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## Hyper-responsiveness to touch mediates social dysfunction in adults with autism spectrum disorders



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### ABSTRACT

This study investigated whether hyper-responsiveness to touch serves as a mediating variable that predicts social dysfunction in adults with autism spectrum disorders (ASD). Data were obtained from all adults with administratively defined intellectual disability in a region in Sweden ( $n = 915$ , where 143 had ASD). A multiple mediation modeling analysis revealed a well-fitted model (Satorra–Bentler scaled chi-square = 10.91,  $df = 7$ ,  $p = 0.14$ , CFI = 0.99, RMSEA = 0.025), demonstrating that social dysfunction among adults with ASD was completely mediated by hyper-responsiveness to touch followed by impairment of speech and aggressive/destructive behavior. The results demonstrated that in adulthood, the tactile sensory system is foundational for social functioning in people with ASD, with diagnosis and intervention implications.

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## 1. Introduction

Social disability is the central defining feature of autism. However, mechanisms that might account for this disability are poorly understood (Baron-Cohen & Belmonte, 2005; Volkmar, 2011). Despite strong support for cognitive explanations, such as Theory of Mind deficits, the fact remains that social dysfunction in autism is typically present prior to the time at which the earliest precursors of a Theory of Mind emerge (Tager-Flusberg, 2007). This implies that more primitive/fundamental processes may govern social dysfunction in people with autism. In general, research tends to focus on visual and auditory channels as routes for social information. However, there is a growing body of evidence considering touch as a channel of social information (Gallace & Spence, 2010; Morrison, Löken, & Olausson, 2010).

Touch is known to serve communicative functions among humans, nonhuman primates, and other animals that influence social behaviors, such as cooperation, dominance, and emotional bonding (Dunbar, 2010; Hertenstein, Verkamp, Kerestes, & Holmes, 2006). In humans, people can identify a broad range of distinct emotions from the experience of being touched (Hertenstein, Holmes, McCullough, & Keltner, 2009), as well as accurately decode emotions by merely watching others communicating via touch (Hertenstein, Keltner, App, Bulleit, & Jaskolka, 2006). The connection between emotion and touch is further supported by studies showing that stimulating the forearm with gentle touch activates areas in the brain involved with social emotional processing (Voos, Pelphey, & Kaiser, 2013). Hence, touch serves an important function in social emotional communication, particularly in the more intimate emotions, such as love and sympathy (App, McIntosh, Reed, & Hertenstein, 2011).

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Atypical sensory processing is common among people with autism (Hilton, Graver, & LaVesser, 2007; Horder, Wilson, Mendez, & Murphy, 2014; Leekam, Nieto, Libby, Wing, & Gould, 2007; Lundqvist, 2011) with a prevalence of 70–80% for aberrant responsiveness to touch (Baranek, David, Poe, Stone, & Watson, 2006). Because touch serves such an important role in social emotional communication, it can be hypothesized that aberrant sensitivity to touch will influence social functioning of individuals with ASD. However, apart from autobiographical annotations (e.g., Gerland, 1997; Grandin, 1992), only a few empirical studies have addressed this issue.

Recently, Foss-Feig, Heacock, and Cascio (2012) found a positive relationship between hypo-, but not hyper-responsiveness, to touch and social impairment in primary school children with ASD. In another study, Hilton et al. (2010) compared children with ASD and a group of typically developed children with no medical or school-based diagnoses, and found significant relationships between hyper-responsiveness to touch and social impairment. Although the children with ASD showed more hyper-responsiveness to touch than typically developing children, the relationships between hyper-responsiveness to touch and social impairment were similar in magnitude. Hence, hyper-responsiveness to touch may influence any individual's social ability, but it is more common among those with ASD.

These studies show that aberrant responsiveness to touch is related to social impairment in children with ASD; however, the results are inconsistent with regard to whether social dysfunction is influenced by hyper- or by hypo-responsiveness to touch. Moreover, these studies were based on convenience samples with relatively small sample sizes, which demonstrate the need for large population-based studies. In addition, aberrant sensory responsiveness and social dysfunction are problems among individuals with ASD, and most likely to persist into adulthood (Billstedt, Gillberg, & Gillberg, 2007), hence warranting studies on adults.

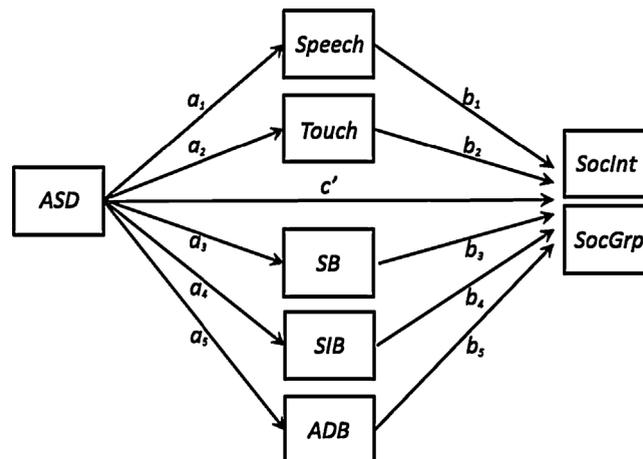
In addition to aberrant sensory processing, other core features of ASD such as verbal communication (Matson, Kozlowski, & Matson, 2012) and challenging behaviors (Kearney & Healy, 2011) are related to social dysfunction, where challenging behavior is found to moderate the impact of communication on social functioning in children with ASD (Matson, Hess, & Mahan, 2013).

Articulating hypotheses of measurable processes that intervene (i.e., mediate) between explanatory variables (e.g., presence of ASD) and response variables (e.g., social dysfunction) are important for the development of theories (Preacher & Hayes, 2008). Based on previous reported research, it was hypothesized that the presence of ASD in adults with intellectual disability (ID) impacts social functioning directly and through mediating variables of ASD core symptoms of hyper-responsiveness to touch, verbal communication ability, and stereotypical behavior, as well as challenging behaviors of self-injurious and aggressive/destructive behaviors, as illustrated in Fig. 1.

## 2. Methods

### 2.1. Participants and procedure

The participants were all individuals 18 years of age or older with administratively defined ID, that is, individuals with ID receiving at least a minimum of service from the local health authorities, living in the county of Örebro, Sweden. Altogether, there were 915 individuals aged between 18 and 87 years, where 143 (90 men and 53 women) with a mean age of 36.3 years ( $SD = 11.5$ ) had ASD and 772 (414 men and 358 women) with a mean age of 44.9 ( $SD = 15.0$ ) did not have ASD. The total adult



**Fig. 1.** A conceptual multiple mediation model on the autism-social dysfunction relationship. Incidence of ASD is hypothesized to impact social functioning (initiates social interaction [SocInt] and functioning in a group [SocGrp]) directly and through mediating variables of communication ability (Speech), hyper-responsiveness to touch (Touch), stereotypical behavior (SB), and challenging behaviors (self-injurious behavior [SIB] and aggressive/destructive behavior [ADB]).  $a_n$ ,  $b_n$ , and  $c'$  denote regression coefficients.

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