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Seeing the funny side of things: Humour processing in Autism Spectrum Disorders

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ABSTRACT

Background: Humour is fundamentally a social phenomenon, occurring frequently in social and playful contexts. The positive affect resulting from an experience of enjoyed humour makes it socially rewarding. A lack of sense of humour has been associated with individuals with autism spectrum disorders (ASD), however, the existing literature is sparse and inconclusive. In this study, we investigated implicit and explicit humour understanding and appreciation in ASD.
Method: Specifically, an implicit item-item associative task was used, in which participants saw neutral-humorous and neutral-neutral sequences of two pictures in an *encoding phase*. Following a filler task, sequence recognition was measured in a *yes/no test phase*. At the end of the task, explicit measures of humour understanding and appreciation were completed by the participants, who rated the picture sequences for humour appreciation and funniness.
Results: Results revealed that, at an explicit level, participants with ASD were able to enjoy and understand the humorous stimuli as much as typically developing (TD) participants. At an implicit level, however, the results suggest that humour processing may be specially content-dependent in ASD. Fine-grained analysis on task performance indeed showed an altered humorous processing for social, but not for non-social humorous content in the ASD group, while that was not the case for the TD group.
Conclusions: These results suggest that participants with ASD may be distinctively motivated to attend to social reward cues such as social humorous stimuli. These findings are discussed within the social motivation hypothesis framework.

1. Introduction

Humour is a vital feature of social functioning: engaging in, and encouraging humorous responses are recognised as a universal phenomenon in human interaction, as it deeply influences social communication and adaptation (e.g., Lefcourt, 2001; Martin, 2001, 2007; Moran, Wig, Adams, Janata, & Kelley, 2004). Inherent to the enjoyment in social interactions, humorous behaviours reflect an ancient heritage of social joy in human neurobiological evolution (e.g., Pankseep, 2000) involving reciprocity such as shared or social laughter (Chapman, 1976). Nevertheless, humour is not easily defined. Considered as a heterogeneous phenomenon, humour involves not only the hedonic responses to the perception of an amusing stimulus, occurring primarily in social and playful contexts, but also cognitive components. To understand a joke, one has to detect and bring together contradictory information between two

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initially incongruent concepts or situations that are associated in a surprising or unexpected manner. The detection and resolution of this unexpected incongruity results in an emotionally arousing experience accompanied by feelings of amusement and laughter (e.g., Martin 2007; Ruch 2008). There are, however, non-solvable nonsense jokes, more complex forms of humour that may challenge rigidity and an intolerance of ambiguity (Ruch & Hehl, 1983). Far from being forthright, humour also has a dark side. Humour may involve the sharing of laugher with others (e.g., Lyons & Fitzgerald, 2004), but it may also involve laughter as a means to shame or humiliate others (Ruch, 2009; Ruch, Hofmann, Platt, & Proyer, 2014).

Whether positive or negative in nature, humour has a significant impact on social communication and social interaction. Indeed, also called "social glue" (Samson, 2013), humour is a current strategy fostering pleasure in social exchanges. In everyday life people implicitly and spontaneously use their sense of humour as a suitable trigger for, and enhance positive interactions (e.g., Lefcourt, 2001; Martin, 2007; Ruch, 2008). The joint positive affect resulting from an experience of enjoyed humour makes it socially rewarding. As prevailing as it is, it seems that not all individuals are able to recognize and experience humour. In Hans Asperger's (1944) early writings on autism spectrum disorders (ASD, APA, 2013), we can find the assertion that, "*an essential characteristic of these children is their humorlessness*" (p.127), and since Kanner's (1943) initial descriptions, the difficulties in emotion perception and expression in the disorder have been associated to difficulties in humour understanding and production (Asperger, 1944; Wing, 1996). Undoubtedly, understanding how individuals with ASD respond to humour would help understanding their difficulties in social communication.

Although sparse, reports of humour appreciation in high-functioning individuals with autism or Asperger syndrome have been documented throughout the years (Everard, 1976; Ricks & Wing, 1975; Werth, Perkins & Boucher, 2001). Several studies report a limited humour processing in autism. For example, children with ASD aged between 3 and 7 years old, do not seem to laugh in response to funny faces and rarely attempt to join to others' laughter (Reddy, Williams, & Vaughan, 2002), and young adolescents with ASD are less able to understand another person's intention to joke (Baron-Cohen, 1997). Adults also show difficulties in understanding and enjoying a joke when it requires considering people's (false) mental states (Samson & Hegenloh, 2010). Other studies using the classical paradigm to test humour processing by presenting jokes or cartoons with different possible endings, found that both adolescents (Emerich et al., 2003) and adults with ASD (Ozonoff & Miller, 1996) chose the correct funny ending less often than their matched controls. In addition to these difficulties, low cheerfulness and high seriousness, as assessed by humour-related self-assessment questionnaires, also seem to impact individuals' sensitivity to humour (Samson et al., 2013). Likewise, children with ASD, as opposed to typically developing children, have been described as less cheerful and less motivated to spontaneously engage with the social world (Asperger, 1944). For instance, they seem to be more likely to express unshared laughter, primarily in response to positive internal states, rather than using laughter as an exchange in social interactions (Hudenko, Stone, & Bachorowski, 2009). Moreover, gelotophobia, or the pathological fear of being laughed at (Titze, 2009), has been highly associated to autism (e.g., Samson, Huber & Ruch, 2011). Linked to a profound sense of shame and fear of being ridiculed by others, individuals with gelotophobia have great difficulty in distinguishing playful teasing and mockery, and laughing is perceived as hostile and as a source of worry, which eventually leads to social withdrawal, low self-esteem, and also, humourlessness (e.g., Chan, 2016; Wu et al., 2015; See Ruch et al., 2014, for a review).

In contrast, other studies seem to indicate an intact ability to appreciate and understand humour in this population. When presented with simpler forms of humour, based on visual puns and semantic cartoons, adults with ASD are able to enjoy them, as measured by their own explicit ratings of funniness (Samson & Hegenloh 2010). Also it has been shown that children with ASD can appreciate short humorous film scenes (Weiss et al., 2013), as well as humour based on rhyme and slapstick, as measured by coding parental report (e.g., Reddy et al., 2002). Yet, so far, the current research has mainly used explicit tasks, such as ratings of different types of humour stimuli (e.g., Weiss et al., 2013), humour-related self-assessment questionnaires (e.g., Samson, Huber, & Ruch, 2013), or choosing the correct joke ending when presented with several endings (e.g., Emerich, Creaghead, Grether et al., 2003), leaving unanswered the crucial need to understand implicit humour processing, and how it may interfere with cognitive and behavioural responses in ASD. Indeed, in most cases, humour occurs implicitly and spontaneously in social interactions (e.g., Lefcourt, 2001; Martin, 2007; Ruch, 2008), and it is this underlying aspect of humour that may contribute to the quality of the social interactions, especially when interacting in playful contexts.

The aim of this study was thus to investigate humour processing in individuals with autism, by using an implicit procedure, and thereby investigate its potential consequences for the quality of their social communication and interaction. We selected a procedure in which participants were not required to respond straightforwardly to humorous material. Previous research indicated that humour may affect various aspects of cognition, for example, it captures more attention (Hildebrand & Smith, 2014) and enhances memory compared to humour-free stimuli (Schmidt & Williams, 2001). We thus adapted a simple item-item associative task, for which we selected non-verbal plain slapstick humour pictures that were free of cognitive requirements commonly impaired in ASD, such as the attribution of (false) mental states to others or language abilities to understand the humorous elements. In addition, memory procedures such as recognition (e.g., simple associative item-item recognition) are assumed to be preserved in high-functioning individuals with autism (e.g., See Boucher, Mayes, & Bigham, 2012 for a review; Bowler, Gaigg, & Gardiner, 2008).

In a simple item-item associative task, a novel relationship is established between two stimuli (a target to be remembered, and an associative item or cue) during an encoding phase, and one stimulus is then used to cue retrieval at test. The effectiveness of the association relies on the fact that the target to be remembered is specifically encoded with respect to that cue (Thomson & Tulving, 1970). It follows that, the stronger the binding, the stronger the remembrance (e.g., Caplan, Madan, & Bedwell, 2015). The idea is that the previously encoded association can implicitly prime the response. In this paradigm we used humorous and neutral pictures as indirect or implicit cues for stimuli association: We presented neutral-humorous and neutral-neutral sequences of two pictures in an *encoding phase*. The cue stimulus at test was always the first picture of the sequence, that is, the neutral one. Following a simple filler