Language development in children with Williams syndrome: New insights from cross-linguistic research

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Introduction

Williams syndrome (WS) is a genetically based neurodevelopmental disorder, which is caused by a microdeletion of chromosome 7, more specifically, at the region of chromosome 7q11.23 (Doll & Grzeschik, 2001; Ewart et al., 1993; Korenberg et al., 2000). Due to its uneven cognitive profile, WS has recently been the focus of scientific research in the field of developmental cognitive neuroscience (Clahsen & Almazan, 1998; Clahsen & Temple, 2003; Jordan et al., 2002; Thomas et al., 2001). Impaired visuo-spatial cognition, planning, and problem solving co-occur with relatively spared abilities in the domain of language, social cognition, and face processing (Bellugi et al., 1988; Karmiloff-Smith, 1998; Karmiloff-Smith et al., 1997; Mervis et al., 2000; Tager-Flusberg et al., 2003; Tager-Flusberg & Sullivan, 2000).

There is much controversy surrounding the status and development of the relatively spared cognitive abilities in WS, especially language. More specifically, some researchers argue that language development in WS (and other developmental disorders) reflects the abnormal development of the entire cognitive system (Karmiloff-Smith, 1998; Thomas et al., 2001; Thomas & Karmiloff-Smith, 2002). Consequently, the developmental pattern in WS is expected to be qualitatively different from typical development. If this is the case, then there should not be selective preservation of cognitive abilities in WS while the rest of the system develops abnormally. In other words, there should be no evidence for “residual normality” in WS (Thomas & Karmiloff-Smith, 2002). Therefore, according to Karmiloff-Smith and collaborators (Thomas & Karmiloff-Smith, 2002; Thomas

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et al., 2001) the linguistic performance on the surface, good or poor, is simply the outcome of abnormal functions in the underlying cognitive mechanisms.

In comparison, other researchers argue that language development in WS, or at least aspects of language development, follows the pattern of typical development. However, there is no consensus among these researchers with respect to (1) which language abilities follow the normal path of development and (2) to what extent those abilities follow the normal path of development. On the one hand, Mervis and colleagues suggest that the whole process of language development in WS is delayed but normal (Mervis et al., 2004). Despite language abilities in WS being below those of typically developing (TD) children matched for chronological age (CA), they are still at the expected level for overall IQ performance. Furthermore, Mervis et al. (2004) argue that, whereas language abilities in WS are linked to all aspects of cognition, they are more dependent on verbal memory than on aspects of conceptual cognition.

On the other hand, Clahsen and colleagues (Clahsen & Almazan, 1998; Clahsen et al. 2004) suggest that only particular aspects of language in WS fall within the normal range; whereas the computational (rule-based) system for language is selectively spared, lexical representations and/or their access are impaired (Clahsen & Almazan, 1998; Clahsen & Temple, 2003; Clahsen et al., 2004). It is, therefore, expected that, although aspects of the computational component of language, that is, phonology, morphology, and syntax, should be completely intact, aspects of the lexical abilities should be problematic.

This chapter addresses the question of how language develops in WS adopting a cross-linguistic perspective, which enables abstraction away from language-particular characteristics and provides a novel insight into the language abilities of WS subjects. In particular, the syntactic abilities of children with WS are focused on by splitting the chapter into two parts. In the first part, current cross-linguistic studies on the syntactic abilities in WS in terms of methodological and theoretical issues are discussed. In the second part, new data from the Greek language concerning sentence comprehension abilities in WS, with particular emphasis on the issue of (normal or abnormal) developmental processes involved in WS, are presented. Overall, this chapter aims to show how cross-linguistic research on WS can provide us with a better understanding of WS language abilities.

Syntax in Williams syndrome

The study of syntactic abilities has received remarkable attention in recent years and has sparked diverse explanations for the status and development of language abilities in WS.

Bellugi et al. (1988) were the first to report that WS subjects have well-preserved syntactic abilities and produce complex syntactic structures in their spontaneous
speech. Because spontaneous speech data do not always constitute a reliable way of assessing grammatical abilities, a number of experimental studies, which tested specific linguistic variables, followed.

Karmiloff-Smith et al. (1998) studied syntactic comprehension in WS using different off- and on-line tasks. They argued that the performance of individuals with WS is significantly lower than that of normal controls on off-line sentence interpretation and is characterized by selective deficits in on-line processing of structures violating subcategory constraints. Based on those findings, Karmiloff-Smith and colleagues suggested first that the WS participants showed difficulties with syntax, and second that the WS participants performed similarly to second-language learners. This is due to problems that both individuals with WS and second-language learners encounter with identifying subcategory violations in sentence processing (see Gleitman, 1990).

Lower performance of WS individuals compared to that of their TD peers matched for CA has also been reported in a study by Mervis et al. (2004). After assessing the grammatical abilities of the WS individuals using a number of measures (e.g., spontaneous speech, Test for Reception of Grammar: TROG; Bishop, 1989), Mervis and colleagues proposed that the grammatical abilities of individuals with WS were in fact predictable from their general level of cognitive ability.

Similarly, Volterra and colleagues (Volterra, Capirci, & Caselli, 1996, 2001) identified specific language problems in Italian WS children. Testing on the basis of receptive language measures (e.g., TROG) revealed lexical and grammatical errors indicating difficulties with different levels of language processing and not exclusive difficulties with grammar per se. As the authors pointed out, considerable dissociations were found within the linguistic domain. In particular, aspects of Italian morphology carrying out a semantic function were found to be more vulnerable in WS grammar than other aspects of morphology (Voltera et al. 2001).

Detailed investigations of the syntactic abilities of WS subjects were carried out by Clahsen and Almazan (1998) who tested the interpretation of passive sentences and syntactic binding of four WS subjects and their mental age (MA) -matched controls. In terms of linguistic theory (Chomsky, 1981), verbal passive formation includes noun phrase (NP) movement from the object to subject position (A-movement), while syntactic binding includes syntactic dependencies formed between reflexives and pronouns and their antecedents. Interestingly, the WS children showed error-free performance on the interpretation of syntactic binding and adult level performance on the interpretation of passive sentences. Based on those results, Clahsen and Almazan (1998) concluded that the computational component in WS language appears to be intact. In contrast, the lexical component of language was considered to be selectively impaired as the WS children produced
lexical errors (Temple et al., 2002) and showed selective problems with the irregular past tense (Clahsen & Alamazan 1998; Clahsen et al., 2004), which has been assumed to be part of the lexicon (Pinker, 1999).

Further evidence for normal syntactic abilities in WS was provided by Bartke (2004) who studied the interpretation of passives by German speaking children with WS. She showed that both WS subjects and TD children performed better on irreversible vs. reversible passives and produced reversal theta-role errors. Quantitative differences, however, were found, but only between the younger WS subjects and their MA-matched controls, with the former performing lower than the latter.

Evidence for advanced grammatical abilities in WS was provided by Stavrakaki (2004) who studied Greek WS children’s ability to produce wh-questions. Two out of three WS children that participated in her study showed ceiling performance on both subject and object wh-questions, whereas one child performed better on the production of who-object than on who-subject questions. The better performance on object than subject wh-questions was interpreted as overuse of grammatical processes and rules required for object wh-questions, in particular A-bar in terms of linguistic theory (Chomsky, 1981).

In addition, Zukowski (2001, 2004, 2009) argued that children with WS make errors in grammar that are “developmental” in nature; hence, they do not show evidence for a deviant pattern of language development in terms of grammar. In particular, Zukowski (2001, 2004, 2009) tested the production of relative clauses and negative questions. Her results strongly suggest that children with WS follow the typical path of language development. First, they showed the typical pattern of performance on the production of relative clauses, that is, better performance on subject than on object relatives; second, children with WS and younger TD children produced negative question errors that cannot be found in the (linguistic) input. Therefore, Zukowski (2001, 2004, 2009) suggested that, despite delays in language development, grammatical abilities in individuals with WS develop normally; consequently, the mechanism of grammar acquisition is normal in WS.

A similar claim concerning language development in WS was made by Perovic and Wexler (2007). They suggested that, whereas language develops normally in WS, some particular aspects of language mature very late in individuals with WS. This selective developmental delay concerns those linguistic phenomena acquired late by TD children. The claims by Perovic and Wexler (2007) are supported by experimental evidence showing normal performance for the acquisition of binding (cf. Ring & Clahsen 2005) but significant difficulties in the acquisition of raising structures (e.g., John seems to Maria to be reading a book). On the assumption that some grammatical abilities never mature in WS, Perovic and Wexler (2007) argued in favor of a specific grammatical impairment in WS. In this respect, their proposal is different from the one put forth by Zukowski (2001, 2004, 2009).
In addition, Joffe and Varlokosta (2007) provided further evidence for significant grammatical difficulties in WS. Specifically, they reported lower performance by participants with WS than MA-matched TD controls on the comprehension of passives and the production, comprehension, and repetition of wh-questions.

Overall, the research findings appear to be quite conflicting (see Brock, 2007, for a current review of the literature on language in WS). Possible reasons for the attested discrepancy between different studies can be traced to the following factors, which are discussed below: (1) small samples, (2) selection criteria for controls, and (3) properties of language tests employed in the WS studies.

First, in many studies small samples of individuals with WS participated; thus, it is questionable whether the conclusions based on those studies can be generalized to the whole WS population (Brock, 2007). Second, selection criteria for the control groups seem to significantly affect the conclusions. Having mental retardation, the individuals with WS are expected to perform below their CA peers at least in some of the language tasks, as already shown by studies in the field (e.g., Karmiloff-Smith et al., 1998). Thus, comparing the performance of individuals with WS and that of their CA peers can only show whether the WS participants are behind their CA controls and cannot elucidate the developmental processes for language acquisition in WS. A better way of investigating whether there are any similarities and/or differences in language acquisition by WS and TD children is to compare individuals with WS to MA-matched controls (see Temple et al., 2002, for discussion; and Brock, 2007, for a different view). By keeping MA constant, direct comparisons concerning the development of specific cognitive abilities per se become possible; hence, better understanding of the developmental processes in WS and typical development can be achieved (see Chapter 8).

Another reason for the conflicting findings is related to the language tests employed in the WS studies and in particular to the aspects of language that those tests measure. For example, the TROG has been used as a measure of grammatical abilities in WS (Mervis et al., 2004; Voltera et al., 1996), despite the fact that it is not a pure test of grammar (phonology, morphology, syntax). It also assesses lexical/semantic abilities (e.g., meaning of verbs and prepositions) (Clahsen & Almazan, 1998). As a result, the reliance on language tests that simultaneously measure different linguistic abilities (lexical/semantic and syntactic) cannot constitute a reliable measure or accurate assessment of grammatical abilities. More sophisticated language measures should be designed and employed for research purposes.

It is, therefore, evident that more studies on WS should be carried out in order to get a more precise picture of language abilities in this population. In the next sections, a study of receptive syntactic abilities in Greek-speaking individuals with WS is presented.
New data from the Greek language: Sentence comprehension in Greek children with Williams syndrome

Participants

Five Greek children who were independently diagnosed with WS by multidisciplinary teams in Greek hospitals in Thessaloniki participated in this study. The diagnoses were confirmed using the fluorescent in situ hybridization (FISH) technique (i.e., a specialized chromosome analysis utilizing specially prepared elastin probes). WS children’s MA was derived from the verbal and non-verbal IQ scores calculated on the basis of the Greek version of Wechsler Intelligence Scale for Children-III (WISC-III) test (Georgas et al., 1997), which has been standardized for children aged 6;2–16;10 years. The scores obtained by the three younger children on the WISC-III subscales indicated language ages considerably below 6;2. Hence, the exact calculation of MA was not possible. Further testing of TD children younger than 6;2 indicated that only children with a mean CA of 3;4 and 4;2 reached the raw WS scores on the WISC-III; those ages were taken to be the MAs of the WS children. The individual WS profiles are presented in Table 1.

Fifteen control participants whose CAs corresponded to the MAs of the WS children (+/-3 months) participated in the experiment; specifically, each WS child was matched to three control children on the basis of his/her MA. The control children constitute the MA control group. Furthermore, another control group of 16 younger typically developing children (YTD) aged 3;6–5;6 years participated in the experiment in order to get a more accurate picture of the typical language development process with respect to the tested structures. In Table 2, the CA and MA of the children with WS as well as the CA of the control groups are presented.

<table>
<thead>
<tr>
<th>Table 1. Children with Williams syndrome (WS): Chronological age (CA) and mental age (MA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
</tr>
<tr>
<td>WS1</td>
</tr>
<tr>
<td>WS2</td>
</tr>
<tr>
<td>WS3</td>
</tr>
<tr>
<td>WS4</td>
</tr>
<tr>
<td>WS5</td>
</tr>
</tbody>
</table>
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Table 2. CA and/or MA of children with WS, MA-matched controls, and YTD controls

<table>
<thead>
<tr>
<th></th>
<th>CA Mean Range (SD)</th>
<th>MA Mean Range (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS group</td>
<td>10.1 7;9–15 (2.94)</td>
<td>5 3;4–7;2 (1.88)</td>
</tr>
<tr>
<td>N = 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA-matched group</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>N = 15</td>
<td>3;3–7;4 (1.7)</td>
<td></td>
</tr>
<tr>
<td>YTD group</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>N = 16</td>
<td>3;6–5;6 (0.73)</td>
<td></td>
</tr>
</tbody>
</table>

Experimental materials and procedure
Design and materials
The test sentences consisted of six sentence types with different syntactic properties. In particular, the experimental materials included simple transitive structures with SVO (subject–verb–object) word order as well as structures formed by A-bar movement (e.g., subject and object wh-questions, subject and object clefts), and A-movement (e.g., passive sentences).

Examples of the sentence types are presented below:

Simple transitive sentences with SVO word order
(1) O elefantas kiniga ton pithiko
    the elephant-nom chases the monkey-acc
    “The elephant is chasing the monkey”

Subject clefts
(2) O skilos ine pu kinighai tin katsika
    the dog-nom is that chases the goat-acc
    “It is the dog that is chasing the goat”

Object clefts
(3) O pithikos ine pu htipai o elefantas
    the monkey-nom is that hits the elephant-nom
    “It is the monkey that the elephant is hitting”

Who-subject questions
(4) Pjos kinijise ton elefanta?
    who-nom chased the elephant-acc
    “Who chased the elephant?”

Who-object questions
(5) Pjon klotsise i katsika?
    who-acc kicked the goat-nom
    “Who did the goat kick?”
Table 3. Classification of the tested structure

<table>
<thead>
<tr>
<th>Structure</th>
<th>A- or A-bar movement</th>
<th>Word order</th>
<th>Case/theta-role conflict</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple transitive sentences (SVO)</td>
<td></td>
<td>SVO</td>
<td></td>
</tr>
<tr>
<td>Subject wh-questions</td>
<td>Yes</td>
<td>SVO</td>
<td></td>
</tr>
<tr>
<td>Object wh-questions</td>
<td>Yes</td>
<td>OVS</td>
<td></td>
</tr>
<tr>
<td>Subject clefts</td>
<td>Yes</td>
<td>SVO</td>
<td></td>
</tr>
<tr>
<td>Object clefts</td>
<td>Yes</td>
<td>OVS</td>
<td>Yes</td>
</tr>
<tr>
<td>Passives</td>
<td>Yes</td>
<td>SV-by phrase</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Passive sentences

(6) O pithikos sproxnete apo tin tigri
   the monkey-nom push-3s-passive by the tiger
   "The monkey is pushed by the tiger"

The above structures differ with respect to the following parameters: (1) presence (or absence) of A- or A-bar movement; (2) word order: SVO or OVS; (3) existence (or not) of conflict between case marking and theta-role: Such a conflict reveals when nominative case is associated with patient theta-role, as is the case with object clefts and passives.

The experimental sentences of this study have been classified in terms of the above parameters. This classification is presented in Table 3.

It was hypothesized that combinations of the above factors should result in a differential degree of acquisition/processing difficulty. In particular, Stavrakaki expected syntactic parsing to be facilitated (1) when morphological contrast cues are activated by associating nominative case with agent theta-role and accusative case with patient theta-role but not the reverse (nominative case with patient theta-role), and (2) when syntactic cues are activated by associating the first pre-verbal NP with the agent theta-role and the second post-verbal NP with the patient theta-role (hence, preference for the SVO word order) (Stavrakaki, 2002). Therefore, it was predicted that co-occurrence of syntactic movement (A-bar movement) with (1) OVS word order and (2) conflict between case marking and theta-role (as is the case with object clefts) makes sentence comprehension extremely difficult. By contrast, it was predicted that co-occurrence of syntactic (A-bar) movement with
(1) SVO word order and (2) absence of conflict between case marking and theta-role (as is the case with subject clefts) facilitates the sentence comprehension process due to available syntactic (SVO word order) and morphological (nominative case marking corresponds to the agent theta-role) cues.

For each sentence type presented above, there were 14 exemplars except for the wh-questions. Concerning wh-questions, eight stories for each question type were used when the children with WS and MA controls were tested, whereas four stories for each question type were used when YTD children were tested.

Procedure

An acting-out task was employed for all sentences except for wh-questions. This task requires the subject to manipulate toy animals in such a way so as to demonstrate the thematic roles of nouns in verbally presented sentences. Before beginning the task, the children were asked to identify all animals by pointing to them in turn when the experimenter named them. They were also encouraged to play with the toys in order to be familiar with them. Finally, the children were instructed to do what the experimenter asked of them.

A somewhat different method, which is nevertheless based on a toy manipulation task, was used for who-questions (Crain & Thornton, 1998). The children were told that they should help the puppet understand what was going on in the story by telling the puppet the answer. Three figurines were placed on the table; for example, one dog, one elephant, and one fox. The experimenter told the child a story in which the fox was chasing the dog and after that the dog was chasing the elephant. At the same time, the experimenter showed that the fox was chasing the dog and the dog was chasing the elephant. At the end, the child should help the puppet answer the following question: ‘Who chased the dog?’

Results

The correct performance of all groups on the test sentences is presented in Table 4.

Table 4 indicates that all TD children (MA and YTD controls) showed ceiling performance on all structures with SVO word order (simple transitive sentences with SVO word order, subject clefts, and subject wh-questions). Although they showed near-ceiling performance on who-object questions, they had significant problems with object clefts and passive sentences. The individuals with WS showed a similar pattern. In particular, they showed ceiling and near-ceiling performance on all structures with SVO word order and near-ceiling performance on who-object questions. The performance of the WS group on object vs. subject questions did not reach significance (Wilcoxon test $Z = 0.447$, $p = 0.655$). In addition, the WS children performed like TD children and showed low level of performance on
object clefts and passive sentences. In sum, all groups showed the same pattern of performance with low correctness scores for object clefts and passive sentences and high correctness scores for all sentences with SVO word order and object wh-questions. Therefore, the same structures were difficult for all groups. Statistics confirmed the above observations. A $3 \times 6$ analysis of variance with the variables Group $\times$ Sentence Type was carried out to investigate the data. The main effect of Sentence Type was significant [$F(5, 165) = 35.313, p < 0.001$], but neither the main effect of Group [$F(2, 33) = 1658,119, p = 0.674$] nor the interaction of Subject Group $\times$ Sentence Type were significant [$F(10, 165) = 0.711, p = 0.713$]. These findings reflect the fact that all groups showed similar performance on the test structures.

Further analysis of the individual WS children’s performance indicated significant within group variation. In Table 5, the performance of each child with WS on all sentences for which no ceiling performance was found is presented.

While the two older children with WS performed at ceiling, as predicted by their MA (6;9 and 7;2, respectively), the younger children with WS whose MA ranged from 3.4 to 4.2 showed heterogeneous performance. Despite being heterogeneous, the performance of these children with WS is within the normal range as shown by comparing performance in the three youngest children with WS (YWS) to 9 controls on object clefts and passives in Table 6.
Further comparisons did not show any significant differences between the performance of the YWS participants and their corresponding MA-matched control group, except for the case of subject wh-questions (Mann-Whitney U test, $U = 4.5$; $p = 0.010$]. The YWS children performed better on object than subject wh-questions. This pattern of performance was not shown by TD children matched for MA.

Table 5. Performance (%) on subject and object questions, object clefts, and passive sentences for children with WS

<table>
<thead>
<tr>
<th></th>
<th>MA</th>
<th>Subject questions</th>
<th>Object questions</th>
<th>Object clefts</th>
<th>Passives</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS1</td>
<td>3;4</td>
<td>75 (6/8)</td>
<td>75 (6/8)</td>
<td>0 (0/14)</td>
<td>78.5 (11/14)</td>
</tr>
<tr>
<td>WS2</td>
<td>3;4</td>
<td>75 (6/8)</td>
<td>100 (8/8)</td>
<td>78.5 (11/14)</td>
<td>0 (0/14)</td>
</tr>
<tr>
<td>WS3</td>
<td>4;2</td>
<td>100 (8/8)</td>
<td>87.5 (7/8)</td>
<td>0 (0/14)</td>
<td>50 (7/14)</td>
</tr>
<tr>
<td>WS4</td>
<td>6;9</td>
<td>100 (8/8)</td>
<td>100 (8/8)</td>
<td>100 (14/14)</td>
<td>100 (14/14)</td>
</tr>
<tr>
<td>WS5</td>
<td>7;2</td>
<td>100 (8/8)</td>
<td>100 (8/8)</td>
<td>100 (14/14)</td>
<td>100 (14/14)</td>
</tr>
</tbody>
</table>

Table 6. Correct performance (%) of the YWS children (N = 3) compared to that of their MA-matched controls (N = 9)

<table>
<thead>
<tr>
<th></th>
<th>Transitive sentences (SVO)</th>
<th>Subject questions</th>
<th>Object questions</th>
<th>Object clefts</th>
<th>Passives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean Range (SD)</td>
<td>Mean Range (SD)</td>
<td>Mean Range (SD)</td>
<td>Mean Range (SD)</td>
</tr>
<tr>
<td>YWS group</td>
<td>100 (42/42)</td>
<td>83.33 (20/24)</td>
<td>100 (42/42)</td>
<td>87.5 (21/24)</td>
<td>26.2 (11/42)</td>
</tr>
<tr>
<td></td>
<td>100–10</td>
<td>75–100</td>
<td>100–100</td>
<td>75–100</td>
<td>0–78.5 (0–78.5)</td>
</tr>
<tr>
<td>MA group</td>
<td>100 (126/126)</td>
<td>95.83 (72/72)</td>
<td>100 (126/126)</td>
<td>87.5 (69/72)</td>
<td>28.5 (36/126)</td>
</tr>
<tr>
<td></td>
<td>100–100</td>
<td>100–100</td>
<td>100–100</td>
<td>75–100</td>
<td>0–100 (0–50)</td>
</tr>
</tbody>
</table>

Further comparisons did not show any significant differences between the performance of the YWS participants and their corresponding MA-matched control group, except for the case of subject wh-questions (Mann-Whitney U test, $U = 4.5$; $p = 0.010$]. The YWS children performed better on object than subject wh-questions. This pattern of performance was not shown by TD children matched for MA.
Error analysis indicated that TD children and children with WS showed a similar pattern of performance. Table 7 presents the error types produced by all TD children (MA-matched and YTD controls) and participants with WS.

Both groups produced reversal of theta-role errors and case errors while interpreting object-questions. Whereas the former is a receptive error, the latter is a production error and, thus, not related to the receptive abilities of the participants. Case errors were only included in the error types because they do not constitute adult responses. Recall that children were required to tell the puppet the answer in the wh-question comprehension task. Some children produced correct determiner phrase (DP) marked for incorrect case, that is, nominative instead of accusative. One child with WS made a gender error and produced the correct DP marked for incorrect gender. Again this is a production and not a comprehension error. It was included in error types because it does not constitute an adult response.

Although the younger of the WS participants produced a few reversal of theta-role errors in the comprehension of subject wh-questions, the TD children did not. By contrast, both TD (MA-matched controls and YTD children) and WS children produced the same types of errors in the interpretation of passive sentences. Specifically, they produced reversal of theta-role errors and reciprocal interpretation errors. The latter are allowed in Greek due to the fact that both passive and reciprocal verb forms share the same suffix -me. In addition, children with WS and TD children made theta-role errors in the interpretation of object clefts; hence, they misinterpreted object clefts as subject clefts.

### Discussion

This study investigated the receptive linguistic abilities of Greek children with WS compared to children with typical development to provide a characterization of the language abilities of the WS participants as impaired, normal, or delayed. The main findings are as follows.
The results concerning TD children indicate that they performed at ceiling on structures with SVO word order and showed a high level of correct performance on object wh-questions. Therefore, they exhibited knowledge of syntactic operations required for wh-question formation. However, they demonstrated low performance on the interpretation of object clefts and passive sentences. Their low performance on object clefts can be attributed to the linking status of relative operators in object clefts (cf. Wexler, 1991; Guasti & Shlonsky, 1995). In particular, whereas the formation of wh-questions in Greek requires overt raising of a wh-operator to the clause initial position, thus creating an A-bar chain with the wh-operator in Spec-CP binding a variable in the base position (Browning, 1987; Chomsky, 1986), the formation of clefts requires a relative operator moved to an A-bar position, which needs to be co-indexed with its variable and with the head NP, hence, the linking status of the relative operator. (Note: Spec-CP indicates “the specifier position within CP” [Radford, 1997, p. 528]. CP is the complementizer phrase “headed by a complementizer” [Radford, 1997, p. 499]). Therefore, the observed difficulties with object clefts are highly related to the linking status of the relative operator (Guasti and Shlonsky, 1995); Wexler, 1991). In addition to demanding syntactic processes taking place in object clefts, the association of the patient theta-role with nominative case makes these structures even more difficult. Due to misleading surface morphological cues (nominative case is associated with patient theta-role instead of agent theta-role), children have to rely on syntactic operations and overcome “misleading” directions from linguistic input.

Similar constraints may hold for the acquisition of A-movement as TD children showed a low level of correct performance on passives. Borer and Wexler (1987, 1992) claimed that specific maturational constraints are required for the acquisition of passive sentences. Evidence for late acquisition of verbal passives of action verbs by Greek children comes from a study by Terzi and Wexler (2002). Based on comprehension data, Terzi and Wexler (2002) have claimed that children’s low performance on passives can be interpreted in terms of the A-Chain Deficit Hypothesis, according to which the acquisition of A-chains is only possible after a particular point of age maturation (Borer & Wexler, 1992). Stavrakaki suggests that, due to unavailable surface cues for the interpretation of passives (surface word order cues or morphological cues, i.e., association of morphological case with theta-role, see the Design and materials section), children should only rely on syntactic knowledge, which is, nevertheless, late acquired (Terzi & Wexler, 2002). This study revealed many similarities between the WS and TD participants. First, the participants with WS showed a very high level of performance on the structures with SVO word order and who-object questions. With the exception of the YWS participants’ lower performance on the who-subject compared to that shown by the YTD group, analyses revealed the same level of performance on all tested
structures by WS participants and their correspondent MA-matched controls. One possible interpretation for the lower performance of the YWS participants on subject wh-questions compared to that of the YTD group is the ceiling level of performance on subject wh-questions shown by the YTD group. Another interpretation concerns a possible developmental strategy employed by the WS individuals. Noticeably, two of the YWS participants performed better on object than subject wh-questions, a pattern not found in typical development. This peculiar pattern of the WS children’s performance, that is, better accuracy performance scores for object than subject wh-questions, was also reported in a recent study on the production of wh-questions by Greek children with WS (Stavrakaki, 2004). In particular, one child with WS in that study performed better on the production of who-object than who-subject questions. This performance was interpreted as showing a preference for grammatical processes and rules, in particular wh-operator movement (required for object wh-questions) over simple heuristic strategies, in particular, use of the SVO word order strategy (sufficient for successful subject wh-question production).

The proposed interpretation of the present data is along the same lines: Individuals with WS show a strong preference for overusing wh-movement, hence, their better performance on object than subject wh-questions. These findings are compatible with the profile of children with WS described in the literature. Specifically, Clahsen and Almazan (1998) proposed that these children overuse grammatical rules of past tense formation in English as shown by the overgeneralization of the regular suffix both to existing regular forms and to novel words rhyming with existing irregulars. Apart from the stronger than usual reliance on grammatical rules, the children with WS in this study did not show any differences from TD children. They performed similarly low on object clefts and passive sentences as controls. In addition, error analysis indicated the same error types for WS and TD participants. Therefore, the performance of children with WS did not differ from that of TD children in both quantitative and qualitative terms as shown by accuracy scores and error analysis. Consequently, the performance of children with WS cannot be characterized as impaired or even delayed when compared to the performance of TD children.

In sum, TD children and children with WS indicated knowledge of complex syntactic structures. The low performance on object clefts and passives is related to the specific acquisition requirements for these structures, which holds true for both TD children and individuals with WS. In this respect, the results of the present study are taken to support the view that, as far as the reception of syntax is concerned, children with WS show normal abilities consistent with their mental age (cf. Clahsen et al., 2004).
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REFERENCES


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