**Exploring the role of emotions towards physical activity**

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**Abstract**

**Background:** Physical exercise has well-documented benefits. The most prominent health benefits include the risk reduction of heart diseases, cancer, and diabetes and the overall improvement of well-being. Despite these well-known benefits, a significant proportion of the Dutch population, as well as the global population fails to meet the recommended activity guidelines. Behavioural theories, such as the Theory of Planned behaviour focus solely on cognitive factors for exercise behaviour. However, the Affective Reflective Theory (ART) emphasizes the role of emotions in exercise motivation.

This study investigates how the role of the personality trait of extraversion might influence the relationship between the social aspects of exercising, (e.g. exercising with others, the interest one has towards exercise, and the tendency to show off during exercise) and the intention one might have to engage in vigorous exercise. Furthermore, studies have pointed out that the personality trait of extraversion is also positively related to exercise.

**Methods:** The study design consisted of a cross-section survey that measured the variables of interest. 135 participants filled out the whole survey, with an age range of 18-69. There has been made use of three different measurements; the AFFEXX to measure the pleasant or unpleasant valence that is associated with exercising, the TIPI to get insights into the personality types of the participant, and a scale to measure the intention to exercise.

**Results:** The findings of this study indicated that appraisals of interest and showing off were significant predictors of vigorous activity intentions. The appraisal of exercising in groups was not a significant predictor. Furthermore, extraversion has been shown to moderate the relationship between the antecedent appraisal of interest and the intentions of exercise. Lastly, Kendall's Tau correlation analysis pointed out a strong significant correlation between the interest in exercise and the pleasure one experiences in exercise. This pleasure in exercise was also correlated with showing off. Although this association was significant, it was much smaller.

**Conclusion:** This study can give insights into how the personality trait of extraversion interacts with the social aspects of exercise. Understanding these mechanisms can help in the development of more effective interventions to promote participation in exercise, in particular for those who initially do not find exercise appealing. Future research can use these findings by exploring other factors that influence exercise motivation, or gain deeper insight by using other measurements to measure the same constructs in this study.

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**Introduction**

Nowadays, there are plenty of well-documented studies regarding the beneficial effects of physical activity (Warburton et al., 2006). Even a single case of moderate to vigorous physical activity has an immediate positive impact on the health of the heart and brain, can strengthen the bones, and enhances the immune system by improving immunosurveillance against pathogens and carcinogens. (Jones & Davison, 2019; Nieman & Wentz, 2019). Studies have shown that physically active individuals had a 19% reduced chance of colon cancer and active women even had a 12-21% lower chance of breast cancer (Liu et al., 2016; Eliassen et al., 2010). Despite these well-documented benefits, 47% of the Dutch population still failed to meet the guidelines of recommended physical activity by the World Health Organization in 2021 (Rijksinstituut voor Volksgezondheid, Welzijn en Sport, 2023). The numbers in Germany are more or less similar with 42.6% of women and 48% of men reaching these guidelines in 2017 (Finger et al., 2017). Globally, the numbers are even more concerning. Only 80% of the world's adolescent population was physically active in 2022 (World Health Organization, 2022). This inactivity is associated with different negative consequences, such as a significantly higher risk of Diabetes Type 2, poorer blood circulation, higher chances of inflammation, and increased personality problems.

Many behaviour theories solely focus on cognitive parameters. For example, the Theory of Planned Behaviour (Ajzen, 1991) proposes that the determinants of intentions towards exercise are only cognitive (e.g. attitude, subjective norms, and perceived behavioural control. However, the TPB does not consider affective responses, which research has pointed out as crucial in motivation (Ekkekakis, 2012). A theory that addresses this gap is the Affective Reflective Theory (ART). This theory argues that the core affective valences influence the reasoning about exercise engagements and efforts to partake in physical activities. According to ART, affective responses play a two-sided role in exercise behaviour. First, exercise-related trigger stimuli can evoke automatic associations and evaluations in an individual, which can lead to either positive or negative affective responses. Second, in the reflective evaluations, where the person considers if self-resources are available, which will result in an action plan. These two can then direct the individual towards or away from changing the behaviour (e.g. becoming (in)active or staying (in)active) (Brand & Ekkekakis, 2017).

Additionally, current studies often overlook other factors that might influence exercise behaviour. To start with, the personality trait of extraversion might also influence physical activity. This trait is characterized by an orientation of one's energies and interests towards the outside world (APA Dictionary of Psychology, 2014), and is positively related to physical activity (Rhodes & Smith, 2006). The relationship between extraversion and physical activity is intensity-dependent. Stronger observations are noted in vigorous activities when compared to mild-to-moderate ones (Wilson & Dishman, 2015). This suggests that the aspect of "Activity", which is defined as rapid tempo and vigorous movement, in a sense of energy, and in need to keep busy (Costa & McCrae, 1992), plays a

significant role in the aforementioned relationship.

Moreover, researchers, including Ekkakis (2012) and Sabiston et al. (2014) argue that exercise mostly occurs in social settings. These social interactions can positively influence the affective experience of physical exercise as meaningful relationships can grow. Contrarily, these interactions can also create fears of critical evaluations and negative social comparisons, leading to physique anxiety. This anxiety has been shown to negatively impact physical activity participation and commitment (Zartaloudi & Christopoulos, 2021; Raedeke et al., 2007; Sicilia et al., 2016). Finally, research points out that extraversion is positively related to an increased chance of an individual being engaged in a variety of physical, cognitive and social activities (Lai & Qin, 2020; Stephan et al., 2013). Extraverts typically show higher levels of energy and greater sociability, tend to seek more excitement, and are more likely to experience positive emotions. These tendencies of extroverts might explain why individuals who score higher on extraversion report more frequent participation in a variety of activity types, including various sports, either in a group or individually. This pattern is consistent across different social-cultural contexts and a broad age span (Stephan et al., 2013).

Although a substantial amount of research points out the positive relationship between extraversion and physical activity, there is a need for further specific mechanisms that underly this relationship. For example, the to which extra which the personality trait of extraversion influences physical activity behaviour remains unclear. Additionally, it remains unclear to which extent the trait of extraversion influences the relationship between the emotional evaluations of physical exercise as given by the articles of Ekkekakis (2012 & 2017)

**Research aim**

This research aims to investigate how the trait of extraversion might moderate the relationship between affective appraisals and the intention to engage in vigorous physical exercise. The affective appraisals described in the ART theory can be measured with the Affective Exercise Experiences Questionnaire (AFFEXX) (Ekkekakis et al., 2021). These cognitive evaluations influence the experiences that are gained during the exercise activities. Given the outgoing nature and the stimulation-seeking tendencies that extroverted individuals show, a selection of antecedent appraisals are selected that are likely to be most recognisable in these individuals (Lucas et al., 2000).

To start with, extroverts typically enjoy being around other people, which makes the appraisal of "exercising in groups vs. exercising alone" an interesting one to look at. Additionally, the outgoing nature of extrovert people, and the enjoyment that they experience while being at the centre of attention, is most likely to be measured with the appraisal of "showing off vs shying away". Finally, the preference of extroverts to engage in exciting activities highlights the importance of the interest vs boredom appraisal. Among the three core affects that are given in the Affective Reflective Theory, the pleasure-displeasure dualism is particularly relevant. The reason for this is that extroverted individuals naturally tend to experience higher levels of positive emotions and enthusiasm, making the pleasure

aspect crucial to understanding the engagement of extroverts in physical activities.

By investigating how the personality trait of extraversion moderates the relationship between these specific social antecedents and their influence on the core affect of pleasure/displeasure and the intention towards physical exercise, this research might provide deeper insights into how negative associations and emotions towards physical exercise can be transformed into more positive ones. Furthermore, the association between the three social appraisals and the core affect of pleasure/displeasure will be explored to gain deeper insight into the mechanisms underlying the link between extraversion and exercise intentions. The study will collect the necessary data via a questionnaire to answer the following research questions:

**RQ$_1$ : To what extent are the three social antecedent appraisals (showing off, interest, and exercising in groups) associated with the intention to vigorous exercise?**

**RQ2 : To what extent does the personality trait of extraversion moderate the relationship between social antecedent appraisals and intentions of vigorous exercise?**

**RQ3: How are the three relevant antecedent appraisals (showing off, interest, and exercising in groups) associated with the core affect of pleasure/displeasure?**

# Methods

While the research is primarily exploratory and aims to answer hypotheses, it aims to examine the moderation that extraversion has on the relationship between the affective appraisals of physical exercise in a social context, and the moderation effects that extraversion itself has on PE. For the matter of examining this, the choice has been made to employ a cross-sectional study, with a questionnaire as the methodology. This survey will enable the researchers to gather self-reports from a large sample of participants, which could help in building a reliable data set that can answer the stated hypothesis with sufficient confidence (De Vaus, 2013).

## Participants

To be eligible for participation in this study, individuals had to meet the following inclusion criteria; being 18 years of age or older due to ethical concerns, and having proficiency in the English language due to the format and language this study is in. Participants were recruited via a non-probability sampling method. This non-random selection of recruitment can be defined as: "Any process of choosing a subset of participants or cases from a larger population in which it is impossible to precisely determine each unit's likelihood of being selected" (*APA Dictionary of Psychology*, 2024). Within the non-probability sampling, convenience sampling was used as the primary method for the recruitment of participants. This method is a data collection method that relies on taking samples that are readily available or easily accessible to the researchers. There is no fixed pattern in acquiring the participants, but they are recruited solely based on accessibility (Edgar & Manz, 2017).

In total, 135 participants filled out the questionnaire. As sketched in Figure 1, most of the participants aged 21, with the ages ranging from 18-69 years, had a Dutch nationality, identified as female, were single, and were a student at a University. The individuals in the dataset reported exercising on average 2.8 days a week (SD = 1.96, Min = 0, Max = 7, Median; 3), for an average of 41.0 minutes a day (SD = 44.4, Min = 0, Max = 240).

**Table 1.**

*Sample Demographics of the Participants (N = 135)*

| Participant Characteristic | Frequency | % |
|---|---|---|
| Gender | | |
| Male | 76 | 56.3 |
| Female | 57 | 42.2 |
| Non-binary/third gender/others | 2 | 1.5 |
| Nationality | | |
| Dutch | 77 | 57.0 |
| German | 25 | 18.2 |
| Other | 33 | 24.4 |
| Marital status | | |
| Married | 15 | 11.1 |
| Single | 58 | 43.0 |
| Partnered | 57 | 24.2 |
| Prefer not to say | 3 | 2.2 |
| Other | 2 | 1.5 |
| Occupation | | |
| University student | 96 | 71.1 |
| High-school student | 3 | 2.2 |
| Employed | 28 | 20.7 |
| Unemployed | 7 | 5.2 |
| Retired | 1 | 0.7 |
| Living area | | |
| Rural | 54 | 40.0 |
| Urban | 81 | 60.0 |

Furthermore, the individuals in the data set stated that they had a strong preference for competitive sports over non-competitive sports. The sample did not show a preference for indoor sports or outdoor sports, sporing in teams or sporting individually, and practicing sports that need a ball or sports that do not. Finally, there was no strong preference for either cardio sports or non-cardio sports. A short overview of short preferences can be found in Table 2. In this overview, A score of 1 represents the first option listed, 2 represents a neutral response (no preference), and 3 indicates the second option. The values in the table represent the number of participants who selected each option on this scale.

**Table 2.**

*Sport preferences of the sample*

| Sport Preferences | 1 (N) | 2 (N) | 3 (N) |
|---|---|---|---|
| Indoor/outdoor sports | 22 | 62 | 51 |
| Team/individual sports | 50 | 37 | 48 |
| Ball/non-ball sports | 58 | 35 | 42 |
| Competitive/non-competitive sports | 61 | 42 | 32 |
| Cardio/non-cardio | 29 | 89 | 17 |

*Note. For the Sport preferences, score 1 represents the first option, 2 represents neutral, and 3 represents the second option. The values are the number of participants that picked that option*

**Materials**

*Participant information*

　　　　To get an impression of the participants who completed the survey, the start of the survey consisted of items to measure the characteristics. First, general information about the participants was asked, such as; gender, nationality, main occupation, marital status and living area. Next, to sketch an image of the sports profile that each person had, multiple questions have been asked. Participants had to state their preference for indoor or outdoor sports, team sports or individual sports, ball sports or non-ball sports, competitive or non-competitive, and cardio or non-cardio sports. These preferences were presented to the participants as dualisms, which they could answer on a three-point Likert scale. A score of two in this case meant no opinion. The last segment of the participant information contained two items (past and present) to get insights into the variety of sports in which the sample partake. To answer this part, participants had to complete the next prompts (1) "Over the span of my life, I practiced in total … types of sport at least once a week." and (2) "Over the past month, I engaged in … different types of sports at least once a week."

*Affective exercise experience*

　　　　The AFFEXX is a self-report instrument that was developed by Brand and Ekkekakis (2018) and aims to distinguish between various dimensions of affective experiences during physical activity, which include positive and negative states. The AFFEXX's conceptual model states that fundamental affective exercise experiences are at the root of a causal chain. They are shaped by different cognitive assessments that precede them, and this in turn shapes an outcome motivational variable that we refer to as attraction vs aversion towards exercise. Three categories were used to categorize core affective exercise experiences: (a) pleasure vs. displeasure, (b) energy vs. tiredness, and (c) calmness vs. tension. These constructs all consist of 4 different items. There are six relevant antecedent appraisals: (a) interest-boredom, (b) competence-incompetence, (c) liking-disliking exercise in groups, (d)

showing off-shying away, (e) empowering-damaging to health, (f) honour/pride vs. shame/guilt. These appraisals consist of 3 items each, except for the "competence vs incompetence" appraisal, which relies on four different ones. (Ekkekakis et al., 2021).

The AFFEXX consists of 36 dualisms, in which there is a 7-point Likert scale. When one aligns the most with the left statement, the scoring will be 1-3, and for the right statement, it is likely to be 5-7. If one does not feel particularly attracted to one of the scores, he/she will likely give a score of 4 (neutral). Higher scores (e.g. 7) on this scale suggest that an individual finds exercising and physical activities overall more enjoyable. Lower scores (e.g. 1) indicate that the individual experienced overall negative associations while partaking in physical activities, and thus does not experience physical activities enjoyable. Furthermore, the reliability of the scale was also measured, with the Alpha and Omega coefficients of internal consistency being examined. According to the manual of the AFFEXX, all the coefficients of internal consistency (Cronbach Alpha) lie between 0.822 and 0.917 (Ekkekakis et al., 2021). Thus, all the internal consistency values lie above 0.80, generally perceived as sufficient for research purposes (Nunnally & Bernstein 1994).

To answer the research questions proposed in the introduction, there is no need to investigate all the appraisals. For the first research question, only the socially related antecedent appraisals were used (showing off vs. shying away, interest vs. boredom, and exercising in groups vs. exercising alone). For the second research question, those three constructs were also used in a moderation analysis. For the last RQ, the relationship between the three social antecedent appraisals was used in combination was examined in combination with one core affect; pleasure vs displeasure. The rest of the AFFEXX outcomes were not used in this study.

*Intention to exercise*

Intention to exercise was measured with four items that aimed to measure vigorous activities such as jogging, swimming, or High-Intensity Interval Training (HIIT) workouts. The four items that were used are; "How likely is it that you will engage in vigorous exercise 1-2 times per week over the next week?", "Do you have confidence in your ability to engage in sports activities 1-2 times a week?", "How motivated are you to incorporate vigorous exercise in your daily routine?", and "How determined are you to engage in vigorous exercise, despite obstacles that you might face. ". Participants were asked to answer the items on a 7-point Likert scale, ranging from 'Strongly Disagree' to 'Strongly Agree'. The Cronbach Alpha coefficient has been computed for this construct and turned out to be 0.95. This indicates that all of the four items are highly correlated with one another. To calculate the total score that the participant had obtained in this section of the questionnaire, the means of the 4 items was calculated. The higher the obtained value was for this variable, the likelier it is for the participant to engage in vigorous sports activities. These means have been added to the dataset as a new variable per participant. Furthermore, the overall mean of the dataset was also calculated

*The Ten-Item Personality Inventory*

To measure the personality trait of extraversion, the Ten-Item Personality Inventory has been used. The TIPI, as constructed by Gosling, Rentfrow and Swann (2003), is a brief self-report questionnaire that is designed to measure the Big Five personality traits (Extraversion, Agreeableness, Conscientiousness, Emotional Stability, Openness to Experience), and is very commonly used within research and clinical settings due to its brevity and effectiveness in measuring personality traits. The scale itself consists of ten items, with 2 items for each trait. For instance, the respondents were presented with two lines of opposite traits that measure extraversion, such as "Extraverted, Enthusiastic" and "Reserved, Quiet" Respondents have to rate the items on a Likert scale that ranges from 1-7, in which they indicate if they agree or disagree with the statements that describe certain personality characteristics. The items are written to be easy to understand and complete (Gosling et al., 2003). In 29 studies, concerning 27 versions of the TIPI in 18 languages, the TIPI demonstrated acceptable test-retest reliability, with mixed results for convergent and structural validity (Thørrisen & Sadeghi, 2023).

Despite its length, the English version of the TIPI has an acceptable test-retest reliability ($r = 0.72$). The creators emphasised content validity over internal consistency, which was the argumentation for the low values of the Cronbach alphas (between 0.40 and 0.73). They stated that the traditional psychometric measures, such as Cronbach's alpha, might not accurately assess the effectiveness of the TIPI. For this reason, researchers should prioritize test-retest reliability when evaluating the TIPI's reliability.

For the means of this research, only the two items for extraversion were used in the inferential statistics, but the other scores were also calculated to get a better image from the sample. To calculate the score one had obtained for extraversion, the second item (which is reversed) was first transformed by reversing its score. The two items were then summed up and added to the dataset as a new extraversion variable. A higher score on this variable means that the participant is more likely to have the personality trait of extraversion.

**Procedure**

To gather participants, multiple media were used. To start with, social media has been used to distribute a flyer (see Figure 1) with information about the study, as well as a link and a QR code that directly leads to the survey. This has been done to make participation as easy as possible. Furthermore, There has been made use of active recruitment. Before the survey was accessible, all the participants had to fill in the informed consent that was provided online. In this consent, all information about the study, anonymity and confidentially was presented to the participants. Additionally, all ethical concerns were addressed and the participants were informed of all the rights they had. The questionnaire was not available without informed consent. Furthermore, the study obtained ethical approval from the BMS Ethical Committee (registration number 240366), which indicates that the

research adhered to ethical guidelines and protected participants from any harm.

To effectively store the data and to easily answer the questions, the survey was created with the research programme SoSci Survey. This professional tool is designed to quickly, easily and reliably implement an online survey, while strictly adhering to German privacy laws. (Leiner, 2024)When the questionnaire had finished, the participants ended with a "thank you for your participation" page. All the collected data is saved on the cloud of the SoSci page and is only accessible with a password. This password is known only to people who are authorized to view the data (e.g. research team and supervisor). The collected data will be retained for 10 years (2024-2034) on the certified servers of the University of Twente (ISO 27001 and NEN 7510), and will be deleted afterwards.

**Figure 1.**

*The flyer used in the recruitment process.*



**Data analysis plan**

*Data handling*

Rstudio version 2024.04.0 was used to analyse the data that was supplied with the questionnaire after the activity. First, two copies of the data were made. One copy of the data has been uploaded into a read-only environment to ensure that it is always safe to access and stored without being altered. To ensure the confidentiality of the dataset, both files were uploaded to an encrypted environment that could only be accessed by authorised people. The other was converted into a .sav file, which is a format compatible with Rstudio. This choice as made because these kinds of files are excellent for data structure preservation. Ensuring the integrity of data is crucial while transferring or sharing a file among various researchers. Additionally, the .SAV file provides a reliable and standardized format for long-stored data.

*Data preparation and data cleaning*

After loading the file in the program Rstudio, the data was checked for missing values and was cleaned to make the results as easy to interpret as possible. If the dataset contained missing values, such as incomplete responses, were deleted from the dataset because they could interfere with the analyses, which require complete datasets. There were a total of 208 participants that started the survey. from these 208, 140 reached the last page. Unfortunately, 5 other respondents were deleted due to missing values (i.e. not completing the survey). In the end, the dataset consisted of 135 responses, which was the sample size for this study.

*Data adjustments and descriptive statistics*

When the dataset was cleaned, and ready for use, the data was adjusted in such a way that only the values that were needed for answering the RQs remained in the dataset. Furthermore, new variables were created based on the frameworks that were used. This means that scores of the used materials were computed, and added to the dataset as a different variable. After this, the descriptive statistics of the dataset were calculated and investigated, which provided insights into the dataset and the distribution of different variables. These statistics that were calculated included the mean, standard deviation, skewness, and kurtosis for each important variable. Afterwards, the correlations between the variables have been computed as well.

*Model assumptions and analysis*

Before proceeding to the regression models, the univariate correlations were calculated to investigate the associations that variables might have with each other. To choose an appropriate method for answering the research questions, the model assumptions were checked per research question. To check the assumption of normality, a histogram was computed. While the histogram looked normal for all three models, the statistical Shapiro-Wilk test was also employed to accompany the histogram. For the assumption of linearity and homoscedasticity, visual tests were used in the form of a scatterplot. Lastly, the multicollinearity assumption was checked with the help of a correlation matrix.

For the first research question, which investigates the relationship between the social antecedent appraisals and the intentions to engage in vigorous exercise, the assumptions of linearity, normality, and correlation were met. However, the assumption of homoscedasticity was violated for this research question. The second research question examines if the personality trait of extraversion acts as a moderator in the relationship between the social antecedent appraisals and the intention of vigorous exercise, and the third RQ explores the association between the three relevant antecedent appraisals and the core affect of pleasure vs displeasure. For these models, the Shapiro-Wilk test indicates a violation for both models (RQ2, $W = 0.97$, $p = <0.05$; RQ3: $W = 0.97$, $p = < 0.05$). Despite the violation of the normality assumption and the presence of heteroscedasticity, the assumptions of linearity and correlation were still met in these models.

For RQ1, a multiple regression analysis was employed. The choice for this parametric method has been made while the sample size (N = 135) is deemed adequate to provide robustness against potential violations of homoscedasticity (Statistics Solutions, 2013). For this model, a multiple regression analysis was employed. A Robust linear regression model was used for the second RQ, this method was chosen because it takes into account the violation of the normality and the homoscedasticity principles, which were found in the data. To investigate how extraversion moderates the relationship between social appraisals and the intentions to exercise, the first model was extended, and the moderator of the personality trait extraversion was included. To establish a baseline relationship, and to see if it differs from the one that was established with the parametric method for RQ1, the main effects were examined first. The effect of the social appraisals on exercise intentions was then examined across different levels of extraversion, after which the direction and strength of the moderation were determined. This followed the moderator model as described by Baron and Kenny (1986). For the last RQ, Kendall's Tau was used to examine the correlation between variables, due to the same violations of the model assumptions.

## Results

**Descriptive statistics**

Table 3 presents the descriptive statistics for all the variables in the dataset. In this table, insights are offered into the distribution and the characteristics of the variables. The core affect of pleasure that one has in exercising has a mean of 5.81 and a standard deviation of 1.13. This suggests that, on average, the participants reported high levels of pleasure in their affective exercise experiences. For the core affects, it could be noted that the sample showed interest in physical activities (M = 5.54, SD = 1.26), and preferred exercising in groups (M = 4.81, SD = 1.55), but did not have a preference for either showing off or shying away (M = 3.60, SD = 1.41). To put this in context, the sample did not enjoy being in the centre of attention during exercise, nor did they have a preference for avoiding this attention. The sample exhibited a moderately high level of extraversion, with a mean score of 4.44 and a standard deviation of 1.45. For the intention to exercise, participants reported a relatively high intention to engage in vigorous exercise activities (M = 5.27, SD = 1.69).

**Table 3.**

*Descriptive statistics for all variables in the dataset.*

| Variable | N | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|
| Interest towards exercise | 135 | 5.54 | 1.26 | -1.24 | 4.74 |
| Showing off while exercising | 135 | 3.60 | 1.41 | -0.18 | 2.39 |
| Exercising in groups | 135 | 4.81 | 1.55 | -0.46 | 2.40 |
| Pleasure in exercising | 135 | 5.81 | 1.13 | -1.60 | 6.38 |
| Extraversion | 135 | 4.44 | 1.45 | -0.12 | 2.19 |
| Intention to exercise | 135 | 5.27 | 1.69 | -0.95 | 3.02 |

In Table 4, a correlation matrix is given between all the variables in the dataset. The findings suggest that there are significant relationships between the variables that are related to the social antecedent appraisals, the core affect, and the intention to vigorous exercise. However, it seems that extraversion is not strongly associated with the other variables.

**Table 4.**

*Correlation matrix for all the variables, with significance taken into account.*

| | Intention to exercise | Pleasure in exercising | Interest towards exercise | Showing off while exercising | Exercising in groups | Extraversion |
|---|---|---|---|---|---|---|
| Intention to exercise | - | | | | | |
| Pleasure in exercising | 0.47 * | - | | | | |
| Interest toward exercise | 0.46 * | 0.83 * | - | | | |
| Showing off while exercising | 0.45 * | 0.47 * | 0.46 * | - | | |
| Exercising in groups | 0.34 * | 0.43* | 0.46 * | 0.55 * | - | |
| Extraversion | -0.10 | 0.06 | 0.05 | 0.05 | 0.02 | - |

* $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

**Inferential statistics**

*Model assumptions*

As described in the data analysis plan, the assumptions for parametric tests were assessed. For the first research question, heteroscedasticity was noted within the model. The other three assumptions were met.  Because of the adequate sample size, and its robustness for the heteroscedasticity, a parametric multiple regression model was used to answer the research question. The Shapiro-Wilk test indicated that the normality assumption is violated for the second and third models. The assumption of homoscedasticity was also violated. While two assumptions were violated, it has been chosen to use the Robust linear regression model and Kendall's Tau, which are non-parametric measures. Following these assumption checks, the statistical analyses were conducted.

*Research question 1*

A multiple regression analysis was chosen as the method to answer the first research question "To what extent are the three social antecedent appraisals (showing off vs. shying away, interest vs. boredom, and exercising in groups vs exercising alone) associated with the intention to vigorous exercise?". The regression model that was made was statistically significant, $F(3, 131 = 17.29, p < 0.001)$, and explained a moderate proportion of the variance (26.7%) in the intention to engage in vigorous exercise. ($R^2 = 0.267$)

The coefficients for interest vs. boredom ($\beta = 0.41$, SE $= 0.12$, t $= 3.57$, p $= < 0.001$) and for showing off vs shying away ($\beta = 0.33$, SE $= 0.11$, t $= 3.02$, p $= < 0.01$) were statistically significant. This indicates higher levels of interest, in contrast to boredom, and a greater tendency to show off, as opposed to shying away, are both associated with a stronger intention to engage in vigorous sports activities. However, the coefficient for the variable of exercising in groups vs exercising alone ($\beta = 0.05$, SE $= 0.10$, t $= 0.48$, p $= 0.63$) was found to be not statistically significant, suggesting that it does not significantly predict one's intention towards exercise.

**Table 5.**

*Regression analysis for predicting vigorous exercise intentions*

| Variable | Coefficient (β) | Standard error | t-value | p-value |
|---|---|---|---|---|
| Intercept | 1.52 | 0.58 | 2.16 | 0.01 * |
| Interest towards exercise | 0.42 | 0.11 | 3.57 | < 0.0001 *** |
| Showing off while exercising | 0.33 | 0.11 | 3.02 | < 0.001 ** |
| Exercising in groups | 0.05 | 0.10 | 0.49 | 0.63 |

* $p < 0.05$; ** $p < 0.005$; *** $p < 0.0005$

*Research question 2*

For the second research question: "To what extent does the personality trait of extraversion moderate the relationship between social antecedent appraisals and intentions of vigorous exercise?", the personality trait of extraversion has been added as a moderator to the model used to answer RQ1. Due to the violations that this model brought (e.g., violation of normality and homoscedasticity), a robust linear model analysis method has been used for this analysis.

This extended model was statistically significant ($F(7,127) = 6.093$, $p = < 0.001$). the R-squared score was 0.336, which suggests that 33.6% of the variances in the intentions of vigorous exercise were explained by the social antecedent appraisals and extraversion. For the first model, with the interaction terms, this was 26.8%, which suggests that adding the interaction terms increases the explained variance by 6.8%. The results from this model can be found in Table 6. The results indicate that the interest that one has in physical activities is significantly associated with the intention of vigorous exercise. In addition, the interaction effect between the interest one has in exercise and extraversion was also statistically significant ($\beta$ = -0.25, $p$ = 0.005), suggesting that extraversion moderates the relationship. Specifically, this negative coefficient for this interaction term indicates that higher levels of extraversion weaken the positive relationship between interest in exercising and the intention to engage in vigorous exercise.

**Table 6.**

*Robust Linear Regression Model coefficients*

| Variable | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| Intercept | -0.51 | 2.12 | -0.24 | 0.81 |
| Showing off while exercising | -0.03 | 0.30 | -0.12 | 0.909 |
| ~ Extraversion | 0.09 | 0.07 | 1.30 | 0.20 |
| Interest towards exercising | 1.55 | 0.39 | 0.45 | < 0.001 ** |
| ~ Extraversion | -0.25 | 0.09 | -2.89 | 0.005 ** |
| Exercising in Groups | -0.48 | 0.30 | -1.61 | 0.11 |
| ~ Extraversion | 0.10 | 0.06 | 1.68 | 0.10 |
| Extraversion | 0.50 | 0.51 | 0.98 | 0.33 |

Note: "~" indicates the moderation effect, * $p$ <0.05; ** $p$ <0.005; *** $p$ <0.0005

*Research question 3*

To find an answer to the last research question, "How are the three relevant antecedent appraisals (showing off vs. shying away, interest vs. boredom, and exercising in groups vs exercising alone) associated with the core affect of pleasure/displeasure", the non-parametric Kendall's tau was

employed. This method was chosen, while the model to answer this research question violated the normality and homoscedasticity assumption. Even after corrections, the violations were still present. Kendall's tau is a non-parametric method that does not take the distribution of the variables into account, and it offers a robust basis for data that contain heteroscedasticity.

All the partial correlation analysis results are given in Table 7. The relationship between the antecedent appraisal of interest towards exercise and the core affect of pleasure in exercising showed a strong relationship ($\tau = 0.62$). This indicates that the interest that one might have in exercising is a significant predictor of his/her affective response. This relationship was also statistically significant ($p < 0.001$). The relationship between showing off during exercise and the pleasure one has in exercise also showed to have a small positive association ($\tau = 0.14$) and is also statistically significant ($p = 0.02$). However, the last partial correlation that investigates the association between the preference to exercise in groups and one's affective response was not statistically significant ($p = 0.87$. These findings confirm the Pearson correlation findings reported in table 3, which shows that the results are robust.

**Table 7.**

*Association analysis between the antecedent appraisals and affective responses using Kendall's Tau Correlation*

| Predictor | Partial correlation ($\tau$) | p-value | Test statistic (z) |
| --- | --- | --- | --- |
| Interest in exercising | 0.62 | $< 0.001$ ** | 10.58 |
| Showing off while exercising | 0.14 | 0.02 * | 2.4 |
| Exercising in groups | -0.01 | 0.87 | -0.17 |

* $p <0.05$; ** $p <0.005$; *** $p <0.0005$

**Discussion**

This study has aimed to investigate the relationships between the social antecedent appraisals (exercising in groups vs exercising alone, interest vs boredom, showing off vs shying away), the personality trait of extraversion, the core affect of pleasure vs displeasure, and the intention to vigorous exercise. First, analyses revealed significant associations between the social appraisals of interest towards exercise and showing off while exercising and one's intention to vigorous exercise. Second, the personality trait of extraversion was shown to exert a moderation effect on the relationship between the interest one has towards exercising and exercise intentions. This positive relationship between interest and exercising intentions was weaker for individuals with a higher grade of extraversion. Finally, a strong association has been found between the antecedent appraisal of interest towards exercise and the affective responses. Showing off during exercising also showed a significant, but smaller association with the pleasure one has in physical activities, but the preference to exercise

in groups does not show a significant association with the pleasure in exercising.

The finding that individuals with a stronger interest in exercise were more likely to report intentions to exercise was as expected. The findings support the notion given by the Affective Reflective Theory (Brand & Ekkekakis, 2018). In this model, the authors suggest that creating opportunities to experience interest in exercise may help to foster interest in physical activity overall, which ultimately may introduce higher intentions to engage in physical activities. Similarly, the positive association between the tendency to show off during exercise and the intention to exercise is not entirely surprising. However, the finding that the appraisal of exercising in groups is not significantly related to intention to exercise is somewhat unexpected. According to the same theory, exercising in groups is significantly related to vigorous exercise due to social support, accountability to others, and the enjoyment experienced during the sharing activities. This argument was not found in the results. The way the participants interpreted the exercising in groups vs the exercising alone might differ from the interpretation they had in the ART, and might in this way explain the differences in results.

The results for the second RQ were unexpected. Other studies point out positive associations between extraversion and exercise intention. For example, Ingledew et al. (2004) found that the personality trait of extraversion promotes intrinsic motivation towards physical exercise. According to the Social Identity Theory (Tajfel & Turner, 1979) extroverts are more likely to be motivated by the social aspects of exercise, such as exercising with others or enjoying social recognition. However, the findings in this study contradict these outcomes by indicating that higher levels of extraversion weaken the positive relationship between interest in exercise and intentions to engage in vigorous activity. This suggests that the interaction between personality traits and intrinsic motivation is more nuanced than previously acknowledged. It is possible that this difference can be explained by different social aspects than solely the interest in exercise, the tendency to show off during exercise or the preference to exercise in groups. Extraverts might for example be more motivated by solely the social interactions during exercise, or other factors such as competition might play a role.

The results of the third research question were mostly expected, except for the absence of a significant association between the preference to exercise in groups and the pleasure one experiences during exercise. Previous research on the impact of group exercise on enjoyment showed that higher perceptions of groupness lead to increased enjoyment and affective valence, and also promote exercising adherence (Graupensperger et al., 2019). Additionally, the sense of belonging, social interaction and recognition during group exercise was found to contribute to the enjoyment one has in exercise (Stevens et al., 2017). The difference in findings suggests that pleasure that comes from group exercise might be more context-dependent than previously assumed. Factors that might influence how pleasurable participants find group exercise might be different per person, or specific type of group exercise.

Concerning the other two social antecedent appraisals, the results are not so surprising. Different studies are in line with our results and point out the role that interest in exercising plays in the pleasure of exercising. An example of such a study is the one conducted by Hagberg et al. (2009) suggested that enjoyment of exercise is associated with interest in exercise activities and that interventions that aim at improving interest in exercise could improve the enjoyment of exercise. Lastly, the positive relationship between showing off during exercise and the pleasure experienced during exercise did not come as a surprise as well. When one refers back to the Social Identity Theory, (Tajfel & Turner, 1979), it has been stated that individuals are motivated by a desire for positive social evaluation. Showing off during exercise can be a way to gain such social recognition, and thus enhance self-esteem. This sense of accomplishment and positive social feedback can contribute to more pleasure in exercise experience (Ekkekakis et al., 2011).

**Strengths**

Within this study, several aspects strengthened the research itself. To start with, the usage of the materials that were used. They were low in cost and thus made the study very cost-effective. Despite these low costs, all the materials were found to be reliable and valid. furthermore, the participants had to provide written consent before participating in this study, otherwise, they were not able to fill in the questionnaire. This ensures their autonomy and understanding of the purpose and procedure of the study.

The study itself gained a sufficient number of respondents (n = 208), of which a total of 135 could be used for the data analysis. The survey was easily accessible via almost all electronic devices with the help of links and a QR code. The respondents reacted to the survey as "fun and interesting to fill in" and "easy to understand". This implies that the answers can be handled as truthfully filled in, and this makes the outcomes more reliable. Finally, the replicability of the study is readily accessible to anyone willing to investigate the same phenomenon.

**Limitations**

A limitation of the study is the usage of convenience sampling. Participants who took part in this study were selected solely on their availability and their willingness to participate in this study. As a result, the sample consisted of the biggest part out of one group with the same characteristics, which might result in the lack of representativeness for the broader population. This limitation raises concerns about the generalizability of the findings for other settings and populations (Etikan et al., 2016).

While participants were mainly positive about the study, they also found some struggles with it. However, participants also noted that the questionnaire was too long. A reason for this could be that some materials were in the questionnaire that was not used within this study. According to

different studies, this might imply some pain points in the data collection. For example, questions that are answered at the end of a long survey mostly have faster and more uniform responses as opposed to those at the beginning (Galesic & Bosnjak, 2009). Longer questionnaires can also increase the burden and are more susceptible to compromising data quantity and quality, making the data less reliable overall (Eisele et al., 2020). Because the questionnaire that was used was fairly long, it might be the case that some of the answers are thus not representative (e.g. participants that had the relatively long AFFEXX questionnaire at the end).

Lastly, it is important to note that this study used a very brief personality measure. The TIPI is a valid instrument when time is scarce, or when one wants to measure personality with the least amount of items possible (Thørrisen & Sadeghi, 2023). This simplistic score, consisting of two items, is thus able to provide a general indication of the extraversion level that one might have. However, it is important to note that the brevity of this instrument costs a potential loss in depth and comprehensiveness. To illustrate this point, Soto and John (2017) pointed out that broader measures are likely to overlook specific facets of personality that might be crucial in predicting eventual behaviour.

**Future research**

For further research, a few things could be taken into account to expand upon this knowledge about this subject. First, the study would benefit from combining multiple ways of gathering participants. While convenience sampling is the most accessible for the researchers, it might impact the validity and reliability of the results. Therefore it is wise to use sampling techniques such as random sampling instead. This might give insights into how other groups score on the same constructs. Comparing them in the end can give answers to differences across generations or populations. Next to this comparison, employing other ways of gathering participants can provide more generalizability of the results, and is more likely to produce data that does not violate any of the model assumptions.

Additionally, one might consider using a more specific questionnaire to measure the personality trait of extraversion. For example, one might use the NEO Personality Inventory (Revised), or the NEO-PI-R (Costa & McCrae, 2008). This 240-item scale has 48 items that solely focus on the trait of extraversion. If one applies this scale, new insights could be obtained into how extraversion influences this study. Because the NEO-PI-R offers a breakdown of extraversion that takes into account different facets, such as warmth or excitement seeking for example, correlations on how extraversion interacts with exercise intention and behaviour could be unveiled and investigated. Furthermore, it would be interesting to take a look at the other personality traits as well. It could be examined to what extent conscientiousness plays its role in the relationship between affective appraisals and exercise responses.

Finally, it might be wise to use a questionnaire that measures only the things needed in light of this research. This way, the questionnaire will be shorter, will save participants time, and reduce respondent fatigue. Ultimately, this will increase completion rates and prevent respondents from just clicking something solely to be done with it.

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**Appendices**

**Appendix A**

*Questions about general participant information*



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7% completed

**1. How old are you?**

I am [        ] years old.

**2. Are you proficient in the English language?**

○ Yes, I am
○ No, I am not

**3. What gender do you identify with?**

○ Female
○ Male
○ Non-binary/ third gender
○ Others
○ Prefer not to say

**4. What is your nationality?**

○ Dutch
○ German
○ Other, namely
[                                                        ]

**Please enter the first letter of your first and last name, as well as the last two digits of your year of birth below (eg: KH89).**
**This will be your personal code.**

1. Personal Code [        ]

**5. What describes your main occupation/job best?**

○ High-school Student
○ University Student
○ Full-Time Office Job
○ Part-Time Office Job
○ Full-Time Physically Active Job
○ Part-Time Physically-Active Job
○ Unemployed
○ Unable to work
○ Retired
○ Other

**6. What is you marital status?**

○ Single
○ Partnered
○ Married
○ Divorced
○ Other
○ Prefer not to say

**7. What describes the area you live in best?**

○ Rural (e.g. Small Town or Village)
○ Urban (e.g. Bigger Town or City)

Next

## Appendix B

*The Affective Exercise Experiences(AFFEXX) exercise questionnaire.*

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# THE "EXERCISE AND ME" QUESTIONNAIRE

Below, you will find a series of statements that people have used to describe their views, attitudes, and experiences with exercise. The statements are presented as pairs of more-or-less opposites (e.g., "I love exercise" versus "I hate exercise"), separated by a seven-point scale. If the statement on the left is closer to your own views, attitudes, and experiences with exercise, mark 1 (if the statement perfectly matches what you would say), 2, or 3. If the statement on the right is closer to your own views, attitudes, and experiences with exercise, mark 7 (if the statement perfectly matches what you would say), 6, or 5. If your own views, attitudes, and experiences with exercise are in-between these two opposites, mark the mid-point, 4. Remember that the questionnaire asks for your own views, attitudes, and experiences with exercise, not what you think "the right thing to say" is. So, do not be concerned with what others may think or the fact that exercise is recommended as a behavior that promotes health. There is no "right" or "wrong" answer. So, try to be as honest as possible in describing your own views, attitudes, and experiences. Do not spend too much time on any one question. Often, your first, spontaneous response is the one that best describes you. So, work quickly but make sure you respond to all questions. At the end, please, check to make sure that you did not leave any blanks. Thanks for your help!

| # | Left statement | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Right statement |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Exercise is stimulating. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is boring. |
| 2. | When my doctor asks if I exercise, I can answer with my head held high. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | When my doctor asks if I exercise, I bow my head in shame. |
| 3. | Exercise is something I dread. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is something I look forward to. |
| 4. | Exercise is very dull. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is very exciting. |
| 5. | I love that exercise makes me feel stronger. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | I hate that exercise may injure me. |
| 6. | Exercise is an uninviting activity. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is a tempting activity. |
| 7. | I feel good to be getting all the great benefits from exercise. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | I feel horrible because I feel like I may get hurt from exercise. |
| 8. | When I exercise, I'd rather be invisible. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | When I exercise, I love showing off. |
| 9. | I feel great exercising in a group. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | I feel intimidated exercising in a group. |
| 10. | Exercise is enjoyable in a group. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is not enjoyable in a group. |
| 11. | Exercise makes me feel worse. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise makes me feel better. |
| 12. | Exercise leaves me feeling exhausted. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise leaves me feeling energized. |
| 13. | I feel drained after exercise. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | I feel revitalized after exercising. |
| 14. | I would choose exercise over most other activities. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | I would choose most other activities over exercise. |
| 15. | After exercise, I feel discouraged. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | After exercise, I feel encouraged. |
| 16. | Exercise gives me a sense of failure. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise gives me a sense of accomplishment. |

| No. | Left statement | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Right statement |
|---|---|---|---|---|---|---|---|---|---|
| 17. | For me, exercise is a relaxing activity. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | For me, exercise is a stressful activity. |
| 18. | Exercise is very tiring. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is very invigorating. |
| 19. | Exercise gives me serenity. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise stresses me out. |
| 20. | Exercise makes me feel drowsy. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise makes me feel refreshed. |
| 21. | Exercise is something everyone ought to be doing but I am sorry to say that I do not. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is something everyone ought to be doing and I am happy to say that I am. |
| 22. | Exercise soothes me. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise makes me feel tense. |
| 23. | Exercise is interesting. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is uninteresting. |
| 24. | When others look at me when I exercise, it makes me feel great. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | When others look at me when I exercise, it makes me feel terrible. |
| 25. | Exercise is near the top on the list of things I like. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is near the bottom on the list of thigs I like. |
| 26. | I enjoy the thought that exercise builds up my body's defenses. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | The idea that exercise puts stress on my body scares me. |
| 27. | I love when others watch me as I exercise. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | I hate it when others watch me as I exercise. |
| 28. | Exercise deflates my ego. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise boosts my ego. |
| 29. | Exercise is low on my priority list. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise is high on my priority list. |
| 30. | The feeling I get from exercise is awful. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | The feeling I get from exercise is fantastic. |
| 31. | Exercise makes me feel peaceful. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise makes me feel aggravated. |
| 32. | Exercise worsens my mood. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise improves my mood. |
| 33. | I love exercising with others. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | I hate exercising with others. |
| 34. | Being a regular exerciser is so gratifying. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Being an on-and-off exerciser is so embarrassing. |
| 35. | Exercise feels terrible. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise feels wonderful. |
| 36. | Exercise makes me feel incompetent. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | Exercise makes me feel like I could do anything. |

**Appendix C**

*Intention to vigorous exercise questions.*



**1. Intention vigorous activity**
Vigorous exercise is characterised by high-intensity activities such as jogging, swimming, or HIIT workouts.

| | Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| How likely is it that you will engage in vigorous exercise 1-2 times per week over the next month? | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Do you have confidence in your ability to engage in sport activities 1-2 times a wee | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| How motivated are you to incorporate vigorous exercise in your daily routine? | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| How determined are you to engage in vigorous exercise, despite obstacles you may face? | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

29% completed

Next

Geeke Bekhuis, Anne Marie van den Berg, Gizella van Beveren, Antonia Freiberg, Luuk Hessels, Grzegorz Kacmarek, Twan Zandstra, University of Twente, NL – 2024

**Appendix D**

*The Ten-Item Personality Inventory (TIPI)*

Ten-item measure of the Big Five   1

Ten-Item Personality Inventory-(TIPI)

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.

| Disagree strongly | Disagree moderately | Disagree a little | Neither agree nor disagree | Agree a little | Agree moderately | Agree strongly |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

I see myself as:

1. _____ Extraverted, enthusiastic.

2. _____ Critical, quarrelsome.

3. _____ Dependable, self-disciplined.

4. _____ Anxious, easily upset.

5. _____ Open to new experiences, complex.

6. _____ Reserved, quiet.

7. _____ Sympathetic, warm.

8. _____ Disorganized, careless.

9. _____ Calm, emotionally stable.

10. _____ Conventional, uncreative.

_____

TIPI scale scoring ("R" denotes reverse-scored items):

Extraversion: 1, 6R; Agreeableness: 2R, 7; Conscientiousness; 3, 8R; Emotional Stability: 4R, 9;

Openness to Experiences: 5, 10R.

**Appendix E**

*R-script used for data preparation*

library(fmsb)

library(gridExtra)

library(tidyverse)

library(broom)

library(janitor)

library(psych)

library(readr)

library(dplyr)

library(readxl)

library(car)

library(moments)

library(MASS)

library(mgcv)

library(broom.mixed)

library(estimatr)

library(jtools)

library(ppcor)


### Importing the Dataset from Sosci ###

data <- read_excel("data_AFFEXX24_2024-05-01_16-38.xlsx")

datauntouched <- read_excel("data_AFFEXX24_2024-05-01_16-38.xlsx")

datademo <- read_excel("data_AFFEXX24_2024-05-01_16-38.xlsx")


### Making the dataset numeric ###

data$D201_01 <- as.numeric(data$D201_01)

data$D201_02 <- as.numeric(data$D201_02)

data$D201_03 <- as.numeric(data$D201_03)

data$D201_04 <- as.numeric(data$D201_04)

```r
data$D202_01 <- as.numeric(data$D202_01)

data$D202_02 <- as.numeric(data$D202_02)

data$D202_03 <- as.numeric(data$D202_03)

data$D202_04 <- as.numeric(data$D202_04)

data$E102_01 <- as.numeric(data$E102_01)

data$E102_02 <- as.numeric(data$E102_02)

data$E102_03 <- as.numeric(data$E102_03)

data$E102_04 <- as.numeric(data$E102_04)

data$E102_05 <- as.numeric(data$E102_05)

data$E102_06 <- as.numeric(data$E102_06)

data$E102_07 <- as.numeric(data$E102_07)

data$E102_08 <- as.numeric(data$E102_08)

data$E102_09 <- as.numeric(data$E102_09)

data$E102_10 <- as.numeric(data$E102_10)

data$E102_11 <- as.numeric(data$E102_11)

data$E102_12 <- as.numeric(data$E102_12)

data$E102_13 <- as.numeric(data$E102_13)

data$E102_14 <- as.numeric(data$E102_14)

data$E102_15 <- as.numeric(data$E102_15)

data$E102_16 <- as.numeric(data$E102_16)

data$E102_17 <- as.numeric(data$E102_17)

data$E102_18 <- as.numeric(data$E102_18)

data$E102_19 <- as.numeric(data$E102_19)

data$E102_20 <- as.numeric(data$E102_20)

data$E102_21 <- as.numeric(data$E102_21)

data$E102_22 <- as.numeric(data$E102_22)

data$E102_23 <- as.numeric(data$E102_23)

data$E102_24 <- as.numeric(data$E102_24)

data$E102_25 <- as.numeric(data$E102_25)

data$E102_26 <- as.numeric(data$E102_26)

data$E102_27 <- as.numeric(data$E102_27)
```

```
data$E102_28 <- as.numeric(data$E102_28)

data$E102_29 <- as.numeric(data$E102_29)

data$E102_30 <- as.numeric(data$E102_30)

data$E102_31 <- as.numeric(data$E102_31)

data$E102_32 <- as.numeric(data$E102_32)

data$E102_33 <- as.numeric(data$E102_33)

data$E102_34 <- as.numeric(data$E102_34)

data$E102_35 <- as.numeric(data$E102_35)

data$E102_36 <- as.numeric(data$E102_36)

data$F901_01 <- as.numeric(data$F901_01)

data$F901_06 <- as.numeric(data$F901_06)



### Cleaning the Dataset ###
# Removing unneccessary columns #
data <- data[, -c(1:8, 10)]

data <- data[-c(1), ]
# Checking for missing values #
data <- data[-c(28, 73, 87, 124, 128), ]


# Deleting columns that are not of interest anymore #
data <- data[, -c(1:8)]
# IAT #
data <- data[, -c(203:340)]
# Excercise demographics #
data <- data[, -c(1:7)]
# IPAQ-SF #
data <- data[, -c(1:11)]
# Other questionnaires #
data <- data[, -c(45:174)]
```

```
# Item 2,3,4,5,7,8,9,10 of TIPI #

data <- data[, -c(51:54)]

data <- data[, -c(46:49)]


# Combining variables into one #

# Intention #

data$vigorous_activity <- rowMeans(data[, c("D202_01", "D202_02", "D202_03", "D202_04")])

# Testing Cronbach Alpha #

cronbach_alpha <- alpha(data[c("D202_01", "D202_02", "D202_03", "D202_04")])

print(cronbach_alpha)

# Extraversion #

# Recoding item 6 (EV) #

data$F901_06 <- 8 - data$F901_06

data$extraversion <- (data$F901_01 + data$F901_06) / 2

# AFFEXX #

data$E102_01 <- 8 - data$E102_01

data$E102_02 <- 8 - data$E102_02

data$E102_05 <- 8 - data$E102_05

data$E102_07 <- 8 - data$E102_07

data$E102_09 <- 8 - data$E102_09

data$E102_10 <- 8 - data$E102_10

data$E102_14 <- 8 - data$E102_14

data$E102_17 <- 8 - data$E102_17

data$E102_19 <- 8 - data$E102_19

data$E102_22 <- 8 - data$E102_22

data$E102_23 <- 8 - data$E102_23

data$E102_24 <- 8 - data$E102_24

data$E102_25 <- 8 - data$E102_25

data$E102_26 <- 8 - data$E102_26

data$E102_27 <- 8 - data$E102_27
```

```
data$E102_31 <- 8 - data$E102_31

data$E102_33 <- 8 - data$E102_33

data$E102_34 <- 8 - data$E102_34

data$interest <- (data$E102_01 + data$E102_23 + data$E102_04) / 3

data$showingoff <- (data$E102_24 + data$E102_27 + data$E102_08) / 3

data$empowerment <- (data$E102_05 + data$E102_07 + data$E102_26) / 3

data$pride <- (data$E102_01 + data$E102_34 + data$E102_21) / 3

data$competence <- (data$E102_15 + data$E102_16 + data$E102_28 + data$E102_36) / 4

data$groups <- (data$E102_09 + data$E102_10 + data$E102_33) / 3

data$pleasure <- (data$E102_11 + data$E102_30 + data$E102_32 + data$E102_35) / 4
```

**Appendix F**

*R-script used for the sample demographics*

### Sample demographics ###

### selecting variables that are needed ###

```
datademo <- datademo[-c(28, 73, 87, 124, 128), ]

datademo <- datademo[1:136, c(9:27)]

# numeric #

datademo$C101_01 <- as.numeric(datademo$C101_01)


# Age #

frequentie <- table(datademo$C101_01)

max_frequentie <- max(frequentie)

modus <- as.numeric(names(frequentie[frequentie == max_frequentie]))

range(datademo$C101_01)

print(modus)

mean(datademo$C101_01)

min(datademo$C101_01)

max(datademo$C101_01)

sd(datademo$C101_01)

t.test(datademo$C101_01)$conf.int

table(datademo$C101_01)

# Gender #

table(datademo$C105)

# Nationality #

table(datademo$C106)

table(datademo$C106_03)

# Occupation #

table(datademo$C110)

# Relationship status #

table(datademo$C111)
```

```r
# Living area #

table(datademo$C112)

# Preferred sport type #

table(datademo$C205_01)

table(datademo$C205_02)

table(datademo$C205_03)

table(datademo$C205_04)

table(datademo$C205_05)

# engagement in sport (days a week) (vigorous)#

datademo$D102_02[datademo$D102_02 == "5 days a week"] <- "5"

datademo$D102_02 <- as.numeric(datademo$D102_02)

mean(datademo$D102_02)

sd(datademo$D102_02)

max(datademo$D102_02)

median(datademo$D102_02)

# engagement in sport (minutes a day) (vigorous)#

datademo$D103_02[datademo$D103_02 == "(=60 minutes}"] <- "60"

datademo$D103_02[datademo$D103_02 == "60-120 minutes"] <- "90"

datademo$D103_02[datademo$D103_02 == "120-180"] <- "150"

datademo$D103_02[datademo$D103_02 == "P"] <- "0"

datademo$D103_02 <- as.numeric(datademo$D103_02)

mean(datademo$D103_02)

sd(datademo$D103_02)

max(datademo$D103_02)


print(datademo$D102_02)
```

**Appendix G**

*R-script for the descriptive statistics*

#### Descriptive statistics ###


# Selecting the variables #

variables <- data[, 54:63]

variables <- variables[, -c(3,4,5)]

variables$interest <- as.numeric(variables$interest)

variables$showingoff <- as.numeric(variables$showingoff)

variables$groups <- as.numeric(variables$groups)

variables$pleasure <- as.numeric(variables$pleasure)

variables$extraversion <- as.numeric(variables$extraversion)

variables$vigorous_activity <- as.numeric(variables$vigorous_activity)


# Mean #

mean(variables$interest)

mean(variables$showingoff)

mean(variables$groups)

mean(variables$pleasure)

mean(variables$extraversion)

mean(variables$vigorous_activity)


# SD #

sd(variables$interest)

sd(variables$showingoff)

sd(variables$groups)

sd(variables$pleasure)

sd(variables$extraversion)

sd(variables$vigorous_activity)


# alpha #

```
alpha(variables)


# range #
mode(variables$interest)

mode(variables$showingoff)

mode(variables$groups)

mode(variables$pleasure)

mode(variables$extraversion)

mode(variables$vigorous_activity)


# Skewness #
skewness(variables$interest)

skewness(variables$showingoff)

skewness(variables$groups)

skewness(variables$pleasure)

skewness(variables$extraversion)

skewness(variables$vigorous_activity)


# Kurtosis #
kurtosis(variables$interest)

kurtosis(variables$showingoff)

kurtosis(variables$groups)

kurtosis(variables$pleasure)

kurtosis(variables$extraversion)

kurtosis(variables$vigorous_activity)


# correlation #
correlation_matrix <- cor(variables)

correlation_pvalues <- function(correlation_matrix, n) {

 r <- correlation_matrix

 p <- 2 * pt(abs(r) * sqrt((n - 2) / (1 - r^2)), df = n - 2, lower.tail = FALSE)
```

```
 p
}
p_values <- correlation_pvalues(correlation_matrix, nrow(variables))
print(correlation_matrix)
print(p_values)
```

**Appendix H**

*R-script for the model assumption + inferential statistics*

### Making the models ###

```
model1 <- lm(vigorous_activity ~ interest + showingoff + groups, data = data)

summary(model1)

model2 <- lm(vigorous_exercise ~ showingoff * extraversion + interest * extraversion + groups *
extraversion, data = data)

print(model2)

model3 <- lm(pleasure ~ showingoff + interest + groups, data = data)

summary(model3)
```

### MODEL 1 ###

```
# Normality #

residuals <- residuals(model1)

print(residuals)

hist(residuals, main = "Histogram of Residuals", xlab = "Residuals", ylab = "Frequency")

curve(dnorm(x, mean=mean(residuals), sd=sd(residuals)),

    col="blue", lwd=2, add=TRUE)

hist_data <- hist(residuals, plot=FALSE)

y_max <- max(hist_data$density)

hist(residuals, freq=FALSE, main="Histogram of Residuals", col = "green")

curve(dnorm(x, mean=mean(residuals), sd=sd(residuals)),

    col="blue", lwd=2, add=TRUE, ylim=c(0, y_max))

shapiro.test(residuals)

# linearity #

plot(vigorous_activity ~ interest, data = data)
```

```
abline(lm(data$vigorous_activity ~ data$interest))

plot(vigorous_activity ~ showingoff, data = data)

abline(lm(data$vigorous_activity ~ data$showingoff))

plot(vigorous_activity ~ groups, data = data)

abline(lm(data$vigorous_activity ~ data$groups))

ggplot(data, aes(x = vigorous_activity)) +

  geom_point(aes(y = interest, color = "Interest")) +

  geom_smooth(aes(y = interest), method = "lm", se = FALSE, color = "blue") +

  geom_point(aes(y = showingoff, color = "Showing Off")) +

  geom_smooth(aes(y = showingoff), method = "lm", se = FALSE, color = "red") +

  geom_point(aes(y = groups, color = "Groups")) +

  geom_smooth(aes(y = groups), method = "lm", se = FALSE, color = "green") +

  labs(title = "Relationship between IVs and Vigorous Activity",

      x = "Vigorous Activity",

      y = "IVs",

      color = "IVs") +

  scale_color_manual(values = c("blue", "red", "green"),

            labels = c("Interest", "Showing Off", "Groups")) +

  theme_minimal()

# homoscedasiticity #

rq1 <- data %>% select(vigorous_activity, interest, showingoff, groups)

rq1 <- rq1[, -c(5:6)]

skew <- sapply(rq1, skewness)

print(skew)

# transforming the data #

rq1$log_interest <- sqrt(data$interest)
```

```r
rq1$log_vigorous_activity <- sqrt(data$vigorous_activity)

model5 <- lm(log_vigorous_activity ~ log_interest + showingoff + groups, data = rq1)

# Making a new plot #

plot(model5$fitted.values, model$residuals, xlab = "Fitted values", ylab = "Residuals")

# Multicollinearity #

cor(model1)


### MODEL 3 ###

# Normality

residuals3 <- residuals(model3)

hist(residuals3, main = "Histogram of Residuals", xlab = "Residuals", ylab = "Frequency")

curve(dnorm(x, mean=mean(residuals3), sd=sd(residuals)),

    col="blue", lwd=2, add=TRUE)

hist_data <- hist(residuals3, plot=FALSE)

y_max <- max(hist_data$density)

hist(residuals3, freq=FALSE, main="Histogram of Residuals", col = "green")

curve(dnorm(x, mean=mean(residuals3), sd=sd(residuals3)),

    col="blue", lwd=3, add=TRUE, ylim=c(0, y_max))

shapiro.test(residuals3)

# linearity #

plot(pleasure ~ showingoff + interest + groups, data = data)

abline(lm(data$vigorous_activity ~ data$interest))

plot(vigorous_activity ~ showingoff, data = data)

abline(lm(data$vigorous_activity ~ data$showingoff))

plot(vigorous_activity ~ groups, data = data)

abline(lm(data$vigorous_activity ~ data$groups))
```

```
# homoscedasiticity #

plot(model3$fitted.values, model3$residuals, xlab = "Fitted values", ylab = "Residuals")



### MODEL 2 ###

# Normality

residuals2 <- residuals(model2)

hist(residuals2, main = "Histogram of Residuals", xlab = "Residuals", ylab = "Frequency")

curve(dnorm(x, mean=mean(residuals2), sd=sd(residuals)),

    col="blue", lwd=2, add=TRUE)

hist_data <- hist(residuals2, plot=FALSE)

y_max <- max(hist_data$density)

hist(residuals2, freq=FALSE, main="Histogram of Residuals", col = "green")

curve(dnorm(x, mean=mean(residuals2), sd=sd(residuals2)),

    col="blue", lwd=2, add=TRUE, ylim=c(0, y_max))

shapiro.test(residuals2)

# homoscedacity #

plot(model2$fitted.values, model2$residuals, xlab = "Fitted values", ylab = "Residuals")

# linearity #

plot(pleasure ~ showingoff * extraversion + interest * extraversion + groups * extraversion, data =
data)



### RESULTS RQ1###

summary(model1)
```

### RESULTS RQ2 ###

# Fit the Robust Linear Regression model with multiple antecedents

```
nonparametric_model <- lm_robust(vigorous_activity ~ showingoff + interest + groups + extraversion +

                    showingoff:extraversion + interest:extraversion + groups:extraversion,

            data = data)
```

# Summary of the model

```
summary(nonparametric_model)
```

### RESULTS RQ3 ###

```
data %>%

  dplyr::select(pleasure, showingoff, interest, groups) %>%

  pcor(method = "kendall")
```