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Paranormal experience and the COMT dopaminergic gene: A preliminary attempt to associate phenotype with genotype using an underlying brain theory

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ABSTRACT

Paranormal belief and suggestibility seem related. Given our recent findings outlining a putative association between suggestibility and a specific dopaminergic genetic polymorphism, we hypothesized that similar exploratory genetic data may offer supplementary insights into a similar correlation with paranormal belief. With more affordable costs and better technology in the aftermath of the human genome project, genotyping is increasingly ubiquitous. Compelling brain theories guide specific research hypotheses as scientists begin to unravel tentative relationships between phenotype and genotype. In line with a dopaminergic brain theory, we tried to correlate a specific phenotype concerning paranormal belief with a dopaminergic gene (COMT) known for its involvement in prefrontal executive cognition and for a polymorphism that is positively correlated with suggestibility. Although our preliminary findings are inconclusive, the research approach we outline should pave the road to a more scientific account of elucidating paranormal belief.

1. Introduction

Attempts to characterize paranormal belief have been traditionally phenomenological. Several researchers have endeavored to characterize the differences among individuals who are skeptical about, believe in, or experience the paranormal. An emerging theme from these reports identifies variations in the tendency to perceive patterns in ambiguous or statistically random data. For example, one study showed that believers in Extrasensory Perception (ESP) were poorer at making probability judgments compared with skeptics (Blackmore, 1985). In addition, believers in ESP were more likely to attribute chance effects to non-chance causes, relative to non-believers. This notion has since been generalized, positing that believers in the paranormal are more likely to detect patterns in random noise where no such patterns exist (Brugger and Taylor, 2003).

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About three decades ago increased interest in the biological substrate of paranormal belief and religious experience identified the role of the temporal lobe and epileptic foci therein (Mandell, 1980). Support for this hypothesis came from several sources. One study reported that individuals diagnosed with temporal lobe epilepsy syndrome showed a tendency for multiple religious conversions (Geschwind, 1983). Electrophysiological accounts reported that electroencephalogram (EEG) of non-epileptic individuals revealed spontaneous paranormal experiences and proposed that the psychological components of complex partial (psychomotor) epilepsy may represent a continuum of temporal lobe sensitivity, suggesting that healthy people may display, albeit less strongly, experiences and non-convulsive behaviors similar to those of patients diagnosed with electrical foci within the temporal lobe (Persinger, 1984). Finally, EEG findings showed a positive correlation between higher numbers of major complex partial (temporal) epileptic signs and both paranormal experience and a specific personality profile, including stereotyped, ruminative and overly judgmental behavior (Persinger and Makarec, 1987).

Similar to other higher brain functions, paranormal belief probably involves both genes and specific experience. Although elucidating the role of genes in cognitive networks underlying human performance is still in its infancy (Fossella et al., 2002a, 2002b; Fan et al., 2003), recent investigations into the biological basis of paranormal belief and religious experience take the approach that human spirituality has an innate genetic component (Hamer, 2004). Rather than claiming that a specific gene is responsible for spirituality, humans may possess a predisposition for a well-characterized phenotype. For example, one gene that was at least correlated with a form of ''self-transcendence'' is vesicular monoamine transporter number 2 (VMAT2), a gene known to influence monoamines in the brain (Hamer, 2004). To avoid a ''fishing expedition,'' however, it is better to frame genotype–phenotype correlations within an overarching brain theory. As a case in point, multiple studies report that emotional sensitivity involves brain monoamines (Liu and Nakamura, 2006). Therefore, a positive correlation between VMAT2 and self-transcendence seems more meaningful than a correlation unsupported by such an underlying brain theory.

The gradual introduction of biological assays complements the phenomenological approach. In a yet-to-be-published study exploring the tendency to pick up meaningful information among scrambled words or faces, investigators administered the dopamine agonist levodopa (L-dopa) – a drug typically used to relieve the symptoms of Parkinson's disease by increasing levels of dopamine in the brain – to both skeptics and self-confessed believers in the paranormal (Krummenacher et al., 2002). In the no-drug condition, believers were more inclined than skeptics to assume the presence of meaningful information. Under L-dopa, however, the probability of seeing a meaningful pattern increased for the skeptics but remained unchanged for the believers, probably due to a ceiling effect.

Dopamine, which has been studied in the context of Magical ideation (MI) and suppressing negative schizotypal symptoms (Mohr et al., 2005a, 2005b, 2004), is also central to executive functions and selective attention (Raz, 2004; Raz and Buhle, 2006). We have recently outlined close links between mechanisms of attention and suggestion and provided preliminary data to support a candidate gene approach to suggestibility (Raz, 2005; Raz et al., 2005, 2006). Although suggestibility is a complex phenomenon likely associated with many genetic polymorphisms, we identified a positive correlation between a specific polymorphism of a dopaminergic gene and suggestibility (Raz et al., 2006) and have shown that neuroimaging assays and exploratory genetic associations from the domain of attention research may elucidate the underlying neural substrates (Fan et al., 2003).

Suggestibility, interchangeably termed hypnotizability (Raz, 2007), and paranormal belief likely share a common or largely overlapping phenotype (Braffman and Kirsch, 1999; Kirsch et al., 1999a, 1999b; Kirsch, 1997; Brugger, 2001; Brugger et al., 1994). For example, suggestibility shares at least some personality traits often seen in paranormal believers (Persinger and Makarec, 1987; Hines, 2003; Tellegen and Atkinson, 1974). The association between the genotype we previously identified – catechol-o-methyl transferase (COMT) high/low enzyme activity polymorphism – and suggestibility probably relates to COMT's role in the breakdown of dopamine in the central nervous system (Cooper et al., 2002).

The putative association between paranormal thoughts and high levels of dopamine in the brain (Krummenacher et al., 2002) contextualizes both the notion that differences in the COMT genotype correlate with multiple cognitive and psychiatric variables (Diamond et al., 2004; Zubieta et al., 2003; Craddock et al., 2006) and that individuals with a valine/methionine (VM) COMT polymorphism correlate positively with suggestibility (Raz, 2005; Raz et al., 2005, 2006). In addition, frontal brain regions, including the anterior cingulate cortex, are key nodes in executive functions and dopamine plays a pivotal role in such control networks (Raz, 2004; Raz and Buhle, 2006). The activity of COMT in the brain varies as a function of location therein and substantive evidence indicates that COMT has its greatest effect in the frontal areas (Craddock et al., 2006). Interpretation of functional magnetic resonance imaging data suggests that regions within human prefrontal cortex were involved in the perception of patterns in sequences of random stimuli (Huettel et al., 2002). Because individuals who believe in paranormal phenomena are typically more likely to construe non-existent patterns in random sequences, these individuals may well be endowed with a special ability to dissociate, get absorbed, and suspend belief – hallmarks of both suggestibility (Kirsch, 1999; Kirsch and Braffman, 2001) and paranormal belief (Brugger, 2001; Brugger et al., 1994; Hines, 2003). Thus, such individuals would be more likely to correlate with the heterozygous COMT genotype. Guided by this logic, in the present study we tested the hypothesis of whether a well-defined phenotype of believing in the paranormal will positively correlate with the dopaminergic VM COMT polymorphism.

2. Methods

2.1. *Participants*

One hundred and thirteen students from the Pleasantville campus of Pace University were recruited from various