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# Motivational approach and avoidance in autism spectrum disorder: A comparison between real photographs and cartoons

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## ABSTRACT

Individuals with autism spectrum disorder (ASD) show a lack of motivation to engage in spontaneous social encounters with other human beings. However, the basis for these diminished approach-related social behaviours is still unclear. This study investigated social motivation in ASD using an approach–avoidance task. In particular, we presented a group of ASD and a group of neurotypical adolescents with a series of emotionally positive, negative, and neutral visual stimuli, comprised of real photographs and cartoons – a stimulus with incentive salience for individuals with ASD. Participants were asked to either push or pull a joystick in response to an emotionally independent feature of the stimuli (colour frame). Following the main task, participants also rated the stimuli for affective valence and arousal. Results showed a dissociation in motivational responses towards positive stimuli for the ASD group only: faster avoidance from positive real photographs, but greater approach to positive cartoons, while no differences were found between emotionally negative or neutral stimuli. By contrast, no differences between the groups were found for the self-reported affective ratings. In light of the social motivation hypothesis, these atypical motivational responses suggest a deficit in assigning reward to socio-emotional stimuli in adolescents with ASD.

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## 1. Introduction

Autism spectrum disorders (ASD) are characterized by significant impairments in communication and social interaction as well as by repetitive stereotyped behaviours (DSM-V, APA, 2013). In these complex and heterogeneous disorders the social sphere appears to be severely affected. However, the fundamental mechanisms underlying abnormal social function in ASD remain unclear. Since the earliest descriptions, atypical socio-emotional processing in ASD has been frequently reported. For example, it has been long reported that relative to typically developing individuals, those with ASD show poor social interest,

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diminished eye contact and social aloofness (Osterling, Dawson, & Munson, 2002). Furthermore, they appear to be indifferent to the face of others (Kanner, 1943) and do not spontaneously interact with other people (Klin, Jones, Schultz, Volkmar, & Cohen, 2002). Impairments in emotion processing, and in particular, in the ability to detect emotion from facial expressions, pivotal for successful social interaction, have been also reported in ASD individuals (e.g., Harms, Martin, & Wallace, 2010).

In general, impairments in reciprocal social interaction have been often associated with reduced attention and/or motivation (e.g., Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012; Dawson et al., 2004; Leekam, Lopez, & Moore, 2000) to social cues in the environment. More recently, it has been suggested that this may be also influenced by an exaggerated interest for non-real patterns, such as animated ones (e.g., Dichter et al., 2012; Grelotti et al., 2005), which in turn could hypothetically overload brain resources commonly dedicated to social information (Sasson, Turner-Brown, Holtzclaw, Lam, & Bodfish, 2008). This excessive incentive salience of animated stimuli was shown in the compelling fMRI study conducted by Grelotti et al. (2005). These authors reported abnormal hypoactivation of the amygdala and the fusiform face area (FFA) for human faces but not for cartoon faces, in an autistic boy with a particular interest for cartoon characters. This pattern of activation was thought to reflect not only an exaggerated motivational salience tagged to the cartoons, but also an impairment in assigning proper reward value to socially relevant stimuli (Grelotti et al., 2005).

Further confirmation that individuals with ASD do not process human and cartoon stimuli in the same way was provided by a later behavioural study by Rosset et al. (2008). This study showed that while typically developing children employ the same strategy to process emotional expressions in both human and cartoon faces, children with ASD do not. In particular, typically developing children processed emotional facial expressions using a configural strategy. Such strategy involves the coding of both the shapes of individual features in a face and the relations among them, and is considered the hallmark of expertise in face processing (e.g., Maurer, Le Grand, & Mondloch, 2002). In contrast, children with ASD employed a local strategy for the emotional processing of human faces, based solely on the identification of specific facial features. Instead, they used the optimal configural strategy to process emotion in the cartoon faces only. These findings provide evidence that children with ASD can successfully process emotion when this information is presented in a cartoon-like configuration, as also shown using the face in the crowd paradigm (Rosset et al., 2011).

In line with this, Van Der Geest and collaborators (2002) showed that the eye movement behaviour of a group of children with ASD and a control group of neurotypical children was highly similar when presented with cartoon-like scenes depicting a human figure and several items (e.g., cars, boxes). Results showed that for all children the human figure was fixated earlier, longer and more often than other items in the scene. This contrasts with reports of spontaneous looking behaviour of children with ASD, showing that they spent less time looking at people (both parents and two experimenters in the session room) than neurotypical children, and more time looking at objects (Swettenham et al., 1998). Taken together, these studies suggest that when extracting information from a cartoon-like configuration, processing is relatively spared in ASD. These findings are in line with the recent view that socio-emotional impairments in ASD may be explained in terms of atypical social motivation, where the incentive salience of a given stimulus on a social context seems to have a significant function.

According to the social motivation hypothesis (Chevallier et al., 2012), socially motivated behaviours (*orienting, seeking, and maintaining*) result from naturally selected and conserved mechanisms towards reward, with the ultimate goal of providing species fitness for cooperative environments. People are intrinsically motivated to approach and seek out a reward, but also to avoid and withdraw from peril. In a social context, motivational driven behaviours are actions thought to be manifested partially through socio-emotional or highly incentive cues (Chevallier et al., 2012; Kohls, Chevallier, Troiani, & Schultz, 2012; Öhman, Flykt, & Esteves, 2001). Socially motivated behaviours are also assumed to emerge early in development and to play an important role in guiding socio-emotional learning and behaviour. Deficits in this domain can ultimately deprive a child of social exposure and learning, crucial for the development of social brain function (Chevallier et al., 2012).

Prosociality is inherently rewarding, and within this framework, atypical motivational responses are hypothesized to reflect difficulties in representing the reward value of social stimuli, which may affect social orienting and approach, thereby resulting in diminished motivation for social interactions (Chevallier et al., 2012; Dawson et al., 2002; Dawson, Webb, & McPartland, 2005; Kohls et al., 2012). Yet, the question of whether these atypical responses reflect an intrinsic or a learned process, or a combination of both, remains to be clarified. In the case of ASD, there seems to be an atypical orienting and approach response to non-social stimuli as opposed to social ones. Hence, from the perspective of the social motivation hypothesis ASD may represent an extreme case of reduced social interest, in which the natural disposition of an individual to orient towards the social world is profoundly altered (Chevallier et al., 2012). Furthermore, it has been recently suggested that this reduced approach motivation for social interactions in ASD may, eventually, lead individuals to experience social interactions as disinteresting, thereby amplifying social impairments and social avoidance towards others (Shillingsburg, Bowen, & Shapiro, 2014).

The aforementioned studies (Grelotti et al., 2005; Rosset et al., 2008) indicate that relative to human stimuli, animated stimuli such as cartoons are processed differently in ASD. This raises the question of the extent to which the incentive salience that non-human, or animated stimuli seem to have for people with ASD may facilitate motivational approach-related behaviours. The present study aims to tackle this question using an Approach–Avoidance Task (AAT; Rinck & Becker, 2007) and directly comparing motivational approach and avoidance responses to real photographs and cartoons depicting socio-emotional scenes.

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