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Research paper

# Absence of delay in spontaneous use of gestures in spoken narratives among children with Autism Spectrum Disorders

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ABSTRACT

*Background:* Gestures are spontaneous hand movements produced when speaking. Despite gestures being of communicative significance, little is known about the gestural production in spoken narratives in six- to 12-year-old children with Autism Spectrum Disorders (ASD).

*Aims:* The present study examined whether six- to 12-year-old children with ASD have a delay in gestural production in a spoken narrative task, in comparison to their typically-developing (TD) peers.

*Methods and procedures:* Six- to-12-year-old children with ASD ($N = 14$) and their age- and IQ-matched TD peers ($N = 12$) narrated a story, which could elicit spontaneous speech and gestures. Their speech and gestures were then transcribed and coded.

*Outcomes and results:* Both groups of children had comparable expressive language skills. Children with ASD produced a similar number of pointing and marker gestures to TD children and significantly *more* iconic gestures in their spoken narratives. While children with ASD produced more reinforcing gestures than their TD counterparts, both groups of children produced comparable numbers of disambiguating and supplementary gestures.

*Conclusions:* Our findings indicate that children with ASD may be as capable as TD children in gestural production when they engage in spoken narratives, which gives them spontaneity in producing gestures.

**What this study adds?**

Previous studies have reported reduced gesture rates in young children (aged below six) with Autism Spectrum Disorders (ASD). However, a few studies have shown that there is *no* significant gesture delay among individuals with ASD in their adolescence and even in their middle and late childhood. Yet, iconic gestures (e.g., two hands flapping for a bird or an action of flying) were understudied in previous research. Iconic gestures convey attributes and actions associated with entities, thus are beneficial for effective communication. Therefore, the present study examined whether children with ASD had a delay in producing iconic gestures and how they used these gestures in relation to speech.

This study examined gesture use by 14 six- to 12-year-old children with ASD and 12 age-matched typically developing (TD) children. Children with ASD had comparable levels of IQ and language abilities to the TD children. Both groups of children were required to tell a story about a picture. They were expected to gesture while speaking. This is the first study to investigate gesture use in spoken narratives in six- to 12-year-old children with ASD. We found that children with ASD produced more iconic gestures than TD children and both groups produced similar numbers of pointing and marker gestures. Like TD children, children with ASD used gestures to disambiguate and supplement accompanying speech. Thus, children with ASD may be as capable as TD children in

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gestural production in their spoken narratives. Our study extends various previous research investigating whether six- to 12-year-old children with ASD are delayed in their gestural production.

## 1. Introduction

Children with autism spectrum disorders (ASD) are characterized by impairments in communication and social interaction (American Psychiatric Association, 2013; Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, DSM-V). It is well known that children with ASD have difficulty in non-verbal communication. For example, they have significant impairments in maintaining eye contact with conversation partners, understanding and expressing facial expressions, and producing gestures (e.g., Asperger, 1944; Bartak, Rutter, & Cox, 1975; Wetherby & Prutting, 1984). The present study focuses on gesture use among children with ASD.

Early studies reported reduced gesture rates in children with ASD (Bartak et al., 1975). Recent studies have also found a gesture delay in these children (Charman, Drew, Baird, & Baird, 2003; Luyster, Lopez, & Lord, 2007). Previous findings have shown that young children with ASD overall gesture less often than both typically developing (TD) and developmentally delayed (DD) children (e.g., Bono, Daley, & Sigman, 2004; Mastrogiuseppe, Capirci, Cuva, & Venuti, 2015). Among different types of gestures, researchers have a consensus that children with ASD have a delay in producing proto-declarative gestures (gestures that elicit joint attention and shared interests, e.g., a child points to a toy car in order to direct his mother's attention to it) (Baron-Cohen, 1989; Carpenter, Pennington, & Rogers, 2002; Watson, Crais, Baranek, Dykstra, & Wilson, 2013; Wetherby & Prizant, 2002). However, their ability to generate proto-imperative gestures (gestures that are used for making requests, e.g., a child points to a cookie in order to ask his mother to give him one) is relatively spared (Baron-Cohen, 1989; Wetherby & Prizant, 2002). It should be noted that pointing gestures, especially proto-declarative pointing, are of social and communicative importance to establish joint attentional frame or common ground (Tomasello, Carpenter, & Liszkowski, 2007). Children with ASD, who lack social and communicative intentions, may therefore be less motivated to produce pointing gestures for sharing social interests.

Having said that, findings on other types of gestures are not conclusive. Some studies have found that children with ASD produce fewer markers (gestures that carry culturally specific meaning, e.g., the raised thumb for hitchhiking) and iconic gestures (gestures that depict the actions or attributes of the entities, e.g., two hands flapping for bird or an action of flying) than their TD peers (Mastrogiuseppe et al., 2015; Wetherby et al., 2004). Other studies have reported that young children with ASD, children with Down's syndrome (DS), and TD children produced comparable numbers of markers when interacting with other children (Attwood, Frith, & Hermelin, 1988). Likewise, Capps, Kehres, and Sigman (1998) found that young children with ASD were as likely as DD children to enact activities with iconic gestures during the 6-min conversation about schools, friends, and vacations. A recent study by Mastrogiuseppe and colleagues also found that young children with ASD, children with DS, and TD children did not differ in the number of iconic gestures produced when interacting with their mothers (Mastrogiuseppe et al., 2015).

There is a recent trend in investigating the gestural production of school-aged children with ASD (aged six or 18). For example, Braddock, Gabany, Shah, Armbrecht, and Twyman (2016) asked adolescents with ASD (aged 11–16) completed a narrative task and found that they produced quite a number of iconic gestures and tended to use gestures to supplement information to speech. However, their study did not include TD adolescents. On the other hand, de Marchena and Eigsti (2010) found that there was no significant difference in overall gesture rate (i.e., total number of gestures divided by total number of utterances) and in the numbers of different types of gestures produced between adolescents with high-functioning ASD (aged 12–17) and their age-matched TD peers. Participants in their study were presented with picture cards about two monkeys and told to narrate a story. Both groups of adolescents produced similar numbers of different types of gestures including iconic gestures, pointing gestures, speech beats, and markers. Likewise, Medeiros and Winsler (2014) examined the gestures produced by seven to 18 years old children with ASD and children who were asked to work on the Tower of Hanoi task with their parents. Overall, children with ASD gestured less often than TD children, especially deictic gestures, but both groups produced similar numbers of iconic gestures and speech beats.

So and colleagues studied the gestures produced by younger children (aged 6–12). In one of their studies, So, Lui, Wong, and Sit (2015) examined gestures produced by six- to12-year-old children with high-functioning ASD (IQs $>$ 69), in comparison to their aged-matched TD peers in an experimental task. Both groups of children were asked to demonstrate four different daily-life routines (e.g., eating lunch, washing face, and packing schoolbag) to an experimenter. Children with ASD and TD children produced comparable numbers of pointing and iconic gestures, including when controlling for the amount of speech. The same pattern was found after controlling for the amount of speech (i.e., number of gestures per word). In the other study, So, Wong, Lui, and Yip (2015) asked children with high-functioning ASD and their TD peers to play farm blocks with their caregivers. Children with ASD produced fewer markers but comparable numbers of iconic, pointing, and speech beat gestures to TD children. Nevertheless, children with ASD produced a significantly smaller proportion of supplementary gestures (i.e., gestures that add semantic information that is not explicitly conveyed in the co-occurring speech) than their TD peers. The proportions of disambiguating gestures (i.e., gestures that clarify underspecified referents in the co-occurring speech) and reinforcing gestures (i.e., gestures that emphasize or convey the same semantic information as the co-occurring speech) were similar in both groups.

Based on the aforementioned findings, it seems that there is *no* significant gesture delay among individuals with ASD in their adolescence and even in their middle and late childhood. However, there are limitations in previous studies on gestural production in six- to 12-year-old children with ASD. The tasks administered in So, Lui et al. (2015) and So, Wong et al., (2015) studies might impose constraints on the varieties of gestures produced. Particularly, children in So, Wong et al. (2015)'s study were provided with a set of toys so as to facilitate interactions with their caregivers. Thus, more than half of the gestures produced by the children with ASD and TD children were pointing gestures. This was not surprising as children were playing with blocks, which were easily referred to by