# PSYCHOLOGICAL CORRELATES OF SLEEP-WAKE PATTERN

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## Abstract

The 40-items of sleep-wake pattern (SWP) questionnaire were selected among the short statements of a former 200 items list using statistical procedures (Putilov, 1990). The analysis of the multivariate structure of the questionnaire revealed 3 scales and 2 subscales which can be labelled as levels of morning ($M$) and evening wakefulness ($E$), quality of sleep ($S$), capacities to be awake ($w$) and to fall asleep at any time ($f$). High positive scores indicate lateness in the morning or evening on $M$- and $E$-scales, good sleep on $S$-scale and high capacities to change time of sleep or wakefulness on $f$- and $w$-subscales. The age- and sex-related variability of the questionnaire scores was studied in a town population (2000 males and 2126 females aged 9 to 79 years). All scale and subscale scores are near zero in the thirties, higher in younger and lower in older age, and in all age groups females show lower adaptability of sleep-wake cycle (higher $M$- and lower $E$-, $S$- $w$-, $f$-scores).

To investigate relations between chronobiological and psychological dimensions, the SWP questionnaire, Cattell's 16PP Questionnaire, the Rotter 1-E Scale, and Raven's Progressive Matrices were administered to 255 men and 77 women aged 24 to 40 years (averaged 32.0 ± 0.1). Moderate, but significant ($p < 0.001$) correlations were found between SWP scores and 9 Cattellian first ordrr personality factors as well as with 4 of 5 computed second order factors ('big five'). Higher 'Exvia' ($g$/), 'Cortertia' ($QW$), and Independence $(QIV)$, and lower Anxiety ($QII$) and Sociopathy $(QV)$ were associated with higher adaptability of sleep-wake cycle. Only the $E$-component of momingness-eveningness was positively correlated with $QI$, while the M-component correlated negatively with $QI$ and positively with $QII$ and $QV$. We hypothesized , that the findings of other authors on relations between personality and diurnal type are often inconsistent because they conceptualize momingness-eveningness as a unitary construct.

***Key words:*** multidimensional questionnaire, sleep-wake cycle, diurnal type, psychological correlates of sleep-wake pattern, chronobiological and personality dimensions

## Introduction

The momingness-eveningness preference has received much attention since the publication of an English version of Ostberg's questionnaire (Home & Ostbcrg, 1976). This and the majority of other chronobiological questionnaires have concentrated on differences in phases of circadian rhythm and have distinguished between morning and evening types. Only Folkard, Monk, and Lobban (1979) have published the questionnaire to distinguish people whose circadian rhythms can adjust to night work on basis of more than one characteristic namely, morningness, flexibility of sleep habits, and ability to overcome drowsiness. Later Putilov (1990) presented a questionnaire for the multidimensional assessment of individual differences in the pattern of the sleep-wake cycle.

A sleep-wake pattern questionnaire (consisting of 40-items) for the self-assessment of

individual peculiarities and the adaptability of the sleep-wake cycle was constructed by selecting short statements from a former 200-items list using statistical procedures (Putilov, 1990). The analysis of the multivariate structure of the questionnaire revealed 3 scales and 2 subscales which can be defined as levels of morning (*M*) and evening wakefulness (*E*), quality of sleep (*S*), capacities to be awake (*w*) and to fall asleep at anytime (*f*). High positive scores indicate lateness on *M*- and jE-scales, good sleep on 5'-scale, and high ability to sleep or be awake on /- and w-subscales. The age- and sex-related variability of the questionnaire scores was studied in a town population (2000 males and 2126 females aged 9 to 79 years). All scale and subscale scores are near zero in the thirties, higher in younger and lower in older age. In all age groups females differ from males in direction of lower adaptability of the sleep-wake, cycle (higher *M*- and lower *E*-, *w*-, *f*- and S-scores). To validate the questionnaire, several studies were conducted and significant correlates of the scales and subscale scores with basic chronobiological, .psychiatric, physiological, and endocrinological parameters were found.

The diurnal type has been related to personality dimensions. Oquist (1970) investigated the relationships between the morningness-eveningness and the personality factors of Cattell's Sixteen Personality Factor (16PF) Questionnaire and found connections between morningness and schizothymia and between eveningness and cyclothymia (cited by Home & Ostberg, 1977). Morning types attained a lower score on the sensation seeking scale: less tendency to engage in new, exciting or dangerous activity, than evening types. They also attained lower scores on the somatic neuroticism and the self-defensiveness scales, but did not differ from evening types with respect to extraversion, emotionality, and impulsiveness (Kerkhof et al.. 1981).

Neither the Wiggins Introversion Scale of the Minnesota Multiphasic Personality Inventory (MMPI) nor the Rotter Internal-External (I-E) Scale correlated with the Horne-Ostberg scale (Webb & Bonnet, 1978), while Patkai (1971) found morning types selected by her questionnaire to be-negatively correlated with the extra-version scale of the MMPI. No significant differences were found between morning and evening types on the extra-introversion scale of the Eysenck Personality Inventon (EPI) (Home & Ostberg, 1977; Moog, 1980; Torsvall & Akcrstcdt, 1980), but in one of these studies a low significant correlation between diurnal type and neuroticism - less neuroticism in the morning types - was shown (Torsvall & Akerstedt, 1980). In contrast the significant correlations between Horne-Ostberg scale and the extra-introversion scale but not between the Horne-Ostberg scale and neuroticism scale were found in some recent investigations (see, e. g., Adan & Almirall, 1991). Also negative correlation was found by Folkard et al. (1979) between the scores of the *M*-factor (which is concerned with morningness-eveningness in Folkard's questionnaire) and EPI extraversion scores, i. e., there is less extraversion in morning types. Hepburn, Ortiz, & Locksley (1984) found no differences between morning and evening types on any of the traits related to extraversion: outgoing, sociable, impulsive, friendly, introverted. However, Larsen (1985) showed that several measures of extraversion correlate significantly with morningness-eveningness and that the sociability component of extraversion is most responsible for the time-of-day differences.

The Horne-Ostberg Questionnaire has been noticed to be somewhat impure in that it contains several dimensions and questions with low item-total correlations (Wendt, 1977; Moog, Mauke, &.Kittler, 1982; Larsen, 1985; Smith, Reilly, & Midkiff, 1989; Adan & Almirall, 1991). Even for the shortened 7-items version, the rotated factor analysis sorted out the morning and evening items (Torsvall & Akerstedt, 1980).

According to the sleep-wake pattern questionnaire (Putilov, 1990), morningness-eveningness is a combined trait of the sleep-wake cycle. In the very beginning of the process of the SWP questionnaire construction tlie *M*- and *E*-items were identified as rather

independent. Also it was found that w-scores show positive correlation with J'-scores and negative correlation with M-scores.

We hypothesized that the inconsistency between data of different authors on the question whether morningness-eveningness is related to extraversion-introversion may be the result of the complexity not only of the personality trait, but of the chrono-biological trait, too. The main question of the present study is: which personality factors are related to individual differences in sleep-wake pattern and in its adaptability?

## Method

Subjects were students of the Novosibirsk Political High School, 255 men and 77 women aged 24 to 40 years averaging $32 \pm 0.1$. They were asked to complete the sleep-wake pattern questionnaire (Putilov, 1990), Cattell's 16 PF Questionaire, the Rotter I-E Scale, and Raven's Progressive Matrices.

Five second order factors have usually been obtained in the 16 PF (Krug & Johns, 1986; Noller, Law, & Comrey, 1987; Boyle, 1989). These so-called "big five" have been labelled as Exvia or Extraversion *(QI)*, Anxiety (*QII*), Cortertia or Tough Poise *(QIV)*, and Sociopathy or (in terms of its opposite pole) Control. We used the equations provided in 16 PF Handbook for their calculation (Cattell, Eber, & Tatsuoka, 1970

## Results

Neither Raven's Progressive Matrices nor Rotter's scale had significant correlations with SWP scales. At the same time moderate and significant ($p < 0.001$) correlations were found between sleep-wake scales and 9 of the 16 ofCattell's 'first order' factors. A relationship between Intelligence (*B*) and good quality of night sleep (+*S*) was observed. Factor *C* (Ego Strength/Stability) was associated with highvcapacity to be awake at any time (+*w*), high level of morning wakefulness (-*M*), and good sleep *(+S)*. Dominance *(E)* was connected with capacity to fall asleep at any time (+*f*) and high level of evening wakefulness (+*E*). Factor *G* (Super Ego/Conscientious) showed a link with good sleep (+*S*) and high level of morning wakefulness (-*M*). Factor *H* (Parima/Boldness) was related to high level of morning wakefulness (-M). Factor *L* (Pretension/Suspicious) correlated with high capacity, to fall asleep at any time (+/), while Guilt Proneness (*Q*) correlated with low capacity to be awake at any time (+w). Self-Sentiment (*Q*3) could predict high level of morning wakefulness (-*M*), whereas Ergic Tension (*Q*4) predicted low level of morning wakefulness (+*M*), low capacity to fall asleep at any time (-*f*), and bad night sleep (-*S*). Lower, but also significant *(p < 0.05)* correlations were found for all oilier 'first order' factors. Chrono-biological traits correlated moderately and significantly *(p < 0.001)* with 4 of 5 computed 'second order' factors, the so called 'big five'. High scores on 'second order' factors such as Exvia/Invia (0/), 'Cortertia/Pathemia' (Tough Poise) (*QIII*), Independence *(QIV)*, and Control *(QV)* and low scores on Anxiety *{QII)* could predict high adaptive ability of the sleep-wake cycle (low *M-* - and high *E-, w-, f-* and *S*-scores). Extravcrsion *{QI)* was associated with some predictors to success of adjustments to night and shift work: capacities to fall asleep at any time (+*f*) *(p < 0.01)*, to be cheerful in the morning (-M) *(p < 0.05)*. and, especially, to be cheerful in the evening and to prolong wakefulness on night hours (+*E*) *(p < 0.01)*. Tough-Mindedness (*QIII*) related weakly to three such predictors: good quality of night sleep (+*S*) *(p < 0.01)*, high capacity to fall asleep at any time (+*f*) *(p < 0.01)*, and high level of evening wakefulness (+*E*) *(p < 0.05)*. Independence *{QIV)* showed a link with high capacity to fall asleep at any time (+*f*) *(p < 0.001)*. Control/Superego (low Sociopathy) (0V) was connected with high level of morning wakefulness (-*M*) *(p < 0.001)* and good sleep *(+S)* *(p < 0.001)*. The lower

Anxiety *{QII)* corresponded to the higher level of morning wakefulness (-*M*) *(p < 0.001)*, the higher quality of sleep (+*S*) *(p < 0.001)* and the higher capacity to be awake at any time (+*w*) *(p < 0.001)*.

## Conclusions

The findings show that there are some correlation between personality traits and the sleep-wake pattern. Indicators of the lability of the nervous and vegetative system such as extraversion, anxiety, cortertia, independence, and sociopathy were shown to be related to adaptive capacities of sleep-wake cycle.

We found a positive relation of extraversion to evening component of morningness-eveningness and an inverse relation of extraversion to the morning component of morningness-eveningness. Hence, individuals with high extraversion scores have high *E*- and low *M*-scores (late to bed, early rise) and persons with low extraversion scores have low *E*- and high *M*-scores (early to bed, late rise). This result is in full agreement with the observation by Hartrnann, Baekeland, and Zwilling (1972) that there are higher extraversion scores for short sleepers compared to long sleepers. The contradictions between authors who used different diurnal type questionnaires (Patkai, 1971; Home & Ostberg, 1977; Wcbb & Bonnet, 1978; Folkard ct al., 1979; Moog, 1980; Torsvall & Akerstcdt, 1980; Hepburn et al., 1984) with respect to the relation between morning/eveningness and extra/introversion may be the result of the non-unitary constructs, not only oftlic personally trait (Lorscn, 1985), but-also of the chrono-biological trait.

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