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Short Communication

Morning or Evening person? Which type are you? Self-assessment of chronotype

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ABSTRACT

A marked individual difference is the morningness–eveningness preference or chronotype. Presenting its high relevance in predicting human behavior, we stress the need to control for this dimension in different studies, suggesting that this can be easily and succinctly done since individuals are aware of their chronotypes. We tested this hypothesis selecting the self-assessment item from the rMEQ scale, demonstrating that the item by itself is capable of classifying individuals in the same category as the score obtained through the original scale.

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1. Introduction

Human beings are, in a general manner, a diurnal species. But inter-individual differences exist, leading people to consistent preferences regarding day- or night-time activities (e.g., Kleitman, 1939). These differences for preferred time of day to be active or to sleep define the morningness–eveningness dimension, or chronotype. Chronotype reflects a somewhat stable personality trait when considering a classification through individuals' morning- and evening-types, being an intermediate-type the most common classification (60–70% of individuals; see Natale & Cicogna, 2002).

Here, we state chronotype's impact on different psychological processes, offering empirical studies a quick way to assess and control for it. A critical analysis of morningness–eveningness dimension measures supports the hypothesis that individuals have self-awareness of their chronotype allowing for its direct assessment with a single item.

1.1. The morningness–eveningness dimension

People differ in how much they are typically morning- or evening-types. Morning-types ("larks") raise early in the morning and go early to bed. Evening-types ("owls") sleep until later, staying up until later hours (Natale & Cicogna, 2002).

Physiological measures corroborate chronotypes, showing that morning-types' body-temperature rises in the morning, whereas evening-types' body temperature rises steadily during day, peaking during middle evening (Horne, Brass & Pettitt, 1980), and morning-types display higher auditory and visual evoked potentials in the morning than in the evening, while evening-types display the opposite tendency (Kerkhof, Korving, Willemse, Geest & Rietvald, 1980).

Chronotype also relates with personality traits. For instance, morning-types are more conscientious and agreeable (e.g. Randler, 2008a), have higher scores in persistence and self-directedness (Adan et al., 2010), are more satisfied with their lives comparing to evening-types (Randler, 2008b), and have higher academic scores (Randler & Frech, 2006).

Given these differences, it is not surprising that chronotypes also differ in their cognitive performances in a time of the day that matches or mismatches their chronotypes. This synchrony effect (May & Hasher, 1998) has been detected in various executive control tasks measuring response inhibition (e.g., Hahn et al., 2012), being inhibitory control greater at optimal times. Research has also shown this synchrony to increase attention to persuasive messages and to promote greater elaboration (e.g. Martin & Martin, 2013), reduce stereotyping (Bodenhausen, 1990), and promote higher working-memory capacity (Rowe, Hasher, & Turcotte, 2009) among others.

1.2. Measurement of morningness–eveningness

Measurement of the morningness–eveningness dimension relies on questionnaires and Likert-scales (Adan et al., 2012), offering continuous

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scorings or classifications in two (morning vs. evening) or three categories (morning, evening and intermediate types; Natale & Cicogna, 2002).

The Morningness–Eveningness Questionnaire (MEQ), was originally developed by Horne & Östberg (1976) and even though the literature showed several attempts to introduce other tools to measure the circadian typology[1] it continues to be the most popular measure, and has shown repeatedly to be a reliable and valid measure of individuals' chronotype (see Adan et al., 2012). The original 19-item version was however considered too long to be applied with other instruments and in settings with time constraints (Burisch, 1997), being reduced to a 5-item version (rMEQ — Adan & Almirall, 1991, see scoring system in Table 1).

The rMEQ has been adapted to several countries being a reliable and valid scale for example in English (Chelminski, et al., 2000), Italian (Natale et al., 2006a), German (Randler, 2008), and Polish (Jankowski, 2012). Most, but not all of these, are pure translations (see, for instance, the Polish adaptation).

Scores on the rMEQ range from 4 to 25, in a low-high morningness continuum, able to be grouped into three chronotypes (Adan & Almirall, 1991): 4–11 as evening-type; 12–17 as neutral-type; and 18–25 as morning-type. These chronotypes have been erroneously understood as representing population criterions. But they are simple cut-off scores arbitrarily chosen. If reference to a population was aimed, individual position on that continuous should be described in reference to a normalization group (Anastasi & Urbina, 1997), which was not made, and differences in gender, age (Kerkhof, 1985) and culture (Tankova, Adan, & Buela-Casal, 1994) should have been reflected in such cut-offs.

Alternatively to arbitrary cut-offs some authors have classified participants regarding their studied samples, contrasting for instance the P_{10} with P_{90} (Natale & Cicogna, 2002) or Q_1 with Q_4 (Randler & Frech, 2006). Additionally, other authors have used scale-scores as reflecting a continuum (Natale & Cicogna, 2002).

1.3. Self-assessment of chronotype

rMEQ's validation studies (e.g., Jankowski, 2013; Randler, 2013; Urbán et. al., 2011), suggest one item (rMEQ-5) to consistently load strongly on its principal factor. The item asks for a Self-assessment of morning/evening-type (see Table 1) and, along with item rMEQ-4, presents an item-total high correlation (e.g., .73; Chelminski et al., 2000). These features suggest the rMEQ-5 to be likely to represent by itself the chronotype dimension, and that chronotype is a conscious dimension.

However, the above conclusion is not without problems. A good item on a scale is not necessarily a good item outside the scale. By being separated from the other set of items, the self-assessment item may lose its power. Peoples' answer to the item might be oriented and primed by all of the information that is previously activated by the other items. Preceding items can make people self-conscious of their chronotype, by making accessible daily contexts and how this variable might influence them. Thus, while isolated, the item might not offer a good measure.

This paper has thus, two empirical aims: to develop a Portuguese version of the rMEQ and to test if chronotype is a dimension able to be self-assessed via one single item. We address this hypothesis studying how rMEQ-5 relates with other items when assessed alone (before other items) or as the last item of the scale.

[1] Examples of other measures: 7-item Diurnal Type Scale (Torsvall & Akerstedt, 1980); 13-item Composite Scale of Morningness (having items from the MEQ and the DTS; Smith, Reilly, & Midkiff, 1989); 7-item short version of the CS (Pornpitakpan, 1998) and its Basic Language Morningness Scale version (Brown, 1993); 12-item Early/Late Preference Scale (Smith, et al., 1993); 19-item Circadian Type Questionnaire (Folkard, Monk, & Lobban, 1979).

Table 1
Reduced morningness–eveningness questionnaire (Portuguese translation between parentheses).

rMEQ-1. Approximately what time would you get up if you were entirely free to plan your day? (Aproximadamente a que horas se levantaria se fosse inteiramente livre para planear o seu dia?)
- [5] 5:00–6:30 AM
- [4] 6:30–7:45 AM
- [3] 7:45–9:45 AM
- [2] 9:45–11:00 AM
- [1] 11:00–12 noon

rMEQ-2. During the first half hour after you wake up in the morning, how do you feel? (Durante a primeira meia hora após acordar de manhã, como se sente?)
- [1] Very-tired (Muito-cansado)
- [2] Fairly-tired (Algo-cansado)
- [3] Fairly-refreshed (Algo-revigorado)
- [4] Very-refreshed (Muito-revigorado)

rMEQ-3. At approximately what time in the evening do you feel tired, and, as a result, in need of sleep? (Aproximadamente a que horas da noite se sente cansado, e, como consequência, a precisar de dormir?)
- [5] 8:00–9:00 PM
- [4] 9:00–10:15 PM
- [3] 10:15–12:45 AM
- [2] 12:45–2:00 AM
- [1] 2:00–3:00 AM

rMEQ-4. At approximately what time of day do you usually feel your best? (Aproximadamente a que horas do dia se costuma sentir no seu melhor?)
- [5] 5–8 AM
- [4] 8–10 AM
- [3] 10 AM–5 PM
- [2] 5–10 PM
- [1] 10 PM–5 AM

rMEQ-5. One hears about "morning-types" and "evening-types." Which one of these types do you consider yourself to be? (É comum ouvirmos falar de tipos de pessoas "nocturnas" e "matutinas"/"matinais". Qual dos seguintes tipos se considera?)
- [6] Definitely a morning-type (Definitivamente uma pessoa "matinal".)
- [4] Rather more a morning-type than an evening-type (Mais uma pessoa "matinal" do que "nocturna")
- [2] Rather more an evening-type than a morning-type (Mais uma pessoa "nocturna" do que "matinal")
- [0] Definitely an evening-type (Definitivamente uma pessoa "nocturna")

2. Method

2.1. Participants and design

134 undergraduates (66.4% females; $M_{Age} = 20.99$; $SD_{Age} = 7.27$) were randomly distributed by E-prime software to one of two conditions: measurement with the original order of rMEQ items (SA-5) or measurement with the target item as first (SA-1 condition). Sample size guaranteed the identification of small magnitude effects having $\alpha = 0.05$ and $1\text{-}\beta = 80\%$ (Faul, Erdfelder, Lang, & Buchner, 2007) and took into consideration a 10 participants per item ratio (e.g. Kieffer, 1999).

2.2. Translation and adaptation

Two independent proficient speakers of both languages provided translations (see Table 1) of the rMEQ English items into Portuguese from Portugal, which were subsequently verified by a third element and back-translated to English by a fourth person, offering a good fit. The terms "morning-types" and "evening-types" were adapted to how Portuguese break their daily activities (night activities occur after 11 PM o'clock) becoming direct translations of "day-types" and "night-types".[2]

[2] "Day type" = pessoa matutina/matinal and "night type" = pessoa nocturna.

Table 2
Factor analysis and item statistical description.

Group	Item	Mean	SD	Item-total correlation	Factor 1	Factor 2
SA-5	rMEQ-1	3.51	1.223	.622	.762	
	rMEQ-2	2.37	.902	.348	.520	
	rMEQ-3	3.39	.920	.657	.804	
	rMEQ-4	3.16	.771	.626	.774	
	rMEQ-5	3.25	1.664	.707	.753	
SA-1	rMEQ-5	3.34	1.610	.676	.724	.339
	rMEQ-1	3.43	1.158	.545	.732	−.305
	rMEQ-2	2.33	.746	.265	.434	.823
	rMEQ-3	3.39	1.058	.600	.746	−.178
	rMEQ-4	3.31	.802	.647	.789	−.313

2.3. Procedure

Data was accessed in the context of other experiments. Half the participants responded the rMEQ with the self-assessment item as last (SA-5), and the other half with this item as first (SA-1), being each item presented in separate screens.

3. Results

Total scores were obtained by summing item responses coded as described in Table 1. Cronbach's alpha for SA-5 and SA-1 conditions was .782 and .755, respectively. Table 2 presents results of the factor analysis. SA-5 promoted a single factor (eigenvalue of 2.833; 56.7% of variance explained) and SA-1 two factors (eigenvalues: 2.428; 1.015, explaining 68.8% of variance).

Participants were ascribed to morning (M-type: 18–25), neutral (N-type: 12–17) or evening (E-type: 4–11) types. Replicating the literature, the majority of participants was classified as belonging to a neutral type category 52.2% whereas morning and evening-types include 30.6% and 17.2% of participants, respectively.[3]

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Analysis of rMEQ total-scores, revealed no differences, $t < 1$, between SA-5 ($M = 15.69$, $SD = 4.17$, range [6; 25]) and SA-1 ($M = 15.81$, $SD = 3.97$, range [4; 24]) conditions, suggesting that the placement of the item did not influence participants' responses.

There were also no differences on *Self-assessment item* responses ($t < 1$) between SA-5 ($M = 3.25$; $SD = 1.66$) and SA-1 ($M = 3.34$; $SD = 1.61$) conditions, suggesting that item responses were not dependent upon individuals being primed with the first set of items.

To test the SA-item for converging validity with the rMEQ scale, we contrasted it with 1) the scale continuous score, 2) a priori categories and 3) median-split categories.

3.1. Correlation between scale scores and SA-item

Correlations between scale total scores and the target item inform about SA-item's capacity to distinguish between chronotypes relatively to the scale's capacity. The SA-item correlated significantly and equally with the scale total score, both when applied in the last ($r = .878$) and in the first place ($r = .865$; $t < 1$). Additionally, it was the item that correlated the highest with the rMEQ total score, compared to all other 4 items, and regardless of order of measure (see Table 3) suggesting that the SA provides the same information as the rMEQ total score.

[3] Contrary to what was expected, males' scores were higher compared to females, $t(132) = -2.99$, $p = .003$.

Table 3
Inter-item and total score correlations for SA-5 and SA-1 conditions.

Group		rMEQ-1	rMEQ-2	rMEQ-3	rMEQ-4	rMEQ-5
SA-5	rMEQ-2	.252*	1.000			
	rMEQ-3	.590**	.261*	1.000		
	rMEQ-4	.457**	.194	.571**	1.000	
	rMEQ-5	.561**	.370*	.548**	.617**	1.000
	rMEQ-TS	.785**	.531**	.773**	.732**	.878**
SA-1	rMEQ-5	.431**	.308*	.543**	.655**	1.000
	rMEQ-2	.184	1.000			
	rMEQ-3	.479**	.201	1.000		
	rMEQ-4	.521**	.079	.462**	1.000	
	rMEQ-TS	.733**	.436**	.757**	.757**	.865**

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

3.2. Scale categorization and SA-item

Aiming to understand if the SA-item converges in offering the same information, allowing for participants' categorization into rMEQ categories, we contrasted the two categorical systems (see Table 4). These showed to overlap in both conditions (SA-5: $x^2_{(6)} = 66.877$, $p < .001$; SA-1: $x^2_{(6)} = 60.266$, $p < .001$) suggesting that the SA categorizations provide the same information as rMEQ categorizations.

3.3. Median-split categorization and SA-item

Aiming to understand if the SA-item informs about categories created on the basis of participants' distribution in their rMEQ responses, we compared item responses categorized by a median-split. Table 5 shows that participants' classification based on the median-split of rMEQ-scores and SA-scores overlap (SA-5: $x^2 = 32.603$, $df = 1$, $p < .001$; SA-1: $x^2 = 35.325$, $df = 1$, $p < .001$), suggesting again that the SA provides the same information as rMEQ.

4. Discussion

This study provides evidence that the Portuguese version of the rMEQ is a unitary measure of chronotype with high reliability.

Additionally, it corroborates that individuals are aware of their chronotypes, being able to assess it through a single self-awareness item. Regardless of its' assessment order, the SA-item loaded significantly together with all other items, and was shown not to change significantly if assessed separately or after the other set of four items. The only difference was that in the SA-1 condition a two-factor structure emerged because of one item (rMEQ-2), showing a slight desegregation from the other four items. Importantly, in the SA-1 condition the target SA-item continued to load significantly together with all other items. Also, the single SA-item shows convergent validity with the scale total score. The item maps the total score informing equally about individuals chronotype, being highly correlated with the scale total score and promoting the same type of categorization promoted by the rMEQ scoring system and by total scores median split. Thus

Table 4
Contingency table for rMEQ and SA categorizations frequencies.

	Categorization	SA-definitely E-type	SA-rather more E-type	SA-rather more M-type	SA-definitely M-type	Row total
	rMEQ-Evening	6	6	0	0	12
SA-5	rMEQ-Neutral	0	16	21	0	37
	rMEQ-Morning	0	0	9	9	18
SA-1	rMEQ-Evening	5	6	0	0	11
	rMEQ-Neutral	0	15	18	0	33
	rMEQ-Morning	0	0	14	9	23

Table 5
Contingency table for rMEQ and SA categorizations (defined by median-split) frequencies.

Group	Categorization (median-split)	SA-evening	SA-morning	Row total
SA-5	rMEQ-Evening	24	6	30
	rMEQ-Morning	4	33	37
SA-1	rMEQ-Evening	23	6	29
	rMEQ-Neutral	3	35	38

rMEQ-5 offers an easy, reliable equivalent to the rMEQ scale, measure of individuals' chronotype.

Previous studies (Natale et al., 2006; Tonetti et al., 2011) have suggested that the midpoint of sleep, calculated considering the hourly preference for getting up or go to sleep (rMEQ items' 1 and 3) may offer a reliable measure of the circadian typology. Although that measure is a more indirect self-assessment measure than the one offered by rMEQ-5 item we interpret those results as also corroborating our argument that chronotype is a conscious dimension able of self-assessment.

Overall, our study offers all researchers an easy way to assess this dimension in their studies. Assessing the dimension with the SA-item can spread its use, increasing the understanding of how this dimension modulates our thinking and behavior in and out of social contexts.

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