



## Research report

# Feelings of regret and disappointment in adults with high-functioning autism



Tiziana Zalla <sup>a,\*</sup>, Angela Sirigu <sup>b</sup>, Suzanne Robic <sup>c</sup>, Pauline Chaste <sup>d</sup>,  
Marion Leboyer <sup>d</sup> and Giorgio Coricelli <sup>e,f</sup>

<sup>a</sup> Institut Jean Nicod, Centre National de la Recherche Scientifique, Département d'Etudes Cognitives, Ecole Normale Supérieure, Paris, France

<sup>b</sup> Centre de Neurosciences Cognitives, CNRS, UMR 5229, Bron, France

<sup>c</sup> Lyon Neuroscience Research Center (Brain Dynamics and Cognition Team), INSERM U1028, CNRS UMR 5292, Lyon 1 University, Lyon, France

<sup>d</sup> INSERM U 955, IMRB, University Paris Est Creteil, AP-HP, Henri Mondor-Albert Chenevier Hospitals, Department of Psychiatry, Fondation FondaMental, French National Science Foundation, Creteil, France

<sup>e</sup> Laboratoire de Neurosciences Cognitives, INSERM U 960, Département d'Etudes Cognitives, Ecole Normale Supérieure, Paris, France

<sup>f</sup> Department of Economics, University of Southern California, Los Angeles, USA

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## ABSTRACT

Impairments in emotional processing in Autism Spectrum Disorders (ASDs) can be characterised by failure to generate and recognize self-reflective, cognitive-based emotions, such as pride, embarrassment and shame. Among this type of emotions, regret and disappointment, as well as their positive counterparts, result from a counterfactual comparison, that is the comparison between an actual value (“*what is*”) and a fictive value (“*what might have been*”). However, while disappointment is experienced when the obtained outcome is worse than the expected outcome that might have occurred from the same choice, regret occurs when one experiences an outcome that is worse than the outcome of foregone choices. By manipulating a simple gambling task, we examined subjective reports on the intensity of negative and positive emotions in a group of adults with High-Functioning Autism or Asperger syndrome (HFA/AS), and a control group matched for age, gender and educational level. Participants were asked to choose between two lotteries with different levels of risk under two conditions of outcome feedback: (i) *Partial*, in which only the outcome of the chosen lottery was visible, (ii) *Complete*, in which the outcomes of the two lotteries were simultaneously visible. By comparing partial and complete conditions, we aimed to investigate the differential effect between disappointment and regret, as well as between their positive counterparts. Relative to the control participants (CP), the group with HFA/AS reported reduced regret and no difference between regret and disappointment, along with a preserved ability to use counterfactual thinking and similar choice behaviour. Difficulties to distinguish the feeling of regret in

\* Corresponding author. Institut Jean Nicod-CNRS, Ecole Normale Supérieure, 29 rue d'Ulm 75005, Paris, France.

E-mail addresses: [tiziana.zalla@ens.fr](mailto:tiziana.zalla@ens.fr), [tiziana.zalla@gmail.com](mailto:tiziana.zalla@gmail.com) (T. Zalla).

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participants with HFA/AS can be explained by diminished emotional awareness, likely associated with an abnormal fronto-limbic connectivity.

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## 1. Introduction

Individuals with Autism Spectrum Disorders (ASDs) are characterized by qualitative impairments in the domains of social interaction, communication, and stereotyped behaviour. Diagnostic criteria for ASDs, as defined by the DSM 5 (American Psychiatric Association, 2013), the Revised Autism Diagnostic Interview (ADI-R) (Lord, Rutter, & Le Couteur, 1994) and the Autism Diagnostic Observation Scale (ADOS, Lord et al., 2000), all include difficulties in emotional processing. Recently, there has been a considerable progress in the understanding of the socio-emotional nature of impairments in ASDs and an increasing number of studies has acknowledged the idea that individuals with ASDs exhibit both difficulties in mindreading and in processing self-related knowledge (Lombardo et al., 2009; Millward, Powell, Messer, & Jordan, 2000; Willians, 2010). Indeed, difficulties both in reporting own past thoughts and in keeping track of prior intentions have also been reported in individuals with High-Functioning ASDs (Hurlburt, Happe & Frith, 1994; Phillips, Baron-Cohen, & Rutter, 1998). Noteworthy, disturbances in understanding others' affective states in ASDs often arise when the appreciation of the emotion requires the representation of others' beliefs, such as surprise or embarrassment (Zalla, Stopin, Ahade, Sav, & Leboyer, 2009), but not when emotions are generated by factual events (i.e., reality-based emotions) (Baron-Cohen, 1991; Baron-Cohen, Spitz, & Cross, 1993).

Concerning self-related knowledge, children with autism possess a less coherent representation of their own emotional experiences, and they may also be less able to generate and regulate emotionally laden situations introspectively or in interaction with others (Rieffe, Meerum Terwogt, & Kotronopoulou, 2007). Previous studies also revealed that children with autism have difficulties with emotions related to introspection and self-reflection, such as pride, guilt, or shame (Capps, Sigman, & Yirmiya, 1995; Kasari, Chamberlain, & Bauminger, 2001) and suggested that failure to distinguish emotional experiences would stem from a lack of reflective appraisal of those experiences (Harris, Olthof, Meerum Terwogt, & Hardman, 1987). Overall, these findings support the view that emotional responses are not normally integrated with cognitive processes in ASDs and that this might result from a diminished introspective awareness about one's own intentional and affective states, leading to serious consequences in the development of self-other relations.

Recent reports have underlined that there is a considerable overlap in the clinical presentation of persons with a diagnosis of Asperger's Syndrome and alexithymia, a condition characterized by difficulties in identifying ones' own emotions, feelings and bodily sensations, and to use them in communication and to regulate interpersonal exchanges

(Fitzgerald & Bellgrove, 2006; Hill, Berthoz, & Frith, 2004; Hill & Berthoz, 2006). Precisely, it has been estimated that somewhere between 40% and 50% of the ASD population is affected by alexithymia, (Fitzgerald & Bellgrove, 2006; Hill et al., 2004). Remarkably, while high level of Alexithymia is associated with diminished mentalizing abilities in non-autistic individuals (Moriguchi et al., 2006), in ASD individuals, it may be associated with abnormal empathic brain responses, poorer facial emotion recognition and atypical gaze fixations, suggesting that difficulties in introspecting on own emotions and aspects of the reciprocal social impairments in ASDs share a common neuro-cognitive basis (Bird et al., 2010, Bird, Press, & Richardson, 2011). Silani et al. (2008) reported that, differently from controls, individuals with HFA/AS showed reduced activation of the anterior insula, when they were asked to introspect on their feelings. Interestingly, in this study, behavioural measures of self-reported alexithymia and lack of empathy were correlated, indicating a link between understanding one's own and others' emotions.

These findings are mainly based on social emotions, but little is known about emotional impairments of ASD individuals in private settings. Our study aimed to fill this gap. In the present study, we investigated whether the observed impairments of ASD individuals in self-reflective emotional responses are present also in private contexts, where self-reflection should be independent from any social interaction. To do so, we measured self-reported affective responses to (private) events that differ in terms of the level of subjective responsibility for the outcome of one's own choice. These events can be associated with the emotions of disappointment and regret and their positive counterparts.

Disappointment and regret are common self conscious, cognitive-based, unpleasant experiences arising when the current state of affairs is worse than initially expected. Both emotions originate from a comparison processes in which the outcome obtained is compared to the outcomes that might have occurred. However, despite these commonalities, these *counterfactual* emotions differ on the basis of several characteristics. While disappointment (and its positive counterpart, joy) is experienced when the obtained outcome is worse than un-obtained outcomes from the chosen option, in a *within-option* comparison; regret (and its positive counterpart, relief) results from a *between-choice* comparison, thus a comparison between the outcome of a choice ("what is") and "what could have been if I had chosen another option". The experience of regret is focused on the alternative *choice* rather than on the alternative *outcome*: we experience regret when realizing or imagining that our present situation would have been better, had we decided differently (Zeelenberg, van Dijk, & Manstead, 1998). The difference between these two emotions is normally reflected in the amplification of the self-reported affective responses (e.g., regret is reported as

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