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REVIEW PAPER

Empathic Abilities and Theory of Mind in Adolescents with Asperger Syndrome: Insights from the Twenty-First Century

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Abstract It has been proposed in the literature that there exists a dissociation between the cognitive and the affective components of empathy among individuals with autism spectrum disorders, among them, Asperger syndrome (AS). The existing results, however, show mixed results. This literature review aims to shed some light on this field by reviewing studies on empathy and theory of mind (ToM; which is a basic requirement towards cognitive empathy) in adolescents with AS. Whereas it seems clear that ToM is impaired, but not absent in this population, the deficit in empathy appears as either specific or global to the cognitive component of empathy, depending on whether the measures used are performance or self-report measures, respectively. This literature review is the first of its kind because it is focused on quantitative data obtained using measures of both empathy and ToM. Limitations of the current evidence and future recommendations are discussed.

Keywords Review · Asperger syndrome · Empathy · Dissociation · Theory of mind

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Introduction

Social impairments have been historically considered to be a core feature of autistic disorders, among them, Asperger syndrome (AS). This syndrome belongs to the autistic spectrum disorders (ASD) and is mainly characterized by social impairments (such as lack of emotional reciprocity or impairments in emotional recognition) and restrictive interests (American Psychiatric Association 2000). Within the social impairments, impairments in empathy and theory of mind (ToM) have drawn special attention and their nature have been long debated. The purpose of this study is to shed some light on the current state of these specific areas by reviewing studies on both empathy and ToM in this population.

Empathy in Adolescents with Asperger Syndrome

There is consensus among scholars in the field of ASD that a lack of empathy is one of the key characteristics of individuals with AS (Baron-Cohen and Wheelwright 2004). A debate exists, however, on the nature of this "empathy deficit" because for many researchers, people with AS do not lack empathy but instead have impairments in some aspects of empathic understanding and empathy-related behaviors (Blair 2008; Frith 2012; Roegers et al. 2007; Smith 2006, 2009a). Regarding empathy itself, there are several definitions. For example, Baron-Cohen and Wheelwright (2004) define empathy as the ability to adopt another person's point of view and to respond to their emotion with an appropriate emotion (e.g., feelings of concern for someone's pain). Davis (1980, 1983) also defines empathy as including both cognitive and affective aspects that are interdependent on each other. This set of constructs is related to concern responsivity to others but also to discriminate the self from others. Other authors, for example, Eisenberg (Eisenberg and Miller 1987a, b; Zhou et al. 2003), distinguish between empathy

and sympathy. Empathy would imply a mirrored emotion, whereas sympathy is an affective response triggered by either empathy or other cognitive processes. The difference between empathy and sympathy is that empathy is *feeling as* and sympathy is *feeling for* (Eisenberg et al. 2006). Although there is variability among researchers in how they define empathy, its developmental concomitants, and underlying mechanisms (Batson et al. 1991; Decety and Jackson 2004; Preston and De Waal 2002), most scholars agree that empathy is comprised of two components: a cognitive one, usually called perspective-taking, and an affective one, called affective or emotional empathy. These different approaches to the construct have led to the development of several measures of empathy that are different in their nature depending on the theoretical framework. Whereas some measures of empathy assess both cognitive and affective components (e.g., Interpersonal Reactivity Index [IRI; Davis 1983], Multifaceted Empathy Test [MET; Dziobek et al. 2008], Questionnaire of Cognitive and Emotional Empathy [QCAE; Reniers et al. 2011]), others measures only assess one of these components (e.g., emotional empathy measured via the Mehrabian Emotional Empathy Scale [MEES; Mehrabian and Epstein 1972]), and others do not differentiate between cognitive and affective empathy (e.g., Empathy Quotient [EQ; Baron-Cohen and Wheelwright 2004]; the Empathy Accuracy Task [Ickes 1993]).

Dissociation Between Cognitive and Emotional Empathy in AS

Within the theoretical literature, at least two views have been posited to account for the deficits in empathy that exist among population with AS. On one hand, scholars such as Blair, Frith, and Smith (Blair 2008; Frith 2012; Smith 2006, 2009b) consider that individuals with AS are able to display empathy once they understand the demands of the situation. These researchers contend that problems in empathy are due to impairments specific to the cognitive domain of empathy. On the other hand, there are scholars who consider ASD as a problem of reciprocity and mutuality (Milton 2012). Baron-Cohen (2011) defends a distinction between autistic disorders and other disorders of empathy, such as borderline personality or psychopathy. Among individuals with ASD there is a lack of empathy due to impairments in ToM, but there is no intention to hurt or injure others. In contrast, among the latter individuals ToM abilities remain intact, but there is an absence of feelings of concern for others (Baron-Cohen 2011; Jones et al. 2010; Schwenck et al. 2012).

Empathy and Theory of Mind

When conceptualizing empathy as a bi-dimensional construct—one that includes both affective and cognitive components—a discussion of the concept of theory of mind is relevant because of its connection to the cognitive dimension of empathy, perspective-taking. The term ToM was first coined by Premack and Woodruff within the primatology field (1978) and was then applied to humans by Baron-Cohen et al. (1985). ToM refers to the ability to attribute intentions, desires, beliefs, and feelings to another person different from one's own perspective. This ability would be the first step towards taking another's perspective and to recognize another's emotions (Baron-Cohen et al. 2001). The "mindblindness" theory of autism (Baron-Cohen 1995; Baron-Cohen et al. 1985) suggests that the social impairments suffered by people with ASD are due to either poor mentalization abilities or lack of them. In contrast to the current empirical evidence on empathy, which is not yet clear on whether there exists a deficit on the empathic abilities or only in part of them (Blair 2008; Dziobek et al. 2008; Smith 2009a), there seems to be agreement that people with AS lack adequate ToM abilities. Explanations for this deficit in ToM account for a delayed development of ToM among children with AS, an incomplete development of their ToM or a difficulty using this ability in the "real world" (since they have proved to be able to pass ToM tasks in laboratory; Kuroda et al. 2011; Montgomery et al. 2010).

Aims of this Review

Understanding the mechanisms underlying empathic abilities among individuals with AS is essential for gaining further insights into their social competencies. Given the importance of ToM for developing and performing empathic behaviors as well as the close link between ToM and perspective-taking (the cognitive component of empathy), in the present paper we review current empirical evidence on both empathy and ToM in adolescents with AS. Recent reviews exist that offer a wide approach to different aspects of ASD; for example, abilities of emotional recognition, behavioral interventions, or genes related to it (Harms et al. 2010; Malone 2012; Palmen et al. 2012; Patterson et al. 2010). To our knowledge, there is only one review on empathy in adolescents with ASD to date (Bons et al. 2013). These authors reviewed the current literature concerning neuropsychological studies developed with adolescents with ASD and those with conduct disorder using the model of empathy proposed by Decety and Jackson (2004). In light of this, the present review will be a helpful approach to the current state of the field because it brings together studies carried out using empirical measures of empathy and ToM. We present this work structured in three sections. In the first one, we focus on studies on empathy and we discuss the conclusions obtained through them. In the second section, we present studies on ToM together with the conclusions reached. Finally, we present a general discussion regarding the current evidence on empathy and ToM in

adolescents with AS, and we provide limitations of this study and future recommendations.

Method

Search Procedures

The first step was to ask a question that would be answered throughout this review: Is there a dissociation between cognitive and affective empathy in adolescents with AS? To answer this question, systematic searches were conducted in five databases considered relevant in the field: Psycinfo, ERIC (Education Research Information Center), Pubmed, Web of Science, and Web of Knowledge. We established a year range from 1990 to 2013; this range is consistent with systematic reviews within the field of ASD (Bons et al. 2013; Palmen et al. 2012).

In order to select the search terms, we looked for synonyms of each of the words used as search terms in the thesaurus of each database to ensure that the scope of each search comprised most of the existing studies. The search terms were: Asperger syndrome, Asperger disorder, pervasive developmental disorder, high functioning autism, developmental disabilities, developmental disorders, empathy, empathic abilities, cognitive empathy, emotional empathy, affective empathy, perspective-taking, empathic concern, and sympathy. We also included the terms ToM, mentalization, eyes test, and reading the mind in the eyes test in order to retrieve those studies related to cognitive empathy and/or mentalization. The term "autism" was not used because the aim of this review was on empathic abilities of adolescents with AS and not of those with autism. The searches combining all of the search terms retrieved a total of 1,177 papers. Based in the articles' titles, we exported 264 references to a reference manager (Refworks) for further screening. We completed the second screening based on the articles' abstracts. Finally, we conducted a third screening, this time going through the entire article. This last screening resulted in 40 papers.

Inclusion and Exclusion Criteria

To be included in this review, the studies had to meet five criteria. First, the study had to be an empirical study. Second, given that the focus of our review is on the adolescent period, the mean age of the participants had to be between nine and 18 years of age. In those cases where the mean age of the sample was higher than 18 years because it comprised both adolescents and adults, the sample had to include adolescents younger than 18. Third, to be included in our review, at least one group in the study had to be comprised of adolescents diagnosed with either AS or high functioning autism (HFA). There has been debate on whether high-functioning autism is an independent disorder from AS or not. For example, Baron-Cohen et al. (1999) contend that they are indistinguishable. In contrast, Kaland et al. (2008) and Klin et al. (1995) consider AS and HFA different disorders.[1] Entering this debate is beyond the scope of this work. At the same time, restricting our review to studies that exclusively focused in participants with AS would have left out relevant data because most of the studies did not differ between AS and HFA. Therefore, we decided to include studies that also involved participants diagnosed with HFA. Fourth, to be included in this review, the study had to focus on either empathy or ToM. Fifth, in those studies looking at ToM, the measures used could not be restricted to first and second order ToM tasks, but include advanced ToM tasks.

Four exclusion criteria were also established. First, those studies comprising only children with severe autism were discarded, as well as those studies including only participants in the early childhood or adulthood (second). Third, studies focused on intervention programs were not included either, as they usually lack of a control group composed of typically developing children. Fourth, as the focus of this review was not neuroscientific data, we decided not to include studies carried out from a neuroscientific perspective nor theoretical papers (understood as papers lacking of quantitative data).

Results

We present the findings from this review in two sections: the first section focuses on studies measuring only empathy; the second section focuses on studies measuring ToM.

Empathy in Adolescents with AS

Seven of the final 40 papers reviewed were related to empathy among individuals with AS (see Table 1). The results obtained regarding the dissociation between cognitive and affective empathy in adolescents with AS are mixed: 43 % of them (three studies) did find this dissociation whereas 51 % (four studies) failed to find it. Dyck et al. (2001) did not find differences in a multicomposite empathic ability task (score composed by four subtasks, all of them developed for the study) among a group of adolescents with AS, a group with mental retardation (MR), a group with autism, a group with ADHD, a group with anxiety, and a typically developing group (TD) when IQ was controlled. In contrast, when IQ was not controlled, the group with AS performed worse than the TD group in empathic ability, and higher than individuals

[1] For an exhaustive review, see Baron-Cohen et al. (1999, 2001) and Ozonoff et al. (1991a, b).

Table 1 Empathy in adolescents with AS

Authors	Participants	Diagnosis criteria	Measure of IQ	Measures	Results
Auyeung et al. (2009)	256 mothers of children with autism, Asperger Syndrome (AS), and High Functioning Autism (HFA) 1,256 mothers of typically-developing (TD) children Both groups' age range, 4–11 years	DSM-IV ICD 10	–	Empathy Quotient (EQ) Systemizing Quotient (SQ)	Group with ASD obtained lower scores on the EQ and higher on the SQ than control group.
Demurie et al. (2011)	19 Autism Spectrum Disorder (ASD) 16 Attention Deficit Hyperactivity Disorder (ADHD) 18 TD All groups' age range, 11–17 years	DSM-IV TR Autism Diagnostic Inventory-Reviewed (ADI-R) Autism Diagnostic Observation Schedule (ADOS) Childhood Autism Rating Scale (CARS)	Known only for clinical groups. Measure not specified.	Interpersonal Reactivity Index (IRI) Eyes Test Empathy Accuracy Task	Group with ASD obtained lower scores on all of the three measures.
Dyck et al. (2001)	20 Autism 34 Mental retardation (MR) 35 ADHD 14 Anxiety 28 AS 36 TD All groups' age range: 9 to 16 years	DSM-IV	WISC	Strange Stories Test (ToM) Empathic ability (created for the study): facial cues test, comprehension test, unexpected outcomes, emotional vocabulary test	Empathic ability: Using IQ as covariate no differences were found within any of the groups. Without using covariates, group with AS scored lower than controls, higher than autistics and MR and equal than ADHD and anxiety. Strange Stories Test (ToM): Using IQ as covariate AS did score equal than controls and MR, scored lower than the ADHD group, and higher than Autism. Without covariates, AS scored lower than controls and ADHD, higher than autistics and MR, and equal than the group with anxiety.
Johnson et al. (2009)	20 ASD (AS and autistic disorder) and their parents. Age range, 9.3–18.2 years 22 TD and their parents. Age range, 9.3–18 years	DSM-IV TR	WASI>75	Autism Quotient (AQ) EQ SQ	Subjects with ASD scored lower than controls on the EQ. Their parents rated them lower compared to ratings given by parents of TD children to their children. Also, the parents of the participants with ASD rated them lower than they did themselves. No differences were found between both groups on the SQ. Participants with ASD scored higher on the AQ (and were rated higher by their parents compared to parents of TD group).
Jones et al. (2010)	21 Conduct disorder (CD) with psychopathic tendencies (CD-CU+) 23 CD without psychopathic tendencies (CD-CU−) 21 ASD (autism, AS and atypical autism) 31 TD All groups' age range: 9.3–16.9 years	-Child Symptom Inventory (CSI) -CD-CU+: scores above 50 on the conduct disorder subscale of the CSI and scores above 32 on the Inventory for callous unemotional traits (ICU) -CD-CU−: scores above 50 on the CD subscale of CSI and below 31 on the ICU - ASD: diagnosis by a psychiatrist	WASI	- Outcome Values Measure (consequences of aggressive behaviors) - Emotions attribution to the self: attributions of emotions to the self - First and Second order ToM - ToM animation task: attribution of intentionality and appropriateness of behaviors.	Participants with CD and psychopathic tendencies showed a specific deficit in affective empathy (lower scores on the task "Emotions attribution to self") in contrast to those with ASD, who showed a deficit specific for ToM and cognitive empathy (lower scores on first and second order ToM tasks and on the ToM animation task).
Schwenck et al. (2012)	55 ASD (autism, AS and pervasive developmental disorder, PDD) 36 CD with callous unemotional traits (CD-CU+) 34 CD without callous unemotional traits (CD-CU-) 67 TD	DSM-IV-TR ADI-R Social Communication Quest (SCQ) Observed Rating Scale for Conduct Disorder (FBB-SSV) ICU	–	Child Behavior Checklist (CBCL) Animated Shapes Task (emotional perspective taking) Video Sequencies Task (emotional and cognitive empathy) Morphing Task (emotion recognition)	Group with ASD showed deficits in cognitive empathy; mixed results for emotion recognition. No impairments were found in affective empathy.

Table 1 (continued)

Authors	Participants	Diagnosis criteria	Measure of IQ	Measures	Results
	Age range not specified. Mean age for all of the groups between 11.8 and 12.7 years				
Shamay-Tsoori et al. (2002)	2 AS, 17 and 18 years old 6 TD. Age range, 16–25 years	DSM-IV-TR	WAIS R Raven's Progressive Matrices	Empathy: IRI (cognitive subscales) Questionnaire Measure of Emotional Empathy (QMEE) ToM: Faux Pas Test Understanding Irony Cognitive Flexibility: Wisconsin Card sorting test; Verbal fluency, Design fluency, Torrance Test of Creative Thinking and Alternate Uses Test. Emotional processing: Modified version of Ekman and Friesen task (1976). Ross et al., affective prosody recognition task.	Participants with AS scored lower on all of the measures of empathy (IRI and QMEE) and made more errors in the Faux Pas Test, although they were able to identify irony. No differences with TD were found on either emotional processing or mental flexibility.

with autism and individuals with MR. In addition, the group with AS performed equal to the ADHD group and the group with anxiety. They used the Strange Stories Test (Happé 1994) to measure ToM and found that the AS group scored lower than the TD group and the ADHD group, equal than the group with anxiety, and higher than both autism and MR groups. When IQ was controlled, however, the differences between TD and MR disappeared and remained for the autistic group and the ADHD group, whose score were still higher than the scores of the AS group (the AS group scored higher than the autistic group even controlling IQ). Regarding their results, these authors concluded that individuals with AS do not have a specific deficit in empathic ability, rather, their deficits were comparable to their IQ or ToM abilities. Results in this line are reported by Schwenck et al. 2012, who compared children and adolescents with AS with two groups of children and adolescents with conduct disorder (one with callous unemotional traits, one without them), and a control group. Using both measures of cognitive and affective empathy, the deficit suffered by the group with AS in cognitive empathy was statistically significant, whereas mixed results were found in the affective measure related to the accurate recognition of sadness. These results are in line with the study by Jones et al. (2010), who found that individuals with ASD scored higher on affective empathy than individuals identified with conduct disorders.

Whereas these studies point out to a specific deficit in cognitive empathy among adolescents with AS, a different perspective is given in the study by Demurie et al. (2011). They compared adolescents with ASD, ADHD, and typically developing adolescents on three measures: the IRI (Davis 1983), the Eyes Test (used as a measure of empathic accuracy; Baron-Cohen et al. 2001), and the empathy accuracy task (Ickes 1993). The ASD group scored lower on all of the three measures, which suggests a deficit in empathy that is not specific to the cognitive domain. It should be noted that the authors did not specify whether the group with ASD was composed only of adolescents diagnosed with HFA or adolescents diagnosed with AS or other diagnosis, such as atypical autism.

A similar study was carried out by Shamay-Tsoori et al. (2002) who studied the cognitive profile of two adolescents with AS (compared to six age-matched controls) using several measures of mental flexibility (the Wisconsin Card Sorting Test), understanding of irony, ToM (via the Faux-Pas Test; Baron-Cohen et al. 1999), and both cognitive and emotional empathy (via cognitive scales of the IRI and the QMEE, respectively; Davis 1983; Mehrabian and Epstein 1972). The two adolescents with AS scored lower on all of the measures of empathy but did not differ from controls' on the ToM task. These findings led these authors to argue difficulties to integrate cognitive and emotional information in these adolescents. Johnson et al. (2009) used the EQ (Baron-

Cohen and Wheelwright 2004) to measure empathy in a group of adolescents with ASD (including both AS and HFA) and in a TD group. They also included in the study the perceptions that their parents had of their children's empathy. As expected, adolescents with ASD scored lower on the EQ although their own perceptions of themselves were slightly higher than the perceptions of them reported by their parents. Differences were also found between both groups of parents rating their children. Parents of adolescents with ASD rated their offspring lower than parents of TD adolescents did. Using the same questionnaire, Auyeung et al. (2009) asked mothers of children with autism, AS, and HFA to rate their children. They rated their children lower on empathy compared to ratings given by mothers of TD children.

Only two of the studies actually had a group composed purely of participants diagnosed with AS. The remaining studies had a group composed of individuals with several diagnosis, such as HFA (Auyeung et al. 2009), atypical autism (Jones et al. 2010), autism (Auyeung et al. 2009; Dyck et al. 2001; Jones et al. 2010; Schwenck et al. 2012), or pervasive developmental disorder (Schwenck et al. 2012). Other studies did not specify the actual diagnosis of their participants, including all of them under the label "autism spectrum disorder" (Demurie et al. 2011). We believe that the heterogeneity among the participants' diagnosis could be behind the lack of consensus among these studies.

The variety of measures used across studies is also remarkable. The most common, used in two of the referred studies, are self-report measures: the IRI (which distinguishes between cognitive and affective empathy; Davis 1983) and the EQ (which do not distinguish between cognitive and affective empathy; Baron-Cohen and Wheelwright 2004). These two studies found lower empathy in the group with ASD. It is also important to note that when the measures used are performance tasks, the deficit found in the group with ASD is specific to the cognitive domain (Schwenck et al. 2012) or even do not appear (Dyck et al. 2001). In our view, these interesting points suggest, on the one hand, the need to carry on studies on empathy that exclusively include participants with either AS or HFA—and avoid groups composed of mixed diagnosis, such as atypical autism, autism, pervasive developmental disorder or others. On the other hand, it is necessary to replicate studies using performance measures that differentiate between cognitive and affective empathy in order to disentangle whether or not this dissociation exists. Future studies should have into account the recent changes made to the diagnostic criteria, since AS as a nosological entity has been withdrawn from the DSM V (American Psychiatric Association 2013), in spite of major disagreement among the scientific community (Ghaziuddin 2010). Finally, studies comparing results obtained via performance vs. self-report measures are essential because different profiles are obtained depending on the measure used.

Theory of Mind in Adolescents with AS

Whereas among the measures described for empathy we can distinguish between self-report measures and performance measures, all of the measures used for ToM are performance tasks. Among them, we did distinguish between first and second order tasks, and advanced ToM tasks. First order tasks involve the ability to attribute others thoughts, intentions, desires, and feelings different from one's (Baron-Cohen et al. 1985, 2001). Examples of these types of tasks are the Sally and Anne Task (Baron-Cohen et al. 1985) and the Smarties Task (Perner et al. 1989). Second order tasks involve the ability to know what others think that others think, this is "what subject A thinks that subject B thinks" (Baron-Cohen et al. 1999). Some of these tasks are the Second Order Belief Attribution Task (Perner and Wimmer 1985) or the Ice Cream Van Story (Baron-Cohen 1989). Finally, advanced ToM tasks involve the ability to understand specific aspects of human communication such as irony, sarcasm or figurative sense (Baron-Cohen et al. 1999; White et al. 2009), and/or to be able to attribute complex mental states to others (Baron-Cohen et al. 1999, 2001). Some of these measures are the Strange Stories Test (Happé 1994), the Faux Pas Test (Baron-Cohen et al. 1999), the Social Attribution Task (Klin 2000), or the Reading the Mind in the Eyes Test (Baron-Cohen et al. 2001). According to our inclusion criteria, only studies carried out using advanced ToM tasks were included in this revision.

In contrast to the paucity of studies on empathy in adolescents with AS, we found a total of 33 papers on ToM in this population that met the criteria to be included in this review (see Table 2). Similar to our experience with reviewing studies on empathy, it is not easy to reach a general consensus among studies regarding the ToM abilities in this population. What might take place is a strong relationship between ToM abilities and language development, since this is a common finding (Paynter and Peterson 2010; Pilowsky et al. 2000; Tine and Lucariello 2012). When we look at studies including participants with AS as a unique group, 58 % of them (7 studies of 12) found participants with AS to have poorer ToM abilities than typically developing children (Baron-Cohen et al. 2001; Kaland et al. 2002, 2005, 2008; Klin 2000; Montgomery et al. 2012; Peterson et al. 2012). Peterson et al. (2009) compared ratings on ToM abilities given by parents of children and adolescent with AS, with autism, and TD. They found that parents of children and adolescent with AS rated their offspring with poorer ToM abilities compared to the ratings given by parents of TD children.

Poorer performance on ToM tasks among individuals with AS was also found in a study by Dorris et al. (2004), who compared performance of siblings of people with AS with siblings of TD people on the Eyes Test (Baron-Cohen et al. 2001). This result posits the possibility of a genetic influence on the abilities of emotional recognition and ToM.

Table 2 Theory of mind (ToM) in adolescents with AS

Authors	Participants	Diagnosis criteria	Measure of IQ	Measures	Results
Adler et al. (2010)	16 AS and HFA*. Mean age, 21.87 years 21 TD. Mean age, 22.90 years	DSM-IV ICD 10	WAIS	Eyes Test Strange Stories Test Autobiographical memory (AM): personality trait questionnaire Rey Auditory Verbal Learning (RAVLT)	ASD group obtained lower scores on both ToM tests. In the TD group, AM correlated with the Strange Stories Test; in the ASD group AM correlated only with Eyes Test.
Back et al. (2007)	Two experiments: 1) 18 ASD (11 autism and 7 AS). Age range, 10.8–14.9 years 18 controls (13 TD and 5 general development delay, GDD). Age range, 10.2–.7 years	1) DSM-IV	1) WASI	1) Movie clips showing complex mental states developed for the study. Stimuli used were dynamic and static	1) Participants with ASD performed poorer than controls. Neither dynamic nor static stimuli were easier. Participants with ASD also performed poorer when the stimuli was static-neutral mental state than when it was the whole dynamic face.
	2) 18 ASD (11 autism and 7 AS). Age range, 11.3–15.7 years 18 TD. Age range, 11.4–14.11 years	2) DSM-IV	2) WASI	2) 32 facial images including eight dynamic mental states and eight static mental states. Two types of presentation: isolated eyes and the whole face	2) No differences between both groups on emotional recognition, either on the isolated eyes or the eyes in the context of the whole face.[a]
Bakhshipour et al. (2012)	15 HFA. Age range, 6–13 years 15 TD. Age range, 6–13 years	DSM-IV-TR	WISC R>70	Theory of Mind Scale (4 subtasks)	Half of the participants with HFA were able to pass desire and belief tasks, however, none of them passed neither knowledge nor real/apparent emotion.
Bal et al. (2013)	41 ASD (AS, autism, PDD NOS). Year range, 6–15 years 58 TD. Age range, 7–17 years	DSM-IV ADI-R ADOS	WISC>80	Triangles Playing Tricks	Participants with ASD obtained lower scores on attribution of intentionality and less appropriate responses. Although age and performance was correlated in both groups, this association was higher among the TD participants. Age and attribution of intentionality were correlated among the TD participants but not among participants with ASD.
Baron-Cohen et al. (1999)	12 AS and HFA. Mean age, 12 years. 16 TD. Mean age, 11.3 years.	ICD 10	British Picture Vocabulary Scale (BPVS) WISC (blocks subscale)	Faux Pas Test	ASD group obtained lower scores than the TD group.
Baron-Cohen et al. (2001)	15 AS. Age range, 8–14 years. Two control groups: Group 1: 103 TD. Age range, 12–13 years Group 2: 53 TD. Age range, 6–12 years	DSM IV ICD 10	WISC R	Folk Physics Test (given only to the TD group 1) Eyes Test Child Version (folk psychology test; given only to the TD group 2)	The group with AS performed significantly better than the TD group 1 on the folk physics test. For the Eyes Test (folk psychology test) the scores obtained by the group with AS were lower compared to that obtained by the TD group 2.
Brent et al. (2004)	20 autism and AS. Age range, 6–12 years 20 TD. Age range, 5–13 years	DSM-IV	Clinical Evaluation of Fundamental Language-Revised (CELF) WISC >70 Kauffman Assessment Battery for Children	1st order ToM tasks: Sally & Anne, Smarties task, Picture Sequence Task Advanced ToM tasks: Eyes Test Strange Stories Test Cartoons Task	ASD participants were close to ceiling on the first order ToM tasks. ASD group scored lower on both the Eyes Test and the Strange Stories Test, not in the Cartoons Task.
Bühler et al. (2011)	86 ASD. Age range, 9–15 years 85 ADHD. Age range, 4.5–22 years	ICD 10 ADI-R	WASI	Test battery for attention performance ToM measures: Facial emotion matching	No differences were found in ToM performance between ASD and ADHD. Younger participants with ASD did

Table 2 (continued)

Authors	Participants	Diagnosis criteria	Measure of IQ	Measures	Results
	52 ASD + ADHD. Age range, 6.2–18.5 years	ADOS-G		Social Attribution Task	show lower performance on Facial Emotion Matching. Participants with ASD + ADHD had lower inhibitory control.
Chevallier et al. (2011)	Three experiments: Experiment 1) 17 ASD. Age range: 11.1–17.10 years 17 TD Age range, 11.7–17.9 years Experiment 2) 20 ASD. Age range, 11.5–16.3 years 20 TD Age range, 12.7–16.2 years Experiment 3) 32 ASD. Age range, 11.5–16.3 years 32 TD Age range,: 12.2–16.7 years	School reports based on DSM-IV criteria (participants were recruited from special schools) Dorothy's Bishop Dinos Task	–	Experiment 1: assessed the ability to take a variety of vocal cues into account in order to retrieve information about the speaker's physical or mental state. Experiment 2: assessed the ability to recognize a variety of vocal cues whilst involved in a dual task. Participants' first task was to decide—as fast as they could—whether or not they had heard the sound "ing" in the spoken stimulus. The interfering task was presented as the primary task and the emotional task was presented as the secondary task Experiment 3: assessed the ability to detect and interpret a variety of vocal cues whilst involved in a highly demanding dual task. Participants were asked to concentrate on the number of times they heard the letter T in the utterance whilst also having to monitor the speaker's emotional state	ASD participants showed no ToM-specific impairment in a highly demanding dual task. They were slower than TD participants in all conditions, which suggests that, when placed under high cognitive load, they have difficulties identifying vocal cues in general, independently of underlying mindreading requirements.
Dorris et al. (2004)	27 siblings of people with AS. Age range, 7.6–11 years 27 TD. Age range, 7.4–17.7 years	ICD 10 BPVS	–	Eyes Test	Siblings of people with AS performed poorer on the Eyes Test, which suggests a phenotype for AS and autistic disorders.
Golan et al. (2008)	23 ASC (AS and HFA). Age range, 8.3–11.8 years 24 TD. Age range, 8.2–12.1 years	DSM-IV ICD 10 CAST	WASI>75	Reading the Mind in Films Task The Cambridge Mindreading Face-Voice Battery	Participants with ASC obtained lower scores on both measures. They seem to have difficulties to integrate information from different channels. Age was relevant regarding the performance on the task, especially among TD participants.
Kaland et al. (2002)	21 AS. Age range, 10.2–20.4 years 20 TD. Age range, 9.6–20.9 years	ICD 10	WISC>81	New Advanced Test of ToM	Participants with AS performed worse than TD participants. They inferred better physical states than mental ones. A high correlation between intelligence and mentalization was found but it should be noted that reaction times among the group with AS were higher.
Kaland et al. 2005	21 AS. Age range, 10.2–20.4 years 20 TD. Age range, 9.6–20.9 years	ICD 10 ADI-R ADOS	WISC III>81	Strange Stories Test Physical States Control Task	Participants with AS did not differ from the participants with TD on the physical control task. They obtained lower scores than the TD group on the Strange Stories Test, which means they have more problems with mindreading. Verbal IQ was strongly associated with the performance on the task.
Kaland et al. (2007)	21 AS. Age range, 10.2–20.4 years 20 TD. Age range, 9.6–20.9 years	ICD 10 ADI-R ADOS	WISC>90	The Everyday Stories Test	Participants with AS needed more time to respond. Response time for the physical state was greater than for the social test.
Kaland et al. (2008)	21 AS. Mean age, 15.9 years 20 TD. Mean age, 15.6 years	ICD 10 ADI-R ADOS	WISC>81	Smarties The Birthday Present Eyes Test Strange Stories Test Stories from Everyday Life	Participants with AS scored lower than TD participants on the three advanced ToM tasks (Eyes Test, Strange Stories Test and Stories from Everyday Life).
Klin (2000)	20 HFA and autism. Mean age, 20.5 years	DSM-IV	WISC	Social Attribution Task	

Table 2 (continued)

Authors	Participants	Diagnosis criteria	Measure of IQ	Measures	Results
	20 AS. Mean age, 18.9 years 20 TD Mean age, 20.2 years	ADI-R ADOS-G Vineland Adaptive Behavior Scales Extended Version	WAIS		Group with AS performed better than the group with HFA but worse than TD participants on the task.
Kuroda et al. (2011)	17 HFA. Age range, 16–45 years. 11 PDD (8 AS and 3 PDD NOS). Age range, 16–45 years 50 TD. Age range, 18–22 years	DSM-IV	WISC>85 WAIS>85	Motion Picture Mindreading Task Autism Quotient	Neither of the measures was associated with IQ. Participants grouped under PDD did not differ from TD participants in mindreading abilities. A deficit in the integration of cognitive and emotional information is argued.
Le Sourn-Bissaoui et al. (2011)	10 AS. Mean age, 16.1 years 10 TD. Mean age, 15.9 years	DSM-IV	WAIS R WISC III	Ambiguity Detection Task Ice Cream Van Story test Rey–Osterreith Complex figure test	Three participants of the ASD group did not show impairments in ToM. Participants with AS showed pragmatic difficulties with ambiguous expressions, although they were able to correctly select their figurative meanings.
Loth et al. (2008)	21 ASD (11 autism and 10 AS). Age range, 8–28 years. Grouped according to their ToM abilities (passers vs. failers). Comparison group for ToM failers: 8 GLD and 10 TD (total=18). Age range, 4–7 years Comparison group for ToM passers: 3 GLD and 10 TD (total=13). Age range, 8–10 years	DSM-IV	WAIS>56 WISC>56	ToM measures: False Belief Task Strange Stories Test Central Coherence measures: Embedded Figures, Block Design Test, Sentence Completion Task Event Narration Task	ToM failers with ASD showed profound impairments in describing common events. Those who passed the ToM tasks shower rigid expectations and excessively detailed descriptions, but were able to some extent to understand and expect. High heterogeneity among participants within the autism spectrum in their event schemas.
Montgomery et al. (2012)	25 AS. Age range, 16–21 years	KADI	WAIS>85	Eyes Test Delis–Kaplan Executive Function System (D-KEFs) Emotional intelligence measures: Bar-On and EQ-i:s Mayer, Salovey, and Caruso Emotional Intelligence Test (MSCEIT) Social outcomes measure: BASC	Participants with AS obtained lower scores than the normative group on the Eyes Test, but performed better than a mixed group including HFA. Participants with AS showed adequate performance on the MSCEIT but obtained lower scores on the Bar-On EQ-i:s. ToM (Eyes Test) did not predict social outcomes measured via the BASC, but they were predicted by both MSCEIT and Bar-On EQi:S. ToM accounted for social stress but not for social interactions. High ToM and low emotional intelligence explained perceived social stress in participants with AS.
Narzisi et al. (2012)	22 ASD (10 HFA and 12 PDD NOS). Age range, 5–16 years 44 TD matched 2:1 for age, gender and education	DSM-IV TR	WISC>80	NEPSY (battery of neuropsychological tests)	Participants with ASD scored lower on most of the tasks. For social perception (ToM): they obtained lower scores on affect recognition but not on contextual tasks (inference of links between situation and emotions).
Ozonoff et al. (1991a, b)	23 HFA and PDD. Age range, 8–20 years 20 TD. Age range, 8–19 years	DSM III CARS	WAIS III>69	Emotion Perception Task ToM measures: Picture Sequence Measure Appeareance Reality Task Mental Physical Distinction Task Smarties Second Order Belief Attribution Task Executive function: Tower of Hanoi Wisconsin Card Sorting Test	High-functioning autistic individuals had selective deficits in executive function, theory of mind, emotion perception and verbal memory. In contrast, they performed as well as controls on spatial tests, IQ measures and most control tasks.

Table 2 (continued)

Authors	Participants	Diagnosis criteria	Measure of IQ	Measures	Results
				Discriminant Domain: Buschke Selective Reminding Test Children's Embedded Figures Test	
Ozonoff et al. (1991a, b)	13 HFA. Age range, 8–20 years 10 AS. Age range, 8–20 years 20 TD. Age range, 8–19 years	DSM III for HFA ICD 10 for AS CARS	See previous study	See previous study	Participants with HFA were poorer in ToM, emotion perception and verbal memory. Participants with AS were only poorer than their matched TD in EF and emotion perception. Executive function deficit was the main deficit in both HFA and AS.
Paynter and Peterson 2010	19 HFA 24 AS 20 TD All groups' age range: 4–13 years.	Two diagnosis based on DSM-IV criteria of either HFA or AS	Peabody Picture Vocabulay Test (PPVT)	Syntatic Skills ToM (false belief tasks): Sally and Anne, Deceptive Box Test, Belief Emotion Test.	Participants with AS showed earlier performance on false belief tasks than participants with HFA. 8 years old participants with AS did not differ from TD participants on false belief tasks. Mentalization abilities were linked to language development.
Perra et al. (2008)	14 ASD. Age range, 6.3–13.2 years 13 GDD. Age range, 8.6–13.6 years 16 TD. Age range, 6.16–12.75 years	ADOS ADI-R	BPVT	Imitation tasks ToM battery	ToM abilities can discriminate between ASD and other disorders. Including imitation improves the distinction accuracy between ASD and other disorders. Deficits in imitation abilities are important features of ASD.
Peterson et al. (2009)	85 parents of autistic children and adolescents. Children's age range, 5–17 years 230 parents of AS. Age range, 5–17 years 24 parents of TD. Age range, 5–17 years	DSM IV	Not measured	Everyday Mindreading Skills and Difficulties (EMSD)	TD children obtained lower scores than both groups of autism and AS on all of the items but two, which indicates that they have less difficulties in mindreading. On these two items, both groups of TD and autism scored lower than the group with AS.
Peterson et al. (2012)	31 deaf. Age range, 6–12 years 44 autistic. Age range, 5–12 years 41 AS. Age range, 5–12 years 68 TD. Age range, 5–12 years	DSM-IV	CELF	ToM task by Wellman and Liu (2004) plus an extra item measuring understanding of sarcasm	Both groups with autism and with AS performed lower than the TD group. They performed equally once age and IQ were controlled.
Pilowsky et al. (2000)	12 HFA. Age range, 6.5–20.6 years 12 schizophrenia. Age range, 10.4–15.16 years 12 TD. Age range, 6.5–11.5 years	DSM-IV ADI-R Autism Behavior Checklist (ABC)	WISC	Fact and Value Belief Task Deception Task Sally & Anne	Participants with HFA scored lower than TD participants on the three measures. In this group (HFA), ToM was related to verbal abilities.
Ponnet et al. (2008)	22 ASD. Mean age, 19.32 years 22 TD. Mean age, 19.26 years	DSM III and IV	WAIS>75	Two videotapes created for the study. Two measures derived from the videotapes: valence accuracy and content accuracy	Participants with ASD were able to perform better in structured situations and in situations with neutral content. Emotional cues were found to help TD participants but were distracting for participants with ASD.
Salter et al. (2008)	56 autism, AS and atypical autism. Age range, 6–18 years 56 TD. Age range, 6.12–20.93 years	ICD 10 ADI-R ADOS	WASI>70	Attributing mental states to animated shapes (ToM measure)	No major differences between participants with ASD and controls were found except for appropriateness: language of participants with ASD was less sophisticated and accurate than that of TD participants. High heterogeneity among participants with ASD.
Shimoni et al. (2012)	25 ASD and their parents. Age range, 7–18 years 28 TD and their parents. Age range, 7–18 years	ADI-R ADOS SCID K-SADA-P	WISC WAIS	Social Attribution Task Vineland Adaptive Behavioral Scale	No differences were found between fathers. Mothers only differed on the personality index. Participants with ASD scored lower than TD on the Social Attribution Task. ToM deficits are more subtle among individuals with HFA or AS, they are able to pass first and second order ToM tasks. ToM abilities were inversely related to autistic symptoms.

Table 2 (continued)

Authors	Participants	Diagnosis criteria	Measure of IQ	Measures	Results
Silliman et al. (2003)	15 ASD (AS and autistic disorder). Age range, 11.7–20 years 15 age-matched TD. 15 verbal matched TD.	–	PPVT	New Test of Theory of Mind	Both participants with ASD and their verbal matched TD peers performed worse than controls. Participants with ASD obtained higher scores on the social inferencing task than on the logical one.
Tine and Lucariello (2012)	39 autism. Age range, 8–13 years 34 AS. Age range, 8–13 years	DSM-IV	Raven's Progressive Matrices >70	Test of Language Development (TOLD) ToM measures: Story Vignette pretest, Unexpected Contents pretest, Unexpected Identity pretest, color filters pretraining.	They found ToM as comprised of two components: social ToM and intrapersonal ToM. The social ToM was weaker in autism than in the group with AS. No differences were found between both groups in the intrapersonal ToM. ToM was highly correlated to language.

We created two other groups of studies inside this category: those studies in which no differences were found between participants with AS and TD participants, and a group comprising those studies in which no differences were found between participants with AS and participants diagnosed with autism. The former subgroup is mainly represented by the studies carried out by Le Sourn-Bissaoui et al. (2011) and Ozonoff et al. (1991a, b). Paynter and Peterson (2010) showed that children with AS 8 to 13 years old did not differ from their matched TD peers on ToM abilities, in contrast to younger participants, who performed lower than their matched TD peers.

Only two studies failed to find differences between participants with AS and participants with autism. Peterson et al. (2012) found that when controlling for age and IQ, the performance of participants with AS was equal than those of participants with autism. This result is in line with findings from Tine and Lucariello (2012), who found ToM comprised of two components: interpersonal and intrapersonal. They documented the interpersonal component being stronger for participants with AS compared to those with autism, and scores on the intrapersonal component being equal for both groups.

In another array of studies, it was found that when the clinical group was comprised of participants diagnosed either with AS or HFA, the results consistently showed lower performance by participants with HFA compared to TD participants (Adler et al. 2010; Baron-Cohen et al. 1999; Golan et al. 2008). The same type of results came up when the clinical group included participants with autism (Back et al. 2007; Bal et al. 2013; Brent et al. 2004; Loth et al. 2008). Regarding the study by Brent et al. (2004), the clinical group performed worse than the control group on two of the measures used (the eyes test [Baron-Cohen et al. 2001] and the Strange Stories Test [Happé 1994]) but not on the third one, the Cartoons Task (Happé et al. 1999) where no differences between both groups were found. It should be also pointed out that some participants in the study by Loth et al. (2008) were able to pass the False Belief Task (Wimmer and Perner 1983) and the Strange Stories Test (Happé 1994), used to measure first order and advanced ToM, respectively. In fact, they divided them into two groups labeled "ToM passers" and "ToM failers" in order to compare their performance on an event narration task.

Consensus exists among all of the studies which clinical groups were comprised only of participants with HFA (Bakhshipour et al. 2012; Pilowsky et al. 2000). All these studies showed lower performance by the group with HFA compared to TD participants.

It is common within this field to find the clinical group named "participants with ASD." Some of the studies did specify the diagnosis included under this name (Back et al. 2007; Bal et al. 2013; Loth et al. 2008; Narzisi et al. 2012;

Silliman et al. 2003). Except for the study by Loth et al. (2008) all of them found poorer performance by this group compared to a TD group. Some of the studies, however, did not specify the diagnosis of the participants (they named the clinical group "participants with ASD" without providing additional information), so it is not possible to know the proportion of individuals with autism, AS, HFA, atypical autism or even pervasive developmental disorder not specified (PDD NOS) that were included. Five of the 33 studies reviewed referred to their clinical groups like this. Three of them (Bühler et al. 2011; Chevallier et al. 2011; Shimoni et al. 2012) reported similar performance on ToM tasks between the clinical group and groups composed either of TD participants (Chevallier et al. 2011; Shimoni et al. 2012) or participants with ADHD (Bühler et al. 2011) although participants with ASD performed significantly slower than TD participants in the study by Chevallier et al. (2011). Perra et al. (2008) aimed to understand whether mentalization abilities were able to discriminate between children and adolescents with ASD and their matched peers with general development delay (GDD). Using imitation tasks in addition to ToM measures they found that those with ASD had poorer ToM abilities than participants with GDD and TD participants, due to impairments in their imitation abilities.

Recently, Ponnet et al. (2008) pointed out that participants with ASD were able to some extent to identify valence and content of the mental states showed in two videotapes created for the study. They differentiated structured vs. unstructured situations and found that adolescents with ASD performed better in the structured ones with neutral content. Another interesting finding was that in contrast to TD participants (for whom emotional cues facilitated the identification of mental states), emotional cues were distracting for those with ASD. Chevallier et al. (2011) and Ponnet et al. (2008) concluded that the difficulty inherent to the situation, such as the cognitive demands (cognitive load) or the variety of emotions involved, influenced the accuracy of participants with ASD attributing mental states to others. This has been also noted by Golan et al. (2008), Kuroda et al. (2011), and Montgomery et al. (2012) related to the difficulty that this people show to integrate information from different channels (e.g., visual vs. auditory) and information of different kind, such as cognitive vs. affective content.

As a final consideration, we should take two aspects into account. First, the heterogeneity among the participants included within the clinical groups, as occurred with studies on empathy previously reported. In order to reach a conclusion, we needed to group the studies according to their samples, resulting in six different categories. A second aspect is the wide variety of tasks used to measure ToM abilities. Several studies created their own tasks, for example, Back et al. (2007) or Chevallier et al. (2011). Nevertheless, we identified the use of the Strange Stories Test (Happé 1994) in five studies of the 33 included in the evaluation, the Eyes Test (Baron-Cohen et al. 2001) in four (five including the study with siblings of people with AS), and the Social Attribution Task (Klin 2000) in three of the studies, making them the most common measures of advanced ToM within the field of ASD.

Discussion

The purpose or our review was to answer the question "Is there a dissociation between cognitive and affective empathy in adolescents with AS?" by reviewing the existing evidence on empathy and ToM in adolescents with AS. We performed several searches in five scientific databases relevant to the field, following the steps recommended by Petticrew and Roberts (2006).

Dissociation Between Cognitive and Affective Empathy in Adolescents with AS

Recent research provides evidence for two separate neurological systems supporting both cognitive and affective empathy (Decety and Jackson 2004, 2006; Greimel et al. 2010; Shamay-Tsoory et al. 2009). Accordingly, theoretical papers by important scholars within the field of ASD, including Smith (2006), Blair (2008), Baron-Cohen (2011), or Frith (2012), present people with AS as having problems with cognitive empathy due to impairments either in ToM or Central Coherence mechanisms, but able to display the affective component, called by Eisenberg and colleagues "sympathy" (Tantam and Girgis 2009; Eisenberg and Miller 1987b). Nonetheless, we should not dismiss those views of ASD as completely absent of empathic abilities (Milton 2012; Myles et al. 2007; Shamay-Tsoori et al. 2002). For the studies reviewed, 57 % of them (four of seven) did not find this dissociation whereas 43 % did find it. It is very interesting to look deeper and notice that when the measures used are performance measures and actually distinguish between cognitive and affective empathy this dissociation appears, but it is not "visible" when the measures used are self-report measures (such as the IRI; Davis 1983). We believe that the lack of consistency in the diagnosis requirements within the participants is an important explanation to the lack of consensus across studies. Whereas some of the studies actually differentiate between HFA and AS (e.g., Klin 2000), some of them mix participants with AS and participants with HFA (e.g., Adler et al. 2010), and even participants with autism (Back et al. 2007). Another inconsistency between studies (apart from the measures used, which are different almost from one study to other) is the minimum IQ required as an inclusion criteria, which ranged from as low as 56 on WAIS or WISC in some studies (Loth et al. 2008) to a minimum score of 90 on

WISC (Kaland et al. 2007). Although most of the studies required a measure of intelligence, not all of them did specify the average IQ of their samples (Auyeung et al. 2009). Therefore, further investigation is needed to determine whether this dissociation is present in adolescents with AS overcoming limitations that could be misleading the results obtained, such as the heterogeneity of the participants' diagnosis, the wide age range studied into one single group, or the minimum IQ required to be part of the studies.

Theory of Mind in Adolescents with AS

The knowledge acquired through the papers reviewed led us to conclude that there is a deficit in mentalization abilities (ToM) among the population with AS. It seems that this deficit is not all about a total absence of this cognitive domain, but a failure to use it. Typically developing children are usually able to pass first order ToM tasks by the age of 3 or 4 years (Baron-Cohen et al. 2001) and second order ToM tasks between the ages of 6 and 8 years (Paynter and Peterson 2010). It has been suggested that this development in children with AS or HFA might be delayed and/or not completely accomplished since several studies have reported that adolescents and adults with AS, and even children older than 8 years, were able to pass first and even second order ToM tasks (Kaland et al. 2008; Paynter and Peterson 2010). To our knowledge, when the groups compared are purely AS vs. TD the deficit in ToM becomes evident, although it does not seem to be a total absence of these abilities, but a delay in its development (Paynter and Peterson 2010) or an impairment performing in advanced ToM tasks that would not be evident while performing in first order tasks (Klin 2000). This reasoning would not be opposite to that of authors who propose a difficulty to integrate cognitive and affective information, due to the subtle and quick nature of "real" interactions occurred day by day (Kuroda et al. 2011; Montgomery et al. 2010).

Although there is no absolute agreement among all of the studies, it seems clear that when we focus on the three advanced ToM tasks most often used to assess ToM abilities (the Strange Stories Test [Happé 1994], the Social Attribution Task [Klin 2000], and the Eyes Test [Baron-Cohen et al. 2001]), people with AS have impairments performing on these tasks when compared to TD people. Nonetheless, the research indicates that most of them are able to perform adequately in first and second order ToM tasks. The percentage of studies that found people with AS, HFA, or ASD to perform worse on these tasks than controls was of 80 %.

Study Strengths and Limitations

The main contribution of this review is to provide new insights within two relevant topics (empathy and ToM) in a disorder with a prevalence estimated of 3.6 per 1,000 (Ehlers and Gillberg 1993), as well as be focused on a specific stage of development, adolescence. Despite of being two topics largely studied, a review focused on studies using performance and self-report tasks was missing, having into account that tests are commonly used to research purposes within the field of psychology. We meant to restrict the studies included in this review to those including only adolescents with AS, in order to maintain an appropriate focus in AS. Such restriction, however, would have left out many interesting papers, since is common in the field to create clinical groups mixing both AS and participants with HFA. Paradoxically, this can be considered both a strength and a limitation, since it is not possible to carry on a review including a considerable number of studies if we consider only those studies focused on participants with AS. Another limitation of this study points to the age range. Although our focus was the adolescence period, considered from early adolescence (10 years old) to late adolescence (18 years old), some of the studies actually cover extent year ranges, such as from 16 to 45 years old (Kuroda et al. 2011) or from 8 to 28 years old (Loth et al. 2008). In addition, using such a variety of measures to assess both empathy and ToM, together with the wide range of age of the samples, makes it difficult to reach strong conclusions and impossible to carry on a meta-analysis, as is being done in other fields in the present (Harms et al. 2010).

Future Directions

The knowledge acquired should be a guide for researchers, clinicians, and significant people around adolescents with AS in order to be able to help them to achieve success and wellness in life. Looking ahead, we consider it necessary to give a turn to the research in this population, especially to research on their empathic abilities via increasing the accuracy of the studies. Considering the limitations named above we really encourage future researchers to be more cautious with the inclusion criteria of the participants, as much in regards to the diagnosis criteria as in the minimum IQ required to be part of the study. In this sense, it would be also desirable to design studies that replicate previous research done across different developmental stages. This would allow us to further know the mechanisms through which empathic abilities and ToM among children, adolescents, and adults with AS develop and work as well as longitudinal studies to go deeper into the understanding of the individual development of empathy and ToM in AS.

Regarding ToM, evidence suggesting a link between its development and the language abilities (Lind and Bowler 2009; Paynter and Peterson 2010; Tine and Lucariello 2012) makes it necessary to carefully take into account both IQ and language ability in any analysis. To investigate whether a relation between ToM and executive function exists seems

to be also a potential source of new insights within the field. Given the heterogeneity among people affected by AS (characterized for great differences from one individual to another in areas such as social communication, presence of mannerisms or emotional recognition; Holliday 2004; Tantam and Girgis 2009), it would be advantageous for researchers and clinicians to reach some consensus and work together to develop interdisciplinary protocols, as it has been done in others disorders such as schizophrenia, where an established protocol must be followed to carry on studies within this field (MATRICS [Measurement And Treatment Research to Improve Cognition in Schizophrenia], Marder and Fenton 2004).

In sum, although the advancements in the knowledge, treatment, and recognition of Asperger syndrome among professionals and the general public have experienced a great impulse over the last few years, further research is still needed to overcome the existing weaknesses and limitations. Finally, this knowledge, based on empirical evidence and accuracy would lead clinicians and significant people around to help them to develop better quality of life.

Conclusions

The present review showed that using performance tasks to measure empathy in adolescents with AS reveals a dissociation between cognitive and affective empathy (the latter preserved). Those studies carried out using self-report measures fail to support this dissociation, since they obtained mixed results. Regarding ToM, our results point out that there exists a deficit in advanced ToM; however, this deficit does not correspond to a total absence of mentalization abilities. Stronger consensus on the inclusion criteria required to participate in the studies is needed (i.e., diagnosis and IQ) in order to reach general conclusions through the studies.

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