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Linguistic description of sentence production of Spanish speakers with Williams syndrome

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ABSTRACT

This paper describes the grammatical complexity and sentence production in spontaneous speech among Spanish-speaking adults with Williams syndrome (WS). The goal is to provide a linguistic description of the typical sentence patterns used by Spanish speakers with WS. A sample of 30 spontaneous speech corpora (16 WS, 14 TD) was collected, transcribed and manually analyzed. The study identifies significant differences between the two groups, particularly in the complexity of syntactic constructions and the discourse production. Results show that WS speakers produce fewer words and significantly fewer complex sentences, such as those involving complementizers, pronominalized objects, or relative clauses. These findings align with prior research, suggesting deficits in working memory, syntactic production, and the manipulation of hierarchical grammatical rules among WS individuals. This study corroborates the notion that while WS individuals often display notable verbal strengths, these coexist with an atypical development of their syntactic capacity.

1. Introduction

Williams syndrome (hereinafter, WS) is a rare neurodevelopmental genetic disorder resulting from the deletion of approximately 19–25 genes on chromosome 7q11.23 (Brock, 2007). This condition is marked by a unique cognitive and linguistic profile with pronounced challenges in specific cognitive areas, such as spatial reasoning and complex language processing. Individuals with WS typically exhibit a heightened sensitivity to social engagement and expressive language, but they often face difficulties when it comes to mastering certain grammatical structures, especially within syntax and morphology (Benítez-Burraco et al., 2016; Karmiloff-Smith et al., 1997; Perovic & Wexler, 2007).

This study seeks to provide an analysis of the linguistic characteristics of adult individuals with WS, examining how their sentence production in spontaneous oral discourse compares to that of typically developing (TD) individuals. Most studies on WS have been conducted from an ontogenetic perspective. To our knowledge, no research in descriptive linguistics has focused on adults with WS as a population group with distinct linguistic characteristics—one that, therefore, still requires systematic description. By focusing on syntactic complexity and grammatical usage, this research aims to determine whether there are both distinctive and overlapping patterns in language use between these two groups.

The data for this paper includes orthographic transcriptions of spontaneous speech from 30 linguistically adult participants. The underlying idea is that, although individuals with WS often display relatively strong expressive language skills, they may struggle with the production of syntactically complex sentences and tend to simplify or avoid certain grammatical constructions. Research on WS this far highlights a discrepancy: while individuals with WS can produce language fluently and socially, their linguistic competence, especially in structured syntax and morphology, may not align with that of TD individuals (Benítez-Burraco et al., 2016).

While the goal is to provide a clinical linguistic description of sentence production, the main research question focuses on whether there is a significant difference in the types of sentences produced by individuals with WS compared to TD individuals in spontaneous speech. To do so, the list of sentence types included in the *Test de comprensión de estructuras gramaticales* (CEG) (Mendoza et al., 2005) was used as a

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reference guide, since it allows a clear categorization of sentence types and facilitates comparisons across different grammatical structures. Just as the linguistic description of a language is typically based on the speech produced by adult speakers, we believe that any linguistic description of the way people with WS speak should also be based on adult speakers. Thus, the focus of the present study is not on tracking language development in WS, but rather on identifying the typical characteristics of discourse in individuals with WS.

The paper is structured as follows: after the introduction, 2 characterizes WS from both a general and a linguistic point of view, 3 presents the methodology used in the study, and 4 presents the results, which are discussed in 5. Finally, 6 includes some conclusions.

2. Williams syndrome: a characterization

2.1. Clinical characterization

Williams syndrome is a rare genetic disorder that was initially described by New Zealand cardiologist John C. P. Williams in 1961 (Williams et al., 1961) and later by German pediatrician Alois Beuren (Beuren et al., 1962), who laid the groundwork for the understanding of this genetic condition.

The incidence of WS has been estimated to be between 1 in 7500 and 1 in 20,000–25,000 births (Bellugi et al., 1988; Brock, 2007). This condition results primarily from a deletion of genetic material in the 7q11.23 region of chromosome 7, involving 19–25 genes, which include the elastin (ELN) gene, among others that impact neurocognitive regions (Garayzábal & Cuetos, 2010).

The deletion affecting the ELN gene, which encodes elastin, is linked to supravalvular aortic stenosis (SVAS), a hereditary vascular disease that can cause heart failure or death (Ewart et al., 1994). ELN plays a critical role in providing elasticity to blood vessels, joints, and other tissues essential for growth. Its absence can result in vascular constriction, premature skin aging, joint problems, and distinct facial traits, including a broad forehead, upturned nose, prominent cheeks, full lips, a wider mouth, small, spaced teeth, and a small jaw (Morris et al., 1988).

Additional features are visual issues like strabismus, myopia, or hypermetropia (Beuren et al., 1964). WS patients often experience slower growth in childhood and adolescence, which might result in a shorter-than-average stature (Morris, 2010; Partsch et al., 1999).

Furthermore, a reduced total brain volume has been reported, with specific reductions in prefrontal and parietal cortices linked to challenges in executive planning and visuospatial coordination (Galaburda et al., 2002; Mervis et al., 2003; Reiss et al., 2000). Additional studies show a significant reduction in gray matter volume within the occipital lobe in adults with WS. This atypical volume may relate to reduced parietal lobe activation during visual tasks (Boddaert et al., 2006; Meyer-Lindenberg et al., 2004).

In summary, research on the neuroanatomical distinctions in WS highlights a complex profile of structural and functional brain alterations, explaining many of the cognitive and behavioral traits associated with WS.

2.2. Cognitive profile

The cognitive development of individuals with TD and those with WS can differ significantly due to the unique characteristics associated with this genetic disorder (Bellugi et al., 1994).

To start with, unlike typically developed individuals, those with WS often exhibit uneven patterns in their cognitive abilities (Mervis & Becerra, 2007). On the one hand, they often demonstrate remarkable adaptability and proficiency in social situations, which can help them compensate for some of their cognitive difficulties. However, these social skills may not be sufficient to overcome all limitations associated with the syndrome, especially in academic or professional environments that demand specific skills where they may struggle. On the other hand, individuals with this syndrome frequently encounter challenges with motor skills, which can hinder their ability to perform tasks requiring coordination, such as writing, dressing, or participating in sports.

A hallmark of those affected by Williams syndrome is their pronounced social profile. They tend to exhibit a strong affinity for social interaction and are often described as “great conversationalists” (Garayzábal et al., 2007). However, they often struggle to grasp social subtleties and implicit social norms, which can lead to awkward situations or misunderstandings. At the same time, they might have specific phobias and obsessions, even though there is a cognitive heterogeneity in WS (Miezah et al., 2020; Miezah et al., 2021). This heterogeneity has often led to difficulties in the assessment of their linguistic abilities.

2.3. Linguistic profile

Despite challenges in other areas of cognitive development, speakers with WS often exhibit remarkable abilities to learn and use language, which has led different authors to consider that language is a strength for individuals with WS. For instance, according to Bellugi et al. (1988), the general cognitive impairment observed on individuals with WS contrasts with their relative strength in language, and what they consider facility and ease in using sentences with complex syntax.

However, other studies have identified some alterations in language development. For instance, Karmiloff-Smith et al. (1997) argue that the language acquisition process is delayed, and linguistic abilities are not spared, but delayed or perhaps impaired across diverse domains. A similar perspective is that of Perovic and Wexler (2007), who state that people with WS acquire and process language differently than typical speakers due to the overall characteristics of their cognitive development (Miezah et al., 2020).

Some authors have noted that morphological and syntactic errors are not uncommon in these individuals (Niego & Benítez-Burraco, 2019), even though not all levels of language seem to be equally affected. Different patterns apply according to the different language areas —phonology, lexicon and semantics, pragmatics, and morphosyntax.

Concerning phonetics and phonology, speakers with WS appear to have relatively good speech production, as well as better short-term phonological memory compared to individuals with other syndromes, such Down syndrome (though not compared to typical speakers).

In the fields of lexicon and semantics, the situation is more complex. On the one hand, studies such as those by Clahsen and Almazan (1998); Clahsen and Almazan (2000) or Ring and Clahsen (2005) assert that speakers with WS might have an impairment of the lexical system or its access mechanism. On the other hand, Brock (2007) suggests that there isn’t enough evidence to imply that children with WS have different vocabularies than those of individuals with similar nonverbal abilities and considers that receptive vocabulary is even a strength for them.

Regarding pragmatics, Díez-Itza et al. (2022) and Moraleda and López Resa (2024) indicate that speakers with WS experience significant difficulties throughout their development. It has been found that, while these individuals are often characterized as hypersocial, they exhibit delays in developing joint attention skills (such as coordinating attention between a person and an object or event of mutual interest). They also struggle to infer communicative intentions behind pointing gestures and eye contact, commit more violations of Grice’s maxims than typical speakers (such as repetitive disfluencies and a higher proportion of non-contingent language in conversations), and sometimes do not adequately understand figurative language (Díez-Itza et al., 2022).

Finally, at the morphosyntactic level, which is the focus of this paper, the findings appear even more ambiguous than in the lexicon and semantics. On one hand, some authors (Clahsen & Almazan, 1998; Ring & Clahsen, 2005; Stavrakaki, 2004) argue that there is little evidence suggesting atypical development of syntax or morphology in speakers with WS. For instance, Brock (2007) points out that studies with children indicate a normal relationship between sentence complexity and lexical repertoire. However, several authors (notably Karmiloff-Smith

et al., 1997, and Benítez-Burraco et al., 2016) show, in contrast to other studies, that speakers with WS do exhibit relatively atypical errors in word order, gender agreement, verb inflection, and the comprehension of certain complex grammatical structures. In the same line, Díez-Itza et al. (2017) suggest that individuals with WS "demonstrate persistent problems with grammatical gender, prepositions, tenses, verb-noun agreement, referencing indicators, overgeneralization of grammatical rules and irregularities in sentence structure" (p. 313–314). Llull Febrer et al. (2025) examined agreement in Spanish among individuals with Williams syndrome, finding largely similar gender and number patterns to those of typically developing speakers. Minor differences, like a slight TD preference for unmarked gender, and low error rates in both groups suggest individual variation rather than syndrome-specific deficits—though limited statistical power warrants caution.

Recent studies by Cremades and Barceló-Coblijn (2024) suggest that the syntax of speakers with WS is significantly different from that of typically developing speakers, and Sederias et al. (2024) explain that individuals with WS produce "fewer complex sentences, shorter utterances, and more frequent function words than chronological-age matched controls" (p. 1).

Thus, the question of how language develops in individuals with Williams syndrome remains open, which highlights the importance of further investigating how linguistic skills develop in the context of this genetic disorder. This is what the present paper intends to do.

3. Methodology

3.1. Corpus configuration

To build the corpus, the Laboratori d'Investigació en Complexitat i de Lingüística Experimental (LICLE) at the University of the Balearic Islands collaborated with the Àncora project, a project that focuses primarily on gathering linguistic data from individuals with WS, including spontaneous speech samples, from which the current study's corpus was derived.

The primary objective of the Àncora project is to gather linguistic data from individuals with Williams Syndrome (WS). As part of this effort, spontaneous speech corpora are being compiled, and the corpus analyzed in the present study was drawn from this collection. The project, titled *Semantic Knowledge in Williams Syndrome*, was conducted in accordance with the Declaration of Helsinki and received approval from the Parc de Salut MAR Research Ethics Committee on Drug-Related Research (approval code 2018/8360/I, approved on 26 March 2021).

Part of this project focuses on collecting spontaneous speech samples and analyzing grammatical errors. Each speech sample lasted between 4 and 6 min and was transcribed orthographically in all cases. Participants took part individually in a spontaneous speech session with a researcher, during which they were free to speak about any topic of their choice. As is well known, individuals with WS tend to be highly talkative, so it was not difficult to collect conversation samples. Table 1 summarizes the characteristics of the participants.

The sample included 30 participants: a control group of 14 individuals (mean age = 24.25 years, SD = 13.55) and a WS group of 16 individuals (mean age = 26.93 years, SD = 14.10). The WS group consisted of 9 men and 7 women, while the control group included 6 men and 8 women. In the WS group, 8 participants were Peninsular Spanish speakers, and 8 were Mexican Spanish speakers. In the control group, 10 participants were Peninsular Spanish speakers, and 4 were Mexican Spanish speakers. The youngest participant with Williams syndrome was 13 years old, while the oldest was 52. In the control group the youngest participant was 8 years of age, while the oldest was 57. All participants were informed of the procedure and provided consent to participate in the study.

Table 1
Participants' characteristics.

WS group		TD group	
16 (mean age = 26.93 years, SD = 14.10)		14 (mean age = 24.25, SD = 13.55)	
Men	*Women*	*Men*	*Women*
9	7	6	8
Peninsular Spanish	*Mexican Spanish*	*Peninsular Spanish*	*Mexican Spanish*
8	8	10	4

3.2. Data analysis

This section summarizes the procedures and techniques used to analyze the data collected from participants with TD and WS. The variables analyzed include the clinical condition and sentence type based on the *Test de comprensión de estructuras gramaticales* (CEG) (Mendoza et al., 2005). The CEG is an assessment tool designed to measure the ability to understand a range of grammatical structures of increasing difficulty in children aged 4–11 with typical language development, as well as in children and adults with various language pathologies (e.g., children with SLI/LD, aphasia, children with different types of language learning disorders, and individuals with mild hearing impairments). The test follows a multiple-choice format: children need to choose a drawing among four options, one of which is correct, and the others are distractors.

There are several reasons why this study has based its classification of clauses on the CEG, the main four being the ones we present below. First, given the lack of instruments in Spanish for assessing grammatical comprehension, the CEG is a unique and standardized tool that provides a consistent framework for evaluating the grammatical comprehension of the Spanish language. Second, it encompasses a broad range of grammatical constructions, allowing for a thorough and detailed analysis of various aspects of grammar. This facilitates a comprehensive understanding of the grammatical abilities of the subjects under study. Third, the CEG has been used in various populations, including children, adults, and individuals with language disorders, demonstrating its versatility and applicability across different groups. Finally, as the CEG has been applied in other studies, its results can be compared, and the findings can be situated within broader contexts (Mendoza et al., 2005).

3.2.1. Variables

In this study, the main variables analyzed the clinical condition, on the one hand (i.e., presence or absence of WS), and the sentence type, based on categories from CEG. The sentences in this test include simple, coordinated, and complex sentences, assessing the ability to produce and understand grammatical structures of varying complexity. This study has also included completive and adverbial clauses to investigate the production of sentences that the CEG does not consider. Detailed below are the specific syntactic structures analyzed in the spontaneous spoken discourse of the participants.

3.2.2. Classification of clauses

In this section the classification of grammatical structures considered for this study are presented. As said, this study has based its classification on the CEG (Mendoza et al., 2005). Of all the grammatical constructions, the CEG selects those that have been most studied in relation to the Spanish language. This study analyzes almost all these grammatical constructions, with the particularity that the focus of this research is not on the comprehension of these structures but on production. Table 2 exemplifies the grammatical constructions observed for the study, based on the CEG. A manual analysis was conducted on the transcriptions of the spontaneous oral corpus of the speakers to identify and quantify the production of each grammatical structure.

In addition to the grammatical structures provided by the CEG, this study has examined the production of completive and adverbial subordinate clauses, which are more complex syntactic structures. The paper also included unfinished sentences and phrases, which appeared due to the spontaneous nature of oral discourse. Under the label "unfinished

Table 2
Classification of grammatical constructions used for this study, based on CEG (with some modifications).

Type of sentence	Example (in Spanish)
Attributive sentence	*El coche es azul.* ('The car is blue') *El chico parece mayor.* ('The child looks older')
Negative predicative sentences	*El ordenador no funciona.* ('The computer doesn't work')
SVO predicative sentences (no distinction of subject or reversibility)	*La profesora escucha al alumno.* ('The teacher listens to the pupil')
SVCC predicative sentences with a locative (*above, below, in front of, behind*)	*El perro se esconde detrás del sofá.* ('The dog hides behind the sofa')
Absolute comparative sentences	*El lápiz es más corto.* ('The pencil is shorter')
Sentences with pronominalized object (without contrast of gender and number)	*Las niñas lo miran.* ('The girls are looking at him')
Reversible OVS passive sentences	*La niña es empujada por el niño.* ('The girl is pushed by the boy') *El niño es empujado por la niña.* ('The boy is pushed by the girl')
OVS sentences with a focalized subject	*Agua, hemos comprado, y no pan* ('We have bought water, not bread')
SVO clauses with a cleft subject	*Es el gato el que muerde al perro.* ('It is the cat that bites the dog')
Sentences with a cleft object	*Es al gato al que muerde el perro.* ('It is the cat that the dog bites')
Coordinated disjunctive sentences	*Ni el gato ni el perro son negros.* ('Neither the cat nor the dog are black')
Coordinated adversative sentences	*El ordenador es viejo pero todavía funciona* ('The computer is old but it still works')
Relative sentences of the types OS / SS / SO	*El gato [al que el perro persigue] es pequeño.* ('The cat [that the dog is chasing] is small')
Completive sentences	*Creo [que aprobaré el examen].* ('I believe [that I will pass the exam].')
Causal adverbial clauses	*No fuimos al parque [porque estaba lloviendo].* ('We went to the park [because it was raining].')
Conditional adverbial clauses	*Iremos a la playa si hace buen tiempo.* ('We'll go to the beach [if the weather is good].')
Temporal adverbial clauses	*Salí cuando empezó a llover.* ('I left [when it started raining].')
Goal adverbial clauses	*Tienes que estudiar mucho para aprobar el examen.* ('You need to study a lot [to pass the exam]')
Manner adverbial clauses	*Hazlo como te lo indica.* ('Do it as it is indicated.')
Incomplete sentences	*"después (.) después de comer me [/] nos iremos al [alarga el sonido vocálico] a Sansha [ø?] […]"* ('after (.) after eating I [/] we'll goooo to Sansha [ø?] […]')
Phrases	*Aquí en Mallorca* ('Here in Mallorca')

sentences" we included sentences that the speaker does not complete, either due to a sudden change of topic, interruption by the interlocutor, or a change in linguistic strategy, seeking linguistic alternatives when producing certain grammatical constructions. On the other hand, when referring to "phrases," we denote a linguistic unit composed of one or more words that form a coherent group within a sentence. This group of words functions as a unit and serves a specific syntactic function within the sentence.

The first grammatical construction considered is the attributive clause, as exemplified in (1). This type of sentence features a copulative verb (such as *ser, estar, parecer*), which serves as a link between the subject and an attribute.

(1)	a.	El	perro	es	negro.
		The	*dog*	*is*	*black.*
	b.	El	agua	está	fría.
		The	*water*	*is*	*cold.*
	c.	El	suelo	parece	mojado.
		The	*ground*	*looks*	*wet.*

In contrast, predicative clauses with an SVO structure follow the canonical pattern in Spanish: Subject-Verb-Object. In these clauses, the verb conveys an action, process, or state related to the subject. The structure indicates that the subject performs the action of the verb, which then affects a direct object. Unlike attributive clauses, where the verb carries no semantic weight and serves merely to connect the subject with the predicate, the verb in predicative sentences is semantically loaded. The grammatical constructions considered for predicative clauses are illustrated in (2), with (2a) pertaining to negative predicative clauses and (2b), to a reversible SVO predicative clause.[3] In (2c) the sentence belongs to the group of SVCC predicative sentences indicating location (*above, below, in front of, behind*). These sentences include a locative adjunct, such as those introduced by *arriba* ('above'), *abajo* ('below'), *delante* ('in front of'), and *detrás* ('behind').

(2)	a.	El	gato	no	corre.			
		The	cat	no	runs			
		The cat does not run.						
	b.	El	hombre	besa	a	la	mujer.	
		The	man	kisses	to	the	woman	
		The man kisses the woman.						
	c.	El	perro	se	esconde	detrás	del	sofá
		The	dog	REFL.3SG	hides	behind	of+the	sofa
		The dog hides behind the sofa.						

Coordination is the grammatical procedure by which two syntactic constituents are associated without establishing a grammatical hierarchy between them. This is achieved using coordinating conjunctions, such as i*y* ('and'), *ni* ('*neither*'), *o* ('or'), and *sino* ('(not) but'). This study has assessed disjunctive coordinated sentences, specifically the coordinated element *ni…ni…* ('neither…nor') as in (3).

(3)	a.	Ni	el	gato	ni	el	perro	son	negros.
		neither	the	cat	nor	the	dog	are	black.PL
		Neither the cat nor the dog is black.							

Another type of coordination investigated in both the CEG and this study is adversative coordination, which contrasts the different coordinated elements. The most common adversative coordinating conjunctions are *pero* (4a) and *sino* (4b):

The next construction considered in this research is the cleft clause in which the focalized constituent is the subject, as in (5). In these constructions, there is an attributive clause introducing the cleft constituent (in this case, the subject), and a complementizer introducing a relative

[3] In this study, given that the difficulty level in the CEG test is similar, we do not distinguish between types of subjects (animated—human or animal—or inanimate), nor do we consider the reversibility of the action. This means that the subject and object of such sentences can be interchanged without significantly altering the basic meaning or grammar of the sentence.

(4)	a.	El	ordenador	es	viejo	pero	todavía	funciona.			
		the	computer	is	old	but	still	works			
		The computer is old, but it still works.									
	b.	El	ordenador	no	solo	es	viejo	sino	que	no	funciona.
		the	computer	no	only	is	old	but	that	no	works
		The computer is not only old, but it doesn't work.									

clause that is attributed to the cleft constituent.

(5)	Es	el	gato	el	que	muerde	al	perro.
	is	the	cat	the	that	bites	to the	dog
	It is the cat that bites the dog.							

Absolute comparative sentences were also considered. These sentences make a comparison without specifying the second term of comparison. Instead of explicitly comparing two elements, the second term is implied, like in (6).

(6)	El	lápiz	es	más	corto.
	the	pencil	is	more	short
	The pencil is shorter.				

Additionally, we analyzed OVS sentences with focalized objects, as in (7). These structures place the direct object at the beginning of the sentence (Object-Verb-Subject) to emphasize or highlight it, followed by the verb (and, if necessary, the subject).

(7)	Agua,	hemos	comprado,	y	no	pan.
	water	have.1PL	bought	and	no	bread
	We have bought water, not bread					

The study also examined sentences with pronominalized objects, as in (8). In these structures, the direct or indirect object is replaced with a clitic pronoun to avoid unnecessary repetition of the same noun, making the sentence more fluid and natural. Although the CEG distinguishes between sentences with pronominalized objects based on gender and number contrasts and those with gender contrasts alone, this study does not make this distinction since both constructions exhibit a similar level of difficulty in comprehension and production.

(8)	El	perro	los	persigue.
	the	dog	them.ACC	chases
	The dog chases them.			

Reversible OVS passive sentences (9) are also part of this study. Reversible passive sentences allow for the roles of subject and object to be inverted, making both forms equally valid and understandable.

(9)	a.	La	niña	es	empujada	por	el	niño.
		the	girl	is	pushed.F.SG	by	the	boy.
		The girl is pushed by the boy.						
	a.	El	niño	es	empujado	por	la	niña.
		the	boy	is	pushed. M.SG	by	the	girl
		The boy is pushed by the girl.						

Another group of sentences considered were the *it-cleft* sentences with a focus on the object, as in (10). In these constructions, the attributive clause introduced the object, and the relative also refers to it.

(10)	Es	al	gato	al	que	muerde	el	perro
	is	to the	cat	to the	that	bites	the	dog
	It is the cat that the dog bites.							

Relative clauses are subordinate sentences introduced by a relative pronoun, adjective, or adverb that act as modifying complements of an element known as the antecedent (Bosque & Demonte, 1999). In (11) there is an example illustrating the use of the relative pronoun that introduces the subordinate clause.

(*continued on next page*)

(13)	a.	No	salimos	[*porque*	llovía].				
		no	got out. 1PL	because	was raining				
		We didn't get out because it was raining.							
	b.	Iré	a	la	playa	[*si*	hace	buen	tiempo.]
		go.1SG.FUT	to	the	beach	if	makes	good	weather
		I will go to the beach if the weather is good.							
	c.	Salí	[cuando		paró	de	llover.]		
		got out.1SG	when		stopped	to	rain		
		I went out when it stopped raining.							
	d.	Necesitas	estudiar		[*para*	aprobar		el	examen.]
		need.2SG	study		to	pass		the	exam
		You need to study to pass the exam.							
	e.	Hazlo	[como		te	lo		indica	
		do it.ACC	as		you.DAT	it.ACC		indicates	
		Do it as indicated.							

(*continued*)

(11)	El	perro	[que	persigue	al	gato]	es	pequeño.
(11)	El	perro	[que	persigue	al	gato]	es	pequeño.
	the	dog	that	chases	to the	cat	is	small
	The dog [that is chasing the cat] is small							

In addition to the grammatical structures provided by the CEG, this study has examined the production of completive and adverbial subordinate clauses, which are more complex syntactic structures. A completive clause is a subordinate clause introduced by a complementizer (*que* 'that', *si* 'if') that can perform functions typically reserved for noun phrases, such as subject (12a) or direct object (12b).

(12)	a.	Me	molesta	[que	no	confíes	en	mi].
		me.DAT	bothers	that	no	trust. 2SG	in	me.
		It bothers me that you distrust me.						
	b.	El	doctor	me	recommendó	[que	tomara	vitaminas.]
		the	doctor	me.DAT	recommended	that	take.1SG.SUBJ	vitamins
		The doctor recommended that I take vitamins.						

On the other hand, an adverbial subordinate clause is a type of subordinate clause that functions as an adverb within the main sentence. This means it modifies the verb, adjective, or adverb of the main sentence, providing additional information about circumstances such as cause (13a), condition (13b), time (13c), goal (13d), and manner (13e). Adverbial subordinate clauses are introduced by specific subordinating conjunctions, marked in italics.

Finally, the paper also included unfinished sentences and phrases, which appeared due to the spontaneous nature of oral discourse. Under the label "unfinished sentences" we included sentences that the speaker does not complete, either due to a sudden change of topic, interruption by the interlocutor, or a change in linguistic strategy, seeking linguistic alternatives when producing certain grammatical constructions. On the other hand, when referring to "phrases," we denote a linguistic unit composed of one or more words that form a coherent group within a sentence. This group of words functions as a unit and serves a specific syntactic function within the sentence.

Next section explains how the statistical analysis was conducted and how the production of grammatical structures in individuals with Williams syndrome was compared to that of individuals with typical language development.

3.2.3. *Statistical analysis*

For the analysis, a manual annotation and quantification of grammatical structures were performed on the transcripts derived from the speakers' spontaneous oral corpora. Subsequently, statistical analyses were conducted utilizing the JASP Version 0.17.1 (JASP Team, 2023) and IBM SPSS Statistics Version 27 (IBM Corp, 2020).

4. Results

Fig. 1 and Fig. 2 illustrate the distribution of different types of grammatical constructions produced by TD speakers (Fig. 1) and WS speakers (Fig. 2). The constructions that were not produced (or that were produced only once) were excluded from the figures.

For the first group, Fig. 1 shows that speakers with typical development tend to predominantly use attributive sentences (44.7%), followed by completive clauses (13.3%) and relative clauses (8.1%) and phrases (8.0%). This distribution also indicates a balance between the use of simple sentences and the ability to produce more complex structures, reflecting a diverse grammatical competence. However, there is a noticeable tendency toward simplicity in spontaneous oral discourse.

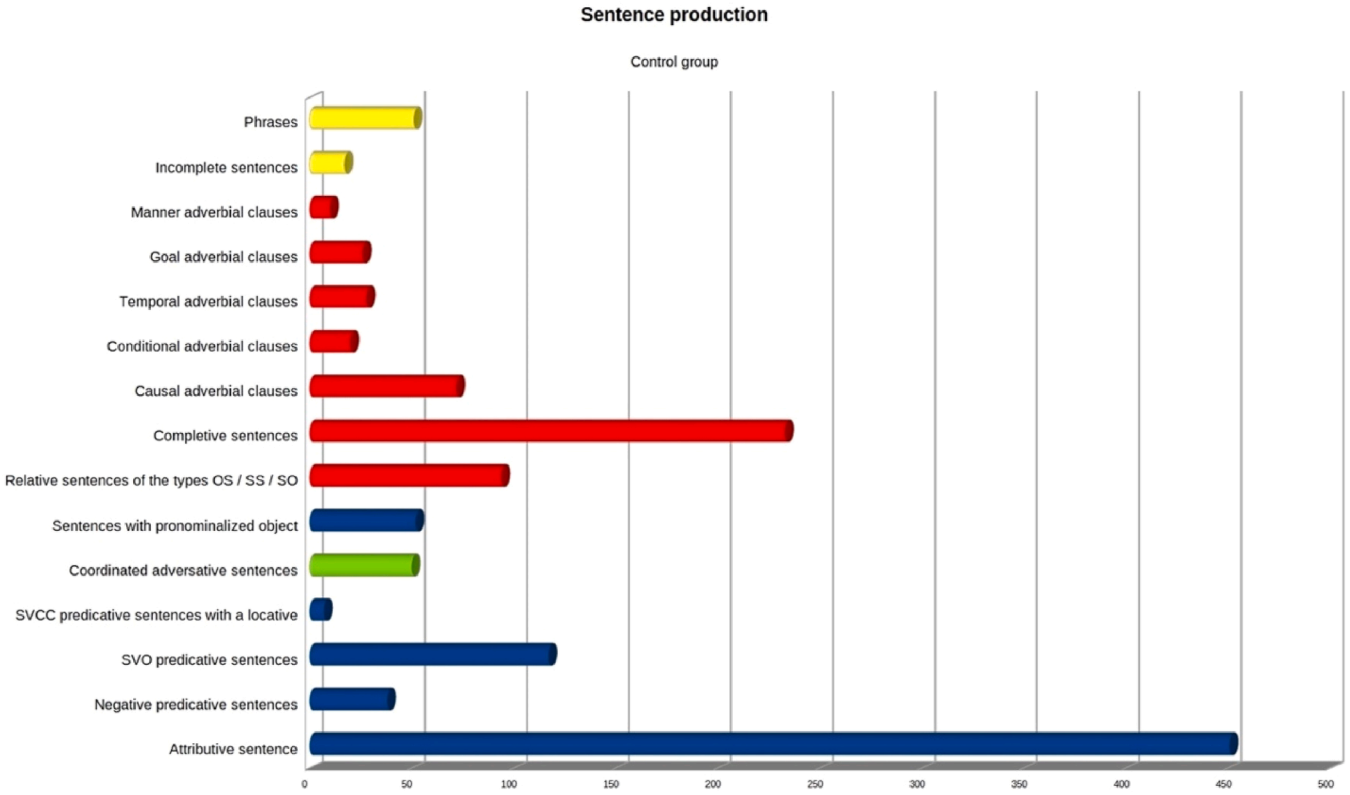

Fig. 1. Types of sentences produced by TD speakers: in red, complex sentences; in yellow, non-sentential structures; in green, sentences with informative changes; in blue, simple sentences.

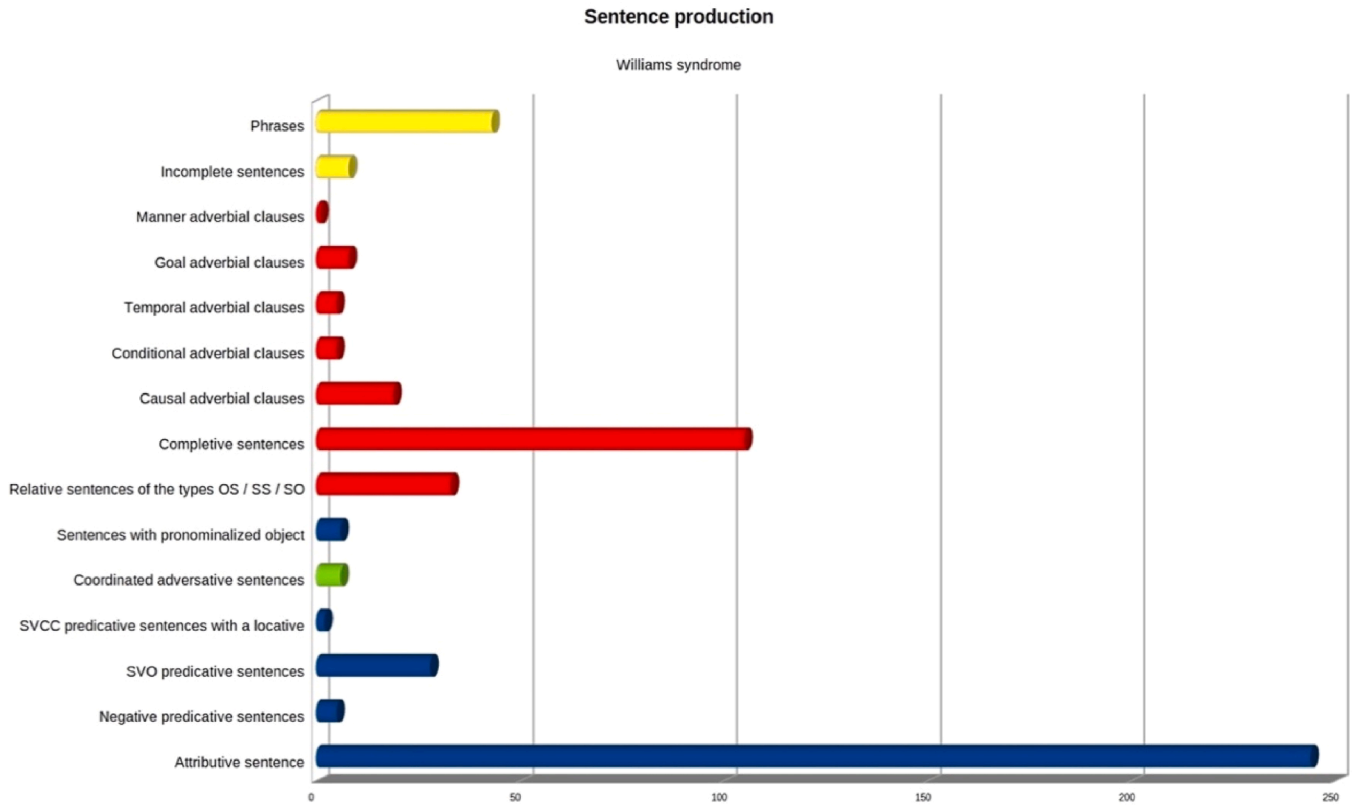

Fig. 2. Types of sentences produced by WS speakers: in red, complex sentences; in yellow, non-sentential structures; in green, sentences with informative changes; in blue, simple sentences.

When we compare Fig. 1 with 2, which illustrates the sentence types produced by speakers with WS, notable differences emerge in the production of grammatical structures. Speakers with WS show a similar distribution compared to TD speakers, with a high percentage of attributive clauses (with a 41.4% of the clauses, which is slightly lower than the number of attributive clauses produced by TD speakers). Moreover, both groups use completive and relative clauses of OS/SS type, although with differing frequencies. WS speakers produce a higher percentage of relative (17.8%) and completive clauses (17.8%) compared to TD speakers (8.1% and 13.3%, respectively).

Overall, the results of the comparative analysis of spontaneous spoken language between WS and TD speakers show significant differences in the types of sentences used more frequently. Interestingly, these findings suggest a marked preference for certain levels of sentence complexity and structure. TD speakers demonstrate a greater variety and complexity in their constructions. Furthermore, WS speakers not only produce fewer sentences overall but also tend to repeat the same grammatical structures.

Table 3
Analysis of variance (ANOVA), homogeneity correction: Brown-Forsythe.

	Sum of Squares	df	Mean Square	F	p	η^2
Attributive sentence	2148810	1000	2148810	20479	< .001	435
SVO predicative sentences	325952	1000	325952	33950	< .001	566
Relative sentences	161572	1000	161572	17877	< .001	401
Completive sentences	758715	1000	758715	14692	< .001	353
Causal adverbial clauses	116815	1000	116815	19845	< .001	428
Incomplete sentences	3810	1000	3810	1597	.217	54

Descriptive statistics for all variables are provided in Appendix 1. To start with, there are differences regarding lexical productivity, with TD participants producing a mean of 821.9 words (SD = 261.9) and WS participants, a mean of 315.4 words (SD = 100.1). Considering the differences in the average number of words between groups, as well as the standard deviation of age within each group, an ANCOVA was conducted to control for the potential influence of age as a covariate. The analysis revealed that the variable WS had a statistically significant effect on the number of words produced, with a large effect size ($F = 55.072$, $p < .001$, $\eta^2 = 0.631$). Conversely, the covariate age also showed a statistically significant effect, albeit with a small effect size ($F = 5.169$, $p = 0.031$, $\eta^2 = 0.059$).

Leven's test for equality of variances identified significant differences ($p \leq 0.05$) across the following variables: number of words ($p = 0.006$); negative predicative sentences ($p = 0.025$); SVCC predicative sentences with a locative ($p = 0.026$); coordinated adversative sentences ($p < 0.001$); sentences with pronominalized objects ($p = 0.008$); conditional adverbial clauses ($p = 0.025$); temporal adverbial clauses ($p = 0.017$); goal adverbial clauses ($p = 0.017$); manner adverbial clauses ($p = 0.002$). Conversely, no significant differences were observed for the following variables: attributive sentences ($p = 0.551$); SVO predicative sentences ($p = 0.054$), noted as approaching but not reaching the significance threshold ($p \leq 0.05$); relative sentences ($p = 0.122$); completive sentences ($p = 0.108$); causal adverbial clauses ($p = 0.088$); incomplete sentences ($p = 0.411$). Certain variables could not be subjected to statistical analysis due to insufficient sample sizes. These include coordinated disjunctive sentences, SVO clauses with a cleft subject, absolute comparative sentences, OVS sentences with a focalized subject, reversible OVS passive sentences, and sentences with a cleft object.

A one-way analysis of variance (ANOVA) was conducted for the variables that did not show significant results in Levene's test (see

Table 4
Mann-Whitney *U* test, effect size (Hedge's g) given by the rank biserial correlation.

	W	p	Rank-Biserial Correlation	SE Rank-Biserial Correlation	95% CI for Rank-Biserial Correlation	
					Lower	Upper
Number of words	224.000	< .001	1.000	0.212	1.000	1.000
Negative predicative sentences	213.000	< .001	0.902	0.212	0.786	0.956
SVCC predicative sentences with a locative	131.000	0.269	0.170	0.212	-0.245	0.532
Coordinated adversative sentences	198.500	< .001	0.772	0.212	0.541	0.895
Sentences with pronominalized object	217.000	< .001	0.938	0.212	0.861	0.973
Conditional adverbial clauses	179.500	0.003	0.603	0.212	0.270	0.807
Temporal adverbial clauses	195.500	< .001	0.746	0.212	0.494	0.882
Goal adverbial clauses	162.000	0.025	0.446	0.212	0.059	0.717
Manner adverbial clauses	169.500	0.003	0.513	0.212	0.145	0.757
Attributive sentence	204.000	< .001	0.821	0.212	0.629	0.919
SVO predicative sentences	209.500	< .001	0.871	0.212	0.723	0.942
Relative sentences of the types OS / SS / SO	197.000	< .001	0.759	0.212	0.517	0.888
Completive sentences	191.500	< .001	0.710	0.212	0.435	0.864
Causal adverbial clauses	198.500	< .001	0.772	0.212	0.541	0.895
Incomplete sentences	155.000	0.040	0.384	0.212	-0.016	0.678

Table 3), with the Brown-Forsythe correction applied to account for heterogeneity of variances.

The ANOVA results indicated significant differences for attributive sentences ($p < .001$, $\eta^2 = 0.435$), SVO predicative sentences ($p < .001$, $\eta^2 = 0.566$), relative sentences ($p < .001$, $\eta^2 = 0.401$), completive sentences ($p < .001$, $\eta^2 = 0.353$), and causal adverbial clauses ($p < .001$, $\eta^2 = 0.428$). These variables exhibit a large effect size (*i.e.*, $\eta^2 > 0.37$), which demonstrate a moderate effect size bordering on large ($\eta^2 = 0.353$). However, no significant effect was found for incomplete sentences ($p = 0.217$, $\eta^2 = 0.054$).

An independent samples *t*-test (Mann-Whitney *U* test) was conducted for all variables that showed significant results in Levene's test (see Table 4). The effect size was calculated using Hedges' g with a 95% confidence interval. The results of the Mann-Whitney *U* test indicated significant differences for the following variables: number of words ($p < .001$, $g = 1.0$), negative predicative sentences ($p < .001$, $g = 0.9$), coordinated adversative sentences ($p < .001$, $g = 0.7$), sentences with pronominalized objects ($p < .001$, $g = 0.9$), conditional adverbial clauses ($p = 0.003$, $g = 0.6$), temporal adverbial clauses ($p < .001$, $g = 0.7$), and manner adverbial clauses ($p = 0.003$, $g = 0.5$). Non-significant results were found for SVCC predicative sentences with a locative ($p = 0.269$, $g = 0.17$) and goal adverbial clauses ($p = 0.025$, $g = 0.4$).

The data indicate, thus, that the spoken production of WS speakers significantly deviate from the population's typical linguistic patterns. Moreover, the effect size (Hedges' *g* rank-biserial correlation) for several grammatical structures is either above 0.8 (moderate effect) or 0.9 (high effect), revealing differences in the production of certain grammatical constructions between the two groups (WS and TD) is substantial. Specifically, the constructions with a moderate effect include attributive sentences ($g = 0.821$) and SVO predicative sentences ($g = 0.871$), and constructions with a high effect size (above 0.9) include negative predicative sentences ($g = 0.902$) and sentences with pronominalized objects ($g = 0.938$). These high effect sizes mark a pronounced divergence in the production of these constructions by each of the groups.

Given the relatively small sample size of 16 WS and 14 TD speakers, traditional parametric methods may not adequately capture the variability and distributional characteristics of the data. Bootstrapping, however, offers a powerful non-parametric alternative by resampling the observed data to generate an empirical distribution of the statistic of interest. Using 2000 iterations ensures stable results, and a 95% confidence interval provides a clear measure of uncertainty. This approach is well-suited for small samples and improves the reliability of the study's conclusions.

The main effects analyzed using bootstrapping revealed significant differences across several measures (see Appendix 2). The analysis shows significant differences between the group with Williams syndrome (WS) and the control group across most types of sentences under study. Attributive sentences ($F = 21.57$; $p < 0.001$), negative predicative sentences ($F = 35.17$; $p < 0.001$), SVO predicative sentences ($F = 36.48$; $p < 0.001$), adversative coordinated sentences ($F = 22.44$; $p < 0.001$), sentences with pronominalized objects ($F = 44.32$; $p < 0.001$), relative sentences ($F = 18.71$; $p < 0.001$), completive sentences ($F = 15.27$; $p = 0.001$), and adverbial clauses (causal, conditional, temporal, purposive, and manner clauses) showed significant effects ($p < 0.05$). In contrast, some structures such as SVCC sentences with locatives, reversible OVS passive sentences, or incomplete sentences did not show significant differences.

The multivariate measures (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) were significant for both the intercept ($p < 0.001$) and the WS factor ($p = 0.001$), indicating a strong overall group effect on the analyzed variables. This suggests that the WS group exhibits a distinct pattern in the use of syntactic structures, suggesting specific difficulties in certain constructions and better performance in others. The high values of these measures (e.g., Pillai's Trace = 0.97 for the intercept) confirm the robustness of the observed differences. The bootstrapped confidence intervals further confirm the reliability of the significant effects, as none include zero.

5. Discussion

This study focuses on describing the typical syntactic patterns of adult speakers with Willams syndrome as a population group in spontaneous speech —i.e., no experiments were conducted to elicit comprehension or production of these structures. The results show, in line with some previous studies, that individuals with WS, despite having been reported to possess relatively strong verbal skills, significantly differ from speakers with TD in the use and production of certain constructions. According to our study, while speakers with WS tend to frequently produce certain grammatical structures (like individuals with TD), their patterns differ from those of TD individuals in most constructions. Indeed, the results of the statistical tests evidence salient disparities in both lexical productivity and their use of grammatical structures in their spontaneous speech.

To start with, the results indicate a reduced output of WS speakers when compared to TD speakers, with a lower mean number of words. Although we cannot rule out the effect of the age variable, as it has been shown to be significant, its effect size is small. This aligns with prior research showing narrative limitations in WS populations, even though most studies focused on children with WS instead of adults. In any case, differences in development have often been attributed to deficits in both working memory and semantic processing, affecting the ability to produce and retrieve a diverse vocabulary during discourse (Vicari et al., 1996; Volterra et al., 2003). Gonçalves et al. (2010), for instance, explain narratives by individuals with WS are characterized by "low

levels of structural coherence and process complexity, even though with moderate levels of content diversity" (p. 94). This was also observed in Garayzábal et al. (2012), who state that "WS had surprisingly low results in all measures of the narrative process" (p. 57), i.e. narrative structure and coherence, in narrative process and complexity and in narrative content and multiplicity.

On the other hand, the findings highlight differences in sentence production between WS and TD groups, particularly for certain syntactic constructions. The analysis proves that WS speakers produce significantly fewer sentences involving grammatical constructions such as SVO predicative sentences, attributive sentences, and sentences with pronominalized objects. Such observations are consistent with findings that individuals with WS struggle with syntax, particularly constructions requiring hierarchical or abstract rules (Benítez-Burraco et al., 2016; Perovic & Wexler, 2007), even though those findings were related to the linguistic abilities of children with WS. Apparently, WS might rely on avoiding certain complementizers, and producing certain syntactic movements, such as the ones required by relative and interrogative pronouns (Joffe & Varlokosta, 2007). In a recent meta-analysis Romero-Rivas et al. (2023) pointed out that WS seem to have worse-semantic skills than TD individuals, and problems with semantic memory organization and verbal working memory skills.

It is true that there is variability among speakers, as emphasized by Romero-Rivas et al. (2023) when stating that "people with WS present very diverse cognitive and linguistic profiles" (p. 12). Nonetheless, despite individual differences, our data indicate that WS speakers consistently produce simpler structures than TD speakers, suggesting potential deficits in the cognitive mechanisms underlying syntactic planning or a strategic preference for linguistic simplicity due to limited processing resources, as shown in Garayzábal et al. (2012). Indeed, a recent study by Sederias et al. (2024) argues that WS speakers rely more on holistic (statistical) representations than on abstract grammatical rules, characterizing WS language as consisting of "short and syntactically simple utterances with a tendency to overuse familiar (strongly collocated) word combinations" (p. 9).

Most previous studies on Williams syndrome have focused on the linguistic behavior of children, whereas most participants in our study were over 12 years old. Thus, the results suggest that an atypical developmental trajectory persists into adulthood. The analysis highlights clear preferences for certain sentence types, which differ from the usage patterns of typically developing speakers. However, there is a need for further exploration of the mechanisms underlying these differences and their implications for understanding language in WS.

6. Conclusions

This paper presents a statistically supported analysis of the type of sentences produced in oral spontaneous discourse by speakers of Spanish with WS and compares them with speakers of Spanish with TD, to answer the question of whether the speech of individuals with WS is comparable to that of individuals with TD in terms of sentence types. Results have shown that some statistically significant differences emerged.

According to the data, individuals with WS tend to use simpler sentences and rely more on basic syntactic structures than those with TD. The latter group displays greater diversity and complexity in sentence construction, suggesting a more advanced capacity to handle grammatical structures.

The findings indicate that, even if some previous studies have concluded that individuals with WS may demonstrate remarkable verbal skills, these coexist with significant deficits in other language areas, especially syntax. Therefore, language development in WS requires a nuanced approach that recognizes the complexity and variability of their linguistic profile. Although WS individuals may appear proficient in vocabulary and verbal expressiveness, they produce significantly less fluent discourse than speakers with TD, and their grammatical construction and discourse coherence remain limited.

It is also important to consider the study's limitations, which should be addressed to improve the validity of these findings. First, the sample size, with only 16 participants with WS and 14 with TD, is limited, which may restrict the generalizability of the results. Expanding the participant sample size could therefore help obtain more conclusive data.

The results of this study contribute to a better understanding of the features that characterize the spontaneous speech of individuals with Williams syndrome as a population group. Future research on ontogeny will shed light on the developmental trajectory of language acquisition into adulthood in this population.

Moving forward, it is essential to continue investigating how language interacts with other cognitive functions in individuals with WS, as this could lead to a better understanding of their unique linguistic and cognitive traits. Another possible extension of this work involves a broader comparison of the linguistic profiles of people with WS to those with other developmental disorders, such as Down syndrome or SLI. Such comparisons would offer a more comprehensive view of the differences and similarities in language development across various conditions. These research directions not only have the potential to deepen understanding of WS but also to aid in the development of tools and methods that more effectively support affected individuals.

CRediT authorship contribution statement

Cremades Cortiella Elga: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Juan de Leon Andrea:** Writing – original draft, Investigation, Formal analysis, Data curation. **Lluís Barceló-Coblijn:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix 1. descriptive statistics

	Age	
	TD	WS
Valid	14	16
Missing	0	0
Mean	26.929	24.250
Std. Deviation	14.014	13.552
Minimum	13.000	8.000
Maximum	52.000	57.000

	Number of words	
	TD	WS
Valid	14	16
Missing	0	0
Mean	821.929	315.438
Std. Deviation	261.994	100.167
Minimum	532.000	98.000
Maximum	1438.000	497.000

	Number of words		Attributive sentence		Negative predicative sentences		SVO predicative sentences		Coordinated disjunctive sentences	
	TD	WS	TD	WS	TD	WS	TD	WS	TD	WS
Valid	14	16	14	16	14	16	14	16	14	16
Missing	0	0	0	0	0	0	0	0	0	0
Mean	821.929	315.438	32.214	15.250	2.714	0.313	8.357	1.750	0.000	0.000
Std. Dev.	261.994	100.167	11.866	7.996	1.383	0.793	3.754	2.113	0.000	0.000
Min.	532.000	98.000	16.000	6.000	1.000	0.000	1.000	0.000	0.000	0.000
Max.	1438.000	497.000	67.000	31.000	6.000	3.000	15.000	7.000	0.000	0.000

Descriptive Statistics

	SVCC predicative sentences with a locative		SVO clauses with a cleft subject		Absolute comparative sentences		OVS sentences with a focalized subject		Coordinated adversative sentences	
	TD	WS	TD	WS	TD	WS	TD	WS	TD	WS
Valid	14	16	14	16	14	16	14	16	14	16
Missing	0	0	0	0	0	0	0	0	0	0
Mean	0.500	0.125	0.000	0.000	0.000	0.000	0.000	0.000	3.571	0.375
Std. Dev.	1.092	0.342	0.000	0.000	0.000	0.000	0.000	0.000	2.563	0.806
Min.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Max.	4.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8.000	3.000

Descriptive Statistics

	Sentences with pron. object		Reversible OVS passive sentences		Sentences with a cleft object		Relative sentences of the types OS / SS / SO		Completive sentences		Causal adverbial clauses	
	TD	WS	TD	WS	TD	WS	TD	WS	TD	WS	TD	WS
Valid	14	16	14	16	14	16	14	16	14	16	14	16
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Mean	3.714	0.375	0.143	0.000	0.143	0.000	6.714	2.063	16.643	6.563	5.143	1.188
Std. Dev	1.858	0.719	0.535	0.000	0.363	0.000	3.429	2.435	8.054	6.044	2.825	1.870
Min.	1.000	0.000	0.000	0.000	0.000	0.000	2.000	0.000	8.000	0.000	1.000	0.000
Max.	7.000	2.000	2.000	0.000	1.000	0.000	13.000	7.000	31.000	20.000	11.000	7.000

Descriptive Statistics

	Conditional adverbial clauses		Temporal adverbial clauses		Goal adverbial clauses		Manner adverbial clauses		Incomplete sentences		Phrases	
	TD	WS	TD	WS	TD	WS	TD	WS	TD	WS	TD	WS
Valid	14	16	14	16	14	16	14	16	14	16	14	16
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Mean	1.429	0.313	2.000	0.313	1.857	0.500	0.714	0.063	1.214	0.500	3.643	2.688
Std. Dev.	1.158	0.602	1.359	0.479	1.834	0.894	0.825	0.250	1.578	1.506	4.749	3.198
Min.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Max.	4.000	2.000	4.000	1.000	6.000	3.000	3.000	1.000	5.000	6.000	13.000	11.000

Appendix 2. Bootstrapping

Bootstrapping with IBM SPPS Statistics (Version 27)
1 = Williams syndrome, 0 = typical development

Between-Subjects Factors

		N
WS	0	14
	1	16

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.97	19.888[b]	18	11	0
	Wilks' Lambda	0.03	19.888[b]	18	11	0
	Hotelling's Trace	32.54	19.888[b]	18	11	0
	Roy's Largest Root	32.54	19.888[b]	18	11	0
WS	Pillai's Trace	0.92	7.399[b]	18	11	0
	Wilks' Lambda	0.08	7.399[b]	18	11	0
	Hotelling's Trace	12.11	7.399[b]	18	11	0
	Roy's Largest Root	12.11	7.399[b]	18	11	0

a. Design: Intercept + WS
b. Exact statistic

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Number of words	1915447.934[a]	1	1915447.93	51.43	0
	Attributive sentence	2148.810[b]	1	2148.81	21.57	0
	Negative predicative sentences	43.072[c]	1	43.07	35.17	0
	SVO predicative sentences	325.952[d]	1	325.95	36.48	0
	Coordinated disjunctive sentences	.000[e]	1	0	.	.
	SVCC predicative sentences with a locative (above, below, in front of, behind)	1.050 [f]	1	1.05	1.7	0.2
	SVO clauses with a cleft subject	.000[e]	1	0	.	.
	Absolute comparative sentences	.000[e]	1	0	.	.
	OVS sentences with a focalized subject	.000[e]	1	0	.	.
	Coordinated adversative sentences	76.288 [g]	1	76.29	22.44	0
	Sentences with pronominalized object (without contrast of gender and number)	83.260 [h]	1	83.26	44.32	0
	Reversible OVS passive sentences	.152[i]	1	0.15	1.15	0.29
	Sentences with a cleft object	.152[j]	1	0.15	2.49	0.13
	Relative sentences of the types OS / SS / SO	161.572[k]	1	161.57	18.71	0
	Completive sentences	758.715 [l]	1	758.72	15.27	0
	Causal adverbial clauses	116.815 [m]	1	116.82	20.95	0
	Conditional adverbial clauses	9.301 [n]	1	9.3	11.39	0
	Temporal adverbial clauses	21.262[o]	1	21.26	21.7	0
	Goal adverbial clauses	13.752[p]	1	13.75	6.91	0.01
	Manner adverbial clauses	3.172[q]	1	3.17	9.07	0.01
	Incomplete sentences	3.810[r]	1	3.81	1.61	0.22
	Phrases	6.815 [s]	1	6.82	0.43	0.52
Intercept	Number of words	9658891.8	1	9658891.8	259.34	0
	Attributive sentence	16821.34	1	16821.34	168.86	0
	Negative predicative sentences	68.41	1	68.41	55.85	0
	SVO predicative sentences	762.75	1	762.75	85.36	0
	Coordinated disjunctive sentences	0	1	0	.	.
	SVCC predicative sentences with a locative (above, below, in front of, behind)	2.92	1	2.92	4.73	0.04
	SVO clauses with a cleft subject	0	1	0	.	.
	Absolute comparative sentences	0	1	0	.	.
	OVS sentences with a focalized subject	0	1	0	.	.
	Coordinated adversative sentences	116.29	1	116.29	34.21	0
	Sentences with pronominalized object (without contrast of gender and number)	124.86	1	124.86	66.46	0
	Reversible OVS passive sentences	0.15	1	0.15	1.15	0.29
	Sentences with a cleft object	0.15	1	0.15	2.49	0.13
	Relative sentences of the types OS / SS / SO	575.17	1	575.17	66.61	0
	Completive sentences	4020.72	1	4020.72	80.93	0
	Causal adverbial clauses	299.22	1	299.22	53.65	0
	Conditional adverbial clauses	22.63	1	22.63	27.72	0
	Temporal adverbial clauses	39.93	1	39.93	40.75	0
	Goal adverbial clauses	41.49	1	41.49	20.85	0
	Manner adverbial clauses	4.51	1	4.51	12.88	0
	Incomplete sentences	21.94	1	21.94	9.26	0.01
	Phrases	299.22	1	299.22	18.76	0
WS	Number of words	1915447.93	1	1915447.93	51.43	0
	Attributive sentence	2148.81	1	2148.81	21.57	0
	Negative predicative sentences	43.07	1	43.07	35.17	0
	SVO predicative sentences	325.95	1	325.95	36.48	0

(continued on next page)

(*continued*)

Tests of Between-Subjects Effects						
	Coordinated disjunctive sentences	0	1	0	.	.
	SVCC predicative sentences with a locative (above, below, in front of, behind)	1.05	1	1.05	1.7	0.2
	SVO clauses with a cleft subject	0	1	0	.	.
	Absolute comparative sentences	0	1	0	.	.
	OVS sentences with a focalized subject	0	1	0	.	.
	Coordinated adversative sentences	76.29	1	76.29	22.44	0
	Sentences with pronominalized object (without contrast of gender and number)	83.26	1	83.26	44.32	0
	Reversible OVS passive sentences	0.15	1	0.15	1.15	0.29
	Sentences with a cleft object	0.15	1	0.15	2.49	0.13
	Relative sentences of the types OS / SS / SO	161.57	1	161.57	18.71	0
	Completive sentences	758.72	1	758.72	15.27	0
	Causal adverbial clauses	116.82	1	116.82	20.95	0
	Conditional adverbial clauses	9.3	1	9.3	11.39	0
	Temporal adverbial clauses	21.26	1	21.26	21.7	0
	Goal adverbial clauses	13.75	1	13.75	6.91	0.01
	Manner adverbial clauses	3.17	1	3.17	9.07	0.01
	Incomplete sentences	3.81	1	3.81	1.61	0.22
	Phrases	6.82	1	6.82	0.43	0.52
Error	Number of words	1042832.87	28	37244.03		
	Attributive sentence	2789.36	28	99.62		
	Negative predicative sentences	34.3	28	1.23		
	SVO predicative sentences	250.21	28	8.94		
	Coordinated disjunctive sentences	0	28	0		
	SVCC predicative sentences with a locative (above, below, in front of, behind)	17.25	28	0.62		
	SVO clauses with a cleft subject	0	28	0		
	Absolute comparative sentences	0	28	0		
	OVS sentences with a focalized subject	0	28	0		
	Coordinated adversative sentences	95.18	28	3.4		
	Sentences with pronominalized object (without contrast of gender and number)	52.61	28	1.88		
	Reversible OVS passive sentences	3.71	28	0.13		
	Sentences with a cleft object	1.71	28	0.06		
	Relative sentences of the types OS / SS / SO	241.8	28	8.64		
	Completive sentences	1391.15	28	49.68		
	Causal adverbial clauses	156.15	28	5.58		
	Conditional adverbial clauses	22.87	28	0.82		
	Temporal adverbial clauses	27.44	28	0.98		
	Goal adverbial clauses	55.71	28	1.99		
	Manner adverbial clauses	9.8	28	0.35		
	Incomplete sentences	66.36	28	2.37		
	Phrases	446.65	28	15.95		
Total	Number of words	12092778	30			
	Attributive sentence	21039	30			
	Negative predicative sentences	139	30			
	SVO predicative sentences	1277	30			
	Coordinated disjunctive sentences	0	30			
	SVCC predicative sentences with a locative (above, below, in front of, behind)	21	30			
	SVO clauses with a cleft subject	0	30			
	Absolute comparative sentences	0	30			
	OVS sentences with a focalized subject	0	30			
	Coordinated adversative sentences	276	30			
	Sentences with pronominalized object (without contrast of gender and number)	248	30			
	Reversible OVS passive sentences	4	30			
	Sentences with a cleft object	2	30			
	Relative sentences of the types OS / SS / SO	941	30			
	Completive sentences	5958	30			
	Causal adverbial clauses	549	30			
	Conditional adverbial clauses	53	30			
	Temporal adverbial clauses	85	30			
	Goal adverbial clauses	108	30			
	Manner adverbial clauses	17	30			
	Incomplete sentences	91	30			
	Phrases	748	30			
Corrected Total	Number of words	2958280.8	29			
	Attributive sentence	4938.17	29			
	Negative predicative sentences	77.37	29			
	SVO predicative sentences	576.17	29			
	Coordinated disjunctive sentences	0	29			
	SVCC predicative sentences with a locative (above, below, in front of, behind)	18.3	29			
	SVO clauses with a cleft subject	0	29			
	Absolute comparative sentences	0	29			
	OVS sentences with a focalized subject	0	29			
	Coordinated adversative sentences	171.47	29			
	Sentences with pronominalized object (without contrast of gender and number)	135.87	29			
	Reversible OVS passive sentences	3.87	29			
	Sentences with a cleft object	1.87	29			
	Relative sentences of the types OS / SS / SO	403.37	29			

(*continued on next page*)

(*continued*)

Tests of Between-Subjects Effects		
Completive sentences	2149.87	29
Causal adverbial clauses	272.97	29
Conditional adverbial clauses	32.17	29
Temporal adverbial clauses	48.7	29
Goal adverbial clauses	69.47	29
Manner adverbial clauses	12.97	29
Incomplete sentences	70.17	29
Phrases	453.47	29

a. R Squared = .647 (Adjusted R Squared =.635)
b. R Squared = .435 (Adjusted R Squared =.415)
c. R Squared = .557 (Adjusted R Squared =.541)
d. R Squared = .566 (Adjusted R Squared =.550)
e. R Squared = . (Adjusted R Squared =.)
f. R Squared = .057 (Adjusted R Squared =.024)
g. R Squared = .445 (Adjusted R Squared =.425)
h. R Squared = .613 (Adjusted R Squared =.599)
i. R Squared = .039 (Adjusted R Squared =.005)
j. R Squared = .082 (Adjusted R Squared =.049)
k. R Squared = .401 (Adjusted R Squared =.379)
l. R Squared = .353 (Adjusted R Squared =.330)
m. R Squared = .428 (Adjusted R Squared =.408)
n. R Squared = .289 (Adjusted R Squared =.264)
o. R Squared = .437 (Adjusted R Squared =.416)
p. R Squared = .198 (Adjusted R Squared =.169)
q. R Squared = .245 (Adjusted R Squared =.218)
r. R Squared = .054 (Adjusted R Squared =.021)
s. R Squared = .015 (Adjusted R Squared = −.020)

Data Availability

The data that has been used is confidential.

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