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Reduced social coordination in Autism Spectrum Disorders



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ABSTRACT

In the present study, we investigated whether individuals with Autism Spectrum Disorders (ASD) were able to coordinate with an unknown partner on the same outcome using a two-person pure coordination game. Twenty-one adults with ASD and twenty-one typically developed (TD) control participants were presented with sets of four items, and were asked to choose one of these items under three conditions: picking one's own personal preferred item, guessing what might be the partner's preference, and choosing an item in order to coordinate with the partner's choice. Each set included a salient item that stood out for its distinctive properties, known as the *focal point*. The results showed that individuals with ASD choose more often their preferred items than the salient cues to coordinate with others and to guess the partner's preference, as compared to TD controls. Performance for coordination was related to clinical scores assessing difficulties in communication and the severity of the autistic traits, but was unrelated to verbal intelligence and verbally mediated Theory-of-Mind task. These findings suggest that self-bias processes in decision-making might be a source of impairment in social coordination and interaction in ASD.

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1. Introduction

Successful social interactions often require that social partners coordinate their behavior despite minimal communication. Impairments in social interaction and communication are core features of Autism Spectrum Disorders (ASDs) (DSM-V, American Psychiatric Association; ICD-10, World Health Organization). Social difficulties in individuals with ASD have generally been investigated using Theory of Mind (ToM) tasks, which assess the ability to attribute mental states, such as intentions, beliefs, and desires, to oneself and to others (Baron-Cohen, Leslie, & Frith, 1985; Leslie 1987). Adults with ASD are usually able to pass first- and second-order ToM tasks (Bowler, 1992), but they encounter greater difficulties when tested with more advanced ToM tasks, such as those of the *Strange Stories* (Happé, 1994) and the *Faux Pas* (Zalla, Stopin, Ahade, & Leboyer, 2009), or in situations requiring spontaneous mentalizing abilities (e.g., Senju, Southgate, White, & Frith, 2009). While the ToM hypothesis is of considerable interest in explaining social impairments in ASD, in most tasks used to

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investigate social abilities, participants are passive observers of social scenarios, and do not play an active role in the experimental situation.

Recently, the game-theoretic framework has provided novel tools for studying how individuals make decisions in meaningful social interaction (King-Casas, & Chiu, 2012). Social exchanges often result from coordination between two or more people trying to achieve a common goal despite minimal communication. For example, if two friends get lost separately in a multiplex hotel before they have checked into a common room, it is likely that they would converge on the same outcome: that the reception desk is the location to which they have to come back to regain contact and coordinate. The basic features of this kind of interaction are modeled in pure coordination games. Formally, the solutions for these kinds of games cannot be obtained by adopting an optimal single strategy based on the mathematical structure of the game (Dixit, Skeath, & Reiley, 2009). Empirical results in economic behavioral studies have demonstrated that the solution of a coordination game relies on the recognition of *focal points*, i.e., items that are more salient than others for a matter of “conventional, cultural or psychological priority” (Bardsley, Mehta, Starmer, & Sugden, 2010; Mehta, Starmer, & Sugden, 1994; Schelling, 1960). The use of *focal points* does not require the making of inferences about other individuals’ choices or preferences, it rather consists in the recognition of conventional items, which stand out for their distinctive, categorical, and stereotypical properties, that is, for their uniqueness. The search for such objective criteria, requiring the setting aside of one’s personal preferences or monetary incentives, would likely rely on a set of preserved cognitive abilities for coordination.

When facing coordination tasks, people could recognise that there is no valid logical solution, and give responses based on features that spontaneously come to mind, essentially based on personal preferences. This is referred as *primary salience* (Mehta et al., 1994). In psychological terms, this kind of behavior would be driven by choices based on self-relevance. Alternatively, to guide their choice people might employ *secondary salience*. In that case, each partner would choose the item that he/she believes to have primary salience for the other. Thus, participants should construct a representation of the partner’s response and possibly inhibit processes linked to their own primary salience. Decisions based on secondary salience would likely depend on ToM abilities and/or self-other perspective-taking.

Here, we argue that the selection of socially salient features on which partners might coordinate, regardless of their respective personal preferences, requires the metacognitive capacities to represent other minds as different from one’s own mind and to form the shared intention to converge on the same solution. In line with the “theory-theory” (Gopnik, & Wellman, 1992), in order to make sense of other minds, that is to appreciate when others are in different situations or in possession of different knowledge and mental states, one has to learn and apply a general ToM. Conversely, according to the “simulation theory” view (Goldman, 1992; Gordon, 1992), people use themselves as a source model, predicting others’ thoughts and feelings by imagining themselves in the other person’s situation. While both theory-theory and simulation mechanisms may play a role in understanding others, it is likely that by adulthood, an individual’s attempts at perspective-taking in everyday life often result from the integration of these two types of cognitive processes.

In the present study, we investigated coordination abilities in adults with ASD and in typically developed volunteers using a modified two-person coordination game (Bardsley et al., 2010). Participants were asked to select one label in three experimental conditions. In the picking condition, they had to choose one of four presented labels on the basis of their own preference. In the guessing condition, they had to choose the label corresponding to the partner’s putative preference. In the coordination condition, they had to choose a label (the *focal point*) in order to coordinate with the partner’s choice. Each set included one label, the *focal point*, whose salience was determined by the *odd-one-out rule* – i.e., *exclusion of the item that does not belong to a set of stimuli that share a common feature* – (Bardsley et al., 2010; Mehta et al., 1994). The labels in each set correspond to items of the same semantic category, but only one label has a distinctive or salient feature and can be used as a *focal point*. For instance, in the set composed of “diamond”, “emerald”, “glass”, and “sapphire”, “glass” works as the focal point since this is the only non-precious stone within the set. We expected participants with ASD to show diminished abilities to coordinate with a partner, as indexed by their difficulties with choosing the focal points in the coordination condition. Furthermore, we examined whether their performance was affected by difficulties in ToM, as measured by the Faux Pas test (Baron-Cohen, O’Riordan, Stone, Jones, & Plaisted, 1999; Zalla et al., 2009) and by the severity of the autistic symptomatology, as assessed by the Autism Spectrum Quotient (Baron-Cohen et al., 2001) and the Autism Diagnostic Interview-Revised (ADI-R) (Lord, Rutter, & Le Couteur, 1994) in the areas of reciprocal social interaction and communication. Importantly, ToM impairments in individuals with ASDs might imply not only failure to understand that others have minds and that behaviour is determined by mental states, but also that other minds have thoughts, desires and preferences different from theirs.

Due to the verbal nature of the task, to rule out the possibility that performance in coordination would be affected by diminished abstract reasoning and verbal intelligence, participants were administered a semantic categorization test, prior to the experiment, and experimental variables were correlated with the verbal subscale score of the Wechsler Adult Intelligence Scale (WAIS-III, Wechsler, 1997). We predicted that difficulties in coordination would be related to a deficit in ToM and/or the self-other distinction, leading participants with ASD to use more often their own preferred items, based on primary salience, to coordinate with a partner.

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