

Short Communication

Morningness–eveningness, sleep–wake variables and big five personality factors

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Abstract

The aim of this study was to explore associations between chronotype and sleep–wake variables on the one hand and personality on the other in a large and gender balanced sample based on the big five inventory, encompassing the factors extraversion, neuroticism, openness, agreeableness and conscientiousness. 1231 participants (652 female, 579 male) responded to the composite scale of morningness (CSM) as a measure of chronotype and to a short version of the big five inventory (Rammstedt & John, 2007). Morningness correlated positive with agreeableness and conscientiousness, even when controlling for age and when examining gender separately. Neuroticism was related to eveningness only in females and in adolescents (10–17 years). In adults (18–47) only conscientiousness correlated with morningness. Positive correlations existed between agreeableness and conscientiousness and sleep length on weekdays and on weekends. Misalignment correlated significantly negative with agreeableness and conscientiousness but positive with extraversion. © 2008 Elsevier Ltd. All rights reserved.

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1. Introduction

Individuals differ in their circadian typology or diurnal preference and this morningness–eveningness is usually measured on a continuous scale (Natale & Cicogna, 2002), where both ends are viewed in contrasting manner as morning ‘larks’ and evening ‘owls’ (Cavallera & Giudici, 2007). A genetic influence accounts for about 50% percent of the variance in morningness (see, e.g. Hur, 2007) but other factors also have a significant influence, e.g., age, gender, culture and social, and environmental zeitgeber. Adolescents shift from morningness–eveningness during the age of puberty, most obvious around the age of 13 years (e.g. Díaz-Morales, De Leon, & Sorroche, 2007; Randler, 2008b) and back towards morningness at the end of adolescence (Roenneberg et al., 2004). Further, changes exist between young adulthood and the elderly (Kramer, Kerkhof, & Hofman, 1999). Concerning gender, males

are slightly more evening oriented than females (Adan & Natale, 2002; Randler, 2007). Cultural differences exist but are mediated by social, biological and environmental factors or zeitgeber (e.g. Caci et al., 2005a; Randler & Díaz-Morales, 2007; Smith et al., 2002). Concerning cognitive abilities, evening types were more intelligent (Roberts & Kyllonen, 1999), but morning types cope better with early school start times and, in consequence, achieve higher academic scores (Randler & Frech, 2006). Lateralisation in information processing revealed that morning types scored higher in the left-thinking scale and evening types in the right-thinking scale (Fabbri, Antonietti, Giorgetti, Tonetti, & Natale, 2007) and evening orientation was found to be related to the ability of creative thinking (Giampietro & Cavallera, 2007). Additionally, morning types were less pessimistic than evening types (Lewy, 1985) and more satisfied with life (Randler, in press).

Diurnal preferences – or chronotype - have been found to correlate with other personality dimensions (reviews: Cavallera & Giudici, 2007; Kerkhof, 1985; Tankova, Adan, & Buela-Casal, 1994). Previous studies which examined the

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relationship between personality and morningness–eveningness mainly focused on three of Eysenck’s personality dimensions, namely extraversion, neuroticism and psychoticism. For example, Kerkhof (1985) and Tankova et al. (1994) report negative correlations between morningness and extraversion. Higher scores on extraversion corresponds with a greater tendency to eveningness (Adan, 1992; Kerkhof, 1985; Mecacci, Zani, Rocchetti, & Luciola, 1986; Neubauer, 1992). In more detailed analyses of sub-components of extraversion, a negative relationship between morningness and the impulsivity component was found by Neubauer (1992), Caci, Robert, and Boyer (2004), and Caci et al. (2005b) while, in contrast, Larsen (1985), Matthews (1988) and Wilson (1990) supposed an influence of the sociability component on morningness. Larsen (1985) found a negative relationship between sociability and morningness. Matthews (1988) identified both, the impulsivity and the sociability sub-scale of extraversion, as negatively related to morningness in women, while, in men, only impulsivity was related to morningness. Caci et al. (2004, 2005) found the component impulsivity – but not venturesomeness – related to morningness. Also positive correlations between neuroticism and eveningness existed in some studies (Ishihara, Myasita, Inugami, Fukuda, & Myiata, 1987; Mecacci & Rocchetti, 1998; Neubauer, 1992; but see Mecacci et al., 1986 for contrary results). With respect to psychoticism, evening types had higher scores than morning types (Matthews, 1988; Mecacci & Rocchetti, 1998; Mecacci et al., 1986). However, DeYoung, Hasher, Djikic, Criger, and Peterson (2007) state: “the number of null results suggests caution in drawing conclusions” (p. 268).

Recently, Díaz-Morales (2007) using the Millon index of personality styles (MIPS) found that morningness–eveningness orientation was related both to the manner in which individuals seek out, regulate, internalize, and transform information about their environments and themselves (thinking styles), and to the way in which people relate to and negotiate with others in their social spheres (behaving styles).

With respect to sleep–wake variables, no significant correlations emerged between any of the personality variables and any of the sleep duration variables (Soehner, Kennedy, & Monk, 2007). These authors suggest that personality appears to affect certain aspects of the timing of sleep but not of its duration while Gray and Watson (2002) found that conscientious people went to bed and awoke earlier and Gau (2000) reported that junior high school students in Taipei who went to bed later and slept less reported higher neuroticism.

The present study is based on the big five factor model which has become one of the most widely used taxonomy of personality encompassing the five factors extraversion, neuroticism, openness, agreeableness and conscientiousness (Costa & McCrae, 1992). Despite its wide distribution, studies using the big five inventory (BFI) to look at associations with morningness–eveningness are few. For exam-

ple, in a previous study, only agreeableness correlated with morningness in a zero-order correlation (DeYoung et al., 2007) while in another one conscientiousness was the best predictor of chronotype (Hogben, Ellis, Archer, & von Schantz, 2007). Jackson and Gerard (1996) found a higher conscientiousness in morning types and they proposed that conscientiousness rather than extraversion is the dimension that best distinguishes diurnal types. The development of the short scale of the big five inventory (Rammstedt & John, 2007) enabled one to include the questionnaire easily in studies to survey a large sample with more or less balanced gender samples.

2. Methods

2.1. Participants

One thousand two hundred and thirty one German pupils and university students participated in this study. There were 652 women and 579 men. The sample consisted of 923 preadolescents/adolescents aged 10–17 years (431 boys, 492 girls) and of 308 adults (148 men, 160 women). The mean age was 15.76 years ($SD = 4.83$, range = 10–47). Most of the university students attended classes at different times during the day, either morning or afternoon, without having a strict study schedule. The pupils were tested during their normal school schedule which ranged from 7.45 until 13.15. All participants were tested in groups ranging in size from 10 to 40 students; their participation was voluntary and they were not paid. Data collection took place in summer (May–August 2007).

2.2. Measurement instruments

Composite scale of morningness (CSM; Smith, Reilly, & Midkiff, 1989). The CSM is a 13-item scale with a Likert-type response format. Five of the elements of the scale refer to different times of day. The score is obtained summing the items and ranges from 13 (extreme eveningness) to 55 (extreme morningness). The German version of the CSM is a good and valid instrument (Randler, 2008a; *in press*) and the transcultural validity of the CSM has been well established (Caci et al., 2005a; Randler & Díaz-Morales, 2007; Smith et al., 2002). The CSM’s Alpha Cronbach coefficient for the present sample was 0.86 (internal consistency) and the range of inter-item correlations (homogeneity) was from 0.11 to 0.77 (Mean: 0.33). I have used slightly different scales for (school) pupils and university students, for example used the German “du” for “you” in pupils and “sie” for “you” in adults and asked for class test (in pupils) versus exams (in students). However, the scales are comparable.

2.3. Sleep parameters

Students were asked for their usual bed time and rise time during the week and during the weekend. These data

were used to calculate sleep length on weekend and on weekdays, weekend oversleep (difference between sleep length on weekends and on weekdays) and misalignment (difference between rise time on weekend and weekdays; see Wittmann, Dinich, Merrow, & Roenneberg, 2006).

2.4. Short big five inventory (Rammstedt & John, 2007)

To measure personality, I used a short version of the big five inventory provided by Rammstedt and John (2007). These authors provided the scale in English and German, therefore, a translation into German was not necessary. Based on the BFI-44 (Benet-Martinez & John, 1998; John, Donahue, & Kentle, 1991) Rammstedt and John (2007) shortened the BFI-44 scale down to a 10-item questionnaire with two items for each personality dimension (extraversion, agreeableness, openness, neuroticism and conscientiousness). Always one item per dimension is reverse coded. The scale retains significant levels of reliability and validity albeit effect sizes were lower than in the full 44-item version. The BFI-10 always showed a clear five factor structure and correlations with peer-ratings showed good external validity (Rammstedt & John, 2007). As Buri-sch (1997) emphasised, many of the super-short instruments show respectable psychometric characteristics (see Rammstedt & John, 2007). The German scale is simple and easy to understand, using four to eleven words per item (six on average). There is evidence that the big five dimensions begin to be salient and emerge as a coherent, stable and valid self-perceptions already in childhood (Measelle, John, Ablow, Cowan, & Cowan, 2005).

3. Results

Group mean for CSM was 34.87 (SD = 7.00, range = 13–53) and 35.58 (SD = 6.94, range = 13–53) and 32.72 (SD = 6.74, range = 14–51) for adolescents and

adults, respectively. As expected, age correlated significantly negatively with morningness ($r = -0.244$, $p < 0.001$, $N = 1231$). The relationship between morningness–eveningness and personality was calculated first using zero-order Pearson correlations (see Table 1) and second controlling for age via partial correlations. Further, men and women and adolescents/adults were considered separately (Table 1). There were significant positive associations between morningness and agreeableness, and morningness and conscientiousness. These correlations remained significant when controlling for age and when examining gender separately. Extraversion and openness showed no relationship with diurnal preference. Neuroticism was related to eveningness. When considering gender separately, neuroticism was related to eveningness in females only. When splitting of the samples into preadolescents and adolescents (10–17) and adults (18 years and above) the correlation between chronotype and agreeableness remained significant only in the 10–17 years sample but not in adults, while the correlation with conscientiousness remained significant in both samples. Interestingly, the correlation between neuroticism and eveningness was also confirmed in the (pre-)adolescent sample.

Considering sleep variables, there were significant relationships between personality and sleep length on weekdays and on the weekend, and between personality and weekend oversleep and misalignment (Table 2). In detail, significant correlations existed between both agreeableness and conscientiousness on the one hand and sleep length on weekdays on the other suggesting that longer sleep duration is linked with higher agreeableness and conscientiousness. Sleep length on the weekend correlated positively with neuroticism. Weekend oversleep was significantly negatively associated with conscientiousness. Misalignment correlated significantly negatively with agreeableness and conscientiousness but positively with extraversion.

Table 1
Correlations between morningness–eveningness (CSM scores) and personality factors from the big five inventory

		CSM score	CSM score ^a	Male ^a	Female ^a	Adolescents (10–17 years) ^a	Adults (18–47 years) ^a
Extraversion	<i>r</i>	.007	.012	-.052	.071	.029	-.034
	<i>p</i>	.815	.665	.216	.071	.376	.556
	<i>N</i>	1231	1228	576	649	920	305
Agreeableness	<i>r</i>	.130	.112	.094	.132	.105	.040
	<i>p</i>	<.001	.000	.025	.001	.001	.488
	<i>N</i>	1229	1226	574	649	918	305
Conscientiousness	<i>r</i>	.336	.368	.342	.412	.370	.289
	<i>p</i>	<.001	.000	.000	.000	<.001	<.001
	<i>N</i>	1229	1226	574	649	919	304
Neuroticism	<i>r</i>	-.069	-.057	-.043	-.079	-.073	-.012
	<i>p</i>	.016	.046	.304	.044	.027	.831
	<i>N</i>	1229	1226	575	648	918	305
Openness	<i>r</i>	.020	.032	-.007	.070	.038	.007
	<i>p</i>	.487	.265	.868	.073	.253	.908
	<i>N</i>	1229	1226	575	648	918	305

^a Correlations were based on partial correlation with age as covariate. CSM = composite scale of morningness.

Table 2
Correlations between sleep–wake variables and factors of the big five inventory

		Sleep length on weekdays	Sleep length on weekends	Weekend oversleep	Misalignment
Extraversion	<i>r</i>	-.031	-.056	-.039	.060
	<i>p</i>	.315	.076	.221	.035
	<i>N</i>	1040	1005	1001	1215
Agreeableness	<i>r</i>	.096	.133	.068	-.074
	<i>p</i>	.002	.000	.031	.010
	<i>N</i>	1038	1003	999	1213
Conscientiousness	<i>r</i>	.227	.062	-.084	-.226
	<i>p</i>	.000	.048	.008	.000
	<i>N</i>	1039	1004	1000	1213
Neuroticism	<i>r</i>	.020	.066	.055	.031
	<i>p</i>	.514	.036	.081	.280
	<i>N</i>	1038	1003	999	1213
Openness	<i>r</i>	.003	-.030	-.031	-.050
	<i>p</i>	.927	.336	.329	.083
	<i>N</i>	1038	1003	999	1213

All correlations were carried out using age as covariate. Misalignment was computed by subtracting rise time on week days from rise time on weekends, i.e. difference in rise times.

4. Discussion

Research in the area of personality and chronotype has focused mainly on neuroticism or extraversion, or sub-components of the latter. In this study, further evidence for a link between personality dimensions and chronotype and sleep variables is provided. Agreeableness was found to correlate positively with morningness, a finding that has been previously proposed by DeYoung et al. (2007). However, in the present study conscientiousness correlated even higher with morningness than agreeableness, which is in accordance with the study of Jackson and Gerard (1996); but contra to DeYoung et al. (2007). Jackson and Gerard (1996) found a higher conscientiousness in morning types and they proposed that conscientiousness rather than extraversion is the dimension that best distinguishes diurnal types. Neither DeYoung et al. (2007) nor Jackson and Gerard (1996) nor the present study found an association between extraversion and diurnal preference using versions of the BFI. However, studies focusing on the EPI revealed associations between extraversion and chronotype, namely a higher extraversion in evening types (Adan, 1992; Kerkhof, 1985; Mecacci et al., 1986; Neubauer, 1992). One aspect of these contrasting results may lie in the nature of the different questionnaires. It is more or less speculative but as the MEQ and CSM have some items in common (Smith et al., 1989) and both correlated highly with each other (e.g. Randler, 2008a) the differences may lie in the instruments for personality assessment. DeYoung et al. (2007) suggested that previous findings of a relationship between eveningness and extraversion may have resulted from the conflation of impulsivity and extraversion inherent in Eysenck's original model, prior to his addi-

tion of psychoticism (DeYoung et al., 2007; Tankova et al., 1994; p. 273).

Neuroticism was related to eveningness in females but not in males and in adolescents aged 10–17 years. Positive correlations between neuroticism and eveningness were also found in some studies (e.g. Mecacci & Rocchetti, 1998; Neubauer, 1992). Neubauer (1992) had a mostly female sample (71%) and his results fit with those of the present study while Mecacci et al. (1986) reported a negative correlation between neuroticism and morningness only in male respondents but not in females. More interestingly, Mecacci et al. (1986) found an even higher neuroticism score in morning types, providing contrary results. Neubauer (1992) further suggested that the relationship between neuroticism and eveningness seems related to the specific nature of the questionnaire (MEQ). However, using the CSM revealed similar results (both CSM and MEQ have some questions in common, see Smith et al., 1989). As a consequence, the association between gender, chronotype and neuroticism deserves further research. One aspect may be the link between the metatrait stability (as proposed by DeYoung et al., 2007) and morningness–eveningness that is consistent with a neurobiological model that posits individual differences in serotonergic function as a primary source of stability as a trait (DeYoung, 2006; DeYoung, Peterson, & Higgins, 2002). As serotonin is strongly involved in the modulation of circadian rhythm in the SCN (Yuan, Lin, Zheng, & Sehgal, 2005) these differences in serotonergic function may be reflected in circadian rhythms, and, hence, also in personality.

Concerning sleep–wake variables, evidence in previous studies is mixed (e.g. Gau, 2000; Gray & Watson, 2002; Soehner et al. 2007). The significant correlations between both agreeableness and conscientiousness on the one hand and sleep length on weekdays on the other suggest that longer sleep duration may lead to higher agreeableness and conscientiousness. However, the correlational evidence does not support causal inferences, which is a limitation of the study. On the other hand, conscientiousness could also lead to longer sleep because conscientious individuals might meticulously pay more attention to retiring and rising times. The relationship between neuroticism and sleep length (see Gau, 2000) could not be confirmed in the present study (see also Soehner et al., 2007), moreover, an association between sleep length on the weekend and neuroticism emerged which is in contrast to Gau (2000). In keeping with Gau (2000), “the complicated nature of the sleep–wake cycle, sleep disturbance, sleep habits, and neurotic characteristics, which interact with biological and environmental factors, make the inference for causal relationship even more difficult” (Gau, 2000, p. 7).

Misalignment, i.e. the difference in wake-up times between weekdays and weekends, was negatively associated with both agreeableness and conscientiousness, suggesting that this difference – which could be considered as the difference between “individual (or biological) time”

and “social time” (Wittmann et al., 2006) – is lower in conscientious and agreeable persons which make them better able to fit into social demands of our society. Morning people cope more easily with early morning schedules because their misalignment is lower, while evening types have difficulties coping with early schedules which may lead to a lower agreeableness. Further, people with a higher misalignment showed higher extraversion scores.

The weakest relationships existed between weekend oversleep and personality. This was an expected result since weekend oversleep compensates for sleep loss during the week. However, as weekend oversleep was negatively associated with conscientiousness one may speculate that conscientious people may pay more attention towards their bed and wake times and may therefore show less oversleep. As a cautionary note it should be mentioned that age is a variable that significantly influences morningness–eveningness and age should be imposed as a covariate, except in study populations that possess a small variance in age (as, e.g. in Adan & Natale, 2002). As a conclusion, the paper contributes to the knowledge about the relationship between circadian types and personality. Future work should further investigate different age classes and explore the genetic basis of these traits.

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