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Circadian typology and style of thinking differences

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Abstract

The purpose of the present study aims to investigate the relationship between circadian typology and learning–thinking styles conceptualised as a preference toward information processing typical of the right vs. the left cerebral hemisphere. A sample of 1254 undergraduates (380 boys and 874 girls; mean age $= 21.86 \pm 2.37$,) was administered the reduced version of the Morningness–Eveningness Questionnaire (r-MEQ), which detects three chronotypes (morning-, intermediate- or evening-types), and the Style Of Learning And Thinking (SOLAT) questionnaire, conceived as a tool to measure the tendency toward the right-, integrated-, and left thinking. A two-way ANOVA on SOLAT scores with circadian typology and gender, as between-subjects factor, and age as covariant, showed that morning-types scored higher in the left-thinking scale than intermediate- and evening-types, and that evening-types obtained significant higher scores for right-thinking style than intermediate- and morning-types. This circadian typology effect was also confirmed by multiple regression.
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1. Introduction

On the basis of the strength of the rest–activity rhythms, individuals can be classified in three chronotypes: morning-, intermediate- and evening-types. Morning-types (also called "larks") are more active in the first part of the day and tend to go to bed early in the evening .On the contrary, evening-types (also called "owls") tend to wake late in the morning and are more active in the second part of the day. Finally, those who show patterns of behaviour belonging to an intermediate area between the two extremes of this continuum are labelled intermediate-types (Natale & Cicogna, 2002). The circadian typology can be assessed by the Morningness–Eveningness Questionnaire (MEQ) (Horne & Östberg, 1976) which is correlated with circadian fluctuations in several physiological and behavioural measures (Tankova, Adan, & Buela-Casal, 1994). The MEQ also maintains good psychometric properties and predictive validity in his reduced version (r-MEQ) (Adan & Almirall, 1991; Natale, Esposito, Martoni, & Fabbri, 2006).

Many investigations tried to correlate morning and evening dimensions to personality traits. Taking into account Millon's model (1994), relationships have been identified between the morningness and the Sensation, Intuition and

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Conformism scales (Morales & García, 2003). The individual profile describes a "lark" who processes incoming information from the outside on the basis of pragmatic data and direct experience, using consolidated schema and considering social norms and rules. On the contrary, the eveningness has shown relationships with the Feeling, Novation, Indecision and Acquiescence scales. This profile describes a person who processes outside information through subjective and emotional parameters, who builds new and original schema, and is highly creative but lacks of self-confidence in social relationships. These profiles have been supported by findings according to which morningness was negatively correlated to novelty seeking, whereas it was positively correlated to persistence and was independent on character dimensions and anxiety trait (Caci, Robert, & Boyer, 2004). Finally, it has been found that evening-types are more field independent than morning-types (Sarmány, 1984).

Other variables of individual differences are styles studied mainly in student learning (Grigorenko & Sternberg, 1997). Three kinds of styles have been found: cognitive styles, learning styles, and thinking styles (Sternberg & Zhang, 2001). Cognitive styles indicate attitudes and tendencies to activate distinctive mental operations in a variety of situations; thinking styles concern which set of reasoning strategies an individual is inclined to apply; learning styles characterise how a person faces study tasks. In any case, styles are not abilities but they refer to preferred ways of information processing.

Learning and thinking styles have been related to individual's hemispheric preference (Springer & Deutsch, 1997). Hemisphericity is defined as the tendency of a person to rely on the processes associated with one rather than the other cerebral hemisphere in information processing (Albaili, 1993, 1996). The left hemisphere is mainly involved in information processing logically and sequentially and in dealing with verbal, analytic, temporal, and digital materials. The right hemisphere is involved in information processing holistically and nonlinearly and in dealing with nonverbal, concrete, spatial, analogical, emotional, and aesthetic materials (Torrance, 1982).

Torrance interpreted the concept of cerebral hemisphericity as a psychological dimension supported by neurological data and devised a self-report questionnaire: the Style Of Learning And Thinking (SOLAT) (for psychometric properties see Albaili, 1993; Torrance, McCarthy, & Kolesinski, 1988; Torrance, Reynolds, Ball, & Riegel, 1978; Torrance, Reynolds, Riegel, & Ball, 1977). This tool assesses whether an individual is a left-, right- or integrated thinker. The left-thinker follows an analytic and sequential mode of reasoning and he/she relies preferably on verbal–abstract representations. On the contrary, the right-thinker tends to process information in an intuitive, holistic, Gestalt-type, synthesised, and visual–motor way. Finally, the integrated thinker shifts from the left to the right style or vice versa according to the task.

Many studies tried to relate the left–right thinking styles to personality traits, temperaments, problem-solving performances, majors, and academic achievement. Right-thinkers are intuitive, impulsive, creative, feeling and perceiving-oriented people, developing affective and social learning strategies, inclined toward cultural individualism and with high tolerance of ambiguity (Zhang, 2004b). However, right-thinkers show emotional disorders, behavioural/learning problems and encounter difficulties in having to integrate at school (Zhang, 2004b). On the other hand, left-thinkers are sensing, thinking and judging-oriented people, developing cognitive and meta-cognitive learning strategies, inclined toward cultural collectivism and with a low tolerance of ambiguity (Zhang, 2004b). Administering a typical problem-solving task, like the Tower of Hanoi (Albaili, 1996), left-style participants made more moves and took a longer mean time to carry out the tasks than right-thinkers did. Finally, applied science majors were attended mainly by left-thinking students whereas social science majors were attended mainly by right-thinking students (Saleh, 1998).

Relationships between the left–right style of thinking and the circadian typology have never been studied before. The aim of the present study is to investigate this kind of relationships. We hypothesise that the morningness is associated to the left-thinking style and the eveningness to the right-thinking style. Such hypothesis is grounded on the fact that an overlap between some related personality traits of thinking styles and circadian typology might be. As reported above, there are many contact points among the descriptions of morning- and left-thinking types and evening- and right-thinking types. As discovered by Giampietro e Cavallera (2007), for instance, evening-disposition was correlated with the ability to apply divergent thinking strategies (creative thinking) to visual content.

2. Methods

2.1. Participants

A total of 1254 students attending courses at the universities of Bologna and Milano (Italy) participated to the study. The mean age of the sample was 21.86 ± 2.37 years (range: 18–30 years). They were 380 men (mean age $= 22.45 \pm$