Title:

Circadian preferences in young adults: Psychometric properties and factor structure of the Portuguese version of the Preferences Scale (PS-6)

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Abstract

Morningness is a trait-like variable which has been extensively studied within chronobiology. Despite the number of existing measures to assess morningness, there is a need for brief instruments that are psychometrically sound to be used in applied settings. Accordingly, the modified version of the Preferences Scale (PS-6) comprises six items and was reported to have adequate reliability and satisfactory validity indicators. In this paper, the psychometric properties of the Portuguese version of the PS-6 are reported. A total of 700 students attending medical school were recruited and this sample was randomly divided into two groups. In the first group (n = 352) we assessed the internal consistency calculations and conducted a principal component analysis of the posited structure. In the second group (n = 348) we conducted a confirmatory factor analysis (CFA) using structural equation modelling. Overall, the results indicated that the PS-6 has adequate reliability (α = .75) and is constituted by two components: (I) preferred cognitive activities timings and (II) preferred sleeping-eating timings, respectively. This factorial structure was then verified through CFA. In conclusion, the Portuguese version of the PS seems suitable for use in research and applied settings such as shift work schedules management. However, the applicability of the PS-6 in other samples and further validity indicators should be both investigated. The use of actigraphy and biological measures should be also collected to enhance the robustness of the PS-6.

Keywords: circadian preferences, morningness, eveningness, scale, psychometrics.

Introduction

It is known that circadian rhythmicity is essential for health and well-being. In the chronobiology and chronopsychology domains, morningness has been perhaps the most studied construct (Roenneberg, 2012a). Morningness is a dimension of the chronotype and pertains to the time of day that individuals perform and feel best (Roenneberg, 2012b). Basically, individuals who go to bed and wake up early, and report peak performance in the morning are defined as morningness-type. On the other hand, people who go to bed and wake-up later, and report their performance peak in the afternoon/night period are considered to be evening type (Adan et al., 2012; Roenneberg, 2012a). Most individuals are intermediate or neutral, though a tendency to morningness or eveningness may be present. The literature increasingly suggests morningness is considered a trait comprising a highly heritable load (Roenneberg, 2012b).

The impact of biological rhythms on health and well-being is routinely reported. Shift workers, for instance, constitute a group prone to develop a number of dysfunctions related to rhythms desynchronization (Drake & Wright Jr., 2016). Furthermore, Adan et al. (2012) provided a recent review of the literature on chronotype and well-being. The importance of biological rhythms on humans´ lives suggests the need for chronobiology to develop and/or refine instruments that can accurately assess chronotype. Morningness may be objectively evaluated directly through biological measures such as regular recording of temperature variation, or changes in bio-chemical markers such as melatonin. Alternatively, a number of self-report measures have been developed and the more commonly used instruments were recently reviewed by Di Milia et al. (2013). Self-report tools reveal some advantages over the biological methods since they comprise fewer costs, are non-invasive, and are easy-to use measures (Gomes, 2005).

Over the last few decades, several instruments concerned with chronotype and morningness type have been developed (Adan et al., 2012). One of them is the 12-item Preferences Scale (PS; Smith et al., 2002). The studies which have used the 12-item PS reported good psychometric properties but there has been disagreement pertaining to its factorial compositions is not clear. Studies by Bohle, Tiller and Brown (2001) and Zickar, Russell, Smith, Bohle and Tilley (2002) posited a unifactorial structure, whereas Smith et al. (2002) proposed a two-factor solution.

The PS was also the focus of an investigation by Di Milia (2005) that resulted in a 6-item version of the PS (PS-6) due to the weak measurement properties of some items in the original scale. A strength of the PS is that unlike most self-report measures that refer to timing of activity, the PS-6 makes no reference to timing. A limitation of reference to timing is that activity appears to reflect cultural differences for such behavior and therefore, such measures are not useful in cross cultural research (Caci et al., 2005). Instead, the PS-6 asks participants to consider their preference for activity in terms of much earlier or later compared to other people. The PS-6 is presented as having a two-factor structure and was developed based upon a student sample, and subsequently replicated in a working sample using confirmatory factor analysis. Di Milia (2005) reported the measure had good internal properties and construct validity. A follow up study again demonstrated psychometric robustness of the PS-6 (Di Milia, Wikman, & Smith, 2008).

The utility of the PS-6 (Di Milia, 2005) however, has not been further explored in other cultures and/or work settings. The aim of the present study is to extend the few studies that have employed the PS (Smith et al., 2002) and the PS-6 by testing the psychometric properties of the PS-6 in a sample of Portuguese undergraduate students.

In doing so, this study will assess the relevance of the posited two-factor structure in a new culture.

Materials and Methods

Participants

In total, 700 (from 713) students accepted to take part in this study (461 women; age: *M* = 19.30; *SD* = 1.26; age ranged from 17 to 24). Consistent with the data analytic approach taken by Di Milia (2005) this sample was also randomly divided into two subsamples. For the first study, data from 352 students were considered (235 women; age: *M* = 19.23; *SD* = 1.28). For the second study, data from 348 individuals were analyzed (235 women; age: *M* = 19.38; *SD* = 1.24). Both subsamples were equivalent concerning age [$t_{(697)} = 1.585$; $p = .11$] and gender proportion [*Pearson´s* χ^2 *with Yate´s Continuity Correction* = .183; $p = 669$].

Measures

Preferences Scale (PS). The PS-6 is a self-report measure of morningness (Di Milia, 2005). It comprises 6 items which evaluates two factors: "best prepared" for activity (3 items) and morning activity (3 items). Responses are made using a 5-point Likert scale (1 = *much earlier than most people*; 5 = *much later than most people*). Low scores on the PS-6 denote morningness, whereas higher scores represent more evening preferences. The PS was translated from English into European Portuguese by a psychiatrist (MD / PhD) who has extensive experience in sleep medicine and on the translation of psychological assessment instruments and a psychologist (PhD) with experience in chronobiology. It was then back-translated into English by a bilingual

translator without previous knowledge of the scale and no significant discrepancies with the original English version were found. Overall, the recommended guidelines on translation and adaptation of psychological instruments were followed (Hambleton, 2005).

Procedures

This study was approved by the Ethics Committee and the Scientific Council of the Faculty of Medicine at the University of Coimbra. The professors were initially contacted in order to obtain authorization to administer the questionnaires to the students at the beginning/ending of a class session (out of the evaluation period). The aims of the study were explained to the students and, it was emphasized that their cooperation was voluntary, and confidential. All participants accepted to take part in the study. All ethical requirements to conduct chronobiological studies on human individuals were met (Portaluppi, Smolensky, & Touitou, 2010).

Data Analysis

The data concerning subsample 1 were analyzed with IBM SPSS Statistics™ v.22 for Windows. Means and standard deviations were computed in order to characterize the samples. For subsample 1, internal consistency indices, inter-item correlations, correlation matrices and principal components analysis (PCA) were carried out followed by oblique rotation (Direct Oblimin). For subsample 2, we employed structural equation modeling to run a confirmatory factor analysis (CFA) of the PS-6 with the support of AMOS Graphics™ software v.22. CFA is a hypothesis-testing procedure whose objective is to confirm whether the empirical data fits the theory (Tabachnick & Fidell, 2012; Weston & Gore, 2006). First, we checked univariate skewness and kurtosis,

multivariate kurtosis (Mardia´s D^2 critical ratio and outliers). Maximum Likelihood Estimator Type was used. Several goodness-of-fit indexes were computed and interpreted according to the recommendations of Byrne (2010) and Kline (2005): Chi-square test (χ^2 , ideally it should be not significant); Critical Ratio (χ^2 /df; it should be ≤ 5); Root Mean Square Error of Approximation with its associated 90% confidence interval (RMSEA, it should be ≤ .08); Comparative fit index (CFI, it should be >.90), Goodness-of-Fit Index (GFI, it should be >.90), and Expected Cross-Validation Index (ECVI, the value should be as small as possible).

In order to examine associations among variables Pearson´s correlation coefficients (*r*) were computed. To investigate differences between groups, Student-*t* tests were performed (Field, 2013). The interpretation of effect sizes interpretation was based on Cohen´s *d* guidelines i.e., 0.2 = small; 0.5 = medium; 0.8 = large (Cohen, 1988). Percentiles were also computed to generate normative scores. For all analyses, a *p*-value < .05 was considered to indicate statistical significance.

Results (Study 1)

Descriptive statistics

Regarding the PS-6 total score the overall mean was 17.78 (3.51) [min = 7, max = 30]. Pertaining to results concerning gender (men: *M* = 17.93; *SD* = 3.69 / women: *M* = 17.71; *SD* = 3.43), no differences were observed [$t_{(350)} = .566$; $p = .572$]. No significant association between PS-6 and age was verified ($r = -.01$; $p = .84$).

Internal Consistency

Cronbach alpha for the total scale was .75 which is considered an adequate value (Field, 2013). The corrected item-total correlations ranged from .44 to .58 and this suggested no further improvement to scale reliability (cf. Table 1).

INSERT TABLE 1 HERE

PS-6 factor structure

To study the composition of the PS-6 we followed the statistical procedure employed by Di Milia (2005). First, a PCA with Direct Oblimin rotation was performed given that the two-factor components should be correlated (Field, 2013; Tabachnick & Fidell, 2012). In order to check the suitability of our data to a principal component analysis, various assumptions were verified: adequate sample size in terms of case to item ratio (minimum n=10:1); the majority of correlation coefficients (r) above 0.3, absence of multicollinearity and singularity among variables; Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy = .746 (> .60), and a significant Bartlett's Test of Sphericity [$\chi^2_{(15)} = 554.146$; $p < .001$]. For components´ extraction, we followed three methods: Kaiser´s eigenvalue criterion > 1, Cattell´s Scree Plot and Parallel Analysis. The Parallel Analysis was run through a SPSS syntax file (O'Connor, 2000). Despite its infrequent use, parallel analysis seems to be the more stringent and valid method to extract components / factors (Horn, 1965). All these methods converged to a same factorial solution. Two components were extracted accounting for 65.9 % of the total variance (cf. Table 2). The component I (preferred cognitive activities timings) was constituted by items 1, 3, and 5, whereas component II (preferred sleeping-eating timings) was constituted by the remaining items (i.e., 2, 4, and 6). No cross-loadings were observed and the minimum factor loading was $\lambda = .62$.

INSERT TABLE 2 HERE

Results (Study 2)

Descriptive statistics

The overall mean score for the PS-6 in the second sample was 17.70 (3.53) [min=8, max=30] and again, no gender differences were found (men: M = 17.83; SD = 3.73 / women: M = 17.64; SD = 3.43) [$t_{(346)}$ = .479; p = .63]. A significant association between PS-6 and age was verified (r = .13; p = .01) albeit of small magnitude.

Confirmatory Factor Analysis

Prior to conducting the CFA we confirmed the data were suitable for the analysis. We checked: adequate sample size; absence of significant outliers and multicollinearity, and normality of the data. Our sample size was > 200 which enabled to perform CFA without major concerns, no significant outliers were found and none of the associations of the variables was r > .85. With regard to normality of the data we found that both univariate skewness (*min*: - 0.55 [item 4]; *max*: 0.37 [item 1]) and kurtosis (*min*: - 0.46 [item 3]; *max*: 0.53 [item 6]) were within the normality boundaries frequently considered (i.e., $sk < |3|$ and $ku < |7|$) (Kline, 2005; Weston & Gore, 2006). Multivariate kurtosis was evaluated through the Mardia´s normalized estimate. The obtained value (9.97) was greater than the recommended estimate and this may be considered a slight violation of the multivariate kurtosis (Byrne, 2010; DeCarlo, 1997). Multivariate outliers were evaluated through Mahalanobis Distance statistic (D^2). Possible outliers were identified; however, we decided to retain them in the analysis as

they did not significantly influence the overall results. Two possible solutions were tested using CFA: a unidimensional and a two-factor structure according to the literature. Overall, the unidimensional structure showed a poor goodness-of-fit. In terms of local adjustment, the minimum standardized coefficients path was $\lambda = .47$ (items 4 and 6) being superior to > .40 as recommended by Tabacknick and Fidell (2012). Regarding global adjustment the principal results were: $\chi^2_{(9)} = 78.043$; $p = .00$; χ^2/ df = 8.67; CFI = .86; GFI = .99; RMSEA = .15 [CI 90% = 0.12 – 0.18]; ECVI = .29. On the other hand, the two-factor structure achieved an excellent fit to the data. In terms of local adjustment, the minimum standardized coefficients path was $\lambda = .53$ (item 6) being superior to > .40 as recommended by Tabachnick & Fidell (2012) (cf. Figure 1). Regarding global adjustment the principal results were: $\chi^2_{(8)} = 6.36$; $p = .61$; χ^2/ df = .794; CFI = 1.000; GFI = .994; RMSEA = .000 [CI 90% = 0.000 – 0.054]; ECVI = .093.

INSERT FIGURE 1 HERE

In addition, composite reliability (CR) indices were calculated for PS-6 total score and both factors (i.e., preferred cognitive activities timings and preferred sleeping-eating timings). CR values were .83, .74 and .68, respectively. According to the recommendations, CR > .70 is used as a good indicator of the scale´s reliability (Kline, 2005; Tabachnick & Fidell, 2012). Regarding average variance extracted (AVE) which concerns to a well-known measure of convergent validity related to CFA, the values for PS-6 total score and both factors (i.e., preferred cognitive activities timings and preferred sleeping-eating timings) were .46, .50 and .42, respectively. Despite these values are in general below the cut-off of .50, it is probable that this may be related to the few items that compose each factor (i.e., 3 items) in particular and the overall scale

in general (i.e., 6 items). Even so, another convergent validity evidence is when the CR > AVE which is the case in our study.

Association between PS and its components

The correlation between the total score of the PS-6 and component I and II were r = .82 and r = .84, respectively. As to association between both components the value was r = .39.

Multiple-Groups analysis

In order to check whether the two-factorial structure was invariant for sexes, a multi-group analysis was performed. The unconstrained model (comprising only free parameters) was tested against models with constrained measurement weights ($\Delta\chi^2_{(4)}$ = 1.05; p = .90), structural covariances ($\Delta\chi^2_{(7)}$ = 2.02; p= .96) and measurement residuals ($\Delta\chi^2_{(13)}$ = 4.043; p = .99). The results indicated a non-significant chi-square difference which suggested that the PS-6 structure was equivalent for men and women.

Normative scores for the PS-6

To facilitate the interpretation of the data and assisting the professionals who may use this scale in applied settings, the percentiles are displayed in Table 3. To compute these values, the total sample (N = 700) was considered.

INSERT TABLE 3 HERE

Discussion

The aim of this study was to extend the pioneering work on the PS-6 (Di Milia, 2005) and to assess its suitability in a Portuguese sample of undergraduate students. Several studies in chronobiology use student samples, namely when there is interest in developing or adapting a new measure. The results of our investigation suggest the PS-6 has sound internal consistency and we replicated the posited two-factor structure.

As to internal consistency, we observe that the PS-6 total score and both components show adequate values. The Cronbach´s alphas were quite similar to the ones achieved in the original study. For example, the internal consistency value of the overall PS-6 in the current study is α = .75. In the study by Di Milia (2005) and Di Milia et al. (2008) is α = .73 and α = .71, respectively.

The component analysis indicates that PS-6 comprise two subscales which are in accordance with the study by Smith et al. (2002). In their study the total explained variance was 61%, 43% for component I and 18% for component II. In our study, the total explained variance was 66%, 46% for component I and 20% for component II. In addition, there is a total overlapping in terms of factor loadings in both studies, which add to the robustness of the scale. Comparatively to the original study, we chose to change slightly the components´ labels. Despite the total overlapping of the items with the original study, our component I (i.e., "prefer to take an important 3-hour examination"; "prefer to do some difficult mental work which needed full concentration"; "prefer to have an important interview at which you needed to be at your best") was designated "preferred cognitive activities timings" and not "best prepared for cognitive activity" and the component II (i.e., "prefer to get up"; "prefer to get up if you had a day off and nothing to do"; "prefer to eat breakfast") was designated "preferred sleeping-eating timings" and not "morning activity" (Di Milia, 2005). These

designations seem more appropriate and specific taking into account the content of the items.

The confirmatory analysis shows an almost perfect fit to the posited two-factor structure, which is the proposed structure in the published studies on the scale and in the study 1 of current paper. This two-factor structure was compared against a unifactorial one - as posited by other studies - which exhibited a poor fit to the data.

Interestingly, and in line with some previous published research on chronotypes and circadian preferences, no significant differences concerning sex were found (for a review cf. Gomes (2005). Therefore, the factorial composition of the PS-6 is invariant for gender. Notwithstanding, more recent research have found a significant difference between circadian typology of males and females; men present a more noticeable eveningness preference compared to women (Adan & Natale, 2002; Randler, 2007).

In spite of the encouraging results there are some limitations to be outlined. First, the sample was constituted in its majority by young adults – all attending medical school – with a prevalence of female students, which may not represent the scale´s behavior in other samples. At the same time, Di Milia (2005) replicated the factor structure in a much older and working sample. Second, no measures were used to correlate with PS-6 to examine concurrent validity; it would be relevant to explore the association of the PS-6 with other morningness measures, and third, temporal stability of the PS-6 was not considered. However, in a different university student sample (n = 159) the test-retest reliability coefficient over one month was high (r = .8; p <.001) (data not published).

Future studies should attempt to collect data from more self-report measures and, if possible, using some form of objective measure such as actigraphy and the circadian

melatonin profile. Besides, the factorial structure of the PS-6 should be verified in other populations and in other cultures.

To sum up, the revised 6-item PS appears to be a valid and reliable Portuguese-language measure of circadian preferences, specifically in young adults.

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Declaration of Interest statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

Adan, A., Archer, S. N., Hidalgo, M. P., Di Milia, L., Natale, V., & Randler, C. (2012). Circadian Typology: A Comprehensive Review. *Chronobiology International*, *29*(9), 1153–1175. http://doi.org/10.3109/07420528.2012.719971

Adan, A., & Natale, V. (2002). Gender differences in morningness-eveningness preference. *Chronobiology International*, *19*(4), 709–20. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12182498

Bohle, P., Tilley, A. J., & Brown, S. (2001). Psychometric evaluation of the early/late preferences scale. *Ergonomics*, *44*(10), 887–900. http://doi.org/10.1080/00140130110064694

Byrne, B. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). New York: Routledge.

Caci, H., Adan, A., Bohle, P., Natale, V., Pornpitakpan, C., & Tilley, A. (2005). Transcultural properties of the composite scale of morningness: the relevance of the "morning affect" factor. *Chronobiology International*, *22*(3), 523–40. http://doi.org/10.1081/CBI-200062401

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

DeCarlo, L. (1997). On the meaning and use of kurtosis. *Psychological Methods*, *2*(3), 292–307. Retrieved from http://dx.doi.org/10.1037/1082-989X.2.3.292

Di Milia, L. (2005). A psychometric evaluation and validation of the Preferences Scale. *Chronobiology International*, *22*(4), 679–93. http://doi.org/10.1080/07420520500180454

Di Milia, L., Adan, A., Natale, V., & Randler, C. (2013). Reviewing the psychometric properties of contemporary circadian typology measures. *Chronobiology International*, *30*(10), 1261–71. http://doi.org/10.3109/07420528.2013.817415

Di Milia, L., Wikman, R., & Smith, P. (2008). Additional psychometric evidence and construct validity for a revised Preferences Scale of morningness. *Chronobiology International*, *25*(5), 776–87. http://doi.org/10.1080/07420520802391098

Drake, C., & Wright Jr., K. (2016). Shift work, shift-work disorder, and jet lag. In M. Kryger, T. Roth, & W. Dement (Eds.), *Principles and Practices of Sleep Medicine* (6th ed., pp. 714–725). Philadelphia: Elsevier.

Field, A. (2013). *Discovering Statistics using IBM SPSS Statistics* (4th ed.). London: Sage Publications.

Gomes, A. A. (2005). *Sono, sucesso académico e bem-estar em estudantes universitários*. University of Aveiro.

Hambleton, R. K. (2005). Issues, designs, and technical guidelines for adapting tests

into multiple languages and cultures. In R. K. Hambleton, P. Merenda, & C. Spielberger (Eds.), *Adapting educational and psychological tests for crosscultural assessment* (pp. 3–38). Mahwah, NJ: Lawrence Erlbaum.

Horn, J. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30*(2), 179–185.

Kline, R. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford.

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and velicer's MAP test. *Behavior Research Methods, Instruments, & Computers : A Journal of the Psychonomic Society, Inc*, *32*(3), 396–402. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11029811

Portaluppi, F., Smolensky, M. H., & Touitou, Y. (2010). Ethics and Methods for Biological Rhythm Research on Animals and Human Beings. *Chronobiology International*, *27*(9–10), 1911–1929. http://doi.org/10.3109/07420528.2010.516381

Randler, C. (2007). Gender differences in morningness–eveningness assessed by self-report questionnaires: A meta-analysis. *Personality and Individual Differences*, *43*(7), 1667–1675. http://doi.org/10.1016/j.paid.2007.05.004

Roenneberg, T. (2012a). *Internal Time: Chronotypes, Social Jet Lag, and Why You're So Tired*. Cambridge, Massachussetts: Harvard University Press. Retrieved from https://books.google.com/books?id=HqxHlkg6qHEC&pgis=1

Roenneberg, T. (2012b). What is chronotype? *Sleep and Biological Rhythms*, *10*(2), 75–76. http://doi.org/10.1111/j.1479-8425.2012.00541.x

Smith, C. S., Folkard, S., Schmieder, R. A., Parra, L. F., Spelten, E., Almiral, H., … Tisak, J. (2002). Investigation of morning–evening orientation in six countries

using the preferences scale. *Personality and Individual Differences*, *32*(6), 949–968. http://doi.org/10.1016/S0191-8869(01)00098-8

Tabachnick, B., & Fidell, F. (2012). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson Education.

Weston, R., & Gore, P. A. (2006). A Brief Guide to Structural Equation Modeling. *The Counseling Psychologist*, *34*(5), 719–751. http://doi.org/10.1177/0011000006286345

Zickar, M. J., Russell, S. S., Smith, C. S., Bohle, P., & Tilley, A. J. (2002). Evaluating two morningness scales with item response theory. *Personality and Individual Differences*, *33*(1), 11–24. http://doi.org/10.1016/S0191-8869(01)00131-3

Table 1. Corrected item-total correlations and Cronbach´s alpha if item is excluded

	Corrected item-total correlation	Alpha if item deleted
1. When would you prefer to take an important 3-hour examination?	.534	.717
2. When would you prefer to get up?	.582	.700
3. When would you prefer to do some difficult mental work which needed full concentration?	.495	.725
4. When would you prefer to get up if you had a day off and nothing to do?	.444	.743
5. When would you prefer to have an important interview at which you needed to be at your best?	.485	.727
6. When would you prefer to eat breakfast?	.494	.728

Table 2. Factorial solution for the PS

Items	I	II
1. When would you prefer to take an important 3-hour examination?	.814	
3. When would you prefer to do some difficult mental work which needed full concentration?	.812	
5. When would you prefer to have an important interview at which you needed to be at your best?	.797	
2. When would you prefer to get up?		.900
4. When would you prefer to get up if you had a day off and nothing to do?		.842
6. When would you prefer to eat breakfast?		.628
Cronbach´s alpha	.73	.72
Eigenvalue	2.765	1.194
Variance explained (%)	46.08	19.90
Total variance explained (%)	65.99	

Note. Only component loadings ≥ .30 were considered for Component Matrix.
Extraction Method: Principal Component Analysis; Rotation: Direct Oblimin (Delta = 0).
Component I = preferred cognitive activities timings; Component II = preferred sleeping-eating timings.

Table 3. Percentiles for PS-6 total score

Percentile	Score
5	12
10	13
20	15
30	16
40	17
50	18
60	19
70	20
80	21
90	22
95	24

Note. $N = 700$. No differentiation is made for males and females since no differences were observed [t (698) = .734; p = .46].

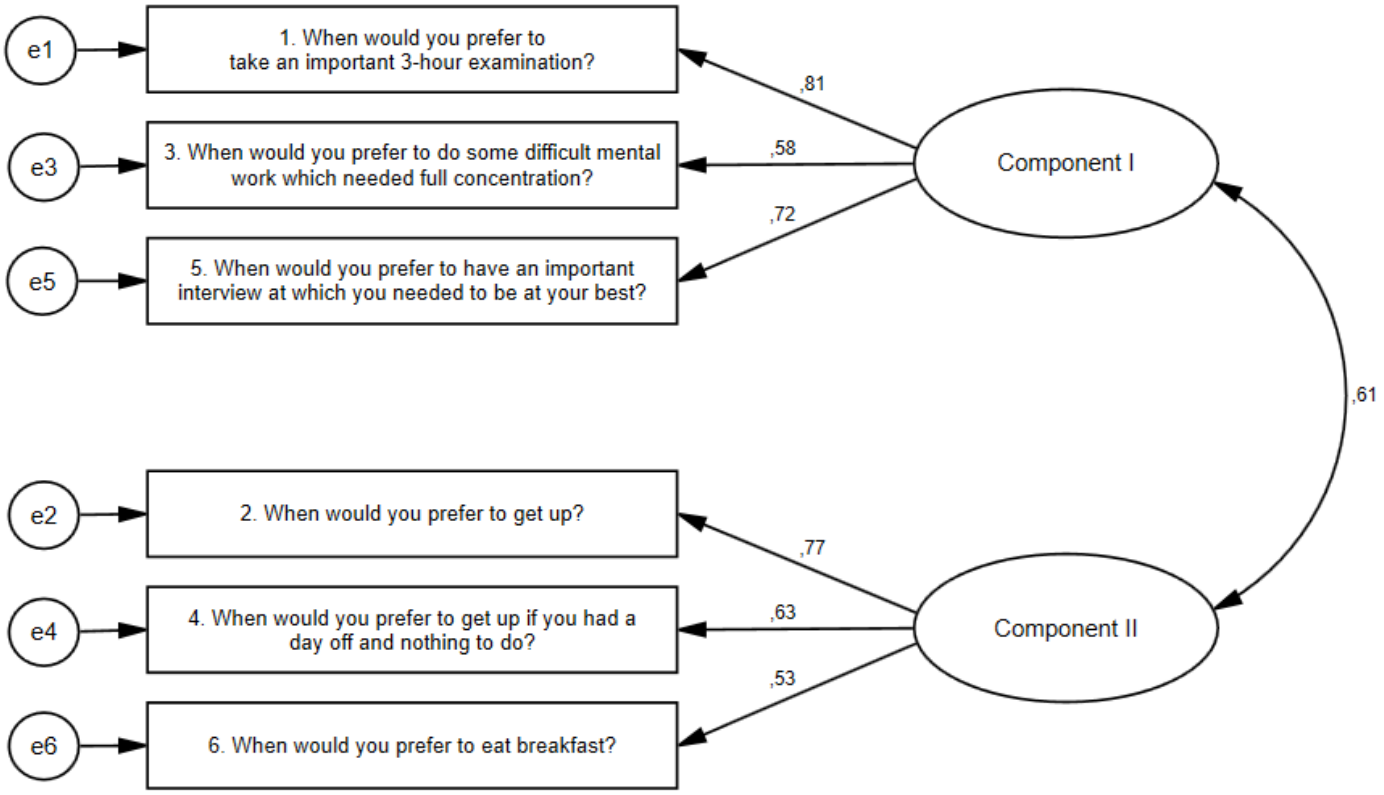

Figure 1. Two-factor structure for PS-6 (N = 348). All paths are statistically significant (p < .001). The standardized coefficients (β) and the measurement errors (e) are displayed. Component I = preferred cognitive activities timings, Component II = preferred sleeping-eating timings.