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BRIEF REPORT

The Production of Pronouns and Verb Inflections by Italian Children with ASD: A New Dataset in a Null Subject Language

Greta Mazzaggio[1] · Aaron Shield[2]

Abstract

The language of children with autism spectrum disorder (ASD) is often characterized by difficulties with pronouns. The underlying reasons for such difficulties are still unclear. This study is the first to test the abilities of children with ASD who speak Italian, a language in which overt subject pronouns are optional but verbs obligatorily feature person-referencing morphology. We found that Italian children with ASD were less accurate than typically-developing (TD) Italian children in the production of first-, second-, and third-person singular pronouns, avoiding pronouns in favor of nouns or names more often than controls. Moreover, children with ASD produced more overt pronouns than null pronouns in marked contexts, compared to TD children. These phenomena can be accounted for by difficulties with pragmatics.

Keywords Autism spectrum disorder · Pronoun production · Pronoun avoidance · Language development

Autism spectrum disorders (ASD) are characterized by impairments in the area of pragmatics, the ability to use language in its social context. Pragmatic abilities are related not just to linguistic abilities (such as, e.g., the ability to interpret intonation and other suprasegmental features, regulate turn-taking, and comprehend non-literal language) but also to cognitive and social skills such as the interpretation of facial expressions and body language and the use of eye contact during conversation (Baltaxe 1977).

Specifically, the acquisition of personal pronouns (e.g., *I, you* in English) has long been a focus of the literature on the language development of children with ASD, since pronouns derive their meaning from the specific context in which they are uttered. Kanner (1943), in the first published report on

children with ASD, noted that some of the children in his sample reversed first- and second-person pronominal forms. Kanner attributed this phenomenon to echolalia: "personal pronouns are repeated just as heard, with no change to suit the altered situation. […] Not only the words, but even the intonation is retained" (1943, p. 249). Since Kanner, many studies have investigated the acquisition of personal pronouns by children with ASD as well as by typically-developing (TD) children. Pronoun reversals have been documented in TD children (Dale and Crain-Thoreson 1993) and in non-imitative contexts (Oshima-Takane 1992), and children with ASD have also been found to sometimes avoid pronouns in favor of proper names (Jordan 1989; Lee et al. 1994; Shield et al. 2015).

There is evidence that pronouns are more difficult to acquire compared to proper names. Personal pronouns do not behave like descriptions since their reference is not fixed and vary based on the speaker's role. This deictic shifting leads TD children to produce English personal pronouns at around the age of three (Rozendaal and Baker 2010), long after children first start to use their own—and others'—names. According to Wechsler (2010), in order to understand the first-person singular pronoun, the addressee must recognize that the speaker attributes to himself/herself the property of being the referent, and in producing the second-person pronoun, the speaker must recognize that the hearer will attribute the property of being the referent to him/herself.

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Thus, the ability to produce both pronouns correctly depends crucially on the recognition of the relationship between self and other as it is encoded by language in its social context. Indeed, two recent studies have shown that pronoun reversals could result when the development of language skills outpaces the development of social skills (Evans and Demuth 2012; Naigles et al. 2016).

Multiple theories have been proposed to explain why some children with ASD struggle with pronouns; see Brehme (2014), Naigles et al. (2016), and Sterponi et al. (2015) for recent analyses. In general, some studies have emphasized the role of language skills in the acquisition of pronouns (e.g., Markova and Smolík 2014; Shield et al. 2015) while others have highlighted the importance of social abilities such as perspective-taking and communicative engagement on the one hand (Chiat 1982; Hobson et al. 2010; Ricard et al. 1999) or theory of mind on the other (ToM; Wechsler 2010). However, a discrepancy has been noted between the seriousness and pervasiveness of such social impairments and the low rate of pronoun errors in children with ASD (Naigles et al. 2016). The ability to fully understand the use of pronouns in the speech of others has also been proposed to have a role (Oshima-Takane and Benaroya 1989).

Today, what is clear is that children with ASD appear to reverse pronouns at the same (low) rate as TD children; indeed, a longitudinal study of English (Naigles et al. 2016) found that reversals occur in young children (TD children at 24 months and children with ASD at 35 months) but TD children stop reversing while children with ASD continue to show difficulties at older ages, though with decreased frequency. Moreover, a recent brain-imaging study confirmed that adults with ASD show persistent difficulty with mastering deictic shifting (Mizuno et al. 2011). In sum, the data seem to support the view that people with ASD have more difficulties using pronouns compared to the general population and that this difficulty seems to go beyond a general delay in language acquisition, with multiple cognitive, social and linguistic factors at play (Fay 1979; Naigles et al. 2016), even if the precise mechanism of interaction remains unclear.

To date, nearly all studies on the production and comprehension of pronouns by children with ASD have been conducted in English [though see Overweg et al. (2018) for a study of Dutch children with ASD, Terzi et al. (2019) for a study of Greek children with ASD, and Shield et al. (2015) for a study of signers of American Sign Language with ASD], and data from other languages remain scarce. Various studies have examined pronoun acquisition by TD children in languages other than English (e.g., French, Girouard et al. 1997; Czech, Markova and Smolík 2014; Ukrainian, Chumak-Horbatsch 2003; Italian, Mazzaggio 2016; Serratrice and Sorace 2003; Valian 1991; American

Sign Language, Petitto 1987). Data from non-English-speaking children with ASD has the potential to shed light on the various theories about pronoun difficulties in ASD due to the particular linguistic complexities of specific languages. In this paper, we present a study of children with ASD who are acquiring Italian. Unlike English, Italian is a null subject language in which overt subject pronouns are optional and verbs obligatorily exhibit person-referencing morphology, thus allowing speakers to infer the subject from the verb alone. To date, there is only one report on the production of pronouns by children with ASD who were acquiring a null subject language, Greek (Terzi et al. 2019). Using a narrative task, they found that both TD children and children with ASD produced more null than overt subject pronouns, indicating that the children with ASD know that Greek is a null subject language. However, the children with ASD also produced Determiner Phrases (DPs) more often than the TD children and in equal proportion with null subjects, suggesting a strategy of partial pronoun avoidance. We seek to add to this report by investigating the production of pronouns and verbs by Italian children with ASD. Such a study could increase our understanding of how children with ASD use overt and null pronouns when subjects can be inferred from context (and thus their use may depend crucially on pragmatic skills).

In this study, we investigated the ability of Italian children with ASD to produce person-referencing pronouns and verb inflections in relation to both cognitive (IQ, ToM) and linguistic (morphosyntactic) skills.

Method

Participants

26 Italian children (2 females) with ASD ($M_{age} = 7.3$, $SD = 2.0$, range 3.7–10.3) and 35 TD children (18 females; $M_{age} = 5.5$, $SD = 0.5$, range 4.8–6.4) participated in the study. Standardized tests were used to measure non-verbal intelligence (Raven's Colored Progressive Matrices, Italian standardization by Belacchi et al. 2008), linguistic abilities (the morphosyntax subtest of the *Batteria per la Valutazione del Linguaggio 4–12*, Marini et al. 2015), and ToM skills (the first four tasks from Wellman and Liu (2004) and the second-order ToM test of the ToM Task Battery; Hutchins et al. 2014). Information about age, mean scores and between-group statistical comparisons are presented in Table 1. Parents of children with ASD were also asked to complete the Italian version of the Children's Communication Checklist—Second Edition (CCC-2, Bishop 2006; Di Sano et al. 2013; see Table 1 of Supplemental Materials for scores). On average, the children with ASD were older and had higher scores on standardized measures of nonverbal

Table 1 Mean age, standardized test (IQ, morphosyntax), and ToM scores

	TD children N=35		Children with ASD N=26		Mann–Whitney U
	Mean (SD)	Range	Mean (SD)	Range	
Age	5.45 (.45)	4.75–6.38	7.26 (2.03)	3.73–10.29	$U=250.5; p=.003$
Raven's raw score	20.86 (4.64)	12–30	24.50 (6.56)	11–36	$U=304.5; p=.03$
Syntax	28.11 (6.23)	13–39	28.81 (5.96)	19–39	$U=455.0; p=1.0$
ToM	4.29 (1.54)	1–7	2.00 (1.33)	0–7	$U=694.0; p<.001$

intelligence, but performed less well than the TD children on ToM. However, the groups did not differ in their syntactic abilities ($U=455.00, p=1.0$). We believe that matching for grammatical abilities is more important than for chronological age because many studies have suggested that linguistic skills play an important role in pronoun production for participants with ASD (e.g., Markova and Smolík 2014; Shield et al. 2015), and TD children gradually master the pronoun system in early childhood while pronoun difficulties persist for children with ASD (Naigles et al. 2016; Ritvo et al. 1994; Tager-Flusberg 1994).

Participants with ASD were recruited at the Azienda Provinciale per i Servizi Sanitari (Provincial Health Service—APSS) Hospital in Trento, Italy, where ASD diagnosis was confirmed by child psychiatrists using standard clinical criteria (i.e., using the Autism Diagnostic Observation Schedule (ADOS); Lord et al. 1989; ADOS-2; Lord et al. 2012). One child was excluded from the analyses due to a subsequent diagnosis of Social (Pragmatic) Communication Disorder. TD children were recruited from a kindergarten classroom in the northeast of Italy.

The study was approved by the Ethics Committee of the University of Trento, and all parents provided written informed consent prior to testing (Table 1).

Materials and Procedure

The experiment was conducted in a quiet room of the APSS for the children with ASD and in a quiet room of the kindergarten for the TD children. The experimenter for the children with ASD was a psychologist employed at APSS whom the children were familiar with, while the experimenter for the TD children was a psychology student at the University of Trento. To avoid participant fatigue, we saw each child on two or three different days, depending on their needs. All sessions were video-recorded.

In order to assess the production of first- and second-person singular pronouns, we used an adapted version of the Paired Photographs Task described in Lee et al. (1994) and Shield et al. (2015). The child and the experimenter sat near one another. For the first-person task, the experimenter presented the child with a picture of the child that had been obtained previously from his/her parents, asking in Italian

"Who is this person?" (*Chi è questa persona?)* and then "What's happening in this picture?" (*Cosa sta succedendo in questa foto?*). The first question was designed to elicit a pronoun uttered in isolation (i.e., without a verb). The second question was designed to elicit a verb with an overt or null pronoun. Similarly, to elicit the second-person singular pronoun, the experimenter presented a clear picture of herself, again asking "Who is this person?" and following up with the second question "What's happening in this picture?". We also elicited third-person pronouns as a control, presenting two pictures of a boy and a girl, in which one was pictured doing an activity in a conventional way (e.g., reading a book on a sofa) while the other was pictured interacting with the same object in an unusual way (e.g., putting the book on his/her head). The experimenter then asked "Who is reading properly, him or her?" (*Chi è che sta leggendo bene, lui o lei?*) followed by "Why? Can you describe the pictures for me?" (*Perché? Mi descrivi le immagini?*). In one picture, the conventional action was performed by the girl, while in the second it was performed by the boy, thus providing an opportunity to produce both the masculine and feminine third-person singular pronouns. Thus, we presented children with eight total trials: two questions for first-person, two trials for second-person, and four trials for third-person (two for the male subject pronoun and two for the female subject pronoun). None of the questions were repeated.

Finally, we included a simple task to assess comprehension of first- and second-person singular pronouns and verb inflections. The pictures used in the previous tasks were placed on the table and the experimenter said, "The game is finished! Now we have to clean up. *I* will take the pictures of the girls and put them on that table, and *you* take the pictures of the boys and put them on the armchair."[1] The experimenter then waited for the child to pick up the photos (either of the boys or the girls) first.

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[1] In Italian, with first-person pronouns and person-marking verb morphology bolded and second-person pronouns and person-marking morphology underlined: **Io** prend**o** le foto delle bambine e le mett**o** in quel tavolo, e <u>tu</u> prend<u>i</u> le foto dei bambini e le mett<u>i</u> nell'armadio.
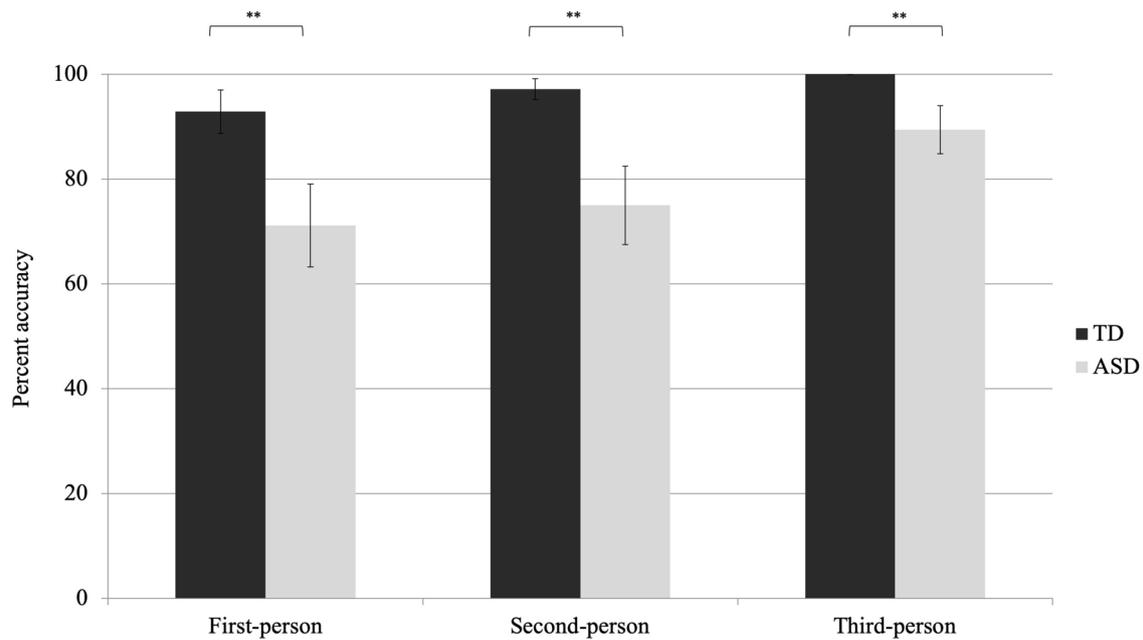
Fig. 1 Mean percentage of correct first-, second-, and third-person pronouns produced by the two groups. Error bars represent the standard error of the mean. ** $p < .01$

Results

We used non-parametric tests in the following analyses because assumptions of normality were not met. In the pronoun comprehension task, one point was awarded if the child correctly picked up the cards in the way described by the experimenter. Pronoun comprehension was at ceiling in both groups (TD = 97.1%, ASD = 100%; $U = 442$, $p = .389$). For the elicitation of first-and second-person pronouns, one point was awarded for each correct pronoun produced (first question) and/or verb with person-agreeing morphology (2nd question). The production of proper names/nouns, pronouns other than the target, and/or a verb lacking the appropriate person-agreeing morphology (e.g., infinitive, third-person singular) were considered errors. For the third-person pronoun, one point was assigned for each correct pronoun produced (first question) and/or verb with person-agreeing morphology (2nd question). Thus, children could receive up to eight points.

We summed the total number of points on both questions and calculated overall accuracy rates for both groups. The groups differed in their overall production of first-, second- and third-person pronouns and verbs in response to both questions (Fig. 1), with TD children producing the correct pronominal and verb forms significantly more often than the children with ASD (first-person: TD 92.9%, ASD 71.1%, $U = 321.5$, $p = .006$; second-person: TD 97.1%, ASD 75%, $U = 319.5$, $p = .003$; third-person: TD 100%, ASD 89.42%, $U = 542.5$, $p = .007$).

On the first-person pronoun elicitation task, six children with ASD and two TD children produced their own name rather than a first-person pronoun ($p = .06$, Fisher's Exact Test). We did not count one child as avoidant who immediately uttered his own name but then continued on to produce the first-person pronoun, saying "it's me" (*sono io*). Moreover, one child with ASD used the object pronoun (tonic form, *me* in Italian) instead of the subject pronoun *I* (*io* in Italian), which is ungrammatical in Italian. On the second question of the first-person task (i.e., *What's happening in this picture?*), the children with ASD produced more errors ($N = 8$, 30.77%) than TD children ($N = 3$, 8.57%; $p = .04$, Fisher's Exact Test). We did not find any instances of pronoun reversal on the first-person task. Table 2 shows numbers and percentages of correct and incorrect uses of the first-person pronoun in response to the first ("Who is this person?") and second questions ("What's happening in this picture?") for the two groups. For a translated list of errors, see Table 2 of Supplemental Materials.

Production of the optional subject pronoun (overt pronoun instead of the null form) in combination with a verb in response to the second question was not considered an error. However, when producing the correct verb form (in answering to the second question "'What's happening in this picture?'), children with ASD produced the null form ($N = 13$, 50%) significantly less frequently than the TD children ($N = 31$, 88.6%; $p = .02$, Fisher's Exact Test); omission of the pronoun in this context is considered the unmarked, default form in Italian.

Table 2 Number and percentages of correct and incorrect uses of the first-person pronoun in response to the first ("who is this person?") and second questions ("what's happening in this picture?") for the two groups

	TD children	Children with ASD
	Number of occurrences (%)	Number of occurrences (%)
Question 1		
First-person overt correct pronoun (*io*)	33 (94.3)	19 (73.1)
First-person error: proper name	2 (5.7)	6 (23.1)
First-person error: tonic form (*me*)	0 (0)	1 (3.8)
Question 2		
First-person correct, unmarked use (*null pronoun + first-person inflected verb*)	31 (88.5)	13 (50)
First-person correct but marked use (*overt pronoun + first-person inflected verb*)	1 (2.9)	5 (19.2)
First-person error (*null pronoun + verb infinitive*)	1 (2.9)	2 (7.7)
First-person error (*null pronoun + third-person inflected verb*)	2 (5.7)	4 (15.4)
First-person error (*proper name + 3rd-person inflected verb*)	0 (0)	2 (7.7)

Table 3 Number and percentages of correct and incorrect uses of the second-person pronoun in response to the first ("who is this person?") and second questions ("what's happening in this picture?") for the two groups

	TD children	Children with ASD
	Number of occurrences (%)	Number of occurrences (%)
Question 1		
Second-person overt correct pronoun (*tu*)	33 (94.3)	22 (84.6)
Second-person error: experimenter's proper name	2 (5.7)	0 (0)
Second-person error: other third-person reference	0 (0)	4 (15.4)
Question 2		
Second-person correct, unmarked use (*null pronoun + second-person inflected verb*)	34 (97.1)	13 (50)
Second-person correct but marked use (*overt pronoun + second-person inflected verb*)	1 (2.9)	4 (15.4)
Second-person error (*null pronoun + 3rd person inflected verb*)	0 (0)	3 (11.6)
Second-person error (*DP + 3rd person inflected verb*)	0 (0)	4 (15.4)
Second-person error (*proper name without a verb*)	0 (0)	1 (3.8)
Second-person error (*mentioning object in the picture, no pronoun, no verb*)	0 (0)	1 (3.8)

With regard to the second-person pronoun elicitation task, the groups were equally likely to produce a second-person pronoun ($p = .387$, Fisher's Exact Test); however, the two TD children who avoided the pronoun replaced it with the experimenter's name, while the four children with ASD who avoided the pronoun used a more generic noun phrase ("una signora" *a lady*, "la signora" *the lady*, "una persona" *a person* and "bottiglia, signora" *bottle, lady*), despite the fact that the children were familiar with the experimenter and appeared to recognize her. Nine TD children (25.7%) and seven children with ASD (26.9%) used the object pronoun (tonic form, *te* in Italian) instead of the subject pronoun *you* (*tu*); however, unlike the first-person pronoun, this is not considered ungrammatical because it is common in many Italian varieties. For the second question ("What's happening in this picture?"), no TD children

produced erroneous verb forms while 9 children with ASD (34.6%) did ($p = .0002$, Fisher's Exact Test). Table 3 shows the numbers and percentages of correct and incorrect uses of the second-person pronoun in response to the first ("Who is this person?") and second questions ("What's happening in this picture?") for the two groups. The translated list of errors can be found in Table 3 of Supplemental Materials.

As with the first-person task, we did not find any instances of pronoun reversal on the second-person task. However, there was a significant difference in the frequency with which TD and ASD children produced the second-person null subject pronoun (ASD: $N = 13$, 50%; TD: $N = 34$, 97.1%; $p < .001$ Fisher's Exact Test).

On the first question of the third-person pronoun elicitation task (two items, one for the masculine singular and one for the feminine singular pronominal forms: "Who is reading

Table 4 Number and percentages of correct and incorrect uses of the third-person pronoun in response to the first ("who is reading/eating properly, him or her?") and second questions ("why? Can you describe the pictures for me?") for the two groups

	TD children	Children with ASD
	Number of occurrences (%)	Number of occurrences (%)
Question 1		
Third-person overt correct pronoun (*lui/lei*)	70 (100)	47 (90.4)
Third-person error: gender error	0 (0)	3 (5.8)
Third-person error: other third-person reference	0 (0)	2 (3.8)
Question 2		
Third-person correct, unmarked use (*null pronoun + second-person inflected verb*)	2 (2.9)	5 (9.6)
Third-person correct, marked[a] use (*overt pronoun + third-person inflected verb*)	66 (94.2)	35 (67.3)
Third-person correct, marked use with DP	2 (2.9)	6 (11.5)
Third-person gender error	0 (0)	2 (3.9)
Third-person grammatical error (e.g., *DPs, infinitive verb*)	0 (0)	4 (7.6)

While it is true that the production of overt subject pronouns is generally a marked use in combination with inflected verbs, the context of the question elicited more overt pronouns than in the first- and second-person tasks. We suggest that this difference is due to the fact that children were given a choice between pictures of a boy and a girl; overt pronouns are considered unmarked in contrastive focus contexts such as these

properly, him or her?" and "Who is eating properly, him or her?"), TD children made no errors, while four children with ASD produced five errors out of 52 opportunities (9.6%). These children either produced a pronoun gender error (i.e., using the male pronoun instead of the female pronoun or vice versa; 5.6% of productions) or avoided the pronoun (i.e., by producing DPs such as "bimbo" *boy* or "bambina" *girl;* 3.9% of productions). Thus, children with ASD were more likely to make an error on the first third-person pronoun elicitation question than TD children ($p = .01$, Fisher's Exact Test).

On the 2nd question of the third-person pronoun elicitation task (two items, one for the masculine singular and one for the feminine singular pronominal forms: "Why? Can you describe the pictures for me?"), the TD children again produced no errors, while the children with ASD produced six errors (11.5%). These children again either produced a pronoun gender error (3.9% of productions) or avoided the pronoun (i.e., by producing DPs such as "l'altro" *the other one*, "bimbo bravo" *good boy*, "bambina legge libro" *girl reads book,* or verbs in the infinitive such as "mangiare" *to eat*; 7.6% of productions). Thus, children with ASD were also more likely than TD children to make an error on the second question of the third-person task ($p = .03$, Fisher's Exact Test). Table 4 shows the numbers and percentages of correct and incorrect uses of the third-person pronoun in response to the first ("Who is reading/eating properly, him or her?" and second questions ("Why? Can you describe the pictures for me?") for the two groups. Both groups produced many more instances of the overt pronoun than the null pronoun on the second question of the third-person task (TD: overt pronoun n = 66, null pronoun n = 2; ASD: overt pronoun n = 37, null pronoun n = 5), though the two groups

did not differ in how often they produced the overt or null pronoun (Fisher's Exact Test, $p = 0.10$). It is important to note that unlike the first- and second-person trials, responses with overt subject pronouns to the third-person questions may have been produced because the children were asked to choose between a picture of a boy and a picture of a girl. Children tended to answer by comparing the behavior of the two characters (a context of contrastive focus); the overt pronominal form is considered unmarked in such cases. The translated list of errors can be found in Table 4 of Supplemental Materials.

Since the TD children were at ceiling on all tasks, we focused on the children with ASD for follow-up correlation analyses (Pearson partial correlation analyses, controlling for age). First of all, performance on the first-person task was strongly correlated with the second-person task; if children produced the correct pronoun on one they were also likely to produce the correct pronoun on the other [$r(23) = .68$, $p < .001$]. First-person pronoun production was also moderately correlated with morphosyntactic abilities [$r(23) = .43$, $p = .04$], with the *Speech* category on the CCC-2 [$r(21) = .48$, $p = .02$] and, interestingly, with the General Communication Composite (GCC) score on the CCC-2 [$r(21) = .50$, $p = .02$], as well as moderately negatively correlated with the Social Interaction Difference Index (SIDI) [$r(21) = -.47$, $p = .02$], in which a very low score indicates pragmatic difficulties, while a very high score indicates language impairments (a profile similar to children with Specific Language Impairment). Similarly, production of second-person pronouns was positively correlated with the *Speech* category on the CCC-2 [$r(21) = .54$, $p = .008$] and negatively correlated with the SIDI [$r(21) = -.49$, $p = .02$]. The mean SIDI score of children with ASD who produced the overt first-person subject

pronoun along with a verb ($M = -19$, $SD = 2.9$) was significantly higher than the children with ASD who produced the null subject pronoun in combination with a verb, indicating that the former exhibited greater language difficulties than the latter ($M = -6.2$, $SD = 11.7$; $U = 15.5$, $p = .02$).

There were three items on the CCC-2 parent questionnaire that directly probed children's use of pronouns, where lower scores indicate better pronoun production. We summed these three items and investigated whether this reported score was related to observed performance on the three pronoun elicitation tasks. Performance on the tasks was strongly negatively correlated with the CCC-2 pronoun sub-score [first-person: $r(20) = -.60$, $p = .003$; second-person: $r(20) = -.51$, $p = .01$; third-person: $r(20) = -.45$, $p = .03$], indicating that our observations in an experimental setting were confirmed by parent report.

We did not find a relationship between ToM and pronoun production on either the first-person [$r(23) = .35$, $p = .08$] or second-person [$r(23) = .14$, $p = .52$] tasks.

Discussion

The aim of this study was to investigate the ability of Italian children with ASD to produce first-, second-, and third-person singular subject pronouns and verbs with person-referencing morphology. As already noted with younger TD children by Mazzaggio (2016), studies of the acquisition of Italian can shed light on the challenges that pronouns and verbs pose for TD children and children with ASD alike, since null subject pronouns may be produced if the referent is clear from context. Indeed, when verb morphology makes the subject clear, subject pronouns are typically omitted and production of the overt pronoun is considered a marked form. The choice of whether or not to produce an overt subject pronoun is above all an aspect of pragmatic competence.

Overall, the children with ASD in our sample showed greater difficulty with all pronouns tested, despite being older than the TD group and having higher nonverbal intelligence scores. In line with at least two other studies on American and British English-speaking children with ASD (Jordan 1989; Lee et al. 1994) and one study on deaf signers of American Sign Language with ASD (Shield et al. 2015), Italian children with ASD showed a tendency to produce their own name rather than the first-person subject pronoun more often than TD children on a picture identification task, although in our sample this did not quite rise to the level of significance ($p = .06$). However, children with ASD were more likely than TD children to produce overt subject pronouns in contexts where null pronouns are considered the unmarked form (i.e., in association with a verb conjugated for first- or second-person). In other words, children with ASD both avoid and produce pronouns in different ways than

TD children in different contexts. Our results are similar to the very recent results of Terzi et al. (2019) on the production of third-person subject and object pronouns by Greek children with ASD, which found that children with ASD produce more DPs than TD children. However, Terzi et al. (2019) also found that children with ASD used more null than overt pronouns (like TD children), while our results show that children with ASD produced fewer first- and second-person singular null pronouns compared to TD children. One possible explanation is that the study of Terzi et al. focused on third-person pronouns while we focused on first- and second-person singular pronouns. Nonetheless, in our third-person singular pronoun task, both TD children and children with ASD produced many more overt pronouns than null pronouns. We believe such differences are likely attributable to different methodologies; while Terzi et al. analyzed narratives, we used a structured task to directly elicit pronouns, and in the third-person task children had to compare two pictures, so responses with overt pronouns were grammatically correct.

The pattern of results suggests that Italian children with ASD are generally able to acquire and use pronominal forms, at least at the ages we observed, but struggle with understanding when and where to use them in conventional ways, pointing to underlying challenges with pragmatics. We suggest that both patterns observed (i.e., producing an overt rather than a null pronoun and producing names or DPs instead of a pronoun) represent cases where more information is provided than necessary, and as such these uses constitute violations of a pragmatic rule of conversation: to not make contributions more informative than required (Grice 1975). Providing more information than what is necessary may also reflect a failure to fully consider the mental states of one's interlocutor. However, in our data, pronoun errors (including the use of overt pronouns when they are not required and the use of names rather than pronouns) were not correlated with performance on a classic ToM task testing false belief. Rather than focusing on ToM, some scholars have posited that difficulties mastering pronouns may be related to the ability to identify psychologically with others (Hobson et al. 2010). In other words, what is different about ASD is not the ability to calculate what others think and know (as measured by the false-belief task), so much as the lack of inclination to do so naturally and without prompting (Schneider et al. 2013; Senju et al. 2009). This lack of psychological identification could result in the pragmatic violations that these pronoun errors represent, because such an identification could aid speakers to understand how much information (e.g., about who the subject of a sentence is) is necessary to provide to interlocutors.

With regard to the role of linguistic and/or ToM abilities in the development of the pronominal system, in our data linguistic abilities predicted pronoun production better than

ToM, similar to other studies (e.g., Shield et al. 2015). The studies that have found a more primary role for ToM in the mastery of the pronominal system (e.g., Mazzaggio 2016; Naigles et al. 2016) have tended to focus on much younger children. It is likely that ToM could play a larger role earlier in development, and that early reversal errors could be a symptom of the difficulties involved in shifting roles in discourse (e.g., Charney 1980; Chiat 1982; Tager-Flusberg 1994).

The fact that we did not find first-/second-person reversal errors might be related to the fact that we tested older children who have developed different strategies to cope with pronouns (i.e., pronoun avoidance); this could also explain why linguistic abilities seem necessary to manage the pronominal system.

Like all studies, our research has limitations. The two groups were not matched for sex, and there were more females in the TD group than in the group with ASD. Girouard et al. (1997) found that French- and English-speaking TD female toddlers were generally more precocious than TD male toddlers in the production and comprehension of French and English pronouns. However, we do not believe that sex differences are at the root of the linguistic differences evidenced in this study, because the children in our study were far beyond the age at which sex differences have been found (i.e., 21–29 months). Similarly, the use of two different experimenters (one for the group with ASD in a hospital context and another for the TD group in a school setting) could lead to variations in test administration. However, both experimenters were trained by the first author, and we used very simple elicitation protocols that could be easily learned and implemented. Finally, since a few of the children with ASD produced ungrammatical sentences, despite the fact that they are matched for syntactic abilities with TD children, future studies might consider matching children for expressive as well as receptive abilities.

Conclusion

In conclusion, we have presented novel data from Italian to add to the discussion of pronoun acquisition and mastery by children with ASD. Our data confirm that Italian children with ASD differ from Italian TD children in their production of personal pronouns: they are *less* likely to produce pronouns in the context of picture identification than are TD children, but are *more* likely to produce overt pronouns instead of null ones in association with verbs that are morphologically marked for first- and second-person subjects. Both of these differences suggest that pragmatic difficulties may be at the heart of the challenge of using pronouns, at least at the ages we tested. Future studies should investigate younger children, focusing on the developmental trajectory

of the pronominal system in Italian children with ASD, as well as speakers of other languages. A more complete understanding of the challenges facing children with ASD will be critical in the creation of better tools and interventions that may be useful for resolving these problems at a younger age.

Compliance with Ethical Standards

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