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Personality correlates of startle habituation

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Abstract

This study investigated the relationship between extraversion and rates of acoustic startle habituation, a potential biological marker for individual differences. Personality was measured using the Eysenck Personality Questionnaire (EPQ), the Sensation Seeking Scale (SSS), and Tellegen's Multidimensional Personality Questionnaire (MPQ). Higher EPQ Extraversion and higher SSS scores were associated with faster, more rapid startle habituation. Moreover, the relationship between extraversion and faster startle habituation was replicated in a second, follow-up sample. Within the initial study sample, lower scores on the Constraint (CON) factor of the MPQ (reflecting greater impulsiveness, risk-taking, and nonconformity) were also associated with faster startle habituation. Follow-up analyses revealed relationships between EPQ Extraversion, SSS, and low MPQ CON. These results suggest that faster habituation within the CNS may be associated tendencies toward impulsivity and behavioral disinhibition.

Keywords: Acoustic startle response; Habituation; Extraversion; Constraint; Sensation seeking

1. Introduction

A major challenge in personality research involves determining the basic biological underpinnings of individual differences in personality and temperament. Eysenck (1967, 1994) has long attempted to describe individual differences in terms of biological processes. For instance, the theory of extraversion posits that the behaviors associated with this construct – i.e., sociability, liveliness, sensation seeking, and assertiveness (Eysenck, 1994) – result from a relatively lower level of cortical arousal associated with diminished activity in the Ascending Reticular Activating System (ARAS; Eysenck, 1994). Consistent with this, psychophysiological experiments involving measures of arousal such as electroencephalography (EEG) and skin conductance responses (SCR) have found evidence for lower arousal in extraverts (see Eysenck, 1994 for a review).

Extrapolating from the hypothesized lower cortical arousal in extraverts, Eysenck has suggested that extraversion may be associated with faster, more rapid habituation in cortically mediated physiological response systems (Eysenck, 1967, 1994). Habituation, defined as ''decreased response to repeated stimulation'' (Groves and Thompson, 1970, p. 419), is generally believed to be a ubiquitous and fundamental property of living organisms (Davis and File, 1984). Because habituation is such a fundamental biological process, it is arguably a useful physiological index in the ongoing study of the basic biological underpinnings of individual differences in personality and temperament.

The earliest studies investigating habituation in extraverts have been extensively reviewed elsewhere (see O'Gorman, 1977). Relationships between extraversion and habituation have not been uniformly observed across all of the earlier studies (see O'Gorman, 1977; Smith et al., 1990); however, when effects are found, they generally support a relationship between extraversion and faster habituation, consistent with Eysenck's predictions. Early studies linked extraversion to faster habituation of electrodermal responses (EDR) to auditory tones of varied intensity (Crider and Lunn, 1971; Mangan and O'Gorman, 1969). More recently, Jansen et al. (1989) found evidence of faster EDR habituation in response to a series of 1000 Hz 85 decibels (dB) in participants high in sensation seeking, a personality variable related to extraversion (Zuckerman, 1979).

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Similarly, a study by Smith et al. (1990) found that extraverts showed evidence of more rapid habituation of EDR to presentations of 1000 Hz 100 dB tones. The link between faster habituation and extraversion has been found in other physiological responses as well, such as in measures of evoked response potentials (ERPs), which are measures of electroencephalographic (EEG) responses to discrete stimuli. Ditraglia and Polich (1991) measured the P300 ERP brain potential, which is believed to be an index of post-perceptual processing, in response to a target stimulus consisting of a 2000 Hz 60 dB tone. Their results suggested that extraversion was associated with more rapid habituation of the P300. Taken together, the evidence supports Eysenck's hypothesis of more rapid habituation in extraverts, although additional replication in other physiological response systems is needed.

The eyeblink component of the acoustic startle response, is mediated in part by brainstem reticular structures (Davis et al., 1999), suggesting that the habituation of the startle response may serve as a potentially useful measure to investigate the biological underpinnings of extraversion. Two studies to date have found evidence that extraverts show reduced startle reactivity, consistent with the notion of lower CNS arousal in these individuals (Blumenthal et al., 1995; Blumenthal, 2001). While neither of these studies was explicitly designed to measure habituation, one found some indication of slower startle habituation in extraverts (Blumenthal, 2001). However, the study compared the mean of a block of 6 startle responses collected at baseline to the mean of a block of 6 additional startles collected between 5 and 20 min later, rather than assessing habituation trial-by-trial in response to a single continuous series of habituation stimuli. In contrast, the present study assessed habituation of the startle response to probes presented within a single continuous session. In addition, rates of startle habituation were quantified using individual regression techniques that are arguably more sensitive to time-dependent changes in response magnitude than is a block-to-block comparison (Petrinovich and Widaman, 1984).

1.1. The present studies

Here, we report findings from two experiments that examined the extent to which startle habituation is associated with personality trait variables. Experiment I examined whether faster startle habituation was associated with higher levels of extraversion and sensation seeking, as measured by the Eysenck Personality Questionnaire (EPQ; Eysenck and Eysenck, 1975), and the Sensation Seeking Scale (SSS, Zuckerman, 1979), respectively. Experiment I also included the Multidimensional Personality Questionnaire (MPQ; Tellegen, 1982), which (like the EPQ) assesses personality in terms of three higher-order factors (Patrick et al., 2002). The Negative Emotionality (NEM) factor of the MPQ is most closely aligned with EPQ Neuroticism (EPQ-N), MPQ Positive Emotionality (PEM) is most closely aligned with EPQ Extraversion (EPQ-E), while the inverse of MPQ Constraint (CON) is most closely aligned with EPQ Psychoticism (EPQ-P; Tellegen and Waller, in press). However, NEM includes a component of aggression, which relates most to EPQ-P, PEM includes a component of well being, which is represented (in reverse) in the EPQ-N factor, and CON includes a component of impulsivity, which is part of the EPQ-E factor. Thus, the factors of the MPQ and those of the EPQ provide overlapping but non-identical mappings of a similar three-dimensional personality space (Tellegen and Waller, in press). Based on the aforementioned studies of individual differences in habituation in other physiological systems, we predicted that higher EPQ Extraversion and higher sensation seeking would both be associated with faster startle habituation. With regard to the MPQ, we predicted that higher scores on PEM (because it relates most strongly to extraversion) and lower scores on CON (because lower scores relate most strongly to higher sensation seeking; Patrick et al., 2002) would also be associated with faster startle habituation rates.

Data for Experiment II were part of a larger investigation of individual differences in physiological reactivity. While the methods and design of Experiment II were comparable to those of Experiment I, they were not identical. Thus, the data from Experiment II not only provided an opportunity to replicate the essential findings of Experiment I, but also provided an opportunity to replicate the results in the context of slightly varied experimental methodology.

2. Experiment I

2.1. Method

2.1.1. Participants

Healthy volunteers were recruited from an introductory psychology course at Florida State University. Participants were 24 males and 24 females who indicated on a brief self-report medical checklist that they had no conditions (e.g., vision or hearing loss) that would affect startle responding. The subjects ranged in age from 18 to 24. All participants attended two experimental sessions; all participants received course credit for attending the first session and monetary compensation ($15) for attending the second.

2.1.2. Stimulus materials

Visual foreground stimuli were simple, affectively neutral black and white slides depicting simple geometric shapes and were designed to minimize the effects of emotion and foreground attentional engagement on startle responding. Slides consisted of 8 basic geometric shapes (circle, square, hexagon, triangle, etc.); each shape had two variants (elongated, and elongated and rotated), for a total of 24 unique shapes. The slides were presented in a semi-random order (i.e., every 3 slides contained a normal shape, an elongated shape, and an elongated and rotated shape). Slides were projected onto a 1 m $\times$ 1 m opaque slide screen using a slide projector positioned behind a one-way mirror in an adjoining equipment room. Participants were administered acoustic startle probes that consisted of 50 ms bursts of 105 dB (Scale A) white noise with instantaneous rise time. Startle probes were presented binaurally to participants through Telephonics (TDH-49) headphones.

2.1.3. Stimulus presentation and design

The timing of stimulus presentation was similar to that of prior picture-startle paradigms (e.g., Stritzke et al., 1995). Each slide was presented for 6 s, with intertrial intervals (ITIs) varying in length from 10 to 20 s. To minimize the predictability of noise presentation, startle probes occurred at one of three times following slide onset (1.8, 3.5, 4.5 s) during 12 of the 24 slide presentations, and at one of four onset times (4, 6, 8, or 10 s) during 12 of the 23 ITIs. Presentation and timing of slide and startle stimuli, along with collection and storage of session data, were controlled by an IBM-compatible computer, using the VPM software package (Cook et al., 1987).