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Triangles, tricks and tics: Hyper-mentalizing in response to animated shapes in Tourette syndrome

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ABSTRACT

Tourette syndrome (TS) can feature complex tics involving socially inappropriate behaviours. Adults with TS can also demonstrate differences to healthy controls when reasoning about mental states. This study investigated spontaneous mentalizing in TS. Twenty adults with TS and twenty healthy controls completed the animations task. Participants were asked to watch short ambiguous animations involving two triangles and describe what was happening. Some animations featured random movement of the triangles, while others depicted social interactions that were simple (e.g., dancing) or more complex (e.g., one triangle tricking the other). Measures were taken of executive functions, alexithymia and clinical symptoms. Individuals with TS responded similarly to controls when viewing animations featuring simple and complex interactions, demonstrating intact mentalizing ability. However, significant group differences were apparent for the random movement animations. TS was associated with a greater tendency to attribute mental states during this condition, and to describe random movements as motivated actions guided by the intentions of the triangles. There were no group differences for the alexithymia scale, but TS was associated with mild executive deficits. No relationships were apparent between animation responses and other measures. Our findings suggest that TS is associated with a propensity to adopt the intentional stance. Hyper-mentalizing in TS could be linked to both dopamine dysfunction and altered social behaviour, whereby amplified salience of social cues could contribute to the complex interplay between environmental context and tic expression. These observations may offer further insight into the potential effects of dopamine dysfunction on social cognition.

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1. Introduction

Tourette syndrome (TS) features tics, which are repetitive movements and vocalisations, frequently preceded by a sensory-cognitive premonitory urge. Common co-morbid conditions include obsessive-compulsive disorder (OCD) and attention deficit hyperactivity disorder (ADHD). Some of the more interesting complex tics have significant social relevance. These include coprolalia: swearing tics; echo-phenomena: the urge to imitate other people's speech and behaviour; and non-obscene socially inappropriate symptoms (NOSIS): urges to perform behaviours which will cause social disruption or offence to others (Cavanna, Ali, Leckman, & Robertson, 2010; Eddy & Cavanna, 2013a, 2013b; Kurlan et al., 1996).

Socially inappropriate tics prompted the study of patients' Theory of Mind (ToM): the ability to reason about mental states such as beliefs and emotions. Studies found that individuals with TS may interpret social stimuli differently to controls, with unconventional interpretations of emotional facial expressions and socially inappropriate or sarcastic remarks (Eddy, Mitchell, Beck, Cavanna, & Rickards, 2010a; Eddy, Mitchell, Beck, Cavanna, & Rickards, 2011; Eddy, Rickards, & Cavanna, 2011). TS is not associated with a straightforward lack of ability in terms of attributing mental states (Eddy & Cavanna, 2013c). However, certain kinds of ToM tasks elicit unconventional interpretations. For example, accidental socially inappropriate faux pas may be interpreted by individuals with TS as intentional behaviours (Eddy, Mitchell, Beck, Cavanna, & Rickards, 2010b).

This study further explored how individuals with TS reason about social stimuli using an implicit test of ToM. The animations task (AT: Abell, Happé, & Frith, 2000; Castelli, Happe, Frith, & Frith, 2000) was chosen because of the more ambiguous nature of the stimuli it contains. During the task, participants are faced with a series of video-clips showing the movements of two triangles. In some animations, the movements are random. In others, there is either a simple interaction (e.g., one triangle follows or dances with the other), or a more complex interaction (e.g., one triangle tries to trick or surprise the other triangle). Participants are simply asked to explain what is happening in the video-clips. Healthy individuals are more likely to draw inferences linked to the presence of mental states (e.g., emotions, intentions) in response to video-clips featuring complex interaction, than those animations showing random movements. However, viewers with autism spectrum disorders often fail to draw such higher level inferences (Abell et al., 2000). More concrete interpretations that may indicate ToM impairment have been reported in a range of conditions, from dementia (Gregory et al., 2002) to somatoform disorder (Subic-Wrana, Beutel, Knebel, & Lane, 2010). In schizophrenia, some patients with paranoia over-mentalize and report a higher level of intention in random animations than control participants (Russell, Reynaud, Herba, Morris, & Corcoran, 2006), while others show poorer interpretation of both simple and complex interactions (Horan, Nuechterlein, Lee, Castelli, & Green, 2009).

It has previously been shown that interpretation of AT video-clips can be linked to alexithymic characteristics (Moriguchi et al., 2006), which encompass difficulties in describing feelings, or in disentangling emotions from physical states (Taylor et al., 1988). This association may arise because the assignment of mental states to external stimuli is linked to analytical abilities based on internal experience. Mood disorder can influence AT interpretations. For example, Ladegaard, Lysaker, Larsen, and Videbech (2014) demonstrated that major depression was associated with decreased mentalizing in response to the AT. However, executive dysfunction was an additional finding in this study. While fairly minor cognitive difficulties are reported in TS (e.g., Eddy, Rizzo, & Cavanna, 2009), limitations in memory or attention could affect performance on the AT. In the current study, we therefore investigated relationships between AT responses, alexithymia and executive functions. Based on previous studies of ToM in TS, we hypothesised that individuals with TS may form less conventional interpretations of the AT clips when compared to controls. We further hypothesised that AT responses would be related to scores on the alexithymia scale. Although previous studies have highlighted emotional differences in TS including affective dysregulation (e.g., Martino, Madhusudan, Zis, & Cavanna, 2013), this could be the first study to use the Toronto Alexithymia Scale (TAS) in a TS population.

2. Method

2.1. Participants

The study was approved by the local NHS research ethics committee and all volunteers provided written informed consent. Twenty adults with TS according to DSMV criteria (17 males) volunteered to participate and were screened using the National Hospital Interview Schedule for TS (Robertson & Eapen, 1996). Mean age was 35 years (SD = 16; median = 32; range = 19–68) and mean years of education was 14.01 (SD = 3.09; median = 13; range = 11–19). A few patients reported co-morbid OCD (n = 4) or mood disorders (n = 2). Fifteen patients were taking medications (atypical antipsychotic = 9; SSRI = 2; clonidine = 3; tricyclic antidepressant = 1). All patients who were taking medications were stable on these medications for at least 6 months prior to testing. YGTSS motor tic ratings were quite high in terms of frequency (mean score 3.75; SD = 1.07; median = 4; range = 1–5), intensity (mean 3.45; SD = 1.00; median = 4; range = 1–5) and complexity (mean 3.25; SD = .97; median = 3; range = 1–5). Phonic tics were of moderate frequency (mean 2.55; SD = 1.19; median = 3; range = 1–4), intensity (mean 2.65; SD = 1.04; median = 3; range = 1–4) and complexity (mean 2.90; SD = 1.83; median = 2.5; range = 1–5). Most patients scored similarly for their motor and phonic tics. Ten adults with TS reported NOSIS, 13 reported echo-phenomena and 12 reported copro-phenomena (these features commonly co-occurred in the same patients). Twenty healthy controls (17 males) of mean age 34.60 years (SD = 15.02; median = 28.5; range = 18–65) and mean education 14.55 years (SD = 1.82; median = 14.00; range = 13–19) also participated. Healthy volunteers were only invited to participate if they did not have any psychiatric or neurological diagnoses, and were not taking any psychoactive medications. The groups did not differ for