PERGAMON

Morningness–eveningness across two student generations: would two decades make a difference?

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Abstract

The majority of morningness–eveningness questionnaires measure differences in preferred time of various daily activities. This study measured differences in actual habits during a 24-h period by means of the Student Morningness–Eveningness Questionnaire (SMEQ) developed by [Šverko, B., Vidaček, S., & Kaliterna, L.J. (1979)]. Osobine ličnosti I svakodnevne navike života [Personality characteristics and daily habits]. *Revija za psihologiju, 9*, 49–58.). Data on actual daily habits were collected in the 1998 student generation ($n = 189$) and compared to those of the generation examined in 1977 ($n = 128$) that were published by Šverko et al. (1979). The aims of the study were to examine psychometric properties of the SMEQ as well as to see if two student generations, 21 years apart, differed in their results on the questionnaire. Cronbach alpha coefficients were identical for both generations (0.77). Discrimination value of the items has not changed significantly, except on four questions. The results on the SMEQ were distributed normally in both generations and no significant differences were found between the mean values of the two groups. The results of the study testify to a high stability of the SMEQ as well as to stability of the morningness–eveningness dimension across two generations. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Individual differences in morningness–eveningness can be measured by asking the participants about their preferred or actual habits during a 24-h period. Both preferred and actual habits should reflect differences in phase of endogenously determined circadian rhythms of morning and

evening persons. Systematic empirical research of morningness–eveningness started three decades after the first review of the subject was published by Kleitman (1939). Research was performed in the early seventies in Sweden. In 1976 Horne and Östberg published the English version of the Morningness–Eveningness Questionnaire (MEQ). Since then several new or modified questionnaires have been developed or translated into different languages (e.g. Croatian, Dutch, German, Italian, Japanese, Korean, Portuguese, Spanish, Swedish, and Thai).

The first morningness–eveningness questionnaire in Croatian was developed a year after Horne and Östberg (1976) published the MEQ. Vidaček, Šverko and Miljević (1977) used the newly developed questionnaire to examine the relationship between introversion–extraversion and morningness–eveningness. Two years later Šverko, Vidaček and Kaliterna (1979) published the final version of the questionnaire, named the Student Morningness–Eveningness Questionnaire (SMEQ), along with its psychometric properties.

The same year that the SMEQ was published Folkard, Monk and Lobban published the Circadian Type Questionnaire - CTQ (1979) whose analysis indicated the existence of a factor that was labelled as "Morningness". In 1980 Torsvall and Åkerstedt published the English translation of the Diurnal Type Scale (DTS). A year later Moog (1981) published the psychometric properties of the Marburger Questionnaire, the morningness–eveningness questionnaire in German. In 1989 Smith, Reilly and Midkiff published the Composite Scale of Morningness (CSM) combining the items from the MEQ and the DTS. Four years later Brown (1993) simplified the CSM at elementary school reading level into the Basic Language Morningness Scale (BALM). Vidaček and Radošević-Vidaček (2001) have recently developed the Adult Morningness–Eveningness Questionnaire (AMEQ), which emerged from a questionnaire for a shiftwork population developed by Vidaček, Kaliterna and Radošević-Vidaček (1985).

The published scales differ in the way the authors chose to search for the morningness–eveningness dimension. The MEQ comprises 19 questions, of which five refer to actual behaviour while 14 refer to preferred behaviour or behaviour under specified hypothetical circumstances. The DTS measures the actual behaviour by three, and the preferred behaviour by four questions. The CSM is composed of five items that measure actual behaviour, seven that measure the preferred behaviour and one item that calls for self-classification into a circadian type. The BALM, however, measures the preferred behaviour by 11 questions and the remaining two questions consider the behaviour under hypothetical circumstances. The AMEQ comprises 15 questions on both actual and preferred daily habits on working and free days.

The approach to measuring individual differences in morningness–eveningness also depends on the population in question. It has been demonstrated that engagement in an occupation, which results in a more constraining way of life, shifts scores on the morningness–eveningness questionnaires towards morningness (Mecacci & Zani, 1983; Park, Matsumoto, Sheo, Shinkoda & Park, 1997; Šverko & Fabulić, 1985). In a working population a significant part of a 24-h day is defined by the fixed working schedule. Therefore, some daily habits are more a consequence of that schedule than of preferences in accordance with one's circadian rhythms. On the other hand, students have relatively more freedom in organising their daily activities. In such a population actual behaviour, rather than preferences or behavioural intentions, could provide more reliable information on morningness–eveningness. The SMEQ is designed to measure morningness–eveningness in a student population, with 11 questions measuring actual behaviour during a 24-h period and one question measuring behaviour in a hypothetical situation.

Psychometric properties of the SMEQ have been established exclusively on the population of psychology students in Zagreb. Šverko et al. (1979) reported internal consistency coefficients of 0.72 and 0.83, with a test–retest stability of 0.76 in a 12-month period. Šverko and Fabulić (1985) examined the stability of the SMEQ on 90 participants in a 7-year period and found the test–retest coefficient of 0.66. They found a statistically significant increment in morningness scores, which was expected as a consequence of engagement in regular professional activities.

Greenwood (1991, 1994, 1995) examined psychometric properties of the DTS, the CSM and the CTQ. The stability coefficients were obtained after 9 months on a group of 35 female college students who engaged in shiftwork after finishing their studies. The author reported a very high stability coefficient of 0.82 for the CSM. The test–retest coefficient of the Morningness scale in the CTQ equalled 0.70 whereas the DTS revealed to be the least stable with a coefficient of 0.48. However, Torsvall and Åkerstedt (1980) reported the stability coefficient of the DTS to be 0.79 on a working sample after a 14-month period. On a group of 74 students Larsen (1985) established a 3-month test–retest coefficient of the MEQ (Horne & Östberg, 1976) that equalled 0.88. On a sample of 48 students Neubauer (1992) obtained a 2-month test–retest coefficient of 0.89 for the MEQ. He also examined a 2-month stability of the Moog's Marburger Questionnaire and obtained coefficients of 0.91 for the SCP (Subjective Circadian Phases) and 0.40 for the PSCP (Perceived Stability of the Circadian Phases) scales. The AMEQ was applied to various populations such as high school students, shiftworkers and day workers. The reported Cronbach alpha reliability of this scale was 0.69, which increased to 0.73 after deleting two items that had low discrimination value (Vidaček & Radošević-Vidaček, 2001). The stability of the AMEQ was established on 58 workers in a 9-year period and proved to be 0.61.

High test–retest coefficients obtained in aforementioned studies indicate relative stability of morningness–eveningness dimension. The characteristic of the SMEQ is to measure actual and not preferred daily habits. Two decades from the first administration of the SMEQ students' daily habits could easily have changed having been influenced by educational, political, economic, technological and lifestyle alterations in society. We were curious to find out whether psychometric properties of the questionnaire, as well as the morningness–eveningness dimension in a student population remained the same after a considerably long period of time. The aims of the study were to examine the internal consistency of the Student Morningness–Eveningness Questionnaire and item discrimination after 21 years, and to see if two student generations 21 years apart differed in their results on the questionnaire.

2. Method

2.1. Sample

Participants of the study were 189 psychology students (166 females and 23 males) at the Department of Psychology, University of Zagreb in 1998. The students' age ranged from 18 to 34 with the mode of 20 years. Their results were compared to the results of 128 psychology students (91 females and 37 males) that were studying at the same university in 1977. The age of the students in 1977 ranged from 19 to 39 with the mode of 21 years. The results of the generation

examined in 1977 were published in Šverko et al. (1979). In both generations the total population of Zagreb psychology students was examined with the exception of a few students who were not present at the lectures on the day of testing.

After a 21-year period the age and sex structure of psychology students has changed. There were significantly more female students in the 1998 generation than in 1977, $\chi^2(1, n = 317) = 13.89$, $P < 0.001$. Furthermore, there were fewer older students in 1998 than in 1977 (Kolmogorov-Smirnov $Z = 2.12$, $P < 0.001$), which could be attributed to more rigorous rules that regulate the study duration.

2.2. Procedure

Participants answered the SMEQ in a group testing procedure during psychology classes. For the 1977 generation the questionnaire was administered in April and for the 1998 generation in May, June and November.

2.3. Student Morningness–Eveningness Questionnaire (SMEQ)

The SMEQ comprises 12 questions on daily habits and usual behaviour. In seven questions participants are supposed to state the time when they usually perform certain activities. The remaining five questions are multiple choice type with three or four alternatives. Responses are scored 0, 1 and 2. Total score is calculated by summing the scores on each question. Total score of 0 indicates extreme morningness and a total score of 24 indicates extreme eveningness. The authors have chosen this direction of scoring since it is less confusing if lower scores denote an earlier phase position, i.e. morningness, and higher scores denote a later phase position, i.e. eveningness. The SMEQ is meant to measure a single dimension ranging from extreme morningness to extreme eveningness that is continuously and normally distributed. The cut off scores identifying the "circadian types" could arbitrarily be determined on the basis of either z-scores or percentiles.

The characteristics of the response distribution on some questions required minor modifications of the scoring key proposed by Šverko et al. (1979). In questions where participants stated the exact time of a specific activity, time slots had to be defined more precisely since the responses like "7:25" or "23:45" were not covered by the original scoring key. In the first, sixth, seventh and twelfth question it was necessary to broaden the time intervals for certain scores so that the scoring key could cover all the responses. None of those modifications changed the scoring of the results obtained in 1977. The English translation of the SMEQ with the modified scoring key is given in Table 1.

3. Results

The results were analysed with SPSS 7 statistical package. In order to enable comparison between generations, data gathered in 1977 were also entered into a computer and the same analyses were performed as for the 1998 generation.

Table 1
The English translation of the SMEQ with modified scoring key[a,b]

Item	Scoring
1. At what time do you usually wake up in the morning? _____	0 (05:00–07:29)
	1 (07:30–08:59)
	2 (09:00–14:00)
2. How do you usually wake up?	
a. As a rule on my own	0
b. Usually on my own	1
c. Usually by alarm clock, member of family etc.	2
d. As a rule by alarm clock, member of family etc.	2
3. Do you have difficulty getting up after awakening?	
a. Never. I get up easily immediately after awakening.	0
b. Sometimes I have difficulty and need to stay in bed a little longer.	1
c. I always have difficulty and usually stay in bed for a while.	2
4. How long does it take you to become wide awake in the morning?	
a. A few moments	0
b. Less than 5 minutes	1
c. 5 to 10 minutes	1
d. 10 to 30 minutes	2
e. More than 30 minutes	2
5. How is your appetite in the morning (during the first hour after awakening)?	
a. Good. I enjoy my breakfast.	0
b. Fairly good. I can have some breakfast but not much.	1
c. Poor. I generally do not feel like having breakfast.	2
6. At what time do you usually take your first meal? _____	0 (07:00–08:59)
	1 (09:00–10:59)
	2 (11:00–16:00)
7. At what time do you usually take your last meal in the day? _____	0 (14:00–19:29)
	1 (19:30–21:59)
	2 (22:00–01:00)
8. At what time in the evening do you usually start feeling tired and sleepy? _____	0 (18:00–22:29)
	1 (22:30–23:59)
	2 (24:00–03:00)
9. At what time do you usually go to bed? _____	0 (22:00–23:59)
	1 (24:00–24:59)
	2 (01:00–03:30)
10. If you have to stay awake after your usual bed-time, do you find it difficult?	
a. I always find it difficult	0
b. I usually find it difficult	0
c. I usually do not find it difficult	1
d. I never find it difficult	2
11. At what time of day can you study or do some work, that requires your full concentration, most easily and successfully?	
a. In the morning (From _____ to _____)	0
b. In the afternoon (From _____ to _____)	1
c. In the evening (From _____ to _____)	2
d. At any time, regardless of the time of day	1
12. State only one hour in the day when you usually feel most alert, most efficient or most successful. _____	0 (07:00–12:59)
	1 (13:00–19:59)
	2 (20:00–01:00)

[a] The questionnaire is administered with the following instructions: This is a short questionnaire regarding your everyday habits. Some questions can be answered by writing the answer in the blank space provided. Other questions can be answered by circling the answer that best describes your usual behaviour. Please do not omit any question and answer each question honestly.

[b] Time is given in hours and minutes (hh:mm) ranging from 01:00 to 24:59

3.1. Scale reliability

Cronbach alpha coefficients were calculated separately for each generation. Both coefficients equalled 0.77. In the context of internal consistency coefficients obtained on the other seven well-known morningness–eveningness scales this value is adequately high (Table 2). As has been mentioned, Šverko et al. (1979) reported the internal consistency reliability coefficient of 0.72 for the generation of 1977. This negligible difference is most probably the result of different statistical techniques used to obtain the internal consistency coefficient (computerised program versus calculation without any technical support).

3.2. Properties of individual items

Inter-item correlations and corrected item-total correlations were calculated. Inter-item correlations were very similar in both generations and had the same mean. In 1977 the inter-item correlations ranged from -0.04 to $+0.64$, with a mean of 0.22. In 1998 correlations between items ranged from -0.14 to $+0.82$, also with a mean of 0.22.

Item-total correlations were used as indicators of discriminatory capacity of items. As can be seen in Table 3 the discrimination value of most of the items has not changed much since 1977. t-Tests showed that the corrected item-total correlations only differed significantly on four items. Those were the way of awaking [$t\ (300) = 2.04$, $P < 0.05$], morning appetite [$t\ (300) = 2.36$, $P < 0.05$], first mealtime [$t\ (300) = 2.94$, $P < 0.01$] and the hour of peak wakefulness [$t\ (300) = 2.00$, $P < 0.05$]. The first and the last one mentioned had lower, while the other two had higher, discrimination values in 1998 than in 1977.

3.3. Morningness–eveningness dimension

The distribution of the results of either generation does not differ significantly from a normal distribution (Kolmogorov–Smirnov $Z_{77} = 0.829$ and Kolmogorov–Smirnov $Z_{98} = 1.129$: Fig. 1). The results in 1977 ranged from three to 21 with $M_{77} = 12.3$ and $S.D._{77} = 4.66$. The results in 1998 ranged from two to 23 with $M_{98} = 13.2$ and $S.D._{98} = 4.51$. t-Test showed no significant difference between the mean values of the two generations [$t\ (315) = 1.66$]. Accordingly, nor did the distributions differ significantly from each other (Kolmogorov–Smirnov $Z = 0.742$).

4. Discussion

It is generally thought that actual behaviour is a more reliable indicator of one's latent characteristics than either preferences or behavioural intentions in hypothetical situations. This principle is applied when measuring individual differences in the phase of circadian rhythms by means of the SMEQ. Unlike other morningness–eveningness questionnaires the SMEQ almost exclusively measures actual daily behaviour. It is considered that actual daily habits are reliable indices of morningness–eveningness in a student population, since their daily behaviour is not significantly constrained by external situational or social demands. In addition, studying individual differences in actual rather than preferred daily behaviour might reveal the practical importance

Table 2
Internal consistency coefficients for eight morningness–eveningness questionnaires

Questionnaire	No. of items	Study	No. of participants	Internal consistency
Morningness–Eveningness Questionnaire (Horne & Östberg, 1976)	19	Posey and Ford, 1981	259	0.89
		Smith et al., 1989	501	0.82
		Neubauer, 1992	113	0.86
		Chelminski, Ferraro, Petros and Plaud, 1997	1617	0.78
		Steele, McNamara, Smith-Coggins and Watson, 1997	2614	0.82
		Roberts and Kyllonen, 1999	420	0.72
Circadian Type Questionnaire — Morningness scale (Folkard et al., 1979)	6	Smith et al., 1989	501	0.26
		Greenwood, 1995	445	0.39
Student Morningness–Eveningness Questionnaire (Šverko et al., 1979)	12	Šverko et al., 1979	128	0.72
				0.83
Diurnal Type Scale (Torsvall & Åkerstedt, 1980)	7	Torsvall and Åkerstedt, 1980	315	0.75
		Smith et al., 1989	501	0.65
		Greenwood, 1991	445	0.29
Marburger Questionnaire (Moog, 1981)	16 SCP	Moog, 1981[a]	135	0.82
	10 PSCP			0.77
	16 SCP		176	0.88
	10 PSCP			0.73
	12 SCP	Neubauer, 1992	113	0.89
	8 PSCP			0.70
Composite Scale of Morningness (Smith et al., 1989)	13	Smith et al., 1989	501	0.87
		Greenwood, 1994	424	0.88
		Guthrie, Ash and Bendapudi, 1995	454	0.90
		Jackson and Gerard, 1996	360	0.86
		Pornpitakpan, 1998	321	0.79
		Roberts and Kyllonen, 1999	420	0.81
Basic Language Morningness Scale (Brown, 1993)	13	Brown, 1993	150	0.88
			150	0.91
		Pornpitakpan, 2000	100	0.79
Adult Morningness–Eveningness Questionnaire (Vidaček & Radošević-Vidaček, 2001)	13	Vidaček and Radošević-Vidaček, 2001	1219	0.73

[a] The number of items included in calculating internal consistency was not explicitly stated in the original paper. The numbers that are given here have been inferred from Table 1 in Moog (1981).

of the phase differences in endogenous circadian rhythms. Namely, endogenous phase differences in circadian rhythms would be of limited practical importance if they were not related to phase differences in actual behaviour. In order to use the SMEQ in such studies its psychometric properties have to be established first.

This study has confirmed that the SMEQ has good psychometric properties in the population of psychology students. Identical values of internal consistency coefficients obtained on two student generations testify to a high stability of the psychometric properties of the scale after 21 years. The mean inter-item correlations were also the same in both generations. Smith et al.

Table 3
Corrected item-total correlations and their ranks in two generations

| Item	r_{77}	Rank$_{77}$	r_{98}	Rank$_{98}$
1. Waking time	0.49	5	0.44	5.5
2. Way of awaking	0.32	10	0.09	12
3. Difficulties getting up	0.33	9	0.38	9
4. Awakening duration	0.36	7.5	0.41	7
5. Morning appetite	0.15	12	0.40	8
6. First meal time	0.36	7.5	0.62	1
7. Last meal time	0.38	6	0.32	10
8. First signs of sleepiness and fatigue	0.50	4	0.52	2
9. Bed time hour	0.62	1	0.48	3
10. Staying awake after usual bed time	0.25	11	0.31	11
11. Period of greatest mental efficiency	0.58	3	0.47	4
12. Hour of peak wakefulness	0.61	2	0.44	5.5
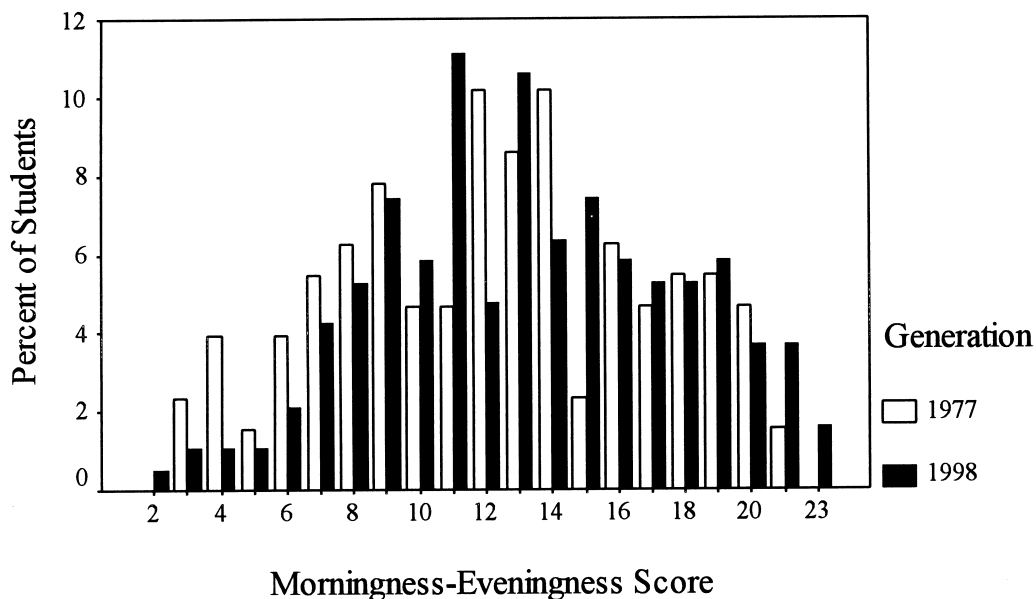
Fig. 1. Distributions of the SMEQ scores in the generations of 1977 and 1998.

(1989) reported similar means of inter-item correlations for the MEQ and DTS (0.20 and 0.21, respectively). Since extremely high as well as invariable inter-item correlations would lower item discrimination the obtained ranges of inter-item correlations are considered to be more evidence of good psychometric properties of the SMEQ. Item discrimination for 1998 remained similar to that for 1977, both in values and ranks. Šverko and Fabulić (1985) obtained similar item discrimination values on a sample of students from the 1977 generation in a retest after 7 years.

Although most of the items in our study have similar discrimination values in both generations, the values of two items increased and another two decreased in comparison to 1977. The item on the way of awakening had a lower and non-significant discrimination value in 1998 than in 1977. In addition, it was very poorly and mostly non-significantly correlated to other scale items with inter-item correlations varying from −0.03 to 0.23. Deleting the item from the scale would have increased the reliability from 0.77 to 0.79. Šverko and Fabulić (1985) reported a similarly low discrimination value of the same item in the sample of employed psychologists. Vidaček and Radošević-Vidaček (2001) found a zero correlation between that item and the total AMEQ score in the overall adult population. Our results of the student generation of 1998 indicate that "way of awakening" is not informative enough to adequately discriminate the morning from the evening types. It has been proposed that morning types have a more limited rising period since their body temperature rises more steeply in the morning hours than is the case with the evening types (Kerkhof, 1985). Our findings do not support the assumption that morning types awake spontaneously more often than the evening types, at least when the observed groups wake up at different times. Maybe if we were to compare the way of awakening at a given time, e.g. 06:00 in the morning, the differences between the extreme groups could be more pronounced. The value of this item should be further explored.

Even though "the hour of peak wakefulness" has also lowered discrimination value in the student generation of 1998 compared to the generation of 1977, its value remained moderately high. Natale and Cicogna (1996) reported the time of greatest mental efficiency to be the most discriminative dimension in categorising the participants into three circadian types — morning, intermediate and evening. Compared to a working or high-school population, university students in Croatia have more freedom in choosing whether to comply with their engagements or not. They have freedom to choose times for studying and other activities that will be synchronised with their rhythm of subjective alertness. Also, most of them do not have any commitments related to child rearing. Therefore, this item may be the most informative on the peak of endogenously regulated alertness rhythm. Other daily behaviours might be influenced by exogenous factors (e.g. schedule of lectures or a part-time job) to a greater extent.

Some studies showed poor discrimination values of the item on morning appetite (Adan & Almirall, 1990; Pornpitakpan, 1998; Vidaček & Radošević-Vidaček, 2001). In our study, the questions on morning appetite and first mealtime discriminated morning from evening persons even better in 1998 than in 1977, justifying their inclusion in the SMEQ. The inconsistency between our results and the results of other studies should be investigated further.

The so far reported data on the distribution of morningness–eveningness are inconsistent even though the majority of the participants in those studies were college students. Some authors reported on negatively asymmetrical distributions that indicated a higher degree of morningness (Greenwood, 1991, 1994; Mecacci & Zani, 1983; Pornpitakpan, 1998). Some others reported on distributions that did not differ from normal (Chelminski et al., 1997; Park et al., 1997; Posey &

Ford, 1981; Smith et al., 1989; Vidaček & Radošević-Vidaček, 2001). Ishihara and his co-workers (as cited in Chelminski et al.) demonstrated a greater tendency towards eveningness in teen age and early adulthood. Our study complies with the studies that give evidence of a normal distribution. The distributions of the results in the SMEQ, both in 1977 and 1998, did not differ significantly from normal, as shown by the Kolmogorov–Smirnov test. The observed distributions of the results in the SMEQ indicated that neither of the groups in this study exhibited a tendency towards the extreme poles of the morningness–eveningness dimension. Even though the sample composition in the two generations differed by sex and age their mean values did not differ significantly. As has been mentioned, morningness increases with age. Chelminski et al. also reported on greater morningness in female students. In our study the student generation of 1998 comprised more female students but of younger age than the student generation of 1977. The interaction of sex and age could have resulted in statistically non-different mean values of the two student generations.

Regarding lifestyle changes in society, the differences between the SMEQ scores of the two student generations might have been expected on at least two major grounds. Habits of social life in young adults have changed in a way that going out in the evening has shifted towards later hours than 20 years ago. Secondly, working hours in Croatia start and finish later than 20 years ago. In the seventies a typical working day would last from 6 or 7 a.m. to 2 or 3 p.m. whereas nowadays it starts between 7 and 9 a.m. and lasts up till 6 p.m. Accordingly, the whole organisation of everyday life in society has been rescheduled to some extent. These changes could have shifted the SMEQ scores towards eveningness; that is, if daily habits of students were predominantly a result of exogenous factors. Our study shows that lifestyle changes in society have not influenced the usual behaviour of psychology students. It seems that their daily habits are influenced more by endogenous than by environmental factors. Therefore, the degree of morningness–eveningness, measured by the SMEQ, proved to be a constant phenomenon for a population of psychology students.

As Greenwood (1995) pointed out, to possess predictive validity an instrument has to have an adequate test–retest reliability, internal consistency and long-term stability. Several earlier studies established good psychometric properties of the SMEQ (Vidaček et al., 1977; Vidaček, Kaliterna, Radošević-Vidaček & Folkard, 1988; Šverko et al., 1979; Šverko & Fabulić, 1985). Vidaček et al. examined the construct validity of the SMEQ measuring 24-h variations of nine variables. The importance of morningness in determining individual differences in the phase of circadian rhythms was explored in relation to extraversion. Morningness was associated with phase differences in subjective alertness, oral temperature and, combined with extraversion, with choice reaction time. Phase differences between morning and evening persons were not statistically significant for other variables in the study (skin conductance, heart rate, performance in vigilance, manual dexterity and simple reaction time tasks). Further exploration of the SMEQ's construct validity is called for.

This study shows that both internal consistency of the SMEQ and item discrimination is very similar 21 years after its construction and first administration. Therefore, actual daily habits have proved to be good indices of morningness–eveningness in a student population. Unchanged distribution and the mean result of the student generation of 1998 in comparison to the generation of 1977 testify to the stability of the morningness–eveningness dimension on a population level.

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