistent with the principle that vivid representations of physical activity may be more effective in eliciting participation by increasing perceived competence, a key component of Self-Determination Theory's (SDT) intrinsic motivation (Ryan & Deci, 2020).

Participants' focus on body aesthetics within the health category highlights a prevalent societal emphasis on the physical outcomes of PA. This is consistent with previous research on body image and motivation (Heinberg et al., 1995). The effectiveness of the fitness category in motivating individuals was closely tied to perceptions of achievable competence in the activities depicted. This is consistent with SDT's assertion that satisfying competence needs is paramount to intrinsic motivation (Deci & Ryan, 2002).

Paradoxically, the social Benefits category elicited frequent mentions of demotivation due to the depiction of unattainable ideals, despite its high aesthetic appeal. This phenomenon is consistent with social comparison theory, which suggests that exposure to idealized images can lead to feelings of inadequacy and a decrease in motivation (Festinger, 1954). Such findings underscore the complex interplay between aesthetic appeal and motivational outcomes in the context of imagery related to PA.

My analysis also highlights gendered aesthetic preferences and their implications for motivation. Consistent with previous literature, women showed a preference for lean body images, whereas men had a preference for more muscular representations (Hargreaves & Tiggemann, 2009). Interestingly, this study observed a shift among women toward a preference for fit and toned bodies, indicating an evolution in body ideals (Robinson et al., 2017). Notably, the content focus on PA and muscle definition was universally motivating, particularly within the fitness category, although gender and physical activity level did not significantly affect overall motivation.

Biological factors emerged as a nuanced aspect of motivation. Some participants perceived biological limitations, such as different ethnicity depicted in images, as a barrier to achieving certain body ideals. This highlights the importance of representational diversity in motivational images. It supports the notion that individuals are more likely to be motivated by images that reflect achievable aspirations (Miller et al., 1988).

PA levels influenced motivation differently across groups, with differences suggesting alignment with SDT levels of motivation. This differentiation supports the argument that higher levels of physical

activity correlate with closer alignment with self-determined extrinsic motivation, driven by intrinsic values such as improved health rather than external pressures (Mears, 2008).

Adding a new dimension to my understanding of visual motivation is the reported strong correlation between aesthetic experience of images and motivation. Gender differences in this correlation— with males showing a strong association while females show no correlation—suggest that aesthetic appeal may have a different effect on motivation in different genders. This divergence deserves further investigation to effectively target motivational strategies.

VI. CONCLUSIONS AND LIMITATIONS

My study showed that among the three categories, fitness images had the most significant impact on motivating physical activity, indicating that stimuli that directly evoke thoughts of physical activity help enhance motivation. Additionally, it was found that motivation for physical activity and aesthetic appeal were related, with males showing a strong correlation while females show no correlation. The present study found that images showing people involved in physical activity and highlighting muscular features were found to be effective. Moreover, the study suggests that images should refrain from showing excessively idealized body types, while emphasizing dynamism and color contrast. All three of these elements collectively contribute to enhancing motivation and aesthetic appeal in images of physical activity. These key findings should be taken into consideration in designing physical activity apps.

Caution should be exercised in generalization of my findings because my study focused on a specific ethnic group, a limited age range, and individuals with high levels of education. For future research, it is essential to include participants from diverse age groups, ethnicities, and levels of education. Moreover, instead of assessing physical activity levels after participant recruitment, a physical activity questionnaire will be administered during the participant recruitment stage to select participants and match sample sizes across different levels of physical activity. In addition, the images for each category were curated by a research team comprising certified designers. However, participant consensus regarding the suitability of these images for each category remains undetermined. Further research endeavors will involve pilot testing with laypersons to ascertain the appropriateness of images pertaining to health, fitness, and social benefits. Finally, scales related to aesthetic appeal and motivation should be more articulated and further developed for future studies

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