



Original Articles

The social nature of overimitation: Insights from Autism and Williams syndrome

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ABSTRACT

When imitating novel actions, typically developing preschoolers often copy components of the demonstration that are unrelated to the modeled action's goal, a phenomenon known as 'overimitation'. According to the social motivation account, overimitation fulfills social affiliation motives (i.e., the imitator's drive to experience social connectedness with the demonstrator and the social context). Conversely, according to the social-cognitive account, overimitation reflects overattribution of causal relevance (i.e., the imitator's failure to appreciate that some components of the demonstration are not relevant to the action's outcome). Autism Spectrum Disorder (ASD) and Williams syndrome (WS) are characterized by reduced and enhanced spontaneous social motivation, respectively, as well as similar impairments in social-cognition, thus providing helpful test cases to understand the nature of overimitation. Using a novel eye-tracking paradigm, we examined overimitation in 31 preschoolers with ASD, 18 age- and IQ-matched peers with WS, and 19 age-matched typically developing children. We found that children with WS and typically developing children were more likely to overimitate, and to increase their attention to the model's face during demonstration of causally irrelevant actions, compared to those with ASD. These findings will be discussed in the context of support for the social-motivational account of overimitation.

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1. Introduction

Overimitation is the tendency to copy elements of a demonstration that are irrelevant to the goal of the modeled action (Berl & Hewlett, 2014; Legare, Wen, Herrmann, & Whitehouse, 2015; Mesoudi, 2016; Shipton & Nielsen, 2015). This phenomenon, which represents one of the most debated facets of human social learning (Bjorklund & Beers, 2016; Nielsen, Mushin, Tomaselli, & Whiten, 2016), is illustrated in the following example. A knowledgeable model (the demonstrator) shows a naïve observer (the imitator) how to operate a new coffee machine. Just before closing the lid, the demonstrator knocks twice on the handle of the coffee machine. When his turn comes to operate the machine, the imitator reproduces all the demonstrator's actions – including the two knocks on the handle.

The inclination to copy actions that are superfluous to the accomplishment of the task at hand has been documented in preschoolers (Horner & Whiten, 2005; Kenward, 2012), older children (Jimenez, Lorda, & Mendez, 2014; Marsh, Ropar, & Hamilton, 2014) and adults (Flynn & Smith, 2012; McGuigan, Makinson, & Whiten, 2011). Interestingly, while overimitation has been documented in response to both a live model (e.g., Nielsen & Tomaselli, 2010) and video-recorded demonstrations (e.g., McGuigan et al., 2011), live interactions elicit a higher frequency of overimitation (Chudek, Baron, & Birch, 2016; Nielsen, Simcock, & Jenkins, 2008). Additionally, recent research suggests that people are more likely to overimitate when they experience social connectedness with the model (Nielsen & Blank, 2011), when the model has higher social status (McGuigan, 2013), when the casually superfluous action is accompanied by the demonstrator's ostensive ('pedagogical') signals (Buchsbaum, Gopnik, Griffiths, & Shafto, 2011), and is interpreted as being intentional (Lyons, Damrosch, Lin, Macris, & Keil, 2011).

A number of theories have been advanced to account for this phenomenon, which fall into the two broad camps of social-motivational and social-cognitive explanations. Social-motivational explanations propose that overimitation might be

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driven by social affiliation motives, including the imitator's motivation to experience social connectedness with the demonstrator and conform to the perceived norms of the social context (Nielsen, Moore, & Mohamedally, 2012; Over & Carpenter, 2012; Watson-Jones, Legare, Whitehouse, & Clegg, 2014). Several different perspectives of the social motivation account have been proposed (Kenward, Karlsson, & Persson, 2011; Lyons & Keil, 2013; Nielsen, Kapitany, & Elkins, 2015). However, all of these models converge on the view that the imitator recognizes that the superfluous action is not relevant to the instrumental outcomes of the task, but nevertheless reproduces the action for social affiliation purposes. For example, an apprentice waiter might imitate the causally irrelevant rule of serving wine by holding the bottle at the base, rather than close to the neck, as this will facilitate connectedness with the trainer, and adherence to arbitrary rules that are relevant to the social context.

Conversely, social-cognitive explanations suggest that the imitator's behavior might be driven by the genuine belief that all the demonstrator's actions are somewhat relevant to accomplish the task (Kenward et al., 2011; Lyons & Keil, 2013; Lyons, Young, & Keil, 2007). According to this account, overimitation reflects overattribution of causal relevance—that is, the inclination to encode by default others' intentional actions as relevant to the goal of the task, even if the link between the action and the goal is not immediately perceptible. Using the example above, when the demonstrator holds the wine bottle at the base, the imitator will assume that this action must accomplish an instrumental goal that could not be accomplished by holding the bottle close to the neck.

Although there is empirical support for both explanations (Lyons & Keil, 2013; Moraru, Gomez, & McGuigan, 2016; Oostenbroek & Over, 2015), the nature of overimitation remains a point of debate. As understanding the processes underlying this phenomenon has the potential to provide critical insight into mechanisms of human development and cultural learning (Over & Carpenter, 2013; Subiaul, Winters, Krumpak, & Core, 2016; Whiten, McGuigan, Marshall-Pescini, & Hopper, 2009) in both typical and atypical development (Nielsen, Slaughter, & Dissanayake, 2013; Vivanti & Hamilton, 2014), novel research approaches are needed to advance knowledge in the field.

Autism Spectrum Disorder (ASD) and Williams syndrome (WS) provide a striking test case to examine the social-motivational versus social-cognitive explanations of overimitation. From infancy, children with ASD and those with WS share overlapping difficulties in social cognition, and in particular in the ability to understand the goals of others' actions and infer mental states (Porter, Coltheart, & Langdon, 2008; Sparaci, Stefanini, D'Elia, Vicari, & Rizzolatti, 2014; Tager-Flusberg & Skwerer, 2013; Van Herwegen, Dimitriou, & Rundblad, 2013; Vivanti et al., 2011; Zalla, Labruyere, Clement, & Georgieff, 2010). However, they present with contrasting profiles in their motivation for social engagement, which is atypically low in ASD (Bernier, Webb, & Dawson, 2006; Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012; Shultz, Jones, & Klin, 2015) and atypically high in WS (Hocking, 2016; Jarvinen, Korenberg, & Bellugi, 2013; Jones et al., 2000). Accordingly, ASD has often been described as a disorder encompassing both social-cognitive and social-motivational impairments (e.g., Mundy, 2016), and WS as disorder where social motivation and social-cognitive skills are dissociated (Tager-Flusberg & Skwerer, 2013). Given this pattern of similarities and differences across social-cognitive and social-motivational dimensions of learning, examination of overimitation across these two disorders might provide critical insight into the relative merits of social-cognitive and social-motivational accounts of this phenomenon.

The existing studies examining overimitation in ASD have not yet provided unequivocal support for either of the theoretical accounts. There is a body of evidence to suggest that children with

ASD are inclined to omit, rather than imitate, the components of the demonstration that are not relevant to the instrumental outcomes of the modeled task (Hobson & Hobson, 2008; Jimenez, Ortiz-Tudela, Mendez, & Lorda, 2015; Vivanti, Trembath, & Dissanayake, 2014). In a recent study, reduced overimitation in ASD was unrelated to the understanding of the causal relevance of the demonstrated actions, suggesting that children with ASD overimitate less frequently as a consequence of being less inclined to affiliate or conform to the social context (Marsh, Pearson, Ropar, & Hamilton, 2013). This interpretation is consistent with the social motivation account of overimitation.

Conversely, other studies have reported that children with ASD show the same propensity to overimitate that is observed in children with Down syndrome and typically developing children (Nielsen & Hudry, 2010; Nielsen et al., 2013). Additionally, in a related line of research, two recent studies reported a heightened tendency to imitate irrelevant actions in adults with ASD, using a task where participants were instructed not to imitate those actions (Foti et al., 2014; Spengler, Bird, & Brass, 2010). In the Spengler et al. (2010) study, this tendency was associated with reduced activity in the brain regions that mediate processing of intentionality, suggesting that “unnecessary” imitation in ASD might reflect an “echopraxic” phenomenon – i.e. lack of appreciation of what actions, in the stream of the demonstrator's behavior, are intended to be imitated. Further support for this notion is provided by D'Entremont and Yazhek (2007), who showed that children with ASD, unlike typically developing children, tended to imitate a model's intentional as well as ‘accidental’ actions (e.g., unintentionally pressing a button while saying ‘whoops...’), thus failing to appreciate the difference between causally relevant and causally irrelevant actions in the demonstration (see also Malvy et al., 1999; Pellicano, 2012, for clinical reports of ‘echopraxia’ in ASD). Together, these studies suggest that overimitation in ASD is linked to difficulties in reading the causal structure of to-be-imitated actions (see also, Vivanti et al., 2011). This line of research supports social-cognitive accounts of overimitation, i.e., the notion that overimitation in typical and atypical development occurs when the imitator fails to distinguish components of the demonstration that are relevant versus those that are irrelevant to the overall goal of the task at hand.

There are a number of confounding factors that might have affected performance of individuals with ASD in previous overimitation studies. First, individuals with ASD often show reduced or atypical visual attention during imitation tasks, which is known to affect performance (Gonsiorowski, Williamson, & Robins, 2015; Vivanti & Dissanayake, 2014; Vivanti, Nadig, Ozonoff, & Rogers, 2008; Vivanti et al., 2014). Additionally, children with ASD might imitate or ignore specific components of the demonstration depending on the rewarding value of the outcomes of the demonstrated actions (Ingersoll, Schreibman, & Tran, 2003; Vivanti, Hocking, Fanning, & Dissanayake, 2016a), and their understanding/interpretation of task instructions, which is often atypical (Smith, Lowe-Pearce, & Nichols, 2006). Furthermore, elicited imitation in the context of explicit tasks might not reflect how individuals on the autism spectrum spontaneously learn from others in unstructured situations of everyday life (Klin, Jones, Schultz, & Volkmar, 2003; Senju, 2012; Vivanti, 2015). Thus more research is needed that takes into account all of these factors when examining overimitation in ASD.

Less is known about overimitation in individuals with Williams syndrome (WS), a rare neurodevelopmental disorder (estimated prevalence of 1:7500–1:20,000; Stromme, Bjornstad, & Ramstad, 2002) characterized by an increased drive for social approach alongside impaired social-cognitive skills (Brock, Einav, & Riby, 2009; Hocking, 2016; Karmiloff-Smith, 2007). In particular, individuals with WS have been reported to show social-cognitive

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