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The understanding of others intentions can predict the improvement of symptomatology in children with autism – An exploratory study.

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Abstract

The Understanding of Others' Intentions (UOI) is a precursor of the theory of mind. The purpose of this study is to verify whether the absence of UOI is related to the Intelligence Quotient (IQ) or constitutes a typical characteristic of the autistic disorder, and if its presence could be a predictor of a positive symptomatologic evolution. To this aim, the UOI was evaluated in a sample of 100 non-verbal autistic children and in a sample of 50 non-autistic children with intellectual disability. The control group, in contrast to the children with Autistic Disorder, positively respondend to the test, thereby demonstrating the independence of the presence of the UOI from the IQ score. Assessing children with autistic disorder after 2 years of therapy, it was possible to verify that the presence of the UOI is a valid predictor of positive developments then highlighted by better ADOS scores.

Keywords: Autism spectrum disorder, Understanding of intention, Theory of mind, ADOS score.

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Introduction

The international scientific community considers autism a neurodevelopmental disorder characterized by restricted and repetitive behaviors and a severe impairment in socio-relational and communication areas [1]. The diagnosis is based on the clinical observation of restricted and repetitive behaviors and deficits in social interaction and communication aspects. The delay in any of these areas or in the use of the symbolic skill should appear before the third year of life.

This study aims to explore the atypical development of a theory of mind within the relationship and social communication deficits and to present a research about the understanding of others' intentions in children with autism spectrum disorder performed with a revised and adapted version of the *Behavioral Re-Enactment Procedure*, that is the comprehension test of the intentions elaborated by Meltzoff [2].

The understanding of mental and emotional states of the others is the structural element of the ability to be in relationship and to define as individuals with thoughts, so recognizing mental states in terms of intentions, desires and beliefs both in one and in others. In typical development, these skills make their appearance starting at about 18 months of life together with the ability to understand the intentions of the others. At four years of life, the child reaches a complex and sophisticated level of theory of mind that allows him to refer to his own mind and that of others, and to explain and predict behaviors [3-9].

In children with autism, it has already highlighted the lack of cognitive abilities that pass through the imitative behaviors of the body and that enable to give an experiential content to their own emotions and those of the others [10,11]. The socio-cognitive development, therefore, needs to be studied with particular reference to the imitation processes which lack in nearly all autistic children [12-18].

In autism, the inability to create meta-representations could be determined by a primary deficit in the somatopsychic area that concerns a block in emotional development [19-22]. This deficit prevents proper connections between emotions, sensory processing, motor planning and formation of symbols and hinders the development of empathy and theory of mind, intentional and relational behaviors, problem-solving, so bringing the child to do repetitive actions without purpose [23]. Meltzer pointed out that the restricted and repetitive behavior of autistic children prevents the attribution of mental states and socio-relational skills, this in function of seeking partial sensory stimulation, without that the attention could unify

and coordinate the single elements in the perception of an integrated object [24-28]. Such behaviors would be, in this perspective, those defensive processes defined as *sensory dismantling* (that is the reduction of the object to single sensory components) and *adhesive identification* (that is the confusion between subject and object).

A little scene with two characters, Sally and Anne playing with each other with a marble, is presented to children. The first character, Sally, after hiding the ball in a basket, leaves the scene. In his absence, Anne, the second character, moves the marble from the basket in a box and then she also leaves the scene. When Sally comes back, the child is asked where Sally will look for the marble. The task is resolved when the child is able to respond according to the mental state of the character (Sally will look for the marble exactly where she left it, that is, according to her belief, even if false) and not on the basis of the informations about the actual state of the things.

Generally in clinical, to investigate the presence of intentions, we use the experimental paradigm of the false belief developed by Wimmer and Perner and later simplified by Baron-Cohen, in order to assess how children understand that people possess a representation of reality that drives behaviors, as demonstrated by the Sally-Anne test (Figure 1) [3,29].

In children with typically development, the false belief task is resolved starting from 4 years of age [29,30]. In a previous study, the false belief task was administered to a group of 51 children, all with an autism spectrum diagnosis, and nobody was able to solve it [31]. Once confirmed the hypothesis of the complexity of this task in highlighting the competence in the specific are concerned, we decided to investigate a less complex state of mind than the false belief, that precisely is the understanding of intentions, which is considered a precursor of the theory of mind [2-5,29,30].

We would emphasize that the assessment of such skills in autistic children is a recent field of research, and that the results are often contradictory. In these studies, in addition, there is no reference to the influence that the different levels of severity of autistic symptoms can have on understanding the intentions. Russell and Hill found

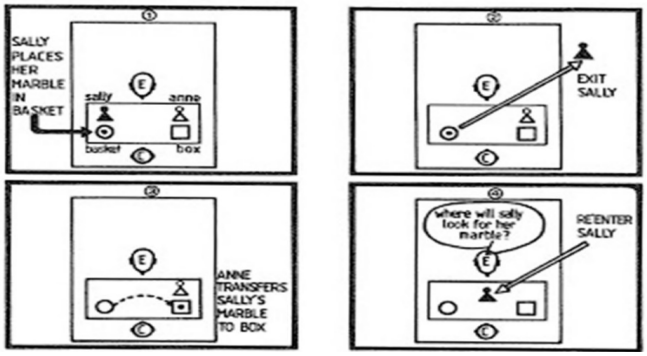

Figure 1: *The false belief task – The Sally-Anne Test [29]*

that autistic children aged between 5-17 years showed the same level of understanding of the intentions of the control group [32]. All the children described in this study, however, completed vocabulary and grammar tests and verbal scales evaluated their cognitive level. Both groups, those of the autism spectrum and those with typically development, achieved the same level of performance in all the tests. This means that the level of understanding of the intentions was evaluated in autistic children who showed the same verbal skills of children with typically development. Another study, instead, concluded that autistic children aged 3.5-5.5 years only imitated the examiner's action without understanding the intention and showed difficulties in performance, even when the examiner provided verbal clue to suggest the target action [33]. It is interesting to note that the children of this research did not show severe autistic symptoms, as defined by the mean score of 29 obtained at the Childhood Autism Rating Scale (CARS) [34].

Tomasello et al. [35] suggested that the ability to understand the intentions of others involves both cognitive components, in the understanding of target action, both the social motivation to recognize and share emotions with others, all aspects that are combined in typical development. Children with autism may have the cognitive understanding of the function of the object, while its social and emotional understanding could be particularly compromised, so that autistic children show difficulties in joint attention and in understanding of others' mental states [3-5,35-37].

In the light of these divergent results, this research has the purpose to verify the presence of the ability to understand the intentions of the others in a sample of autistic children who were included in a therapeutic project, in a longitudinal study. The hypothesis who led the research is that the deficit in the UOI is determined by the autistic symptoms and not by cognitive impairment.

The first objective of this study is to evaluate the UOI at the time of intake both in children with autism spectrum disorder and in children with intellectual disabilities, in order to verify if the UOI is correlated to the Intelligence Quotient (IQ) and to Chronological Age (CA).

The second objective is to evaluate how the UOI, the IQ and the autistic symptoms change after two years of treatment and then verify the predictive value of the UOI, at the time of intake, on the evolution of autistic symptoms.

Method

Participants

The sample was comprised of 100 Children With Autism spectrum disorder (CWA, 81 males and 19 females) aged between the ages of three and 13 years (mean=5.7, SD=2.3) and 50 Children With Intellectual Disabilities matched on age (CWID, 30 males and 20 females) who were between the ages of three and 11 years (mean=6.5, SD=1.9). The

male to female ratio of CWA children was approximately 4:1, consistently with national and international data [38,39]. Most of children in both groups came from Italian middle class families (Table 1).

The CWID group included children with intellectual disabilities (IQ<70; 22%), children who in addition to the intellectual disability showed associated language delays (6%), emotional disorder (6%) and developmental delay of mixed etiology (66%). All the CWID children included in the control group had spontaneous and communicative language, and these skills were evaluated both in production and in understanding and through the evaluation of the phrasal structure, and through lexical, semantic, articulators and pragmatic aspects [40-46]. At the clinical evaluation, moreover, the CWID children did not show restricted and repetitive behaviors or other signs that indicate the presence of autism, so no diagnostic test has been administered for it.

The CWA children were assessed with the ADOS scale (ADOS) and clinical evaluations, and so received a diagnosis of autism according to the DSM-IV [47,48]. All CWA children had no spontaneous speech and presented stereotyped and repetitive behaviors. Their ADOS scores indicated the presence of autism.

Procedure

Participants were recruited from the Institute of Ortofonologia (IdO). The Institute is accredited by the National Health System and it follows the procedures for taking charge of children and their families for the monitoring protocol of the therapeutic project established by the regional agency. All CWA were diagnosed by a highly experienced clinical team consisting of psychologists, child psychiatrists, neurologists, speech/ language pathologists and occupational therapists, all of whom have extensive experience with children with autism (ranging from five to over 10 years of expertise). The team that took part in the assessment is composed by specialized figures different from the ones involved in the therapeutic plan.

The CWA and CWID children were recruited between 2011 and 2012. The CWA were included in a treatment plan, the Turtle Project, for the next two years after the intake. This program provides individualized therapeutic paths of ten hours per week for children with autism [49,50].

The CWA were assessed at the intake and two years later to see the change in the ability to understand the intentions of the others and in ADOS scores.

The CWID were assessed at the intake and have not been evaluated after two years because they showed the ability to understand the intentions of the others already at the intake.

Table 1. *Clinical and socio-demographic characteristics of sample*

Variable	**Mean (SD)**			**Range**			***F*- Fisher**	***P* (η_p^2)**
	CWA		**CWID**	**CWA**		**CWID**		
Chronological Age (years)	5.7 (2.3)		6.5 (1.9)	3.02–13.1		3.0–11.0	CWA *vs.* CWID: F=3.7 AD *vs.* SpD: F=2.9	*0.06 (0.11)* *0.11 (0.10)*
	AD	SpD		AD	SpD			
	5.5 (1.9)	6.4 (2.8)		3.02–12.2	3.06–13.1			
IQ scores	60.5 (20.9)		67.7 (8.5)	36-102		49-80	CWA *vs.* CWID: F=5.4 AD *vs.* SpD: F=6.2	*0.02 (0.09)* *0.01 (0.18)*
	AD	SpD		AD	SpD			
	53.3 (18.2)	75.8 (17.9)		36-98	40-102			
ADOS scores	14.8 (4.4)			7–22		/	/	
	AD	SpD		AD	SpD			
	17.4 (2.7)	9.3 (1.1)		12-22	7-11			
Categorical variables								
	CWA	CWID		***Chi square***		***P***		
Gender (N, % Male)	81 (81%)	30 (60%)		6.58		0.01		
Socio-economic level Low Middle High	10 (10%) 73 (73%) 17 (17%)	4 (8%) 44 (88%) 2 (4%)		5.58		0.07		
Nationality Italian East European South American Asian African	86 (86%) 4 (4%) 3 (3%) 3 (3%) 4 (4%)	48 (96%) 1 (2%) 1 (2%) 0 (0%) 0 (0%)		7.77		0.17		

CWA: Children with Autism (N=100); CWID: Children with Intellectual Disability (N=50); AD: Autism Disorder (N=68); SpD: Spectrum Disorder (N=32)

The children's selection of the sample was not randomized, but were included all the children taken in charge by the Institute at the first assessment. The decision to include children aged three to 13 years (wide age range) was made to see how the ability to understand the intentions of others, often absent in even older autistic children, is present in the different age groups.

Children were included in the research on a voluntary basis after providing their families an explanation of the purpose of the study and after obtaining the informed consent (Declaration of Helsinki). This research complies with ethical guidelines and legal requirements of the country in which it was conducted and meets the ethical standards of the American Psychiatric Association.

Measures

Understanding of intentions

To assess the understanding of intention in CWA and CWID, we administered a task inspired by Intention Condition of Behavioral Enhancement Procedures [2]. In Meltzoff's study, the task has been used with 18 month-old children with typical development. As suggested by other authors, the task may also be used with autistic children with a higher chronological age [33,51,52]. Moreover, in our research, CWA children showed a severe symptomatology and impairment of verbal language. For this reason, the procedure of Meltzoff can also be used over the age range expected. We used the items proposed in the original version of the procedure Meltzoff, making some changes.

The original version of the procedure involved the use of five objects: the first was a dumbbell-shaped toy that could be pulled apart and put back together again; the second object consisted of a horizontal prong and nylon loop; the third object consisted of a cylinder with a flared base coupled with a loop of beads; the fourth object consisted of a transparent plastic square and a wooden dowel; and the fifth object was a small black box with a slightly recessed rectangular button on the top surface. The button activated a buzzer inside the box.

In the present study, only the first four objects were used (Figure 2). The box with the buzzer inside was excluded due to a floor effect: in a preliminary study carried out on a sample of 40 CWA, most of the children scored zero items correct because the sonic characteristics of the object elicited stereotypical responses: whenever the task with the buzzer-object was administered, the entire test was interrupted [31].

During the Intention condition, children watched as an experimenter attempted to perform a target action but failed (e.g. pulled on the ends of the dumbbell but his hands slipped off); children never saw the target action successfully performed. We emphasized that children had never seen a complete action in order to rule out imitation.

For each of the four objects, the experimenter showed

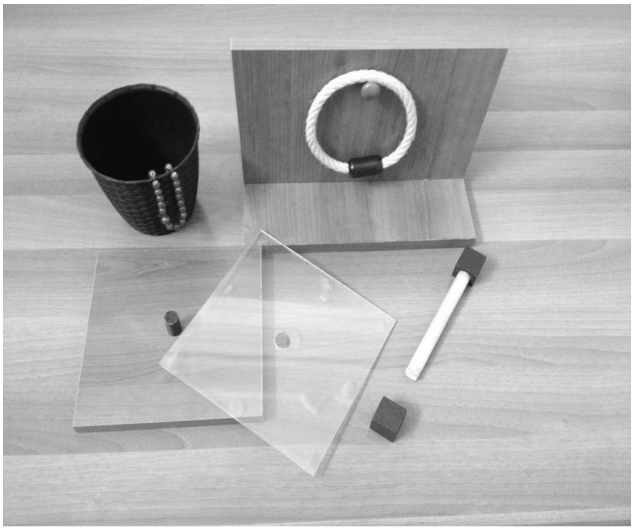

Figure 2: *Intention condition of behavioral enhancement procedures revised [31]*

three failed attempts to perform the action on the object; then, the experimenter left the object on the table in front of the child and said "now it's your turn."

Once the child touched the object, a 20 s response period began. This procedure was repeated with each of the remaining objects. Therefore, during the Intention condition, children were required to understand what experimenter meant to do — his unfulfilled intention — and they should therefore perform that intended action, not the action he actually did (e.g. hands slipping off the sides of the dumbbell).

Each task is assigned 0 to 4 points: 0 is assigned when the child is not able to pay attention to the task, when the child stereotypically manipulates the object, or when the child imitates the failed attempt by the experimenter. One point is assigned if the child correctly performs only one task (poor ability). Two points are assigned if the child correctly performs two tasks (discrete ability). Three points are assigned if the child correctly performs three tasks (good ability). Four points are assigned if the child correctly performs four tasks (excellent ability).

The UOI administrations were all recorded and the responses were scored from the videotape.

The measure used to evaluate UOI was administered by two experts who independently observed five children with autism (not included in this study). The inter-observer reliability was high (Cohen's k=0.92), indicating an excellent level of agreement.

Cognitive Assessment

The Leiter International Performance Scale–Revised was designed to assess the non-verbal intellectual function of children and adolescents aged between two and 20 years. The Leiter–R was designed to meet the clinical need of evaluating nonverbal intelligence through an assessment of strengths and limitations in relation to a comprehensive neuropsychological and cognitive assessment [53].

The Leiter-R composite score had a mean of 100 and a standard deviation of 15. Cognitive delay was indicated by a composite score that deviates two standard deviations or more below the mean, so a score of 70 was the borderline value. The reliability coefficients of the scores obtained with the Leiter-R were 0.88, 0.90 and 0.89, calculated for each age group (2–5, 6–11, and 11–20 year). The Leiter–R has good evidence of validity from content analysis studies with data from extensive item analyses, from criterion-related studies, from the accuracy of classification of cognitive delay, and from various studies related to the construct.

Autism Diagnostic Observation

The Autism Diagnostic Observation Schedule (ADOS) is a standardized observation procedure that evaluates the response to some stimulus situations and defines children's skills in the areas of social interaction and communication [37]. Since the whole sample at the intake was characterized by the absence of spontaneous speech, we used the ADOS Form 1 specifically for pre-verbal children. The total score defines three diagnostic categories: Absence of autism (ADOS score between 0 and 6); Autistic spectrum (ADOS score between 7 and 11); and Autism (ADOS score between 12 and 24).

The reliability was assessed by the inter-rater agreement (.92) and through the test-retest reliability (.82).

Statistical Analyses

An ANOVA was used to evaluate the differences between groups. Repeated measures ANCOVA were used to analyse the changes in the abilities after two years from the beginning of treatment. Chronological age at baseline was included as a covariate to control the potential influence of this variable. Effect sizes were calculated using partial eta-squared (η_p^2). A η_p^2 of 0.02 was considered a small effect size, 0.13 a medium effect size and 0.23 a large effect size [53]. An analysis of the correlation (Spearman's *r*) was conducted to evaluate the relationship between cognitive abilities and the understanding of intention scores. Chi-squared analyses were conducted to assess the degree of association between changes in the UOI task and changes in the symptomatology classification. The significance level was set at $p<0.05$. To establish which variables could predict further autism symptomatology scores (ADOS scores) all variables (including demographics) were made part of a multiple linear regression model. All statistical analyses were performed using SPSS Software Version 19.0.

Results

Differences between groups, Related to Age, Gender and IQ

The CWA group (N=100) consisted of 68 children with ADOS scores between 12 and 20, defined as Autistic Disorder (AD), and 32 children with ADOS scores between 7 and 11, defined as Spectrum Disorder (SpD).

The descriptive analysis (Table 1) showed that the CWA and CWID groups and the AD and SpD subgroups were similar with respect to age. Instead, as regards the gender distribution, the males/females ratio was different between CWA and CWID, with a prevalence of males between autistic children significantly higher than that present in children with intellectual disabilities. Some differences between groups and subgroups were found with respect to the IQ, in particular the mean IQ score of the CWID children was higher than that of the CWA children ($P<0.02$) and the mean IQ score of SpD children was higher than that of the AD children ($P<0.01$), while the post hoc analysis did not reveal differences between SpD and CWID (Tukey's test, $P=0.06$). Despite this difference, both CWA (IQ=60.5) and CWID (IQ=67.7) scores fall into the intellectual disability category (Table 1).

Differences between groups in the Understanding of Others' Intentions at Intake

At the intake, the CWA group showed lower scores of UOI compared to CWID ($F_{1,148}=31.31$, $P<.001$, $\eta_p^2=0.18$). In addition, the AD subgroup showed significantly lower scores than the SpD and CWID groups ($F_{1,147}=55.24$, $P<0.001$, $\eta_p^2=0.43$), while the post hoc analysis did not reveal differences between the SpD and CWID (Tukey's test, P=0.99) (Table 2). Adding the Chronological Age (CA) as covariate to control the impact it could have on U.O.I. skills, there was a significant effect, but of low extent ($F_{1,144}=5.9$, $P<0.05$, $\eta_p^2=0.04$). Specifically, in AD children the increasing of age corresponds to an increase of UOI skills ($F_{1,144}=7.4$, $P<0.01$, $\eta_p^2=0.10$); on the other hand it was not significant the effect of CA in SpD ($F_{1,144}=0.6$, P=0.44) and CWD children ($F_{1,144}=0.9$, P=0.36). When the IQ score was added as a covariate, the analysis revealed a significant effect ($F_{1,144}=27.1$, $P<0.05$, $\eta_p^2=0.16$); specifically, in AD children, increasing in IQ scores corresponded to an increase in UOI skills, with a medium extent (F1, 67=7.4, $P<0.01$, $\eta_p^2=0.10$); also in the group of CWID children the IQ scores increased with

Table 2. *Means (SD) of Understanding of Intention scores (UOI) in CWA, AD, SpD and CWD, at intake*

	Total CWA ***(N=100)***	**AD** ***(N=68)***	**SpD** ***(N=32)***	**CWID** ***(N=50)***	**Statistics**
UOI score	2.2 (1.5)	1.6 (1.4)	3.5 (0.8)	3.5 (0.5)	CWA vs. CWID: F=5.4 ($P<0.001$; $\eta^2=0.18$) AD vs. SpD (Tukey's test: $P<0.001$; $\eta^2=0.24$) AD vs. CWID (Tukey's test: $P<0.001$; $\eta^2=0.25$) SpD vs. CWID (Tukey's test: P=0.99)

CWA: Children with Autism; AD: Autism Disorder; SpD: Spectrum Disorder; CWID: Children with Intellectual Disability

the UOI skills but the size of this effect is much greater ($F_{1,144}$=115.3, P<0.001, η_p^2=0.70); instead it was not significant the effect of the IQ covariate in the group of SpD children ($F_{1,149}$=0.2, P=0.89). Finally, there was no effect of the gender, included as a covariate, on UOI skills ($F_{1,144}$=0.1, P=0.78) (Table 2).

Relationship between the Understanding of Others' Intentions and Other Variables, at the Intake and After Two Years of Treatment

The correlation analysis between IQ and UOI, adjusted for age at the intake revealed that there was a moderate positive correlation within the AD group and a high positive correlation within the CWID group, but there was no linear correlation within the SpD group (Table 3). After two years of treatment, these relations changed and a No Autism (NA) category appeared, referring to children with ADOS scores between 0 and 6. The relationship between IQ and UOI increased in both the AD and SpD groups; conversely, in the NA group, there was not a linear correlation.

Changes after Two Years of Treatment

After two years of treatment, a significant change in ADOS categories was found (χ^2=53.28; P<0.001): after two years, the diagnosis of 11 of 68 children who were AD at intake was amended to SpD, and 6 of 68 no longer met the criteria for a diagnosis of autism (NA); similarly, 21 of 32 children who were SpD at intake became NA, and 11 of 32 remained SpD.

In addition, after two years of treatment, there was a significant increase in UOI skills. In fact, the repeated measures ANCOVA with chronological age included as a covariate revealed a significant main effect for the *treatment factor* ($F_{1,97}$=27.39; P<0.001; η^2=0.22), a significant main effect for *groups* ($F_{1,97}$=45.86; P<0.001; η^2=0.32) and a significant interaction effect between *treatment factor* and *groups* ($F_{1,97}$=8.48; P<0.001; η^2=0.15). As shown in Table 4, the CWA group showed a significant increase on UOI. Scores after two years of treatment, but this increase was significant only in the AD group; nevertheless, AD continued to show lower scores than the SpD group.

Predictors of Autistic Symptomatology

A multiple linear regression analysis was conducted to investigate which variables could predict changes in ADOS scores after two years of treatment. Socio-economic status, UOI scores, CA and IQ variables were included as predictors. All predictor variables referred to measurements at intake.

The assumptions of multiple linear regressions were checked. UOI scores were normally distributed (skewness=-0.31; kurtosis=-1.40); IQ scores were normally distributed (skewness=0.42; kurtosis=-1.31); and CA was normally distributed (skewness=1.1; kurtosis=0.78). Multicollinearity among predictors was verified and reported in Table 5. The findings showed that the UOI variable was the best predictor of the reduction in ADOS scores and the IQ variable represented the second significant predictor. Socio-economic status and CA were not significant predictors.

Finally, it was investigated whether the variation of UOI skills, expressed as changes of category between intake and re-test (Low=scores 0 and 1, Medium=scores 2 and 3, High=score 4), corresponded to a change in ADOS category (AD, SpD and NA) between the intake and the retest.

Data analysis showed that 34 of 51 children (66%) who were AD at intake and who remained AD after two years of treatment did not show any improvement in the UOI category (from Low to Low and from Medium to Medium). Instead, 21 of the 27 children (78%) who no longer met the criteria for a diagnosis of autism (NA) after two years already had excellent UOI at intake (χ^2=86.30; P<0.001) (Table 6).

Table 3. *Correlation (r Spearman) between understanding of intention scores (UOI) and intelligence quotient scores (IQ) in AD, SpD and CWID*

At Intake			After 2 years of Treatment		
AD *(N=68)*	**SpD** *(N=32)*	**CWID** *(N=50)*	**AD** *(N=51)*	**SpD** *(N=22)*	**NA** *(N=27)*
0.48**	0.13	0.84**	0.70**	0.40*	0.24

AD: Autism Disorder; SpD: Spectrum Disorder; CWID: Children With Intellectual Disability; NA: No Autism
** P<0.001; * P<0.05

Table 4. *Means (SD error) of understanding of intention scores (UOI) in AD and SpD children, over two years of treatment*

Total CWA (N=100)		AD (N=68)		SpD (N=32)	
Pre	Post	Pre	Post	Pre	Post
2.0 [a] (0.1)	3.6 [a] (1.9)	1.6 [a] (0.2)	2.3 [a] (0.1)	3.4 [a] (0.2)	3.8 [a] (0.2)

Pre: At Intake; Post: After 2 years of Treatment; Age: Chronological Age
a. Covariates appearing in the model are evaluated at the following values: Age (years, months)=5,7

Discussion

The results emphasize the importance of investigating the ability to understand the intentions of the others in children with autism, because not only it is related to the current level of symptoms that the child presents, but also especially for the significant predictive value that such skill could take at a prognostic level. The Intention Condition made it possible to quantify the presence of the ability to understand the intentions of the others. The task is of quick and easy administration: it requires a minimum time of attention from the child and is suitable in the cases with severe symptoms. It was proposed to both the CWA and the CWID groups during the early stages of the diagnostic process, that is before the course of treatment, to see if the UOI was also compromised in children with

Table 5. *Linear regression model: IQ, chronological age, U.O.I. and socioeconomic status at intake as predictors of change in ADOS category after two years of treatment (N=100)*

Predictors	B	SE	*P*	90%–95%CI Exp(B)		Collinearity statistics	
				Lower	Upper	Tolerance	VIF
Socioeconomic status	0.43	0.76	0.56	-1.07	1.94	0.90	1.10
U.O.I.	-2.08	0.32	0.001	-2.72	-1.44	0.56	1.76
Chron. age	0.062	0.18	0.73	-0.29	0.41	0.80	1.24
IQ	-0.090	0.02	0.001	-0.13	-0.04	0.64	1.55
Constant	20.49	2.04	0.001	16.43	24.54		

Table 6. *Changes in UOI category and corresponding changes in ADOS category*

		Changes in ADOS category			
		AD intake/AD re-test (N=51)	**AD intake /SpD re-test (N=11)**	**SpD intake /SpD re-test (N=11)**	**NA re-test (N=27)**
Changes in UOI category	Low intake/Low re-test (N = 16)	16 (31%)	0 (0%)	0 (0%)	0 (0%)
	Medium intake/Medium re-test (N=26)	18 (35%)	4 (36%)	4 (36%)	0 (0%)
	High intake/High re-test (N = 28)	2 (4%)	1 (9%)	4 (36%)	21 (78%)
	Low intake /Medium re-test (N=17)	14 (28%)	1 (9%)	1 (9%)	1 (4%)
	Medium intake/High re-test (N=13)	1 (2%)	5 (46%)	2 (18%)	5 (18%)
		100%	100%	100%	100%

AD: autism disorder; SpD: spectrum disorder; NA: No Autism
Low=scores 0 and 1; Medium=scores 2 and 3; High=score 4

only intellectual disabilities and in children with autism, where the deficit as well as cognitive is mainly social and relational.

The results obtained with this research have an important value at a clinical level for various reasons. It was found that, despite all the children (CWA and CWID) were characterized by intellectual disabilities; the UOI was significantly lower in children with AD, compared to both the SpD and the CWID. The latter two groups, in fact, obtained adequate scores of UOI on average. This finding may explain the heterogeneity of the findings in literature with respect to the UOI in autism, because in such researches the severity of autistic symptoms is not defined [32,33,54].

The data of the present study suggest that the Intention Condition of Behavioral Re-Enactment Procedure allows to discriminate AD from SpD children (the classification is based on the ADOS scores), more than the false belief task [2]. The UOI deficit also comes as a specific characteristic of autism and not only of intellectual disability, because it does not seem to be compromised in CWID group. This is confirmed by correlation analysis that highlight how the cognitive and understanding of the intentions aspects are related to each other both in the absence of autistic symptomatology (as emerged from CWID group) and in the presence of severe symptomatology (as emerged from the AD group). In the SpD group, however, this linear relationship is not significant and this may be an expression of disharmony and lack of integration of social and cognitive skills that characterize the group of children of the autistic spectrum. Children of the spectrum immediately obtain good results in the UOI test, being this category characterized by less severe symptoms, regardless of cognitive level. This further indicates that the UOI is related to the severity of autism and not to the IQ. All children, both AD and SpD, were included in the Turtle Project, which assumes that language, intelligence, emotional, and social skills are learned through interactive relationships involving affective exchanges [49,50]. After two years of therapy, it was found that the CWA group improve the UOI; this increase is significant in AD children, particularly those of 3-5 years as they started from lower levels of UOI, while it is less evident in the SpD group and in children aged 6-13 years who at the intake already showed to better possess such capacity.

Another finding emerged two years after the beginning of treatment is that the 26% of the children got an ADOS score that does not make them fall longer in a diagnosis of autism; of these, the most had a great expertise in the UOI already at the intake. The results finally confirmed that the presence of a high UOI skill, more than cognitive ability, is a valid predictor of a positive evolution in autistic symptomatology, even after two years of therapy.

A limitation of this study was to use only one of the tasks referred by the Meltzoff's procedure that is the Behavioral Re-Enactment Procedure, as we mainly focused on mentalizing capacity while it would be interesting to verify the imitative capacity too.

As for the absence of re-testing in CWID children, these were evaluated only once, as they showed high skills in the UOI even before taking charge. It would be useful to verify if children with autism spectrum disorder who have achieved excellent scores in the UOI, are able to deal with the false belief task. Although some authors criticized the Behavioral Re-Enactment Procedure, considering it unreliable as they believe they are the same characteristics of the objects to suggest the target actions to the child and not the ability to understand the other's intentions, we remain of the view that it could instead be a reliable measure of the investigated skills [55-57]. We share with other studies the idea that it could provide useful information on a first evolutionary step in the development of the theory of mind [3,33,58-60].

However, the results of this study are part of an unexplored and still open debate on the ability to understand the intentions of autistic children, suggesting the discriminating value of this capacity in relation to the severity of autistic symptoms. We emphasize also that in spite of the severe impairment of children with severe autism, the therapeutic intervention, already after two years, highlighted important improvements in mentalizing abilities.

Finally, the predictive value of these skills on the reduction of autistic symptoms suggests the possibility of using the Intention Condition during the diagnostic assessment at the time of taking charge. This task is in fact characterized by rapidity of administration, especially in severe situations in which there are serious difficulties on the part of the child in supporting prolonged attention in more structured performances.

References

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5®). American Psychiatric Pub 2013.
2. Meltzoff AN. Understanding the intention of others: Re-enactment of intended acts by 18-months-olds. Development Psychology 1995; 31: 838-850.
3. Baron Cohen S. Precursors to a theory of mind: Understanding attention in others. In : Natural theories of mind: Evolution, development and simulation of everyday mindreading (eds A. Whiten). Oxford: Basil Blackwell 1991: 233-251.
4. Baron-Cohen S. Mindblindness: An essay on autism and theory of mind. Cambridge, MA: The MIT Press 1995.
5. Baron-Cohen, S. Theory of mind and autism: A review. International review of research in mental retardation 2001; 23: 169-184.
6. Bruner JS. The relevance of education. New York: Norton 1973.
7. Bruner JS. Child's Talk: Learning to Use Language. New York: Norton 1983.
8. Bruner JS. Self-making and world-making. Journal of Aesthetic Education 2001; 25: 67-78.
9. Bruner JS. The intentionality of referring. In: Developing theories of intention: Social understanding and self-control (eds P.D. Zelazo, J.W. Astington & D. Olson). Mahwah, NJ: Erlbaum 1999: 329-339.
10. Gallese V. The shared manifold hypothesis: from mirror neurons to empathy. Journal of consciousness studies 2001; 8: 33-50.
11. Gallese V. The roots of empathy: the shared manifold hypothesis and the neural basis of intersubjectivity. Psychopathology 2003; 4: 24-47.
12. Gaddini E. On imitation. International journal of psycho-analysis 1969; 50: 475–484.
13. Buccino G, Riggio L, Melli G, et al. Listening to action-related sentences modulates the activity of the motor system: A combined TMS and behavioral study. Cognitive Brain Research 2005; 24: 355-363.
14. Rizzolatti G, Vozza L. Nella mente degli altri. Neuroni specchio e comportamento sociale. Mirror neurons and social behavior. Bologna: Zanichelli 2007.
15. Iacoboni M. Mirroring people. The new science of how we connect with others. New York: Farrar, Straus and Giroux 2008.
16. Damasio A. Self comes to mind: constructing the conscious brain. New York: Pantheon Books 2010.
17. Rizzolatti G, Fabbri-Destro M. Mirror neurons: from discovery to autism. Experimental Brain Research 2010; 200: 223-237.
18. Damasio A, Carvalho GB. The nature of feelings: Evolutionary and neurobiological origins. Nature reviews. Neuroscience 2013; 14: 143-152.
19. Bion WR. Second Thoughts. London: William Heinemann 1967.
20. Stern D. The interpersonal world of the infant. New York: Basic Books 1985.
21. Stern D. The present moment in psychotherapy and everyday life. New York: Norton 2004.
22. Bucci W. The language of emotions; An evolutionary perspective. Journal of Evolution and Cognition 2002; 8: 172-183.
23. Lingiardi V, Del Corno F. The Psychodynamic Diagnostic Manual (PDM) in the USA and in Europe: between commercial success and influence on professionals and researchers. Bollettino di Psicologia Applicata 2012; 265: 5-10.
24. Meltzer D. Explorations in autism. A psychoanalytical study. Perthshire: Clunie Press 1975.

25. Alvarez A. The thinking heart: three levels of psychoanalytic therapy with disturbed children. Routledge: Hove. 2012.

26. Marcelli D. La position autistique. Hypotheses psychopathologiques et ontogénétiques. Psychiatrie enfant 1983; 24: 5-55.

27. Tustin F. Autistic barriers in neurotic patients. London: Karnac Books 1986.

28. Tustin F. The protective shell in children and adults. London: Karnac Books 1990.

29. Wimmer HM, Perner J. Beliefs about beliefs: representation and constraining function of wrong beliefs in young children's understanding of deception. Cognition 1983; 13: 103-128.

30. Perner J. Understanding the Representational Mind. Cambridge: MIT Press 1991.

31. Di Renzo M. I significati dell'autismo: integrazione della realtà emotiva e cognitiva nella ricerca e nella clinica. Roma: Magi 2007.

32. Russell J, Hill EL. Action-monitoring and intention reporting in children with autism. Journal of Child Psychology and Psychiatry 2001; 42: 317–328.

33. D'Entremont B, Yazbek A. Imitation of Intentional and Accidental Actions by Children with Autism. Journal of Autism and Developmental Disorders 2007; 37: 1665–1678.

34. Schopler E, Reichler R, Rochen Renner B. The Childhood Autism Rating Scale (CARS). Los Angeles: Western Psychological Services 1988.

35. Tomasello M, Carpenter M, Call J, et al. Understanding and sharing intentions: The origins of cultural cognition. Behavioural and Brain Sciences 2005; 28: 675–735.

36. Rogers SJ, Hepburn SL, Stackhouse T, et al. Imitation performance in toddlers with autism and those with other developmental Disorders. Journal of Child Psychology and Psychiatry 2003; 44: 763–781.

37. Rogers S, Cook I, Young G, et al. Imitation of instrumental versus non instrumental actions in young children with autism. Boston: International Meeting for Autism Research 2005.

38. SNLG-ISS, Sistema nazionale per le linee guida-Istituto superiore di sanità 2011.

39. Baio J. Prevalence of Autism Spectrum Disorders: Autism and Developmental Disabilities Monitoring Network. Morbidity and Mortality Weekly Report. Centers for Disease Control and Prevention. Surveillance Summaries 2012; 61.

40. Cossu G. TNL- Test Neuropsicologico Lessicale per l'età evolutiva. Firenze: Hogrefe 2013.

41. Dunn L, Dunn L. Peabody Picture Vocabulary Test. San Antonio, TX: Pearson 2006.

42. Levorato M, Roch M, Nesi B. TOR, Test di comprensione del testo orale. Firenze: Giunti O.S 2007.

43. Cianchetti C, Sannio Fancello G. TVL, Test di Valutazione del Linguaggio. Trento: Erickson 2003.

44. Rustioni D, Lancaster M. PVCL, Prove di Valutazione della Comprensione Linguistica. Firenze: Giunti O.S 2007.

45. Rossi M. Test di articolazione. Torino: Omega 1999.

46. Axia G. TPL, Test del Primo Linguaggio. Firenze: Giunti OS 1995.

47. Lord C, Rutter M, Di Lavore PC. ADOS-G – Autism Diagnostic Observation Schedule-Generic. Firenze: Giunti O.S 2005.

48. APA, American Psychiatric Association. Diagnostic and statistical manual of mental disorders, (DSM-IV). Washington, DC 1994.

49. Di Renzo M, Bianchi di Castelbianco F, et al. Assessment of a long-term developmental relationship-based approach in children with autism spectrum disorder. Psychological Reports: Disability & Trauma 2015; 117: 26-49.

50. Di Renzo M, Bianchi di Castelbianco F, Vanadia E, et al. From the Emotional Integration to the Cognitive Construction: The Developmental Approach of Turtle Project in Children with Autism Spectrum Disorder. Autism-Open Access 2016; 6: 160-169.

51. Aldridge MA, Stone KR, Sweeney MH, et al. Preverbal children with autism understand the intentions of others. Developmental Science 2000; 3: 294–301.

52. Roid GH, Miller LJ. Leiter-R, Leiter International Performance Scale – Revised. Firenze: Giunti O.S 2002.

53. Pierce CA, Block RA, Aguinis H. Cautionary note on reporting eta-squared values from multifactor ANOVA designs. Educational and Psychological Measurement 2004; 64: 916-924.

54. Carpenter M, Pennington B F, Rogers SJ. Understanding of others' intentions in children with autism. Journal of Autism and Developmental Disorders 2001; 31: 589–599.

55. Assanelli A, D'odorico L. La comprensione delle intenzioni altrui: una riproduzione di azioni intese o una scoperta spontanea? Giornale italiano di psicologia 2004; 31. 421–433.

56. Huang C, Heyes C, Charman T. Infants' behavioural re-enactment of ''failed attempts'': Exploring the roles of emulation learning, stimulus enhancement, and understanding of intentions. Developmental Psychology 2002; 38: 840–855.

57. Huang C, Heyes C, Charman T. Preschoolers' behavioural re-enactment of 'failed attempts': The roles of intention-reading, emulation and mimicry. Cognitive Development 2006; 21: 36–45.

58. Bellagamba F, Colonnesi C. Evoluzione della comprensione delle intenzioni altrui: le origini della teoria della mente nella prima infanzia. Giornale italiano di Psicologia 2005; 4: 781-798.

59. Camaioni L. The development of intentional communication. A re-analysis. New perspectives in early communicative development. London: Routledge 1993.

60. Camaioni L, Perucchini P, Bellagamba F, et al. The role of declarative pointing in developing a theory of mind. Infancy 2004; 5: 291-308.

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