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## Exploring the boundary between temperament and generalized anxiety disorder: A receiver operating characteristic analysis

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### Abstract

Studies of individuals with an increased tendency to experience negative emotions such as fear, sadness, and anger have documented links between this temperamental trait and anxiety disorders. There exists debate, however, concerning the degree to which high levels of a temperamental trait are a necessary and/or sufficient component of a DSM diagnosis. In this study, receiver operating characteristic (ROC) analyses assessed the relations between levels of harm avoidance (HA) and generalized anxiety disorder (GAD) diagnoses in 334 children and their parents. Analyses revealed HA scores to be highly predictive of GAD diagnoses in children ( $AUC = .791$ ,  $P < .001$ ) and adults ( $AUC = .818$ ,  $P < .001$ ). However, there were many individuals with high HA scores who did not qualify for a GAD diagnosis. These findings suggest that while there are strong associations between HA and GAD, high levels of HA are neither necessary nor sufficient in the formation of clinically significant anxiety symptoms.

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## 1. Introduction

The interface between temperament and psychopathology has received increased interest of late as researchers continue to find strong links between temperamental traits and a wide array of psychiatric disorders (Nigg & Goldsmith, 1998; Rettew & McKee, 2005). The degree of association has stirred both methodological and theoretical debate about the distinction between these supposedly independent domains (Frick, 2004). Complicating matters further is the fact that the definition of temperament remains somewhat elusive (Rothbart, 2004), although there is at least some consensus that temperament refers to individual differences in emotional reactivity and regulation that can be observed early, are moderately stable, and under at least some genetic influence (Goldsmith et al., 1987).

Some researchers have postulated temperament as a subclinical variant of psychiatric disorders (von Zerssen & Akiskal, 1998) with temperament and corresponding psychopathology existing along a single continuum (Carey, 1999; Graham & Stevenson, 1987). Under this view, more extreme levels of a particular temperamental trait would be a necessary although not sufficient element of a corresponding psychiatric disorder. A large twin study conducted in Australia (Jardine, Martin, & Henderson, 1984) reported the genetic correlation between neuroticism and anxiety to be approximately .8. Hettema, Prescott, and Kendler (2004) recently found evidence that not only is there a high degree of correlation between neuroticism and generalized anxiety disorder (GAD) but that the two conditions may involve some of the same genes. Others, however, view temperamental dimensions as one of many risk factors for later psychopathology (Schwartz, Snidman, & Kagan, 1999) and something qualitatively distinct between psychopathology itself.

Anxiety disorders have been particularly linked to temperamental dimensions. Kagan (1994) and coworkers have proposed the temperamental dimension of behavior inhibition (BI) to describe children who become overly fearful and reticent when confronted with novel situations and people. BI as a toddler has been found to predict later psychopathology, particularly anxiety disorders (Biederman et al., 1993; Schwartz et al., 1999). Other measures of related temperamental or personality traits, variably named neuroticism, negative affectivity, or negative emotionality have also been found to have strong associations with anxiety disorders (Anthony, Lonigan, Hooe, & Phillips, 2002; Caspi, 2000; Kuo, Chih, Soong, Yang, & Chen, 2004). Using Cloninger's framework, the related dimension of harm avoidance (HA) appears to be strongly linked to many anxiety and affective disorders in both children and adults (Öngür, Farabaugh, Iosifescu, Perlis, & Fava, 2005; Pelissolo et al., 2002; Rettew, Copeland, Stanger, & Hudziak, 2004).

Many hypotheses concerning the temperament/psychopathology boundary are now able to be tested and quantified using modern data analytic techniques. One type of analysis that holds promise in quantifying the relations between

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