Conscientiousness predicts diurnal preference

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**Abstract**

The relationship between diurnal preference, as measured by the Horne-Östberg questionnaire, and quantifiable personality traits was investigated in 620 participants. A hierarchical multiple regression demonstrated that conscientiousness was the single biggest predictor of diurnal preference ($\beta = 0.26$), after controlling for depression, sleep disorders, shift work, age, gender, and demographic characteristics. Morningness has previously been associated with physiological parameters of the circadian clock and with polymorphisms in circadian clock genes, suggesting the possibility that conscientiousness, too, may be linked to the same parameters.
Key words

Circadian rhythms
Interindividual differences
Personality
Introduction

Ever since the posthumous publication 40 years ago of the data collected by Blake {Blake, 1967 #2504}, investigators have proposed a link between circadian phenotype, as measured by diurnal preference, and quantifiable personality traits. Two recent publications {Caci, 2004 #2463} {Caci, 2005 #2505} presented evidence that morningness correlates negatively with impulsivity, whereas no correlation was found with venturesomeness. This suggested an involvement of the circadian system in specific facets of an individual's personality. However, various measures of impulsivity are available, and there are considerable discrepancies and disagreements as to what constitutes impulsivity. It is generally agreed, however, that impulsivity is a composite of several higher-order domains of personality {Whiteside, 2001 #2545}.

In the present investigation, we sought to explore further the nature of the previously reported association by assessing the possible link between diurnal preference and a more extensive set of psychometric measures.

Materials and Methods

This investigation complied with the tenets of the Declaration of Helsinki, and had received a favourable opinion from the University of Surrey Ethics Committee. Participants were recruited through advertising and directed towards a website specifically set up for the purpose, where they were presented with the following questionnaires: (1) The Horne-Östberg diurnal preference questionnaire (HÖ) {Horne, 1976 #2167}, (2) the Pittsburgh Sleep Quality Index (PSQI) {Buysse, 1989 #2540}, (3) the depression dimension of the Hospital Anxiety and Depression Scale (HADS), {Zigmond, 1983 #2541}, (4) the impulsiveness subscale of the Impulsiveness-Venturesomeness-Empathy 7 (IVE-7) questionnaire {Eysenck, 1985 #2497}, and (5)
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the Five Factor Inventory (NEO-FFI) questionnaire (Costa, 1992 #2543) which assesses openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. Participants were also asked additional questions in order to determine whether they fulfilled the inclusion/exclusion criteria. Because of age-related changes in HÖ score (Jones, 2007 #2550) the study was limited to subjects below 40 years of age. Participants reporting a chronic illness or medication affecting dopamine and serotonin levels were excluded.

**Results**

Valid responses were obtained from 620 participants [mean age 25.2 ± 5.5 years (standard deviation), 413 females]. Their average HÖ score was 47.9 ± 11.5. A hierarchical multiple regression was undertaken to examine the personality predictors of diurnal preference (Table 1). After controlling for demographic factors (age and gender), levels of sleep disturbance (as determined by the PSQI), depression (HADS), and night shift work, only 1.3% of the variance (β = -0.13) in diurnal preference was explained by impulsivity. On addition of the Big Five to the regression model, a further 7.3% of the variance was explained by conscientiousness, neuroticism, agreeableness, and openness to experience, whereas impulsivity no longer remained a significant predictor. Additionally, conscientiousness was found to be the single biggest predictor of diurnal preference (β = 0.26).

We investigated the relationship between diurnal preference and conscientiousness further by selecting the respective 10% of participants whose conscientiousness scores were the highest and the lowest, and compared the average HÖ scores in these two groups. The high-conscientiousness group had an average HÖ score of 54.5 ± 11.8, and the low-conscientiousness one 43.6 ± 11.1. An independent t
test \( t(122) = 5.31, p < 0.001 \) demonstrated a significant difference between these extreme groups, with the more conscientious group displaying a significantly greater degree of morningness.

**Discussion**

A previous publication has reported that participants high in conscientiousness were more likely to maintain a more morning-oriented schedule {Gray, 2002 #2542}. The current study shows that there is an association based on an actual intrinsic morning preference, rather than extrinsic constraints. Although it would be prudent to validate conclusions based on psychometric questionnaires in future behavioural studies, it is worth noting that the HÖ score as a measure of diurnal preference has itself been validated as a correlate of the timing both of core body temperature and melatonin rhythms {Duffy, 1999 #2144} and of sleep-wake timing {Kerkhof, 1996 #2143} {Taillard, 2004 #2528}.

Although impulsivity was chosen for recent association studies with diurnal preference {Caci, 2005 #2505} {Caci, 2004 #2463}, our findings indicate that conscientiousness would be a dimension of personality more likely to be linked with diurnal preference and thus, by association, with the circadian clock. The other dimensions studied (agreeableness, openness to experience, and neuroticism) contributed to a lesser degree. Because variability in circadian clock genes, including \( CLOCK \) {Katzenberg, 1998 #1613}, \( PER1 \) {Carpen, 2006 #2544}, \( PER2 \) {Toh, 2001 #2085} {Carpen, 2005 #2503}, and \( PER3 \) {Archer, 2003 #2264} has been associated with diurnal preference as measured by the HÖ score, the findings reported here would suggest that variability in these genes may also associate directly with conscientiousness. It remains to be determined whether the link between the circadian
clock and personality traits, which is also supported by reported associations between
clock gene polymorphisms and psychiatric conditions {McClung, 2007 #2551}, is
best described by a pleiotropic action of clock genes outside of the clock itself, or by
an interaction between the circadian oscillator and biological mechanisms specifically
related to personality.

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References
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<th>Personality Trait</th>
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<td>0.148**</td>
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<td>Conscientiousness</td>
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<td>Impulsivity</td>
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<td>-0.033</td>
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($r^2 = 0.18$, $AR^2 = 0.16$, $F = 11.89**$)

* $p<0.05$

** $p<0.01$

Table 1

Hierarchical multiple regression analysis of personality traits as predictors of diurnal preference. In block one, demographics and control variables (sleep disorders, night shift work, and depression) were entered. Block two contained impulsivity scores, and the final block contained each dimension of the Big Five scale of personality.