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SOCIAL-COMMUNICATIVE ABILITIES AND LANGUAGE IN PRESCHOOLERS WITH AUTISM SPECTRUM DISORDERS: ASSOCIATIONS DIFFER DEPENDING ON LANGUAGE AGE

ABSTRACT

The aim of this study was to look at the unique contributions of imitation, pretend play and joint attention to differences in receptive and expressive language. Associations between social-communicative and language abilities were assessed thoroughly in a large sample (*N* = 83) of preschoolers with ASD. We hypothesized that these associations are dependent of language age. Therefore the sample was divided in two subsamples based on either the receptive or expressive language age for each of the analyses. Results revealed that imitation, pretend play, response to joint attention and imperative and declarative joint attention, were all uniquely associated with language. However, these relationships were different for receptive and expressive language and they also differed depending on the language age of the children. While imitation and pretend play showed unique associations with language in children with a language age under 2 years old and children with a language age above 2 years old, joint attention abilities were only uniquely associated with language in children with the youngest language age. These findings lend support to the idea that social-communicative abilities are important intervention targets for children with ASD.

INTRODUCTION

Autism spectrum disorder (ASD) is a heterogeneous disorder with great variability in outcome (Magiati, Moss, Charman, & Howlin, 2011). Despite the pervasive nature of ASD the development of children with this disorder can be influenced by intervention (Warren et al., 2011). Because a stable diagnosis is possible in 2-year-olds (Chawarska, Klin, Paul, Macari, & Volkmar, 2009), there is recently a greater emphasis on early intervention (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009). Early social-

communicative abilities such as imitation, joint attention and pretend play are seen as important intervention targets, given the clear deficits observed in young children with ASD and the pivotal role these skills play in development (Lam & Yeung, 2012; Paparella, Goods, Freeman, & Kasari, 2011; Vanvuchelen, Roeyers, & De Weerdt, 2011b). Especially the association of these abilities with language has been studied extensively (e.g., Luyster, Kadlec, Carter, & Tager-Flusberg, 2008; Poon, Watson, Baranek, & Poe, 2012). The present study aims to investigate this association in a large sample of preschoolers with ASD with a more rigorous measurement of the social-communicative abilities than in previous research.

Studying language in children with ASD is important, considering it is one of the variables most significantly associated with later outcome (Anderson, Oti, Lord, & Welch, 2009). Moreover a language delay is one of the first symptoms that raises parental concern (Wetherby et al., 2004). Imitation, joint attention and pretend play all play a role in language development. Children learn their first words by imitating their parents, which makes a relationship between imitation and language obvious. This expected association has been confirmed both in typical children (McEwen et al., 2007) and in children with ASD (Ingersoll & Meyer, 2011). Joint attention is said to be important in language learning, because children need social cues like the eye gaze of a social partner to map new words to objects (Baldwin, 2000). Research has found concurrent and longitudinal associations between joint attention and language in typical children (Mundy et al., 2007) and children with ASD (Charman, 2003; Schietecatte, Roeyers, & Warreyn, 2012). Pretend play and language are theoretically associated because they both rely on a symbolic representation ability (Lewis, 2003). Moreover the age at which pretend play begins to develop coincides with the age at which expressive language starts to develop. Even the onset of combinations in language and play are associated (Mccune, 1995). Although the association between pretend play and language is well established in typical development, this relationship is less clear in children with ASD (Lewis, 2003). Interventions targeting imitation, joint attention or pretend play have an impact on language ability (e.g. Ingersoll & Lalonde, 2010; Kasari, Paparella, Freeman, & Jahromi, 2008), providing indirect evidence for the link between these skills and language.

Because imitation, joint attention and pretend play are interrelated (Toth, Munson, Meltzoff, & Dawson, 2006) it is important to consider their relative contribution to language development, controlling for the effect of the other social-communicative abilities. Studies that have looked at the concurrent link between social-communicative abilities and language yielded mixed results. Some studies have found a unique association between imitation and expressive language (Luyster et al., 2008) whereas others have concluded that imitation does not explain any variance when pretend play or joint attention are already accounted for (Charman et al., 2000; Weismer, Lord, & Esler, 2010). Longitudinal studies pointed more consistently to imitation as an important predictor, especially with respect to expressive language (Charman et al., 2003; Stone & Yoder, 2001; Thurm, Lord, Lee, & Newschaffer, 2007). This was also found in typically developing children (Charman et al., 2000). However, some studies found that other variables, such as joint attention are equally associated with language (Toth et al., 2006). The differential age of the participants could be responsible for the contradictory findings.

Another replicated finding is that response to joint attention is uniquely associated with receptive language both concurrently (Luyster et al., 2008) and longitudinally (Thurm et al., 2007). Pretend play seems to show the least unique contribution to the prediction of language. However, a possible explanation for this is that it is mostly measured with very broad scales (e.g. ADOS), which could make it more difficult to discover a relationship with language. Another possible explanation can be deduced from the study by Toth et al. (2006). These authors show that although there is no unique association between pretend play and language concurrently or longitudinally, pretend play ability is predictive for the rate of communication development from age 4 to 6.5 years. Other studies did not look at the rate of language or communication development, and therefore possibly fail to unravel the relation between pretend play and language.

The present study aims to further investigate the concurrent link between social-communicative abilities and language. Although several studies have replicated this connection, most of them lack a sufficient sample size to explore these relationships in more depth. Moreover the studies with a larger sample size often do not use fine-

grained measurement of the social-communicative abilities (Thurm et al., 2007; Weismer et al., 2010). In order to study children with ASD at a very young age some studies (e.g. Weismer et al., 2010) have recruited siblings of children with ASD, because they are a high risk population. This has the disadvantage that it makes the sample less representative, because those children have an older sibling with ASD, which can affect their social-communicative abilities and language.

The present study describes a large sample of preschoolers with ASD, exploring imitation, joint attention and pretend play in relation to language abilities, with a thorough assessment. Because the association between social-communicative abilities and language has rarely been studied with this level of detail in such a large sample, this study can contribute significantly to the understanding of language development in children with ASD. Since findings from previous studies were often contradictory, we hypothesized that the language age of the children could have an effect on the relationships between their social-communicative abilities and language. Typically developing children reach an important milestone in language development on average around their second birthday. While in the second year of life the mapping of words to objects is central, by the end of that year 2-word-sentences start to emerge. With this new level of complexity different social-communicative abilities could play a role in language development.

METHOD

Participants

Ninety-two children with either an official (n = 81) or working diagnosis (preliminary diagnosis; Charman & Baird, 2002; n = 11) of ASD were recruited for this study, that was part of a larger study, in which children were followed up to look at the effect of the intervention they received (Van der Paelt, Warreyn & Roeyers, 2014). The participants were recruited from 16 treatment centres, serving children with developmental delays. Parents gave their written consent for participation. The Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore & Risi, 1999) was used to confirm diagnoses.

Nine children scoring clearly below the cut-off for ASD (severity score 1 or 2) were excluded from further analysis. Because all children received intervention, which might have positively influenced their symptoms (Pellicano, 2012), children with a severity score of 3 were included (*n* = 6). The remaining 83 children (67 boys) were between 22 and 75 months old, 49 months on average (*SD* = 14 months) at the time of the assessment. Their cognitive level was assessed before the start of the study by the treatment centre with the Dutch version of one of the following tests: Bayley Scales of Infant Development, second edition (BSID-II-NL; Van der Meulen, Ruiter, Spelberg & Smrkovsky, 2000; *n* = 43), Wechsler Preschool and Primary Scale of Intelligence, third edition (WPPSI-III; Hendriksen & Hurks, 2009; *n* = 10), Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R NL; Vander Steene & Bos, 1997; used because the WPPSI-III was not yet available in Dutch in all treatment centres at the time of the assessment; *n* = 13), Snijders-Oomen Non-verbal Intelligence Test – Revised (Tellegen, Winkel, Wijnberg-Williams & Laros, 1998; *n* = 14), Psychoeducational profile – Revised (PEP-R; Pameijer & van Beukering, 1997; *n* = 1) and McCarthy Developmental Scales (MOS; Van der Meulen & Smrkovsky, 1986; *n* = 2). Forty-five children were firstborns, 38 had at least one older sibling. The sample was divided into subgroups based on the language level of the children. Because we expected different associations for receptive and expressive language, we used both receptive and expressive language age (age equivalent scores) separately to divide the sample. To study the associations between social-communicative abilities and receptive language the sample was divided in a subgroup of children with a receptive language age of less than 2 years old and a subgroup of children with a receptive language age of 2 and above. For the associations with expressive language, a subgroup with an expressive language age of less than 2 was compared to a subgroup with an expressive language age of 2 and above. Tables 1 and 2 present the participant characteristics in the different subgroups based on receptive and expressive language level.

Table 1

Participant characteristics for the subgroups based on receptive and expressive language level

Characteristic	Receptive language age		Expressive language age	
	< 2 yrs	≥ 2 yrs	< 2 yrs	≥ 2 yrs
N	32	51	38	45
Mean age (*SD*)[a]	39.19 (12.01)	55.36 (10.43)	39.48 (11.49)	57.27 (9.11)
No. of boys	22	45	27	40

[a] in months

Table 2

IQ distribution for the subgroups based on receptive and expressive language level

IQ category	Receptive language age		Expressive language age	
	< 2 (*n* = 32)	≥ 2 (*n* = 51)	< 2 (*n* = 38)	≥ 2 (*n* = 45)
IQ < 55	20	7	21	6
IQ 55-70	7	11	9	9
IQ 71-85	4	15	7	12
IQ 86-115	1	17	1	17
IQ > 115	0	1	0	1

Measures

Preschool Imitation and Praxis Scale (PIPS; Vanvuchelen, Roeyers, & De Weerdt, 2011a). The PIPS was used to measure motor imitation. The PIPS consists of 30 items, of which 21 items measure bodily imitation (gestural and facial imitation) and 9 procedural imitation. The bodily imitation scale comprises meaningful (e.g. wave good-bye) and

non-meaningful (e.g. place one fist on top of the other) actions. The procedural scale encompasses goal directed (e.g. raise a toy bear by pulling a cord) and non-goal directed (e.g. open a box, turn it upside down and put a block on the bottom of the box) actions.

Test of Pretend Play (ToPP; Lewis & Boucher, 1997). The structured version of the ToPP was used to asses three main types of pretend play: object substitution, property attribution and reference to an absent object. The test assesses the child's ability to use him/herself as the object of pretend play as well as the ability to use a doll or teddy bear as agent. Moreover the ability to combine play acts into a script is tested. A nonverbal version, in which actions were modelled, was used in children with a language comprehension level of less than 3 years old. In children with a better language comprehension we used the verbal version, in which next to modelled actions, also verbal instructions were used. Every item consists of a part where the child can produce original play and a part where the child is asked to copy a modelled action (e.g. using an ambiguous object as a hat for a doll) or to follow an instruction ("show me the bear is sad"). Only the spontaneous pretend play (not the instructed or imitated pretend play) was used to compute a total score (which is a variant described in the manual of the test). This was done to avoid overlap with the imitation scores.

Early Social Communication Scales (ESCS; Mundy et al., 2003). The abridged version of the ESCS was used to measure initiation of joint attention (IJA), initiating behaviour request (IBR) and response to joint attention (RJA). Four different mechanical toys (3 wind-up toys and a pop-up puppet) were activated in sight of the children. The experimenter gave each toy to the child when he or she requested it. The child could play with the toy for 30 seconds, after which the experimenter requested the toy back and activated it again. This procedure was repeated with each toy three times. Two of the toys were first placed in a box that the child could not open by himself and were given to the child in the box in order to elicit requesting to open it. In order to assess RJA four pictures (A4 size) of Winnie the Pooh and friends were placed on the walls right and left of the child, two in their visual field (at approximately 60 degrees from the child's midline) and two behind the child (at approximately 150 degrees form the child's midline). After gaining the child's attention, the experimenter gazed at each of the four posters and said the name of the child three times before looking back to the child. If

the child did not follow the gaze of the experimenter to the first two posters, a pointing gesture was added for the last two posters. Children received a score from 0 to 4, depending on the number of posters they followed the gaze and/or point to.

The coding of the ESCS was done with the Observer XT, version 9.0 (Noldus, 2009) by four independent coders. Scores for IJA and IBR are based on frequency counts of nonverbal and verbal communication during the whole observation. Verbal communication was included because we tested children up to 6 years old in our sample. It can be expected that the older children become, the more they will use language as a means for sharing attention. Yoder, Stone, Walden, and Malesa (2009) also used the ESCS to count the frequency of nonverbal and verbal joint attention, (called *unweighted triadic communication*).

The following nonverbal IJA behaviours were observed: (a) making eye contact with the experimenter to share interest, (b) alternating eye contact between an active/moving toy and the experimenter, (c) proximal or distal pointing with or without eye contact to share interest, (d) showing an object to the experimenter with eye contact. Verbal IJA was defined as using one or more words to share interest with the experimenter. The number of words per utterance was coded (vocalization or non-word, one word, two words, three words, more than three words). The following nonverbal IBR behaviours were coded: (a) making eye contact with the experimenter to request something, (b) reaching for a toy, with and without eye contact, (c) proximal or distal pointing with and without eye contact to request, (d) giving an object to the experimenter. Verbal IBR was defined as using one or more words to request something, with a distinction between the number of words, in the same way as the verbal IJA score. Nonverbal and verbal scores for IJA and IBR were combined in a total IJA score and a total IBR score. Interrater reliability was determined with single measures intraclass correlations (ICCs) by double coding of 25% of the observations. The ICCs were .94 for nonverbal IJA, .96 for verbal IJA, .87 for nonverbal IBR, .91 for verbal IBR and .84 for RJA.

Reynell Developmental Language Scales – Dutch version (RTOS; Schaerlaekens, Zink, & Van Ommeslaeghe, 2003). The RTOS was used to assess expressive and

receptive language. Age equivalent scores, based on a sample of Dutch speaking children, were available.

Procedure

The tests were administered in the treatment centres of the children, on two separate days, with approximately one week in between. The first assessment started with the ADOS, after which the PIPS was administered. The second assessment consisted of the ESCS, ToPP and RTOS, in this order. Both assessments took approximately 60 to 90 minutes. We chose to start both assessments with the tests with the most liberal instructions to let the children warm up and get used to the test administrator. Since the tests were playful and provided enough variation of tasks and materials, children were able to remain engaged throughout the administration of the tests, with minimal signs of fatigue. The assessment was videotaped and all the tests were scored afterwards from the video. The study design was prospectively reviewed and approved by the Ethics Committee of the Faculty of Psychology and Educational Sciences of Ghent University, where the study was conducted.

RESULTS

Relationships among social-communicative abilities and language

Table 3 presents mean scores (*M*), standard deviations (*SD*) and ranges for the social-communicative abilities and language measures. Raw scores were used in all analyses because some children had bottom scores on the age equivalent scores. Pearson correlations between social-communicative abilities and receptive and expressive language differed depending on the receptive or expressive language level of the children (see Table 4 and 5).

Table 3

Descriptive statistics for social-communicative and language abilities

Ability		Receptive language age		Expressive language age	
		< 2 (*n* = 32)	≥ 2 (*n* = 51)	< 2 (*n* = 38)	≥ 2 (*n* = 45)
Procedural imitation[a]	*M* (*SD*)	4.63 (5.19)	15.57 (5.44)	5.26 (5.73)	16.49 (4.41)
	Range	0-21	0-21	0-21	0-21
Bodily imitation[a]	*M* (*SD*)	4.34 (8.29)	29.86 (13.97)	5.84 (9.86)	32.00 (12.62)
	Range	0-28	0-57	0-34	0-57
Total imitation[b]	*M* (*SD*)	8.94 (12.58)	45.43 (18.61)	11.08 (14.83)	48.49 (16.13)
	Range	0-49	0-78	0-54	0-78
Pretend play[a]	*M* (*SD*)	2.44 (3.16)	9.04 (7.10)	2.26 (2.95)	10.07 (6.93)
	Range	0-14	0-26	0-14	0-26
IJA[c]	*M* (*SD*)	1.37 (1.22)	3.29 (1.61)	1.37 (1.03)	3.54 (1.59)
	Range	0-5.11	0.27-9.67	0-3.47	0.27-9.67
IBR[d]	*M* (*SD*)	1.30 (.81)	2.51 (1.25)	1.53 (1.16)	2.48 (1.16)
	Range	0-3.07	0.32-5.66	0-5.66	0.32-5.51
RJA[e]	*M* (*SD*)	.31 (.25)	.64 (28)	.32 (.25)	.68 (.27)
	Range	0-1	0-1	0-1	0-1
Expressive language[a]	*M* (*SD*)	2.69 (6.51)	42.35 (19.44)	3.53 (4.91)	46.93 (16.12)
	Range	0-35	6-75	0-16	18-75
Receptive language[a]	*M* (*SD*)	5.06 (5.79)	43.00 (14.96)	9.24 (11.36)	44.53 (15.14)
	Range	0-17	18-69	0-40	17-69

[a] Raw score. [b] Sum of procedural and gestural imitation. [c] Rate per minute of initiating joint attention. [d] Rate per minute of initiating behavioural request. [e] Proportion of responding to joint attention

Table 4

Correlations between receptive language and predictor variables

Receptive language level	Age	Bodily im.	Procedural im.	Total im.	Pretend play	IJA	IBR	RJA
< 2 yrs	.25	.56**	.57**	.60**	.69**	.72**	.60**	.41**
≥ 2 yrs	.49**	.58**	.47**	.57**	.61**	.12	-.19	.15

Note. im. = imitation; IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

**$p < .01$.

Table 5

Correlations between expressive language and predictor variables

Expressive language level	Age	Bodily im.	Procedural im.	Total im.	Pretend play	IJA	IBR	RJA
< 2 yrs	.22	.41*	.29	.38**	.28*	.38*	.63**	.18
≥ 2 yrs	.44**	.63**	.57**	.64**	.58**	.06	-.12	.04

Note. im. = imitation; IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

*$p < .05$. **$p < .01$.

The joint attention variables only correlated significantly with language in the children with the lowest language level. IJA and IBR showed associations with receptive and expressive language, whereas RJA was only associated with receptive language. Pretend play and imitation showed significant correlations with both language variables in all children. Age correlated significantly with language (only in children with a

receptive or expressive language level above 2 years old) and was therefore used as a control predictor variable in the subsequent regression analyses. Procedural and bodily imitation were highly correlated in all language subgroups (r = .73−.80). To avoid multicollinearity the total imitation score was used in subsequent regression analyses. Correlations between the different social-communicative abilities were low to moderate in all groups. Multicollinearity diagnostics indicated adequate tolerance levels.

Predicting language

Multiple hierarchical regression analyses were conducted for receptive and expressive language separately. Because the dependent variables in the regression analyses were receptive and expressive language, it was not possible to include receptive and expressive language age and the interaction between language age and the other predictors directly into the regression models as predictors. Therefore regression analyses were also performed separately in each receptive and expressive language age group. This implies that in total four regression analyses were performed. In each analysis age was entered in the first step, to control for its effect on the language level. The predictors imitation, pretend play, IJA, IBR and RJA were entered together in the second step, to control simultaneously for the other predictors in the model.

Receptive language < 2 years. A model with age alone could not significantly predict receptive language in the group of children with a receptive language age of less than 2 years old, $F(1, 30) = 2.06$, $p = .16$. The model with the social-communicative abilities explained 73 percent of the variance in receptive language, $F(6, 25) = 11.03$, $p < .001$. Standardized betas revealed that pretend play and IJA explained unique variance. See Table 6.

Receptive language age ≥ 2 years. A model with age explained 24 percent of the variance in receptive language in children with a receptive language age of 2 and above, $F(1, 49) = 15.12$, $p < .001$. The social-communicative abilities added significant variance to that, $F(5, 44) = 3.92$, $p = .005$. The combined model explained 47 percent of the variance. Only pretend play was a unique contributor to the variance in receptive language. See Table 6.

Table 6

Hierarchical regression for receptive language

Receptive language level	Step	*B* (*SE*)	β	R^2	ΔR^2
< 2 yrs	1 (constant)	0.28 (3.48)		.06	
	Age	0.12 (0.09)	.25		
	2 (constant)	-0.89 (2.07)		.73**	.67**
	Age	0.01 (0.06)	.02		
	Imitation	0.10 (0.07)	.22		
	Pretend play	0.74 (0.25)	.41**		
	IJA	1.89 (0.69)	.40*		
	IBR	1.23 (1.03)	.17		
	RJA	-3.96 (3.24)	-.17		
≥ 2 yrs	1 (constant)	4.43 (10.09)		.24**	
	Age	0.70 (0.18)	.49**		
	2 (constant)	12.49 (11.02)		.47**	.24**
	Age	0.29 (0.21)	.20		
	Imitation	0.18 (0.15)	.22		
	Pretend play	0.95 (0.31)	.45**		
	IJA	-1.72 (1.30)	-.19		
	IBR	0.88 (1.59)	.07		
	RJA	2.30 (6.58)	.04		

Note. IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

*$p < .05$. **$p < .01$.

Expressive language age < 2 years. Age could not significantly predict expressive language in the group of children with an expressive language age of less than 2 years old, $F(1, 36) = 1.91$, $p = .18$. A model with the social-communicative abilities accounted for 55 percent of the variance, $F(6, 31) = 6.22$, $p < .001$. Imitation, IBR and RJA all explained unique variance in expressive language. While imitation and IBR showed positive predictive values, the predictive value of RJA was negative. See Table 7.

Expressive language age ≥ 2 years. The model with age explained 20 percent of the variance in expressive language in children with an expressive language level of 2 years and above. The social-communicative abilities added significant variance to that, $F(5, 38) = 5.24$, $p = .001$. Together with age they explained 52 percent of the variance. Imitation and pretend play were the only significant predictors in this model. See Table 7.

Direct comparison language age effect. To compare the effect of the predictors from models with different language ages, we computed 95 % confidence intervals (CI) of the difference of the standardized betas of the predictors. When 0 was not included in the CI, we could assume that standardized betas were different. In that way we could compare whether the effect of each of the predictors was larger/smaller for children with a receptive or expressive language age below 2 years old than for children with a receptive or expressive language age above the age of two. Results are presented in Table 8.

Table 7

Hierarchical regression for expressive language

Expressive language level	Step	*B* (*SD*)	β	R^2	ΔR^2
< 2 yrs	1 (constant)	-0.26 (2.85)		.05	
	Age	0.10 (0.07)	.22		
	2 (constant)	-2.21 (2.26)		.55**	.50**
	Age	0.05 (0.06)	.11		
	Imitation	0.13 (0.05)	.39*		
	Pretend play	0.24 (0.24)	.14		
	IJA	0.19 (0.71)	.04		
	IBR	2.55 (0.60)	.61**		
	RJA	-6.87 (3.26)	-.35*		
≥ 2 yrs	1 (constant)	2.21 (14.04)		.20**	
	Age	0.78 (0.24)	.44		
	2 (constant)	6.01 (14.10)		.52**	.33**
	Age	0.23 (0.25)	.13		
	Imitation	0.44 (0.17)	.44*		
	Pretend play	0.84 (0.33)	.36*		
	IJA	-2.23 (1.41)	-.22		
	IBR	2.12 (1.91)	.15		
	RJA	0.79 (7.26)	.01		

Note. IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

*p < .05. **p < .01.

Table 8

95% Confidence Intervals for the difference between standardized betas of predictor variables for the receptive and expressive language age groups below versus above 2 years old.

Predictor	Receptive language	Expressive language
Age	[-0.56, 0.20]	[-0.40, 0.36]
Imitation	[-0.45, 0.46]	[-0.50, 0.39]
Pretend play	[-0.44, 0.35]	[-0.61, 0.18]
IJA	[0.19, 0.98]	[-0.14, 0.66]
IBR	[-0.29, 0.48]	[0.07, 0.84]
RJA	[-0.59, 0.15]	[-0.77, 0.04]

Note. IJA = initiating joint attention. IBR = initiating behavioural request. RJA = responding to joint attention.

Results show that IJA explained more variance in the receptive language of children with a receptive language age of less than 2 years old than in children with a receptive language age of 2 years and above. Moreover IBR explained more variance in the expressive language age of children with an expressive language age of less than 2 years old compared to children with an expressive language age of 2 years and older. The predictive value of age, imitation and pretend play was not different in children belonging to different language age groups. Figure 1 provides an overview of associations between social-communicative abilities and language in the different language age groups.

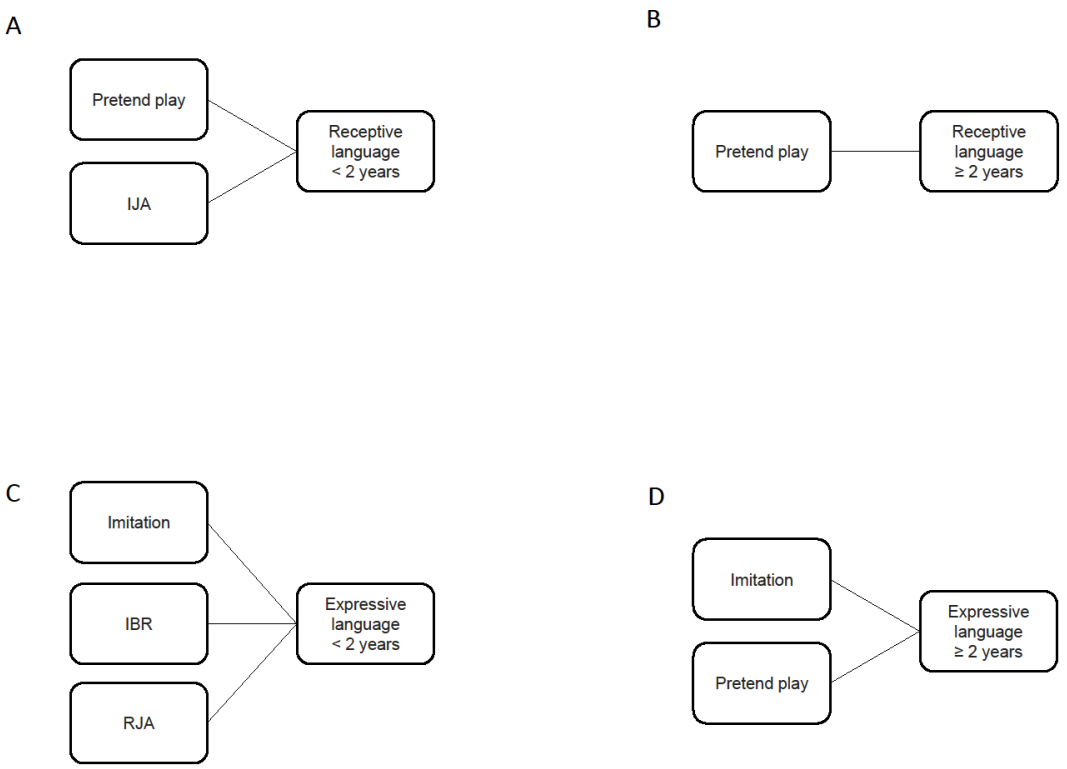

Figure 1. Associations between social-communicative abilities and receptive or expressive language in children with (A) a receptive language age of less than 2 years old, (B) a receptive language age of above 2 years old, (C) an expressive language age of less than 2 years old, (D) an expressive language age above 2 years old.

DISCUSSION

The goal of this study was to look at the associations between social-communicative abilities and language. Our results reveal that relationships are different for receptive and expressive language and also differ greatly depending on the language level of the children.

Receptive language

As shown in Figure 1A, pretend play and IJA both explain unique variance in receptive language in children with a receptive language level of less than 2 years old. In children with a receptive language age above 2 years old, only pretend play explains unique variance in receptive language, as is shown in Figure 1B.

IJA. Previous research pointed to the importance of joint attention for the language development of children with ASD. The association of IJA and receptive language is in line with Charman et al. (2003). However, several other studies that included IJA and RJA, found a unique association between RJA and receptive language, and no association between IJA and language in general (Luyster et al., 2008; Murray et al., 2008; Thurm et al., 2007). Part of the children in these studies had a language age higher than 2 years old. This could explain the different findings because our results show that IJA is a more important predictor for receptive language ability in children with a receptive language age below the age of 2 than in children with a higher receptive language age. An explanation for the importance of IJA for early receptive language, could be that children with ASD especially pay attention to the language of others when they have initiated the joint attention episode. IJA could be an important mechanism in the mapping of words to objects, but seems less important for more complex receptive language skills. We did not replicate the unique association between RJA and receptive language, although we did find a significant correlation. Possibly a complexity measure of RJA (as was used in several previous studies), rather than a frequency measure is more sensitive to capture the unique link of RJA and receptive language.

Pretend play. Our findings reveal that pretend play explains unique variance in receptive language in both language age groups. This could mean that pretend play may be a more important factor for the language development of children with ASD than previously thought (e.g. Lewis, 2003). Pretend play could be particularly related to language understanding because of a common reliance on symbol formation ability. Previous studies with both concurrent (Luyster et al., 2008) and longitudinal (Charman et al., 2003; Stone & Yoder, 2001) designs had not found a unique association between pretend play and language, after controlling for other social-communicative abilities. Other studies did find an association between pretend play and language, under specific conditions. Weismer et al. (2010) found a concurrent association between pretend play and language in children with autism, but not in children with PDD-NOS. Moreover, a study by Toth et al. (2006) revealed an association between pretend play and the rate of communication development, but not with concurrent language. In these studies pretend play was measured less detailed (e.g. with the ADOS) than the other social-communicative abilities, whereas in the present study a more elaborate measurement was used. This could account for the difference.

Expressive language

Figure 1C shows that in children with an expressive language level of less than 2 years old, imitation, IBR and RJA explain unique variance in expressive language**.** In the children with an expressive language age above 2 years old imitation and pretend play explain unique variance in expressive language.

Imitation. The results concerning expressive language reveal that imitation explains unique variance in expressive language in both children with an expressive language age under and above 2 years old. This indicates that imitation is important at several phases of expressive language development. Previous studies also concluded that imitation was the most important predictor for expressive language abilities (Luyster et al., 2008; Stone & Yoder, 2001; Thurm, Lord, Lee, & Newschaffer, 2007).

The importance of imitation for expressive language development already became apparent both in research focusing on typical development as well as in studies in children with ASD. In typically developing children more frequent vocal imitation of new,

but not of familiar words is associated with a more elaborate vocabulary, suggesting children use vocal imitation as a mechanism to learn new words (Masur & Eichorst, 2002). In the second year of life both motor and vocal imitation are highly frequent in typically developing children in free play interactions with their mothers (Masur & Rodemaker, 1999). Furthermore these authors showed that in the first half of this year, when first words emerge, children mainly imitate the actions of their mothers. In the second half however, when their vocabulary starts to expand more rapidly, vocal imitation becomes more important. Also in children with autism this sequence in which motor imitation precedes vocal imitation and leads to an expansion of the expressive vocabulary has been found (Paul, Campbell, Gilbert, & Tsiouri, 2013). These authors evaluated an intervention strategy to elicit first words in which children were first trained in motor imitation, if necessary. Subsequently they used the Rapid Motor Imitation Antecedent procedure (RMIA): children were first encouraged to imitate a series of simple motor actions, before they were presented with the opportunity to imitate verbal requests or labels. This procedure led to an improvement in the number of spoken words produced by the children. Furthermore both vocal imitation and imitation of actions have been found to be associated with language in children with ASD (Thurm et al., 2007). Taken together these results support the interpretation that imitation is an important mechanism for the expressive language development of children with ASD.

IBR. Apart from imitation, also IBR is associated with expressive language. As was the case with IJA and receptive language, also IBR shows a stronger association with expressive language in children with an expressive language age of less than 2 years old than in children with more complex expressive language skills. Possibly IBR plays a pivotal role in early word learning, but is less central in the development of more elaborate conversational skills. It could be that most children with a language age above 2 have reached a sufficient level of IBR ability, sustaining further language development. In these children variations in pretend play and imitation may be more crucial for the understanding of language differences. In typically developing children RJA was positively related to vocabulary between 6 and 18 months, but not at 21 or 24 months (Morales et al., 2000) and IJA was positively related to language at 21 and 26 months,

but not at 31 months (Vuksanovic & Bjekic, 2013). These studies suggest that also for other joint attention variables associations with language are in particular apparent at younger ages, which is in line with our results.

Previous studies that examined the relationship between joint attention and language have primarily looked at IJA and RJA, not IBR. To our knowledge only one study (Toth et al., 2006) did include IBR as a possible predictor for concurrent language abilities. These researchers did however not find an association between the imperative form of joint attention and expressive language, as in the present study. It is possible that IBR plays a more important role in expressive language development of children with ASD than IJA, because of motivational factors. Possibly children with autism are more motivated to learn new words for instrumental purposes than for the purpose to share their interests with someone else. This explanation corresponds with the social motivation theory of autism which links a lack of social attention early in life to a deprivation of social learning experiences that further negatively impacts social development (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012). Because most of the children in our sample had spoken language, we expanded the original coding scheme for the ESCS with verbal utterances to share interest or request. The ESCS was originally developed to assess joint attention in children with a mental age of less than 30 months (Mundy et al., 2003). For older children verbal language also becomes an important means of joint attention. In previous studies this was however not taken into account, which could also explain the difference of our findings in comparison to earlier studies.

RJA. Remarkably, while the correlation between RJA and expressive language is low and non-significant, RJA has a negative predictive value in the regression model when included together with IBR and imitation. This deserves further investigation.

Pretend play. In children with an expressive language age above 2 years old besides imitation, also pretend play significantly predicts expressive language. A possible explanation for this association is that children with better pretend play skills are also more skilled in social pretend play, which can provide a context to expand expressive language abilities. Research in children with language impairments suggests that conversations between dyads of children are more elaborate in social pretend play than in other forms of play (DeKroon, Kyte, & Johnson, 2002). Social pretend play emerges

around 24 to 30 months (Howes, 1987), which could explain why pretend play explains unique variance in expressive language of children with a language age above 2 years old, but not in children with a younger expressive language age.

Predictors of language: integration

Taken together, these findings can contribute to our understanding of language development in children with ASD. In neither language age group, chronological age is a significant predictor for language over and above the social-communicative abilities. Moreover, all social-communicative abilities that were measured in this study seem to play a role in language development. However, relationships are specific for receptive and expressive language and differ depending on the language age of the children. While imitation and pretend play show unique associations with language in children with a language age under 2 years old and children with a language age above 2 years old, joint attention abilities are only uniquely associated with language in children with the youngest language age.

These findings are in line with studies on the development of these abilities in typically developing children where imitation and pretend play still show clear development after the age of two and become increasingly complex abilities (e.g. Fein, 1981; Kuczynski, Zahnwaxler, & Radkeyarrow, 1987). Joint attention abilities on the other hand develop especially by the end of the first and in the second year of life (Beuker, Rommelse, Donders, & Buitelaar, 2013). Previous studies had not yet taken into account the effect that the language age of the children may have on these associations. This may be a factor that contributed to contradictory results in previous research.

Clinical implications

Our results are in accordance with the growing body of literature that supports the idea that imitation, joint attention and pretend play are important intervention targets for children with ASD. Given their association with language, one of the most important predictors for the outcome in the long run, stimulating these abilities could also have an effect on language abilities and future development in general. Previous studies indeed

showed improvement in language after a training in one of these abilities (Kasari et al., 2008; Paul et al., 2013). Because they all explain unique variance in language, a training programme that focuses on all abilities at once could even be more beneficial, especially in children with limited language abilities. We showed that IJA and IBR are more strongly related to language in children with limited language abilities, than in children with a language age above the age of 2. This implies that a training in joint attention abilities may especially be important for children with minimal language abilities. For children with somewhat better language abilities, a more direct focus on language itself may be more appropriate.

Strengths and limitations

The current study has taken into account several limitations of previous studies. First, the total sample size and even the number of participants in the subgroups was larger than sample sizes in the majority of earlier studies on this topic. Second, we used a more thorough assessment of the social-communicative abilities than in most of the previous studies. Third, to our knowledge no other study has compared associations between social-communicative abilities and language in different language age groups. However, an important limitation of this study is that we only looked at the concurrent relationships between social-communicative abilities and language. These findings need further replication with a longitudinal design, in which children are followed up throughout several phases of language development.

Conclusion

In summary, this study is to our knowledge the most comprehensive study on the associations between social-communicative abilities and language in children with ASD. We showed that imitation, pretend play, IJA, IBR and RJA are all uniquely associated with language. However, these associations depend on the language level of the children and the specific language ability that is measured. Because language is one of the most important predictors of the future outcome, stimulating social-communicative abilities associated with language development should be an important goal of early intervention in children with ASD.

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