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## Extraversion and neuroticism, partially independent dimensions?

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### Abstract

Eysenck suggested that the extraversion (E) and neuroticism (N) dimensions are independent except amongst high N scorers, hence the frequently reported negative correlation between the two dimensions. Eysenck Personality Questionnaire data from 877 undergraduate psychology students were analysed to determine support for this notion of partial independence. A negative correlation between E and N was found for both male (−0.35) and female (−0.22) respondents. Chi-squared tests were employed to analyse the frequency of respondents with extreme scores (high and low quartiles) on both the E and N scales. In line with Eysenck's notion of partial independence a significantly higher proportion of neurotic male and female respondents were classified as introverted as opposed to extraverted. However, amongst respondents low on neuroticism a significantly higher proportion of females were classified as extraverted rather than introverted. Robinson's personality dimensions were noted as a possible alternative to Eysenck's notion of partially independent E and N dimensions. © 2001 Elsevier Science Ltd. All rights reserved.

*Keywords:* Extraversion; Neuroticism; Eysenck Personality Questionnaire; Partial independence

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### 1. Introduction

With meta-analysis of factorial studies providing strong support for a hierarchical system of personality which includes the dimensions of extraversion (E), neuroticism (N) and psychoticism (P) at the fourth level (Royce & Powell, 1983; Zuckerman, Kuhlman & Camac, 1988), it is now generally agreed that Eysenck's three superfactors provide a useful set of co-ordinates for describing personality differences.

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Although factor analysis may identify the smallest number of independent dimensions from a data set, there is no logical necessity that these dimensions should provide the most appropriate level of description for the development of causal theories. The final factors to emerge from an analysis will be influenced, to some extent, by the methods of extraction and rotation employed by personality researchers. To avoid the *circulus vitiosus* entailed in correlational studies, Eysenck (1991, 1992) stressed that a personality dimension should only be considered to have validity when supported by evidence of a biological basis.

Eysenck (1967) focused attention on the biological substrates of E, and to a lesser extent, N. He related E differences to differences in the level of activity in the ascending reticular arousal system and consequently to higher levels of cortical arousal in introverts relative to extraverts. N differences were causally related to differences in visceral brain activity and consequently to higher levels of autonomic activation in neurotics relative to stables. Eysenck was unable to delineate a biological basis for P and, indeed, the status of P as an independent personality factor remains the subject of debate (e.g. Costa & McCrae, 1992).

While Eysenck proposed two structurally distinct neurological substrates for the E and N dimensions, factor analytic studies have frequently revealed a negative correlation between the two dimensions. Indeed, this lack of independence was evident in Eysenck's (1959) analysis of scores from the Maudsley Personality Inventory and his attempts to overcome the problem with the construction of the Eysenck Personality Inventory were unsuccessful (Eysenck & Eysenck, 1964). Zuckerman (1991) notes that subsequent studies using scores from the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) have continued to reveal a negative correlation between the two dimensions.

An interaction between E and N was formally recognized by Eysenck (1967) when he proposed that ascending and descending pathways between the reticular formation and the hypothalamus ensure that autonomic activation can also produce cortical arousal. This autonomic influence was, however, regarded as negligible for the most part. Eysenck suggested that cortical arousal is typically produced by sensory stimulation or problem solving and will not necessarily involve any visceral brain activity. He argued that it is only on those rare occasions "when strong emotions are involved frequently and for long periods that activation and arousal tend to become synonymous" (Eysenck, p. 233). Further to this, Eysenck argued that:

...this confluence of the two concepts under extreme conditions has in fact been documented even in the questionnaire field; while E and N are quite independent in the normal population, they tend to be negatively correlated in neurotic populations and among subjects with very high N-scores (Eysenck, p. 233).

While Eysenck's arousal theory provides a clear acknowledgment of an interrelationship between E and N, other comments made by Eysenck suggest a greater ambivalence. Eysenck and Eysenck (1985), for example, suggest that the negative correlation may be due to either an underlying relationship between the two super-factors (i.e. a "partial independence") or psychometric faults.

Eysenck's notion of partial independence leads to some clear predictions concerning the distribution of E scores amongst extreme scorers on N. First, the theory suggests that for individuals high on N, E and N are related such that there are likely to be more low E than high E individuals. Second, the theory suggests that for individuals low on N, the two dimensions are independent

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