The Relation Between Being Permanently Online, Permanently Connected and Mental Health While Considering the Fear of Missing Out, Personality and Age

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APA 7th Edition
Word count: 9060
Date: 02.07.2023

Abstract

Introduction. With a rising trend of today's society to be Permanently Online and Permanently Connected (POPC) its effects on mental health should be considered. As previous research was mostly focused on social media or internet addiction, this study is exploring POPC. The Fear of Missing Out (FoMO) and personality were both previously identified to be precursors of POPC and mental health, therefore their influence on the relationship between POPC and mental health is investigated. Furthermore, the Big Five personality traits' influence, on POPC and age differences between young adults and middle-aged adults regarding POPC are explored. **Methods.** A total of 167 participants (124 female, 42 male, and one non-binary) were examined in the cross-sectional study in the form of an online survey. The age ranged from 18 to 64 (M = 29.87, SD = 13.08). The scales included the Online Vigilance Scale, the Mental Health Continuum -Short Form, the Fear of Missing Out Scale, and the Big Five Inventory-10. **Results.** Results indicated that POPC is significantly negatively correlated with mental health with an effect size of -.27. Yet, the moderation analysis of FoMO and personality on this relationship was not significant. In addition, it was found that the personality traits of Conscientiousness and Agreeableness were significantly negatively correlated with POPC (-.34; -.24), while Neuroticism was significantly positively related to POPC with .23. Additionally, a significant difference in POPC between the age group of young adults (18 to 30) including 117 participants and middle-aged adults (31 to 65) including 50 participants was distinguished, with young adults being higher POPC on average. **Conclusion.** Overall, this research added valuable contributions to existing research, by further clarifying the relationship between POPC and mental health, while also taking FoMO and personality into account. Finally, the differences between age groups regarding POPC could further be distinguished.

Keywords: Permanently Online - Permanently Connected, Fear of Missing Out, Mental Health, Personality, Young Adults, Middle-aged Adults

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Introduction

With a gradual increase in implementing internet usage into everyday life, some people struggle to choose a life without it. Smartphones and computers are integrated as an inherent part of our daily activities. With that change over the last few years, it has shown to be hard to choose a life without it. Especially during the pandemic, the use of digital- and social media increased globally (Perez, 2020, as cited in Gabbiadini et al., 2020). In 2021 the average digital media usage of adults between 16 and 64 worldwide comprises of six hours and 54 minutes daily in comparison to the average of six hours and 20 minutes in 2015 (Kemp, 2021). While global social media usage increased from one hour and 51 minutes to two hours and 25 minutes. People had to rely on online communication to feel connected to others (Gabbiadini et al., 2020). In addition, many workplaces switched to working remotely (Battisti et al., 2022). Therefore, being online in some situations was the only way to stay connected with other people and continue working.

Permanently Online and Permanently Connected

This gradual increase in online presence can be related to people being *permanently online* and *permanently connected* (POPC) (Vorderer et al., 2016). *Permanently online* (PO) hereby describes the online presence like scrolling through the phone or laptop, but also watching movies or reading articles online. On the other hand, *permanently connected* (PC) includes online communication with people and interacting with others, for example, on social media or communication apps like WhatsApp or Instagram. POPC can hereby happen simultaneously with other everyday activities like taking a walk or meeting friends, but also thinking about being online during the engagement in other activities is included in the expression POPC (Vorderer et al., 2016).

POPC can also be described as online vigilance, referring to how much we attend to being online. A differentiation can be made between three different dimensions (Reinecke et al., 2018). Firstly, including salience, describing thoughts attending to being connected online and online presence. The second aspect is reactability including responding to messages when being busy with something else. Thirdly, monitoring describes observing what is happening online via for example the smartphone while engaging in offline activities. A differentiation is made between three psychological dimensions within a person that influence their behaviour regarding online vigilance: cognition, attention, and motivation. Meaning a person's cognitive effort of staying connected, attention given to digital media and motivation to prioritise the digital world over offline experiences (Reinecke et al., 2018).

The Impact of POPC on Mental Health

Being POPC can have different effects on a person's well-being. On the one hand, it has been found that being POPC increases a person's stress level (Freytag et al., 2020). Being permanently online can also lead to addictive behaviour patterns of using the internet, which is associated with many negative health outcomes such as depression, anxiety, low self-esteem, and generally lower mental health (Aderinto, 2022; Lebni et al., 2020). In addition, being online on social media platforms can impact the ability to find one's own identity. People generally tend to compare themselves with others, which can become a problem regarding social media, where many pictures do not portray reality and people mostly show their positive sides (Samra et al., 2022). The same study found that young adults are mostly affected, as they might perceive what they see as normal and try to live up to these standards or are negatively impacted regarding their mental health when they realise, they cannot.

However, being online on for example social media and communicating with people online can also have a positive impact on a person. Social media helps people express themselves and provides a medium to receive social support which contributes to an improvement of general mental health (Vaingankar et al., 2022). Moreover, receiving positive feedback on social media, such as likes and comments can boost a person's self-confidence and releases dopamine (Bromberg-Martin et al., 2010). The problem is that the release of dopamine can become addicting quickly, which makes people want an increased amount of online attention (Macit et al., 2018). The effects this has on the brain can be compared to taking drugs (Macit et al., 2018). Therefore, even though being online has some positive effects, overall, the negative effects predominate, meaning digital media usage is generally negatively connected to mental health.

Impact of FoMO on POPC and Mental Health

Another factor negatively impacting mental health is the Fear of Missing Out (FoMO), referring to the concern to be left out (Gupta & Sharma, 2021). In this study it was found that FoMO goes along with the desire to have and maintain social connections, wanting to be part of a group and feeling accepted by peers. The problem this poses can be an avoidance of in-person-contacts, social comparison, and a need for online validation. As a result of not wanting to feel excluded, Zhou (2018) and Reinecke et al. (2018) have found a positive relationship between FoMO and POPC. Therefore, people with a high FoMO often turn to digital media and specifically social media as an attempt to find social connections and diminish the feeling of being lonely (Zhou, 2018). Through these behaviours, pressure can rise to maintain the positive feedback that is received online, which ultimately leads to worse

mental health and creates a predisposition for mental illnesses such as depression and anxiety (Gupta & Sharma, 2021; Liu et al., 2023). Therefore, higher levels of FoMO can be connected to decreased mental health but can also relate to a rise in POPC.

Impact of Personality on Mental Health and POPC

While higher levels of experiencing FoMO can be linked to POPC behaviour and mental health, the expression of different personality traits can also be connected with POPC and mental health. Specifically, a meta-synthesis conducted by Strickhouser et al. (2017), found that in the 22 studies they compared the average correlation of the personality traits Agreeableness and Conscientiousness were positively correlated with mental health, while Neuroticism was negatively correlated with mental health. Extraversion and Openness also showed a positive correlation with mental health but did not have a big effect size.

Regarding the connection between personality and digital media behaviour, it was found that a person scoring high on Extraversion and Openness is more likely to use social media to a greater amount (Lampropoulos et al., 2022). A study on internet addiction on the other hand found the traits of Conscientiousness and Agreeableness to have a negative correlation with internet addiction and Neuroticism to have a positive correlation to internet addiction (Lachmann et al., 2019), which was also replicated and confirmed with a study by Peterka-Bonetta et al. (2019). A meta-analytic review about internet addiction conducted by Kayiş et al. (2016) confirmed these findings, but in addition to Conscientiousness and Agreeableness also found the personality traits of Extraversion and Openness to be negatively associated with internet addiction, while Neuroticism showed a positive relation to internet addiction.

While personality traits are associated with mental health as well as digital media behaviour, they also influence how people mentally process the information they come across online. Especially Neuroticism can be linked to problematic internet use and decreasing mental health when engaging in online activity. Meaning, people high on Neuroticism react more extremely to conflicts with other people and stress (Thomsen, 2006; Suls & Martin, 2005; Widiger, 2017, as cited in Marciano et al., 2020). At the same time, they are more critical towards themselves and care more about what others think about them (Watson et al., 1994, as cited in Marciano et al., 2020). Another finding was the positive relationship between Extraversion and social media use in general, but specifically regarding the male population it was detected that emotionally unstable men would use social media more often (Correa et al., 2010, as cited in Lampropoulos et al., 2022).

Impact of Age on POPC

In addition to personality traits, age can also be a predictor of how much people are online. It is suggested that young adults between the ages of 18 and 29 have a different relationship with technology and online behaviour in comparison to adults older than 30 (Raggiotto et al., 2023). That difference is explained by the fact that people under 29 grew up with technology, while the age group older than 30 had to adapt to technology (Raggiotto et al., 2023). Also, engagement in social media platforms varies for different age groups. A study conducted in the US has shown that the age group between 25 and 29 were most likely to engage in the social media platforms YouTube and Facebook, while the age group between 18 and 24 was most likely to use Instagram, Snapchat and Twitter (Ortiz-Ospina, 2019). In conclusion, the age groups most using online platforms seem to have had the technology available when they grew up. Therefore, adolescence and young adults seem more prone to online behaviour than older age groups.

Current Research

As most literature is either related to social media behaviour or internet addiction limited research has been conducted regarding POPC in specific. Therefore, some gaps in previous research can be identified which should be addressed. With different findings regarding the relationship between POPC and mental the negative direction of the relation should be confirmed. In addition, FoMO and personality should be tested for their influence on the relationship between POPC and mental health, as they have been separately connected to both in previous research. In addition, in previous research limited research was focused on how personality affects POPC specifically. Regarding the relationship between age and POPC not much research has been conducted in comparing the different age groups of young adults and middle-aged adults, but instead mostly focussed on adolescent social media usage and online behaviour in general.

The research question is therefore: *"To what extent does POPC influence the mental health of adults in the Netherlands and Germany, is that relationship moderated by FoMO and personality and are personality and age related to POPC?"* The hypotheses are *1. POPC is negatively related to mental health. 2. FoMO moderates the relationship between POPC and mental health 3. The Big Five personality traits moderate the relationship between POPC and mental health. 4. The Big Five personality traits are related to POPC behaviour 5. POPC behaviour differs between young adults and middle-aged adults.*

Methods

Participants

The participants for the study were gathered using convenience- and snowball sampling. For students at the University of Twente, the non-probability sampling method of volunteer sampling was used. The inclusion criteria for participation were being aged between 18-65, being a resident of either Germany or the Netherlands, understanding English sufficiently to fill in the questionnaire and using digital media at least once a week. The desired sample size was 185 to have sufficient statistical power which was determined with the statistical analysis G*power, designed, and extended by Faul et al. (2007).

The exclusion criteria for participating in the study were being aged >65 or <18, living outside of Germany or the Netherlands, and not having English language skills. Furthermore, people that did not use digital media at least once a week were not included in the sample.

Materials

The study was implemented using the online software Qualtrics which allowed the participants to complete the study from their own devices like a laptop or phone. For students at the University of Twente, 0.25 SONA credits were granted for participation. To take part in the survey a link and a QR code of the online survey were created to direct to the questionnaire. In addition, digital advertisement posters were created to promote the survey and draw attention to the research which can be found in Appendix A. The posters included the inclusion criteria, a short description of the content and the link or the QR code to access the survey.

The survey included an informed consent form at the beginning and the end of the study, which can be found in Appendix B and C. In addition, different already established scientific questionnaires were included, of which the ones that were used in this research can be found in Appendix D. Participants were also asked some demographic questions and general questions about their digital and social media habits. In total eight scientific questionnaires were incorporated, regarding the topics of online vigilance (OVS), overall mental health (MHC-SF), Fear of Missing Out (FoMO Scale), sleep quality (PSQI), stress (PSS), loneliness (UCLA loneliness scale), personality (BFI-10), and generalised anxiety disorder (GAD-7). As three other researchers collaborated on the study only the following four questionnaires will be relevant for this research paper to answer the research question.

Online Vigilance Scale Measuring POPC (OVS)

The online vigilance scale was developed by Reinecke et al. (2018) and is used to investigate the participants' behaviour of being POPC. It includes four items within each of

the three subscales, namely salience (SA), monitoring (MO) and reactability (RE), thus 12 items in total, which can be found in Appendix D. It consists of a five-point Likert-scale scored between 1 and 5, ranging from "does not apply at all" to "fully applies". The score outcome ranges from 12 to 60 with a higher score indicating higher online vigilance. A study conducted by Reinecke et al. (2018) could also detect high convergent, discriminant validity, and internal consistency of the scales (SA: α = .91; RE: α = .83; MO: α = .91) regarding all subscales.

Mental Health Continuum Short Form (MHC-SF)

The MHC-SF is the short version of the original Mental Health Continuum, which has been reduced from 40 to 14 items. The MHC-SF consists of three dimensions which assess emotional well-being (three items), psychological well-being (six items), and social well-being (five items) (see Appendix D). They can be answered on a six-point Likert scale ranging from "never" to "every day", scored from 0 to 5. The outcomes range between 0 and 70 with higher scores indicating better mental health. The scale has been shown to have high internal consistency (α > .80) as well as discriminant validity (Lamers et al., 2010).

Fear of Missing Out Scale (FoMO Scale)

The Fear of Missing Out Scale was developed by Przybylski et al. (2013) and contains ten items measuring a person's fear of not being part of social events on one scale (Appendix D). The responses are recorded on a five-point Likert scale ranging from "not at all true" to "extremely true", scored from 1 to 5. The outcome scores range between 10 and 50 with higher scores representing higher levels of FoMO. Przybylski et al. (2013), confirmed that the scale has high internal consistency (α = .82), as well as good construct validity. Through an additional measure they conducted, also convergent validity was proven to be high (r = .40).

Big Five Inventory (BFI-10)

The BFI-10 was developed by Rammstedt and John (2007), as the short form of the 44-item long BFI. It measures the Big Five personality dimensions of Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism in a total of 10 items. Each personality trait is assessed with two items, one represents the true-scored item of the trait, and one represents a reverse-scored item of the trait (Appendix D). The answer scale ranges from "Disagree strongly" to "Agree strongly" scored from 1 to 5. After scoring the reverse-scored items the right way a higher score on a personality trait indicates a higher expression of that trait covering scores between 2 and 10. The discriminant validity of the items has shown to be good, while the internal consistency is different per personality trait. While Extraversion (.89), Neuroticism (.86) and Conscientiousness (.82) have high internal

consistency, Agreeableness (.74) and Openness (.79) show moderate internal consistency (Rammstedt & John, 2006).

Procedure

Ethical approval was obtained through the Ethics Committee of the University of Twente (code: 230333, Appendix E). The gathering of participants took place between the 9th of April and the 27th of April 2023. The researchers distributed the survey to their acquaintances as well as via social media including Instagram, WhatsApp, and LinkedIn with advertisements. After agreeing to be a participant in the research some demographic questions were asked, including age, nationality, relationship status and education level. Also, general questions about digital media habits were included, asking which platforms were used most often and the number of hours spent on digital and social media.

In the next section of the study, participants were presented with the eight scientific questionnaires mentioned earlier, which compose the main part of the study. After filling out these the debriefing took place which thanked the participant for taking part and informed them about possibilities to get help in case of distress. It also presented the Email addresses of the researchers in case of any questions. After that, the participants are asked to give consent another time and have the possibility to withdraw from the research. In addition, participants got the possibility to fill in their Email addresses after concluding, to receive the study results after the data is analysed.

Study Design

A cross-sectional study design was chosen for this study. To explain how the data was analysed after the data collection had been concluded the variables had to be defined beforehand. As the aim was to determine the effect POPC has on Mental Health, POPC is the independent variable, while Mental Health is the dependent variable. To find out whether FoMO and personality have an influence on that relationship they were tested as moderator variables. Finally, the effect POPC has on Mental Health was compared between the two age groups of young adults and middle-aged adults.

Data Analysis

For data analysis, the statistical software R Studio was used with the version 2022.02.3+492 (R Core Team, 2022). Firstly, the data was cleaned, and the five reverse-scored items of the BFI-10 were scored correctly for data analysis. Thereafter, the participant's demographics were investigated, and the hypotheses were tested. As parametric tests require the assumptions of linearity, independence, normality, homogeneity, and multicollinearity to be met, they were tested beforehand. Therefore, the data was visualised with Scatterplots. Then, the Breusch-Pagan test was conducted to test for heteroscedasticity.

Furthermore, bar charts and the Shapiro-Wilk normality test were computed to find out about the distribution of the data for which no additional R packages were necessary. To test multicollinearity VIF (variance inflation factor) values were created, whereas a significant result indicates multicollinearity to be present. As in regarding each hypothesis testing at least one assumption was violated, non-parametric tests were chosen for the analysis.

Consecutively, the first hypothesis was tested by calculating a Spearman's rank correlation to find out about the strength of the relationship between POPC and Mental Health. Subsequently, the relationship was tested with the moderators FoMO and personality included by performing the Permutation method and observing whether the strength of the relationship changed and therefore tested the second and third hypotheses. To find out which personality characteristics of the Big Five are correlating with POPC, they were all separately tested with POPC using Spearman's rank correlation. Finally, to analyse the different age groups of young adults and middle-aged adults regarding their POPC behaviour, a Mann-Whitney U test/ Wilcoxon rank sum test was implemented to compare the means of the two groups.

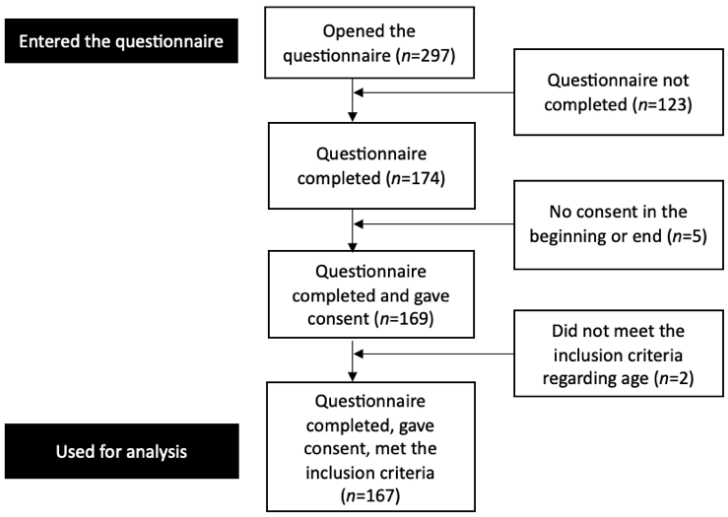
Results

Demographics

In total 297 people took part in the study, of which 167 were detected after cleaning the dataset, which can be retraced in Figure 1. At first, 123 people had to be removed as they did not fill in the whole questionnaire. After that people that did not consent in the beginning, or at the end of the study were removed (n = 5). Finally, people who did not meet the inclusion criteria regarding the age range were excluded (n = 2). The age range of participants that remained was between 18 and 64 *(*M = 29.87*,* SD = 13.09*)*. With 117 of them belonging to the age group of young adults between 18 and 30 *(*M = 22.09, SD = 2.57*)* and 50 belonging to the age group of middle-aged adults between 31 and 65 *(*M = 48.06, SD = 9.09*)*. 124 of the total participants identified as female, 42 as male and one as non-binary or third gender. Regarding their heritage, 47 participants indicated to be Dutch, 112 to be German, six to be from another European country and two to not come from Europe. The three most common levels of highest obtained education were secondary or high school, which 76 participants indicated, 33 people indicated to have obtained a graduate degree and 22 participants have obtained a degree at a University of Applied Sciences.

Figure 1

Flowchart of Participant Removal



Digital Media Usage

To find out how much time the participants spend using digital media a day they were asked to indicate the range of hours they identify with. Most of the participants indicated spending an average of three to six hours on digital media (n = 60) a day which can be seen in Table 1. To have a better overview of which age groups used how much digital media the age groups of young adults from 18 to 30 were compared to middle-aged adults between the ages of 31 and 65 regarding their digital media usage. The age groups were hereby divided according to Ericson's stages of psychosocial development (Ericson, 1958, as cited in Mcleod, 2023). In this theory, it is mentioned that in early adulthood people are more focused on their relationship with others, while in the middle age, the focus lies on contributing to society and family. In this study, most young adults spend between three to six hours or six to nine hours on digital media (n = 42) each, while most middle-aged adults indicated using it between zero to three hours (n = 20).

Table 1

Digital Media Usage in Hours per Age Group

Hours of use	All adults (18- 65)	Young adults (18-30)	Middle-aged adults (31- 65)
0-3 hour	33	13	20
3- 6 hours	60	42	18
6- 9 hours	50	42	8
9- 12 hours	20	17	3
12- 15 hours	3	3	-
More than 15 hours	1	-	1

Social Media Usage

Also, for the hours of social media engagement, participants were asked to indicate their personal usage time. The majority (n = 92) indicated using social media for about one to three hours a day, which can be seen in Table 2. To get a better overview the age groups of younger adults and middle-aged adults were compared (Table 2). It was found that most young adults use social media between one to three hours (n = 72), while most middle-aged adults use it between zero and one hour (n = 26). In addition, participants were asked about which social media platforms they use most frequently. The most used social media platform was WhatsApp, used by 148 participants, followed by Instagram, used by 100 participants and thirdly YouTube, used by 90 participants.

Table 2

Social Media Usage in Hours per Age Group

Hours of use	All adults (18- 65)	Young adults (18- 35)	Middle-aged adults (36- 65)
0- 1 hour	34	8	26
1- 3 hours	92	72	20
3- 5 hours	28	24	4
5- 7 hours	11	11	-
More than 7 hours	2	2	-

Statistical Analysis

Overview of all Scales

To get an overview of how participants scored on the different scales that were used during the survey an overview of participants' scores on all variables is presented in Table 3. The difference in scoring of younger and middle-aged adults is also shown in Table 3. The variables that were important for this paper were POPC, which was measured with the online vigilance scale; Mental health, measured with the MHC–SF; Fear of Missing Out, measured with the FoMO scale and the Big Five personality characteristics, measured with the BFI-10.

Table 3

Mean and Standard Deviation of Participants on the Online Vigilance Scale, MHC-SF, FoMO Scale and BFI-10.

Scale	All participants			Younger adults			Older adults		
	M	*SD*	*Median*	*M*	*SD*	*Median*	*M*	*SD*	*Median*
OVS	28.65	9.09	28	30.77	8.70	30	23.68	8.06	22.5
MHC-SF	37.71	11.06	40	35.79	10.91	37	42.2	10.18	45.5
FoMO scale	23.46	8.36	22	25.91	8.04	27	17.72	6.01	17
O (BFI-10)	7.08	1.74	7	7.15	1.83	7	6.92	1.51	7
C (BFI-10)	7.09	1.88	7	6.74	1.90	7	7.92	1.55	8
E (BFI-10)	6.45	2.07	6	6.38	2.08	6	6.62	2.06	6
A (BFI-10)	7.33	1.63	7	7.43	1.57	8	7.10	1.75	7
N (BFI-10)	5.97	2.28	6	6.18	2.28	6	5.48	2.23	6

Note. The Online Vigilance Scale measures POPC behaviour ranging from 12 to 60, the MHC-SF measures Mental well-being from 0 to 70, the FoMO Scale measures Fear of Missing Out from 10 to 50 and the BFI-10 measures the Big Five personality traits Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism ranging from 2 to 10 (Abbreviated with O for Openness, C for Conscientiousness, E for Extraversion, A for Agreeableness and N for Neuroticism).

When interpreting the scores on all questionnaires the reliability of the scales should also be taken into consideration for the current sample. It was computed with Cronbach's Alpha, which resulted in the following reliabilities, as interpreted by George and Mallery (2003): excellent reliability for the OVS and MHC-SF, good reliability of the FoMO Scale, questionable reliability of the subscales for Extraversion and Neuroticism and unacceptable reliability for the subscales for Openness, Conscientiousness and Agreeableness (Table 4).

Table 4

Reliability of all Scales Computed With Cronbach's Alpha

	OVS	MHC-SF	FoMO Scale	O (BFI-10)	C (BFI-10)	E (BFI-10)	A (BFI-10)	N (BFI-10)
Reliability	.91	.91	.89	.08	.31	.67	.23	.66

*Note. "*O" stands for Openness; "C" stands for Conscientiousness; "E" stands for Extraversion; "A" stands for Agreeableness; "N" stands for Neuroticism.

Hypothesis Testing

POPC and Mental Health

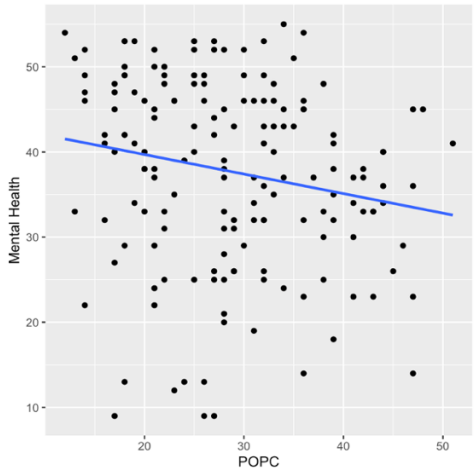
Before applying a linear regression analysis to test the first hypothesis whether POPC is negatively related to mental health the four assumptions of linearity, independence, homoscedasticity, and normality need to be tested. To check the linearity of the data a scatterplot of the residuals versus the predicted values of the model between POPC and mental health was created. In the visualisation in Appendix F, the fitted line is at y= 0 and the data points are randomly scattered around the line with no clear pattern visible, indicating that the linearity assumption is met. To check for independence, the residuals of the model were plotted against the predicted values and visualised in a scatterplot to check for patterns in the residuals. No clear pattern of the residuals was shown; therefore, it could be concluded that the assumption of independence was met. For the assumption of homoscedasticity, the Breusch-Pagan test was conducted. As the p-value turned out to be > .05 (p = .122), it could be concluded that the assumption was met, as there is no evidence to reject the null hypothesis of no violation.

The models' residuals were finally visualised in a histogram to check the assumption of normality which can be seen in Appendix F. The distribution was not normal, but skewed to the left, meaning that the assumption of normality was not met. In conclusion, the assumptions of linearity, independence and homoscedasticity were met, while the assumption

of normality was violated, therefore the linear mixed model cannot be used and a non-parametric alternative need to be applied. Spearman's rank correlation test was conducted to find out whether POPC is related to mental health. The results indicated there is a negative correlation between the two variables (r (165) = -.23, p = .002). The results were visualised in Figure 2. The results are interpreted as significant, as the p-value is lower than .05, meaning that the hypothesis that POPC is negatively related to mental health is accepted.

Figure 2

The Correlation of POPC and Mental Health.



Note. POPC, measured with the online vigilance scale is on the x-axis with scores between 12 and 60, while mental health, measured with the MHC-SF is on the y-axis with scores ranging from 0 to 70.

POPC, Mental Health and FoMO

To test the second hypothesis of FoMO moderating the relationship between POPC and mental health the assumption of multicollinearity was tested in addition to the four assumptions for a regression analysis that were mentioned in the previous section. Multicollinearity was assessed with the VIF (variance inflation factor), which had a value of 1.68 and a condition number of 1.29, which are both low, indicating no multicollinearity. As the normality assumption, mentioned in the previous section was not met a non-parametric alternative had to be applied to test the hypothesis.

The Permutation test is an alternative method that does not rely on the assumption of normality in assessing the significance level of the moderation effect. Therefore, it was chosen as an appropriate method for testing the Null hypothesis that FoMO is not significantly moderating the relationship between POPC and mental health. The results of the Permutation test with 9999 generated permutations resulted in an interaction effect between

online vigilance and FoMO on mental health of .01. During the permutation test this coefficient is then compared to the null distribution of test statistics that was generated from the permuted samples. This comparison resulted in $p = .73$, meaning no significant moderation was detected and the hypothesis that FoMO moderates the relationship between POPC, and mental health is rejected.

POPC, Mental Health and the Big Five Personality Traits

For the testing of the third hypothesis whether the Big Five personality traits moderate the relationship between POPC and mental health the assumptions of a linear regression model were tested, which can be found in Appendix F. In addition, multicollinearity was tested, and the condition number of the model was checked with the conclusion that there is no strong evidence for multicollinearity. As the assumption of normality was violated a Permutation test was used to assess whether a moderation effect of the Big Five personality traits is present.

The Permutation test was conducted with 9999 permutations and resulted in different interaction values of POPC with each personality trait on mental health (Openness = 35.32, Conscientiousness = 29.05, Extraversion = 30.18, Agreeableness = 31.34, Neuroticism = 23.76). To assess the significance these coefficients were compared to the null distribution of the test statistics that was obtained through the permuted samples. The significance level of all interactions was $p = .46$, meaning that no significant effect was found. Therefore, the hypothesis that the Big Five personality traits act as moderators in the relationship between POPC and mental health can be rejected.

The Big Five Personality Traits and POPC

To assess the fourth hypothesis that the Big Five personality traits are related to POPC behaviour the four assumptions for a linear regression analysis were tested for each personality trait with POPC separately. The visualisations that were created for the hypothesis testing can be found in Appendix G. The assumptions of linearity and independence were met for all five personality traits, which can be seen in the scatterplots in Appendix G. The assumption of homoscedasticity was tested with the Breusch- Pagan test and was met for Openness, Conscientiousness, Extraversion and Neuroticism, but not for Agreeableness (Table 5). Normality was tested by creating histograms of the models' residuals, which can be found in Appendix G. In addition, a Shapiro-Wilk normality test was conducted. The only personality trait that showed a normal distribution regarding its residuals was Conscientiousness, which was also confirmed by the Shapiro-Wilk test ($W(166) = .99$, $p = .17$) which can be found in Table 5. This means that the relation between Conscientiousness

and POPC can be measured with a linear regression analysis as all assumptions were met. Regarding all other personality traits, the non-parametric alternative Spearman's rank correlation test was chosen for the analysis.

Table 5

Results of Assumption Testing Regarding Homoscedasticity and Normality of the Big Five Personality Traits.

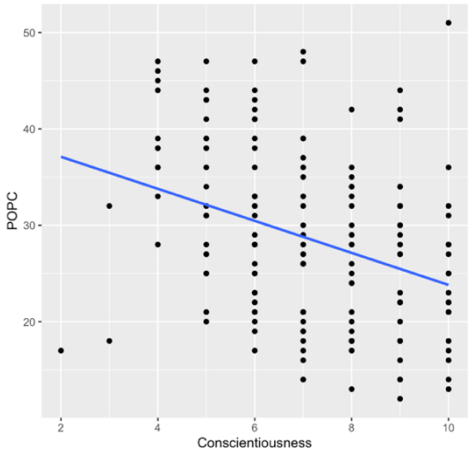
Personality Trait	Homoscedasticity (Breusch-Pagan test)	Normality (Shapiro- Wilk normality test
Openness	1.56 (p = .21)	.97 (p = .007)
Conscientiousness	.38 (p = .54)	.99 (p = .17)
Extraversion	.43 (p = .51)	.97 (p = .003)
Agreeableness	3.93 (p = .047)	.98 (p = .01)
Neuroticism	.12 (p = .74)	.97 (p = .003)

Note. A significant p-value on the Breusch-Pagan test stands for the presence of heteroscedasticity. A significant p-value on the Shapiro- Wilk normality test means the sample is not normally distributed.

To assess the relation between Openness and POPC Spearman's rank correlation was computed r (165) = -.11, p = .17. This means that no significant correlation between Openness and POPC could be distinguished. The association between Conscientiousness and POPC was computed with a linear regression model. The linear regression model was significant (F (1,165) = 21.96, p < .001), with an R^2 of .12. The effect size of the model was β = -1.66, *SE*= .35, p < .001. In addition, Pearson's correlation coefficient was computed, resulting in a significant negative correlation of Conscientiousness and POPC with a size of -.34, p < .001, which is visualised in Figure 3.

Figure 3

The Correlation of Conscientiousness and POPC.



The Spearman's rank correlation rho of Extraversion and POPC was r (165) = -.08, *p* = .32, meaning that no significant relation was found. Agreeableness, on the other hand, showed a significant negative correlation to POPC r (165) = -.24 (*p* = .002), which is visualised in Figure 4. Also, Neuroticism has a significant relation with POPC, but contrary to Conscientiousness and Agreeableness it has a positive correlation with POPC r (165) = .23 (*p* = .003) and can be seen in Figure 5. To sum up, Conscientiousness and Agreeableness showed a negative correlation to POPC, Neuroticism had a positive correlation with POPC, while Openness and Extraversion did not show a significant correlation. Therefore, the hypothesis that all five personality traits are related to POPC can be rejected.

Figure 4

The Correlation of Agreeableness and POPC.

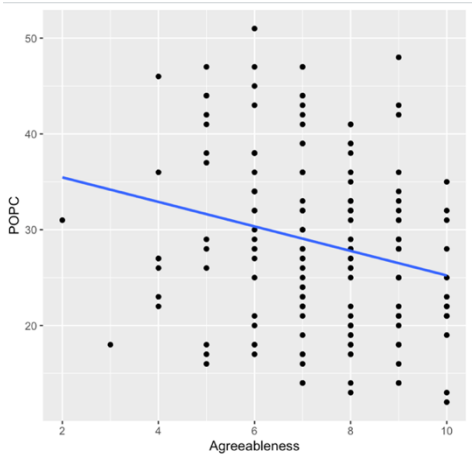
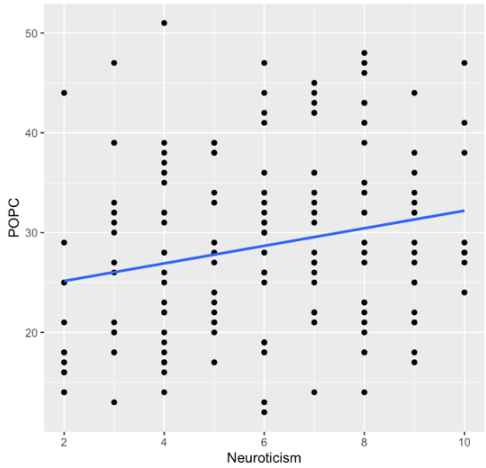


Figure 5

The Correlation of Neuroticism and POPC.



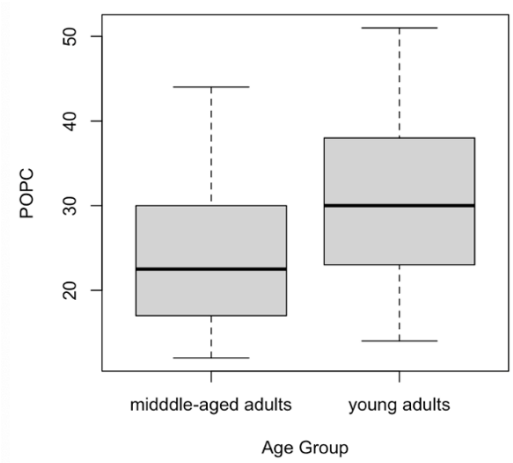
Age Difference in POPC

For assessing the fifth hypothesis whether POPC behaviour differs among young adults and middle-aged adults, the three assumptions for conducting an independent samples t-test were tested, which are independence, homoscedasticity, and normality. Independence was tested by creating a visualisation, which can be found in Appendix H and indicated no violation. Homoscedasticity was tested with Levene's Test for Homogeneity of Variance, which did not have a significant result, $p = .54$, meaning that the assumption is not violated. Lastly, normality was tested with the Shapiro-Wilk normality test and by visualising the distributions of the residuals, which can be found in Appendix H. POPC, the group of young adults and the group of middle-aged adults all did not show a normal distribution (W = .97, $p = .003$; W = .93, $p = < .001$; W = .95, $p = .04$)

As not all assumptions were met, the non-parametric Mann- Whitney- U test was used to test the hypothesis. The results of the test showed that a significant difference between the POPC behaviour of young adults in comparison to the POPC behaviour of middle-aged adults can be concluded; W = 4357.5, p = < .001, which is visualised in Figure 6. It can be summarised that young adults are on average higher on POPC ($M = 30.77$, $SD = 8.70$, Mdn = 30) than middle-aged adults ($M = 23.68$, $SD = 8.06$, Mdn = 22.5). In conclusion, the hypothesis that POPC behaviour differs among young adults and middle-aged adults can be confirmed.

Figure 6

Difference in POPC Behaviour Comparing Young Adults and Middle-aged *Adults.*



Discussion

The aim of this study was to explore the relationship between POPC and mental health, to find out whether FoMO and the Big Five personality traits influence that relationship and how personality traits and age are related to POPC behaviour. While the literature already provided much information about POPC, and addictive internet use being negatively related to mental health this study could confirm the negative relation between POPC and mental health. Though the study results indicated that FoMO and the Big Five personality traits do not influence this relation. Findings regarding the association between the Big Five personality traits and POPC indicated that a high level of Conscientiousness and Agreeableness are negatively related to POPC behaviour, high scores on Neuroticism are positively related to POPC, while levels of Extraversion and Openness did not have a significant effect on POPC. In addition, the age groups of young adults and middle-aged adults were found to exhibit different POPC behaviours. Results showed that young adults had on average higher scores on POPC in comparison to middle-aged adults.

These key findings can be partly explained by the literature, but some outcomes of the study were not foreseeable and need to be examined further. To have an overview of our samples' internet usage habits the participants were asked to indicate how many hours a day they spent using digital and social media. The majority of the sample indicated using digital media between three and six hours (n=60) and social media between one and three hours (n=92). This is in line with previously conducted research, as the average daily digital media consumption was five hours and 26 minutes for Germany and five hours and 28 minutes for

the Netherlands, while the social media consumption in Germany and the Netherlands showed an average of one hour and 24 minutes (Kemp, 2021).

The results of the relationship between POPC and mental health were also in line with previously conducted studies, which found online behaviour to provoke negative health outcomes such as anxiety and depression (Aderinto, 2022). Yet even though the negative relation between POPC and mental health was significant it turned out to be weak (-.23). The explanation for that might be that the literature not only mentions negative effects of POPC but also some positive outcomes of being POPC. The suggested positive influences online behaviour can elicit in some instances can be for example social support and self-expression (Vaingankar et al., 2022). These positive effects might therefore reduce the negative impact POPC has on mental health. Yet, the negative effects are dominating, as the negative relationship between POPC and mental health is grounded in previous research and found in the current study.

FoMO was previously found to be positively related to POPC (Reinecke et al., 2018). In addition, FoMO was found to decrease a person's mental health, while also being associated with some mental illnesses (Liu et al., 2023). Yet, in this study, it could not be identified as a moderator to the relationship between POPC and mental health. An explanation for that could be that FoMO is only related to POPC and mental health separately, but a high FoMO score does not result in different mental health outcomes for somebody being POPC.

A similar effect could be observed when checking for the moderation of the Big Five personality traits on the relationship between POPC and mental health, which could not be confirmed. Previous literature found high Neuroticism to decrease mental health to a higher degree when being more online, because of self-criticism and increased attention to what other people disapprove of them (Watson et al., 1994, as cited in Marciano et al., 2020). Though, in the current study none of the Big Five personality traits could be determined as moderators. That might have different reasons, like personality only influencing POPC behaviour and mental health but having no influence on the relationship between them.

Additional reasons why personality traits are not moderators to the relationship might be other contextual factors that have not been accounted for. Even though Personality did prove to be connected to POPC behaviour as well as mental health, individual differences regarding contextual factors should also be taken into account. An example could be unemployment which negatively impacts a person's mental health (Pelzer et al., 2014). In the study, scores on the personality traits of Neuroticism, Extraversion and Agreeableness did not show a significant difference in depressive symptoms between unemployed and employed

participants, while scores of Conscientiousness and Openness did yield significant results. Numerous social determinants influence the mental health of an adult, including income, discrimination, and familial relationships (Alegría et al., 2018). By taking as many determinants as possible into account when conducting research, the reasons for effects can be better understood.

When assessing the association between the Big Five personality traits and POPC behaviour, the main findings were that Conscientiousness and Agreeableness are negatively related to POPC, while Neuroticism is positively correlated with POPC. This is partly in line with previously conducted research. A study on internet addiction conducted by Lachmann et al. (2019), found the same personality traits of Conscientiousness and Agreeableness to be negatively related to internet addiction, while Neuroticism was positively related to the addiction (Peterka-Bonetta et al., 2019). Though other literature on social media usage found that Extraversion and Openness are positively related to engagement in social media, which did not show a significant effect on POPC in the current study (Lampropoulos et al., 2022).

The negative relation between Conscientiousness and POPC can also be related to how conscientious people behave online. When examining the respective behaviours, it was found that people scoring high on that personality trait tend to use digital media mainly for productive behaviour, like fulfilling obligations or work-related activities instead of engaging in social interactions (Roos & Kazemi, 2021). Though, most people use the internet to engage in social networking, which would therefore explain why highly conscientious people tend not to spend much time online but decide to fulfil their daily obligations instead.

When contemplating why Agreeableness is negatively related to POPC behaviour it can be considered which part of the personality of these people might play a role in that trend. Highly agreeable people tend to be more sociable, collaborative and want to fit in more in comparison to people scoring low on that trait (Marriott & Buchanan, 2013). Therefore, agreeable people might value being connected to their friends in an offline manner in addition to online.

Moreover, FoMO levels should be considered when interpreting these results. It has been confirmed that the personality trait of Neuroticism is positively related to FoMO, while all other personality traits were negatively related to FoMO (Rozgonjuk et al., 2021). This can be seen as one of the reasons why people, that score high on Neuroticism also have a higher score of POPC. In addition, high Neuroticism was linked to a preference for self-expression online, rather than offline (Marriott & Buchanan, 2013). This might be another possible demonstration of why Neuroticism showed a positive relation to POPC behaviour.

The finding that Extraversion and Openness do not show a significant relation to POPC behaviour is not in line with earlier conducted research, which indicated that Extraversion was positively linked to social media use, because of the need to connect to others and maintain social relationships (Bowden-Green et al., 2020). Additionally, a study by Roos and Kazemi (2021) showed that Extraversion and Openness were positively connected to overall internet use. This difference in findings might have occurred due to limitations in the study or external factors such as the post-pandemic execution of the study, which might have shifted this relation.

The difference in age groups regarding POPC behaviour showed significantly higher POPC behaviour of young adults in comparison to middle-aged adults. This result was expected with the background of the literature suggesting that young adults are more online in general in comparison to middle-aged adults (Raggiotto et al., 2023). Furthermore, the result about the hours participants spent on digital and social media daily also showed that young adults have higher average scores on digital as well as social media in comparison to middle-aged adults, which is therefore also in line with the results regarding POPC. Yet not much research has been conducted regarding differentiating POPC behaviour between young adults and middle-aged adults, which can therefore be considered for replications and further research into the subject.

Limitations

Regarding the results of this study, some limitations should also be considered when interpreting the found effects. Firstly, the desired sample size of 185, was unfortunately not reached in this survey, as only 167 participants could be used for the analysis. Therefore, the results obtained from this study are not representative of the observed population, which reduces the reliability of the results. In addition, participants that took part in the survey were not equally distributed regarding their gender and age group affiliation. More than 75% of the participants were female and more than 60% of the total participants were in the category of young adults. This distribution could lead to some misinterpretation of the data, as not enough male participants are represented, and the age group of middle-aged adults is underrepresented.

Furthermore, regarding the questionnaires, most of them showed high reliability, especially the online vigilance scale, MHC-SF and the FoMO scale. On the other hand, in the BFI-10 the personality traits of Openness, Conscientiousness and Agreeableness showed low reliability ($\alpha = .09$, $\alpha = .28$, $\alpha = .26$). Therefore, the results that are related to these three

personality traits are not reliable and could be different when the study is replicated with either the longer version of the BFI or another personality test.

Another problem might be that other participants have lost motivation to think about every question and answer accurately, as the questionnaire took around 20 minutes to complete. This is assumed, as 123 of the participants did not finish the questionnaire and therefore had to be removed before analysing the results. In addition, some memory biases might occur when participants are answering questions about their past behaviour. People's memories can be mood dependent, meaning that they are more likely to remember past behaviour reliably when they are in a similar mood as to the time the behaviour occurred (Lewis & Critchley, 2003). Therefore, it might happen that people do not remember past behaviour accurately through which they might not give accurate answers in the questionnaires, making the results less reliable.

Moreover, this study was conducted in the English language, while the target countries are Germany and the Netherlands. This can lead to a non-response bias, which excludes a certain sub-group of the studied population from participating, making the results less representative of the whole population (Berg, 2005). The current study excluded people that do not speak English sufficiently from participating in the study, leading to certain social groups being excluded, which might have changed the results. In addition, the countries of interest in this study are limited to Germany and the Netherlands which also means that two individualistic countries, that are close to each other are represented, while the input of collectivistic cultures is missing.

Strengths

The strengths of the study include the high reliability of the OVS, MHC-SF and FoMO Scale, which exhibited a Cronbach's alpha between .89 and .91, which can be found in Table 4. High reliability on these scales represents high internal consistency, meaning that similar scores on items measuring the same construct are obtained for most participants (Taber, 2017. Another strength of the study is the cost-effectiveness of the study. All questionnaires used were open-source and therefore free to use for researchers. In addition, the study was set up and monitored by the researchers themselves saving costs of external administrators.

Another strength of the study set-up was that the four researchers collaboratively designed the study including their variables of interest, allowing for numerous relations and constructs to be measured in the same study. This set-up was also beneficial for the distribution of the questionnaire, as each researcher and their supervisors shared the study

with their social network, reaching a broader audience than would have been reached if the study would have been conducted separately for each researcher.

Conducting the research after the pandemic can also be seen as a strength of the study. During the pandemic, an increase of digital and social media was reported globally (Perez, 2020, as cited in Gabbiadini et al., 2020). With an increase in online presence different effects of the online presence on peoples' relatedness can be observed, like a decrease in empathy (Konrath et al., 2011, as cited in Gabbiadini et al., 2020) and an increase of individualism (Wellman et al., 2013, as cited in Gabbiadini et al., 2020). With these personality changes the effects of the current study show new insights and can be compared to pre-pandemic studies.

Lastly, the open and transparent empirical approach that was chosen as a basis for this study makes the study more valuable from a scientific viewpoint. The whole empirical process being transparent includes, for example, the materials used, how data was collected and analysed, and which procedure was followed during data collection (Grant et al., 2022). Due to the openness regarding these aspects in this study replicability by other researchers to validate the findings is encouraged.

Recommendations for Future Research

For future research being conducted in this field, some recommendations can be made that would contribute to the research gap and provide more insights into the subject. It would be advised to gather a larger sample size that is more representative of the population of interest and equally divided regarding gender and age group distributions.

In addition, the study should be conducted in various countries, so that more nations are represented and comparisons in regard to their upbringing, lifestyles, morals and ultimately POPC behaviour and mental health can be drawn. A solution for this would be cross-national research, which is comparative research, focussed on the differences between countries (Wendt, 2019). In this research the findings are considered with the background knowledge of the specific country taking the specific context into account when interpreting results, to try and create a theoretical framework (Wendt, 2019). This approach would make the findings more generalisable and can account for contrasts among countries.

Another relation that needs further investigation is the connection of Conscientiousness to mental health. Roos and Kazemi (2021) found that people high on Conscientiousness use digital media mainly for productive purposes. Therefore, it should be investigated whether the weak negative relation between Conscientiousness and POPC was stronger before the pandemic, as a great extent of work was shifted to remote work, which gives people high on Conscientiousness the possibility to be productive while being online. A

possibility is that the strength of the relationship has changed through that, which future comparative research could focus on.

Another factor that could be explored in the future is whether the findings are different for men and women, as it has been found that women use the internet in different ways than men (Sun et al., 2020) While women mainly use the internet for social purposes and express more emotions online, the male population is in general more direct in communicating and are interested in different subjects than women (Sun et al., 2020) Therefore, finding out more about how women and men are affected by POPC behaviour and which personality traits are the reasons in case different behaviours in regard to POPC is found would be a topic for a follow-up research.

Furthermore, the reasons for young adults to be more POPC than middle-aged adults should be further explored. As upbringing might influence POPC behaviour and online devices have become more accessible in the last years, longitudinal research should be designed. With this study design the people in the age group of young adults will be in the age group of middle-aged adults when the study will be conducted again, which ensures the same access to media during their upbringing and more clarity on whether age is the reason for less POPC, or if other variables need to be considered.

Practical Implications

This study contributed to previously conducted research as it investigates the concept of POPC, a relatively new concept that can be measured with the online vigilance scale, developed by Reinecke et al. (2018). As it was only recently developed, most research that has been conducted in this field is about online behaviour in general, social media behaviour or internet addiction. This study confirmed a significant negative relation between POPC and mental health, which is an important factor to take into account, for example in the mental health care sector. By creating awareness of the negative relation, people and institutions can consider POPC behaviour when trying to improve mental health. As that is only one aspect, additional variables should be considered to further understand the relationship and ultimately understand what benefits mental health and what does not.

Understanding how an individual's personality influences their behaviour, for example, regarding POPC behaviour, is also an important finding of this study. Finding out that Agreeableness and Conscientiousness are negatively related to POPC, while Neuroticism is positively related to POPC can make people aware of their possible tendencies when exhibiting one of these personality traits and can help them understand and control their behaviour more efficiently. Furthermore, the outcome that younger adults are generally more

prone to POPC in comparison to middle-aged adults is also a crucial result, as these age groups have not previously been compared. This finding can be used in further studies about generation differences and can be a basis for exploring which factors are responsible for this different behaviour amongst various age groups.

Conclusion

In this study, a negative effect of POPC on mental health was confirmed. As FoMO was previously found to be related to POPC and have a negative effect on mental health it was tested for its moderating effect on the relation between POPC and mental health but did not have a significant effect. Also, the Big Five personality traits were tested as moderators to this relationship but did not have a significant moderating effect. As the Big Five personality traits have shown to have effects on social media and digital media habits in previous research their relation to POPC behaviour was tested. The traits Conscientiousness and Agreeableness showed a significant negative association with POPC, while Neuroticism was significantly positive related to POPC. Finally, this study could confirm that young adults show higher POPC behaviour in comparison to middle-aged adults. When considering the results, it should be taken into consideration that the sample size was not representative of the whole population of the Netherlands and Germany that met the inclusion criteria and the reliability of the BFI-10 regarding the subscales Openness, Conscientiousness and Agreeableness was low.

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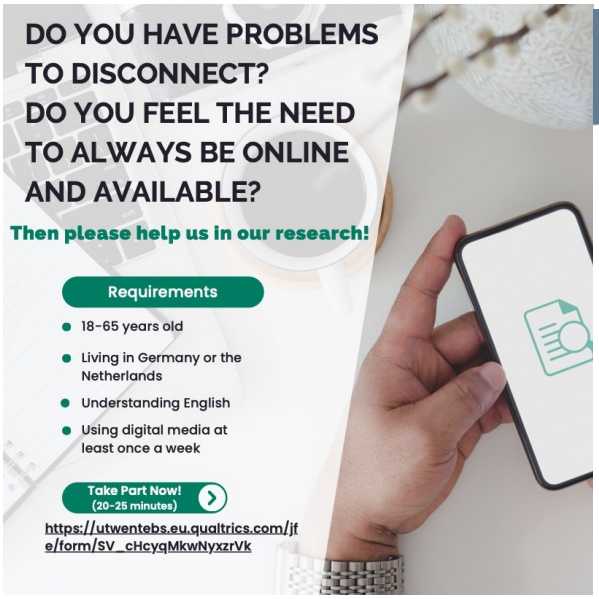
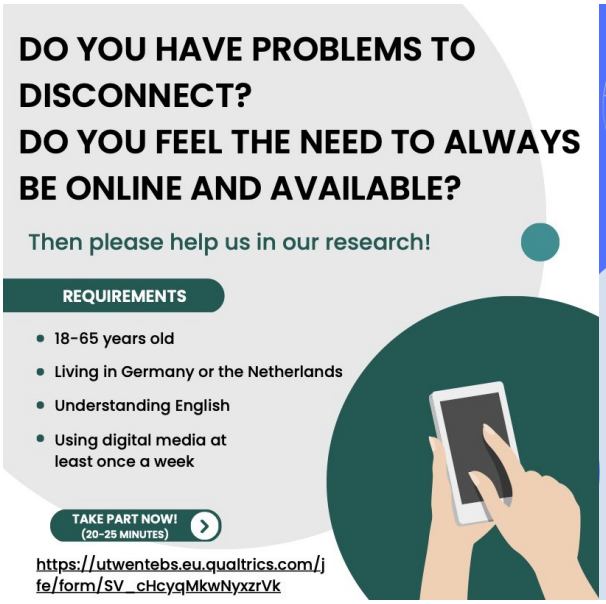
Appendix A

Advertisements





Appendix B

Informed Consent

Welcome!

Thank you for participating in our study about the topic "Permanently Online - Permanently Connected and the Fear of Missing Out and its Impact on Mental Health".
Nowadays, many people are constantly online and available for digital media use. Social media apps are an important part of many people's everyday life. But what are the effects of constantly being online and why do we feel the psychological need to be connected?

This phenomenon of being permanently online and permanently connected (POPC) has different underlying reasons, the most common one being the fear of missing out. In this study, we request your support to answer the following questionnaires, for example regarding online vigilance, which is a term for psychological connectedness that people feel towards digital media use. The main purpose of this study is to investigate the effects of online vigilance (OVS) on overall mental well-being (MHC-SF), sleep quality (PSQI), loneliness (UCLA Loneliness scale), stress (PSS), personality (BFI10) and generalised anxiety disorder (GAD-7). This will be done with this online questionnaire. During this questionnaire general questions will be asked regarding different related topics, like your social media habits, your frequency of use or similar.

The study should take you around 20-25 minutes to complete. In order to take part in this study, you should be between 18 and 65 years old and live either in Germany or the Netherlands. Additionally, being able to answer this questionnaire in English is required and you should use online media apps (e.g., WhatsApp, Facebook, Instagram, online news, etc.) at least once a week.

Your participation in this research is voluntary and you have the right to withdraw at any point during the survey. If you choose to withdraw, by not answering the complete questionnaire, your data will be removed. All information you provide will be anonymized and therefore cannot be traced back to you. At the end of the questionnaire, you will once again be asked if you consent to your data being used or get the possibility to withdraw from the questionnaire, which will result in all your data being deleted.

This study has been reviewed and approved by the BMS Ethics Committee from the University of Twente (Approval Number 230333).

In case of any remarks or questions please contact:

Celine Rosen
Lilli Baune
Ninja Lehmann
Michele Petkovski

Supervisor: Alejandro Dominguez Rodriguez

Informed consent

By clicking "Yes" below, I agree to the following:

- I have read the introduction of the study fully and I am aware of the purpose of this study.
- I understand that information I provide will be used for study purposes only and will be anonymized.
- I consent that my participation in this study is voluntary and I can withdraw from it at any time, without giving reasons.
- I understand that in order to take part in this study, I am between 18 and 65 years old and I live either in Germany or the Netherlands. Additionally, I use online media applications or communication applications (like Instagram, WhatsApp, Tik Tok, online news, etc.) in my daily life at least once a week.

- Yes, I agree to participate in the study.
- No, I do not agree (you will be directed to the end of the study).

Appendix C

Debriefing

You have reached the end of the survey, thank you for your participation!
If you felt any discomfort as a result of taking part in this survey after reviewing your social media habits, or one of the discussed factors, you can contact De Luisterlijn, which offers a free telephone counselling service, as well as an online chat function, in both English and Dutch (https://www.deluisterlijn.nl/).
For German speaking participants it is also possible to contact the "TelefonSeelsorge", both online (https://online.telefonseelsorge.de/), or via phone
Students of the University of Twente can also contact the student psychologist at the University of Twente (xxx).

In case of questions or remarks please contact:
Celine Rosen
Lilli Baune
Ninja Lehmann
Michele Petkovski

Supervisor: Alejandro Dominguez Rodriguez

All information leading back to you will be anonymized. All data entered will only be available for members of the research team and will be stored for two years. After you finish this questionnaire, your data will be analysed and it is not possible to withdraw from the study.

By clicking yes, you consent again and allow us to analyze your anonymized data.

Research outcomes will be reported in an academic thesis, and also may be used for journal articles and/or scientific congress presentations. However, all data and information will remain anonymous!

Are you interested in a summary of the results? Feel free to leave your email address!
(Contact details will be stored separately for anonymization.

Appendix D

Questionnaires in This Study

Online Vigilance Scale

The following questions are about how you personally handle online content. Here you will find statements that describe various forms of dealing with the Internet. When we say “online” or “the Internet”, we don’t refer to the Internet as a whole, but the content that you make use of on a regular basis (e.g., your WhatsApp or Snapchat contacts, your favorite websites, online communities, or social media). Please indicate how the following statements apply to you personally.

	1. Does not apply at all	2.	3.	4.	5. Fully applies
My thoughts often drift to online content.	○	○	○	○	○
I have a hard time disengaging mentally from online content.	○	○	○	○	○
Even when I am in a conversation with other people, I often think about what is happening online.	○	○	○	○	○
Often online content occupies my thoughts, even as I am dealing with other things.	○	○	○	○	○
I constantly monitor what is happening online.	○	○	○	○	○
I often feel the urge to make sure I know what is happening online.	○	○	○	○	○
I often start certain online applications so I don´t miss out on any news.	○	○	○	○	○
I always keep an eye on what is happening online at the moment.	○	○	○	○	○

The following questions pertain to your personal reactions when you receive online messages (e.g., on your smartphone, laptop, or PC). When we say "online message" we refer to messages you receive on WhatsApp, Snapchat, Facebook, Twitter, or via E-Mails, as well as to push messages you receive from different applications (e.g., news apps, fitness apps, games, and learning apps). Please indicate how the following statements apply to you personally.

When I receive an online message...

	1. Does not apply at all	2.	3.	4.	5. Fully applies
My thoughts drift there immediately.	○	○	○	○	○
It triggers an impulse in me to check it right away.	○	○	○	○	○
I immediately attend to it, even if I am engaged in other things at that moment.	○	○	○	○	○
I immediately give it my full attention.	○	○	○	○	○

FoMO Scale

In the following, a collection of statements about your everyday experiences is presented. Using the scale provided, please indicate how true each statement is of your general experiences.

Please answer according to what really reflects your experiences, rather than what you think your experiences should be. Please treat each item separately from every other item.

	Not at all true	Slightly true	Moderately true	Very true of me	Extremely true
I fear others have more rewarding experiences than me.	○	○	○	○	○
I fear my friends have more rewarding experiences than me.	○	○	○	○	○
I get worried when I find out my friends are having fun without me.	○	○	○	○	○
I get anxious when I don´t know what my friends are up to.	○	○	○	○	○
It is important that I understand my friends "in jokes".	○	○	○	○	○
Sometimes, I wonder if I spend too much time keeping up with what is going on.	○	○	○	○	○
It bothers me when I miss an opportunity to meet up with friends.	○	○	○	○	○
When I have a good time, it is important for me to share the details online (e.g., updating status).	○	○	○	○	○
When I miss out on a planned get-together it bothers me.	○	○	○	○	○
When I go on vacation, I continue to keep tabs on what my friends are doing.	○	○	○	○	○

MHC-SF

During the past month, how often did you feel...

	Never	Once or twice	About once a week	or 3 times a week	Almost every day	Everyday
Happy	○	○	○	○	○	○
Interested in life	○	○	○	○	○	○
Satisfied with life	○	○	○	○	○	○
That you had something important to contribute to society	○	○	○	○	○	○
That you belonged to a community (like a social group, or your neighborhood)	○	○	○	○	○	○
That our society is a good place, for all people	○	○	○	○	○	○
That people are basically good	○	○	○	○	○	○
That the way our society works makes sense to you	○	○	○	○	○	○
That you like most parts of your personality	○	○	○	○	○	○
Good at managing the responsibility of your daily life	○	○	○	○	○	○
That you had warm and trusting relationship with others	○	○	○	○	○	○
That you had experiences that challenge you to grow and become a better person	○	○	○	○	○	○
Confident to think or express your own ideas and opinions	○	○	○	○	○	○
That your life has a sense of direction or meaning to it	○	○	○	○	○	○

BFI-10

I see myself as someone who...

	Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
Is reserved	○	○	○	○	○
Is generally trusting	○	○	○	○	○
Tends to be lazy	○	○	○	○	○
Is relaxed, handles stress well	○	○	○	○	○
Has few artistic interests	○	○	○	○	○
Is outgoing, sociable	○	○	○	○	○
Tends to find fault with others	○	○	○	○	○
Does a thorough job	○	○	○	○	○
Gets nervous easily	○	○	○	○	○
Has an active imagination	○	○	○	○	○

Appendix E

Ethical Approval

UNIVERSITY OF TWENTE.

APPROVED BMS EC RESEARCH PROJECT REQUEST

Dear researcher,

This is a notification from the BMS Ethics Committee concerning the web application form for the ethical review of research projects.

Requestnr. :	230333
Title :	Permanently Online -Permanently Connected and Fear of Missing Out and the Influence on Mental Health
Date of application :	2023-03-17
Researcher :	Lehmann, N.L.
Supervisor :	Dominguez Rodriguez, A.
Commission :	Klooster, P.M. ten
Usage of SONA :	Y

Your research has been approved by the Ethics Committee.

The BMS ethical committee / Domain Humanities & Social Sciences has assessed the ethical aspects of your research project. On the basis of the information you provided, the committee does not have any ethical concerns regarding this research project.

It is your responsibility to ensure that the research is carried out in line with the information provided in the application you submitted for ethical review. If you make changes to the proposal that affect the approach to research on humans, you must resubmit the changed project or grant agreement to the ethical committee with these changes highlighted.

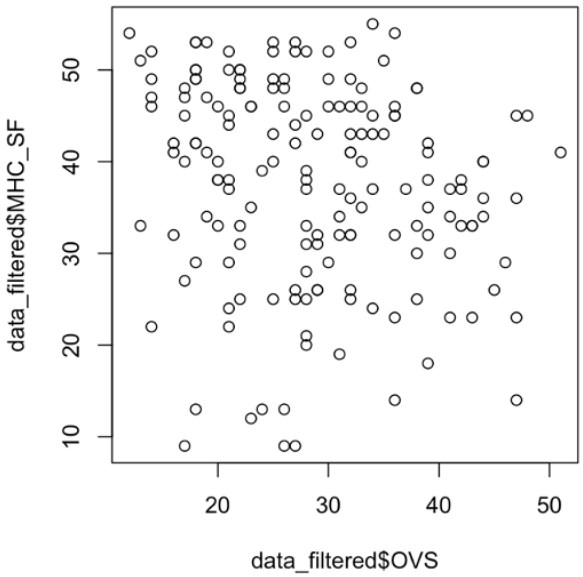
Moreover, novel ethical issues may emerge while carrying out your research. It is important that you re-consider and discuss the ethical aspects and implications of your research regularly, and that you proceed as a responsible scientist.

Finally, your research is subject to regulations such as the EU General Data Protection Regulation (GDPR), the Code of Conduct for the use of personal data in Scientific Research by VSNU (the Association of Universities in the Netherlands), further codes of conduct that are applicable in your field, and the obligation to report a security incident (data breach or otherwise) at the UT.

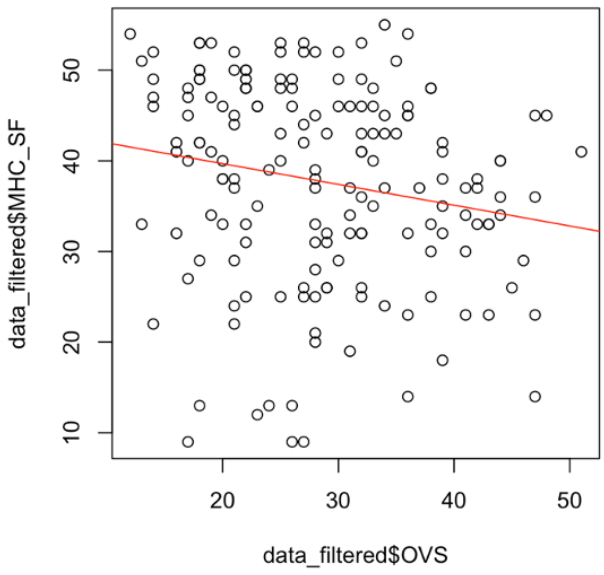
Appendix F

Assumption Testing Hypotheses One, Two and Three

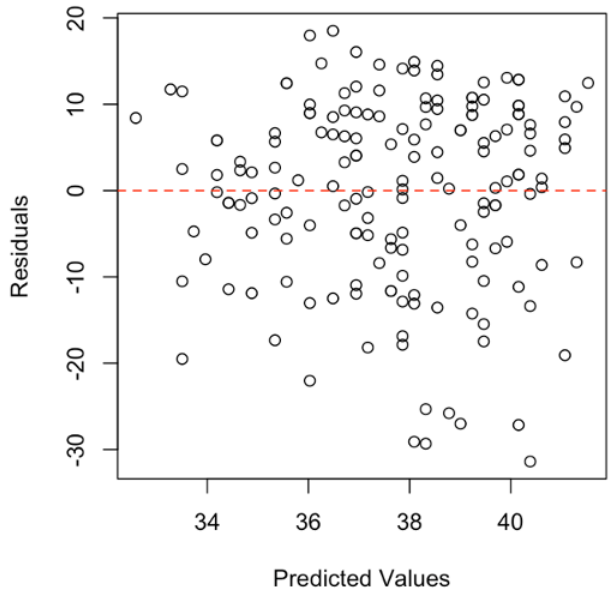
Scatterplot of POPC and Mental Health



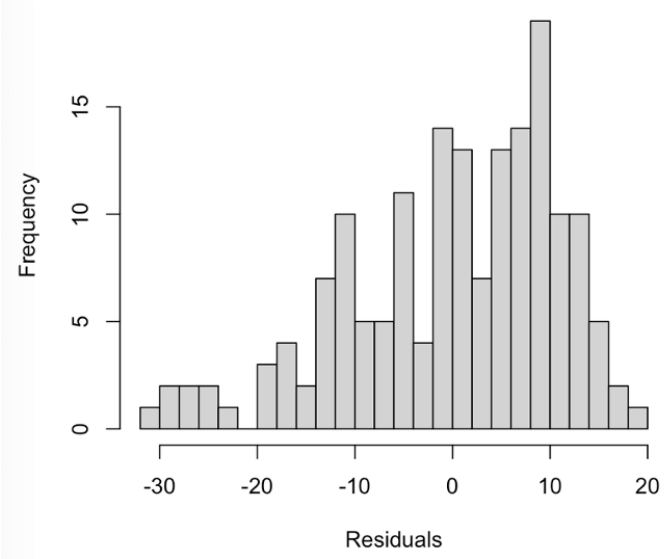
Scatterplot of POPC and Mental Health With Fitted Line



Residual Plot



Histogram of Residuals



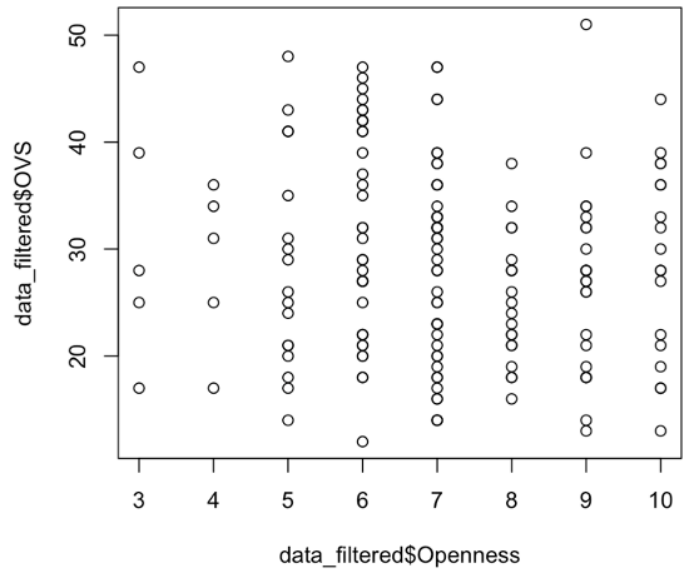
VIF Values

	Online vigilance	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
VIF value	1.24	1.04	1.16	1.13	1.10	1.15

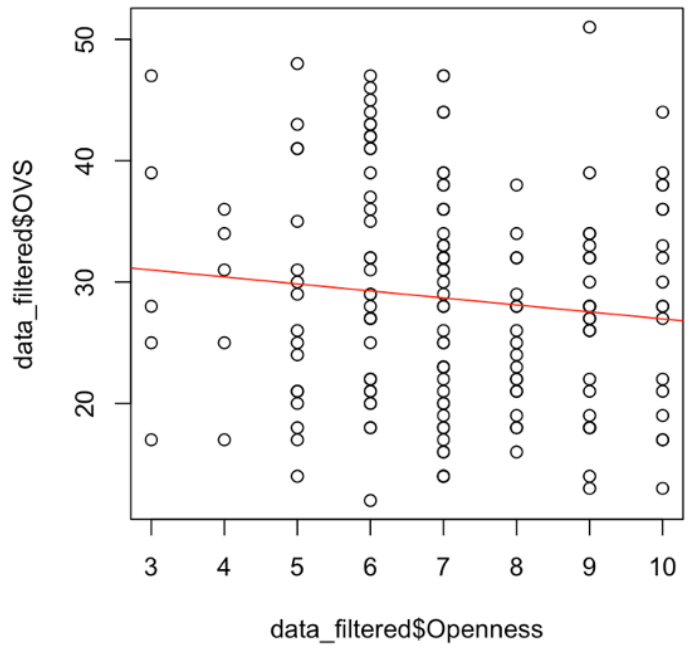
Appendix G

Assumption Testing Hypothesis Four

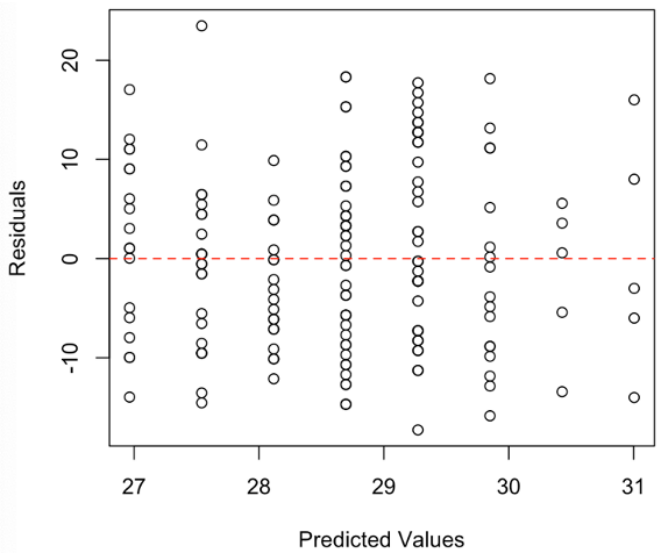
Scatterplot of Openness and POPC



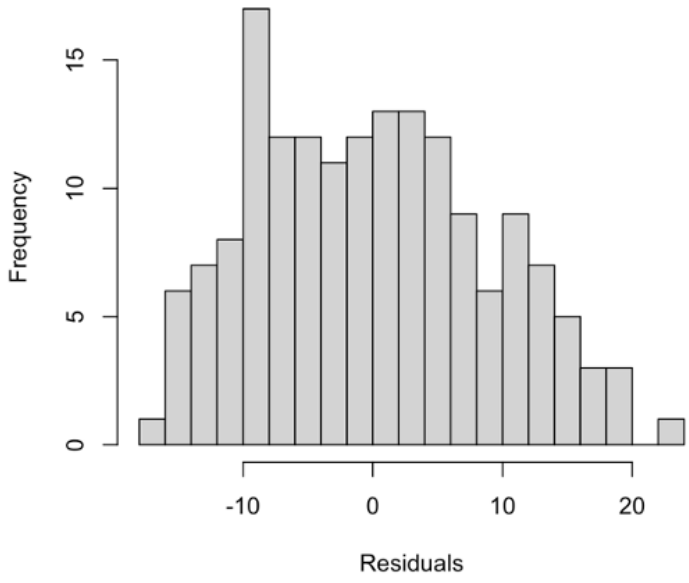
Scatterplot of Openness and POPC With Fitted Line



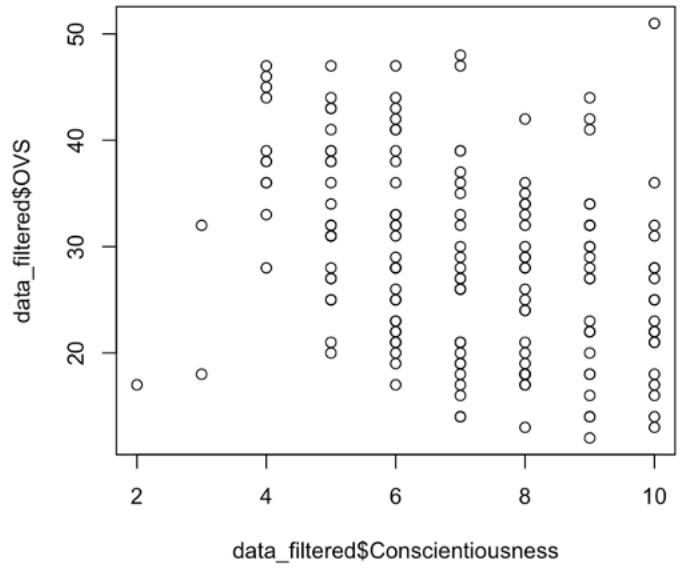
Residual Plot



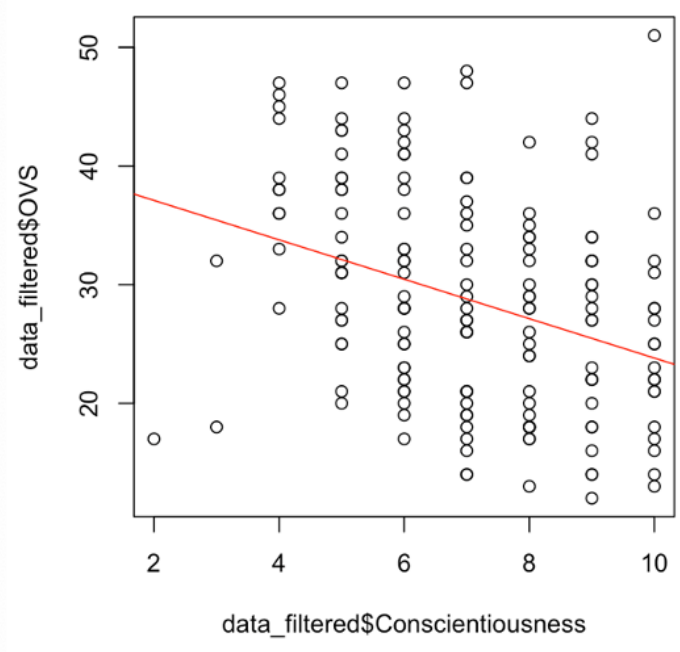
Histogram of Residuals



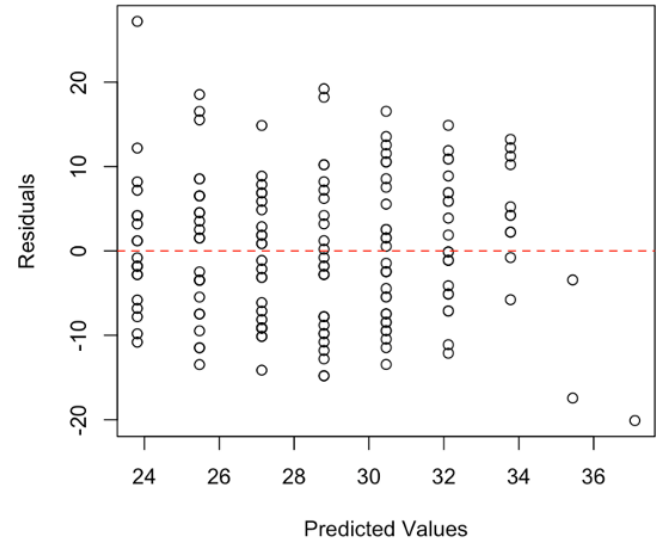
Scatterplot of Conscientiousness and POPC



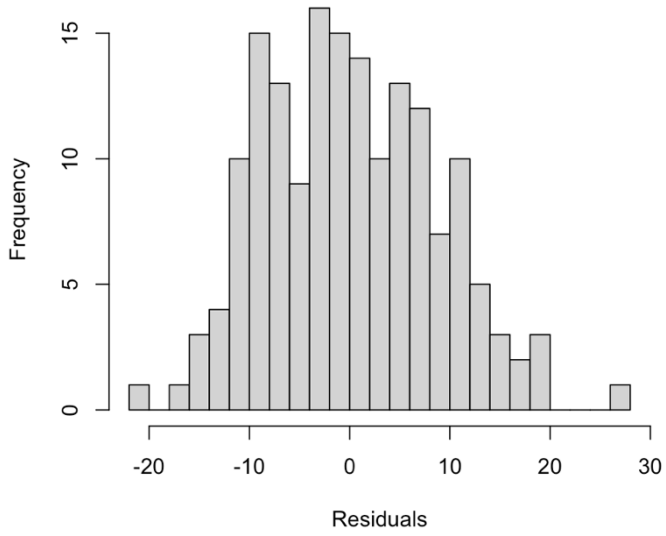
Scatterplot of Conscientiousness and POPC With Fitted Line



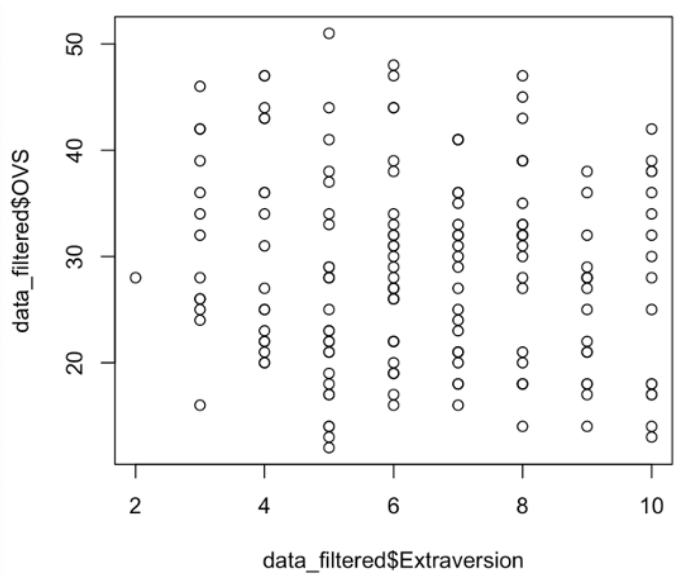
Residual Plot



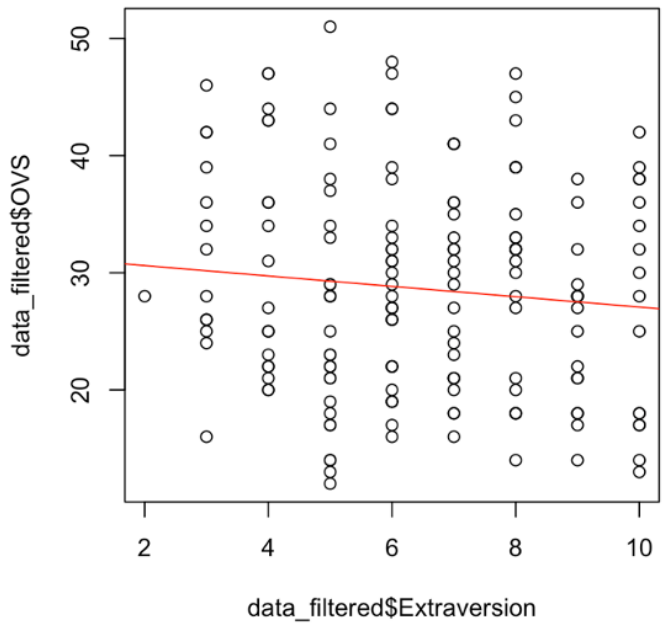
Histogram of Residuals



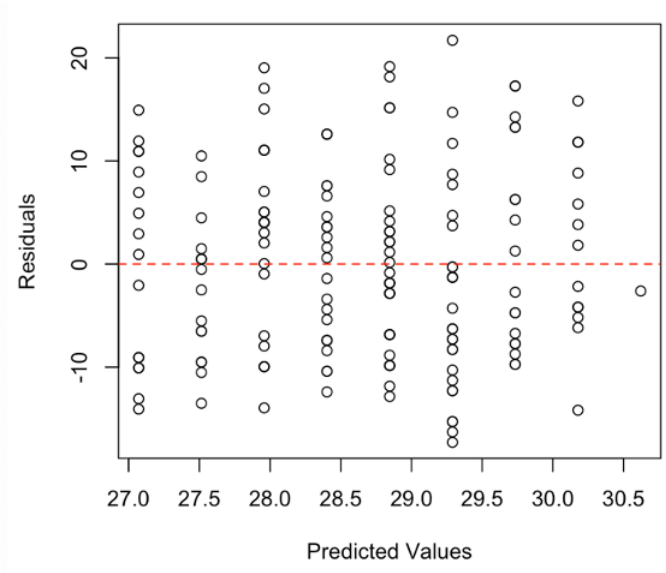
Scatterplot of Extraversion and POPC



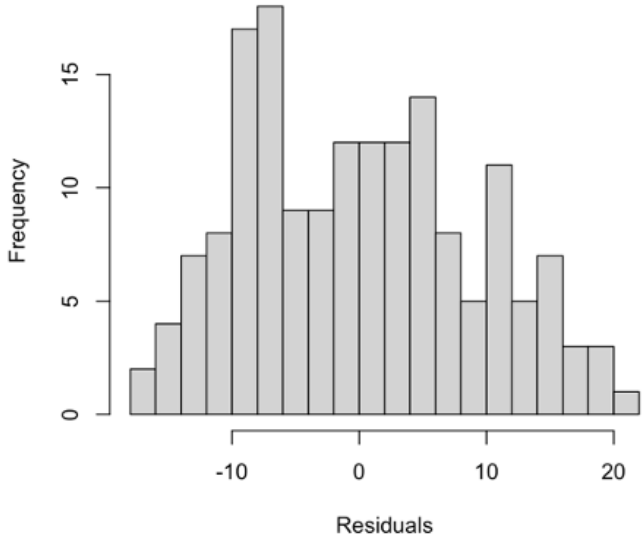
Scatterplot of Extraversion and POPC With Fitted Line



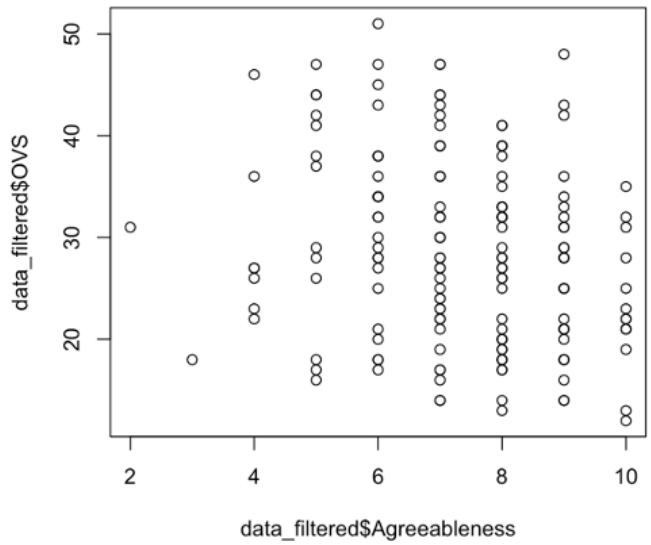
Residual Plot



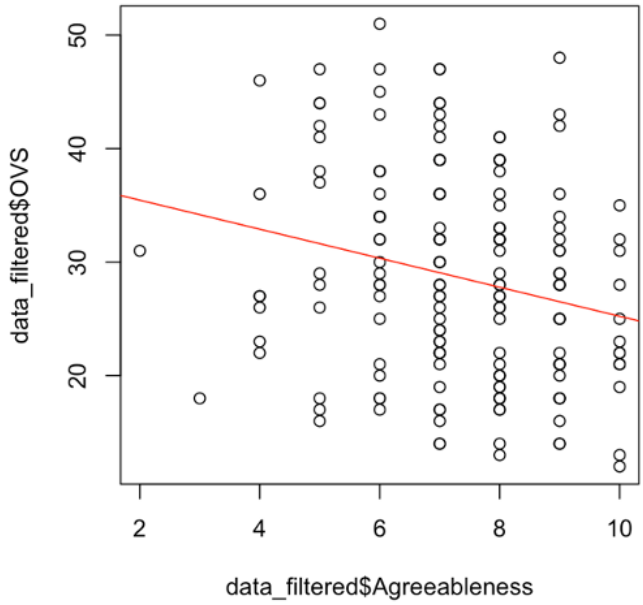
Histogram of Residuals



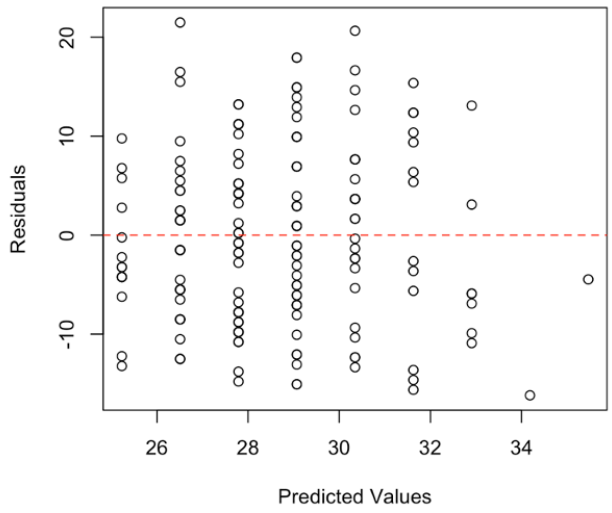
Scatterplot of Agreeableness and POPC



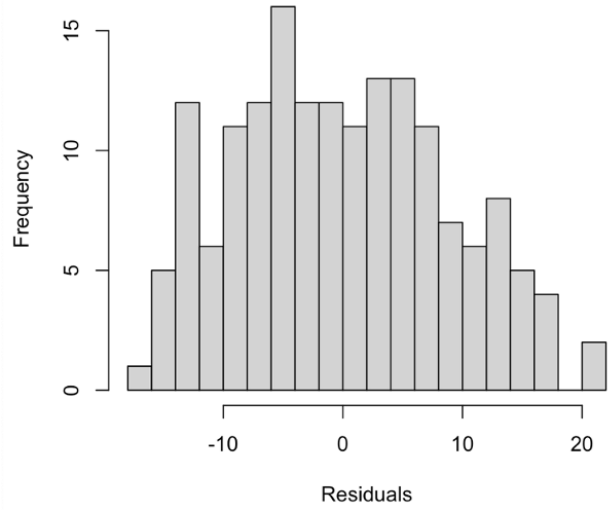
Scatterplot of Agreeableness and POPC With Fitted Line



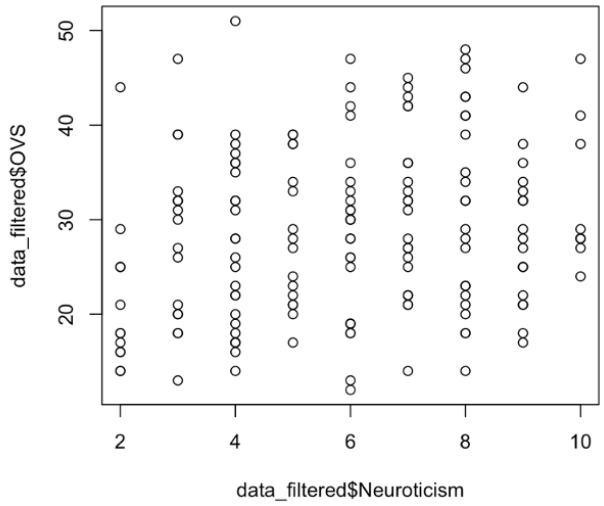
Residual Plot



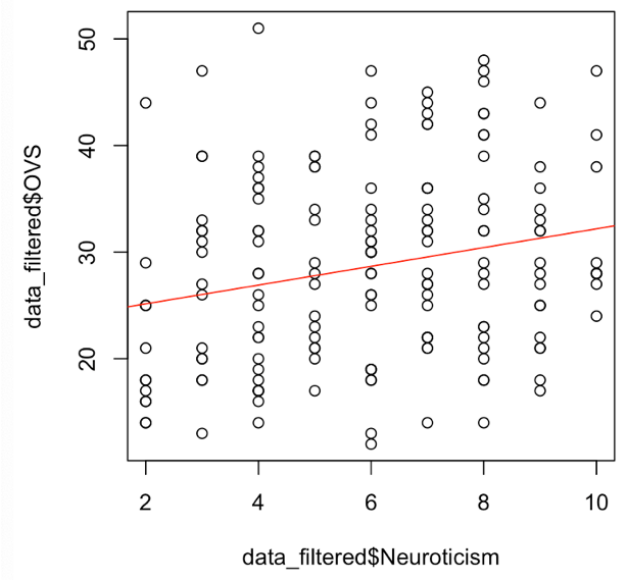
Histogram of Residuals



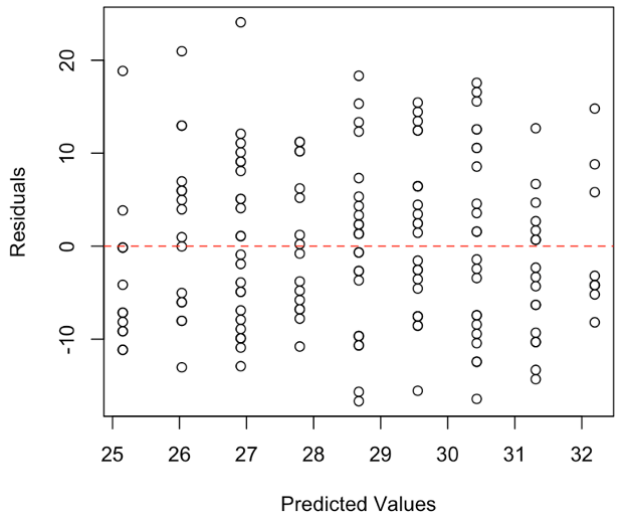
Scatterplot of Neuroticism and POPC



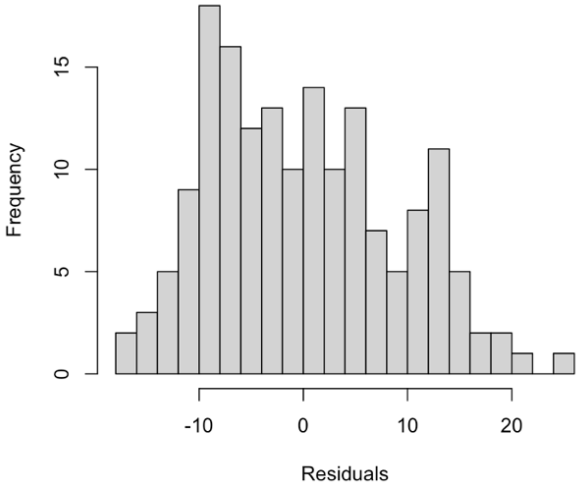
Scatterplot of Neuroticism and POPC With Fitted Line



Residual Plot

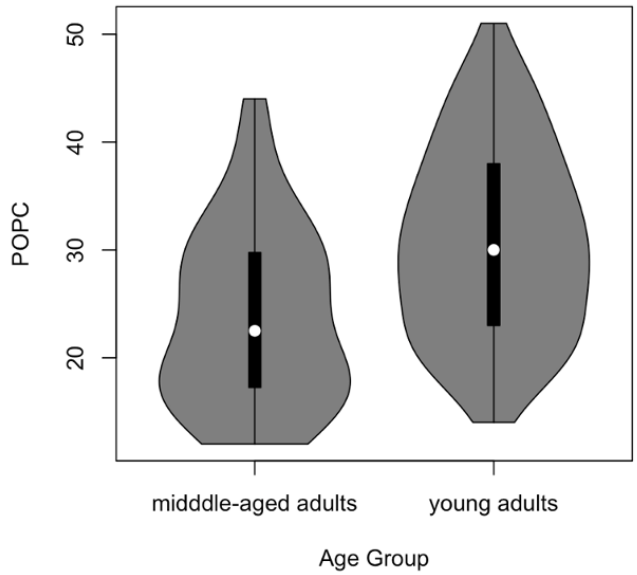


Histogram of Residuals

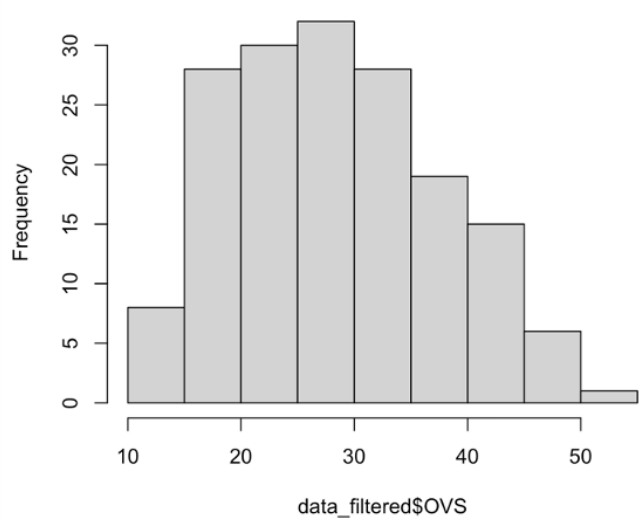


Appendix H
Assumption Testing Hypothesis Five

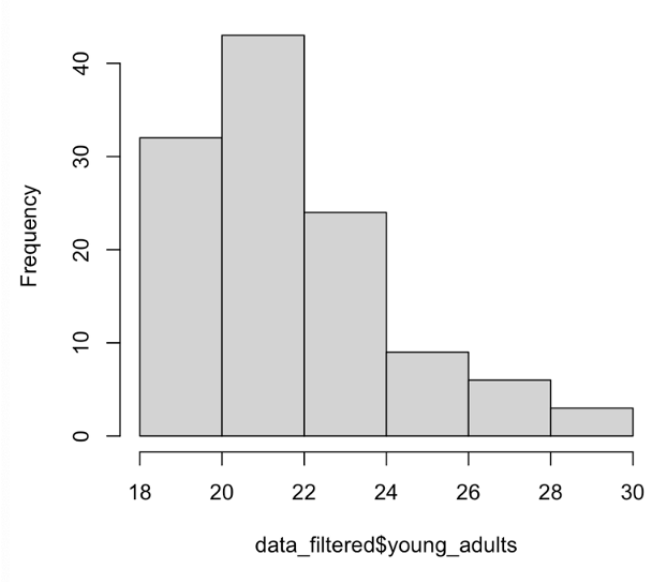
POPC and Age Group



Histogram of POPC



Histogram of Young Adults



Histogram of Middle-aged Adults