



Extraversion, attention, and startle response reactivity

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Abstract

The present study investigated the impact of directed attention tasks performed by introverts and extraverts, using the brainstem startle eyeblink response as a measure of automatic reactivity. Participants (23 introverts and 24 extraverts) were instructed to either attend to a startle-eyeblink-eliciting acoustic noise pulse (90 or 105 dB) or to a drawing of animals, or to ignore all stimuli, while their eyeblink reflex to the noise pulse was measured. In the no-task condition, introverts were generally more reactive than extraverts. When attention was directed to the startle-eliciting stimulus, startle response amplitude was potentiated in both introverts and extraverts. When attention was directed to a visual task, acoustic startle reactivity was reduced for introverts, but not for extraverts. Therefore, introverts were more able to focus their attention, and were less distractible than extraverts. These data support previous findings of a narrower focus of attention in introverts than in extraverts, based on differences in arousal as a function of extraversion. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

The purpose of this study was to investigate variations in attentional processing in introverts and extraverts, using the startle response to probe early stages of information processing. Introverts show more pronounced differences in reactivity as a function of directed attention instructions than do extraverts (Eysenck & Eysenck, 1985). Stenberg, Rosen and Riseberg (1990) measured ERPs (event related potentials) (N120 and P200) and found that attention made more of a difference for introverts than for extraverts, both for directing attention towards a stimulus and for distracting attention away from a stimulus. That is, instructing participants to attend to the ERP-eliciting stimulus resulted in greater reactivity in introverts than extraverts. This pattern was reversed

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when participants were instructed to attend to a stimulus in a different modality, illustrating the fact that introverts were more able to focus attention to the task, and were less distracted by the ERP-eliciting stimulus. Stenberg et al. explained this in terms of higher arousal in introverts (Eysenck, 1967), and narrower attentional focus as arousal increases (Easterbrook, 1959). That is, as arousal increases, the range of cue utilization becomes more restricted, possibly due to arousal-dependent lateral inhibition (Walley & Weiden, 1973). Koelega (1992) reported a meta-analysis of several dozen studies published over a 30-year period in which the relationship between extraversion and vigilant attention was examined.

Although these differences are seen in studies utilizing tasks requiring vigilant attention, variations in arousal explain differences between introverts and extraverts in visual selective attention tasks as well, as seen in assessments of sustained attention and susceptibility to distraction (Szymura & Necka, 1998). Introverts also show greater P3 amplitude than do extraverts, based on differences in attentional allocation (Daruna, Karrer & Rosen, 1985).

Blumenthal, Chapman and Muse (1995) showed that a social encounter reduces startle eyeblink reactivity in introverts, but not in extraverts. The social encounter situation is arousing, and it also draws attention away from the startle stimulus (Bovelsky & Blumenthal, 1997), decreasing startle reactivity. Therefore, this finding supports the hypothesis that introverts focus their attention more effectively on the social encounter, and are less reactive to distracting stimuli, than is the case for extraverts. Brebner and Cooper (1978) hypothesized that introverts are “geared to inspect”, such that increased excitation is associated with cognitive processing to a greater degree than is the case for extraverts. Therefore, reactivity in directed attention tasks should be more pronounced in introverts when attending to a target stimulus, but also more attenuated when attention is focused on stimuli in other sensory modalities.

The startle response is a rapid and automatic response to a sudden stimulus, and one of the motor components of this reflexive response is the eyeblink (Berg & Balaban, 1999). This startle eyeblink response has been used to investigate a wide variety of cognitive, neurophysiological, and clinical phenomena (Dawson, Schell & Boehmelt, 1999). Stelmack (1997) reviewed literature that shows that introverts are more reactive than extraverts to moderate intensity punctate stimuli (75–90 dB), using measures of SCR (skin conductance response) and ERP. Blumenthal et al. (1995) have also found this for startle amplitude, in support of Eysenck's (1967) theory of higher arousal in introverts.

Directing attention towards a startle stimulus generally increases the effectiveness of that stimulus. Distracting attention away from the startle stimulus generally results in reduced reactivity. This attentional modulation of startle has been seen in studies using a variety of stimuli and situations (Anthony & Graham, 1985; Blumenthal, 1999; Hackley & Graham, 1983; Schicatano & Blumenthal, 1998). Bovelsky and Blumenthal (1997) showed that startle is reduced by distracting attention away from the startle stimulus, when this distraction involves directing attention towards a different sensory modality. These data make it clear that instructing participants to direct their attention influences stimulus processing at a fairly early point in the pathway. Subcortical stimulus processing is affected by directions to attend to one stimulus modality or another, as shown by the ability of these instructions to modulate a response with an average latency of 40–50 ms. This also suggests that the impact of attention on startle modulation is modality specific, providing support for an early selection theory of attention.

In the present study, introverts and extraverts were presented with startle stimuli in several attention conditions, including a no-task condition, a condition in which attention was directed

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