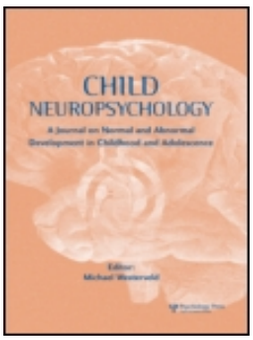

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Nonverbal communication, play, and language in Greek young children with Williams syndrome

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This study investigated nonverbal communicative abilities, functional play, and symbolic play in 11 toddlers with Williams syndrome (WS) during spontaneous communication. The WS group was compared with a group of typically developing (TD) children matched for linguistic abilities. Results demonstrated that children with WS exhibited significantly less spontaneous functional play and imaginary play compared to TD children. On the other hand, children with WS showed significantly more showing and giving guided by their parents than TD children. In addition, it was shown that in both groups aspects of symbolic play are correlated with expressive as well as receptive language. These findings are interpreted through the Theory of Intersubjectivity, which contrasts with the Theory of Mind and suggests that shared arbitrary purposes regarding actions on objects constitute presuppositions for the development of language.

Keywords: Williams syndrome; Nonverbal communication; Play; Language comprehension; Language production.

INTRODUCTION

Williams syndrome (also Williams-Beuren syndrome) is a genetic disorder caused by the deletion of about 25 genes from the region q11.23 of chromosome 7 (Hillier et al., 2003). Earlier studies report that WS occurs in about 1 in 20,000 live births (Beuren, 1972; Greenberg, 1990). However, more recently it is estimated that the prevalence of WS is higher, occurring in about 1 in 7,500 (Strømme, Bjørnstad, & Ramstad, 2002). Phenotypically WS shows a specific physical, cognitive, and social profile. In the physical domain, WS is characterized by facial dysmorphology, supravalvurar aortic stenosis, and transient

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hypercalcaemia (Morris, 2006). In the cognitive domain, WS is characterized by mild to moderate intellectual disability as well as deficiencies in visuospatial cognition, planning, and problem solving and numbering skills, but good verbal short-term memory and a particular interest in music (Arnold, Yule, & Martin, 1985; Bellugi, Bihrle, Jernigan, Tranner, & Deherty, 1990; Levitin et al., 2005). There also appears to be a higher prevalence of left-handedness (van Strien et al., 2005). In the social domain, WS is characterized by overfriendliness with strangers, unusual cheerfulness, intense interest in others' faces, even from a very early age, but also unpredictable negative outbursts (Mervis & Klein-Tasman, 2000; Udwin & Yule, 1991).

However, the most striking finding about individuals with WS is that their performance in assessments of lexical and grammatical abilities is higher compared to the performance of other intellectually disabled individuals, such as individuals with Down syndrome. This pattern held for both comprehension and production (Bellugi, Sabo, & Vaid, 1988; Robinson, Mervis, & Robinson, 2003; Volterra, Caselli, Capirci, Tonucci, & Vicari, 2003).

Despite relative strengths in certain domains of language and social interaction, individuals with WS show particular difficulties with pragmatic abilities such as turn-taking, conversational and topic maintenance (Mervis, 2006), and appropriate use of eye gaze (Mervis et al., 2003), while they have great difficulty in understanding the difference between lies and jokes (Sullivan, Winner, & Tager-Flusberg, 2003). The language of individuals with WS has often been described as "cocktail party" speech, which is filled with stereotypic social phrases and little content, and is not well tuned to their conversational partner (Mervis, 2006; Stojanovik, 2006; Udwin & Yule, 1991).

These findings imply that individuals with WS may show deficits in communicative abilities related to the conscious sharing of motives, intentions, and emotions about topics in the surrounding environment with another person. These abilities are described as secondary intersubjectivity (Trevarthen & Hubley, 1978). Secondary intersubjectivity is a species specific process, which appears around 9 months and is based on the developing awareness that the other is a source of new ideas concerning objects, an intentional agent, and a carrier of feelings. Before 9 months, infants perceive interactions with others from their own perspective. However, after 9 months, infants become capable of perceiving interactions from the other's perspective as well. The primary manifestation of Secondary Intersubjectivity is joint attention (Hubley & Trevarthen, 1979; Trevarthen & Hubley, 1978). Joint attention refers to the mutual focus of attention and communication between the child and another person about a target external to the space of the dyad. Joint attention marks a shift from the primarily dyadic interactions between the infant and another person about emotions. Infants of this age attempt to direct the other's attention towards a topic of their own interest by using gestures such as pointing or showing, or by alternating their gaze between the communicative partner and an object. Moreover, infants now follow the other's focus of attention by looking where the other is looking, imitating what the other is doing with an object, or following arbitrary verbal and vocal instructions.

Toddlers' ability to coordinate their intentions and emotions about a topic in the environment with those of another person develop further and are revealed in functional and symbolic play (Trevarthen, 1994). Functional play is the primary manifestation of pretend play and is defined as the use of an object or the association of two or more objects in a conventional manner (Ungerer & Sigman, 1981). Functional play emerges during the second year as infants move from indiscriminant stereotypical play to relating objects in a nonfunctional idiosyncratic manner to using objects in an appropriate way

(Bigelow, McLean, & Proctor, 2004). Symbolic play is defined as substituting one object for another, attributing an imaginary property to something or someone, and referring to an absent object or person as if it was present. From a Piagetian point of view, it is suggested that symbolic play, which develops in the third year is underpinned by a more complex representational system than that which underlies the production of functional play. Symbolic play requires not only a first-order representation of an object as another object but also a second-order representation about this representation (a metarepresentation), namely, that the representation is not true. Moreover, in symbolic play the as-if component of the action exists from the observer's as well as the actor's point of view. On the other hand, functional play does not necessarily involve pretense, while the as-if component of the action exists from the observer's but not from the actor's point of view (Baron-Cohen, 1987; Leslie, 1987). However, the meaningful and imaginative use of objects depends heavily on an extensive understanding of shared reality, which is understood because it is shared. At this age, comprehension of what the mother says about or does with objects is much more evident than it was a few months before, but it is dependent on the interpersonal context. In other words, children's understanding of the meanings carried in linguistic utterances as well as of the way objects function are abut on a richer conception that has been accomplished through mutually coordinated interactions with significant others in the previous months (Trevarthen, 1994).

A number of studies in typical and atypical populations have well documented that joint attention facilitates language development. Tomasello and Farrar (1986) showed that inside, as opposed to outside, episodes of joint attention children produced more utterances, more words, and more words referring to objects. Moreover, inside joint attention episodes maternal references to objects that were already the child's focus of attention were positively correlated with the child's vocabulary. It has also been shown that joint attention measures contribute to multiple regression equations predicting individual differences in language development in normally developing children (Mundy, Fox, & Card, 2003) as well as in children with Down syndrome (Mundy, Kasari, Sigman, & Ruskin, 1995; Yoder & Warren, 2004). Mundy and Gomes (1998) argued that aspects of joint attention are related differentially to expressive and receptive language. In particular, in typically developing children initiating joint attention is a significant predictor of expressive language, while responding to joint attention is related to both expressive and receptive language. Similarly, in children with autism the ability to respond to the joint attention bids of others was positively correlated with receptive language scores and mean length of utterance, while better joint attention skills were associated with greater language development (Bono, Daley, & Sigman, 2004; Murray et al., 2008). As regards the relation between joint attention and functional play, Bigelow and her colleagues (2004) observed that typically developing infants displayed more functional play during joint attention episodes with the mother compared to outside joint attention episodes. Functional play within joint attention, but not outside joint attention, correlated with functional play when alone. The authors conclude that mothers' ability to scaffold infants' activities within joint attention may facilitate infants' advanced play.

Moreover, there is abundant evidence of parallel developments in play and language that are explained from a Piagetian perspective as deriving from a common underlying capacity for cognitive representation. These studies mostly distinguish between functional and symbolic play and investigate the relation of these two kinds of play with language development. Lewis and her colleagues (Lewis, Boucher, Lupton, & Watson, 2000) examined 40 typically developing children aged 1 to 6 years and found that symbolic play was signifi-

cantly positively correlated with expressive and receptive language, while functional play was significantly positively correlated with expressive language, but not with receptive language. The authors argue that the correlation between functional play and expressive language may be explained by the fact that both functional acts on particular objects (e.g., pretending to give Teddy a biscuit) and the understanding and production of the corresponding words (e.g., "Teddy," "biscuit," "eating") require the formation of relevant concepts. On the other hand, symbolic play requires both conceptual understanding and symbolizing ability, as does language. Therefore, symbolic play may be more strongly related to language than functional play is.

Mundy and his colleagues (Mundy, Sigman, Kasari, & Yirmiya, 1988) investigated the relation between nonverbal communicative abilities, play, and language in children with Down syndrome aged 18–48 months. The results demonstrated that in children with Down syndrome expressive and receptive language skills were significantly positively correlated with request behaviors, while in normally developing children expressive and receptive language skills were significantly positively correlated with indicative behaviors. Moreover, it was observed that in children with Down syndrome functional and symbolic play were significantly positively correlated with expressive and receptive language skills, while this correlation was not observed in the control group.

The investigation of the relation between abilities appertaining to joint attention, functional play and symbolic play, and language in typical and atypical populations may contribute to a more thorough understanding of the role of intersubjective communication in the generation and sharing of meanings. Nevertheless, there are very few studies addressing this issue in children with WS. This line of research is based on the premise that WS is a developmental disorder and thus the most appropriate research models should be developmental ones (Mervis, 2003).

Laing and her colleagues (2002) compared a group of young children with WS (mean chronological age 31 months, mean mental age 14 months) with a mentally matched group of typically developing infants and toddlers. Children's social skills were assessed from videotapes of child-experimenter interactions in experimental situations in the laboratory, during which verbal communication was kept at a minimum, using the Early Social Communication Scales (ESCS; Mundy & Hogan, 1996). The ESCS is based on a cognitive developmental model that assumes that successful interactional skills depend on adaptive capacities that entail successful accommodation and assimilation to the social environment. This model derives from the cognitive developmental theories of Piaget and Werner and Kaplan. The results of this study showed that children with WS produced less pointing and less behaviors included in the category Initiating Requesting (e.g., combining eye contact with a reach, pointing to indicate desired object). Moreover, while the WS group produced more behaviors from the Social Interaction category than the control group (e.g., eye contact after tickle, turn-taking with a ball and a car), these behaviors were not well integrated with other aspects of joint attention. The authors argue that the behavior of the WS group was predominantly dyadic, whereas the behavior of the control group was predominantly triadic.

Klein-Tasman and her colleagues (Klein-Tasman, Mervis, Lord, & Phillips, 2006) investigated the sociocommunicative skills of 29 children with WS aged 30 to 63 months (mean age 41.59 months) who had very limited language abilities. The average age equivalent ranged from 12 to 35.5 months (mean 22.9 months). Sociocommunicative skills were assessed using the Autism Diagnostic Observation Schedule (ADOS Module 1; Lord, Rutter, DiLavore, & Risi, 1999) on the basis of recent findings demonstrating that

the types of communicative problems observed in WS overlap with the difficulties exhibited in Autism Spectrum Disorders (Mervis & Becerra, 2007). The ADOS assesses difficulties in the domains of verbal and nonverbal communication, integration of various communicative behaviors, social reciprocity, functional play, creativity, and imagination. Children are observed during play-like interactions with an examiner where predetermined materials are used in structured tasks (e.g., a pretend birthday party). Results demonstrated that children with WS show abnormalities in pointing, giving, showing, and eye contact. Also, individuals with WS very commonly showed abnormalities in their functional play, creativity, and imagination. Initiation and response to joint attention showed some abnormality, but for less than half of the participants, while very few participants showed any abnormality in shared enjoyment or requesting.

Taking into account the above considerations, the present study aimed to examine joint attention, functional play, and symbolic play as well as their relation to language abilities in toddlers with WS during spontaneous interactions. On the basis of previous studies, the hypothesis was formed that children with WS will show deficiencies in nonverbal communicative behaviors, functional play, and symbolic play compared to typically developing children matched for visuospatial, fine-motor, and linguistic skills.

METHODS

Participants

In the present study, 11 children with WS (6 boys and 5 girls, aged 3.2 to 7.4 years) and 11 typically developing (TD) toddlers (6 boys and 5 girls) participated and were matched for visuospatial, fine motor, and linguistic abilities on the raw scores of the Müllen Scales of Early Learning (MSEL). The children with WS were recruited from the Genetic Syndromes Association, a Greek-based parent support group, and had been diagnosed clinically as well as by means of the fluorescence in situ hybridization (FISH) genetic test for deletion of the elastin gene. All participants came from middle-class Greek-speaking families. Mothers' age in the WS group ranged from 29–48 years (mean age 36.6 years), while mothers' age in the typically developing group ranged from 29–38 years (mean age 34.4 years). The vast majority of mothers in both groups had received technological or university education.

None of the participants exhibited severe sensory or motor deficiencies or had been hospitalized within the previous 6 months. Among children with WS, 8 attended a mainstream private preschool, 1 child attended mainstream public preschool, 1 child attended mainstream primary school, and 1 child did not attend school. The majority (64%) of children with WS received early intervention services by a speech therapist and an occupational therapist approximately three times a week. None of the participants in the control group attended any preschool. Written parental permission was attained before the children's participation in the study.

Materials

Visual processing, fine motor skills, and receptive and expressive language were assessed using the MSEL (Müllen, 1995). This test is administered in infants and preschool children from birth to 68 months and is commonly used in studies of toddlers and young preschoolers with developmental disorders, WS included (Klein-Tasman et al.,

2006). Visual Reception scale measures visual processing, visual discrimination, and visual memory. Fine Motor scale measures fine motor planning and control. The Receptive Language scale measures the child's understanding of spoken language, knowledge of propositional and spatial concepts, ability to follow oral instructions, auditory short- and long-term memory, auditory organization sequencing, auditory-visual memory, retrieval of facts, and general knowledge. Failure in the Receptive Language scale is often due to an inability to derive linguistic meaning from language. Expressive Language scale assesses the child's ability to use speech to communicate and express ideas, vocabulary, abstract thinking and reasoning, auditory short- and long-term memory, and comprehension of auditory information. In some items of the test, it is marked not only if the child has passed or not but also the degree of one's performance, providing thus a more detailed and accurate account of the child's developmental level.

In addition, productive vocabulary was measured using the Language Development Survey (LDS; Rescorla, 1989). The LDS is a checklist consisting of 310 words arranged into 14 semantic categories, namely: food, toys, outdoors, animals, body parts, places, actions, household, personal, people, clothes, vehicles, modifiers, and others. The LDS assesses spontaneous word production in children aged 18 to 35 months. The LDS has good concurrent validity with object and picture naming on various standardized instruments (Rescorla, 1989; Rescorla & Alley, 2001; Rescorla, Hadicke-Wiley, & Escarce, 1993). Although some of the participants were too old to be scored in this form, it was decided for comparison purposes that all participants should receive the same form. Mothers were asked to mark on the list the words their child says spontaneously, even if they are pronounced in an idiosyncratic way. The form also provides the opportunity for mothers to write in additional words, but these words were not included in any of the analyses described below.

According to the findings presented in Table 1, there were no significant differences between the WS group and the TD group in either of the measures obtained. Therefore, the two groups are considered to be well matched in terms of visual processing, fine motor skills, language comprehension, and language production.

Nonverbal communicative abilities and play performance were assessed from video recordings of spontaneous mother-child interactions in a semi-structured situation taking place at home.

Procedure

All children were visited at their home three times during the month. Home environment was considerate to be more appropriate for eliciting a representative sample of the child's spontaneous behaviors, compared to the laboratory setting (Papaeliou, Minadakis, & Cavouras, 2002). In the first visit each child was administered the Visual Reception scale and the Fine Motor scale of the MSEL, while the mother completed the LDS as well as a questionnaire on demographic information and the child's medical background. In the second and third visits children were administered the Receptive and Expressive Language scales of the MSEL and were videorecorded while playing with their mother in a semi-structured situation with toys provided by the researcher. The set of toys included two different-sized dolls, doll furniture, a tea set, a telephone, a brush and a mirror, a school bus with little people in it, blocks, toy animals, a book, and a wind-up mechanical toy. Mothers were asked to play with their child as they would normally do, introducing

Table 1 Performance on Visual Reception Scale, Fine Motor Scale, Expressive and Receptive Language Scales, and Vocabulary Production.

	WS	TD	*t*-test	*p*
Chronological age (in months)*			5.26	.000
Mean	63.0	30.2		
Range	38 – 89	16 – 49		
SD	17.7	8.9		
Visual reception[1]			0.09	.924
Mean	36.2	35.8		
Range	20 – 47	23 – 47		
SD	9.8	7.4		
Fine motor [1]			0.68	.502
Mean	31.3	29.4		
Range	24 – 42	20 – 47		
SD	5.9	7.0		
Receptive Language [1]			0.62	.544
Mean	31.9	30.2		
Range	23 – 42	14 – 42		
SD	7.0	6.5		
Expressive Language [1]			0.45	.659
Mean	32.2	30.6		
Range	16 – 45	15 – 46		
SD	8.5	8.6		
Vocabulary Production [1]			–0.419	.679
Mean	227.3	244.5		
Range	15 – 310	11 – 310		
SD	109.1	88.2		

[1]Raw scores.
*$p < .05$.

all the toys provided. Each play session lasted approximately 30 minutes. This process yielded a total of 1 hour of videorecording for each child.

The coding scheme for the behavior analysis was based on previous schemes (Laing et al., 2002; Papaeliou & Trevarthen, 2006) and was further expanded from an inductive analysis of the video-recordings. Nonverbal communicative behaviors were grouped into three main categories: Joint Attention (JA), Request (R), and Interpersonal (IP). Functional Play (FP) included the following acts: (a) conventional acts on toys directed to self (e.g., brushing one's hair); (b) conventional acts on toys directed to mother (e.g., holding telephone to the mother's ear); (c) conventional acts on toys directed to a doll (e.g.. placing a spoon to a doll's mouth); and (d) conventional use of two or more objects in combination (e.g., stirring a spoon in a pot). Symbolic play included: (a) doll as agent: The child plays with a doll as if it could act as an independent agent (e.g., could walk); (b) substitution play: The child uses an object as if it was a different object (e.g., substituting a ball for food to feed a doll); (c) imaginary play: The child creates objects or people that are not present in the immediate environment (e.g., talking to someone on the phone). However, during spontaneous communication a particular behavior may not be initiated by the child; rather, it may be directed by the communicative partner, usually the mother. In directive communicative exchanges mothers require verbally or nonverbally the child to attend to, or to produce an action, or to provide information (Holtzman, 1972; Kaye & Charney, 1980). Indeed it has been demonstrated that mothers of typically developing children very

Table 2 Description of the Coding Scheme for Nonverbal Behaviours.

Categories/Subcategories & Behaviors	Description of Behaviors
JOINT ATTENTION	
Joint gaze	
Converging Looking	Child and mother look at the same toy.
Alternating Gaze	Child alternates gaze between mother and a toy.
Eye Contact with Toy	Child makes eye contact while manipulating a toy.
Following Interest	The child looks at the same direction with the mother or at the direction indicated by the mother's pointing, giving, or showing.
Communicative gestures	
Pointing	Child's index finger is extended in direction of a toy.
Showing	Child holds out a toy to mother but does not permit her to take it.
Giving	Child puts a toy into mother's hand and permits her to take it.
REQUEST	
Searching for Mother with Toy	Child looks at mother while she looks away as he/she manipulates a toy.
Requesting Toy	Child points to a toy that is out of reach.
Requesting Action with Toy	Child shows or gives a toy to the mother that he/she cannot use properly.
INTERPERSONAL	
Teasing Mother	Child teases mother.
Responding to Teasing	Child responds positively to mother's teasing.

often use directives, in order to enhance the communicative performance of their child. Moreover, it has been shown that mothers of intellectually disabled toddlers are more directive than the mothers of typically developing toddlers, while intellectually disabled toddlers are more compliant than their nonretarded peers (Mahoney, Fors, & Wood, 1990; Roach, Barratt, Miller, & Leavitt, 1998). Thus, the behavior of following mother's interest, the communicative gestures as well as the behaviors included in the category "Functional Play" were further characterized as spontaneous, if they were initiated by the child or, as directed, if they were produced as a compliance to a mother's request. The coding scheme for nonverbal behaviors is described in Table 2.

Twenty minutes of continuous footage from each play session for each child were analyzed and the frequency of each codified behavior per minute was noted. The first 5 minutes of each session were not analyzed so as to counter adaptation effects. Times where play was interrupted by irrelevant stimuli (e.g., bell ringing) or where it was difficult to see clearly what the mother and the child were doing were excluded from the analysis. Interrater reliability was assessed with videotaped data from a random selection of 4 children from the WS group and 4 children from the TD group. Cohen's kappa ranged from 0.75 to 0.93 for the WS group and 0.79 to 0.95 for the TD group.

RESULTS

As it is frequently the case with atypical groups, the data showed large standard deviations. Therefore, group differences were calculated using the nonparametric test Mann-Whitney U. Table 3 presents the mean number of times each behavior was observed in each group, the standard deviation, and the level of significance in the Mann-Whitney U.

The findings showed that contrarily to TD children, children with WS did not exhibit any alternating gaze at all. However, children with WS demonstrated significantly more spontaneous following interest compared to children in the TD group. One interesting

Table 3 Performance on Nonverbal Communicative Behaviors, Functional Play, and Symbolic Play.

	WS		TD		
	M	*SD*	*M*	***SD***	*P*
JOINT ATTENTION					
Joint gaze					
Converging Looking	39.8	0.4	39.6	10.7	.796
Alternating Gaze	0.0	0.0	1.2	2.8	–
Eye Contact with Toy	23.1	7.7	8.3	10.5	.315
Spontaneous Following Interest*	29.8	6.3	16.3	13.1	.012
Directed Following Interest	6.9	3.5	5.3	4.0	.280
Communicative gestures					
Spontaneous Pointing	5.1	2.9	6.6	4.3	.579
Directed Pointing	0.8	1.1	0.5	0.9	.393
Spontaneous Showing	3.9	3.1	3.7	5.4	.353
Directed Showing*	1.0	1.2	0.2	0.4	.049
Spontaneous Giving	3.2	2.6	1.6	1.5	.165
Directed Giving*	1.7	1.0	1.1	1.9	.047
FUNCTIONAL PLAY					
Spontaneous Functional Play*	16.5	5.3	21.9	7.4	.031
Directed Functional Play	9.7	4.7	11.3	7.2	.971
SYMBOLIC PLAY					
Doll as Agent	4.5	4.6	6.4	5.4	.481
Substitution play	3.4	4.6	1.6	2.8	.190
Imaginary Play*	5.1	2.4	7.4	3.1	.048
REQUEST					
Request for Toy	3.7	3.2	3.5	4.9	.247
Request for Action with Toy	2.1	2.7	0.7	0.9	.436
Searching for Mother with Toy	1.4	2.7	0.2	0.6	.436
INTERPERSONAL					
Teasing Mother	0.6	0.8	0.6	1.9	.353
Responding to Teasing*	1.3	1.1	0.1	0.3	.009

*$p < .05$.

finding was that children with WS exhibited significantly more directed showing and directed giving, compared to TD children. Children with WS did not differ significantly from TD children in any of the other behaviors included in the category "Joint Attention."

As regards functional play, it was demonstrated that children with WS exhibited significantly less spontaneous functional play than TD children. On the other hand, no significant differences were observed between the two groups in directed functional play. Moreover, children with WS demonstrated significantly less imaginary play compared to TD children. No group differences were observed in the behaviors doll as agent and substitution play.

On the contrary, children with WS showed significantly more positive reactions to mothers' teasing compared to TD children, while group differences in the behavior child teases mother were not significant. Also, children with WS did not differ significantly from TD children on any of the behaviors included in the category "Request."

Correlations between measures of language development, joint attention, functional play, and symbolic play as well as age were also calculated for each group, using the Pearson *r* correlation coefficient. Among TD children expressive language skills showed significant positive correlations with receptive language skills and vocabulary production

(r = .891, p < .000 and r = .737, p = .006, respectively). Also, receptive language skills showed significant positive correlation with vocabulary production (r = .777, p = .003). A striking finding was that in TD children of this age there was a significant negative correlation between joint attention and expressive language, receptive language, and vocabulary production (r = .855, p = .003; r = .771, p = .015; and r = .690, p = .027, respectively). On the contrary, imaginary play showed marginal positive correlation with expressive and receptive language skills (r = .361, p = .08 and r = .347, p = .1, respectively) (Table 4). Moreover, it was shown that as TD children grow older, they score significantly higher in measures of expressive language, receptive language, and vocabulary production (r = .772, p = .002; r = .806, p = .003; and r = .651, p = .022, respectively), while they exhibit significantly less Joint Attention behaviors and significantly less Functional Play (r = −.725, p = .027 and r = −.605, p = .038 respectively) (Table 6). It seems that after the age of 2.5 years TD children rely more on language rather than nonverbal behaviors for achieving cooperative communication.

Among children with WS, expressive language skills showed significant positive correlations with receptive language skills and vocabulary production (r = .814, p = .002 and r = .808, p = .008 respectively). Also, receptive language skills showed significant positive correlation with vocabulary production (r = .811, p = .008). Moreover, in this group a positive correlation between doll as agent and receptive language and a positive correlation between imaginary play and vocabulary production also approached significance (r = .398, p = .077 and r = .417, p = .057, respectively). Also, it was demonstrated that as children with WS grow older, they score significantly higher in measures of

Table 4 Correlations of Language Measures with Nonverbal Communicative Behaviors, Functional Play, and Symbolic Play for the TD Group.

	Expressive Language	Receptive Language	Vocabulary Production
Receptive language	.891***	–	.777**
Vocabulary production	.737**	.777**	–
Joint Attention	−.855**	−.771*	−.690*
Functional Play	−.348	−.392	−.266
Doll as Agent	.300	.269	.300
Substitution Play	−.041	−.317	−.377
Imaginary Play	.361	.347	.419

*p < .05. **p < .01. ***p < .001.

Table 5 Correlations of Language Measures with Nonverbal Communicative Behaviors, Functional Play, and Symbolic Play for the WS Group.

	Expressive Language	Receptive Language	Vocabulary Production
Receptive Language	.814**	–	.811**
Vocabulary Production	.808**	.811**	–
Joint Attention	−.367	−.079	−.036
Functional Play	−.382	−.380	−.358
Doll as Agent	.384	.398	.344
Substitution Play	.134	−.079	.386
Imaginary Play	.213	.412	.417

*p < .05. **p < .01. ***p < .001.

Table 6 Correlations of Age with Language Measures, Nonverbal Communicative Behaviors, Functional Play, and Symbolic Play for the Two Groups.

	Age	
	WS	TD
Expressive Language	.686*	.772**
Receptive Language	.589	.806**
Vocabulary Production	.711*	.651*
Joint Attention	.106	−.725*
Functional Play	.361	−.605*
Doll as Agent	−.037	.027
Substitution Play	.394	−.148
Imaginary Play	.418	.351

*$p < .05$. **$p < .01$. ***$p < .001$.

expressive language, receptive language, and vocabulary production ($r = .686$, $p = .032$, $r = .589$, $p = .047$ and $r = .711$, $p = .020$, respectively). The WS group did not exhibit any other significant correlation between age and nonverbal communicative behaviors, functional play, and symbolic play (Table 5).

DISCUSSION

The present study compared toddlers with WS with TD toddlers around 2.5 years matched for visuospatial, fine motor, and linguistic skills and revealed intriguing differences between the two groups in symbolic play, functional play as well as in nonverbal communicative behaviors. In particular, the clinical group exhibited less spontaneous conventional acts with toys towards the self, the mother, a doll, or another toy during interpersonal communication, compared to the control group. Moreover, compared to TD children, children with WS demonstrated less imaginary play, which consists of the creation of objects or people that are not present in the immediate environment. Similarly, Klein-Tasman et al. (2006) demonstrated that toddlers with WS usually show deficiencies in functional play and imagination. On the other hand, children with WS in this sample did not differ from TD toddlers in behaviors related to spontaneous expression of joint attention. This finding contrasts with findings of other studies that demonstrate that children with WS with mental age around one year initiate and respond spontaneously to joint attention bids less than typically developing children at the same level of general cognitive ability (Laing et al., 2002; Mervis & Bertrand, 1997). This discrepancy between the results of different studies may be explained by differences between the samples in mental age. Children with WS of mental age around one year may not be able to produce age appropriate behaviors, such as joint attention. On the other hand, older children with WS may be more capable of producing spontaneously joint attention behaviors corresponding to a younger age, but they exhibit deficiencies in age-appropriate cooperative behaviors, such as functional and imaginary play. Nevertheless, this hypothesis deserves further investigation by a longitudinal study that would examine the development of cooperative behaviors in children with WS.

A noteworthy finding of the present study was that children with WS demonstrate more communicative gestures, such as showing or giving under their parents' guidance, compared to TD children. Mervis and Bertrand (1997) also observed that parents of children

with WS direct episodes of joint attention by using the children's eye gaze to determine what they are looking at or by deliberately placing an object in front of the children's eyes before labelling it for them. Thus, it seems that in toddlers with WS the formation of joint attention episodes, which are considered as critical for vocabulary development, may rely to a greater degree on the parents conduct, rather than the child's initiative.

Moreover, in accordance with other work (Laing et al., 2002; Sullivan & Tager-Flusberg, 1999; Tager-Flusberg, Boshart, & Baron-Cohen, 1998; Tager-Flusberg & Sullivan, 2000), the present study showed that children with WS show relatively good performance in behaviors related to dyadic social interactions. This result supports further the argument that children with WS may be more interested in people than in objects (Bertrand, Mervis, Rice, & Adamson, 1993).

The finding that children with WS have relatively good skills for interpersonal interactions but they show deficiencies in cooperative interactions has originally been explained by the model of Theory of Mind (ToM; Tager-Flusberg & Sullivan, 2000). According to this model, social intelligence comprises of two components where mental stages are represented: a primary social-perceptual component and a higher order social-cognitive component. The social-perceptual component refers to the immediate intuitive representation of a person's mental state, based on information directly available in faces, voices, and body posture and movement. This interpretation is the result of the interaction between innately specified mechanisms for attending to human social stimuli and social information that is obtained through continued interactions with people. By the end of the first year the social-perceptual component makes infants capable of interpreting more complex intentions and emotional states of other people and judging what another person is attending to or is planning to do. The primary areas of the brain that are involved in social-perceptual information processing include the amygdala and associate regions of medial-temporal cortex. The social-cognitive component of the ToM builds on the earlier emerging social-perceptual component. This component is involved in making mental state inferences that depend on integrating information not only from perceptual cues but also from sequences of events over time. The social-cognitive component is more closely linked to other cognitive or information-processing systems, such as working memory and language. It is noteworthy, that language is considered to play a particularly significant role in the development of this component of the ToM. The development of the social-cognitive component begins during the early preschool years, when children begin to talk and reason about mental states and is regulated by regions in the prefrontal cortex (Tager-Flusberg, 2005; Tager-Flusberg & Sullivan, 2000).

In this framework the extremely strong interest in and sensitivity to others showed by children with WS, which was also observed in the present study, were originally supposed to reflect a relative sparing in the social-perceptual component of the ToM in this population (Sullivan & Tager-Flusberg, 1999; Tager-Flusberg et al., 1998; Tager-Flusberg & Sullivan, 2000). However, latter studies provide evidence that people with WS may not be spared in their ability to perceive mental state information from facial and vocal expressions. Rather, the unusual sociability that is a central feature in WS may be mediated by a unique pattern of arousal and emotional functioning (Skewerer et al., 2006, 2009; Tager-Flusberg, 2005). In addition, one may be inclined to attribute the deficiencies in functional and symbolic play observed in the WS group to impairments in the social-cognitive component, since functional and symbolic play rely on the understanding and sharing of the others' intentions when acting on objects. The ToM suggests that the development of the social-cognitive component lies on the development of language, especially the use of

communication verbs and verbs referring to mental states, which begin to appear after the age of 3 years. However, in the present study participants in the control group, who are, on average, younger than 3 years, exhibit significantly more functional and imaginary play compared to the language-matched WS group.

In contrast to the ToM, the Theory of Intersubjectivity (ToI) provides empirical support to the view that shared purposes regarding actions, as these are expressed in conventional use of tools and in pretend play, constitute presuppositions for the development of language, since in language acquisition the learner does not learn from another person, but through and with another person (Tomasello, Kruger, & Ratner, 1993; Trevarthen, 1994). Moreover, the ToI suggests that the ability to share intentions and feelings is not distinct from the ability to perceive social stimuli in interpersonal communication. Rather, these abilities lie in a continuum and the development of the former depends on the development of the latter. The infant's ability to understand the other's emotionality changes from a simple interest in expression at birth to a sensitivity to the reciprocity of emotions at 2 months to a more complex management of affects at 6 months and then, at 9 months, to a more pronounced interest in exploring specific emotional reactions and relating them to external targets. Similarly, an understanding of the other's communicative intentions is changing from a recognition of communicativeness and its absence or appropriateness at 2 months, to a recognition of invitations to games at 6 months, to a recognition of commands and prohibitions at 9 months (Reddy, 1999; Trevarthen, 1994). At this age an infant exhibits a new readiness to tune in with the intentions and interests of a partner in joint exploration and use of objects. This ability forms the basis for a creative imagination of roles, actions, and "tools" that are arbitrary or symbolic.

Data obtained from neuro-anatomical studies also advocate the Theory of Intersubjectivity (Bush, Luu, & Posner, 2000; Cowley, 2007; Morris et al., 1998; Trevarthen & Aitken, 1994, 2003). These studies provide evidence that in typically developing individuals the expression of coherent emotions in coordination with the expressions of other persons is regulated by the Intrinsic Motive Formation (IMF), which involves the brain stem, the basal ganglia, and limbic structures. The IMF is present at birth (Trevarthen & Aitken, 1994). The later maturing of neocortical circuits, which regulate conscious activity, emerges in reciprocal, dynamic, and increasing involvement with IMF. In particular, the integration of emotional expressions with sensory processing, motivation, intention, attention, learning, planned and purposeful action as well as understanding of the other's state of mind is mediated through robust bidirectional pathways between the structures involved in the IMF and the amygdala as well as the temporal and frontal cortex, especially the orbitofrontal cortex and the temporal mesocortex (Bush et al.; Cowley; Morris et al.; Trevarthen & Aitken, 1994, 2003).

If the data from the present and previous studies are synthesized it is illustrated that children with WS do not exhibit age-appropriate forms of communication. Specifically, the extreme social interest observed in this group, even before the first year, seems quite inappropriate in both quality and quantity (Bertrand et al., 1993; Mervis et al., 2003). As regards cooperative communication, it is well documented that infants with WS are delayed in the onset of joint attention (Laing et al., 2002; Mervis & Bertrand, 1997), while the present and other studies (Klein-Tasman et al., 2006) reveal that toddlers with WS show marked deficiencies in functional and symbolic play. At the neuroanatomical level, individuals with WS show abnormalities in neural systems that underlie emotional sharing, cooperative communication, and language development. In particular, it has been demonstrated that individuals with WS exhibit widely distributed brain-volume reductions

in the parietal and occipital lobes, thalamus, basal ganglia, and the midbrain. On the other hand, frontal lobes and amygdala are relatively preserved or even enlarged. This finding may explain the unusual affect regulation and language production in WS (Chiang et al., 2007; Reiss et al., 2004).

The finding of the present study that a group of WS toddlers may reach a similar level of language development, despite their deficiencies in functional and symbolic play, enforces the view that there may be possibly alternative paths to early language competence (Mervis & Bertrand, 1997). However, further research is needed to clarify what these paths might be. What this study demonstrated about the communicative abilities of children with WS may be potentially useful for the formation of more effective intervention programs for this population.

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