Pergamon

PII: 50191-8869(96)00228-0

Person. individ. Diff. Vol. 22, No. 4, pp. 591–593, 1997

0191-8869/97 $17.00+0.00

Harm avoidance and affective modulation of the startle reflex: A replication

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(Received 30 April 1996)

Summary—Affective modulation of the eyeblink startle reflex, by unpleasant slides, was found to be limited to subjects high on Harm Avoidance (HA; Cloninger, 1986); low HA subjects did not respond to unpleasant slides with potentiated startle reflexes. This result provides a replication of Corr, Wilson, Fotiadou, Kumari, Gray, Checkley and Gray (1995a), and supports the hypothesis that individual differences in trait anxiety are important in affective modulation of the startle reflex. It is concluded that Cloninger's HA should be routinely included in future startle modulation experiments. © 1997 Elsevier Science Ltd. All rights reserved.

INTRODUCTION

The startle reflex involves a set of involuntary responses to a sudden, intense stimulus (Landis & Hunt, 1939), which in human beings is most easily and reliably measured by the eyeblink response (Anthony, 1985). Since the observation by Vrana, Spence and Lang (1988) that pleasant foreground stimuli attenuate the basic startle reflex while unpleasant foreground stimuli potentiate the reflex, the startle reflex paradigm has been used to study clinical anxiety (Cuthbert, Patrick & Lang, 1991), phobia (Hamm, Globisch, Cuthbertson & Vaitl, 1991; Vrana & Constantine, 1990), psychopathy (Patrick, Bradley & Lang, 1991), and trait fearfulness (Cook, Hawk, Davis & Stevenson, 1991; Greenwald, Bradley, Cuthbert & Lang, 1991).

Affective modulation of the startle reflex would seem to offer a powerful paradigm with which to study normal variation in reactions to appetitive and aversive stimuli. Previous research in our laboratory has confirmed the basic pattern of affective startle modulation reported by others (Lang, 1995; Lang *et al.*, 1993); and, in addition, has shown that Harm Avoidance (HA; Cloninger, 1986), a measure of trait anxiety, mediates the effects of pleasant and unpleasant slides on startle amplitude (Corr *et al.*, 1995a): only high HA *S*s responded to the unpleasant slides, while only low HA *S*s responded to the pleasant slides.

The present study reports a replication of the effect of high HA on negative affective modulation of the startle reflex.

METHOD

Subjects

Twenty-three *S*s were tested, 10 males (mean age = 33.80 yr, SD = 6.84) and 13 females (32.69, 7.09). *S*s were normal, healthy volunteers; none had hearing or visual impairment, or suffered from psychiatric illness, alcohol or drug abuse.

Design and stimuli

The research design (slides, timing of stimuli and recording procedures) replicated that used in a previous study by Bradley, Cuthbert and Lang (1991) and Corr *et al.* (1995a). One block of 27 slides (Lang, Ohman and Vaitl, 1988) was shown, which consisted of nine pleasant, nine unpleasant and nine neutral slides; slides were grouped in three sets of nine, with three pleasant, three unpleasant and three neutral slides randomly ordered within each set. Each slide was presented for 6 sec, followed by a randomly determined interslide interval of 10–20 sec. The acoustic startle stimulus consisted of a 50 msec presentation of a 100 dB (A) burst of white noise with an instantaneous rise time presented binaurally through headphones. The startle probe was presented 24 times; with 18 probes being presented during six of the nine slides in each of the three categories (pleasant, unpleasant and neutral). Six startle probes were presented during interslide intervals to enhance unpredictability of the startle presentation. The startle stimuli were presented between 3 and 5 sec after slide onset.

Electromyographic (EMG) recording and data capture/reduction are detailed in Corr *et al.* (1995a). In order to allow between-subject comparisons in this study, the amplification 'gain control' was held constant at 3.

After the aims of the study were explained, the *S*s were asked to complete the Tridimensional Personality Questionnaire (TPQ; Cloninger, 1989), which measures Harm Avoidance, Reward Dependence and Novelty Seeking.

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RESULTS

The effects of slide valence and TPQ variables on startle amplitude were examined by multivariate analysis of variance (MANOVA; Jennings, 1987). Median splits were taken on the TPQ scales. Significant results were found only for HA (median = 10).

A significant effect of valence, $F(2, 17) = 6.40$, $P < 0.01$ (linear component: $t = 3.13$, $P < 0.01$) revealed that relative to neutral slides ($M = 78.98$, SEM = 17.45), unpleasant slides (101.61, 20.54) increased amplitude ($t = 3.35$, $P < 0.01$), but pleasant slides (80.96, 17.29) did not differ from neutral slides ($t = 0.45$, $P > 0.05$).

A significant effect of HA, $F(1, 18) = 5.38$, $P < 0.05$, showed that high HA *Ss* ($M = 125.32$, SEM = 30.99) had higher absolute amplitude levels compared with low HA *Ss* (48.32, 10.31).

A significant valence × HA interaction, $F(2, 17) = 3.53$, $P = 0.05$, revealed that in low HA *Ss*, and relative to neutral slides ($M = 43.83$, SEM = 9.38), there was no significant modulating effect of pleasant (50.74, 10.10; $t = 0.98$, $P > 0.05$) or unpleasant (53.36, 13.22; $t = 1.44$, $P > 0.05$) slides. However, in high HA *Ss*, and relative to neutral slides (114.14, 30.38), there was a significant modulating effect of unpleasant slides (149.85, 33.01; $t = 3.39$, $P < 0.01$), but no comparable effect of pleasant slides (111.17, 30.94; $t = 0.58$, $P > 0.05$).

DISCUSSION

The results provide another replication of the effect of unpleasant stimuli on the modulation of startle reflex amplitude (Lang, 1995; Lang *et al.*, 1993). The present results also provide a replication of the effect of HA on modulation by unpleasant slides, as originally reported by Corr *et al.* (1995a). This HA effect supports past research showing that high fear *Ss* show the strongest startle response to aversive stimuli (Cook *et al.*, 1991), and confirms that these effects can be found among non-clinical general population *Ss*.

Cloninger (1986) defines HA as "a heritable tendency to respond intensely to aversive stimuli and to learn to avoid punishment, novelty and non-reward passively". The present results support this theory and highlight the sensitivity of Cloninger's HA measure to individual differences in reactivity to aversive stimuli. Corr, Pickering and Gray (1995b) found that, in a computerized associative learning task entailing appetitive and aversive CS-UCS pairings, high HA *Ss* showed superior learning under aversive UCS conditions, lending further support to Cloninger's claim that HA is a good measure of negative emotional reactivity. However, our laboratory has been unable to replicate this HA effect using short films (Kumari, Corr, Wilson, Kaviani, Thornton, Checkley & Gray, 1996). We believe that films induce relatively strong emotions, thus eliminating individual differences in negative emotional reactivity measured by HA.

The fact that high HA *Ss* had higher overall amplitudes compared with low HA *Ss* is probably due to the amplification gain control being held constant. In Corr *et al.* (1995a), where no main effect of HA was observed, the gain control was altered for each *S* thus reducing, and possibly eliminating, individual differences in the amplitude of basic startle reflexes to the loud and aversive startle stimulus.

The failure to find any effect of low HA in reactions to pleasant slides, as reported by Corr *et al.* (1995a), may reflect the fact that only one block of slides was used in this study. Unpublished analysis of the Corr *et al.* (1995a) data reveals that the effects of unpleasant slides are much stronger in the first of the two blocks, while the reverse is true of pleasant slides. It thus appears that, in the startle reflex paradigm, aversive responses are rapidly developed but dissipate quickly, in contrast to appetitive responses, which take time to develop. Therefore, the effects of unpleasant slides and high HA should be most marked in the first block, as here reported, while the effects of pleasant slides and low HA should be most marked in the second block of slides.

The present experiment clearly shows that high HA *Ss* respond strongly to unpleasant slides with augmented startle reflexes, thus suggesting that the effects of this personality variable should be routinely scrutinised in future startle reflex experiments.

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