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In search of an electrophysiological index for psychoticism

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Abstract

We set out to investigate the potential of an EEG-based index for the Eysenckian personality trait of Psychoticism (P). Our study addresses both restful-wakefulness EEG and the use of an EEG activation method (photic driving). A total of 33 volunteer participants provided us with adequate EEG recordings with eyes closed, and of these 28 provided us with useable data for all photic-stimulation conditions. High P (P+) participants, who comprise 25% of the final sample, are clearly differentiated in terms of an alpha/theta power ratio from low P (P−) participants. For P− there is little differentiation in the alpha/theta power ratio across conditions of photic stimulation; for P+, differentiation is quite high, suggesting a differential responsivity. For P+ participants, in marked contrast to P−, the theta oscillatory system is most responsive to a 6 Hz driving frequency.

Keywords: Personality; Psychoticism; Extraversion; Photic stimulation; EEG; Alpha power; Theta power

1. Introduction

There is a tradition in psychophysiology of viewing electroencephalographic (EEG) measures of cortical arousal as being indicative of some stable individual characteristic, or trait. A notable landmark in this literature is Walter's (1961) differentiation among *persistent*, *responsive* and *minus*

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types, determined from an inspection of their restful-wakefulness EEG alpha. Attempts to correlate this type of resting alpha (and/or task-related, or concomitant alpha) with the subject's dominant mode of thinking (i.e., as one using visual imagery or not) have, however, met with mixed success (Gale, Morris, Lucas, & Richardson, 1972; Glass & Riding, 1999), though the matter is still on the research agenda (Marks & Isaac, 1995). A somewhat related strategy has been employed with respect to the relationship between hypnotic susceptibility and EEG alpha, with a similar degree of confusion as to the prospects here (Graffin, Ray, & Lundy, 1995; Perlini & Spanos, 1991).

The state of research examining EEG alpha and extraversion is also in bad shape (Gale, 1983; Matthews & Amelang, 1993), though is perhaps more promising in terms of theory-driven expectations (e.g., O'Gorman & Lloyd, 1987). Indeed, Eysenck's (1994) theory posits a psychobiological underpinning to each personality trait. Extraversion (E) is associated with cortical arousal (extraverts being chronically hypoaroused), best tapped using electrophysiological (e.g., Mangan, Pellett, Colrain, & Bates, 1993) and/or functional-imaging (e.g., Johnson et al., 1999) techniques. Neuroticism (N) is associated with autonomic arousal. Psychoticism (P) might well be "partly determined by cortical arousal" (Eysenck, 1994, p. 168), though this is an open question. It is for this very reason, that we set out to investigate the potential of an EEG-based index for P.

Our point of departure lies in those studies implicating impulsivity as being the key trait correlated with EEG alpha (O'Gorman & Lloyd, 1987). Our prediction here at the outset was that participants who scored high on both E (E+) and P (P+)—namely, those fitting the profile for impulsivity (Zuckerman, 1994)—would exhibit high EEG alpha. As it turns out, it is the alpha/theta power ratio which is more revealing.

2. Method

2.1. Participants

A total of 33 volunteers (21 females and 12 males) provided us with adequate EEG recordings with eyes closed—namely exhibiting alpha in restful wakefulness with eyes closed. An additional 4 individuals, who were found to exhibit an "alpha-free low voltage EEG" (Niedermeyer, 1997, p. 34)—that is to say, these are Walter's (1961) *minus* type—were excluded from further consideration, because for the purposes of this study their data would be inconsequential. Of the 33 participants, a total of 28 provided useable data for all photic-stimulation conditions (see below). All participants were right-handed (right-handed preference on at least 6/10 of the items of the Edinburgh Handedness Scale; Oldfield, 1971). Their age ranged between 21 and 31, and all had completed at least 12 years of schooling, the majority being students.

2.2. Personality assessment

The *Eysenck Personality Questionnaire-Revised*, short version (*EPQ-R-S;* Eysenck, Eysenck, & Barrett, 1985), which is a shortened and revised version of the EPQ, consisting of 48 items having a forced-choice format, tapping Extraversion (E), Neuroticism (N) and Psychoticism (P), as well as a Lie Scale (L), was completed while electrodes were being secured. By focusing on volunteers,