

## MORNINGNESS-EVENINGNESS PERSONALITY AND CREATIVE THINKING AMONG YOUNG PEOPLE WHO PLAY RECREATIONAL SPORT

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Morningness-eveningness personality and creative thinking were investigated in a sample of young people who play recreational sports. Results showed that male participants were more eveningness-oriented than females; evening types had lower scores in creative thinking, although these were not statistically significant; the elaboration factor of the Torrance Test of Creative Thinking (Torrance, 1989) was positively correlated with taking part in sport activities in the whole sample; and the elaboration and fluidity factors were negatively correlated with intermediate and morningness dispositions. The relationship between the number of hours per week of sport activity, morningness-eveningness personality, and creative thinking was also explored.

*Keywords:* morningness-eveningness personality, creative thinking, sport, Test of Creative Thinking, Morningness-Eveningness Questionnaire.

Personality psychology researchers have explored two personality typologies: *morning types* – *who go to bed early, wake up early in the morning, are active*

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*upon waking, and who are emotionally stable, and evening types – who stay up late at night, get up with difficulty in the morning, are tired upon waking, and are emotionally unstable.*

Three reviews of morningness and eveningness have been published in the last three decades. Kerkhof's (1985) review was the first of these, followed by Tankova, Adan, and Buela-Casal (1994), and in 2008, Cavallera and Giudici wrote the most recent review dealing with the main topics underlying these two personality typologies. Researchers have examined the role of the sleep-wake cycle, personality traits in morning types and evening types, age, gender, the impact of disturbance, shift work, life habits, cognitive abilities, and work schedules, and the effects of biological and genetic influences on morningness-eveningness personality. Studies have been conducted in cross-cultural contexts, and also with reference to sensation seeking parameters (Muro, Gomà-i-Freixanet, & Adan, 2009; Tonetti et al., 2010), stress situations (Achilles, 2003), antisocial and social interactions (McCutcheon, 1998; Susman et al., 2007), creative thinking strategies (Giampietro & Cavallera, 2007), thinking styles (Fabbri, Antonietti, Giorgetti, Tonetti, & Natale, 2007), consumers' emotional state (Chebat, Dubè, & Marquis, 1997), yawning (Zilli, Giganti, & Salzarulo, 2007), sense of humor (Randler, 2008a), Cloninger's Temperament and Character Inventory (TCI; Caci, Robert, & Boyer, 2004), season of birth (Natale & Adan, 1999), and optimal time for studying (Cofer et al., 1999; Pornpitakpan, 2000).

The two personality typologies have been analyzed in the field of psychopathology with reference to depression (Chelminski, Ferraro, Petros, & Plaud, 1999; Drennan, Klauber, Kripke, & Goyette, 1991; Gaspar-Barba et al., 2009; Hirata et al., 2007; Matthews, 1988), bipolar disorders (Leibenluft et al., 1995; Mansour et al., 2005), schizophrenia (Mansour et al., 2005), psychosomatic disorders (Mecacci & Rocchetti, 1998), insomnia (Ong, Huang, Kuo, & Manber, 2007), and eating disorders (Natale, Ballardini, Schumann, Mencarelli, & Magelli, 2008; Schmidt & Randler, 2010). The relationship between depressive mood and chronotype in healthy people was studied by Hidalgo and colleagues (2009), and cardiovascular responses to stress were studied with regard to chronotype by Willis, O'Connor, and Smith (2005).

Physiological data support the differences between the two personality typologies, and have been analyzed on the topics of adrenalin secretion (Pátkai, 1971), cortisol levels (Kudielka, Federenko, Hellhammer, & Wüst, 2006; Randler & Schaal, 2010), temperature acrophase (Horne & Östberg, 1976), and melatonin rhythm (Gibertini, Graham, & Cook, 1999). There have also been studies conducted to examine the impact of heritability on the morningness-eveningness disposition (Klei et al., 2005), nucleotide polymorphism of the human clock gene as a predictor of diurnal preference (Katzenberg et al., 1998), and endogenous circadian oscillators in morning type and evening type (Kerkhof & Van Dongen, 1996).

The identification of morning type (MT) and evening type (ET) has led to the development of specific questionnaires, of which the most frequently used are the Morningness-Eveningness Questionnaire (MEQ), the reduced Morningness-Eveningness Questionnaire (rMEQ), and the Composite Scale of Morningness (CSM; Caci, Deschaux, Adan, & Natale, 2009).

With reference to age, younger children have been found to tend toward morningness, and older children toward eveningness (Kim, Dueker, Hasher, & Goldstein, 2002), with optimal time of day preference being identified as shifting toward eveningness in adolescents (Bearpark & Michie, 1987; Carskadon, 1990; Carskadon & Davis, 1989; Kim et al., 2002; Laberge et al., 2001; Russo, Bruni, Lucidi, Ferri, & Violani, 2007; Tonetti, Fabbri, & Natale, 2008; Wolfson & Carskadon, 1998). Adolescent boys were found to be more morningness-oriented than girls in a study by Heikkinen, Broms, Pitkänemi, Koskenvuo, and Meurman (2009), while Japanese office workers aged between 20 and 50 who were studied by Ishihara, Miyake, Miyasita, and Miyata (1992), were found to have an intermediate disposition, and Díaz-Morales and Sanchez-Lopez (2004) recorded that people over the age of 50 in their study tended toward morningness.

An eveningness disposition in males, and a morningness disposition in females have been observed by Adan and Natale (2002) and Natale and Danesi (2002). However, Steele, McNamara, Smith-Coggins, and Watson (1997) did not observe this in their study of emergency medicine residents. Gender differences in children have also been studied (Kim et al., 2002; Takeuchi et al., 2002).

Recently a very large sample of individuals consisting of 8,972 preadolescents, adolescents, and adults (5,367 females and 3,605 males) was surveyed by Tonetti, Fabbri, and Natale (2008), who noticed that time preference started to shift toward eveningness from the age of 13, and that females reached their peak in eveningness earlier (at about 17 years of age) than did males (about 21 years of age). Moreover, the authors noticed that the ideal sleep time preference advanced for both men and women with increasing age. Randler (2007) observed that results about gender differences in circadian typology based on self-report questionnaires were inconclusive. He applied meta-analytical tools to explore gender differences in morningness-eveningness disposition with particular reference to 52 studies based on morningness-eveningness questionnaires (most of these studies involved students). He concluded in the meta-analysis that there was the suggestion of a weak but significant effect of gender on morningness: girls and women were more morningness-oriented than were boys and men. Moreover, he observed that standard deviations of mean age of the participants in a study can significantly affect effect sizes with a large age range, producing smaller effect sizes, and that the different questionnaires can also produce different effect sizes.

*Creativity* can be defined as *the ability to become sensitive to new solutions, and to grasp aspects of problems, enabling the restructuring of elements*. Creativity concerns not only artistic contexts, but also processes, which break away from usual ways of thinking (Simpson, 1922). In the process of completing shapes in the Torrance (1989) Test of Creative Thinking, cognitive functions work in a sort of life energy, which can lead to new structures of *neurograms* (Simpson, 1922). According to Guilford (1967), in creative thinking one should distinguish between *convergent thinking* (information is produced in a consequential way), and *divergent thinking* (multiple possibilities are produced freely).

There has been very little research into morningness-eveningness personality in sport. However, Zani, Rossi, Borriello, and Mecacci (1984) observed a decrease in morningness from golf and shooting to volleyball and water polo athletes. Rossi, Zani, and Mecacci (1983) studied golfers and water polo players, and noticed no differences in morningness-eveningness disposition among low-performing athletes in the two sports, while high-performance golfers were more morningness oriented than were higher performing water polo players. The authors commented that there could be a relationship between the diurnal typology, the kind of sport performed, the performance level, and the time when the match is played. The study by Rossi et al., which involved 57 sportspeople (22 to 28 years old), is homogenous in terms of sport experience (all had about 7 years of experience). They considered performance of sport in the morning (8 am to 4 pm) and in the late evening (8 pm to 11 pm), with reference to groups of high-performance and low-performance athletes. Winget, DeRoshia, and Holley (1985) pointed out that athletic performances are modulated by morningness-eveningness, as well as by other variables (workload, sleep disturbances, and dietary constituents), which should be taken into consideration to reduce the negative impact of jet lag. In their study, Atkinson and Reilly (1996) found that athletes who are over the age of 50 years show a morningness disposition, and this may play a role in their habitual regimen of performance.

In addition, the role of creative thinking in sport has rarely been researched. When Gondola and Tuckman (1985) investigated running exercise among students, they found that after exercise sessions, these individuals showed significant gains in measures of flexibility and originality. Tuckman and Hinkle (1986) examined the physical and psychological effects of aerobic exercise on 154 children and pointed out that participants in a running program showed better scores on a test of creativity than did participants in a regular physical education program. Steinberg et al. (1997) noticed higher scores for flexibility and fluency in a sample of 63 participants who took part in an aerobic exercise session. Ramocki (2002) studied the effects of aerobic exercise in unfit versus fit groups, on a test for creative thinking, and reported that, when exercise took

place prior to taking the test, an increase in creativity was observed. In the study by Blanchette, Ramocki, O'Del, and Casey (2005), participants who took part in an aerobic exercise session showed greater creative potential than when they did not have an exercise session. Individuals participating in nonspecific treatment groups showed an improvement in general creativity, but those who were in groups receiving specific treatment showed an improvement in game-oriented creativity (Memmert & Roth, 2007), and Memmert and Perl (2009) observed high creativity scores in ball games experts, outlining a framework based on neural networks for analyzing creative performance.

The goal in this study was to investigate morningness-eveningness personality and creative thinking in a sample of young individuals who played recreational sport. A relationship between morningness disposition and extraversion has been observed by some authors (Adan & Almirall, 1990; Wilson, 1990), and researchers have hypothesized that sport participants would score higher on extraversion (Eagleton, McKelvie, & de Man, 2007). Because extraversion components include energy and activity, thus identifying it with active and dynamic people (McCrae & Costa, 1987; Watson & Clark, 1997), our intention was, therefore, to study the relationship between the number of hours of sport participation per week and morningness-eveningness personality. We also set out to explore the relationship between the number of hours of sport participation per week, and creative thinking. Previously, morningness-eveningness personality and creative thinking in sport activities have been investigated almost exclusively with athletes, while the relationship between sport participation and the two personality types and creative thinking has never been explored.

## METHOD

### PARTICIPANTS

The sample comprised 61 students (33 [55.9%] males, 26 [44.1%] females, 2 unspecified) in the Faculty of Human Movement Sciences at the University of Chieti-Pescara, aged between 19 and 31 years, who were players of recreational sport. Participants voluntarily completed the psychometric instruments in the university laboratories. Distribution, completion, and collection of the material took 60 minutes, and the participants were told to answer spontaneously.

### MEASURES

***Reduced Morningness-Eveningness Questionnaire*** The reduced Morningness-Eveningness Questionnaire (rMEQ) was developed by Natale (1999) from the Spanish version of Adan and Almirall (1991), which was based on the MEQ (Horne & Östberg, 1976). The MEQ had been criticized because not all of

its items had high discriminatory power and because of its length. The rMEQ consists of five questions for respondents who provide information on: (a) at what time they prefer to get up, (b) the degree of tiredness in the first half hour after waking, (c) at what time they prefer to go to bed, (d) when they feel their best, and (e) the time of day during which they feel more in shape and more active. Natale validated the rMEQ with 898 university students using the external criteria of body temperature and subjective alertness. Psychometric properties showed significant correlations with the MEQ ( $r = .90$ ;  $p < .000$ ), good internal consistency (Cronbach's  $\alpha = .71$ ), and good interitem correlation (.60 - .67).

**Torrance Test of Creative Thinking (TTCT)** Creative thinking was analyzed using the TTCT (1989), figural series. This is part of set of tests in which creative thinking is evaluated by using verbal and figural measures. The figural series refers to figural content, and contain three activities: a) "Build a picture" (the participant is asked to draw a picture using a round figure, and to give it a title), b) "Incomplete figures" (the participant is given 10 incomplete figures made up of straight and curved lines, and is asked to transform them into structured forms, and to give them a title), c) "Lines" (the participant is presented with a page on which 30 pairs of open parallel vertical lines are drawn). Each activity is scored on originality and elaboration, while the second and third activities (b and c) are also scored on fluidity and flexibility. Originality concerns the ability to find unusual answers, elaboration relates to the ability to develop ideas by adding new elements, fluidity takes into account the number of completed figures, and flexibility refers to the total number of categories in which the figures may be classified, allowing individuals to change strategy easily in the production of ideas.

## STATISTICAL ANALYSES

As can be seen in the tables, we conducted statistical analyses with reference to the sample composition and the sample composition by rMEQ, tested on mean difference of rMEQ by sex, performed cross tabulation of rMEQ group by sex, and one-way analysis of covariance (ANCOVA) for effects of age factor and sex covariate. To make parameter estimates, we tested for mean differences of TTCT factors by sex and by rMEQ group, and performed a Pearson chi-square test for the two-way cross tables.

## RESULTS

No significant differences by sex were observed with reference to age and number of hours of sport played per week (see Table 1). Therefore, the sample showed a substantial homogeneity between groups.

**TABLE 1**  
SAMPLE COMPOSITION

		Sex		<i>t</i>	<i>p</i>
		Total	Male		
Age	Average ( <i>SD</i> )	21.64 (2.85)	21.63 (3.14)	21.65 (2.49)	.97 <i>ns</i>
Hours	Average ( <i>SD</i> )	8.78 (5.93)	9.88 (6.24)	7.31 (5.29)	.13 <i>ns</i>
Minimum		1	1		1
Maximum		26	26		24

With reference to morningness-eveningness disposition, the students were distributed as shown in Table 2.

**TABLE 2**  
SAMPLE COMPOSITION BY RMEQ

Type:	Eveningness	Intermediate	Morningness
	4-11*	12-17*	18-25*
<i>n</i>	12	45	4

Note: \* rMEQ scores.

Our data can be compared to other studies, in which the following percentages have been recorded among adults: 15% morning types, 70% intermediate types, and 15% evening types (Ishihara et al., 1992; Mecacci, Zani, Rocchetti, & Luciola, 1986). In our study a significant difference was found by gender (see student *t* test in Table 3): Males were more eveningness-oriented than females. This result is comparable to those of Chelminski, Ferraro, Petros, and Plaud (1997), Adan and Natale (2002), and Natale and Danesi (2002).

**TABLE 3**  
MEAN DIFFERENCE OF RMEQ BY SEX

Sex	<i>n</i>	rMEQ average	<i>SD</i>	<i>t</i>	<i>p</i>
Male	38	12.8182	2.81130	-3.699	.000
Female	26	15.2692	2.10823		

The cross tabulation analysis shows a significant difference in the distribution of the three rMEQ groups by sex (see Pearson chi-square in Table 4,  $p < .01$ ).

**TABLE 4**  
**CROSS TABULATION OF rMEQ GROUP BY SEX**

Sex	rMEQ group			Total	
	1	2	3		
Unspecified	1	0	1	2	Fisher exact test
<i>F</i>	2	21	3	26	13.069
<i>M</i>	9	24	0	33	<i>p</i> = .004
Total	12	45	4	61	

The ANCOVA analysis confirms the significance of the factor of sex and of the sex-by-age interaction (with reference to females only) on the rMEQ groups (see Tables 5 and 6).

**TABLE 5**  
**ONE-WAY ANCOVA OF EFFECTS OF AGE FACTOR AND SEX COVARIATE**

Source	Type III SS	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Model	11326.030	4	2831.507	469.066	.000
Sex by age	35.345	1	35.345	5.855	.019
Sex	261.310	2	130.655	21.644	.000
Age	8.962	1	8.962	1.485	.228
Error	325.970	54	6.036		
Total	11652.000	58			

**TABLE 6**  
**ONE-WAY ANCOVA PARAMETER ESTIMATES**

Parameter	$\beta$	<i>SE</i>	<i>t</i>	<i>p</i>	Sig.
[Sex=female] by age	-0.440	0.197	-2.236	.030	
[Sex=male] by age	0.145	0.141	1.033	.306	<i>ns</i>
[Sex=female]	24.795	4.228	5.782	.000	
[Sex=male]	9.640	3.071	3.139	.003	

No significant differences were observed in the four factors of the TTCT either by sex (see Table 7) or by the three rMEQ groups (see Table 8).



**TABLE 7**  
**MEAN DIFFERENCES OF TTCT FACTORS BY SEX**

	Sex	<i>n</i>	Average	<i>SD</i>	<i>p</i>
Fluidity	M	33	21.3030	12.131	.651
	F	26	22.6538	10.202	
Flexibility	M	33	14.7273	8.371	.642
	F	26	15.7308	7.958	
Originality	M	33	28.0909	19.104	.691
	F	26	26.1923	16.764	
Elaboration	M	33	65.8485	48.813	.395
	F	26	56.2692	33.139	

**TABLE 8**  
**MEAN DIFFERENCES OF TTCT FACTORS BY RMEQ GROUP**

Sex	<i>n</i>	Average	<i>SD</i>	<i>p</i>
Fluidity				
1	12	22.0833	12.809	.340
2	45	21.3556	10.938	
3	4	30.0000	7.572	
Total	61	22.0656	11.192	
Flexibility				
1	12	14.2500	8.677	.203
2	45	15.0222	7.962	
3	4	22.2500	5.560	
Total	61	15.3443	8.083	
Originality				
1	12	26.3333	18.671	.559
2	45	27.1556	18.403	
3	4	37.0000	5.944	
Total	61	27.6393	17.900	
Elaboration				
1	12	62.0000	41.781	.727
2	45	60.7778	43.074	
3	4	78.7500	46.478	
Total	61	63.1967	49.500	

Finally, we examined the correlations between the number of hours of sport activity per week, and the two tests. With the rMEQ, a significant negative correlation was observed between the number of hours of sport activity per week and evening disposition ( $r = -.843$ ;  $p = .004$ ). With the TTCT significant positive correlations were observed between the number of hours of sport activity per week and elaboration in intermediate-type participants ( $r = .378$ ;  $p = .017$ )

and in the whole sample ( $r = .314$ ;  $p = .028$ ). With both tests, intermediate-type participants showed a significant negative correlation with elaboration ( $r = -.368$ ;  $p = .013$ ), and morning-type participants recorded a significant negative correlation with fluidity ( $r = -.966$ ;  $p = .034$ ).

## DISCUSSION

Our aim was to investigate morningness-eveningness personality and creative thinking in young people who played recreational sport. Because a relationship between morningness disposition and extraversion has been observed by some authors (Adan & Almirall, 1990; Wilson, 1990), we also explored the correlations between the number of hours of sport activity per week and morningness-eveningness personality, and investigated the relationship between personality types and creative thinking. This was an initial study in which we explored correlations between two parameters (morningness-eveningness personality, and creative thinking), that have not been studied frequently.

A limitation of the study was the number of the participants. Also, the studies about morningness-eveningness personality in sport activities that have been cited in our study are based on samples consisting of a group similar in size. For example, the studies by Rossi et al. (1983) and Zani et al. (1984) involved 57 and 87 individuals, respectively. In future, it would be worthwhile to conduct studies with samples consisting of larger numbers, and with people of different ages, and from different ethnic contexts;

We found that the percentages of the three personality typologies (evening types = 19.7%, intermediate types = 73.8%, morning types = 6.5%) confirm trends of morningness-eveningness disposition found by other researchers (Adan & Natale, 2002; Chelminski et al., 1997; Natale & Danesi, 2002). Percentages can depend on the age and the ethnicity of the samples. However, we point out that the majority of the participants in our study had intermediate-type scores, confirming findings gained in previous studies (Ishihara et al., 1992; Mecacci et al., 1986).

We also found that males were more eveningness-oriented than females, a result also recorded by Chelminski et al. (1997), Adan and Natale (2002), and Natale and Danesi (2002). However, these studies involved a larger number of people, that is, 1,617, 2,135, and 1,319 students, respectively. The recommendation of Randler (2007) that standard deviations of mean age of participants have a significant effect on effect sizes, should also be taken into account when analyzing data for studies in which a large number of participants is involved. In addition, chronotype depends on age, and changes can be systematic and are different for males and females, as was observed by Roenneberg et al. (2007) in their study based on a sample of 2,726 participants. This was also evident in our

research: The interaction effect of sex by age on rMEQ scores was significant only for females, with reference to the tendency toward lower rMEQ scores with increasing age.

It should, however, be observed that some researchers have, in fact, noticed morningness disposition in men (Steele et al., 1997), or even no significant gender differences at all in children (Kim et al., 2002).

In our sample, creative thinking was independent of gender and personality typology. These data partially differ from the results of research done by Giampietro and Cavallera (2007) who found a significant negative correlation between morningness disposition and originality for everyone in their sample, and a negative correlation between morningness disposition and originality, fluidity, and flexibility for individuals aged over 52.

According to Watson, and Clark (1997), and McCrae and Costa (1987), extraversion components include energy and activity thus identifying it with active and dynamic people. Since it was hypothesized that sport participants would score higher on extraversion (Eagleton et al., 2007), and some researchers have pointed out that extraversion is positively (Wilson, 1990), or negatively (Adan & Almirall, 1990) correlated to morningness disposition, we tested for the correlation between the number of hours per week of sport activity and morningness-eveningness personality. We also explored the correlation between the number of hours of sport activity per week and creative thinking.

Results showed that higher scores on eveningness disposition corresponded to fewer hours of sport activity. Moreover, with the TTCT creative participants in our study exhibited the tendency to spend more time on sport activities, but only with reference to elaboration, independently of morningness-eveningness personality. With the rMEQ, morning types tended to spend more time on sport activities. With regard to the correlation between the two tests, intermediate types did not show any skill in the area of elaboration, and morning types did not show any skill in the area of fluidity. Finally, none of the three personality types were correlated with originality and flexibility, and neither originality, flexibility, nor fluidity was correlated with the time spent playing sport.

As the results of our study show, it seems possible to apply a multistructured approach to creative thinking, that is concerning different factors, for people playing recreational sport, as has been done in other areas of personality (Torrance, 1989). People who spend more time on recreational sport, or at least intermediate types, have high creative thinking scores with reference to elaboration, and personality typologies seem to be involved differently either in the time spent on sport activities or in areas of creativity. This might confirm that creative thinking is a complex model, in which variables are intermingled with external and internal aspects as well as situations.

As we have pointed out earlier, there has been little previous research about morningness-eveningness personality in sport, with most existing studies having athletes as their focus and morningness-eveningness disposition being described as being related to the sport being played. Even the role of creative thinking in sport has rarely been the subject of research. Instead, it has been shown that, in the playing of sport, as elsewhere, creativity should be understood as a network of intermingled factors that should be investigated separately (Memmert & Roth, 2007; Steinberg et al., 1997).

In future research, samples of older people should be surveyed to gain a better understanding of sport activities in that age group, because an important shift toward morningness preference occurs around the age of 50, and it has been shown that older people are still creative (Cesa-Bianchi, 1987). Younger people should also be surveyed to investigate how the parameters of this study correlate with children. Research should also be extended to different ethnic contexts, in which different results may be gained and as results in our study depended on visual input measures, further research is needed in the area of verbal inputs.

The role of the optimal time of day in enhancing creativity in sport has never been carefully examined. Researchers should investigate how creativity differs in individuals, with reference to their optimal time of day for playing sport. This could allow people to play sport at their optimal time, not only to get the best results with reference to their physiological characteristics, but also to develop creative thinking strategies that can be useful in their performance. We recommend strongly that future research in this direction should be carried out to gain a better understanding of the best ways to play sport either with reference to recreational sport, as in this study, or with regard to professional athletes.

## REFERENCES

- Achilles, G. M. (2003). Individual differences in morningness-eveningness and patterns of psychological functioning, social adaptation, and family stress. *Dissertation Abstracts International: Section B. Sciences and Engineering*, **64**, 6-B.
- Adan, A., & Almirall, H. (1990). Adaptation and standardization of a Spanish version of the Morningness-Eveningness Questionnaire: Individual differences. *Personality and Individual Differences*, **11**(11), 1223-1230.
- Adan, A., & Almirall, H. (1991). Horne and Östberg Morningness-Eveningness Questionnaire: A reduced scale. *Personality and Individual Differences*, **12**(3), 241-253.
- Adan, A., & Natale V. (2002). Gender differences in morningness-eveningness preference. *Chronobiology International*, **19**(4), 709-720.
- Atkinson, G., & Reilly, T. (1996). Circadian variation in sports performance. *Sports Medicine*, **21**(4), 292-312.
- Bearpark, H., & Michie, P. (1987). Changes in morningness-eveningness scores during adolescence and their relationship to sleep/wake disturbances. *Chronobiologia*, **14**, 151.
- Blanchette, D. M., Ramocki, S. P., O'Del, J. N., & Casey, M. S. (2005). Aerobic exercise and creative potential: Immediate and residual effects. *Creativity Research Journal*, **17**(2-3), 257-264.

- Caci, H., Deschaux, O., Adan, A., & Natale V. (2009). Comparing three morningness scales: Age and gender effects, structure and cut-off criteria. *Sleep Medicine*, **10**(2), 240-245.
- Caci, H., Robert, P., & Boyer, P. (2004). Novelty seekers and impulsive subjects are low in morningness. *European Psychiatry*, **19**(2), 79-84.
- Carskadon, M. A. (1990). Patterns of sleep and sleepiness in adolescents. *Pediatrician*, **17**, 5-12.
- Carskadon, M. A., & Davis, S. S. (1989). Sleep-wake patterns in the high-school-to-college transition: Preliminary data. *Sleep Research*, **18**(1), 113.
- Cavallera, G. M., & Giudici, S. (2008). Morningness and eveningness personality: A survey in literature from 1995 up till 2006. *Personality and Individual Differences*, **44**(1), 3-21.
- Cesa-Bianchi, M. (1987). *Psicologia dell'invecchiamento: Caratteristiche e problemi* [Psychology of aging: Characteristics and problems]. Roma: La Nuova Italia Scientifica.
- Chebat, J.-C., Dubé, L., & Marquis, M. (1997). Individual differences in circadian variations of consumers' emotional state. *Perceptual and Motor Skills*, **84**(3), 1075-1086.
- Chelmski, I., Ferraro, F. R., Petros, T., & Plaud, J. J. (1997). Horne and Östberg Questionnaire: A score distribution in a large sample of young adults. *Personality and Individual Differences*, **23**(4), 647-652.
- Chelmski, I., Ferraro, F. R., Petros, T. V., & Plaud, J. J. (1999). An analysis of the "eveningness-morningness" dimension in "depressive" college students. *Journal of Affective Disorders*, **52**(1-3), 19-29.
- Cofer, L. F., Grice, J. W., Sethre-Hofstad, L., Radi, C. J., Zimmermann, L. K., Palmer-Seal, D., & Santa-Maria, G. (1999). Developmental perspectives on morningness-eveningness and social interactions. *Human Development*, **42**(4), 169-198.
- Díaz-Morales J. F., & Sánchez-López, M. P. (2004). Composite and preferences scales of morningness: Reliability and factor invariance in adult and university samples. *Spanish Journal of Psychology*, **7**(2), 93-100.
- Drennan, M. D., Klauber, M. R., Kripke, D. F., & Goyette, L. M. (1991). The effects of depression and age on the Horne-Östberg morningness-eveningness score. *Journal of Affective Disorders*, **23**(2), 93-98.
- Eagleton, J. R., McKelvie, S. J., & de Man, A. (2007). Extraversion and neuroticism in team sport participants, individual sport participants, and nonparticipants. *Perceptual and Motor Skills*, **105**(1), 265-275.
- Fabbri, M., Antonietti, A., Giorgetti, M., Tonetti, L., & Natale, V. (2007). Circadian typology and style of thinking differences. *Learning and Individual Differences*, **17**(2), 175-180.
- Gaspar-Barba, E., Calati, R., Cruz-Fuentes, C. S., Ontiveros-Uribe, M. P., Natale, V., De Ronchi, D., & Serretti, A. (2009). Depressive symptomatology is influenced by chronotypes. *Journal of Affective Disorders*, **119**, 100-106.
- Giampietro, M., & Cavallera, G. M. (2007). Morning and evening types and creative thinking. *Personality and Individual Differences*, **42**(3), 453-463.
- Gibertini, M., Graham, C., & Cook, M. R. (1999). Self-report of circadian type reflects the phase of the melatonin rhythm. *Biological Psychology*, **50**(1), 19-33.
- Gondola, J. C., & Tuckman, B. W. (1985). Effects of a systematic program of exercise on selected measures of creativity. *Perceptual and Motor Skills*, **60**(1), 53-54.
- Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw-Hill.
- Heikkinen, A. M., Broms, U., Pitkaniemi, J., Koskenvuo, M., & Meurman, J. (2009). Key factors in smoking cessation intervention among 15-16-year-olds. *Behavioral Medicine*, **35**(3), 93-99.
- Hidalgo, M. P., Caumo, W., Posser, M., Coccaro, S. B., Camozzato, A. L., & Chaves, M. L. (2009). Relationship between depressive mood and chronotype in healthy subjects. *Psychiatry and Clinical Neurosciences*, **63**(3), 283-290.

- Hirata, F. C., Lima, M. C., de Bruin, V. M., Nóbrega, P. R., Wenceslau, G. P., & de Bruin P. F. (2007). Depression in medical school: The influence of morningness-eveningness. *Chronobiology International*, **24**(5), 939-946.
- Horne, J. A., & Östberg, O. (1976). A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *International Journal of Chronobiology*, **4**(2), 97-110.
- Ishihara, K., Miyake, S., Miyasita, A., & Miyata, Y. (1992). Morningness-eveningness preference and sleep habits in Japanese office workers of different ages. *Chronobiologia*, **19**(1-2), 9-16.
- Katzenberg, D., Young, T., Finn, L., Lin, L., King, D. P., Takahashi, J. S., & Mignot, E. (1998). A CLOCK polymorphism associated with human diurnal preference. *Sleep*, **21**(6), 569-576.
- Kerkhof, G. A. (1985). Inter-individual differences in the human circadian system: A review. *Biological Psychology*, **20**(2), 83-112.
- Kerkhof, G. A., & Van Dongen, H. P. A. (1996). Morning-type and evening-type individuals differ in the phase position of their endogenous circadian oscillator. *Neuroscience Letters*, **218**(3), 153-156.
- Kim, S., Dueker, G. L., Hasher, L., & Goldstein, D. (2002). Children's time of day preference: Age, gender and ethnic differences. *Personality and Individual Differences*, **33**(7), 1083-1090.
- Klei, L., Reitz, P., Miller, M., Wood, J., Maendel, S., Gross, D., ... Nimgaonkar, V. L. (2005). Heritability of morningness-eveningness and self-report sleep measures in a family-based sample of 521 Hutterites. *Chronobiology International*, **22**(6), 1041-1054.
- Kudielka, B. M., Federenko, I. S., Hellhammer, D. H., & Wüst, S. (2006). Morningness and eveningness: The free cortisol rise after awakening in "early birds" and "night owls". *Biological Psychology*, **72**(2), 141-146.
- Labege, L., Petit, D., Simard, C., Vitaro, F., Tremblay, R. E., & Montplaisir, J. (2001). Development of sleep patterns in early adolescence. *Journal of Sleep Research*, **10**(1), 59-67.
- Leibenluft, E., Turner, E. H., Feldman-Naim, S., Schwartz, P. J., Wehr, T. A., & Rosenthal, N. E. (1995). Light therapy in patients with rapid cycling bipolar disorder: Preliminary results. *Psychopharmacology Bulletin*, **31**(4), 705-710.
- McCrae, R. R., & Costa, P. T., Jr. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, **52**(1), 81-90.
- Mansour, H. A., Wood, J., Chowdari, K. V., Dayal, M., Thase, M. E., Kupfer, D. J., ... Nimgaonkar, V. L. (2005). Circadian phase variation in bipolar I disorder. *Chronobiology International*, **22**(3), 571-584.
- Matthews, G. (1988). Morningness-eveningness as a dimension of personality: Trait, state, and psychophysiological correlates. *European Journal of Personality*, **2**(4), 277-293.
- Mecacci, L., & Rocchetti, G. (1998). Morning and evening types: Stress-related personality aspects. *Personality and Individual Differences*, **25**(3), 537-542.
- Mecacci, L., Zani, A., Rocchetti, G., & Luciola, R. (1986). The relationships between morningness-eveningness, ageing, and personality. *Personality and Individual Differences*, **7**(6), 911-913.
- Memmert, D., & Perl, J. (2009). Game creativity analysis using neural networks. *Journal of Sports Sciences*, **27**(2), 139-149.
- Memmert, D., & Roth, K. (2007). The effects of non-specific and specific concepts on tactical creativity in team ball sports. *Journal of Sports Sciences*, **25**(12), 1423-1432.
- Muro, A., Gomà-i-Freixanet, M., & Adan, A. (2009). Morningness-eveningness, sex, and the alternative five factor model of personality. *Chronobiology International*, **26**(6), 1235-1248.
- Natale, V. (1999). Validazione di una Scala ridotta di mattutinità (r-MEQ) [Validation of a shortened Morningness Scale (r-MEQ)]. *Bollettino di Psicologia Applicata*, **229**, 19-26.
- Natale, V., & Adan, A. (1999). Season of birth modulates morningness-eveningness preference in humans. *Neuroscience Letters*, **274**(2), 139-141.
- Natale, V., & Danesi, E. (2002). Gender and circadian typology. *Biological Rhythm Research*, **33**(3), 261-270.

- Natale, V., Ballardini, D., Schumann, R., Mencarelli, C., & Magelli, V. (2008). Morningness-eveningness preference and eating disorders. *Personality and Individual Differences*, **45**(6), 549-553.
- Ong, J. C., Huang, J. S., Kuo, T. F., & Manber R. (2007). Characteristics of insomniacs with self-reported morning and evening chronotypes. *Journal of Clinical Sleep Medicine*, **15**(3), 289-294.
- Pátkai, P. (1971). Interindividual differences in diurnal variations, in alertness, performance, and adrenaline excretion. *Acta Physiologica Scandinavica*, **81**(1), 35-46.
- Pornpitakpan, C. (2000). Additional validity of the Basic Language Morningness (BALM) Scale. *Personality and Individual Differences*, **28**(1), 59-72.
- Ramocki, S. P. (2002). Creativity interacts with fitness and exercise. *Physical Educator*, **59**(1), 8-17.
- Randler, C. (2007). Gender differences in morningness-eveningness assessed by self-report questionnaires: A meta-analysis. *Personality and Individual Differences*, **43**(7), 1667-1675.
- Randler, C. (2008). Evening types among German university students score higher on sense of humor after controlling for Big Five personality factors. *Psychological Reports*, **103**(2), 361-370.
- Randler, C., & Schaal, S. (2010). Morningness-eveningness, habitual sleep-wake variables and cortisol level. *Biological Psychology*, **85**(1), 14-18.
- Roenneberg, T., Kuehne, T., Juda, M., Kantermann, T., Allebrandt, K., Gordijn, M., & Merrow, M. (2007). Epidemiology of the human circadian clock. *Sleep Medicine Reviews*, **11**(6), 429-438.
- Rossi, B., Zani, A., & Mecacci, L. (1983). Diurnal individual differences and performance levels in some sports activities. *Perceptual and Motor Skills*, **57**(1), 27-30.
- Russo, P. M., Bruni, O., Lucidi, F., Ferri, R., & Violani, C. (2007). Sleep habits and circadian preference in Italian children and adolescents. *Journal of Sleep Research*, **16**(2), 163-169.
- Schmidt, S., & Randler, C. (2010). Morningness-eveningness and eating disorders in a sample of adolescent girls. *Journal of Individual Differences*, **31**(1), 38-45.
- Simpson, R. M. (1922). Creative imagination. *American Journal of Psychology*, **33**(2), 234-243.
- Steele, M. T., McNamara, R. M., Smith-Coggins, R., & Watson, W. A. (1997). Morningness-eveningness preferences of emergency medicine residents are skewed toward eveningness. *Academic Emergency Medicine*, **4**(7), 699-705.
- Steinberg, H., Sykes, E. A., Moss, T., Lowery, S., LeBoutillier, N., & Dewey, A. (1997). Exercise enhances creativity independently of mood. *British Journal of Sports Medicine*, **31**(3), 240-245.
- Susman, E. J., Dockray, S., Schiefelbein, V. L., Herwehe, S., Heaton, J. A., & Dorn L. D. (2007). Morningness/eveningness, morning-to-afternoon cortisol ratio, and antisocial behavior problems during puberty. *Developmental Psychology*, **43**(4), 811-822.
- Takeuchi, H., Morisane, H., Iwanaga, A., Hino, N., Matsuoka, A., & Harada T. (2002). Morningness-eveningness preference and mood in Japanese junior high school students. *Psychiatry and Clinical Neurosciences*, **56**(3), 227-228.
- Tankova, I., Adan, A., & Buela-Casal, G. (1994). Circadian typology and individual differences. A review. *Personality and Individual Differences*, **16**(5), 671-684.
- Tonetti, L., Adan, A., Caci, H., De Pascalis, V., Fabbri, M., & Natale, V. (2010). Morningness-eveningness preference and sensation seeking. *European Psychiatry*, **25**(2), 111-115.
- Tonetti, L., Fabbri, M., & Natale, V. (2008). Sex difference in sleep-time preference and sleep need: A cross-sectional survey among Italian pre-adolescents, adolescents, and adults. *Chronobiology International*, **25**(5), 745-759.
- Torrance, E. P. (1989). *Test di pensiero creativo, manuale tecnico e norme* [Test of creative thinking: Norms and technical manual]. Firenze: Organizzazioni Speciali.
- Tuckman, B. W., & Hinkle, J. S. (1986). An experimental study of the physical and psychological effects of aerobic exercise on schoolchildren. *Health Psychology*, **5**(3), 197-207.
- Watson, D., & Clark, L. A. (1997). Extraversion and its positive emotional core. In R. Hogan, J. A. Johnson, & S. R. Briggs (Eds), *Handbook of personality psychology* (pp. 767-793). San Diego, CA: Academic Press.

- Willis, T. A., O'Connor, D. B., & Smith, L. (2005). The influence of morningness-eveningness on anxiety and cardiovascular responses to stress. *Physiology & Behavior*, **85**(2), 125-133.
- Wilson, G. D. (1990). Personality, time of day and arousal. *Personality and Individual Differences*, **11**(2), 153-168.
- Winget, C. M., DeRoshia, C. W., & Holley, D. C. (1985). Circadian rhythms and athletic performance. *Medicine & Science in Sports & Exercise*, **17**(5), 498-516.
- Wolfson, A. R., & Carskadon, M. A. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development*, **69**(4), 875-887.
- Zani, A., Rossi, B., Borriello, A., & Mecacci, L. (1984). Diurnal interindividual differences in the habitual activity pattern of top level athletes. *Journal of Sports Medicine and Physical Fitness*, **24**(4), 307-310.
- Zilli, I., Giganti, F., & Salzarulo, P. (2007). Yawning in morning and evening types. *Physiology & Behavior*, **91**(2-3), 218-222.



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