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## The ability to tickle oneself is associated with level of psychometric schizotypy in non-clinical individuals



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### ABSTRACT

A recent study (Lemaitre et al., 2016, *Consciousness and Cognition*, 41, 64–71) found that non-clinical individuals who scored highly on a psychometric scale of schizotypy were able to tickle themselves. The present study aimed to extend this finding by investigating whether the ability to tickle oneself was associated with level of psychometric schizotypy considered as a continuous variable. One hundred and eleven students completed the Schizotypal Personality Questionnaire (SPQ). A mechanical device delivered tactile stimulation to participants' palms. The device was operated by the experimenter (External) or the participant (Self). Participants were asked to rate the intensity, ticklishness and pleasantness of the stimulation. A significant association was observed between participants' tactile self-suppression (External minus Self) and their score on the SPQ. These results suggest that the ability to suppress the tactile consequences of self-generated movements varies across the general population, and maps directly onto the personality dimension of schizotypy.

### 1. Introduction

One of the most fundamental challenges faced by our nervous system is how to distinguish between sensations caused by our own movements and sensations caused by changes in the external world (Crapse & Sommer, 2008; Hughes, Desantis, & Waszak, 2013). One method our brains have developed to meet this challenge is to use a copy of the motor command (i.e., an 'efference copy') to predict the expected sensory consequences of each self-initiated movement (Sperry, 1950; von Holst & Mittelstaedt, 1950). These sensory predictions can then be compared to sensory feedback, and if the sensory predictions match the sensory feedback then the movement is likely to be self-generated and the resulting sensations are suppressed. Conversely if the sensory predictions do not match the sensory feedback, then the action is likely to be externally-generated and the resulting sensations are not suppressed (Georgieff & Jeannerod, 1998; Jeannerod, 1997). It has been suggested that the passivity experiences characteristic of schizophrenia (including delusions of control and delusions of thought insertion) as well as some classes of auditory hallucinations may reflect an abnormality in the mechanism by which the sensory consequences of self-generated actions are predicted (Feinberg, 1978; Frith, 1992; Frith, Blakemore, & Wolpert, 2000). Such a dysfunction in this 'forward model' (Wolpert & Miall, 1996), could lead to confusion as to whether a given thought action is self or externally-generated (Blakemore, Wolpert, & Frith, 2002; Jeannerod, 2009).

It is well established that tactile sensations are perceived differently depending on whether they are self or externally-generated; the fact that psychologically healthy people are typically unable to tickle themselves is a celebrated example (Blakemore, Wolpert, & Frith, 1998; Weiskrantz, Elliott, & Darlington, 1971). This raises the interesting question as to whether psychotic individuals, who ostensibly have difficulties in predicting and suppressing the sensory consequences of their own actions due to their

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dysfunctional ‘forward model’ are capable of tickling themselves. This question was directly addressed by the seminal study of Blakemore, Smith, Steel, Johnstone, and Frith (2000). In their study, Blakemore et al. recruited three groups of participants: patients with a clinically diagnosed mental disorder (schizophrenia, bipolar or depression) who had recently experienced passivity experiences and/or auditory hallucinations, patients with a clinically diagnosed mental disorder who had not recently experienced these symptoms, and matched healthy controls. These participants were asked to rate, on a Likert scale, the intensity, ticklishness and pleasantness of tactile sensations that were generated either by the experimenter, or by the participant themselves. The results revealed that while the healthy controls and the patients without passivity experiences and/or auditory hallucinations rated self-generated tactile sensations as less intense, ticklish and pleasant than experimenter-generated sensations, the patients who had recently experienced these symptoms rated self and experimenter-generated sensations as equally intense, ticklish and pleasant. In other words, the actively psychotic patients were able to tickle themselves.

Since Blakemore et al.’s study was originally published in 2000, numerous studies have explored the nature and extent of ‘self-suppression’ abnormalities in patients with a diagnosed psychotic disorder, such as schizophrenia (Heinks-Maldonado et al., 2007; Shergill, Samson, Bays, Frith, & Wolpert, 2005; Shergill et al., 2014; Whitford et al., 2011; Williams, Ramachandran, Hubbard, Braff, & Light, 2010). However, an important question which has only recently been addressed is whether these self-suppression deficits are limited to people with diagnosed psychotic disorder, or whether they are also present in individuals who do not meet criteria for a psychotic disorder but do exhibit high levels of schizotypy. Schizotypy refers to a cluster of personality characteristics and experiences – such as suspiciousness, magical thinking, ideas of reference, and cognitive disorganization – that are related to psychosis but which vary continuously throughout the general population (Claridge, 1994; Gruzelier, 1996; Raine, 1991; van Os, Hanssen, Bijl, & Ravelli, 2000; Vollema, Sitskoorn, Appels, & Kahn, 2002). Whilst the factor structure and taxonomicity of schizotypy has been heavily investigated and remain a topic of debate in the literature (Everett & Linscott, 2015; Linscott, Lenzenweger, & van Os, 2010; Meehl, 1990), the basic notion of schizotypy is founded on a dimensional conceptualization of psychosis in which psychotic symptoms are conceived as differing quantitatively but not qualitatively from normality (Nelson, Seal, Pantelis, & Phillips, 2013). Evidence in support of this dimensional account of schizotypy (van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009) has been provided by numerous previous studies which have reported non-clinical individuals who score highly on psychometric measures of schizotypy to show similar behavioural, neurological and neurophysiological characteristics to those previously observed in patients with psychotic disorders (Asai, Mao, Sugimori, & Tanno, 2011; Asai & Tanno, 2007; Badcock, Mahfouda, & Maybery, 2015; Barkus, Stirling, Hopkins, & Lewis, 2006; Lenzenweger & O’Driscoll, 2006; Platek & Gallup, 2002), including electrophysiological evidence of self-suppression deficits (Oestreich et al., 2015a,b).

Following from the original finding of Blakemore et al. in clinical participants, a dimensional account of schizotypy would imply that non-clinical but highly-schizotypal individuals should also be able to tickle themselves. This key result was tested and supported by a recent study by Lemaitre, Luyat, and Lafargue (2016). Lemaitre et al. (2016) used a modified version of Blakemore’s paradigm and compared non-clinical individuals who scored in the top and bottom quartiles on a commonly used psychometric measure of schizotypy: the Schizotypal Personality Questionnaire (SPQ). They found that the high-schizotypes rated self and externally-generated tactile stimulation as equally ticklish, in contrast to the low schizotypes who rated the external condition as significantly more ticklish. This result is important as it provides direct psychophysical evidence that self-suppression deficits – which had previously only been reported in patients with established psychotic disorders – are also present in highly schizotypal individuals without a clinical diagnosis. However, a notable feature of the study of Lemaitre et al. (2016) is that they employed a categorical approach to analysis; that is, they only selected and compared participants who had scored either very highly or very lowly on the SPQ; specifically, in the top and bottom quartiles. If the personality dimension of schizotypy relates to the phenomenon of self-suppression (as the results of Lemaitre et al. imply) but is continuous in nature (as assumed in the dimensional account of schizotypy), then a statistical association would be expected to exist between these two variables. The present study aimed to replicate and extend the findings of Lemaitre et al. (2016) by considering schizotypy and psychometric self-suppression as continuous variables and investigating for a statistical association between these two variables in a large sample of non-clinical participants.

## 2. Method

### 2.1. Participants

One hundred and eleven undergraduate psychology students from UNSW Australia (Sydney, Australia) were recruited to participate in this study in exchange for course credit. Exclusion criteria for the study were a self-reported diagnosis of schizophrenia, schizotypal personality disorder, bipolar I disorder, bipolar II disorder, or any Axis-I disorder based on DSM-IV-TR criteria, a self-reported lifetime history of antipsychotic medication usage, a self-reported family history of schizophrenia or bipolar I disorder, non-fluency in English, and self-reported recreational drug use over the past week. One participant reported smoking cannabis in the 24 h prior to participating in the study, and was excluded from the analysis. Participants’ handedness was assessed with the Oldfield Edinburgh Inventory of handedness (Oldfield, 1971). This study was approved by the Human Research Ethics Advisory Panel (Psychology) at UNSW Australia. After a detailed description of the study, all subjects gave written informed consent to participate. Participants’ demographic information and scores on the SPQ and associated factors (see below) are presented in Table 1.

### 2.2. Procedure

Upon recruitment to the study, all participants completed the Schizotypal Personality Questionnaire (SPQ). The SPQ is a forced

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