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Early grammatical development in Spanish children with Down syndrome*

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ABSTRACT

The objective of this work was to analyze morphosyntactic development in a wide sample of children with Down syndrome (DS) ($n=92$) and children with typical development (TD) ($n=92$) with a mental age (MA) of 20 to 29 months. Children were individually matched for gender and MA (Analysis 1) and for vocabulary size (Analysis 2). Information about morphosyntax was obtained using an adaptation of the CDI for children with DS. In both analyses, the number of children with DS and with TD who combined words was similar. Analysis 1 showed that children with DS produced shorter utterances, with less morphosyntactic complexity and less morphological suffixes than children with TD, despite having the same mental age. The developmental pattern was similar, although slower in children with DS. Analysis 2 showed that the performance of children with DS was lower than the performance of children with TD in relation to morphosyntactic complexity and morphological suffixes.

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INTRODUCTION

One of the main characteristics of individuals with Down syndrome (DS) is language impairments in childhood, adolescence, and adulthood. The language impairments are more than would be expected from their level of cognitive development (Chapman, 1995; Fowler, 1990; Vicari, Caselli & Tonucci, 2000; Yoder & Warren, 2004). They are also more severe than the linguistic impairments found in studies of other syndromes, such as Williams syndrome (WS) and Specific Language Impairment (SLI) (Caselli, Monaco, Trasciani & Vicari, 2008; Eadie, Fey, Douglas & Parsons, 2002; Singer Harris, Bellugi, Bates, Jones & Rossen, 1997; Vicari, Caselli, Gagliardi, Tonucci & Volterra, 2002).

It is generally considered that lexical development is somewhat preserved in children with DS compared to their other linguistic abilities. Indeed, several studies have shown that productive vocabularies emerge at roughly the same mental age (MA) in children with DS and children with typical development (TD) (Berglund, Eriksson & Johansson, 2001; Cardoso-Martins, Mervis & Mervis, 1985; Caselli, Vicari, Longobardi, Lami, Pizzoli & Stella, 1998; Galeote, Sebastián, Checa, Rey & Soto, 2011; Galeote, Soto, Checa, Gómez & Lamela, 2008; Vicari *et al.*, 2000). However, delays are observed as children with DS grow older (Byrne, Buckley, MacDonald & Bird, 1995; Fowler, Gelman & Gleitman, 1994; Miller, 1988, 1992, 1999; but see Galeote *et al.*, 2008, 2011, and Vicari *et al.*, 2000, for contrary evidence).

In view of these vocabulary data, both morphology and syntax seem to be the most affected areas. In general, children with DS show a delay in the transition from one-word to two-word utterances (Iverson, Longobardi & Casselli, 2003). Once they start combining different words, their utterances are still shorter as measured by the mean length of utterance (MLU) (Chapman, Seung, Schwartz & Kay-Raining Bird, 1998), and their syntactic constructions are less complex (Abbeduto *et al.*, 2003; Chapman, Hesketh & Kistler, 2002). With regard to the acquisition of grammatical morphemes, children with DS have serious difficulties with grammatical words (articles, prepositions, etc.) and inflectional morphology, even though it seems that the order of morpheme acquisition is the same for children with TD (Chapman *et al.*, 1998; Eadie *et al.*, 2002; Roberts, Price, Barnes *et al.*, 2007; Rutter & Buckley, 1994).

In most of these studies the participants were children, adolescents, and adults with DS with a higher chronological age than is typical in studies on early language development in children with TD. However, knowledge of the initial stages of language acquisition in children with DS is of great theoretical importance, to confirm or refute any kind of dissociation between language and cognition, as well as between the different components of language (Vicari *et al.*, 2000).

Most of these studies have been carried out with English-speaking children. It is necessary to conduct research on other languages, in order to understand the influence of specific characteristics of the language being learned when it comes to establishing specific developmental profiles.

In fact, cross-linguistic studies have advanced knowledge about the universal and language-particular aspects of typical language development (Slobin, 1985). Likewise, we think that it is necessary to analyze language development in atypical populations. Several relevant studies regarding language development in children with DS have been conducted with Italian children. Italian is a Romance language, morphologically much richer than English. The information about children speaking such languages could therefore be relevant for the study of language development in children with DS. Below we will briefly discuss some of these studies.

Caselli *et al.* (2008) studied sixteen children with DS and sixteen children with SLI (*M* of MA = 54 months), Vicari *et al.* (2000) studied fifteen children with DS (*M* of MA = 30·7 months), and Zampini and D'Odorico (2011) studied twelve children with DS (*M* of MA = 31 months). All of these studies MA-matched a group of children with DS with a group of children with TD, and focused on early morphosyntactic development. All of them studied, among other measures, both lexical and morphosyntactic production. Even though different linguistic measures were used, a series of similar results were found.

There were no significant differences in any of the studies, with regard to the size of the lexicon, between the groups of children with DS and the groups of children with TD. However, there were significant differences between these groups of children in grammatical development. The MLU was significantly lower in children with DS. These children also produced simpler sentences and fewer subordinate clauses. With regard to morphology, children with DS also scored significantly lower and made more mistakes and omissions. They even performed more poorly than the children with SLI (Caselli *et al.*, 2008). Interestingly, despite this apparent dissociation between lexical and grammatical development, Vicari *et al.* (2000) and Zampini and D'Odorico (2011) found a high correlation between size of vocabulary and grammatical development. This result has serious theoretical implications, since it shows that there is a relationship between grammatical and lexical components. These results are contrary to Bates, Dale, and Thal (1995), who claimed that data from children with DS showed a significant dissociation between grammar and lexicon. In particular, they stated that 'lexical size is a necessary but not sufficient condition for the acquisition of grammatical function words, the onset of word combinations, and growth in sentence complexity' (p. 147).

These correlations support the hypothesis of Bates and Goodman (1999) of a close relationship between vocabulary size and the emergence of

grammar, for which a critical mass (between 50 and 100 words) is necessary. Vocabulary size increases as grammar becomes more complex in its forms, and grammar complexity increases as vocabulary size grows. In sum, morphosyntactic elements emerge from a unified language system (Dixon & Marchman, 2007). On the other hand, Bates and Goodman (1999) found a curvilinear relationship between lexicon and grammar. According to these authors, this relationship suggests that lexical development precedes grammatical development (see Dixon & Marchman, 2007, for an alternative interpretation).

It is necessary to point out that the studies with Italian children mentioned above had a small number of participants, and most of them had an MA of more than 30 months. However, the variability in the early stages of language development makes it necessary to include younger participants and wider samples. In particular, as Eadie *et al.* (2002) indicated, small groups cannot be representative of the reference population. In addition, a small sample size leads to low power, which affects the verification of hypotheses.

The aim of this work is to analyze the early stages of morphosyntactic development in a large sample of children with DS and children with TD (20–29 months MA). The children were acquiring Spanish, a language that, like Italian, has a much richer morphological system than English. We are also interested in finding out whether or not there is a dissociation between vocabulary size and grammatical development.

Given the lack of data in Spanish, our research is exploratory. Two analyses were performed to study morphosyntactic development of children with DS and children with TD. First, both groups of children were individually MA- and gender-matched. Second, trying to find out whether there was an association between vocabulary size and morphosyntactic development, both groups of children were matched for vocabulary size. Morphosyntactic measures were: word combinations, MLU, morphosyntactic complexity, and inflectional morphology.

METHOD

Participants

For the first analysis, the participants were 184 Spanish children with an MA of 20 to 29 months (assessed by the Brunet–Lézine Psychomotor Development Scale-Revised; Josse, 1997): ninety-two children with DS and ninety-two with TD. This sample came from a wider sample for the study of language development in children with DS with an MA of 8 to 29 months (Galeote *et al.*, 2011). It was decided that the lowest age should be an MA of 20 months, since children of lower ages showed levels of

TABLE 1. *Mean and range (in months) for chronological age (CA) and mental age (MA) in the DS and TD groups*

MA level	Group	Girls	Boys	Total	CA mean (range)	MA mean (range)
20–22	DS	10	23	33	39·54 (20·97–68·40)	21·06 (20·00–22·90)
	TD	10	23	33	21·42 (16·03–30·30)	21·12 (19·90–23·00)
23–25	DS	15	14	29	42·33 (27·00–64·00)	23·99 (23·00–25·80)
	TD	15	14	29	23·81 (19·37–31·23)	24·04 (23·00–26·00)
26–29	DS	16	14	30	57·05 (39·00–71·03)	27·35 (26·00–29. 40)
	TD	16	14	30	27·09 (22·57–33·43)	27·32 (25·80–29. 40)
TOTAL	DS	41	51	92	46·13 (20·97–71·03)	24·03 (20·00–29. 40)
	TD	41	51	92	24·02 (16·03–33·43)	24·06 (19·90–29·40)

response close to zero on all the measures. Groups were further divided into three-month age ranges in order to detect possible developmental differences: 20–22, 23–25, and 26–29 months. Means (and ranges) of the CA and MA of the participants are shown in Table 1.

Children with DS and TD were individually matched on gender and on MA (the MA of each pair could not differ by more than 9 days). In addition, when possible, children were matched on birth order and/or mother's educational level. Specifically, forty children (43·48%) were matched on mother's educational level, twelve (13·04%) on birth order, and fourteen (15·22%) on both of these.

With respect to the education of mothers of children with DS, twenty-six mothers (28·26%) had completed compulsory secondary studies, twenty-four (26·09%) a Spanish Baccalaureate or A-levels, fifteen (16·30%) technical and further education (TAFE), and twenty-seven (29·35%) a bachelor's degree. With regards to the education of mothers of children with TD, twenty-eight mothers (30·43%) had completed compulsory secondary studies, twenty-five (27·17%) a Spanish Baccalaureate or A-levels, fifteen (16·30%) technical and further education, and twenty-one (22·83%) a bachelor's degree (three mothers did not provide the requested information; 3·26%).

For the second analysis, children of both groups (DS and TD) were individually matched according to their lexical level. This meant that twelve pairs of children, whose levels did not match, were eliminated. The final sample consisted of 160 children: eighty children with DS and eighty children with TD (Table 2). In addition to matching lexical level, 72·5% of the sample was also gender-matched. The following lexical levels were set up: $\leqslant$50, 51–100, 101–200, 201–300, 301–450, $\geqslant$451. These levels correspond to those of (Bates *et al.*, 1994; see also Caselli, Casadio & Bates, 1999). Since our sample was smaller than that in these studies, the number of children in the upper levels was rather low; we therefore set up a level

TABLE 2. *Means and ranges for chronological age (CA), mental age (MA), and lexical production (LP) in the DS and the TD groups for lexical levels*

Lexical level	Group	Girls	Boys	Total	CA mean (range)	MA mean (range)	LP mean (range)
⩽50	DS	7	12	19	37·07 (20·97–59·57)	22·06 (20·20–25·60)	31·47 (6–50)
	TD	3	16	19	20·74 (18·27–23·00)	21·16 (19·90–23·43)	27·05 (6–44)
51–100	DS	6	7	13	42·02 (27·00–62·40)	22·13 (20·10–25·80)	74·00 (56–93)
	TD	9	4	13	22·85 (18·70–26·83)	22·46 (20·20–27·00)	74·08 (55–99)
101–200	DS	2	8	10	47·69 (27·47–68·40)	23·71 (20·50–28·20)	140·80 (105–181)
	TD	4	6	10	22·45 (16·03–31·23)	23·29 (21·60–27·00)	143·20 (102–187)
201–300	DS	5	7	12	52·62 (40·60–67·00)	24·49 (20·00–28·80)	244·50 (201–290)
	TD	4	8	12	24·39 (20·77–28·27)	23·87 (20·70–27·00)	244·83 (203–291)
301–450	DS	10	4	14	50·61 (30·90–71·03)	26·03 (23·00–28·80)	381·57 (302–442)
	TD	7	7	14	26·63 (20·53–33·43)	26·64 (24·60–29. 40)	392·43 (323–449)
⩾451	DS	6	6	12	57·19 (39·67–68·63)	27·38 (23·20–29. 40)	519·58 (469–586)
	TD	9	3	12	27·08 (24·80–32·77)	27·48 (26·00–28·80)	513·50 (470–561)
TOTAL	DS	36	44	80	46·92 (20·97–71·03)	24·13 (20·00–29. 40)	218·49 (6–586)
	TD	36	44	80	23·83 (16·03–33·43)	23·95 (19·90–29. 40)	218·79 (6–561)

from 301–450, and another starting from 451 words (instead of 301–400, 401–500, 501–600, and >601). A two-way ANOVA: group (DS and TD) (2) × lexical levels (6), did not show any significant statistical difference between children with DS and TD, and there was no interaction between the factors. The only factor that was obviously significant was lexical level (all levels differ from one another).

The families of children with DS were contacted through early intervention units (infant stimulation centres) and Down syndrome parents' associations from different cities in Spain (mainly in the south). They were selected on the basis of the following criteria: cytogenetic documentation of Trisomy 21, and absence of neurosensory deficits and psychopathological disorders. All children received regular therapy from birth. (This is common practice in Spain.)

Children in the comparison group were recruited through several private and public childcare centres and nurseries in Málaga (Spain) and its surroundings. TD children with neurosensory deficits and/or psychopathological disorders were excluded.

All children had a monolingual Spanish background. Informed consent was obtained from the participants' families and the research followed the ethical guidelines of the Spanish Psychological Society.

Instruments

For both samples, MA was assessed using the Brunet–Lézine Psychomotor Development Scale-Revised (Josse, 1997). This scale (a test similar to the Bayley Scales of Infant Development) assesses the development of children 1–30 months of age in four domains: postural control and motor function; oculomotor coordination or adaptation to objects; language; and social and personal relationships.

The language development measure employed in the present study was an adaptation of the MacArthur Communicative Development Inventories (CDI) to the developmental profile of children with DS. The adaptation was based on the original English version of the CDI (Fenson *et al.*, 1993) and the Mexican-Spanish version (Jackson-Maldonado, Thal, Fenson, Marchman, Newton & Conboy, 2005; Jackson-Maldonado, Thal, Marchman, Bates & Gutiérrez-Clellen, 1993). Special attention was paid to making pertinent linguistic and cultural modifications. The Galician version (Pérez-Pereira & García-Soto, 2003) and the European-Spanish version (López-Ornat, Gallego, Gallo, Karousou, Mariscal & Martínez, 2005) were also considered. In spite of the changes introduced, our adaptation adheres to shared standards and procedures that make it comparable to the original CDI, containing its major structure categories.

One of the features of our inventory is that the two forms that compose the CDI have been combined in a unique inventory which assesses the whole age range (from 8 to 30 months). We used just one form because the chronological age of the children with DS was very often double their mental age. Therefore, compared to children with TD, children with DS would have a wider experience of the world which may create opportunities for more diverse vocabulary exposure and learning (Chapman, 1995; Grela, 2002, 2003).

The inventory consists of the three parts of the original versions: (1) Vocabulary (words), (2) Actions and gestures; and (3) Sentences and Grammar. For the purposes of the present study we focused mainly on the first and third sections.

Vocabulary. This part consists of four sections: (1) First Signs of Comprehension; (2) Starting to Talk: the Beginnings of Production; (3) How Children Use Words; and (4) Vocabulary Checklist. In this study only the last section was taken into account. The checklist consists of 651 words divided into twenty-one categories: interjections, animal sounds and things; games, routines and social formulas; animals; people; parts of the body; toys, vehicles; food and beverages; clothing; objects and places in the house; objects and places outside the house; verbs; qualities and states; determiners; pronouns; quantifiers; adverbs; questions; prepositions; auxiliaries; and sentence connectors. The parents' task consisted of marking the words their children understood, produced, and/or gestured. Deviation from the standard pronunciation was acceptable for oral word production. In this study, only the total number of words produced in the oral modality was taken into account.

Sentences and Grammar. The *Sentences and Grammar* part assesses the emergence of syntax and increasingly complex use of morphological forms. This part is different from the one in the original English version of the CDI since Spanish is a morphologically richer language. It consists of five sections. Only Word combinations, Mean Length of Utterance of the three longest phrases (MLU3), Morphosyntactic Complexity, and early morphological knowledge sections were analyzed.

In the Word combinations section, parents were asked whether their children had begun to produce word combinations. Parents were given three options for their child's combinatorial language: 'not yet', 'sometimes', and 'often'. For scoring purposes, we took into consideration the responses 'sometimes' and 'often'.

If the parents answered that their children combined words, they were asked to write examples of the three longest utterances they had recently heard their child say. The average length of the three longest sentences (MLU3) was calculated following the rules of Jackson-Maldonado *et al.* (2005), computing the mean length in words (rather than morphemes). Songs, routines, and parent explanations were eliminated.

The Morphosyntactic Complexity section included thirty-four pairs of phrases. Each phrase was presented in two versions: the first being incomplete and the second morphosyntactically complete. Parents were asked to choose which member of each thirty-four phrase or sentence pairs best reflected the way their child talked. For scoring purposes, the total number of morphosyntactically complete phrases was considered.

The assessment of children's early morphological knowledge included eleven items: gender (*niño/niña* 'boy/girl'), number (*coche/coches* 'car/cars'), and diminutives/augmentatives in nouns and adjectives (casa/casita 'house/little house') (3 items); and tense/aspect markers in verbs (8 items). Parents were asked to mark their child's production of these morphological markers. For scoring purposes, the total number of items was taken into account.

Procedure

Interviews were held with the parents of the participating children, either face-to-face or in small groups (up to five parents). We explained the aim of our research, the details of the inventory, the content of the different sections, and also went through some items in more detail. During the interview, parents were told to observe their child for one week before filling in the inventory. All inventories were checked when collected to make sure that parents had filled them out correctly and completely. Care was taken to ensure that the interval between the measurement of MA and the assessment of vocabulary was as short as possible (during the period that parents were filling out the inventory).

We present our data in the following order: Word combinations, MLU3, Morphosyntactic Complexity and early morphological knowledge. Statistical analyses were performed with SPSS version 17.0. An alpha level of 0·05 was used for all statistical analyses.

RESULTS

First analysis: grammatical development and mental age

Word combinations. As described earlier, this section elicits the categorical responses 'not yet', 'sometimes', and 'often'. For scoring purposes, responses 'sometimes' and 'often' were treated as equivalent. Table 3 shows the percentage of children with DS and TD reported to have begun combining words. A chi-square test was performed to determine whether children with DS and children with TD were distributed differently across the three mental age levels. The test failed to indicate a significant difference (χ^2 (2, $N = 184$) = 1·294, $p = ·524$). Thus, the number of children with DS and with TD who combined words was similar at each mental age level. Nevertheless, as expected, differences were found

TABLE 3. *Percentage (frequency) of children with DS and children with TD who combined words for mental age (MA) levels*

	Group					
	DS		TD		Total	
MA (months)	*n*	Percentage (frequency)	*n*	Percentage (frequency)	*n*	Percentage (frequency)
20–22	33	39·39 (13)	33	27·27 (9)	66	33·33 (22)
23–25	29	65·52 (19)	29	82·76 (24)	58	74·14 (43)
26–29	30	96·67 (29)	30	100·00 (30)	60	98·33 (59)
Total	92	66·30 (61)	92	68·48 (63)	184	67·39 (124)

TABLE 4. *Means (standard deviations) for MLU3, morphosyntactic complexity, and morphological suffixes in the DS and TD groups for mental age (MA) levels*

MA level (months)	Group	*n*	MLU3	Morphosyntactic complexity	Morphological suffixes
20–22	DS	33	1·57 (0·99)	0·76 (2·02)	0·91 (1·33)
	TD	33	1·40 (0·86)	1·30 (2·87)	1·33 (1·53)
	Total	66	1·49 (0·93)	1·03 (2·47)	1·12 (1·44)
23–25	DS	29	2·28 (1·28)	3·07 (5·30)	2·14 (2·42)
	TD	29	3·40 (2·45)	6·89 (6·35)	3·72 (2·42)
	Total	58	2·84 (2·02)	4·98 (6·11)	2·93 (2·53)
26–29	DS	30	4·36 (2·51)	10·77 (8·98)	4·83 (2·79)
	TD	30	5·37 (2·47)	16·73 (8·43)	6·33 (2·29)
	Total	60	4·86 (2·53)	13·75 (9·15)	5·58 (2·64)
Total	DS	92	2·70 (2·07)	4·75 (7·38)	2·58 (2·77)
	TD	92	3·33 (2·60)	8·09 (8·93)	3·72 (2·94)
	Total	184	3·01 (2·37)	6·42 (8·34)	3·15 (2·90)

among the three mental age groups (χ^2 (2, $N = 184$) = 62·18, $p < ·001$). The percentage of children who combined words in the youngest group was lower than in the intermediate group, and this group in turn had lower percentages than the oldest group.

MLU3. Table 4 shows mean scores and standard deviations of each group of children. A (2) group (DS and TD) × (3) level of mental age ANOVA was conducted. Both factors were statistically significant. For group ($F(1,178) = 5·52$, $p = ·02$, partial $\eta^2 = 0·03$, observed power = 0·647) (note that the eta squared value was small). Children with DS ($M = 2·70$) produced shorter utterances than children with TD ($M = 3·33$). For mental age level ($F2(2,178) = 50·87$, $p < ·001$, partial $\eta^2 = 0·364$, observed power = 1·00). Pairwise post-hoc analysis as a part of the ANOVA with a Bonferroni

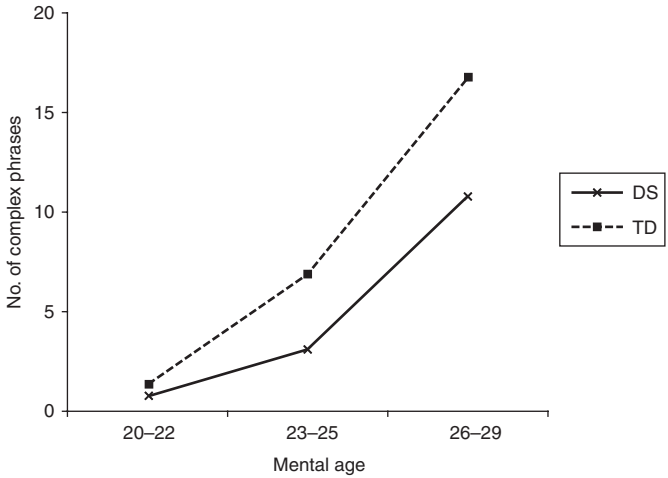

Fig. 1. Morphosyntactic complexity for mental age levels.

correction ($p < .05$) showed that all mental age groups differed from each other, which indicates a gradual growth, with a very low initial level in the youngest mental age level group and a significant increase in the oldest mental age group. The interaction was not significant.

Morphosyntactic complexity. Table 4 shows the mean scores and standard deviations obtained by both groups of children. We performed a (2) group (DS and TD) × (3) level of mental age ANOVA on a number of more complex phrases. All the main effects and interactions were statistically reliable. For group ($F(1,178) = 14.44$, $p < .001$, partial $\eta^2 = 0.07$, observed power = 0.966). Children with DS ($M = 4.75$) had lower scores in syntactic complexity than children with TD ($M = 8.09$). For level of mental age ($F(2,178) = 69.73$, $p < .001$, partial $\eta^2 = 0.439$, observed power = 1.000). After analyzing the main effects, pairwise post-hoc analysis with a Bonferroni correction ($p < .05$) indicated that all mental age groups differed from each other. The same sequence was found as before: a very low initial level in the youngest mental age group and a significant increase in the oldest mental age group. For interaction ($F(2,178) = 3.125$, $p = .046$, partial $\eta^2 = 0.034$, observed power = 0.595). Post-hoc analysis of simple effects with a Bonferroni correction ($p < .05$) showed no significant differences between the youngest groups of children with DS ($M = 0.76$) and with TD ($M = 1.30$). However, the average score was significantly lower in children with DS in the two older groups (23–25 months: $M = 3.07$ for SD, and $M = 6.89$ for TD; 26–29 months: $M = 10.77$ for SD, and $M = 16.73$ for TD). Therefore, morphosyntactic development in children with TD was faster and more linear than in children with DS (Figure 1) (nevertheless,

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note that the partial eta-squared was small with regard to group and interaction).

Morphological suffixes. Table 4 shows the mean scores and standard deviations obtained by children of both groups. A (2) group (DS and TD) × (3) level of mental age ANOVA was conducted. Both factors turned out to be statistically significant. For group ($F(1,178) = 12{\cdot}16$, $p < {\cdot}001$, partial $\eta^2 = 0{\cdot}06$, observed power = 0·934). Children with DS ($M = 2{\cdot}87$) produced fewer morphological markers than children with TD ($M = 4{\cdot}08$), although the partial eta-squared value was small. For level of mental age ($F(2,178) = 67{\cdot}98$, $p < {\cdot}001$, partial $\eta^2 = 0{\cdot}433$, observed power = 1·00). Pairwise post-hoc analysis with a Bonferroni correction ($p < {\cdot}05$) indicated that all mental age groups differed from each other. The interaction turned out not to be significant. This shows a linear growth throughout development.

Summary. No differences were found in word combining between the two MA-matched groups of children. However, children with DS performed less well than children with TD in the rest of the measures. That is, they produced shorter sentences, with less morphosyntactic complexity and they used fewer morphological suffixes. Interactions were only found for morphosyntactic complexity, suggesting that the children in the two groups were following a similar pattern of acquisition, although the children with DS were slower. These results are important since they show that Spanish children with DS, matched in MA with children with TD, have difficulties in their grammatical development.

Second analysis: grammatical development and lexical level

The second analysis focuses on the relationships between grammatical and lexical development. Such a relationship has serious theoretical implications for research on interrelation or dissociation between grammatical and lexical components of language. In the case of interrelation, the differences found in both groups of children should diminish and even disappear when matched on vocabulary (Bates & Goodman, 1997).

Word combination. Table 5 shows the percentage of children with DS and TD who combined words according to the different lexical levels. A chi-square test was conducted to determine whether both groups of children (DS and TD) were distributed differently across the six lexical levels. This test was not significant ($\chi^2(5,\ N = 160) = 2{\cdot}63$, $p = {\cdot}756$). Therefore, the number of children with DS and TD who combined words was similar at each lexical level. This result is consistent with that found when MA was taken into account. However, as expected, there were differences among lexical level groups ($\chi^2(5,\ N = 184) = 75{\cdot}64$, $p < {\cdot}001$). The percentage of children who combined words in the first lexical level ($\leqslant 50$) was lower than

TABLE 5. *Percentage (frequency) of children with DS and children with TD who combined words for lexical levels*

	Group					
	SD		DT		Total	
Lexical level	*n*	Percentage (frequency)	*n*	Percentage (frequency)	*n*	Percentage (frequency)
⩽50	19	26·31 (5)	19	5·26 (1)	38	15·79 (6)
51–100	13	53·85 (7)	13	53·85 (7)	26	53·85 (14)
101–200	10	70·00 (7)	10	60·00 (6)	20	65·00 (13)
201–300	12	91·67 (11)	12	91·67 (11)	24	91·67 (22)
301–450	14	92·86 (13)	14	100·00 (14)	28	96·43 (27)
⩾451	12	100·00 (12)	12	100·00 (12)	24	100·00 (24)
Total	80	68·75 (55)	80	63·75 (51)	160	66·25 (106)

in the lexical levels of 51–100 and 101–200. These two groups in turn had lower percentages than higher levels groups (201–300, 301–450, and >451).

MLU3. Table 6 shows mean scores and standard deviations obtained by children of both groups. A (2) group (DS and TD) × (6) lexical level ANOVA was conducted. Analysis of variance revealed a significant main effect of lexical level, no main effect of group, but a reliable interaction between lexical level and group. For lexical level ($F(5,148)=39·45$, $p<·001$, partial $\eta^2=0·571$, observed power = 1·00). Pairwise post-hoc analysis with a Bonferroni correction ($p<·05$) showed no differences among the first three levels (⩾50, 51–100, and 101–200). These levels differed from the rest, which also differed from each other. This shows a non-linear trend with very low levels in the early lexical levels. MLU3 started to increase when the vocabulary was at level 201–300.

For interaction ($F(5,148)=4·39$, $p<·001$, partial $\eta^2=0·129$, observed power = 0·963). Post-hoc analysis of simple effects with a Bonferroni correction ($p<·05$) indicated that there were only differences at 301–450 words, where children with DS produced shorter sentences. The fact that there were only differences at this level between both groups of children could possibly be due to the effect of individual variability in small groups.

Morphosyntactic complexity. Table 6 shows mean scores and standard deviations obtained by children with DS and TD. A (2) group (DS and TD) × (6) lexical level ANOVA was conducted. Both factors turned out to be statistically significant, as well as the interaction. For group ($F(1,148)=18·41$, $p<·001$, partial $\eta^2=0·111$, observed power = 0·989). Children with DS ($M=4·87$) showed lower scores in morphosyntactic complexity than children with TD ($M=7·60$), although the partial eta-square value was small. For lexical level ($F(5,148)=96·52$. $p<·001$, partial $\eta^2=0·765$,

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TABLE 6. *Means (standard deviations) for MLU3, morphosyntactic complexity, and morphological suffixes in the DS and TD groups for lexical levels*

Lexical level (words)	Group	*n*	MLU3	Morphosyntactic complexity	Morphological suffixes
⩽50	DS	19	1·24 (0·42)	0·05 (0·23)	0·31 (0·58)
	TD	19	1·03 (0·14)	0·21 (0·63)	0·52 (0·96)
	Total	38	1·13 (0·32)	0·13 (0·47)	0·42 (0·79)
51–100	DS	13	1·74 (0·77)	0·69 (1·18)	0·85 (1·07)
	TD	13	1·66 (0·85)	1·69 (2·21)	1·54 (1·33)
	Total	26	1·69 (0·80)	1·19 (1·81)	1·19 (1·23)
101–200	DS	10	1·95 (0·73)	1·70 (2·00)	1·40 (1·26)
	TD	10	1·84 (0·85)	2·90 (3·14)	2·80 (1·32)
	Total	20	1·89 (0·77)	2·30 (2·64)	2·10 (1·45)
201–300	DS	12	3·18 (1·46)	2·92 (2·84)	3·08 (2·02)
	TD	12	3·58 (1·41)	5·17 (5·34)	4·25 (1·86)
	Total	24	3·38 (1·42)	4·04 (4·34)	3·67 (1·99)
301–450	DS	14	3·27 (1·29)	8·36 (7·31)	4·93 (1·82)
	TD	14	6·07 (3·16)	15·43 (5·27)	5·50 (1·69)
	Total	28	4·67 (2·76)	11·89 (7·22)	5·21 (1·75)
⩾451	DS	12	5·95 (2·62)	17·58 (6·88)	6·17 (2·21)
	TD	12	5·48 (1·94)	22·92 (5·21)	8·33 (1·15)
	Total	24	5·72 (2·27)	20·25 (6·56)	7·25 (2·05
Total	DS	80	2·76 (2·04)	4·87 (7·36)	2·64 (2·66)
	TD	80	3·16 (2·58)	7·60 (9·13)	3·57 (2·99)
	Total	160	2·96 (2·33)	6·24 (8·38)	3·10 (2·86)

observed power = 1·000). Pairwise post-hoc analysis with a Bonferroni correction ($p < .05$) indicated no differences among the first three groups (⩾50, 51–100, and 101–200). The second and third groups (51–100 and 101–200) did not differ from the following group (201–300), even though the first group did (⩾50). All of these groups were lower than the remaining groups, which also differed from each other. This again shows a non-linear growth with very low levels in the first lexical levels. Morphosyntactic complexity starts to increase from the 301–400 words level.

The results for interaction were ($F(5,148) = 3·19$, $p = .009$, partial $\eta^2 = 0·097$, observed power = 0·875). Again, the partial eta-square value was very small. Post-hoc analysis of simple effects with a Bonferroni correction ($p < .05$) showed no differences between children with DS and TD in the first four lexical levels (⩾50, 51–100, 101–200, and 201–300). In the last two levels (301–450, and ⩾451), children with DS showed a lower morphosyntactic complexity than children with TD (see Figure 2).

Morphological suffixes. Table 6 shows the mean scores and standard deviations obtained by children of both groups. A (2) group (DS and TD) × (6) lexical level ANOVA was conducted. Both factors turned out to

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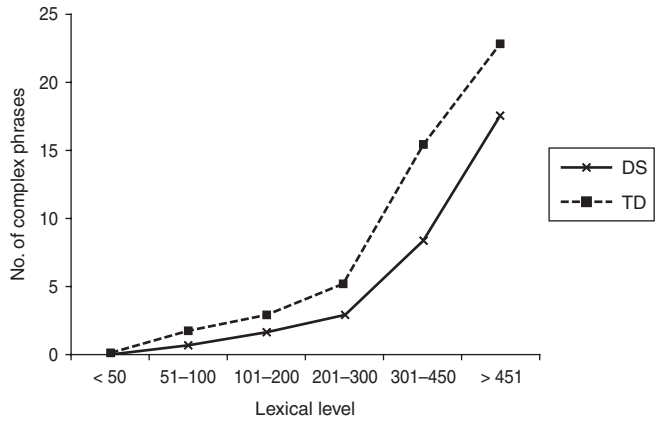

Fig. 2. Morphosyntactic complexity for lexical levels.

be statistically reliable, but the interaction was not significant. For group ($F(1,148) = 16{\cdot}99$, $p < {\cdot}001$, partial $\eta^2 = 0{\cdot}103$, observed power $= 0{\cdot}984$). Again, children with DS ($M = 2{\cdot}95$) produced less morphological markers than children with TD ($M = 3{\cdot}94$), although the partial eta-square value was small. For lexical level ($F(5,148) = 89{\cdot}06$, $p < {\cdot}001$, partial $\eta^2 = 0{\cdot}751$, observed power $= 1{\cdot}000$). Pairwise, post-hoc analysis with a Bonferroni correction ($p < {\cdot}05$) indicated no significant differences between the first two groups ($\geqslant 50$, 51–100). The first group ($\geqslant 50$), but not the second (51–100), differed with regard to group 101–200. All of these groups were lower than the other groups, which also differed from one another. This reveals a non-linear trend, with very low scores in the initial lexical levels up to level 201–300, when the production of morphological markers starts increasing.

Summary. There were no differences between children with DS and vocabulary-matched children with TD in their abilities to combine words. However, in contrast to what was found in relation to MA, there were no differences in the mean length of the utterances. Therefore, when children were matched for vocabulary level, the length of their sentences was similar. The performance of children with DS was lower than that of children with TD in terms of morphosyntactic complexity and morphological suffixes. Therefore, the sentences of children with DS were less complex than those of children with TD, as was the case for their production of morphological markers. It should be emphasized that the differences tended to appear around a lexical mass of 200–300 words. The observed increase, unlike that found in the first analysis, tended to be non-linear with very low levels of response in the first levels and a significant increase in the later ones.

DISCUSSION

The aim of our research was to compare grammatical development in children with DS and children with TD, matched on mental age or lexical level, from the early stages of their language development.

Mental age matching is crucial in order to investigate the possible existence of dissociation between cognition and language. In Analysis 1, the morphosyntactic development of both groups of children from 20 to 29 months individually matched for MA and gender was compared. In Analysis 2, children with DS and with TD were matched for lexical level. Establishing lexical levels will allow us to find evidence in favour or against a dissociation between the lexical and grammatical components.

Starting to combine words means starting to use grammar. Combining words is a critical stage of language development in children with TD, although little is known about this important linguistic milestone in a population with atypical development (Singer Harris *et al.*, 1997). Analysis 1 compared children of both groups and did not find differences between them. This means that children with DS start to combine words at the same MA as children with TD. Moreover, the increase in the number of children who combined words was similar in both groups. These results are contrary to those of Iverson *et al.* (2003), who found a generalized delay in children with DS in the transition to two-word utterances.

Grammatical development has been studied through three measures: MLU3, morphosyntactic complexity, and production of morphological suffixes. There is a series of characteristics common to all of the results on the three measures. First of all, the group of children with DS obtained significantly lower scores than the group of children with TD. Second, the initial level in both groups of children was very low, as can be seen by examining the scores obtained in each of the measures in the group with the youngest MA. Third, there was a progressive linear increase in each of these measures. The absence of interactions (except in morphosyntactic complexity) shows that both groups follow a similar developmental pattern, although slower in the case of children with DS.

These data are consistent with the results obtained by other authors. For instance, Zampini and D'Odorico (2011) did not find differences in word combinations in children with DS and children with TD either. However, they did find significant differences in the use of simple and complex sentences, as well as a lower number of subordinate clauses in children with DS. Vicari *et al.* (2000) did not find significant differences between children with DS and children with TD in vocabulary size, but they did find differences in morphosyntactic complexity, using both the Italian CDI measure (Primo Vocabolario Bambino), and a measure of repetition of sentences and MLU in spontaneous speech. Galeote *et al.* (2011) studied lexical development in a large sample of children with DS and an MA of

8 to 29 months (186 children with DS and 186 children with TD). No statistically significant differences were found in the production of vocabulary between the two groups of children. Therefore, Spanish children with DS showed no specific dissociation between cognitive and lexical development, at least at the levels of MA considered in that study (see also Berglund *et al.*, 2001; Caselli *et al.*, 1998; Galeote *et al.*, 2008; Vicari *et al.*, 2000). The lack of discrepancy between vocabulary production and cognitive development (as measured by mental age) indicates that there is no general impairment in learning productive vocabulary for Spanish children with DS. On the contrary, in the present study, which uses the sample of older children from the study by Galeote *et al.* (2011) (those with an MA of 20 to 29 months), a deficit in morphosyntax was found in children with DS.

As we have mentioned before, our results show that children with DS have no difficulty in combining words when compared with TD children, although they are much slower to develop grammar. Even if children with DS were able to combine words, their MLU and their morphosyntactic complexity were lower, possibly because they omit more free morphemes, as has been maintained by some authors (Caselli, Marchetti & Vicari, 1994; Chapman *et al.*, 1998; Fabretti, Pizzuto, Vicari & Volterra, 1997; Jenkins, 1993; Rondal, 1993).

Analysis 2 focuses on the lexical levels of children using the same grammatical measures. In studies on language development, it was found that lexical levels are closely related to word combination (Bates *et al.*, 1995). This statement is valid both for children with DS and for children with TD in our samples, since no statistically significant differences have been found between the two groups of children. Obviously, the percentage of children in both groups that combine words increased as they increased their vocabularies. From 201 words on, practically all children were able to combine words.

Unlike Analysis 1, no significant differences were found between the two groups with regard to MLU3. This is an important result, because when the size of the vocabulary was equivalent, MLU3 of the children of both groups was similar.

The data were very different in the morphosyntactic complexity measure and in the production of morphological suffixes. With regard to morphosyntactic complexity, children with DS showed a poorer performance than children with TD. The morphosyntactic complexity increased very gradually in both groups of children up to the 300 word level. From that level on, significant differences appeared between the two groups of children.

With regard to the production of morphological suffixes, significant differences were found between the two groups of children. Children with

DS produced fewer morphological markers than children with TD at all lexical levels, though the interaction was not significant. The number of suffixes increased little by little throughout the first three lexical levels. They began to grow more rapidly from the production of more than 200 words onwards. These data coincide with those from Rutter and Buckley (1994), who studied the production of morphological rules stated by Brown (1973), and the onset ages at which they are acquired by children with DS.

Accordingly, even though the children of both groups showed no differences in the combining of words, nor in MLU3, the syntax of children with DS is less complex. Some authors have suggested that individuals with DS may add to their MLUs merely by elaborating phrase structures and juxtaposing utterances without truly developing complex syntax or by using less sophisticated sentence structures (Rondal, 1978; Scarborough, Rescorla, Tager-Flusberg, Fowler & Sudhalter, 1991; but see Thordardottir, Chapman & Wagner, 2002).

In sum, the present work is based on a large sample (92 children) with a rather wide age range in the early stages (20–30 months) of language development. Our data support evidence found in other studies with Italian children (Caselli *et al.*, 2008; Vicari *et al.*, 2000; Zampini & D'Orico, 2011), in terms of syntactic and morphological delay related to mental age in children with DS.

However, when lexical levels were taken into account, morphological and morphosyntactical development were closer in the initial levels, but began to be lower in children with DS once they reached a level of more than 200 words for morphological suffixes and a level of more than 300 words for morphosyntactic complexity.

Many researchers have hypothesized that lexical development might drive grammatical development (Bates & Goodman, 1999). In particular, as the lexicon increases in size, grammar becomes organized into increasingly complex forms. Our data support this hypothesis and challenge a dissociation between lexical and grammatical components. Vicari *et al.* (2000) propose the existence of a selective disadvantage, instead of a dissociation, in the grammar of children with DS. This disadvantage would come from perceptual and/or processing problems, and not from strictly linguistic deficits. Our results support this theoretical position. Additionally, our data suggest that children with DS show a language delay and not a language deviance.

Our study has several limitations. On the one hand, it is possible that the differences found increase with age. Our results point in this direction insofar as the gap between children with DS and children with DT becomes more evident in the later age levels. Second, our data are cross-sectional. Although these data are useful in revealing developmental patterns, it is not

possible to access intra-individual changes. Third, our data are based on measures from parental information. A limitation of these data is that they do not offer information about the frequency of the production of certain linguistic behaviours. An evaluation based on structured tests and/or analysis of the use of language in real contexts could reveal the existence of different profiles between children with DS and children with TD (Vicari *et al.*, 2000).

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