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Within- and between individual variability of personality characteristics and physical exercise

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ABSTRACT

Using two independent samples, the study investigated links of within- and between-individual variability in personality states in three personality domains—Neuroticism, Extraversion, and Conscientiousness—with physical activity. Activity was defined as self-reported quantity of exercising or walking/cycling. More physical activity was associated with people reporting higher levels of Extraversion and Conscientiousness than they usually did, with the associations clearly replicating across samples and generalizing to all items of these domains. This pattern tended to reflect associations at the level of between-individual differences. When the three domains simultaneously predicted activity, within-individual variance in Neuroticism also emerged as a positive predictor, whereas between-individual level associations waned. The findings are consistent with within-individual differences in personality ratings reflecting meaningful, context-relevant variability.

1. Introduction

Personality psychology has been and still is mostly about differences between people. However, it is becoming increasingly clear that individuals do not just differ from each other, but they also differ from themselves by varying over time and across situations (Fleeson, 2012; Fleeson & Jayawickreme, 2015). Individuals' personalities may thus be more comprehensively conceptualized as sets of distributions of personality states than sets of static trait scores (Fleeson, 2007). People reliably differ in the properties of these distributions such as their means (Fleeson, 2001) and perhaps also shapes (Fleeson, 2001; Judge, Simon, Hurst, & Kelley, 2014). At the same time, most people can, and indeed do, occupy many positions on the state continua at different time-points. In fact, it has been suggested that there may be even more variability in personality characteristics within individuals than between them (Fleeson, 2007; Sherman, Rauthmann, Brown, Serfass, & Jones, 2015).

If so, a natural question is: Does the observed within-individual variability in how people report their personality characteristic levels reflect substantive variance—something real and context-sensitive in how people differ from moment to moment—rather than some sort of nuisance variance that should be of little interest to researchers? It is no trivial possibility that such within-individual variability reflects, to a greater or lesser extent, random noise. For example, if people report a personality state at multiple time-points, their responses are expected to vary to some extent due to measurement error alone. In addition to error, the variability may reflect some sort of stochastic processes of potentially unidentifiable origin or consequences.

Observed *between*-individual differences in personality characteristics are often rendered interpretable as reflecting substantive variance by correlating them to various kinds of non-personality variables. If scores of a personality trait predict, say, longevity, it seems plausible that the scores capture something real about people (Ozer & Benet-Martínez, 2006; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). This logic may hold even if we remain agnostic as to what the scores actually reflect—a unitary latent trait or just a composite of more specific characteristics (Mõttus, 2016). The same reasoning can be applied to within-individual variance: if feeling more self-disciplined than usual is linked with making more sensible behavioral choices at that time—choosing a healthier meal over something lucrative but unhealthy, finishing a tedious job or going for a jog instead of watching a TV show—it could reflect substantive temporal dynamics in people's behaviors, thoughts and feelings rather than just nuisance variance. This does not even require that the direction (or presence) of causality in

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such associations be clear: merely the presence of meaningful links would support personality variance being context-relevant.

Indeed, there is evidence for variability in personality states within individuals being meaningfully linked with non-personality variables such as situational characteristics. For example, Fleeson (2007) found a number of associations between variability in Emotional Stability, Extraversion, Agreeableness and Conscientiousness on one hand and several situational features (anonymity, task orientation, other's social status, friendliness) on the other. Likewise, Sherman et al. (2015) reported a number of meaningful links between concurrent situational features and personality states, over and above individual differences in typical state levels and situational experiences. For instance, people tended to report higher levels of Conscientiousness and lower levels of Honesty, relative to their typical levels of these characteristics, in situations that called for dutiful behavior or involved deception, respectively. In a similar vein, workplace experiences and demands have been linked with fluctuations in personality states (Huang & Ryan, 2011; Minbashian, Wood, & Beckmann, 2010), as have been goals (McCabe & Fleeson, 2012) and social roles (Bleidorn, 2009). Wichers et al. (2012) studied time-series data on positive and negative affect in relation to changes in physical activity in a relatively large sample of female twins. They reported that increases in physical activity were associated with subsequent levels of positive affect, but not with negative affect. Consistent findings have been reported in other studies (Bossmann, Kanning, Koudela-Hamila, Hey, & Ebner-Priemer, 2013; Feuerhahn, Sonnentag, & Woll, 2014; Kanning, Ebner-Priemer, & Schlicht, 2013), but not all (Kühnhausen, Leonhardt, Dirk, & Schmiedek, 2013).

To the extent that physical activity is linked to positive affect, it seems possible that it is also associated with other manifestations of personality that vary within individuals—possibly excluding negative affective states (Wichers et al., 2012). For example, one study reported associations between activity and feeling less tired and more energetic (Dunton et al., 2014). It is also conceivable that activity and exercising are linked to the personality manifestations subsumed under the domain of Conscientiousness, as the association exists at the level of between-individual differences (Rhodes & Smith, 2006). For instance, relatively lower levels of self-discipline may contribute towards postponing a gym visit or, in contrast, completing a workout may help to feel more achieved and disciplined than usual.

Based on this rationale, the present study sought to investigate links between personality states from three Five-Factor Model (FFM; McCrae & John, 1992) personality domains, Neuroticism, Extraversion and Conscientiousness, and self-reported physical exercising at the levels of within- and between-individual variability. These three domains were selected because they have been most consistently linked with physical exercise at the level of between-individual variance (Rhodes & Smith, 2006). Although the two levels of analyses can often yield very different results (Kanning et al., 2013; Kievit, Frankenhuis, Waldorp, & Borsboom, 2013), expecting some isomorphism across them seems a sensible starting point. In addition to domain scores, facets of the domains (operationalized as single items) were considered, because many associations between personality characteristics and non-personality variables are facet- or item-specific, and when this happens the associations should arguably be interpreted exactly at this level (Mõttus, 2016; Mõttus et al., 2015; Vainik, Mõttus, Allik, Esko, & Realo, 2015). To the extent that associations between personality states and physical exercising could be identified, this would contribute towards establishing within-individual variability in personality characteristics as something reflecting veridical, context-relevant processes rather than just, for example, measurement error or some stochastic, epiphenomenal processes. Naturally, the associations could also be of substantive interest. For instance, they could elucidate our understanding of the very nature of personality variance or inform attempts to raise individuals' activity levels.

The present study is based on two independent samples, which allowed us to cross-validate the findings. In the second sample, participants also reported on how much they had been walking or cycling, in addition to exercising, which allowed us to test the generalizability of personality-physical activity associations beyond exercising (which is something that mostly happens once a day at most) to other and likely more common forms of activity.

2. Method

2.1. Participants

Sample 1 consisted of 26 people (14 females, 8 males, for 4 sex was unknown) who provided 1323 observations (*N*) in total. Participants' ages ranged from 21 to 58 (mean [*M*] = 33.00; standard deviation [*SD*] = 12.33, for 5 age was unknown). The majority of participants were recruited from among undergraduate and graduate students or their friends, although some participants were recruited from among the participants of another experiment. Participants provided signed informed consent and were told that they could withdraw from the study at any point of time. Participants who requested feedback at the end of study were given information on their personality states which they varied the most in.

Sample 2 consisted of 62 people (36 females, 26 males) who provided 2193 observations in total. Participants' ages ranged from 18 to 65 (*M* = 22.87; *SD* = 7.45). The participants were recruited by a team of undergraduate students from among the people they knew or could access via other means. Most of the participants were students. Participants provided signed informed consent and were told that they could withdraw from the study at any point of time.

2.2. Materials

2.2.1. Personality states

There exists no established measure for within-individual variability of personality characteristics (personality states). Therefore, one was created by drawing inspiration from the facet-level structure of the NEO Personality Inventories (NEO; McCrae & Costa, 2010). Since the aim was to measure personality states falling within the Neuroticism, Extraversion and Conscientiousness domains of the FFM, a selection of the NEO facets defining these domains were employed as basis for constructing the personality state measure. For example, all Neuroticism facets were covered with a total of seven questions (two questions for the Impulsiveness facet), whereas four (or five in Sample 2) Extraversion facets and four Conscientiousness facets were covered. See Tables 1 and 2 for questions; note that in Sample 2 a question on "friendliness" was added and the wordings of other questions were altered. The instruction asked participants to answer each question based on the time-interval since the previous measurement ("Since the last responding [Question]"). In Sample 2, the full question was shown for the first item ["Since the last responding, how worried have you felt"], whereas for following questions only the variable part of the question was shown in order to have as little text on screen as possible [e.g., " ... organized?" or "... in control of your emotions?"]. The items were responded using a sliding scale with endpoints marked "Not at all" and "Very". The sliding scale recorded values on the scale from 0 to 100.