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### Title

A revised method for measuring distraction by tactile stimulation

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### Authors

Schechter, Jacqueline R

Greene, Deanna J

Koller, Jonathan M

et al.

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DATA NOTE

# A revised method for measuring distraction by tactile stimulation [v1; ref status: indexed, <http://f1000r.es/42o>]

Jacqueline R. Schechter<sup>1</sup>, Deanna J. Greene<sup>2,3</sup>, Jonathan M. Koller<sup>2</sup>, Kevin J. Black<sup>2-5</sup>

<sup>1</sup>School of Arts and Sciences, Washington University in St. Louis, St. Louis, USA

<sup>2</sup>Department of Psychiatry, Washington University School of Medicine, St. Louis, USA

<sup>3</sup>Department of Radiology, Washington University School of Medicine, St. Louis, USA

<sup>4</sup>Department of Neurology, Washington University School of Medicine, St. Louis, USA

<sup>5</sup>Department of Anatomy & Neurobiology, Washington University School of Medicine, St. Louis, USA

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### Abstract

Sensory hypersensitivity (SH) refers to the tendency to attend to subtle stimuli, to persist in attending to them, and to find them noxious. SH is relatively common in several developmental disorders including Tourette Syndrome and Chronic Tic Disorder (TS/CTD). This study was an attempt to quantify the extent to which a mild tactile stimulus distracts one’s attention in TS/CTD. Fourteen adults with TS/CTD and 14 tic-free control subjects completed questionnaires regarding SH and ADHD, and TS/CTD subjects completed self-report measures of current and past tic disorder symptoms and of current obsessions and compulsions. All subjects performed a sustained attention choice reaction time task during alternating blocks in which a mildly annoying stimulus (von Frey hair) was applied to the ankle (“ON”) or was not applied (“OFF”). We present here the clinical and cognitive task data for each subject.

### Open Peer Review

#### Invited Referee Responses

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<b>version 1</b> published 12 Aug 2014	 report 1	 report 1

- Andrea Cavanna**, University of Birmingham UK
- Euripedes Constantino Miguel, Marcelo Hoexter**, University of Sao Paulo Brazil

#### Latest Comments

- Kevin J. Black**, Washington University in St. Louis, USA  
19 Sep 2014 (V1)
- Kevin J. Black**, Washington University in St. Louis, USA  
15 Sep 2014 (V1)

**Corresponding author:** Kevin J. Black ([kevin@wustl.edu](mailto:kevin@wustl.edu))

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*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

**Competing interests:** No competing interests were disclosed.

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## Introduction

Tourette Syndrome and Chronic Tic Disorder (TS/CTD) are complex neuropsychiatric disorders in which patients present with multiple motor or vocal tics. In many patients with TS/CTD, attentional problems are present and ADHD is the most common condition that co-occurs with TS/CTD, occurring in about 50% of patients (Greimel *et al.*, 2011). These attentional problems can range from mild to severe and can impact the patient's ability to complete tasks, sustain attention, and keep track of personal items. Sensory hypersensitivity (SH; the tendency to be sensitive to subtle stimuli that most people would no longer attend to after habituation has occurred) is also commonly present in patients with TS/CTD (Belluscio *et al.*, 2011). Patients with sensory hypersensitivity have difficulty tuning out otherwise neutral stimuli such as the tag in their shirt or the voices of people around them. In addition, patients with TS/CTD often experience a premonitory urge before a tic which some patients describe as a feeling of itchiness, pressure, tenseness, or energy. These tics and premonitory urges can also be distracting (Kane, 1994).

The observation that SH can distract one from a cognitively demanding task suggested the approach we used in a small pilot study to attempt to quantify SH by examining the effects of a tactile stimulus on reaction time during a sustained attention task (Panagopoulos *et al.*, 2013). The present study was designed to improve on some of the earlier methods and to compare subjects with TS/CTD to tic-free controls, with the goal of quantifying the extent to which sensory hypersensitivity in patients with TS/CTD affects sustained attention. To do this, participants with and without TS/CTD performed an attention task in the presence and absence of a subtle sensory stimulus.

## Methods

### Ethical approval

This study was approved by the Washington University Human Research Protection Office (IRB), proposal # 201108081.

### Participants

A convenience sample of 14 adults with TS/CTD and 14 tic-free adults participated in the study. Subjects completed a questionnaire that included age, sex, and the question, "Have you ever been diagnosed with any of the following," with check boxes for ADHD (Attention-Deficit/Hyperactivity Disorder), learning disorder, atopic (allergic) dermatitis, OCD (Obsessive-Compulsive Disorder), Tourette syndrome, other tic disorder, and other neurological illness (to be specified by the respondent). All participants also completed the 26-item Adult Sensory Questionnaire (ASQ), developed to screen for sensory defensiveness in adults (Kinnealey *et al.*, 1995), and the ADHD Rating Scale (Barkley, 1998; Magnusson *et al.*, 2006). Subjects endorsing tics also rated symptom severity for the past week using the Yale Global Tic Severity Scale (YGTSS; Leckman *et al.*, 1989), the Yale-Brown Obsessive Compulsive Scale (Goodman *et al.*, 1989a,b), and the Premonitory Urge for Tics Scale (PUTS; Woods *et al.*, 2005). These data were collected using RED-Cap electronic data capture tools hosted at Washington University (Harris *et al.*, 2009). For tic subjects, the Diagnostic Confidence Index (DCI) was also completed; the DCI assesses typical historical features of TS (Robertson *et al.*, 1999).

### Choice reaction time task

The subjects were seated at a fixed distance in front of a laptop computer in a darkened room. All subjects then performed a 12-minute choice reaction time task consisting of pressing one key on a computer keyboard when the capital letter 'S' appeared on the screen and pressing another key when the numeral 5 appeared on the screen. They were instructed to respond as quickly and accurately as possible with the right hand. The task consisted of 11 blocks; the first was a 2-minute OFF condition and the remaining blocks were each 1 minute long alternating between the ON and the OFF condition. Throughout the ON condition, a 4.74N von Frey hair was held against a point previously marked on the subject's ankle, with ~1 Hz mild increases of pressure to just bend the von Frey hair. During the OFF condition, the von Frey hair was absent. E-Prime® 2 software was used to present stimuli and to collect all task data ([www.pstnet.com/eprime.cfm](http://www.pstnet.com/eprime.cfm); Schneider *et al.*, 2002a,b).

#### Dataset 1. A revised method for measuring distraction by tactile stimulation: Subject characteristics and task data

<http://dx.doi.org/10.5256/f1000research.4944.d34156>

**Subject\_data2.csv:** This file includes demographic and diagnostic data for each subject. Legend: Group = self-reported diagnosis (1=TS/CTD, 2=control). ADHD hx = self-reported history of Attention-Deficit/Hyperactivity Disorder. OCD hx = self-reported history of Obsessive-Compulsive Disorder. ASQ = total score on the Adult Sensory Questionnaire. ASQ Pure = score from a subset of ASQ items (#1, 2, 4–14, 17, 23) that the authors felt were less likely to be affected by psychiatric comorbidity. See Methods for remaining abbreviations.

**task\_data.7z:** This file contains a text file for each subject with output from ePrime® including accuracy and reaction time data for the attention task session for each subject. The file can be opened by 7-Zip, free and open source archiving software (<http://www.7-zip.org/>).

### Data availability

*F1000Research*: Dataset 1. A revised method for measuring distraction by tactile stimulation: Subject characteristics and task data, 10.5256/f1000research.4944.d34156 (Schechter *et al.*, 2014).

### Author contributions

All authors contributed to conception of the study and design of the experiments. JRS and DJG carried out the research. JRS and KJB prepared the first draft of the manuscript. All authors were involved in the revision of the draft manuscript and have agreed to the final content.

### Competing interests

No competing interests were disclosed.

### Grant information

This project was supported by National Institutes of Health (NIH) grants K24 MH087913, K01 MH104592, P30 CA091842, UL1 TR000448, the Siteman Comprehensive Cancer Center, and a Tourette Syndrome Association fellowship (DJG). The content is solely the responsibility of the authors and does not necessarily represent the official view of the funders.

*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

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**initial testing of a clinician-rated scale of tic severity.** *J Am Acad Child Adolesc Psychiatry.* 1989; **28**(4): 566–573.

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[PubMed Abstract](#) | [Publisher Full Text](#)

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[Data Source](#)

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[Reference Source](#)

Schneider W, Eschman A, Zuccolotto A: **E-Prime User’s Guide.** Pittsburgh: Psychology Software Tools Inc. 2002b.

[Reference Source](#)

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[PubMed Abstract](#) | [Publisher Full Text](#)

# Open Peer Review

Current Referee Status:



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## Referee Responses for Version 1



**Euripedes Constantino Miguel, Marcelo Hoexter**

Department of Psychiatry, University of Sao Paulo, Sao Paulo, Brazil

**Approved: 18 September 2014**

**Referee Report:** 18 September 2014

**doi:** [10.5256/f1000research.5280.r6165](https://doi.org/10.5256/f1000research.5280.r6165)

This is an interesting and relevant study that examines the effects of a tactile stimulus on reaction time during a sustained attention task in patients with Tourette syndrome/chronic tic disorder (TS/CTD) vs. non-TS/CTD subjects in order to quantify the extent to which sensory hypersensitivity influences attentional outcome.

Sensory hypersensitivity has a conceptual overlap with what we call sensory phenomena <sup>1-4</sup>. We define sensory phenomena by subjective uncomfortable or unpleasant sensations, feelings, and/or perceptions that may precede or accompany repetitive behaviors not only in TS but also in some common comorbid conditions such as obsessive-compulsive disorder (OCD). Types of sensory phenomena include:

1. Physical sensations (tactile and/or muscle-joint), defined as uncomfortable sensations localized in a specific region of the body (skin, muscles, or joints), which precede or occur along with repetitive behaviors;
2. “Just right” perceptions, triggered by tactile, visual, or auditory sensations, including the need for things to feel, look or sound “just right”;
3. Feelings of incompleteness (i.e., inner feeling or perception of discomfort that makes the patient do things indefinitely, or until feeling ‘complete’);
4. Energy release (i.e., generalized inner tension or energy that builds up and needs to be released by an action) and
5. Urge only (i.e., “have to do it” perception related to the repetitive behavior).

In the last 2 decades, our group has developed a brief instrument to assess the presence and the severity of sensory phenomena (the University of São Paulo Sensory Phenomena Scale) to investigate OCD phenotypic subtypes and its relationship with TS/CTD. This instrument has been validated in English <sup>5</sup>. OCD patients with sensory phenomena have more comorbidity with tics, early-onset at OC symptoms, more symptoms of ordering and symmetry and low insight <sup>6,7</sup>. Though the sample size of the Schechter *et al.* study is not large, it will be very interesting to examine the role of OCD (YBOCS Scores) as a confounder in attentional outcomes, as well as whether sensory hypersensitivity mediates the expression or severity of OCD symptoms. Finally, it would be interesting to observe how sensory hypersensitivity predicts TS treatment response and its comorbid conditions, as well as how specific treatments to these disorders influence sensory hypersensitivity.

Therefore, we believe that the investigation of subjective experiences such as sensory hypersensitivity is relevant to better refine the phenomenological presentation of TS/CTD patients, allowing the identification of more homogeneous subgroups and the mechanisms involved in treatment response. This understanding may help to reveal etiological factors as well as the development of more efficacious therapeutic interventions for a spectrum of patients that share common psychopathology involving sensorial experiences.

We are eager to read the final results of the present work.

Acknowledgement:

Both Drs Miguel and Hoexter receive a grant from the Brazilian Agencies for Research: FAPESP and CNPq.

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**We have read this submission. We believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

**Competing Interests:** No competing interests were disclosed.

### 1 Comment

**Author Response**

**Kevin J. Black**, Washington University in St. Louis, USA

Posted: 18 Sep 2014

We thank Drs. Miguel and Hoexter for their thoughtful, forward-looking commentary, and appreciate their suggestions on phenomenology and characterizing comorbidity. I have followed earlier reports on the USP-SPS with great interest, but was unaware of the recent publication on the English version. It would undoubtedly help place sensory hypersensitivity in better context with other sensory phenomena that occur commonly in OCD and tic disorders, and will be of interest to our future work along this line.

**Competing Interests:** No competing interests were disclosed.



**Andrea Cavanna**

Department of Neuropsychiatry, University of Birmingham, Birmingham, UK

**Approved: 08 September 2014**

**Referee Report:** 08 September 2014

**doi:**[10.5256/f1000research.5280.r6060](https://doi.org/10.5256/f1000research.5280.r6060)

This is an interesting and original research project. The methodology is sound and the quality of the data is high.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

**Competing Interests:** No competing interests were disclosed.

**1 Comment****Author Response**

**Kevin J. Black**, Washington University in St. Louis, USA

Posted: 08 Sep 2014

We appreciate Prof. Cavanna's assessment.

**Competing Interests:** No competing interests were disclosed.

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## Article Comments

### Comments for Version 1

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**Author Response**

**Kevin J. Black**, Washington University in St. Louis, USA

Posted: 19 Sep 2014

A preliminary analysis of these data was presented at a student research symposium: Schechter JR, Greene DJ, Koller JM, Black KJ: The effects of tactile stimulation on the attentional performance of subjects with Tourette syndrome. Mind-Brain-Behavior Research Symposium, Washington University Department of Psychology, University City, MO, 29 Apr 2014. Archived at F1000Posters 2014; 5:492 (<http://f1000.com/posters/browse/summary/1095670>).

**Competing Interests:** No competing interests were disclosed.

**Author Response**

**Kevin J. Black**, Washington University in St. Louis, USA

Posted: 15 Sep 2014

The following was omitted from the reference list:

Paul A. Harris, Robert Taylor, Robert Thielke, Jonathon Payne, Nathaniel Gonzalez, Jose G. Conde, Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support, J Biomed Inform. 2009 Apr;42(2):377-81.

**Competing Interests:** N/A