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Impulsivity and time of day: Effects on performance and cognitive tempo

Jennifer B. Lawrence, Matthew S. Stanford*

Department of Psychology, University of New Orleans, New Orleans, LA 70148, U.S.A.

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Abstract

Previous research has suggested that high impulsive individuals perform better in the evening than in the morning because of differential variations in diurnal arousal rhythms. The current study was designed to determine if these findings could be replicated without external manipulation of arousal level. Forty subjects (20 high impulsive and 20 low impulsive as classified by the Barratt impulsiveness scale) were tested twice, once between 8.00 and 10.00 a.m. and once between 6.00 and 8.00 p.m. A variety of performance and cognitive tempo measures were employed in the study. No significant interactions between level of impulsivity and time of day on performance were observed. However, the results did reveal a greater variability of performance and a faster cognitive tempo in high impulsives as compared to low impulsives, a finding that is consistent with previous research. Time of day differences were also discovered on tasks requiring attention, with all subjects performing better in the evening on those tasks.

1. Introduction

Eysenck has proposed a theory of personality based on arousal. Within this theory, extraversion and its subcomponent, impulsivity, are hypothesized to result from low psychological and physiological arousal. This theory holds that when the cortex is underaroused, as it is in impulsive individuals, input from subcortical areas is uninhibited, allowing emotion and aggression to be freely expressed as impulsive behaviors (Eysenck and Eysenck, 1985). According to Eysenck, differences in arousal between personality types arise from differential levels of activity of the ascending reticular activating system (ARAS). The ARAS, in which the main component is the reticular formation, is responsible for relaying the excitation from sensory pathways to the cerebral

* To whom all correspondence should be addressed. Tel.: +1-504-280-5525; Fax: +1-504-280-6049; E-mail: mssps@uno.edu

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cortex (Moruzzi and Magoun, 1949). In introverts, the ARAS is consistently more active than in extraverts, and as a result, cortical arousal is perpetually higher in introverts than in extraverts (Eysenck and Eysenck, 1985). Experimental support for Eysenck's arousal theory has been obtained through a variety of conditioning and psychophysiological studies (e.g. Eysenck, 1967; Barratt, 1971; Carrillo-de-la-Pena and Barratt, 1993). A deeper analysis of the early extraversion research also revealed that the impulsivity component was the influencing factor on the results; the second component of extraversion, sociability, had no effect when the two components were analyzed separately (Eysenck and Eysenck, 1985).

Research concerning the manipulation of arousal levels in impulsives and the subsequent effect on performance has focused on the natural arousal changes that occur as a function of time of day. A study by Blake (1967) revealed that introverts exhibited a quicker increase in body temperature in the morning and an earlier drop in temperature in the evening hours than did extraverts, suggesting that introverts have a higher level of physiological arousal in the morning hours than extraverts and extraverts are slightly more aroused in the evening hours than introverts. According to Blake, if the physiological differences in diurnal arousal that were observed between the introverts and extraverts paralleled a change in nervous system arousal, then the diurnal arousal differences would affect performance between the groups (Blake, 1967).

Research conducted by Anderson and Revelle has expanded on the findings of Blake, focusing on the hypothesis that extraverts are underaroused in the morning and optimally aroused in the evening hours, while introverts are optimally aroused in the morning and less aroused in the evening hours. Revelle et al. (1980) designed a series of 5 experiments to examine the relationship between introversion/extraversion personality types, diurnal arousal rhythms, and artificial arousal changes produced by caffeine. These investigations employed the Eysenck personality questionnaire, the Eysenck personality inventory, and several items from the Guilford and Cattell personality inventories to determine personality type. The overall pattern of results in this series of experiments indicated that the impulsivity component of the introversion/extraversion scale was found to show the greatest and most consistent effects of the diurnal arousal differences. Administration of caffeine generally impaired the performance of low impulsives in the morning and improved it in the evening and had the reverse effect on high impulsives. For high impulsives, caffeine administration improved performance on tasks completed in the morning but caused a performance decrement on tasks completed in the evening. Revelle attributed the differences in performance with caffeine administration to diurnal arousal differences between high and low impulsives and the effect of Yerkes–Dodson Law. High impulsives, they postulated, were underaroused in the morning and optimally aroused in the evening, while low impulsives were optimally aroused in the morning and underaroused in the evening (Revelle et al., 1980). A later study that examined only the impulsivity component of introversion/extraversion (Anderson and Revelle, 1994) supported the findings of Revelle et al. (1980).

The results of these studies suggest that Eysenck's arousal theory of personality is incorrect in its assumption that high impulsives are generally under aroused when compared to low impulsives regardless of time of day (Revelle et al., 1980). While research examining impulsivity and diurnal arousal rhythms and their combined effect on performance conducted up to this point strongly suggests that circadian rhythms differ between high and low impulsives, much still remains unclear. Studies conducted by Revelle and Anderson have used caffeine to manipulate arousal in addition to the change in time of day, which could have altered the normal diurnal arousal patterns. Later