The Association between Conscientiousness and Neuroticism on both the State and Trait Level: An Experience Sampling Study

Kik Voortman

Department of Psychology

Faculty of Behavioural, Management and Social Sciences

University of Twente

Dr. M.L. Noordzij

Dr. J.T. Kraiss

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Abstract

Introduction. Previous studies have primarily been focused on the associations found on the trait- and between-person level of personality aspects, and often disregard personality states. Research on the association between two distinct personality states on the within-person level is limited.

Objective. The current study looked at the association between conscientiousness and neuroticism on the between- and within-person level. The goal was to investigate whether associations between the state measurements could be found in an opposite direction as compared to their negatively associated trait counterparts, highlighting individual differences, and contributing to theoretical and practical applications.

Method. Over a period of two weeks, university students (*N = 26)* were assessed on state conscientiousness and state neuroticism multiple times a day employing the Experience Sampling Methodology. Furthermore, one-time trait measurements were recorded using the NEO-FFI-3. Between- and within-person associations were explored using correlation analysis and linear mixed modelling.

Results. Findings indicate a moderate negative association between trait conscientiousness and trait neuroticism (r = -.389, n = 26, $p < .05$). No significant association was found between trait conscientiousness and average state neuroticism at the between person level (r = *-.098, n = 26, p = .633)*. The linear mixed model revealed a significant strong positive association between state conscientiousness and state neuroticism at the within-person level (β = *.537, SE = .028, p <.001*).

Conclusion. Findings in the current study are largely in line with previous studies. The present study confirmed that trait conscientiousness is negatively associated with trait neuroticism. In line with expectations, the negative direction of the association was reversed at the within-person level, which means that when an individual feels more conscientious at a certain moment they tend to also report higher levels of momentary neuroticism. Against expectations, the current study found no significant association between trait conscientiousness and average state neuroticism. Closer inspection of individual cases revealed substantial variability in the state level measurements of conscientiousness and neuroticism. Theoretical and practical applications were proposed, individual differences were highlighted and discussed in light of existing theory.

The Association between Conscientiousness and Neuroticism on both the State and Trait Level: An Experience Sampling Study

It is traditionally assumed that personality is relatively stable over time and across situations, although recently there has been more attention for the distinction between trait and state personality (Debusscher, Hofmans & De Fruyt, 2017). Previous research on personality has primarily been focused on interactions on the trait-level of personality aspects – which pertain to enduring characteristics or patterns of behaviour – (Beckmann et al., 2010) and the between person differences, which reflect how individuals differ from one another in general (Myin-Germeys et al., 2021). Less emphasis has been put on the state-level of personality aspects – which relate to temporary and circumstantial ways of being – (Roberts et al., 2012) and the within person differences, which focus on how experiences within one individual can differ depending on time and context (Myin-Germeys et al., 2021). The Experience Sampling Method (ESM) can be used to track those momentary experiences and their contexts in the real world and in real time by use of daily self-reports (Myin-Germeys et al., 2021). By examining within-person variation and how this is different from one person to the next, the focus of ESM is on repeated assessment of the individual, making it suitable for outlining specific patterns of behaviour and mental states (Myin-Germeys et al., 2021).

Conscientiousness and neuroticism are two of the most studied aspects of the Big Five personality traits because of their mental health implications and general associations with everyday behaviour and quality of life (Turiano, 2020). Conscientiousness is associated with a large number of positive behaviours and health outcomes (Jokela et al. 2013), whereas neuroticism is connected to several negative behaviours and health outcomes (Cassiello-Robbins et al., 2020). On a trait level, conscientiousness is shown to be negatively associated with neuroticism (Mount et al., 2005). On the state level however, the direction or strength of association may be subject to change due to variations in time and context at the within-person level (Beckmann et al., 2010).

Previous research has primarily concentrated on the fluctuations in state measurements within one and the same personality domain (Schmitt & Blum, 2020). However, there is currently little research that has been done on the associations between two distinct personality dimensions at the state-level, which could be used to assess whether different personality domains are associated over time in daily life. One study by Beckman and colleagues shows that – in a population of managers of large companies – the negative association between conscientiousness and neuroticism is reversed at the within-person level (Beckmann et al., 2010). There is currently limited data available on different target groups

outside of the organisational setting with perhaps more generalisability to the general population, as mentioned in the limitations of the work by Beckman and colleagues (Beckman et al., 2010).

The goal of the current study is to research the association between trait and state level measurements of two distinct personality aspects: conscientiousness and neuroticism. The current study investigates whether associations between the state measurements can be found in opposite direction as compared to their negatively associated trait counterparts. Apart from contributing to research of the general association on the state level, single cases can be analysed to highlight individual differences. On a theoretical level it is important to differentiate between personality traits and states because in psychology, researchers often mistakenly attribute an individual's behaviour to an internal motivation rather than external circumstances (Schmitt & Blum, 2020). This so-called fundamental attribution error may lead to assumptions and generalisations on a person's behaviour based on their trait personality measurements, while work by Fleeson and colleagues (2015) showed that personality traits are not always useful in describing actual behaviour. Research on the state-state associations has relevant practical applications in for example the clinical setting where one could provide a patient with personalised feedback on their current mental states and behavioural patterns, give insight on how these might affect their other symptoms and functioning, and provide tailor made momentary interventions when treatment and care are most needed (Myin-Germeys et al., 2021).

Conscientiousness

A personality trait is the tendency to respond in certain ways under certain circumstances, or more specifically, to think, feel and behave in consistent fashion across time when the situation allows for it (Roberts et al., 2009). This definition provides an important nuance, which is that personality is rather stable over time on the trait level, while certain situations can cause fluctuations in expected outcome of thoughts, feelings, and behaviours.

Conscientiousness is a personality trait that can be defined as the tendency to follow socially described norms for impulse control, to be goal directed, to plan, and to be able to resist immediate pleasure (Turiano, 2020). Generally speaking, conscientious individuals are seen as efficient, organised, and dependable, while less conscientious individuals have a proclivity to procrastinate and tend to not feel overly guilty about this (Turiano, 2020). As the definition of conscientiousness already suggests, higher levels of this trait are associated with many positive behaviours and outcomes, such as academic performance, occupational

attainment, longevity (Jokela et al. 2013), immune function (Sutin et al. 2010), diet, exercise, and even things like substance use (Bogg & Roberts, 2004).

Conscientiousness is part of the Five-Factor Model (FFM), which is a commonly used framework of personality theory that includes Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism, together forming the acronym of OCEAN (Johnson, 2020). The terms for the personality aspects used in the FFM are interchangeable with the names of the traits from the Big-Five Model (B5M), although the models were derived using slightly different methods and some of the concepts are named differently (Johnson, 2020).

Neuroticism

As mentioned above, neuroticism is also one of the five main personality traits of the Five-Factor Model and can be defined as the tendency to experience frequent and intense negative emotions (Roberts et al., 2009). In other words, individuals who are high in neuroticism, are more likely than the average person to experience feelings like anxiety, anger, guilt, and depression (Roberts et al., 2009). This means that they generally respond poorly to environmental stress, are more likely to experience situations as threatening and are easily overwhelmed by a perceived inability to cope with these experiences (Cassiello-Robbins et al., 2020). Neuroticism is the only personality trait in the FFM that is formulated in the negative manner, as opposed to the other traits (e.g. agreeableness, openness) where usually a higher score is considered better or more desirable. The positively formulated variant of neuroticism in the Big Five Model is called 'emotional stability'. Neuroticism has been widely researched compared to other personality domains, in part because of this negative formulation and the corresponding association with several psychological and physical health concerns, such as mood disorders, anxiety levels, substance use disorders, pain sensitivity, and withdrawal (Cassiello-Robbins et al., 2020).

In line with the Biopsychosocial Model, temperament and personality aspects such as neuroticism arise from interactions between genetic, biological and environmental factors (Shiner et al., 2012). Childhood adversity, trauma and parenting styles have also been shown to have an effect on an individual's perception of control, which in turn affects the proclivity towards experiencing negative emotions (Barlow et al., 2014). Parenting styles for example, both overprotective and abusive variants, can add towards negative learning experiences with regards to coping, creating a feedback loop in which environmental factors are influencing biological determinants such as changes in brain functioning (Barlow et al., 2014). A better understanding of neuroticism and conscientiousness as concepts, as well as the potential

plasticity of them, can help us differentiate between stable dispositions and momentary fluctuations.

State Personality

States are characteristic patterns of thinking, feeling, and behaving in a specific situation at a specified moment in time (Schmitt & Blum, 2020). Although it is traditionally assumed that personality is relatively stable over time and across situations, there has recently been more attention for the distinction between trait and state personality (Debusscher, Hofmans & De Fruyt, 2017). Debusscher and colleagues (2017) differentiate between the trait approach on the one hand and the process (i.e. social-cognitive or state) approach on the other hand. Whereas the trait approach mainly emphasises broad behavioural tendencies, the process or state approach is related to intra-individual variability within these broad tendencies, or traits (Debusscher, Hofmans & De Fruyt, 2017). Furthermore, state-personality is often looked at in light of momentary deviations from the average, allowing for analysis at the within person level (Fleeson, 2012). Further work by Fleeson and colleagues (2015) has shown that when repeatedly assessing personality related behaviour in daily life, the variance observed within persons is as large or even larger compared to the variance observed between persons. This means that participants of this study differed more from themselves than from each other, suggesting that the supposed stable personality traits are not always useful in describing what individuals are like in everyday life (Myin-Germeys et al., 2021).

Several theories and models have been formulated that analyse trait-state interactions. Latent state-trait theory (LSTT; Steyer et al., 1999) was one of the first models to define a latent state as the true score of any measure, given the person and the situation. Another model, Whole trait theory (WTT; Fleeson & Jayawickreme 2015) considers a trait as the average state. The limitations of both models were tackled by a more general model, the non-linear interaction of person and situation (NIPS; Blum & Schmitt, 2017). This model assumes that psychological mechanisms are involved when a person with a certain trait encounters a situation with a certain affordance level, stating that there are four social-cognitive parameters – threshold, bias, avoidance, and variability – that can explain the behavioural tendency of a person with a certain trait level (Blum & Schmitt, 2017). These models are mentioned to contextualise the complex interactions between trait and state personality. Researching personality not solely as a constant, in which one person is compared to another person, but instead investigating personality at both the trait and state level, where one person is

compared to their previous self, might give a better understanding of personality as a whole (Fleeson & Jayawickreme, 2015).

Associations Between Conscientiousness and Neuroticism

Previous research indicates that, on a between-person level, trait conscientiousness and trait neuroticism are strongly negatively correlated (Mount et al, 2005). This negative association is in fact evaluated to be the largest cross-domain correlation among the Big Five domains, with estimates as high as -.52 after correcting for sampling error and reliability issues (Lee et al, 2006). In this study we hypothesise that trait conscientiousness is negatively associated with trait neuroticism, suggesting that high neurotic measurements are associated with lower levels of conscientiousness.

A trait measurement is always expressed as a single value, for example a score of 24 (out of 60) in trait neuroticism. Measurements of state neuroticism on the other hand, can consist of several values that might change over the course of hours, days, and weeks. In order to calculate the association between trait and state personality, the state measurements are thus also required to be reduced to an aggregate, single mean value. Because of this, state personality is best described as average state in the comparison between trait and state interactions (Schmitt & Blum, 2020). To the knowledge of the researchers, there is currently no existing research on the association between trait conscientiousness and average state neuroticism on the between person level. However, work by Beckmann and colleagues (2010) shows that average state conscientiousness is negatively associated with average state neuroticism on the between-person level. In view of the fact that the found association by Beckmann and colleagues (2010) and the proposed association of the current study are both on the between-person level, we hypothesise that trait conscientiousness is negatively associated with average state neuroticism.

Previous research on the association between state conscientiousness and state neuroticism is very limited. The existing study by Beckmann and colleagues (2010) found a weak positive association between state conscientiousness and state neuroticism on the within person level. This means that on the within-person level the direction of the association is reversed, showing that conclusions about the relationship between conscientiousness and neuroticism will vary depending on the level of analysis (Beckmann et al., 2010). In their sample of managers of large companies (*N = 115*), Beckmann and colleagues (2010) showed that higher levels of momentary conscientiousness were associated with higher levels of momentary neuroticism. In other words, when an individual experienced putting in more

effort and self-discipline (higher conscientiousness), they also experienced more negative emotions such as anxiety and depression (higher neuroticism). Upon inspecting the individual cases, Beckmann and colleagues (2010) found that for more than two thirds (72%) of their sample the within person conscientiousness-neuroticism association was positive. We therefore hypothesise that in the present study with a university student sample, state conscientiousness is positively associated with state neuroticism at the within-person level.

Current Study Hypotheses

The current study hypothesises:

H1. There is a negative association between trait conscientiousness and trait neuroticism at the between person level.

H2. There is a negative association between trait conscientiousness and average state neuroticism at the between person level.

H3. The negative association is reversed at the within-person level, resulting in a positive association between state conscientiousness and state neuroticism at the within person level.

Method

Design

This study made use of an existing data set from an Experience Sampling Study in which the association between momentary procrastination and state personality was researched (Arndt, 2021). The ESM format allows for repeated assessment of participants in their everyday lives, which improves ecological validity (Myin-Germeys et al., 2021). With regards to the setting, Lobo and colleagues suggest that in order to fully understand experiences and behaviour, they need to be researched in real-world circumstances; outside of the laboratory environment (Lobo et al., 2018). An advantage of the repeated and daily assessment in ESM studies is the reduction in memory biases concerning retrospective recall (Myin-Germeys et al., 2021). Because participants are not asked to assess how they felt at a certain moment in the past, but are instead asked how they are currently feeling, participants are less prone to cognitive and memory biases. Work by Ben-Zeev and colleagues has shown that evaluations based on retrospective recall have been linked to overestimation on both positive and negative emotional states (Ben-Zeev et al., 2009).

The biggest strength of ESM is the ability to analyse the within-person relationship between two different variables, and the possibility to differentiate the between- and the within-person relationship between said variables (Myin-Germeys et al., 2021). In other words: we could not only hypothesise whether individuals who are on average more neurotic also tend to have lower levels of conscientiousness, but we could also check if – when an individual is more neurotic at particular moments – they tend to experience more feelings of conscientiousness at those moments.

Participants

In order to recruit participants, a convenience sampling method was implemented. Participants were able to access this study through the University of Twente's faculty website of Behavioural, Management and Social Sciences. On this website, participants entered the study by clicking a link that asked them to subscribe to a set of surveys. The final group of participants for this study consisted entirely of bachelor students, who were following psychology classes at the University of Twente at the time of the research (*N = 38)*. The ages of the participants ranged from 18 to 23 years old (*M age = 20.4; SD age = 1.63*). The majority of the participants were female (88%). The most common nationalities of the participants were: German (76%) and Dutch (20%).

The recommended sample size for ESM studies depends on the number of participants, the number of measured variables, and the number of time points in which variables are measured (Myin-Germeys et al., 2021). According to Trull and colleagues, most published ESM studies do not report a statistical power analysis to justify the selection of the sample size, as not much is known about statistical power in intensive longitudinal studies (Trull & Ebner-Priemer, 2020). The amount of participants used in the current study is in line with other designs from the meta-analysis of the Experience Sampling Method on mobile devices by Van Berkel and colleagues, where the mean number of participants was 53 due to outliers, while the median number of participants was 19 (Van Berkel et al., 2017). For future research, Myin-Germeys and colleagues suggest using a simulation-based power analysis (Myin-Germeys et al., 2021) that could be performed by use of the application *PowerAnalysisIL* which has been developed in R (R Core Team, 2020).

One of the inclusion criteria for this study was age. To be included in the study, participants had to be at least 18 years of age. Other than that, participants had to be a registered student in possession of a smartphone that could run the Ethica Data App.

Procedure

Participants were first instructed to download the Ethica Data App on their smartphones. Following that, they completed an initial questionnaire concerning trait personality aspects, a shortened version of the NEO-FFI-3. From that point onwards, participants filled in a short questionnaire that consisted of six questions that measured personality states. Participants completed this short questionnaire three times each day for a period of two weeks. In the meta-analysis by van Berkel and colleagues, the median study duration of an ESM study was 14 days, which they explain to be the ideal middle ground in safeguarding participant burden (Van Berkel et al., 2017). A more recent meta-analysis by Vachon and colleagues shows a mean study duration of 11.2 days (Vachon et al., 2019). Ultimately, a duration that will allow the sampling of both weekdays and weekend-days in all participants, eliminating potential differences due to weekdays (when most people work or study) versus weekend-days (when most people have more time for leisure activities and social contact), is recommended (Myin-Germeys et al., 2021).

For the daily questionnaire a signal-contingent sampling method was used, in which participants received a reminder to complete the questionnaire at varying time-periods for three times a day. High ecological validity is one of the main assets of ESM; assessments should therefore not always take place at the exact same time so that assessment selection bias

– where certain data is under- or overrepresented – does not occur (Myin-Germeys et al., 2021). At the same time, Vachon and colleagues recommend some form of consistency in the assessment times, which result in higher compliance to the ESM protocol (Vachon et al., 2019). The notification alerts were randomly generated in the time slots of 09:00 to 10:30 am, 14:00 to 15:30 pm, and 19:00 to 20:30 pm. Participants received a follow-up reminder when they did not fill in the questionnaire, thirty and sixty minutes after the initial notification. The daily questionnaires expired two hours after the initial notification, after which the respective time slot was marked as a missing value. The sampling procedure resulted in a total of 40 participants who registered for the study, 38 of them (95%) actually participated in the study. Participants earned 0.75 credit points from the faculty of Behavioural, Management and Social Sciences by participating in this study. The current study used the data set of an existing reference study that was ethically approved by the Behavioural, Management and Social Sciences Ethics Committee of the University of Twente on January 18th, 2021 (Request-Nr: 201516).

Material and Measures

This study consisted of one initial trait questionnaire and several daily surveys with state-related questions. The questions used in the trait questionnaire came from the short form NEO Five-Factor Inventory-3 for adults. The items used in the daily state questionnaires originate from the Big Five Inventory (BFI) (John, Donahue & Kentle, 1991). The items were selected and adjusted to be made appropriate for daily administration in an ESM study design.

Ethica Data App

The study was created on the Ethica website, whereas participants used the Ethica Data smartphone application to fill in the questionnaires. Ethica is an end-to-end research platform where researchers can use quantitative data to research human behaviour (web address; https://ethicadata.com). The Ethica services can be accessed through the website or by using the smartphone app for iOS and Android devices. Version 460 of the Ethica Data App was used in this study. Participants were guided through the various steps of the study, starting with eligibility screening, followed by informed consent, and finally, data collection. Push notifications that remind users to fill in their questionnaires can be set in place for the participants. Expiration times for missed questionnaires can be configured.

NEO Five-Factor Inventory-3, S-Adult in Short Form (NEO-FFI-3)

The NEO-FFI-3 is a questionnaire that measures personality traits on the Big Five Model (B5M). This version contains 60 items, making it the short-form variant of the original

NEO-PI-3. For this study, only the items concerning the personality domains of conscientiousness and neuroticism were used. For each domain there are 12 items, which added up to a total of 24 items. Eight of these items were reverse scored because they were formulated in the negative manner. An example question for the domain of conscientiousness is: "I work hard to accomplish my goals". An example question for neuroticism is: "I often get angry at the way people treat me". All 24 items were scored on a 5-Point Likert Scale, ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), to strongly agree (5). The total score for neuroticism and conscientiousness ranges from the lowest score of 0 to the highest score of 60. Previous research on use of the NEO-FFI-3 in student populations shows good reliability with an internal consistency of $\alpha = .83$ and $\alpha = .80$ for conscientiousness and neuroticism respectively (Anisi et al., 2012).

Adapted Daily Questionnaire Based on Big Five Inventory (BFI)

The daily questionnaire was used to measure state levels on the personality domains of conscientiousness and neuroticism. The items in this questionnaire were preceded by the sentence: "To what degree do the following statements apply to you at this point in time? The answer options were presented in a 7-Point Likert Scale, ranging from strongly agree (1), agree (2), somewhat agree (3), neutral (4), somewhat disagree (5), disagree (6), to strongly disagree (7). Overall, there were six items in this questionnaire, three for state conscientiousness and three for state neuroticism. Questions measuring state conscientiousness included: "Right now, I am feeling organised", "Right now, I am feeling self-disciplined, and "Right now, I am feeling goal-oriented". The items related to state neuroticism were: "Right now, I am feeling tense", "Right now, I am feeling upset", and "Right now, I am feeling self-conscious". The total score for state conscientiousness and state neuroticism ranged from the lowest score of 3 to the highest score of 21. A high total score implies a heightened state of conscientiousness or neuroticism.

Data Analysis

The analysis of the data was conducted with the programme IBM SPSS (version 28). In line with work by Van Berkel and colleagues, participants with a 50% or higher response rate were included in the final analysis (Van Berkel et al., 2019). Descriptive statistics were performed to display minimum score, maximum score, mean score and standard deviations for the NEO-FFI-3 trait questionnaire measurements of neuroticism and conscientiousness. In order to answer research question two, person mean (PM) was computed for state neuroticism. Person mean can be used to show the average state neuroticism across the

duration of the study per individual, in order to run a between-person analysis. Cronbach's Alpha was calculated in order to asses the reliability – with regards to internal consistency – of the trait measure for conscientiousness and neuroticism respectively.

Analytical Strategy

First, to calculate the association between trait conscientiousness and trait neuroticism, Pearson correlation analysis was conducted. Next, Pearson correlation was used to determine the association between trait conscientiousness and average state neuroticism. Average state neuroticism was calculated by using the aggregate function in SPSS. The results were then opened in a new datafile with the short format orientation, where each row contains one participant, in order to prevent inflating the degrees of freedom. Then, using the original long format dataset again, a Linear Mixed Model (LMM) analysis was performed to analyse the association between state conscientiousness and state neuroticism. Data obtained from ESM studies have a multilevel structure, in which repeated observations over consecutive days are nested within participants (Myin-Germeys et al., 2021). LMM analyses are useful in analysing data that is multilevel and longitudinal, because in these types of data a differentiation needs to be made between the within-person association and between-person association (Curran et al., 2011). Implementing an auto regression structure in the LMM analysis allows for missing data to be accounted for, as well as controlling for dependency between data (Curran et al., 2011). In order to perform the analysis, standardised Z-scores were computed for state conscientiousness and state neuroticism. For sake of completeness, the outcomes of both the unstandardised and standardised variant of the LMM analysis were presented. Finally, individual cases were analysed by splitting the data file, so that a correlation and graph for each participant could be created for comparison. Representative participants were shown to highlight individual differences in the association.

Results

Participants Flow

Participants could register for the original study from the 14th of January 2021 to the 14th of February 2021 (Arndt, 2021). From the total of 38 participants who registered for the study, 12 did not reach the required response rate of 50% and were therefore not included in the final analysis of N = 26.

Descriptive Statistics

Table 1 provides an overview of the minimum, maximum, and mean scores and corresponding standard deviations for trait conscientiousness and trait neuroticism. The mean scores of trait conscientiousness and state neuroticism of the current sample are comparable to similar studies with student samples that used the NEO-FFI-3, as seen in work by Manga and colleagues (Manga et al., 2004) and in work by Aluja and colleagues (Aluja et al., 2005) for example. The current sample scored an average level of trait conscientiousness and trait neuroticism compared to the norm group of young adults aged 18 to 25 (Mcrae et al., 2007).

Table 1

Overview of Minimum and Maximum Scores, Means (M) and Standard Deviations (SD) of Trait Conscientiousness and Trait Neuroticism in N = 26 study.

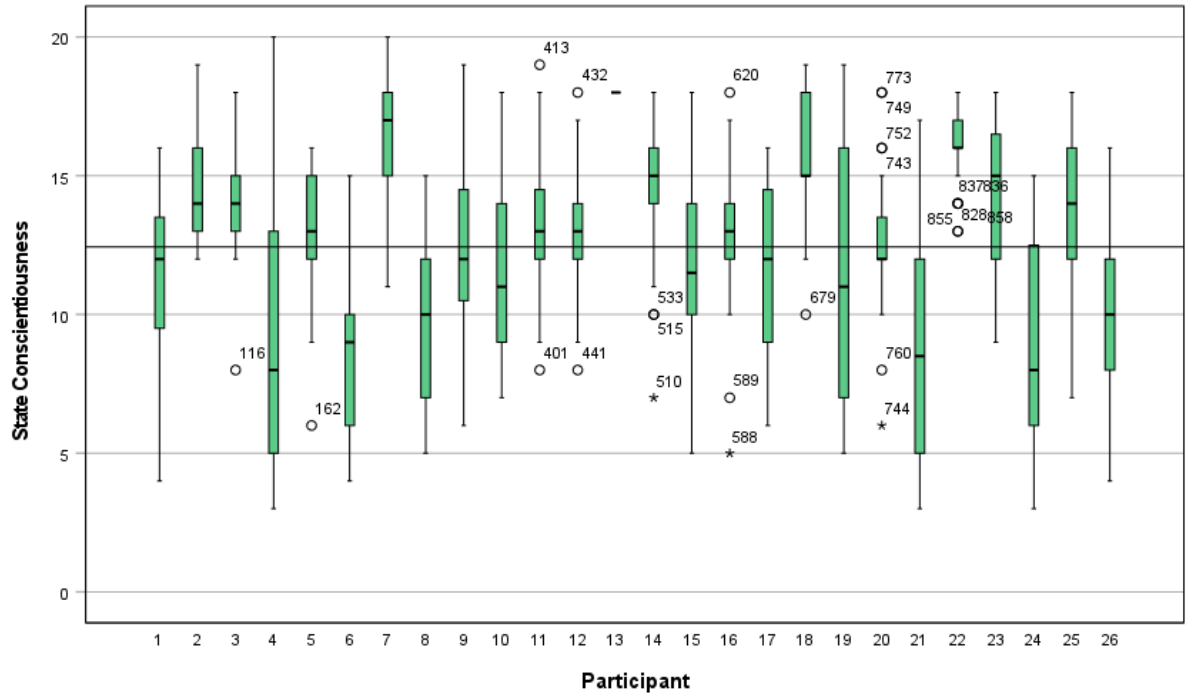
Variables	Minimum	Maximum	M	SD
NEO-FFI-3 Conscientiousness	13 (0)	45 (60)	28.62	7.96
NEO-FFI-3 Neuroticism	8 (0)	41 (60)	25.92	9.18

Note. Scale minimum = 0 and scale maximum = 60

Figures 1 and 2 show a boxplot that illustrates the variation of state conscientiousness and state neuroticism respectively.

Figure 1

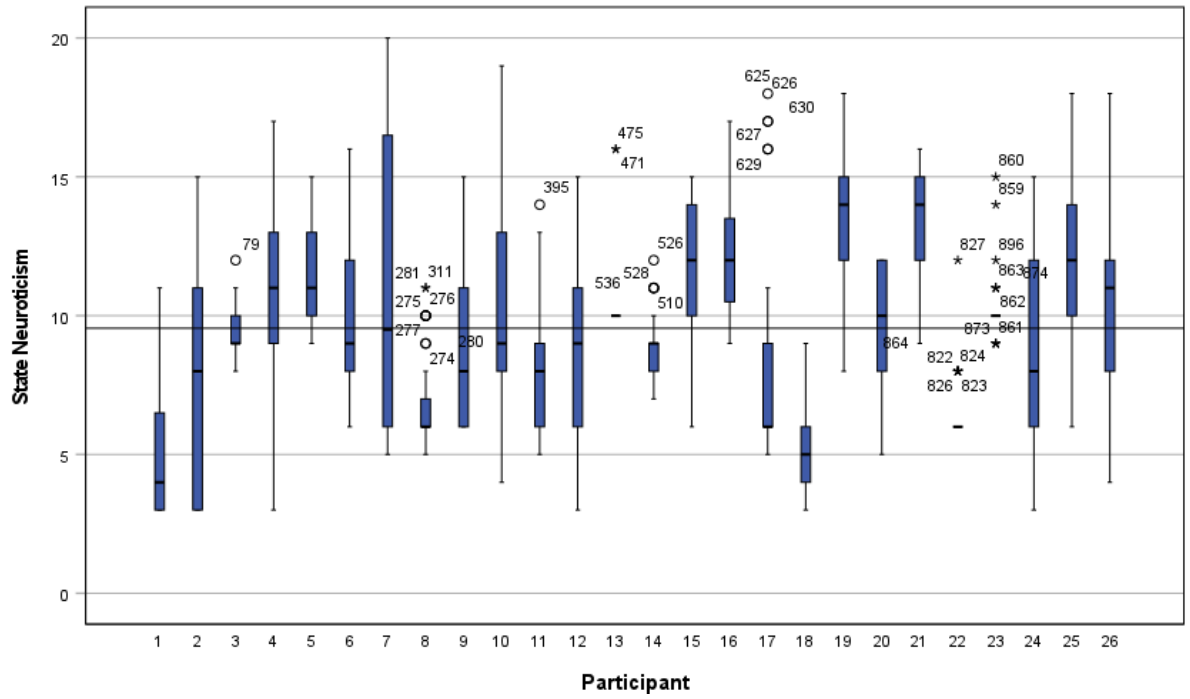
Boxplot illustrating the variation in momentary measurements of conscientiousness for each participant, with a reference line for the group mean (M = 12.5).



Note. Minimum score is 0 and maximum score is 21.

Figure 2

Boxplot illustrating the variation in momentary measurements of neuroticism for each participant, with a reference line for the group mean (M = 9.55).



Note. Minimum score is 0 and maximum score is 21.

Reliability Assessment

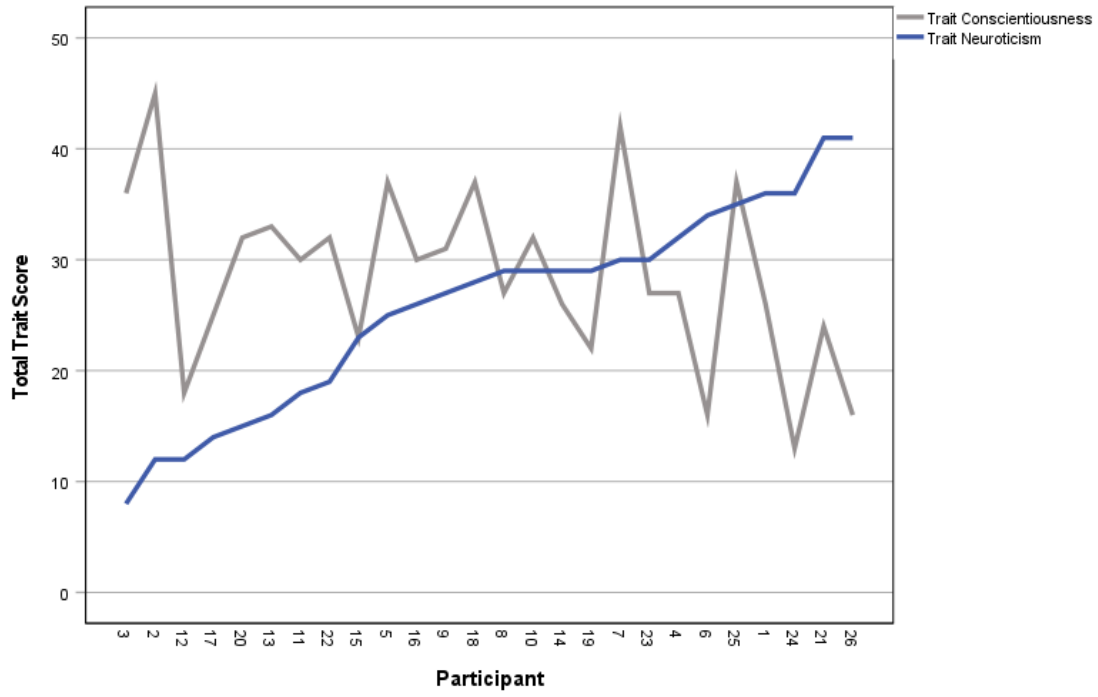
Reliability assessment on the trait measures used in this study showed a good internal consistency of α = .89 for the trait conscientiousness measure and a good internal consistency of α = .89 for the trait neuroticism measure.

Trait Conscientiousness and Trait Neuroticism

To explore the expected negative association from previous studies between trait conscientiousness and trait neuroticism, a bivariate Pearson analysis was performed. In line with expectations, a significant correlation was found with a moderate magnitude and in a negative direction, between trait conscientiousness and trait neuroticism (r = -.389, n = 26, p < .05). This suggests that participants with low scores on trait conscientiousness tend to have high scores on trait neuroticism and vice versa, as illustrated in Figure 3.

Figure 3

Visual representation of the total trait scores of conscientiousness and neuroticism.



Note. Participants were sorted by their neuroticism score, ascending from left to right. Scale minimum = 0 and scale maximum = 60.

Trait Conscientiousness and Average State Neuroticism

To investigate the association between trait conscientiousness and average state neuroticism, a bivariate Pearson analysis was performed. An insignificant correlation between trait conscientiousness and average state neuroticism was found with a weak magnitude and in the negative direction (*r = -.098, n = 26, p = .633)*. This means that trait conscientiousness holds no significant predictive value for state neuroticism and vice versa.

State Conscientiousness and State Neuroticism

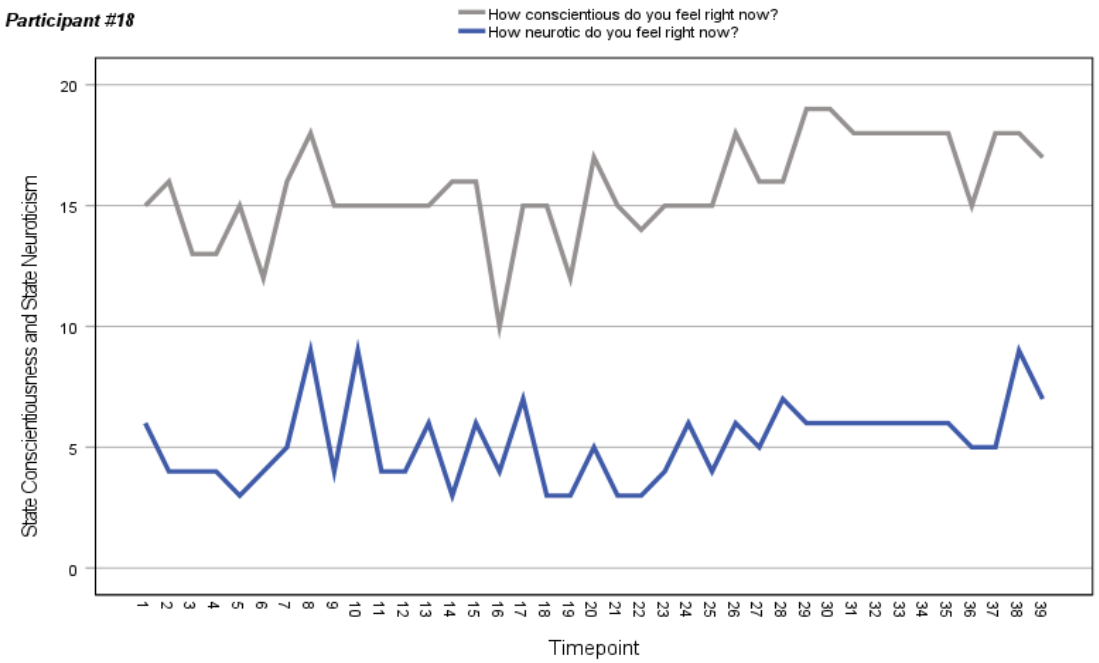
To analyse the association between state conscientiousness and state neuroticism, a LMM analysis was performed. A significant correlation with a strong magnitude and in the positive direction was found (*B = .683, SE =.036, p <.001* with a 95% confidence interval of .612 and .735). This means that for every one unit increase in state conscientiousness, on average, state neuroticism increases by .683 units. However, expressing the outcome of the LMM analysis as an unstandardised beta (*B*) is not very insightful when working with psychological constructs. Therefore, an LMM analysis with the standardised Z-scores was performed, which showed a significant strong positive correlation between state conscientiousness and state neuroticism (*β = .537, SE = .028, p <.001* with a 95% confidence interval of .481 and .592). This means that participants with high scores on state conscientiousness, on average, tend to have high scores on state neuroticism.

Illustration of Individual Cases.

Solely stating a general association is besides the point of ESM type studies, therefore, in this section, data of individual participants is outlined to show the association of state conscientiousness and state neuroticism throughout the total study period. Three participants were chosen to highlight three distinct associations. Figure 7 shows a significant strong positive correlation, this participant is rather representative for the outcome of the LMM analysis. The figure illustrates that, in general, when the momentary level of conscientiousness went up or down, so did the momentary level of neuroticism. This applied to most participants, with slight differences in magnitude of the correlation. Figure 8 on the other hand shows a participant where the direction of the correlation was reversed. This was an outlier, as it was the only participant with a significant moderate correlation in the negative direction. Figure 9 shows a participant that is representative for the five participants that showed no significant correlation between state conscientiousness and state neuroticism.

Figure 7

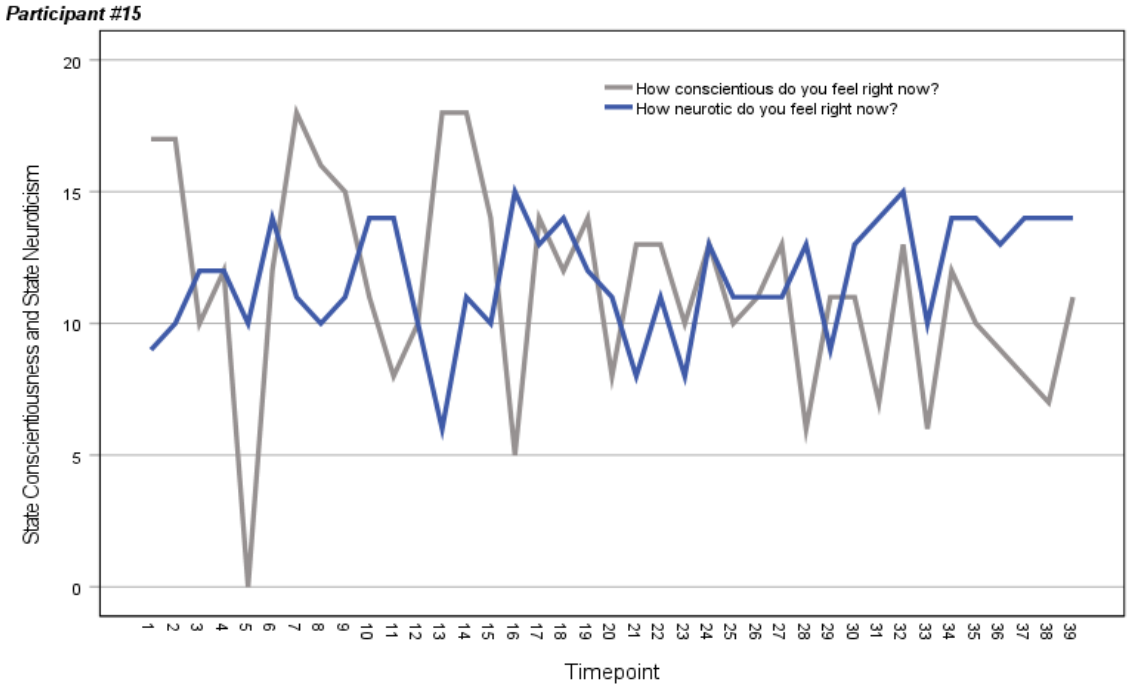
Level of state conscientiousness and state neuroticism per timepoint of participant 18.



Note. Minimum score is 0 and maximum score is 21 for both variables. This participant showed a significant strong positive correlation (r = .531, p < .001).

Figure 8

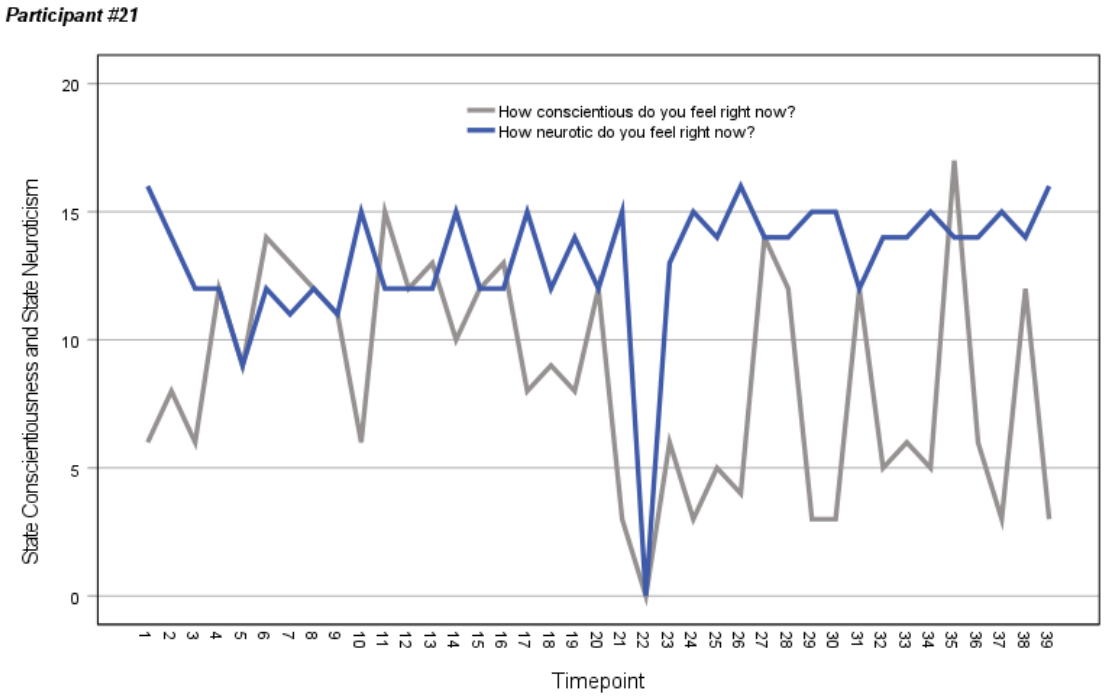
Level of state conscientiousness and state neuroticism per timepoint of participant 15.



Note. Minimum score is 0 and maximum score is 21 for both variables. This participant showed a significant moderate negative correlation (r = -.344, p < .05).

Figure 9

Level of state conscientiousness and state neuroticism per timepoint of participant 21.



Note. Minimum score is 0 and maximum score is 21 for both variables. This participant showed an insignificant weak negative correlation (r = -.091, p = .581).

Discussion

The aim of the current study was to investigate the association between trait and state level measurements of two distinct personality aspects, conscientiousness and neuroticism. The present study analysed whether associations between the state measurements could be found in similar direction as with their trait counterparts. Apart from contributing to research of the general association on the state level, single cases were analysed to highlight individual differences.

The findings of the current study support the first hypothesis that trait conscientiousness is negatively associated with trait neuroticism, suggesting that lower scores in trait conscientiousness are associated with higher scores in trait neuroticism and vice versa.

However, the results of the current study did not support the hypothesis (H2.) that trait conscientiousness is negatively associated with average state neuroticism. This means that when looking at associations between the two constructs on two different measurement levels, the results showed that there was no significant association between trait conscientiousness and average state neuroticism.

Within the state level on the other hand, the current study found a strong positive association between state conscientiousness and state neuroticism. This confirmed the hypothesis (H3.) that participants with high scores on state conscientiousness, on average, tend to have high scores on state neuroticism at within-person level.

When looking more closely at the individual cases, visual analysis of the data suggests that – for large majority of participants (77%) – when their momentary level of conscientiousness went up or down, so did the momentary level of neuroticism. For one individual this association was reversed, and for the remaining five individuals no significant association could be found.

Below we will first discuss these findings in the light of existing theory, after which potential statistical reliability and validity issues are stated, followed by further recommendations for future studies.

Similarity of Results

The findings from the current study surrounding the hypothesised negative direction of the association between trait conscientiousness and trait neuroticism are in line with findings from work by Mount et al. (2005). Additionally, the findings from the current study on the moderate magnitude of the association are similar to the findings from the meta-analysis by Lee and colleagues (2006), which show a moderate association between conscientiousness and neuroticism (with correlations ranging from -.28 to -.52).

Contrary to the hypothesis based on findings by Beckmann and colleagues (2010) there was no significant negative association between trait neuroticism and average state conscientiousness at the between person level in the current study. The study by Beckmann et al. (2010) looked at the association between average state conscientiousness and average state neuroticism and found a moderate negative association at the between person level of analysis. Beckmann and colleagues (2010) concluded that individuals who tend to be less conscientious also tend to be more neurotic compared to others in the same population. Both the study by Beckmann et al (2010) and the current study looked at the association between conscientiousness and neuroticism at the between person level. However, the current study explored new territory by looking at the association between conscientiousness and neuroticism on two different measurement levels; the trait level combined with the average state measurement level. Based on the findings by Mount et al. (2005) surrounding the trait level of analysis and findings by Beckmann et al. (2010) regarding the average state level of analysis, it was hypothesised that a similar association could be found when exploring the

correlation between trait conscientiousness and average state neuroticism. However, this was not the case in the present study as no significant association between trait conscientiousness and average state neuroticism was found. The present study concludes that combining different measurement levels did not lead to finding significant associations between the two personality aspects. This means that for the sample of this study, trait measurements of conscientiousness held no predictive value for momentary measurements of neuroticism. A possible explanation for this is that participants – during the course of the study – did not have a representative period with regards to state neuroticism compared to their usual trait level neuroticism. This further adds to the notion that a personality trait is more than just an average of several states as stated by Fleeson and colleagues (2015).

At the within-person level, the current study replicated the results found by Beckmann et al. (2010) surrounding the positive association between state conscientiousness and state neuroticism. The present study confirmed the hypothesis that the negative association between trait conscientiousness and trait neuroticism is reversed at the within-person level. The majority of the current sample (77%) showed that high scores on state conscientiousness were associated with high scores on state neuroticism and vice versa. This is in line with findings by Beckmann et al (2010) who found that for more than two thirds of their sample (72%), the within person conscientiousness-neuroticism relationship was positive. Where the current study differed from the work by Beckmann and colleagues (2010) is in the magnitude of the association between state conscientiousness and state neuroticism. The current study found a strong positive correlation on the within person level, while the study by Beckmann et al. (2010) found a weak positive correlation between state conscientiousness and state neuroticism. The gap in magnitude of association between the study by Beckmann et al. (2010) might be explained by differences in terms of setting and target group. The study by Beckmann and colleagues (2010) was in the organisational setting and context with a majority male sample of large company managers with an average age of 32.4. The present study had a different target group, as the current university student sample had an average age of 20.4 and was majority female. It could be hypothesised that – compared to male company managers – female students experience more peer pressure in their everyday life that leads to increases in state neuroticism, which leads to momentary increases in conscientious behaviour.

Besides the general positive association found in the current sample, analysis of the individual cases further highlighted the existence of a potential positive relationship between state conscientiousness and state neuroticism that was first assumed by Fisher and Noble (2004) and later confirmed by Beckmann and colleagues (2010). The study by Fisher and

Noble (2004) suggested that – for some individuals – behaving conscientiously (i.e. putting in an effort) might be associated with negative affect, a main aspect of neuroticism. This dynamic suggested by Fisher and Noble (2004) and confirmed by Beckmann and colleagues (2010) can clearly be seen in Figure 7; when an individual feels more conscientious at a certain moment they tend to also report higher levels of momentary neuroticism.

Strengths and Limitations

The main strength of the current study had been the employment of ESM methodology which was used to explore associations on the within person level and further highlight individual differences in patterns of thought, feelings and behaviour. Furthermore, the ESM study format allowed for distinctions on the between- and the within-person level of analysis. Another advantage of the ESM study design is the high ecological validity and corresponding generalisability (Myin-Germeys et al., 2021). Because participants are not solely asked to assess how they felt at a certain moment in the past, but are instead asked how they are currently feeling, participants are less prone to cognitive and memory biases (Ben-Zeev et al., 2009).

The findings of the current study however, should be contextualised by the fact that the sample was a small non-random sample and fully comprised of university students, which somewhat limits the conclusions that could be drawn towards the general public. Another potential limitation of the current study is the fact that the state questionnaires were created based on existing NEO-FFI-3 trait questions and may not measure momentary personality as well as they do for their trait counterparts. Only three questions were selected for state conscientiousness and state neuroticism. The researchers may have been biased in their selection of the questions as the selections were not founded in research, which might introduce randomness to the study.

Exploratory hypotheses of the current study looked at the individual cases of state-state associations and compared overall levels of trait conscientiousness and trait neuroticism across the entire sample as well as in individual outliers. The current sample scored an average level of trait conscientiousness and trait neuroticism compared to the norm group of young adults aged 18 to 25 (Mcrae et al., 2007). In the five individuals that saw no significant association between state conscientiousness and state neuroticism, trait measurements were also average compared to the norm, which indicates that trait measurements were likely not associated with state measurements. Even in the single individual that showed a negative association between state conscientiousness and state neuroticism, no patterns could be found

in terms of outliers on the trait measurements of that particular individual. The findings of this exploratory analysis – together with the absence of a significant association between trait conscientiousness and average state neuroticism – implies that trait personality measurements hold no apparent predictive value for state measurements. This theoretical implication is in line with findings in Myin-Germeys and colleagues (2021) suggesting that the supposed stable personality traits are not always useful in describing what individuals are like in everyday life. This conclusion fits neatly into the theoretical model of the non-linear interaction of person and situation (NIPS) by Blum and colleagues (2017), which suggests that a personality state as an outcome is dependent on several factors such as situation, coping, restrictions, and a person's trait level. More research on potential moderators is needed and in order to establish direction of causality, future experimental research could focus on manipulating state neuroticism and study the effects on behaving conscientiously.

Conclusion and Implications

The current study shows that trait conscientiousness and trait neuroticism are negatively associated. No significant association was found between trait conscientiousness and average state neuroticism. A positive association was found between state conscientiousness and state neuroticism at the within person level. One of the challenges that is ahead is the establishment of reliable and valid self rapport questionnaires on state conscientiousness and state neuroticism. It is recommended that future research on personality does not solely focus on personality as a constant, in which one person is compared to another person, but instead investigates personality at both the trait and state level, where one person is compared to their previous self. The use of a within-person perspective when studying personality allows us to describe more than just the differences between people, it allows us to draw conclusions about the individual processes. This has practical implications for the clinical setting, as health care professionals could help contextualise patterns of thoughts, feelings, and behaviour by looking at individual differences. An example of this is the potential development of interventions for behavioural change in individuals who struggle with neuroticism. Psychologists could study the behaviours that individuals display when experiencing higher levels of neuroticism, and assess whether the current coping mechanisms that are employed are adaptive for the context. The current study adds to the notion that personality traits are not always useful in describing what individuals are like in everyday life.

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