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# Differential lateralization of trait anxiety and trait fearfulness: Evoked potential correlates

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## Abstract

There is an ongoing debate on whether the terms anxiety and fear denote distinct states. Brain imaging studies suggest they may indeed be dissociable and are differentially lateralized. A study of 54 normal college students successfully found doubly dissociable electrophysiological correlates of trait anxiety and fearfulness that had the predicted laterality. Trait anxious participants displayed a left-lateralized visual N1 (localized to the temporo-parietal junction) whereas trait fearful participants presented a right-lateralized P1r (localized to the superior parietal region). These findings support the proposal that trait anxiety and trait fearfulness are distinct personality dimensions with distinctive patterns of laterality. © 1998 Elsevier Science Ltd. All rights reserved.

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## 1. The question of anxiety and fear

Trait anxiety is an individual difference variable that has attracted particular experimental interest. Studies have found a wide array of behavioral differences in the high trait anxious, including narrowed attention, heightened automatic responses and bias towards threatening stimuli. For clinicians, it throws light on neurotic disorders. For personality psychologists, it is related to two of the major self-report personality dimensions (neuroticism and introversion). For emotion researchers, it is the chronic expression of one of the better studied emotions.

For all this interest, trait anxiety remains poorly understood. One problem plaguing researchers has been multiplying constructs with uncertain interrelationships (e.g. anxiety,

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fear, worry, emotionality, arousal, etc.). A related issue is that these instruments are typically all moderately intercorrelated, leaving issues of discriminant and convergent validity clouded.

Two common measures that particularly call for examination are the Spielberger State-Trait Anxiety Inventory (STAI) and the Fear Survey Schedule (FSS). The STAI (Spielberger, 1983) is the most commonly used instrument for measuring anxiety in experiments. Experimenters have found it particularly attractive because it yields scores for both state anxiety and trait anxiety. The latter section asks raters the self-descriptiveness of such phrases as “I lack self-confidence”.

The FSS (Wolpe and Lang, 1964) was developed in the context of behavioral therapy of fear disorders, particularly phobias. It assesses how much the rater fears a wide variety of stimuli compiled from clinical experience (e.g. suffocating, angry people, blood). Several versions have been developed with differing numbers of items but are largely similar.

Studies typically rely on just one or the other measure, depending on which has been customary for that line of inquiry. While these two measures are clearly related, it is unclear in what manner. It could be argued that they both measure the same construct; the two typically correlate in the range of about 0.27 to 0.60 (Hersen, 1973). Measurement specific variance (due to the different question formats) could be responsible for the divergence between the two measures.

Alternatively, they could measure distinct constructs. Some clinicians (Barlow, 1988; Öhman, 1993) have argued that neurotic pathologies fall into two distinct groups, those of anxiety (e.g. generalized anxiety disorder, obsessive–compulsive disorder) and of fear (e.g. phobia, post-traumatic stress disorder, panic disorder). Barlow describes anxiety as a system of associated thoughts, memories and autonomic responses whereas fear is a primitive emergency response. Öhman makes a similar argument, making the additional proposal that fear is set off by preconscious feature detectors whereas anxiety can be set off by either preconscious significance evaluators or postconscious expectancy systems. It is therefore possible that the FSS and the STAI may measure the trait expression or susceptibility to these two states. The moderate correlation could arise from co-occurrence or common measurement error (like acquiescence bias). It is not yet clear from these theories how this putative dichotomy could be tested.

Inspired by clinical observations, some behavioral neuroscience researchers have proposed biological systems that could underlie these two states. An influential formulation (Gray, 1982; Gray and McNaughton, 1996) suggests that the septo-hippocampal system acts as a comparator, detecting unexpected events. In such cases a behavioral inhibition system (BIS) is activated which halts current motor programs, increases arousal and triggers orienting to the unexpected event. Anxiety would represent chronic activation of this system. Panic (what might also be called fear) is suggested to be the activation of a fight/flight system centered on the central gray and triggered by the amygdala (Gray, 1987). While the anxiety system is well defined, the eliciting conditions and behavioral concomitants of the fear system remains rather vague and so it would be difficult to empirically distinguish them, particularly since both are proposed to produce physiological arousal.

The most promising proposal of anxiety and fear that lends itself to experimental tests is that anxiety (anxious anticipation) may be left-lateralized and fear (anxious arousal)

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