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Extraversion, neuroticism and the four temperaments of antiquity: an investigation of physiological reactivity

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Abstract

The present study adopted an historical perspective, which highlighted the place of Pavlov's work on the four classical temperaments in current theory and research on personality. Drawing on the work of Pavlov and the later contribution of [Robinson (1996). *Brain, mind, and behavior: a new perspective on human nature*. Westport, C.T.: Praeger Publishers] it was hypothesised that differences in cerebral reactivity contrast the sanguine (low reactivity) and melancholic (high reactivity) temperaments. The EPQ was used to identify four extreme groups of female subjects corresponding to the classical temperaments: ES/sanguine ($n=16$), EN/choleric ($n=16$), IS phlegmatic ($n=8$) and IN/melancholic ($n=16$). Reactivity indices included P1N1 and N1P2 response components of the vertex evoked potential to three different tone intensities and three different light flash intensities. Using extraversion and neuroticism as between subject factors and intensity as a repeated measures factor, separate analyses of variance for each dependent variable revealed no significant personality related effects. In comparison, planned contrasts between the ES and IN groups revealed a number of significant differences in the auditory modality but no significant differences in the visual modality. In accord with prediction, the IN group exhibited significantly steeper auditory P1N1 and N1P2 amplitude intensity functions than the ES group. Also in accord with prediction, the IN group exhibited higher overall auditory P1N1 and N1P2 amplitudes, however, only the P1N1 difference was significant. It was argued that auditory evoked potential amplitude provides a more appropriate index of cerebral reactivity than visual evoked potential amplitude.

Keywords: Extraversion and neuroticism; Classical temperaments; Reactivity; AEP; VEP

1. Introduction

Pavlov's influence on biologically oriented personality theories has been profound (e.g. Eysenck, 1957, 1967; Gray, 1987; Mangan, 1982; Nebylitsyn, 1972; Robinson, 1996; Strelau,

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1983; Teplov, 1964; Zuckerman, 1994). Pavlov's (1955) extensive study of brain-behaviour relations in the dog led him to conclude that canine temperament could be classified according to the four classical temperaments of antiquity and that these temperamental differences related to differences in the functional properties of brain cells located in the cerebral cortex.

One basic property, central to Pavlov's work, was the strength of the nervous system. Pavlov observed that the size of the conditioned response was typically directly proportional to the intensity of the conditioned stimulus (i.e. the law of strength). However, it was found that for every animal there was a maximum level of stimulation beyond which an increase in intensity produced a reduction in response magnitude. This distortion of the usual relationship between stimulus intensity and response magnitude was attributed to the development of a generalised inhibition induced to protect the central nervous system from functional exhaustion. The onset of protective inhibition came to be used by Pavlov (1957) as a key index of the strength of the nervous system. Relative to a strong nervous system, a weak nervous system was thought to possess highly *reactive* cortical cells, which passed into a state of protective inhibition more easily. The weak and strong nervous systems were found to correspond to the melancholic and sanguine temperaments, respectively.

A number of psychophysiologists have applied the Pavlovian concept of nervous system strength to the event related potential (ERP) and in particular, the augmenting/reducing phenomenon (e.g. Buchsbaum & Silverman, 1968; Lukas & Siegel, 1977; Zuckerman, Murtaugh, & Siegel, 1974). In this context, the terms ''augmenting'' and ''reducing'' typically refer to changes in P1N1 (P100-N140) amplitude at the vertex to an increase in light flash intensity. To define augmenting and reducing styles, Buchsbaum and Silverman (1968) correlated visual evoked potential (VEP) amplitude with the logarithm of flash intensity to identify those subjects who displayed a positive amplitude-intensity slope (augmenters) and those subjects who displayed a negative amplitude-intensity slope (reducers). According to Buchsbaum and Silverman, augmenting was indicative of a strong nervous system, reducing a weak nervous system.

The methodology employed by Buchsbaum and Silverman to classify augmenting and reducing styles has attracted some criticism. In particular, a number of researchers have provided evidence which calls into question the assumption of linearity associated with the VEP slope measure (e.g. Connolly & Gruzelier, 1982a; Iacono, Gabbay, & Lykken, 1982). Furthermore, Soskis and Shagaas (1974) report that change in mean amplitude is a more reliable measure of augmenting/reducing than slope. Several authors have also suggested that the latency ranges for peak identification suggested by Buchsbaum and Pfefferbaum (1971) are too narrow (e.g. Connolly and Gruzelier, 1982b; Carrillo-De-La-Peña and Barratt, 1993). Indeed, one of the main problems with the study of the flash VEP is the large variability in waveform between individuals. As Halliday (1982) observed this makes reliable identification of the different peaks problematic.

1.1. Problems with a Pavlovian conceptualisation of ERP augmenting and reducing

In addition to these methodological issues, there has also been some scepticism concerning Buchsbaum and Silverman's suggestion that the augmenting/reducing phenomenon is related to the Pavlovian concept of nervous system strength. While strength of the nervous system was conceived of as a generalised property (Pavlov, 1957), ERP augmenting/reducing shows poor topographical consistency (e.g. Stenberg, Rosén, & Risberg, 1988; Stenberg, Rosén, & Risberg,