The Influence of Past Experiences on Affective Responses towards Exercise

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Abstract

This study aimed to contribute to the limited body of literature on affective responses towards exercise, which recent studies found to be an important predictor of exercise behaviour. Despite most research focussing on traditional constructs, like attitude and motivation, this study investigated the role of automatic associations in determining affective exercise responses using insights from the ART of physical inactivity and exercise. As automatic associations, the constructs of perception of variety in exercise (PVE) and feelings of boredom towards exercise were explored. Prior research indicated a relationship between the two constructs. Based on this relationship, this research studied how PVE and boredom (automatic associations) influence the affective response of displeasure towards exercise. Additionally, urban and rural environments can influence exercise behaviour and research suggests an influence on automatic associations with exercise. Therefore, the effect of living area on PVE and boredom was investigated.

Using a convenience sample, 138 participants, recruited from the researchers' social networks, participated in an online survey. The variables boredom and displeasure were measured using the AFFEXX-questionnaire, PVE was measured using a 5-item-questionnaire and a dichotomous variable was used to measure if participants lived in rural or urban areas. The statistical analysis included Spearman's-rank correlation tests between the main variables, a multiple regression model measuring the effects of variety perception and boredom on displeasure, and a multivariate model measuring the effects of living area on boredom and PVE.

The results revealed significant positive correlations among boredom and PVE ($r = .46$, $p < .001$), boredom and displeasure ($r = .83$, $p < .001$), and displeasure and PVE ($r = .51$, $p < .001$), indicating strong associations between these variables. The multiple regression model demonstrated that both PVE and boredom significantly predicted displeasure, although the model's robustness was compromised due to violated assumptions. Conversely, living area

did not show any significant associations with the variables, as confirmed by an insignificant multivariate regression model.

These results suggest that variables, like PVE, which are not taken into account by the AFFEXX-questionnaire, also influence affective responses towards exercise. Additionally, as living area had no association with any of the variables, it could be concluded that this variable is not important for determining exercise-related feelings. However, the measurement of the variable was limited by its dichotomous nature and the possible effect of other variables connected to living area. In conclusion, it can be said that this research offers new insights into the impact of different background variables on affective responses towards exercise.

The Influence of Past Experiences on Affective Responses towards Exercise

Despite widespread awareness of the health benefits, a significant portion of the global population does not engage in sufficient physical exercise. Regular exercise is vital for maintaining a healthy lifestyle, offering benefits such as improved mental and cognitive health, reduced mortality, and a lower risk of type-2 diabetes (WHO, 2022). However, many adults choose not to exercise. Factors influencing this decision include environment, motivation, emotions toward exercise, and interest (Feil et al., 2022).

Theoretical Background

According to Brand and Ekkekakis (2018), understanding the emotions associated with exercise is essential for addressing physical inactivity. However, theories that are traditionally used to explain motivation and behaviour, like the Theory of Planned Behaviour (TPB) (Ajzen, 1985) and Self-Determination Theory (SDT) (Deci & Ryan, 1985), focus on rational decision-making processes. Therefore, research using these theories to assess exercise behaviour and motivation often overlooks the role of partially impulsive behaviour through affect and emotions towards exercise (Brand & Ekkekakis, 2018).

Affect or *Core affective valence*, is a broad concept, that connects past experiences with impulsive reactions in the present. It is experienced constantly and includes all states of good or bad feelings (Brand & Ekkekakis, 2018). Positive past experiences with exercise tend to elicit positive emotions in the present, while negative experiences lead to negative emotions (Ekkekakis et al., 2021). This connection between past experiences and current emotions is a significant predictor of exercise behaviour, motivation, and the development of exercise habits (Finne et al., 2022; Weyland et al., 2020). That shows that further investigation into the relationship between emotions, affective responses and exercise behaviour is necessary.

Affective-Reflective Theory (ART) of physical inactivity and exercise

Detecting a lack of research and tools to investigate emotions and affective responses towards exercise, Brand and Ekkekakis (2018), developed the dual model *Affective-Reflective Theory* (ART) of physical inactivity and exercise. It combines findings of studies, based on the TPB or SDT, and alternative theories and research based on affective responses to exercise (Ekkekakis & Russell, 2013), automatic evaluation (Antoniewicz & Brand, 2014; Bargh et al., 1996), evaluation-behaviour link (Bluemke et al., 2010) and aims to explain and predict behaviour in scenarios where individuals decide to either engage in exercise or stay inactive. In this theory, core affective responses (impulse reactions/emotions) are the determining factor for future exercise behaviour and motivation.

The ART proposes that automatic associations with an exercise stimulus, which are based on past experience, can lead to either an automatic type 1 process, in which the individual associates bodily feelings (e.g. pleasant or unpleasant) with the exercise (automatic affective valuation), leading to an impulse reaction, or a type 2 process, in which the individual actively reflects about the exercise behaviour leading to action plans. If the restrictive forces, which could be perceiving the exercise as boring or associating displeasure with exercising, are low and/or self-control resources high, the individual is likely to engage in physical activity. Otherwise, if restrictive forces are high and/or self-control resources low, one is more likely to remain sedentary (Brand & Ekkekakis, 2018).

Affective Exercise Experience Questionnaire

Due to a lack of measurement tools for affective responses, Ekkekakis et al. (2021), propose a measurement tool to investigate affective responses implicitly, based on the ART-theory. It is called the *Affective Exercise Experience* (AFFEXX) Questionnaire and it challenges conventional self-report measures used for other exercise determinants, like attitude. Core affective responses are difficult to research with self-report measures. Affective responses happen automatically and elicit partially impulsive behavioural actions, and might not be captured in full essence (Brand & Ekkekakis, 2018; Ekkekakis et al., 2021).

To assess individuals, each of the 3 constructs (antecedent appraisals, core affective exercise experiences and exercise intention), is tested by different bipolar dimensions, that categorise the emotions and affective responses of individuals. They identified 6 *antecedent appraisals* (liking vs. disliking group exercise, showing off vs. shying away, empowerment vs. damage, pride/honour vs. shame/guilt, competence vs. incompetence, and interest vs. boredom) and 3 *core affective exercise experiences* (pleasure vs. displeasure, energy vs. tiredness, and calmness vs. tension), from now on, referred to as 'core affects'. Lastly, *exercise intention* is tested on only one bipolar dimension (attraction vs. antipathy). Essentially, the antecedent appraisals construct one's core affective exercise experience, which then predicts an individual's intention to exercise (Ekkekakis et al., 2021).

To investigate emotions and affective responses, the constructs of antecedent appraisals and core affects can be connected to stages of the ART. Firstly, antecedent appraisals are formed by an individual's past experiences with exercising, attitudes and emotions towards exercising. Therefore, it can be related to the stage of automatic associations, from the ART. This association influences the affective response of an individual. Past experiences, relating to the positive emotion of the antecedent appraisal (e.g. interest), would enforce a positive affective valuation of the stimulus. Negative past experiences, related to a negative emotion (e.g. boredom), can negatively impact the affective valuation. The more scores lean to either side of the dimension, the bigger would be the impact of the association on the affective valuation (Brand & Ekkekakis, 2018; Ekkekakis et al., 2021). The next stage, Affective valuation, can be directly related to core affects (Ekkekakis et al., 2021). That means, core affects are the unconscious emotional reactions, that are based on past experiences or antecedent appraisals, to an exercise stimulus. Taking these connections into account, this research will investigate the first two stages of the ART closer, by also using insights from the AFFEXX-questionnaire.

Boredom vs. Interest

One interesting dimension of the antecedent appraisals is boredom vs. interest. An emotion towards exercise that has not been extensively researched. A study, by Aaltonen et al. (2014), found that, next to physical fitness and mental wellbeing, interest in and enjoyment of exercise was one of the most mentioned intrinsic motivators of Finnish individuals in their 30s. Beauchemin et al. (2019), found that also in the USA, interest in and enjoyment of exercise is one of the most important exercise motivators for adults.

Perceived Variety of Exercise (PVE)

According to other research interest and enjoyment are closely related to the *perceived variety of exercise* (PVE) (Juvancic-Heltzel et al., 2013; Sylvester et al., 2018; Sylvester et al., 2014a; Velasco & Jorda, 2020). PVE describes the way an individual feels about the selection of sport types they regularly engage with (Juvancic-Heltzel et al., 2013). This construct fits well into the "automatic associations"-stage of the ART, as it describes an association of variety level with a specific exercise. For example, less repetitive and multi-stimuli exercises, including visual, auditory and motoric variety, seem to be interesting and motivating for individuals (Juvancic-Heltzel et al., 2013; Sylvester et al., 2018; Sylvester et al., 2014a). This also suggests that a low PVE relates to a person being bored with their selection of exercise (Velasco & Jorda, 2020) and a high PVE suggests emotions of interest towards exercise (Juvancic-Heltzel et al., 2013; Sylvester et al., 2018; Sylvester et al., 2014a).

Evidence from these studies on the connection suggests a relationship between the two automatic associations of past experiences with exercise: PVE and feelings of boredom. It can therefore be hypothesized that low levels of PVE are connected to scores closer to the boredom pole (Velasco & Jorda, 2020) and higher levels of PVE are connected to scores closer to the interest pole (Juvancic-Heltzel et al., 2013; Sylvester et al., 2018; Sylvester et al., 2014a) of the AFFEXX-questionnaire. This research aims to investigate if a connection can be made between these two constructs and what kind of relationship they display (Figure 1).

Figure 1

*Relationship between Perceived Variance in Exercise (PVE) and Boredom*
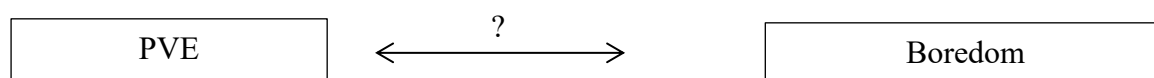
Displeasure, PVE and Boredom

The possibility of a connection between PVE and the interest vs. boredom dimension opens up another gap. Depending on the relationship the two constructs have with one another PVE can be expected to have some effect on the core affects. Right now, the AFFEXX-questionnaire's antecedent appraisals are only based on emotions towards exercise (Ekkekakis et al., 2021). As the ART also states that other past experiences shape an affective valuation of an exercise stimulus (Brand & Ekkekakis, 2018), investigating the relationship between PVE and the pleasure vs. displeasure core affect, could offer important insights into the connection between past experiences and core affects, even if PVE and interest vs. boredom were unrelated.

Based on the relationship between interest vs. boredom and pleasure vs. displeasure (Ekkekakis et al., 2021), a similar relationship is expected between PVE and pleasure vs. displeasure dimension. That means, that higher variety perception would lead to higher scores on the pleasure side and lower variety perception to higher scores on the displeasure side of the dimension. As displayed in Figure 2, this research will investigate the effect of PVE and boredom on displeasure.

Figure 2

Relationship between PVE, Boredom and Displeasure
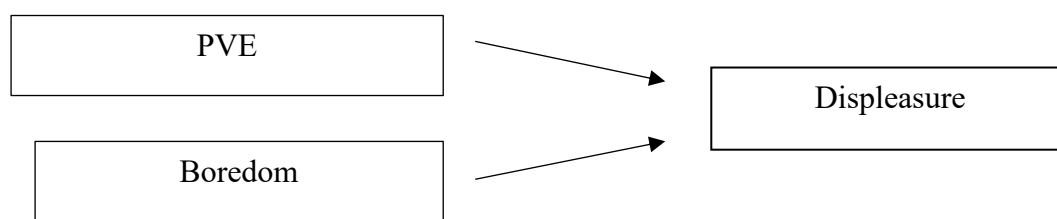
Living Area, PVE and Boredom

Adding to the pool of past experiences and automatic associations with exercise are distal determinants (Brand & Ekkekakis, 2018) research has found that an individual's living environments play a multifaceted role in shaping exercise behaviour (Pharr et al., 2020). Although the living environment describes many things, this research focuses on the living area, referring to either a rural or urban living area.
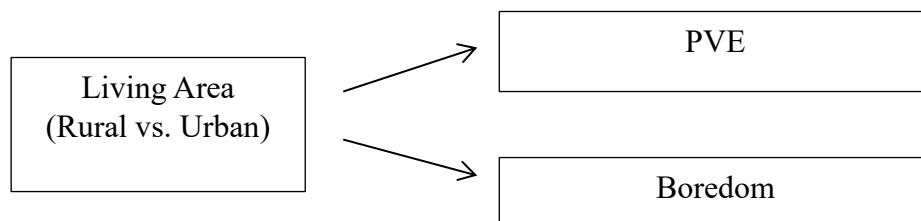
Moreno-Llamas et al. (2021) showed that physical activity levels in Europe decreased almost the same in urban and rural areas between 2002 and 2017. Other research showed that in the United States of America (USA) individuals living in rural areas engage less in physical activity (Gilbert et al., 2019). The reasons for physical inactivity differ. In cities reasons for the decrease in exercise are, for example, accessibility of public transport, so individuals have to engage in less moderate activity, like biking or walking (Moreno-Llamas et al., 2021). In rural areas specifically vigorous activity is lower, one reason being lack of resources, e.g. fitness studios or sport clubs (Gilbert et al., 2019; Moreno-Llamas et al., 2021).

On one hand, the selection of sport an individual can engage in is dependent on accessibility of resources, people living in urban areas have higher accessibility of exercise resources and facilities (Gilbert et al., 2019; Moreno-Llamas et al., 2021). On the other hand, people living in rural areas have greater access to parks and nature, which can also influence how interesting individuals perceive their exercise (Brito et al., 2024).

Based on this body of research it would be interesting to investigate how the living environment can influence the automatic emotional response of boredom towards exercise. Furthermore, previous research showed differences in variety of resources and environment regarding exercise in rural and urban areas. This relationship between living area on PVE has not been investigated previously but could offer interesting insights into the construct of PVE and the influences of one's living area (Figure 3).

Figure 3

Relationship Living Area and PVE and Boredom

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┌──────────────────┐                    ┌──────────────────────────┐
│                  │         ──────────▶│          PVE             │
│   Living Area    │                    └──────────────────────────┘
│ (Rural vs. Urban)│
│                  │                    ┌──────────────────────────┐
└──────────────────┘         ──────────▶│        Boredom           │
                                        └──────────────────────────┘
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Research Questions

Based on the identified research gaps, regarding how past experiences and unconscious impulses influence affective responses, the following research questions were developed:

1. To what extent is Perceived Variety of Exercise (PVE) related to feelings of boredom regarding physical activity?

2. To what extent are PVE and feelings of boredom associated with the core affective experience of displeasure toward physical activity?

3. What effect does the living area of an individual have on PVE and feelings of boredom?

Methods

Study Design

The design of the study was cross-sectional quantitative research using a survey to gather data from a sample of participants at a specific point in time. This research aimed to investigate the relationship between PVE and the antecedent appraisal interest vs. boredom. It furthermore aims to explore what part the living area of an individual and other background characteristics play in that relationship.

Participants

The study included individuals >18 of all genders and ethnicities. Excluding everyone under 18, because they were not able to give consent themselves and the consent of a guardian would be needed to make use of the data. An exclusion was ensured in the survey by explicitly stating it in the informed consent form (Appendix A) and deletion of data of

participants indicating an age <18 during data cleaning. Furthermore, good English skills were necessary to take part in the study, as need to understand the items fully to answer them sufficiently. Therefore, one survey item in the Demographics Section (Appendix B), specifically asked participants to indicate if they possess good English skills. Consenting to the terms of conduct and data handling methods indicated in the informed consent form at the beginning of the survey was crucial for being able to fill out the survey and for the researchers to include the data.

Participants were recruited using convenience sampling. The researchers distributed the survey using their social network and social media platforms. Furthermore, the study was published on SONA systems of the University of Twente.

Materials

To collect data from participants an online survey was administered using the survey web tool: *SoSci Survey*. In the first part, participants had to give their informed consent to participate in the study (Appendix A) and in the second part they had to fill out their demographics, including age, English proficiency, sex, main occupation, marital status and living area. Additionally, they had to answer questions related to their exercise background. All demographic background items were used to describe sample characteristics. To investigate the variable living area from the research question, the item "living area", in which participants had to pick between "rural vs. urban", was used.

After that they had to fill out 10 questionnaires, responding to multiple psychological concepts. This research investigated three concepts: the bipolar antecedent appraisal of interest vs. boredom, the core affect pleasure vs. displeasure and PVE. Lastly, participants had to fill out 3 implicit association tests (IAT) relating to the core affects of the AFFEXX questionnaire. This research did not make use of them. The full survey can be found in Appendix B.

Affective Exercise Experience

Part of the Affective Exercise Experience (AFFEXX) questionnaire was used to assess participants' feelings of boredom vs. interest towards exercise (Brand & Ekkekakis, 2021). The full questionnaire consisted of 36 bipolar items, responding to 10 concepts: 6 antecedent appraisals, of which this research was using the interest vs. boredom concept, 3 core affects, of which the pleasure vs. displeasure concept was used and intention to exercise (attraction vs. antipathy), which is not used in this research. In the survey, all items were randomised in order and polarity, according to the layout provided by Brand and Ekkekakis (2021), and measured on a 7-point bipolar response scale.

Boredom. To investigate the boredom variable, data from the 3 items related to the bipolar antecedent appraisal of boredom vs. interest was used. These items were: "Exercise is interesting vs. Exercise is uninteresting", "Exercise is stimulating vs. Exercise is boring" and "Exercise is very exciting vs. Exercise is very dull" (Appendix B). Scores from 1-3 indicated anticipatory feelings of interest, 4 balanced feelings and 5-7 feelings of boredom towards exercise. The construct scored high on Cronbach's alpha (.859) and McDonald's omega (.860), which showed a high internal consistency of the construct (Brand & Ekkekakis, 2021). This suggested that interest vs. boredom can be measured reliably, independently from the other antecedent appraisals.

Displeasure. Furthermore, to measure individuals' level of displeasure related to exercise, the 4 items of the core affect pleasure vs. displeasure were used. "The feeling I get from exercise is fantastic vs. The feeling I get from exercise is awful", "Exercise makes me feel better vs. Exercise makes me feel worse", "Exercise makes me feel wonderful vs. Exercise makes me feel terrible", "Exercise improves my mood vs. Exercise worsens my mood" (Appendix B), are the bipolar statements for this core affect. Scores from 1-3 indicated affective feelings of pleasure, 4 balanced feelings and 5-7 affective feelings of displeasure towards exercise. This construct can be used independently from the other two core affect measures, justified by its strong internal consistency and reliability. These claims were

supported by scores on Cronbach's alpha (.896) and McDonald's omega (.898). So, the "pleasure vs. displeasure" dimension could stand alone as a valid and reliable measure of affective experience in this study.

Perception of Variety in Exercise (PVE)

For assessing individuals' PVE levels 5 items corresponding to the PVE construct, which was part of a 4-construct questionnaire, by Sylvester et al., 2014b, were used (Sylvester et al., 2014b). Items were assessed on a six-point Likert-type rating scale (1 = false; 6= true), with higher scores indicating greater perceived variety in exercise. An example item is: "I feel like I experience variety in my exercise" (Appendix B). The PVE factor was found to effectively capture a distinct and coherent concept, with a Cronbach's Alpha of .90.

Procedure

After the questionnaire was created by the research team, approval for this research was asked and given by the BMS Ethics Committee under request number 240366. Afterwards, the research team applied to publish the survey on SONA systems, which was also granted. Then, participants were recruited through SONA system and social media platforms. Interested individuals were directed to an online survey link that contained the informed consent form and the survey questions. Participants provided their electronic consent before proceeding to the survey questions. The survey took approximately 30 minutes to complete, and participants were able to complete the survey at any place and time. Participants were instructed to answer all questions honestly and to the best of their ability. After 1 month of data collection, the survey was closed and the results could be analysed**.**

Data Analysis

Data Cleaning and Preparation

After data collection ended, the dataset was imported as a csv-file to RStudio. In the first step, the dataset was cleaned from survey items that were not used in this research. Which left 33 items in total, measuring demographics (6 items), exercise background (7

items), intention to exercise (8 items), interest vs. boredom (3 items), pleasure vs. displeasure (4 items) and Perceived Variety of Exercise (PVE) (5 items). No empty responses needed to be removed, as the SoSci Survey program already removed them pre-download.

The second step, before analysis, is data preparation. For this research, two items had to be reverse-coded. Lastly, the construct scores on the interest vs. boredom and pleasure vs. displeasure dimension, as well as scores on PVE, were calculated by combining corresponding items into one variable and calculating the combined mean value. Three new columns were created for the construct scores, labelled as: "boredom", "displeasure" and "PVE".

Descriptive Analysis

The 'summary()' function was used to get a first overview of the demographic variables: "age", "gender", "nationality", "main occupation", "marital status" "living area" and "exercise background". This function includes, most importantly measures of the mean and median. Because most of the demographic items are not numerical, percentages were calculated for each item individually, to gather insights into the data distribution.

To look at means, standard deviations and ranges of the AFFEXX and PVE scale items the 'describe()' function was used. This function was also used to identify skew values, which helped assess if the data was normally distributed. Ideally, skew values are around 0, indicating normal distribution. Kurtosis values ranged from 1 to -1, depicting data distribution in the tails of the distribution curve; a negative value indicated extensive tail spread, while a positive value suggested concentrated data around the mean. Skew values indicated whether data was positively or negatively skewed, with positive values indicating right skew and negative values indicating left skew.

Correlation Effects

To answer the research questions multiple correlations between constructs, need to be investigated, to gain insights into whether and how these variables interact with each other.

For that, the Spearman's rank correlation was used because the data of the research question variables was not normally distributed. Using the function 'cor()' in R, correlations between 'PVE' and 'boredom', 'PVE' and 'displeasure' and 'PVE' and 'living area', as well as 'boredom' and "living area" are going to be calculated. Spearman's rho can be used as a measure of the strength and monotony of a relationship between two variables. The value should be between 1 and –1, the closer the value is to zero, the weaker the relationship is. Additionally, a negative or positive value indicates the nature of the relationship. The p-value determines whether the relationship is significant or occurred by chance, the higher the p-value is the less significant the relationship between two variables.

Multiple Regression Analysis

Additionally, a Multiple Regression Analysis was used to check the model displayed in Figure 2. It will be checked whether the two independent variables 'PVE' and 'boredom' affect the dependent variable 'displeasure'. The output of the 'summary()' function showed the coefficients of the effects of both independent variables on the dependent variable. The p-value < 0.05, determined if the effect was significant.

Assumptions. The multiple regression model had to be checked for assumptions of linear regression before the results could be interpreted. This included the checking of, assumptions of linearity, homoscedastic, normality, independence and no multicollinearity. Linearity was checked by examining scatterplots of the independent variable against the dependent variables. To test for homoscedasticity the plot of residuals against predicted value was used. The normality of residuals was tested using a QQ-plot. Using the Durbin-Watson test independence was examined. Lastly, no multicollinearity was tested by using the Variance Inflation Factor (VIF).

Multivariate Regression Analysis

To assess the third research question (Figure 3), multivariate regression analysis was used to check whether the independent variable 'living area' predicts the dependent variables

'boredom' and 'PVE'. The 'summary()' function was used to take a first look at the model and a $p < 0.05$ determined if the model effects are significant. Furthermore, the model had to be checked for assumptions of linearity, homoscedastic, normality, independence and no multicollinearity, with the same methods as the multiple regression model.

Results

In the following part of this research paper, an overview of the results on descriptive and statistical analysis, with the goal of answering the research questions, will be given.

Descriptive Statistics

Demographics

In total 208 people started the survey. After data cleaning, the data of 138 participants, that filled out the intention to moderate/vigorous exercise, AFFEXX and PVE questionnaire, were included in the following analysis. Table 1, gives an overview of the sample characteristics, based on demographic data and scores on intention to moderate and vigorous exercise scale. Participants were almost equally distributed in females (55.1%) and males (42.8%) and had a median age of 22 (3). Furthermore, the majority of participants are Dutch (56.6%) and primarily university students (70.3%). 60.9% indicate living in rural areas (Table 1). Interestingly, the mean(sd) score on intention to engage in moderate exercise, which is 6.05(1.12), and the median(IQR) score on intention vigorous exercise, which is 5.75(2.5), demonstrate that participants have high intentions to engage in both moderate and vigorous exercise. These scores also show that the intentions do not differ greatly depending on the exercise type.

Table 1

Overview of Sample Characteristics

Characteristics	All participants	
	n	**%**
Gender		
Female	76	55.1
Male	59	42.8
Non-binary	1	.7
No answer	2	1.4
Nationality		
Dutch	78	56.6
German	26	18.8
Other	34	24.6
Main Occupation		
High-School	3	2.2
University	97	70.3
Working	31	22.5
Other	7	5
Marital Status		
Single	57	41.3
Partnered	58	42
Married	17	12.3
Other	6	4.4
Living Area		
Rural	84	60.9
Urban	54	39.1

Variable Scores

Table 2 displays results on the main variables of the research questions: boredom, displeasure and PVE. Firstly, the median(IQR) score 5.67(1.33), showed that individuals feel more bored regarding exercise. Similarly, median(IQR) scores on displeasure, 6(1.25), demonstrate that participants connected a more displeasing experience to exercise. For both variables, the skew indicates not normally distributed results. Lastly, individuals perceived their exercises as moderately varied, as visible from the mean(sd), 3.74(1.17).

Table 2

Mean, Standard Deviation and Skew Value on the Variables Boredom, Displeasure and PVE

Scales	Mean (sd)	Skew	Median (IQR)
Boredom	5.52 (1.24)	-1.20	5.67 (1.33)
Displeasure	5.80 (1.22)	-1.57	6 (1.25)
PVE	3.74 (1.17)	-.36	3.8 (1.6)

Note. PVE =Perceived Variety in Exercise

Correlation Effects

Table 3 displays the correlation effects of the research question variables: boredom, displeasure, PVE and living area. The results show a significant positive correlation between the variables boredom and displeasure (r_s= .83, p < .001), PVE and displeasure (r_s= .51 p < .001) and PVE and boredom (r_s= .46, p < .001). No correlation between living area and any other variable was found.

Table 3

Results of Spearman Rank Correlation

	Displeasure	Boredom	PVE	Living Area
Displeasure	1	-	-	-
Boredom	.83***	1	-	-
PVE	.51***	.46***	1	-
Living Area	.04	-.05	.15	1

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; PVE = Perceived Variety in Exercise

Multiple Regression Analysis

Overall, the multiple regression model with the independent variables: boredom, PVE and dependent variable: displeasure, was significant ($F(2, 135) = 156.9$, $p < .001$), with an $R^2 = .7$. Boredom was a significant predictor of displeasure ($\beta=0.657$, $t(135)=13.20$, $p<.001$). This indicates that as boredom increases, so does displeasure. Similarly, PVE was a significant predictor of displeasure ($\beta=0.169$, $t(135)=3.19$, $p=.0018$). This suggests that higher perceived value expectancy is associated with increased displeasure. Precisely, for each unit of boredom, scores on displeasure increased by .66 and for each unit of PVE, scores on boredom increased by .17. This reveals, that feelings of boredom have almost four times more influence on displeasure scores than PVE.

Furthermore, analysis of the model assumption revealed violations of homoscedasticity and linearity. Results on homoscedasticity indicated that the absolute value of the residuals is strongly positively correlated with the fitted values, which shows a strong heteroscedastic linear model. The linearity assumption was expected to be violated, because of the high skew values (Table 2) of the variables displeasure and boredom. Even after applying a square transformation, linearity between the variables was not detected. Therefore, this multilinear regression model is seen as not robust.

Lastly, the multivariate regression analysis was not performed because of the low univariate correlation results between living area, PVE and boredom. Therefore, no significant result was expected.

Discussion

RQ1: Perceived Variety of Exercise and Boredom

For the first research question, "To what extent is Perceived Variety of Exercise (PVE) related to emotions of boredom regarding physical activity?", a strong positive association was identified between PVE and boredom. This finding contrasts with the results of Velasco and Jorda (2021), who reported a negative relationship where lower levels of variety predicted higher boredom levels. In this study, however, lower levels of PVE were associated with lower levels of boredom towards exercise.

This unexpected outcome may stem from differences in participant demographics, as our study primarily involved university students, whereas Velasco and Jorda (2021) focused on professional athletes who reported higher average boredom levels during exercise. Professional athletes often face constraints in their exercise routines, such as fixed schedules and specific training regimens, which can contribute to higher levels of boredom (Velasco & Jorda, 2021). In contrast, university students typically have more flexibility in choosing exercise types, times, and intensities, potentially leading to greater interest and lower boredom levels (Wolff et al., 2021). This suggests, that there are mediating factors like freedom to self-determine exercise activities that could influence the relationship between PVE and boredom.

RQ2: Perceived Variety, Boredom and Displeasure

Results regarding the second research question: "To what extent are PVE and boredom predicting the core affect of displeasure toward physical activity?" show that no linear relationship between the variables was found, boredom and PVE are positively associated with and predictive of the core affect displeasure. Although a direct linear relationship between PVE and displeasure was not observed, the significant positive association and

predictive power of both boredom and PVE on displeasure align with findings from Ekkekakis and Brand (2021). According to the AFFEXX-questionnaire, boredom is a significant predictor of core affect, suggesting that individuals experiencing higher levels of boredom are likely to report higher displeasure during physical activity.

The connection between PVE and displeasure gives interesting insights into an automatic association with a physical activity stimulus. As was stated in the ART, different past experiences shape associations with exercise (Brand & Ekkekakis, 2018). While in the AFFEXX-questionnaire only emotional states were taken into account, this connection between PVE and displeasure suggests, that if an individual experiences low levels of PVE, it also experiences low levels of displeasure, which is against the expectations. This could be connected to exercise routines, which are defined by low levels of variety in time, place and exercise an individual engages in. Despite the low variety, exercise routines improve an individual's mood and emotional regulation (Martín-Rodríguez et al.,2024). As the participants reported higher levels of PVE and displeasure, it can be concluded that they did not have well-established work-out routines. They connect exercising to the negative past experience of too much variety in exercise, which leads to a negative affective response of displeasure towards exercise. This connection gives interesting insights into the complexity of past experiences and the interplay of different factors in the first stage of the ART.

RQ3: Living Area, Perceived Variety of Exercise and Boredom

Lastly, for "What effect does the living area of an individual have on PVE and boredom?", no relation between living area and PVE and feelings of boredom was found. These results can be related to the pros and cons of both, rural and urban, living environments. Although individuals in urban areas have more exercise options, they lack the nature rural areas provide. Both, training options, but also a diverse environment has an impact on how individuals perceive the variety of the exercise they engage in (Gilbert et al., 2019; Moreno-Llamas et al., 2021; Brito et al., 2024). Therefore, the benefits of the living areas might cancel

each other out, posing no significant difference in the experience of PVE and boredom related to the exercise they engage in.

Strengths

This research contributes to the limited body of literature on PVE and is one of the first to explore the connections between PVE and different emotional and environmental factors. New perspectives on how PVE impacts feelings of boredom and the affective experience of displeasure and into the effects of living area on PVE provide a basis for future research.

Furthermore, the study design, specifically the broad inclusion criteria, allowed for a diverse sample. This diversity enhances the generalisability of the findings. By not restricting the sample to a specific demographic, it is possible to provide insights that apply to a wider population. This makes the results more relevant for general exercise recommendations and interventions.

Lastly, scales and questionnaires utilised to measure the main variables pose a high internal consistency, as indicated by high Cronbach's Alpha scores. This adds greatly to the reliability of the conclusions drawn from the data. It ensures that the findings are robust and replicable and that the measured constructs accurately reflect the participants' experiences and perceptions.

Limitations

For this research, the measurement of the variable living area seems to give little insight into the participants' background. First of all, it is a dichotomous variable (rural vs. urban), and other factors might play a role in describing this environment, for example, proximity or travel length to sports facilities. Participants living on the outskirts of a city might have limited access to training facilities, while those in rural areas might be close to a fitness studio or sports club. Moreover, various reasons for choosing urban or rural living, such as income, space, health, and work, add complexity to the variable. The variable "living

area" appears more facetted than initially expected. By not considering other environmental factors, the question of why there is no correlation between living area, PVE, and boredom stays mostly unanswered.

Another potential limitation of the variable living area is related to the participant pool, which consisted of mostly university students. Students, who live at home with their parents outside of the city where they study, might indicate that they live in a rural area. However, despite living in a rural area, they still frequently visit the university and therefore have access to sports facilities. This means that these students have the same access to sports facilities as those living in the city, which could affect the results. Specifically, participants from rural areas might score similarly to urban participants, leading to incomplete results because the dichotomous variable (rural vs. urban) does not capture the nuances of their access to sports facilities.

Lastly, the constructs of boredom and displeasure, which both originate from the AFFEXX-questionnaire, showed an extremely high correlation, which could suggest a potential overlap between the constructs. That affected this research insofar that the multiple regression model had many violated assumptions. Most importantly multicollinearity was violated, meaning, that these two constructs could be measuring the same underlying construct. This can conceal the unique contributions of each predictor. Consequently, the overall validity and interpretability of the findings on the multilinear regression model could be significantly affected.

Future Research

To practically use this research, its strengths and limitations provide important insights into a new research topic. Due to a lack of literature, measurements need to be tested and developed, in order to make recommendations for future research.

As the limitations point towards the measurement of the variable living area, future research could focus on refining this measurement. A potential research question could be:

"Which environmental factors influence exercise behaviour?". For now, excluding emotion towards exercising, future research could focus on determining important environmental factors for exercise behaviour, to lay a basis and develop sufficient measurements that can be used in more elaborate research.

It is important to stress the significance of emotions towards exercise and potentially affective responses. Future research should not neglect this area and dig deeper into the unconscious and conscious processes of exercise behaviour, also by using the AFFEXX questionnaire, as its Alpha scores suggest a strong internal consistency of the constructs. However, it can be advised to be careful with the AFFEXX questionnaire, as results from this research suggest an overlap between the constructs of boredom vs. interest and displeasure vs. pleasure from the questionnaire. Therefore, it would be beneficial to evaluate the possibility of using constructs from the questionnaire independently and it can be advised that if only a few constructs from the questionnaire are of interest to potentially search for other questionnaires specific to those variables.

Conclusion

Despite its limitations, this study contributes valuable insights to the field of exercise psychology. It underscores the complexity of measuring and understanding emotional and environmental influences on exercise behaviour. Precisely, the research contributes to the understanding of PVE, offering new perspectives on how PVE impacts the emotions of boredom and the affective response displeasure towards exercise. The findings highlight the importance of considering demographic and environmental factors in future studies and suggest that a more detailed exploration of these variables could yield deeper insights into exercise behaviour and emotional responses.

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Appendix A

Informed Consent

What are the intentions of this study?

You are invited to take part in a research study that aims to investigate the relationship between conscious and unconscious emotions towards Physical activity, with the ultimate goal to transform negative associations towards activity in more positive ones.

What does this study look like?

In this first part, you will be asked to fill in a questionnaire. After filling it in, there will be a field to leave your e-mail adress. It is important to note that this e-mail address is only going to be used to invite you to the second part of the study, which will consist of an Implicit Association Test. Afterwards, your e-mail address will be deleted from the dataset.

Can I also take part in this study?

If you are 18 years or older, and have sufficient skills in the English language (e.g. reading a text fluently and understanding most of the terms), you are suitable to take part in this study.

Do I need to take part?

No. Participation in this study is voluntary, and you have the right to withdraw at any time without any consequences. If you decide to withdraw, your data will not be used in the study, and any information collected till that point will be discarded.

What will happen when I agree to take part in this study?

When you decide to take part in this study, you will automatically be redirected to the questionnaire, which will take around 20 minutes. In this questionnaire, none of the answers are right or wrong, and we are only interested in your own experiences/opinions.

What are the risks of taking part in this study?

During this research, you will answer questions about yourself, and about experiences that you had with exercise in the past. If at some part you might struggle with possible traumas or other factors detrimental to health, feel free to inform one of the following links:

- https://www.113.nl/ or https://www.slachtofferhulp.nl/ (Dutch)

- https://www.hilfe-info.de (German)

- https://www.mind.org.uk/information-support/types-of-mental-health-problems/trauma/useful-contacts/ (English)

After the data collection, what is going to happen with my results?

For the data analysis, no identifiable information will be used, and every possible thing that could link you to the answers is going to be anonymized. The collected data will be stored on a highly encrypted device which are only accessible for us and our supervisor.

If I have any other questions, whom can I contact then?

The research team for this questionnaire is always open to answering questions, and they are reachable by the following email adresses:

- G.R. Bekhuis (g.r.bekhuis@student.utwente.nl)

- A.M. van den Berg (a.m.vandenberg-1@student.utwente.nl)

- G.S. van Beveren (g.s.vanbeveren@student.utwente.nl)

- A.M. Freiberg (a.m.freiberg@student.utwente.nl'

- L.C. Hessels (l.c.hessels@student.utwente.nl)

- G.P. Kaczmarek (g.p.kaczmarek@student.utwente.nl)

- T. Zandstra (t.zandstra@student.utwente.nl)

Who are the supervisors of the project?

The two supervisors for this project are:

- A. Braakman-Jansen (l.m.a.braakman-jansen@utwente.nl)

- M.E. Pieterse (m.e.pieterse@utwente.nl)

After reading the information on the last page thoroughly and carefully, please indicate if you agree to participate and confirm that you understand the information that is provided. If there are still any questions or concerns present, feel free to ask before proceeding.

Appendix B

Complete Survey

1. **Socio-Demographic Data**

   1.1. Age: How old are you? (write number)

   1.2. Language: Are you proficient in the English language (yes/no)

   1.3. Gender: What gender do you identify with? (female, male, diverse, other, prefer not to say)

   1.4. Nationality: What is your nationality (Dutch, German, other)

   1.5. Main Occupation: What describes your main occupation/job best? (Highschool Student, University Student, Full-Time office job, Part-Time office job, Full-time physically active job, Part-time physically active job, retired, unable to work, unemployed)

   1.6. Marital Status: What is your marital status? (single, partnered, married, divorced, other, prefer not to say)

   1.7. Living Area: What describes the area you live in best? (rural (e.g. smaller town, village), urban (e.g. bigger town, city)

2. **Exercise-related Demographics**

   2.1. In the past: How many different types of sports were you engaged with at least once per week? (write number)

   2.2. Over the past month: How many different types of sports (e.g. football, swimming, jogging, etc.) are you engaged in at least once per week? (write number)

   2.3. What type of sports do you prefer? (indoor vs. outdoor; team vs. individual; ball vs. non-ball; competitive vs. non-competitive; cardio vs. non-cardio) (Polarity scale right-middle-left)

3. **International Physical Activity Questionnaire - Short Form (IPAQ-SF)**

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3.1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

3.2. How much time did you usually spend doing vigorous physical activities on one of those days?

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3.3 During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

3.4. How much time did you usually spend doing moderate physical activities on one of those days?

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

3.5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

3.6. How much time did you usually spend walking on one of those days?

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

3.7. During the last 7 days, how much time did you spend sitting on a week day?

4. **Intention to Moderate Exercise** (7-point Likert scale; 1= strongly disagree; 7= strongly agree)

Moderate exercise is less intense than vigorous exercise and can be sustained for longer periods of time, such as brisk walking, cycling on flat terrain or recreational sports like golf or tennis.

4.1. How likely is it that you will engage in moderate exercise 1-2 times per week over the next month?

4.2. Do you have confidence in your ability to engage in moderate exercise 1-2 times a week?

4.3. How motivated are you to incorporate moderate exercise in your daily routine?

4.4. How determined are you to engage in moderate exercise, despite obstacles you may face?

5. **Intention to Vigorous Exercise**

5.1. How likely is it that you will engage in vigorous exercise 1-2 times per week over the next month?

5.2. Do you have confidence in your ability to engage in vigorous exercise 1-2 times a week?

5.3. How motivated are you to incorporate vigorous exercise in your daily routine?

5.4. How determined are you to engage in vigorous exercise, despite obstacles you may face?

6. **AFFEXX** (7-point bi-polar scale)

6.1. Exercising is stimulating. vs. Exercising is boring.

6.2. When my doctor asks if I exercise, I can answer with my head held high. vs. When my doctors asks me if I exercise, I bow my head in shame.

6.3. Exercise is something I dread. vs. Exercise is something I look forward to.

6.4. Exercise is very dull. vs. Exercise is very exciting.

6.5. I love that exercising makes me feel stronger. vs. I hate that exercise may injure me.

6.6. Exercise is an uninviting activity. vs. Exercise is a tempting activity

6.7. I feel good to be getting all the great benefits from exercising. vs. I feel horrible because I feel like I may get hurt from exercise.

6.8. When I exercise, I'd rather be invisible. vs. When I exercise, I love showing off.

6.9. I feel great exercising in a group. vs. I feel intimidated exercising in a group.

6.10. Exercise is enjoyable in a group. vs. Exercise is not enjoyable in a group.

6.11. Exercise makes me feel worse. vs. Exercise makes me feel better.

6.12. Exercise leaves me feeling exhausted. vs. Exercise leaves me feeling energized.

6.13. I feel drained after exercise. vs. I feel revitalized after exercising.

6.14. I would choose exercise over most other activities. vs. I would choose most other activities over exercise

6.15. After exercise, I feel discouraged. vs. After exercise I feel encouraged.

6.16. Exercise gives me a sense of failure. vs. Exercise gives me a sense of accomplishment.

6.17. For me, exercise is a relaxing activity. vs. For me, exercise is a stressful activity.

6.18. Exercise is very tiring. vs. Exercise is very invigorating.

6.19. Exercise gives me serenity. vs. Exercise stresses me out.

6.20. Exercise makes me feel drowsy. vs. Exercise makes me feel refreshed.

6.21. Exercise is something everyone ought to be doing but I am sorry to say that I do not. vs. Exercise is something everyone ought to be doing and I am happy to say that I am.

6.22. Exercise soothes me. vs. Exercise makes me feel tense.

6.23. Exercise is interesting. vs. Exercise is uninteresting.

6.24. When others look at me when I exercise, it makes me feel great. vs. When others look at me when I exercise, it makes me feel terrible.

6.25. Exercise is near the top on the list of things I like. vs. Exercise is near the bottom on the list of things I like.

6.26. I enjoy the thought that exercise builds up my body's defenses. vs. The idea that exercise puts stress on my body scares me.

6.27. I love when others watch me as I exercise. vs. I hate it when others watch me as I exercise.

6.28. Exercise deflates my ego. vs. Exercise boosts my ego.

6.29. Exercise is low on my priority list. vs. Exercise is high on my priority list.

6.30. The feeling I get from exercise is awful. vs. The feeling I get from exercise is fantastic.

6.31. Exercise makes me feel peaceful. vs. Exercise makes me feel aggravated.

6.32. Exercise worsens my mood. vs. Exercise improves my mood.

6.33. I love exercising with others. vs. I hate exercising with others.

6.34. Being a regular exerciser is so gratifying. vs. Being an on-and-off exerciser is so embarrassing.

6.35. Exercise feels terrible. vs. Exercise feels wonderful.

6.36. Exercise makes me feel incompetent. vs. Exercise makes me feel like I could do anything.

7. **Body Image Shame Scale (BISS)** (5-point Likert Scale; 1 =never; 5 = almost always)

The following questionnaire will ask you about your experiences with bodily shame. The answers range from "never" to "almost always". Please answer which applies to you to most. Each question should only be answered once.

7.1. I avoid social situations because of my appearance

7.2. The relationship I have with my body prevents me from having an intimate relationship with someone

7.3. I avoid moving my body in public places because I feel I am exposing my physical appearance to the criticism of others

7.4. I feel uncomfortable in social situations becasue I feel that people may criticise me because of my body shape

7.5. My physical appearance makes me feel inferior in relation to others

7.6. I do not like to exercise in front of others because I am afraid of how they might evaluate me

7.7. The relationship I have with my physical appearance makes it difficult for me to feel comfortable in social situations

7.8. I avoid wearing tight clothes that reveal my body shape

7.9. It bothers me to see my body undressed

7.10. When I see my body in the mirror I feel that I am a defective person

7.11. I choose clothes that hide parts of my body that I consider ugly or disproportional

7.12. I pay close attention to the movements and posture of my body to hide parts that I do not like

7.13. I feel bad about myself when I use clothes that reveal my body shape

7.14. There are parts of my body that I prefer to hide

8. **Emotions during Physical Education classes** (5-point Likert scale; 1 = Strongly Disagree; 5 = Strongly Agree)

8.1. I was proud to be able to keep up with the physical education class

8.2. Because I took pride in my accomplishments in physical education, I am motivated to continue

8.3. I was motivated to go to the physical education class because it is exciting

8.4. I enjoyed being in the physical education class.

8.5. I felt anger welling up in me during the physical education class

8.6. Thinking about all the useless things I had to learn in physical education, annoyed me

8.7. I felt nervous in the physical education class

8.8. I got scared that I might say/do something wrong in the physical education class, and I would rather not say/do anything.

8.9. It was pointless to prepare for the physical education class because I was bad at it anyway.

8.10. I would have rather not gone to the physical education class because it was impossible to perform the exercises correctly

8.11. I got bored during the physical education class.

8.12. I found the physical education class fairly dull

9. **Pittsburgh Sleep Quality Index (PSQI)**

9.1. During the past Month at what time have you usually gone to bed?

9.2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

9.3. During the past month, what time have you usually gotten up in the morning?

9.4. During the past month, how many hours of actual sleep did you get at night? (this

may be different than the number of hours you spent in bed.)

For each of the remaining questions, check the one best response. Please answer all

questions (1 = Not during the past month; 2 = Less than once a week; 3= Once or twice per

week; 4 = Three or more times per week)

During the past month, how often have you had trouble sleeping because you…

9.5. … Cannot get to sleep within 30 minutes

9.6. … Wake up in the middle of the night or early morning

9.7. … Have to use the bathroom

9.8. … Cannot breathe comfortably

9.9. … Cough or snore loudly

9.10. … Feel too cold

9.11. … Feel too hot

9.12. … Had bad dreams

9.13. … Have pain

9.14. During the past month, how often have you had trouble staying awake while driving,

eating meals, or engaging in social activity?

9.15. During the past month, how much of a problem has it been for you to keep up

enthausiasm to get things done?

10. Perceived Variety in Exercise Questionnaire (6-point Likert-scale; 1= False; 6 = True)

10.1. I feel like I engage in a variety of exercises.

10.2. I feel like I try a range of exercises

10.3. I feel like I change the types of exercise that I do

10.4. I feel like my exercise program is varied

10.5. I feel like I experience variety in my exercise

11. **Sleep Quality Scale (SQS)** (1= rarely, 2= sometimes, 3= often, 4= almost always)

In the past week, how often have you experienced the following:

11.1. I have difficulty falling asleep

11.2. I fall into a deep sleep

11.3. I fall into a deep sleep

11.4. I have difficulty getting back to sleep once I wake up in the middle of the night

11.5. I wake up easily because of noise

11.6. I toss and turn

11.7. I never go back to sleep after awakening during sleep

11.8. I feel refreshed after sleeping

11.9. I feel unlikely to sleep after sleep

11.10. Poor sleep gives me headaches

11.11. Poor sleep makes me irritated

11.12. I would like to sleep more after waking up

11.13. My sleep hours are enough

11.14. Poor sleep makes me lose my appetite

11.15. Poor sleep makes it hard for me to think

11.16. I feel vigorous after sleep

11.17. Poor sleep makes me lose interest in work or others

11.18. My fatigue is relieved after sleep

11.19. Poor sleep causes me to make mistakes at work

11.20. I am satisfied with my sleep

11.21. Poor sleep makes me forget things more easily

11.22. Poor sleep makes it hard to concentrate at work

11.23. Sleepiness interferes with my daily life

11.24. Poor sleep makes me lose desire in all things

11.25. I have difficulty getting out of bed

11.26. Poor sleep makes me easily tired at work

11.27. I have a clear head after sleep

11.28. Poor sleep makes my life painful

12. **Perceived Stress Scale** (0 = Never, 1 = Almost never, 2 = Sometimes, 3 = Fairly often, 4 = Very often)

The questions in this scale ask you about your feeling and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

12.1. In the last month, how often have you been upset because of something that happened unexpectedly?

12.2. In the last month, how often have you felt that you were unable to control the important things in your life?

12.3. In the last month, how often have you felt nervous and "stressed"?

12.4. In the last month, how often have you felt confident about your ability to handle your personal problems?

12.5. In the last month, how often have you felt that things were going your way?

12.6. In the last month, how often have you found that you could not cope with all the things that you had to do?

12.7. In the last month, how often have you been able to control irritations in your life?

12.8. In the last month, how often have you felt that you were on top of things?

12.9. In the last month, how often have you been angered because of things that were outside of your control?

12.10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

13. **Athletic Identity Measurement Scale (AIMS)** (7-point Likert scale; 1= strongly disagree; 7= strongly agree)

13.1. I consider myself an athlete

13.2. I have many goals related to sport

13.3. Most of my friends are athletes

13.4. Sport is the most important part of my life

13.5. I spend more time thinking about sport than anything else

13.6. I feel bad about myself when I do poorly in sport

13.7. I would be very depressed if I were injured and could not compete in sport

14. **Ten-Item Personality Inventory (TIPI)** (7-point Likert Scale; 1 = Strongly Disagree; 7= Strongly Agree)

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

I see myself as…

14.1. … Extraverted, enthusiastic.

14.2. … Critical, quarrelsome.

14.3. … Dependable, self-disciplined.

14.4. … Anxious, easily upset.

14.5. … Open to new experiences, complex.

14.6. … Reserved, quiet.

14.7. … Sympathetic, warm.

14.8. … Disorganized, careless.

14.9. … Calm, emotionally stable.

14.10. … Conventional, uncreative.

15. **IAT 1:** Energy (Positive) vs. Tiredness (negative and Vigorous or Moderate Activity

    15.1. Energy words: Energizing, Strength, Power, Motivation, Active, Full of Energy, Drive, Energetical, Endurance

    15.2. Tiredness words: Exhausted, Sore, Tired, Fatigued, Weakness, Sleepiness, Drained, Slow, Heavy

    15.3. Vigorous or Moderate Activity words: Cycling, Running, Weightlifting, Swimming, Jogging, Bootcamp, Working Out

16. **IAT 2:** Calmness (Positive) vs. Tension (Negative) and Vigorous or Moderate Activity

    16.1. Calmness words: Peace, Peacefulness, Calm, Serenity, Untroubled, Restful, Harmony

    16.2. Tension words: Stress, Anxiousness, Nervous, Pressure, Restless, Tense

    16.3. Vigorous or Moderate Activity words: Cycling, Running, Weightlifting, Swimming, Jogging, Bootcamp, Working Out

17. **IAT 3:** Pleasure (Positive) vs. Displeasure (Negative) and Vigorous or Moderate Activity

    17.1. Pleasure words: Enjoyment, Love, Fun, Satisfaction, Joy, Happy, Cheer

    17.2. Displeasure words: Discontent, Dissatisfaction, Frustration, Discomfort, Irritation, Distress, Upset

    17.3. Vigorous or Moderate Activity words: Cycling, Running, Weightlifting, Swimming, Jogging, Bootcamp, Working Out

18. **End**

You have now completed the survey! Thank you for your participation! :)

For any questions/wish to withdraw send an email to one of the researchers

Appendix C

R-Studio Code

#Bachelor Thesis Code#

#Antonia Freiberg#

#17.04.2024 – 20.05.2024#

#1. load and update packages

```
library('readr')

library('tidyverse')

library('dplyr')

library('ggplot2')

library('psych')

library('car')

library('lmtest')
```

#2.Load csv.file

```
data_complete <- read.csv("data1.csv", sep = ",")

view(data_complete)
```


#3.Remove columns and Clean out missing data

```
data_clean <- data_complete[, -c (1:8, 10, 13:14, 25:35, 45:46, 48:53, 55:65, 67:72, 74, 76:77,

79, 80:159, 165:326)]

data_clean <- data_clean [-c (1) ,]

data_clean <- mutate_all(data_clean, ~ ifelse(. == "", NA, .))

data_clean <- na.omit(data_clean)

view(data_clean)
```

Convert data set to numeric

data_clean <- data.frame(lapply(data_clean, as.numeric))

#4. Change column names

names(data_clean) <- c("age", "gender", "nationality", "occupation", "marital_status",

"living_area", "Past_Sport", "Present_Sport", "Types_1", "Types_2", "Types_3", "Types_4",

"Types_5", "moderate_1", "moderate_2", "moderate_3", "moderate_4", "vigorous_1",

"vigorous_2", "vigorous_3", "vigorous_4", "boredom_1", "boredom_2", "displeasure_1",

"boredom_3", "displeasure_2", "displeasure_3", "displeasure_4", "variety_1", "variety_2",

"variety_3", "variety_4", "variety_5")

view(data_clean)

#5. AFFEXXX Reverse Code items

#5.1 Reverse coding for items D202_04 (Boredom1) and E102_22 (Boredom3)

  #Boredom1

data_clean$boredom_1 <- as.numeric(data_clean$boredom_1)

data_clean$boredom_1 <- ifelse(is.na(data_clean$boredom_1), NA, 8 -

data_clean$boredom_1)

  #Boredom3

data_clean$boredom_3 <- as.numeric(data_clean$boredom_3)

data_clean$boredom_3 <- ifelse(is.na(data_clean$boredom_3), NA, 8 -

data_clean$boredom_3)

view(data_clean)

#Intention one score

```
data_clean$intention_moderate<-(data_clean$moderate_1 + data_clean$moderate_2 +

data_clean$moderate_3 + data_clean$moderate_4)/ 4

data_clean$intention_vigorous<-(data_clean$vigorous_1 + data_clean$vigorous_2 +

data_clean$vigorous_3 + data_clean$vigorous_4)/ 4
```

#5.2 Scores for the AFFEXX

  #5.2.1 Boredom vs. interest scores in a new variable

```
data_clean$boredom <- (data_clean$boredom_1 + data_clean$boredom_2 +

data_clean$boredom_3) / 3
```

  #5.2.2 Displeasure vs. Pleasure scores in new variable

```
data_clean$displeasure <- (data_clean$displeasure_1 + data_clean$displeasure_2 +

data_clean$displeasure_3 + data_clean$displeasure_4) / 4
```

#6. One Item scores on Perceived Variety

```
data_clean$PVE <- (data_clean$variety_1 + data_clean$variety_2 + data_clean$variety_3 +

data_clean$variety_4 + data_clean$variety_5)/ 5

view(data_clean)
```

#7. Alpha calculations
#7.1. Alpha intention moderate exercise

```
moderate<- paste("moderate_", 1:4, sep="")

moderate_data <- data_clean[moderate]

alpha(moderate_data)
```

#7.2 Alpha intention vigorous exercise

```
vigorous<- paste("vigorous_", 1:5, sep="")
```

```
vigorous_data <- data_clean[vigorous]

alpha(vigorous_data)


#7.3 Alpha PVE

pve<- paste("variety_", 1:4, sep="")

pve_data <- data_clean[pve]

alpha(pve_data)
```

##############################Descriptive Statistics##############################

```
#1. Sample Characteristics#


summary(data_clean[, c('age', 'gender', 'nationality', 'occupation', 'marital_status', 'living_area',

'Past_Sport', 'Present_Sport')])


#1.1 Age

  #look at age distribution and decide which if mean or median value makes more sense

scatter.smooth(data_clean$age)


#1.2 Gender

#convert numbers into words (1= female, 2= male, 3= non-binary)

# Define the conversion function

convert_gender <- function(gender_numeric) {

  gender_lookup <- c("female", "male", "non-binary", "no_answer")

  gender_word <- gender_lookup[gender_numeric]

  return(gender_word)

}
```

```r
data_clean$gender_word <- convert_gender(data_clean$gender)

#gender = numbers and gender_word = words

#amount of participants with which gender

gender_counts <- table(data_clean$gender_word)

print(gender_counts)

#percentages of gender

percent_female <- (gender_counts["female"] / 138) * 100

percent_male <- (gender_counts["male"] / 138) * 100

percent_non_binary <- (gender_counts["non-binary"] / 138) * 100

percent_no_answer <- (gender_counts["no_answer"] / 138) * 100

print(percent_female)

print(percent_male)

print(percent_non_binary)

print(percent_no_answer)


#1.3 Nationality

#covert numbers (1 = Dutch, 2 = German, 3 = Other)

convert_nationality <- function(nationality_numeric) {

  nation_lookup <- c("dutch", "german", "other")

  nation_word <- nation_lookup[nationality_numeric]

  return(nation_word)

}


data_clean$nation_word <- convert_nationality(data_clean$nationality)

#amount of participants with nationaility
```

```
nation_counts <- table(data_clean$nation_word)

print (nation_counts)

#percentages

percent_dutch <- (nation_counts ["dutch"]/ 138)* 100

percent_german <- (nation_counts ["german"]/ 138)* 100

percent_other <- (nation_counts["other"]/ 138)* 100


print(percent_dutch)

print(percent_german)

print(percent_other)


#1.4 Main Occupation

# covert numbers (1 = Highschool, 2 = University, 3 = Full_Time_Office, 4 =

Part_Time_Office, 5 = Full_Time_Active, 6 = Part_Time_Active, 7 = Unemployed, 8 =

Unable, 9 = Retired, 10 = other)

convert_occupation <- function(occupation_numeric) {

  occupation_lookup <- c("School", "University", "Full_Office", "Part_Office", "Full_Active",

"Part_Active", "Unemployed", "Unable", "Retired", "other")

  occupation_word <- occupation_lookup[occupation_numeric]

  return(occupation_word)

}


data_clean$occupation_word <- convert_occupation(data_clean$occupation)

#amount of people with specific occupation

occupation_counts <- table (data_clean$occupation_word)

view(occupation_counts)
```

#I dont think I need percentages here

#1.5 marital status

#covert numbers (1= single, 2 = partnered, 3 = married, 4 = Divorced, 5 = other, 6 = prefer not to say)

```
convert_marital <- function(marital_numeric) {

  marital_lookup <- c("single", "partnered", "married", "divorced", "other", "none")

  marital_word <- marital_lookup[marital_numeric]

  return(marital_word)

}


data_clean$marital_word <- convert_marital(data_clean$marital_status)
```
#amount of particpants in marital stautus
```
marital_counts <- table (data_clean$marital_word)

view(marital_counts)
```

#1.6 Living area
```
convert_area <- function(area_numeric) {

  area_lookup <- c("urban", "rural")

  area_word <- area_lookup[area_numeric]

  return(area_word)

}


data_clean$area_word <- convert_area(data_clean$living_area)
```
#amount of particpants in marital stautus
```
area_counts <- table (data_clean$area_word)
```

```
view(area_counts)


#percentages;75 number of participants, needs to be changed

percent_rural <- (area_counts ["rural"]/ 138)* 100

percent_urban <- (area_counts ["urban"]/ 138)* 100


print(percent_rural)

print(percent_urban)


#2. Intention moderate

scatter.smooth(data_clean$intention_moderate) #using median


moderate_gender <- data_clean %>%

  group_by(gender) %>%

  summarize(moderate_gender = median(intention_moderate, na.rm = TRUE))

print(moderate_gender)


moderate_nation <- data_clean %>%

  group_by(nationality) %>%

  summarize(moderate_nation = median(intention_moderate, na.rm = TRUE))

print(moderate_nation)


moderate_job <- data_clean %>%

  group_by(occupation) %>%

  summarize(moderate_job = median(intention_moderate, na.rm = TRUE))

print(moderate_job)
```

```
moderate_marital <- data_clean %>%

  group_by(marital_status) %>%

  summarize(moderate_marital = median(intention_moderate, na.rm = TRUE))

print(moderate_marital)


moderate_area <- data_clean %>%

  group_by(living_area) %>%

  summarize(moderate_area = median(intention_moderate, na.rm = TRUE))

print(moderate_area)


#intention vigorous exercise

vigorous_gender <- data_clean %>%

  group_by(gender) %>%

  summarize(vigorous_gender = median(intention_vigorous, na.rm = TRUE))

print(vigorous_gender)


vigorous_nation <- data_clean %>%

  group_by(nationality) %>%

  summarize(vigorous_nation = median(intention_vigorous, na.rm = TRUE))

print(vigorous_nation)


vigorous_job <- data_clean %>%

  group_by(occupation) %>%

  summarize(vigorous_job = median(intention_vigorous, na.rm = TRUE))

print(vigorous_job)
```

```
vigorous_marital <- data_clean %>%

  group_by(marital_status) %>%

  summarize(vigorous_marital = median(intention_vigorous, na.rm = TRUE))

print(vigorous_marital)


vigorous_area <- data_clean %>%

  group_by(living_area) %>%

  summarize(vigorous_area = mean(intention_vigorous, na.rm = TRUE))

print(vigorous_area)


#2. Questionnaiare distribution

describe(data_clean[, c("boredom", "displeasure", "PVE")])


scatter.smooth(data_clean$boredom)

scatter.smooth(data_clean$displeasure)

scatter.smooth(data_clean$PVE)


################################Statistical Analysis############################

#1. Correlation tests (Spearman)

#PVE

cor.test(data_clean$PVE, data_clean$boredom, method=c("spearman"))

cor.test(data_clean$PVE, data_clean$living_area, method=c("spearman")) #significant

cor.test(data_clean$PVE, data_clean$displeasure, method=c("spearman"))


#RQ1: Boredom and Variety
```

```
plot(data_clean$PVE, data_clean$boredom)

abline(lm(boredom ~ PVE, data = data_clean), col= 'red')

plot(data_clean$boredom, data_clean$PVE)

abline(lm(PVE ~ boredom, data = data_clean), col= 'red')


RQ1 <- lm(boredom ~ PVE, data = data_clean)

summary(RQ1)


#very insignificant


#boredom and displeasure

cor.test(data_clean$boredom, data_clean$displeasure, method=c("spearman")) #significant


#boredom and living area

cor.test(data_clean$boredom, data_clean$living_area, method=c("spearman"))


cor.test(data_clean$displeasure, data_clean$living_area, method=c("spearman"))


#2.Multiple Regression Analysis

model <- lm(displeasure ~ boredom + PVE , data = data_clean)

summary(model)

avPlots(model)


#3. Assumptions

# 5.1. Checking normality of residuals (using a Q-Q plot) #significant

qqnorm(model$residuals)
```

```
qqline(model$residuals)


# 2. Checking homoscedasticity of residuals (using a plot of residuals vs. fitted values)

#insignificant

plot(model$fitted.values, model$residuals, xlab = "Fitted values", ylab = "Residuals")


# 3. Checking linearity (independent vs. each predictor variable) #insignificant

#plot(data_clean$living_area, model$displeasure, xlab = "living_area", ylab = "displeasure")

plot(data_clean$boredom, model$displeasure, xlab = "boredom", ylab = "displeasure")

plot(data_clean$PVE, model$displeasure, xlab = "PVE", ylab = "displeasure")


# 4. Checking for multicollinearity among predictor variables (using variance inflation factor -

VIF) #significant; low VIF

vif(model)


# 5. Checking for Indepence (using Durbin-Watson test) #inisignificant

dwtest(model)


#2. Testing effect of living area on boredom and PVE (multivariate regression model)


model2 <- lm(cbind(boredom, PVE) ~ living_area, data = data_clean)

summary(model2)
```

Appendix D

AI Statement

For this research, I, Antonia Freiberg, did not use any Artificial Intelligence (AI) tools.