



From First Steps to Full Acquisition: Comprehension of Subjunctive Clauses in Bilectal Children With Down Syndrome and Typical Language Development

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Previous work on linguistic abilities of individuals with Down syndrome (DS) suggests severe impairment of complex syntactic structures in a number of languages. Given difficulties reported with comprehension and production of relative clauses and object clitics in typically developing Greek Cypriot bilectal children (acquiring Cypriot Greek and Standard Modern Greek), one could hypothesize that the bilectal environment in which children with DS grow up may cause an added difficulty in the acquisition of other complex syntactic structures, such that of the understudied syntactically complex subjunctives. This study examines whether Greek Cypriot bilectal children and adolescents with DS evidence an impairment with the comprehension of subjunctive clauses, corroborating arguments for an overall syntactic impairment from past research on DS. It also explores possible parallel development of subjunctives across the two groups. We aim to provide a developmental trajectory of the comprehension of subjunctive clauses for the two populations. Using an act-out priming task, followed by a picture selection task, subjunctive clauses were examined in 30 children and adolescents with DS and 53 children with typical language development. Full analysis of the comprehension data evidenced high means of accuracy, with parallel performance across the two groups. As a foretaste of this research program, a preliminary analysis on subjunctive production and comprehension in a small subgroup of five participants per group was also conducted. Results revealed that accuracy means for production were lower than those for comprehension, suggesting that both subgroups are lagging behind in performance but are acquiring the subjunctive in a parallel manner. The linguistic differences between Cypriot and Standard Modern Greek do not appear to affect the acquisition of subjunctives. Rather, it appears that the acquisition of this complex syntactic structure seems to be facilitated by the fact that the subjunctive is formed in the same way in both varieties, thus eliminating potential confusion caused by variable inputs.

Keywords: down syndrome, acquisition of syntax, production, comprehension, subjunctive clauses

INTRODUCTION

Previous studies on the grammar of individuals with Down Syndrome (DS) have mainly reported difficulties with the inflectional system and complex syntactic structures. However, there is a small number of studies which do show near-ceiling performance on a number of phenomena, especially morphosyntactic marking (e.g., Eadie et al., 2002 for English; Schaner-Wolles, 2004 for German; Christodoulou, 2011, 2013 for Cypriot Greek).

Problematic production and even comprehension of complex syntactic structures have been reported to be impaired cross-linguistically, including languages such as Greek (Cypriot

the dependent tense value in the subjunctive clause and matching subject–verb agreement with the verb of the main clause, as in (1). For a theoretical analysis of subjunctive clauses (see e.g., Christodoulou and Wiltschko, 2012). Note that the subjunctive is formed in the same way across the two varieties, Cypriot Greek and Standard Modern Greek, which means that for the purposes of the current study, the bilectal language acquisition context, as briefly presented in the Background section, may not have a direct effect on the acquisition of the syntactic structure itself. However, one may hypothesize that bilectal variation with other elements that may be used in the structure such as phonetic or morphosyntactic variation, and other linguistic divergence, may affect development.

- (1) O Jan-is ce i Mar-ia ...
 DET.MASC.SG.NOM John-MASC.SG.NOM and DET.FEM.SG.NOM Maria-FEM.SG.NOM
 ... θel-un na pek-s-un s-ton cip-o.
 want.IMPV-FUT.3.PL SUBJ play-PRF-DEP.3.PL in-DET.MASC.SG.ACC garden-MASC.SG.ACC
 ‘John and Mary want to play in the garden.’

and Standard Modern Greek), Dutch, English, French, German, Italian, Portuguese, Serbo-Croatian, and Spanish. Fowler et al. (1994) and Chapman et al. (1998), among others, argued that the linguistic abilities of individuals with DS are much lower than the DS suggested mental-age peer groups; children with DS aged 5–8 years have linguistic abilities equivalent to those of 2-year-old children with typical language development. These studies argued that older children and adults reach the linguistic capabilities of only a 3-year-old typically developing (TD) child. Numerous other studies also showed delayed development of both inflectional markers and complex syntactic structures such as passives and *wh*-questions (Gordan and Panagos, 1976; Fowler, 1990, 1995; Ring and Clahsen, 2005; Caselli et al., 2008; Rondal, 2009).

Even though most studies group together all syntactic structures and inflectional environments that have been studied, arguing for an overall syntactic impairment, no study to date has examined the performance of individuals with DS with one of the most complex syntactic structures, subjunctive clauses, which function like simultaneous infinitives in English, where the embedded event is interpreted as occurring simultaneously to the matrix event (Christodoulou and Wiltschko, 2012). Research on Greek individuals with DS has already shown that comprehension of binding conditions in subjunctive constructions presented the lowest accuracy rates of all tested structures (Stathopoulou, 2009), suggesting that the mechanisms involved in forming the subjunctive add an extra complication, compared to the other complex structures examined, like relative clauses.

The subjunctive is one of the three moods in Greek, alongside indicative and imperative. It is formed by means of the subjunctive marker *na* and a verb. There are two types of subjunctive constructions: optional and obligatory control. Control over the tense and subject–verb agreement features of the verb in the subjunctive is imposed by the verb in the main clause of a sentence. The verb *θelo* “want” used in our experimental task imposes the obligatory use of a verb carrying

The study of the comprehension and production of subjunctive clauses in a highly inflected language is facilitated by overt inflection, allowing us to observe whether a structure is used appropriately or not. It may also be possible that it is acquired earlier, given all the morphological cues available. This, however, could also mean that young speakers are presented with more morphosyntactic processes, which in turn children will need to use to successfully comprehend and produce a subjunctive clause. Thus, children have much more to observe, manage and later use in the process of acquisition of the subjunctive. The acquisition of this complex syntactic structure in a bilectal environment may create an additional difficulty, as minor or major variation in the input could create confusion. The goal of the current work was to examine whether Greek Cypriot children and adolescents with DS manifested an impairment with the subjunctive construction or have fully acquired the syntactic mechanisms pertaining to the acquisition of subjunctive clauses, such as comprehending morphosyntactic marking, processing restrictions imposed by the verb in the main clause appropriately, and so on. Through this research we also aim to investigate whether the two groups studied present a parallel development of subjunctive clauses and at what age they reach full comprehension. The ultimate objective of this study is to create the first developmental trajectory of the comprehension of subjunctive clauses for the two populations, from the very first signs of comprehension to full acquisition.

BACKGROUND

Cypriot Greek (CG) is the dialect spoken in Cyprus, a speech community traditionally characterized by a diglossic holding of the official language, Standard Modern Greek and CG whose speakers are thus bilectal (Rowe and Grohmann, 2013). Bilectalism in diglossic Cyprus is used here to characterize the situation in which children of Greek Cypriot parents, with CG-speaking family and friends, grow up, yet get exposed to Standard Modern Greek from an early age; first through media such as

TV cartoons, later through public schooling starting in nursery and kindergarten, and becoming gradually more systematic in primary school. In the absence of a separate CG orthographic system, Greek can only be taught through the medium of the standard variety. In the absence of systematic studies on the exact linguistic and lectal input young children receive, we generalize on solid grounds that Greek Cypriot children acquire CG natively from birth and Standard Modern Greek from fairly early. Theodorou et al. (2016) call this the “standard path of language development” by CG children. For further discussion, background, and references (see e.g., Rowe and Grohmann, 2013; Grohmann and Kambanaros, 2016; Grohmann et al., 2016). In support of this, there is also a growing body of evidence that bilingual language development does differ from very early on (Taxitari et al. (2015), and it differs not only from monolingual, but also from bilingual children (Antonou et al., 2016).

Research on the acquisition of complex syntactic structures in Cypriot Greek is very recent. As the following overview on the acquisition of complex syntax in DS shows, some of the existing research is relevant; however, it is not so clear that bilingualism plays as prominent a role in language development of children with DS as it does for bilingual TD children. It is expected that future research targeting parallel environments with and without diversity across the two dialects will provide a more definitive answer to this question.

The first complex syntactic structure we discuss is *wh*-questions. CG-speaking adults with DS have shown considerably higher percentages of comprehension over production (Christodoulou and Grohmann, 2014). This phenomenon is frequently recorded in studies on children with typical language development between 3 and 6 years of age, with individual variation (for a comparable task involving referential and non-referential *wh*-questions, see Varlokosta et al., 2015 for Standard Modern Greek and Varnava and Grohmann, 2014 for CG). Tsakiridou (2006) showed the comprehension of (non-)referential subject and object *which*-NP and *who*-questions, to be problematic for Greek-speaking individuals with DS, with object *who*-questions being the most problematic. Using the same task, Stathopoulou (2009) recorded relatively high accuracy rates with the comprehension of *wh*-questions, with accuracy rates ranging between 73% and 85%, in which *who*-object questions yielded the highest accuracy rates.

Stathopoulou (2009) also examined relative clauses in four conditions: subject head–subject gap, subject head–object gap, object head–subject gap, and object head–object gap. She found difficulties with the comprehension of relative clauses in all four conditions, noting an accuracy rate of 43% (69/160 items) for overall comprehension and 18% (22/121) for overall production. The subject head–object gap condition produced the lowest performance for both production and comprehension; a tendency to resolve toward simple main clauses was observed. Theodorou and Grohmann (2013) investigated the comprehension and production of subject and object relative clauses in TD children ranging from 6 to 9 years. Subject relatives come with at-ceiling performance already at age 5, while object relatives are not fully acquired even as late as 9 years of age. Concerning the comparison between comprehension

and production, the authors noted that object relative clause production is mastered earlier than comprehension, in line with reported cross-linguistic findings. However, they also argue that the gap between comprehension and production accuracy is smaller than the existing literature suggests, which might be because they counted as correct those responses that use resumptive pronouns as a strategy, an acceptable option in the adult grammar.

With regard to pronoun use, participants with DS in Stathopoulou (2009) presented low accuracy rates with the comprehension of clitic and reflexive use in subjunctive clauses, over other tested syntactic structures, suggesting that the syntactic mechanisms involved in the formation of subjunctive clauses could potentially cause an additional difficulty. Sanoudaki and Varlokosta (2014) also showed that the comprehension of reflexive pronouns was challenging for Greek-speaking individuals with DS, though the same was not recorded with clitics and strong pronouns. They argued that the cross-linguistic difficulty with reflexive pronouns is not rooted in an incomplete acquisition with the pronoun system, but rather a DS impairment with the properties of reflexive elements. Concerning the role of object clitics in typical and atypical language development in CG, see Grohmann (2014) for a comprehensive overview.

With regard to research on other languages, English-speaking individuals with DS presented problematic performance with a variety of complex syntactic structures. Through a sentence repetition task, Gordan and Panagos (1976) found problematic production of simple-active declarative, negative, passive, and negative-passive sentences, with the latter presenting the most problematic performance. Errors included word omission, substitution, addition, transposition, transformation, and morpheme modification. Thordardottir et al. (2002) found problematic production with 10 different types of complex structures in narrative discourse, including conjoined and multiple embedding clauses. However, the authors determined that individuals with DS were as competent in using complex sentences as their TD controls matched for mean length of utterance. The production of *wh*-questions in English-speaking children with DS was found to be almost non-existent, with an accuracy rate of only 6%, whereas comprehension was recorded at relatively higher rates (43%) (Joffe and Varlokosta, 2007). The comprehension of active and passive sentences was also recorded at parallel rates, with a mean score of 45% across all sentence types. A cross-linguistic difficulty in the comprehension of reflexives but not pronouns, not only for English but also for Serbo-Croatian, led Perovic (2004, 2006) to argue that the comprehension of reflexives in individuals with DS is fundamentally deviant from that of TD children. She suggested that the problem lies either in the lexical knowledge or pragmatics.

There is only a handful of studies examining complex syntactic structures in languages other than Greek and English. Schaner-Wolles (2004) shows that German-speaking individuals with DS and TD children rarely used (finite and non-finite) verbs in clause-final position, where only non-finite verbs can be used. She argued that when participants with DS used non-finite verbs in finite clauses they essentially succeeded in

restructuring the grammatical pattern to accommodate a verb second structure. This observation is crucial because it implies that German individuals with DS were able to apply alternative methods to achieve the production of a structure with which they were experiencing morphosyntactic difficulties, such as omission of arguments. French-speaking individuals with DS presented low accuracy rates with subordinate and relative clauses, negation, and passive constructions (Tager-Flusberg, 1994). Difficulties with passive constructions were also reported for Portuguese-speaking individuals with DS (Coelho de Barros and Rubin, 2006). Similarly to Greek and English, Bol and Kuiken (1990) found low rates with interrogative structures for Dutch-speaking individuals with DS. The authors also reported overuse of verb–object constructions and stated that their participants avoided the use of negation and subject–predicate constructions. The production of Spanish-speaking individuals with DS was characterized by shorter, simple utterances, with lower morphosyntactic complexity (Galeote et al., 2013). Similar results, with simpler, telegraphic sentences, were also reported for Italian-speaking children with DS (Vicari et al., 2000, 2002; Caselli et al., 2008), though few details are provided by studies on either language.

METHODS

Participants

The DS group originally consisted of 40 children and adolescents, aged 5–18, previously diagnosed with DS and moderate mental disability by a certified psychologist. Participants were either studying in public schools, spending most of their time in special education classes, or public special education schools for children and adolescents with cognitive disabilities. Participants received speech–language therapy weekly. Note that in the public-school system in Cyprus, children are entitled to receive up to 60 min of speech–language therapy or intervention overall, at a maximum of 2 times a week. The amount of time and content of intervention sessions a child needs is entirely determined by the speech–language pathologist. A TD group was used for comparison purposes. This included 53 children ranging from 2 to 6 years of age, not diagnosed with any language disability at the time of data collection. Participants were recruited from schools all across Cyprus and came from families with a parallel socio-economic and educational background, as we were able to determine from the questionnaire given to parents along with the consent form. All participants were bilingual speakers of the two varieties spoken in Cyprus, Cypriot Greek, and Standard Modern Greek.

We ensured that potential hearing challenges would not affect the participants' performance. Participants with DS received a hearing test prior to data collection as part of their annual battery of health tests. As an additional measure, we administered two auditory tests—a repetition test and a picture selection test—to all participants. In the repetition task, participants were asked to repeat 20 words exactly as they were produced at normal speech rate by the experimenter. The picture selection task, consisted of 15 minimal pairs sensitive to stress (e.g., /kɔ:lɪv/ 'sheet of paper' vs. /kɔ:lɪv/ 'it sticks') and a singleton vs. geminate

distinction (e.g., /'ku.pɛ/'savory snack' vs. /'kʊpʰrɛ/, 'bowl'). Two pictures showing each item in the minimal pair were presented to the participants and they, in turn, had to select which picture representation matched the experimenter's production. One participant with DS who used a hearing aid was allowed to participate, since they passed the doctor's hearing test and our mandatory auditory screening tests.

After obtaining informed consent, an initial, informal 5 min interaction with basic questions was conducted by the experimenter, prior to the two hearing tests. The goal of this interaction was to determine if children will be able to follow the experimenter's instructions to perform the tasks and to conclude whether they met the inclusion criteria. Other than the brief interaction, we used information from our questionnaire to decide if children met the inclusion criteria. Those included being bilingual (as defined above), falling within the chronological age range, being diagnosed with trisomy 21 or not being diagnosed with any linguistic or cognitive disability, based on the group they belonged to, having adequate hearing and communication skills, and having the ability to comprehend instructions in order to perform the tasks. In order to assess the participants' cognitive abilities, we administered the Raven's Colored Progressive Matrices (Raven et al., 2000). Participant information is provided in **Table 1**. For TD children, we aimed to have at least 5 children for each 6-month age group. Given that individuals with DS were not found as easily at such numbers, we could not ensure a parallel breakdown. We had at least 2 participants per year, with a gap between 6;0 and 7;11. An exact breakdown is given in the results section in **Figures 4, 5**.

Materials and Procedure

We examined the comprehension and production of subjunctive clauses, with transitive and (obligatory or optionally) intransitive verbs, using a customized syntactic priming task with puppets for the production portion and a picture selection task for the comprehension portion. The experiment included two practice items and 18 test stimuli. A prime was used with both practice and targeted structures, namely the production of a verb (plus object if transitive) as a stimulus to trigger the formation of a specific structure. The first practice item was the intransitive verb *kolimb-o* "(I) swim" and the second one the transitive verb *pin-o* "(I) drink" along with the noun *ner-o* "water." We used the verb *θel-o* "(I) want" for the main clause, yielding obligatory control on the subordinate verb's aspect (perfective) and tense (dependent). In our stimuli, *θel-o* also yields obligatory use of third person singular for the subject–verb agreement, to match the main verb's subject–verb agreement inflection. However, this is not always the case.

Experimental Design and Procedure

Participants were presented with two puppets, a cat and a dog. They were told that the puppets did not know how to speak, they could only whisper. Winnie the Pooh was the only one who could understand their whispers. Therefore, in order for the cat or the dog to communicate and express what they *wanted* to do they had to whisper in *Winnie's* ear. In turn, *Winnie* would report what

TABLE 1 | Participant Information for CG children with DS and CG children with TD.

Groups	N	Gender		Age range	CA		RCPM (max. score 36)		
		F	M		Mean	SD	MA	Raw score	SD
CG _{DS}	30 (40)*	11 (16)*	19 (24)*	5;0–18;8	12;3	3.6	4;3	13	4.2
CG _{TD}	53	24	29	2;0–6;6	4;2	1.3	4;9	14	6.5

N = (Raw) Number; CA = Chronological Age; SD = Standard Deviation; RCPM = Raven's Colored Progressive Matrices; F = Female; M = Male; MA = Mental Age (calculated based on the recently standardized Greek norm; a norm for Cypriot Greek children is in the process of being constructed by the first author). *Ten participants with DS were excluded because they presented no verbal communication skills or lower verbal communication skills than our inclusion criteria required.

the puppet said in one or more words (i.e., provide the prime), depending on whether an intransitive (one word, i.e., the verb) or a transitive verb (two or more words) was used. For example, the experimenter would say:

- (2) ja na ðume ti **θeli na kani/kami** to skillaki mas simera.
'Let's see what our little dog **wants to do** today.'

The experimenter would then put the dog puppet to Winnie's ear and bark, imitating the dog. Then she would ask Winnie:

- (3) Winnie, ti ipe to skillaki mas oti **θeli na kami**?
'Winnie, what did our little dog say that he **wanted to do**?'

Winnie would respond with the prime in two words, as in (4), given that the targeted verb in the subjunctive clause in this case was transitive. In the case of an intransitive verb like *xorevo* "I dance," Winnie would only produce a one-word prime, i.e., the verb *xorevo*. Verbs would be given in their lexical entry form: imperfective, present, first person, singular.

- (4) Potiz-o luluð-ja.
water.IMP-F-PRES.1.SG flower-NEU.SG.ACC
'(I) water flowers.'

The experimenter would first provide the two practice items, in order to explain the procedure and give the participants a chance to practice, before moving on to the test items. During the presentation of the practice items, participants were instructed to start their sentences as in (5), depending on which puppet was whispering in Winnie's ear. The use of the formulaic main clause would enforce the use of the main-subjunctive clause combination, as opposed to the production of an isolated subjunctive clause, or a single main clause. The latter would be marked as an incorrect performance of the task. This information was given only for the practice items and was not repeated throughout the duration of the actual testing, before or after the presentation of each prime. Participants were asked to produce a full main-subordinate utterance expressing what the animal wanted to do.

- (5) i yat-a /o skil-os θel-i na ...
DET.FEM.SG.NOM cat-FEM.SG.NOM DET.MASC.SG.NOM dog-MASC.SG.NOM want.IMP-F-PRES.3.SG SUBJ
'The cat/the dog wants to ...'

The participants were asked to repeat each practice stimulus. The experimenter encouraged participants to try the second practice item alone to ensure that they understood the task. If the

participant seemed unsure or produced an incorrect production, the experimenter administered the practice items again. Once the experimenter was confident that the participant understood what they needed to do, she moved on to the test items. For the prime given in (4), the participant needed to produce the example given for transitive verbs in **Table 2**.

After the completion of each production, the experimenter would repeat the targeted structure in its correct form, regardless of whether the participant produced an utterance matching the target or an alternative structure. This was done to ensure that the participants had heard the correct structure, for which they needed to choose the matching picture. The experimenter would then move on to the comprehension part, presenting a picture booklet to participants. Participants were presented with four pictures and asked to choose the picture that matched the produced utterance. Pictures included four conditions:

- I. agent-match/action-match (Target)
- II. agent-match/action-mismatch
- III. agent-mismatch/action-match
- IV. distractor

Note that for all agent mismatch cases, the agent was always the other puppet. For example, if the targeted agent was the dog, the cat would be the puppet in the agent mismatch case. To avoid any confusion, given that elicitation sessions were only audio recorded, participants were provided with a sheet of sizable 3D stickers (2"-5" diameter), before being presented with the prime. They were asked to position the sticker in the box of the image that best matched the target (**Figure 1**), instead of pointing to the picture. Items were randomized in Excel. Responses and relevant comments were noted on a score sheet. Examples of targeted and produced utterances as well as pictures from the picture-selection task are included in **Table 2**. A total of approximately 20 min was needed to administer both tasks.

Data Analysis/Coding

Participant productions were extracted and entered separately into a Relational DataBase Management System. Utterances

varied in length depending on whether children produced a main-subjunctive clause, a main clause, or only a subjunctive clause. In an attempt to control for every related or external

TABLE 2 | Structural environments tested by the act-out priming production task^a.

Prime	Examples of targeted utterances	Examples of utterances produced by participants	Examples of four conditions and picture selection
Intransitive Xorev-o '(I) dance'	i ɣat-a... DET.FEM.SG.NOM cat-FEM.SG.NOM θel-i na xorep-s-i. want.IMPF-PRES.3.SG SUBJ dance-PRF-DEP.3.SG 'The cat wants to dance.'	i ɣat-a... INCORRECT DET.FEM.SG.NOM cat-FEM.SG.NOM θel-i na xore-[ts]-i. want.IMPF-PRES.3.SG SUBJ dance-PRF-DEP.3.SG 'The cat wants to dance.' [DS29]	
Transitive Potiz-o '(I) water' luluð-ja 'flowers'	o scil-os ... DET.MASC.SG.NOM dog-MASC.SG.NOM θel-i na poti-s-i ... want.IMPF-PRES.3.SG SUBJ water-PRF-DEP.3.SG ta luluð-ja. DET.NEU.PL.ACC flower-NEU.PL.ACC 'The dog wants to water the flowers.'	o scil-os ... CORRECT DET.MASC.SG.NOM dog-MASC.SG.NOM potiz-i ta luluð-ja. water.IMPF-PRES.3.SG DET.NEU.PL.AC flower-NEU.PL.ACC 'The dog is watering the flowers.' [DS4]	
Ditransitive ðin-o '(I) give' luluð-ja 'flowers' all-i at-a 'other cat'	i ɣat-a ... DET.FEM.SG.NOM cat-FEM.SG.NOM θel-i na ðo-s-i ... want.IMPF-PRES.3.SG SUBJ give-PRF-DEP.3.SG luluð-ja s-tin ... flower-NEU.PL.ACC to-DET.FEM.SG.ACC all-i ɣat-a. other-FEM.SG.ACC cat-FEM.SG.ACC 'The cat wants to give flowers to the other cat.'	i ɣat-a... CORRECT DET.FEM.SG.NOM cat-FEM.SG.NOM θel-i na ðo-s-i ... want.IMPF-PRES.3.SG SUBJ give-PRF-DEP.3.SG luluð-ja (s-tin ... flower-NEU.PL.ACC to-DET.FEM.SG.ACC all-i ɣat-a). other-FEM.SG.ACC cat-FEM.SG.ACC 'The cat wants to give flowers to the other cat.' [DS21/2] ^b	

^aA "virtual sticker" has been placed on the targeted picture.

^bThe first participant produced the structure with the indirect object, while the second participant did not.



factor that could have potentially affected the results, each word in each utterance was tagged for information on its phonetic, phonological, morphosyntactic, and structural properties. Given the well-attested phonetic and phonological limitations of individuals with DS, a detailed phonological analysis prior to data analysis was considered critical to eliminate non-morphosyntactic factors that could affect results. For the comprehension part, each participant was given only one opportunity to place the sticker. Their first placement was the one evaluated. All data from score sheets were also entered in a DataBase System for analysis. Data were coded in the following way: 1 for *correct*, 0 for *incorrect*, and 2 for the rare instances of

no answer, with a total of 18 responses per participant. Means of correct responses were calculated out of the total of 18 test items.

Reliability

An experienced experimenter (the first author) conducted all data collection. Initial narrow transcriptions, acoustic analyses, and morphosyntactic analyses were performed by the experimenter and two coders. A third coder transcribed and analyzed 43% of the overall collected data. Reliability between coders in terms of transcription accuracy was achieved at 97%. Discrepancies between coders were resolved by an independent coder. Response evaluation for the picture selection

(comprehension) task was performed by a separate coder and verified by the first author.

The project was fully approved by the Cyprus National Bioethics Committee (EEBK/ΕΠ/2012/29) and underwent ethics evaluation (at the beginning of the project, after data collection, and at its completion) by an independent ethics advisor to ensure that it adhered to the European Commission's Research Executive Agency (REA) ethical guidelines. Parents received a written and informed consent form outlining the purpose of the study, procedure, benefits, and risks. They were also assured that the collected data as well as all information concerning them and their children in the consent form they signed would remain confidential. Parents and/or the legal guardian of all participants had to sign each page of the consent form and complete the questionnaires on the first and last pages of the consent form.

Statistical Analysis

Sample size was calculated based on previous published work on parallel populations. The estimated sample size was 33 for the DS population and 55 for TD children. Means of subjunctive comprehension were calculated for each participant from each group (all 30 children with DS and 53 TD children). A confidence level of 95% was applied, making the cut-off point 0.05.

RESULTS

The full project generated a massive amount of data that are still being transcribed and analyzed. **Figure 2** shows results only on the comprehension portion of the experiment. Means were submitted to a Lineal Regression Model in R (R Core Team, 2017) with *subjunctive accuracy* as the dependent variable, i.e., the mean of correct responses over incorrect responses (out of a total of 18 items), per participant, per group, and *group* (DS vs. TD) and *age* as independent variables. The results showed a parallel performance across the two groups (DS: $M = 83.3\%$, $SD = 15.6$; TD: $M = 87.8\%$, $SD = 16.6$), $R^2 = 0.18$, $F(1, 81) = 1.48$, $p = 0.228$. Results did reveal an interaction of *age with group*: $R^2 = 0.13$, $F(3, 79) = 4.08$, $p = 0.010$, suggesting that while the two groups present parallel performance, there is across as well as within group variation with regard to age, as we clearly see in the developmental trajectories presented in **Figures 4, 5**.

As a preview to the next steps of our research, data from a subgroup of 5 children with DS and a subgroup of 5 TD children, matched on MA, were compared to test for potential interactions with comprehension and production across the two groups (**Figure 3**). The statistical analysis provided below was to merely observe any potential tendencies that might assist with future analysis. It is possible that the current picture might change once full analysis of the data is completed. Data from the two subgroups were submitted to a Linear Regression Model in R, with *subjunctive accuracy*, as the dependent variable and *group* (DS vs. TD) and *age* as factors (i.e., independent variables), separately for each task/ability. Results revealed no *group* effect for either production, $R^2 = 0.005$, $F(1, 8) = 0.04$, $p = 0.854$, or comprehension $R^2 = 0.265$, $F(1, 8) = 2.88$, $p = 0.128$.

With the aim of creating a developmental curve for the comprehension of subjunctive clauses, we plotted the

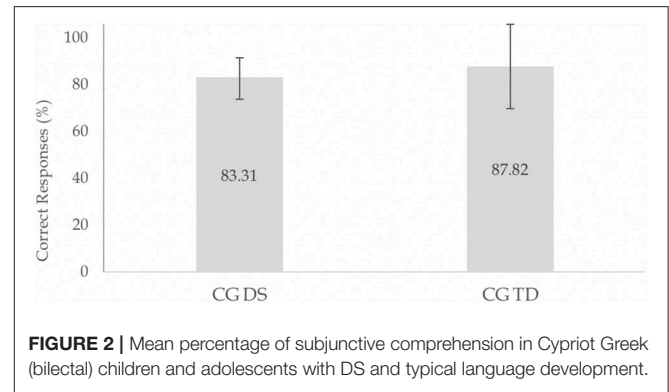


FIGURE 2 | Mean percentage of subjunctive comprehension in Cypriot Greek (bilingual) children and adolescents with DS and typical language development.

participants' performance across different ages. Results are shown in **Figures 4, 5**.

The performance of children and adolescents with DS seemed to be more on a spectrum of individual abilities than on a maturational/developmental scale based on age. That is, we had more "high functioning" children with DS at age 5 ($M = 83.3\%$) than we did at age 8 ($M = 55.6\%$) and again children with DS aged 9 ($M = 87.0\%$) and 10 ($M = 88.9\%$) rather than those aged 11 ($M = 69.4\%$). In addition, the variation across participants within each DS subgroup was slightly greater than in the TD subgroups. A prime example is the subgroup for 13-year-olds, with two participants scoring 66.7% and two scoring 100%.

In contrast, TD children's means of accuracy across different ages were more "gradually ascending." That is, we see a slow increase in means of accuracy as we move from one 6 month group to the next (top panel). Results did evidence a relative plateau, with a slight variation of $\pm 1.5\%$, for three age groups of TD children (bottom panel), aged 3;6–3;11 ($M = 95.8\%$), 4;0–4;5 ($M = 95.5\%$), and 4;6–4;11 ($M = 94.4\%$). Children in the 5;0–5;5 age group performed closer to the oldest age group ($M = 99.1\%$) (i.e., near ceiling) than the following two age groups. When the final group was further divided in TD children aged 6;0–6;5 and at 6;6, results revealed 100% accuracy with children at 6;6, showing the exact age of mastery (full acquisition). The same was also true for individuals with DS, for 17- and 18-year-olds, with teenagers at 18;0 and up showing 100% accuracy. However, both populations also show signs of full acquisition at an earlier age: 13;0–13;11 for DS and 5;0–5;5 for TD children, with the latter being much closer to ceiling.

DISCUSSION

The first goal of the present study was to examine whether Cypriot Greek-speaking children and adolescents with Down syndrome present an impairment with the comprehension of subjunctive clauses. Given the high accuracy rates presented by our DS group, these results contradict arguments of an overall syntactic impairment from previous research on DS on numerous other languages and complex syntactic structures, such as Stathopoulou (2009), Thordardottir et al. (2002), and

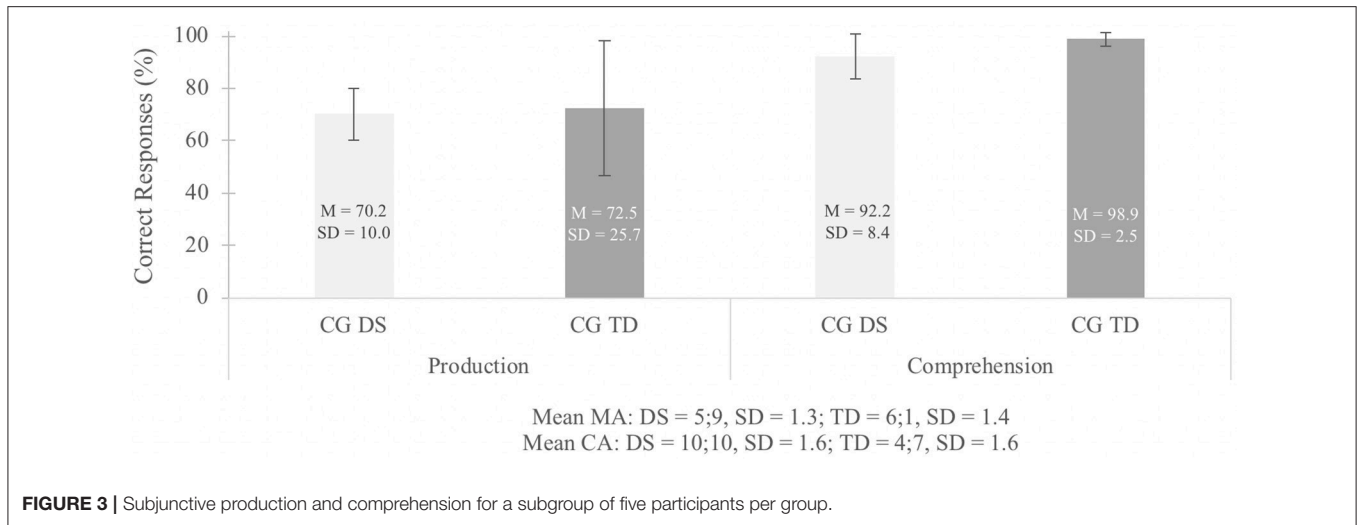


FIGURE 3 | Subjunctive production and comprehension for a subgroup of five participants per group.

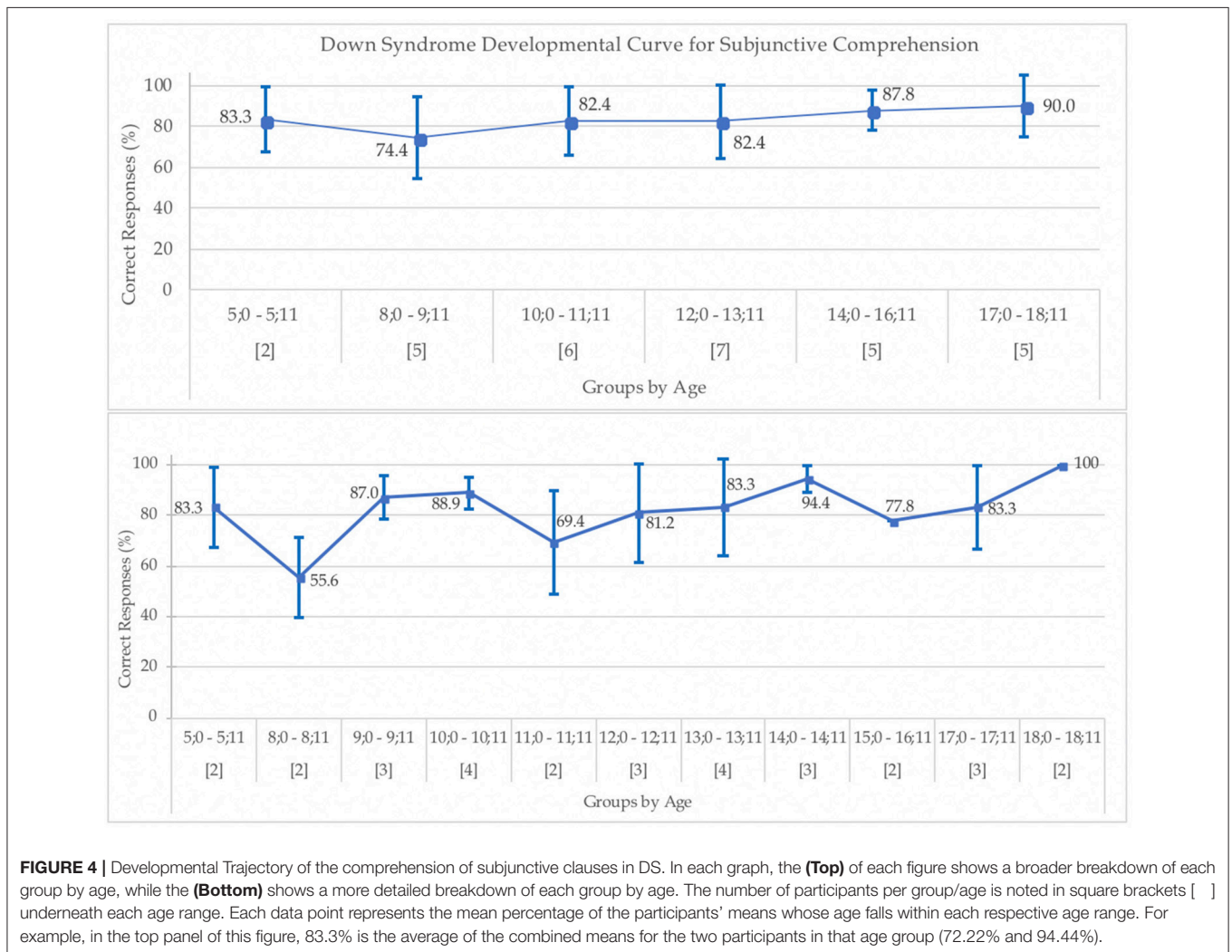


FIGURE 4 | Developmental Trajectory of the comprehension of subjunctive clauses in DS. In each graph, the **(Top)** of each figure shows a broader breakdown of each group by age, while the **(Bottom)** shows a more detailed breakdown of each group by age. The number of participants per group/age is noted in square brackets [] underneath each age range. Each data point represents the mean percentage of the participants' means whose age falls within each respective age range. For example, in the top panel of this figure, 83.3% is the average of the combined means for the two participants in that age group (72.22% and 94.44%).

others, showing accuracy with numerous complex syntactic structures being lower than or at chance level. Despite the complexity of the structure and the fact that the embedded

verb's inflectional marking depends on the matrix verb—with the same subject–verb agreement marking, but different tense marking—participants with DS presented highly accurate

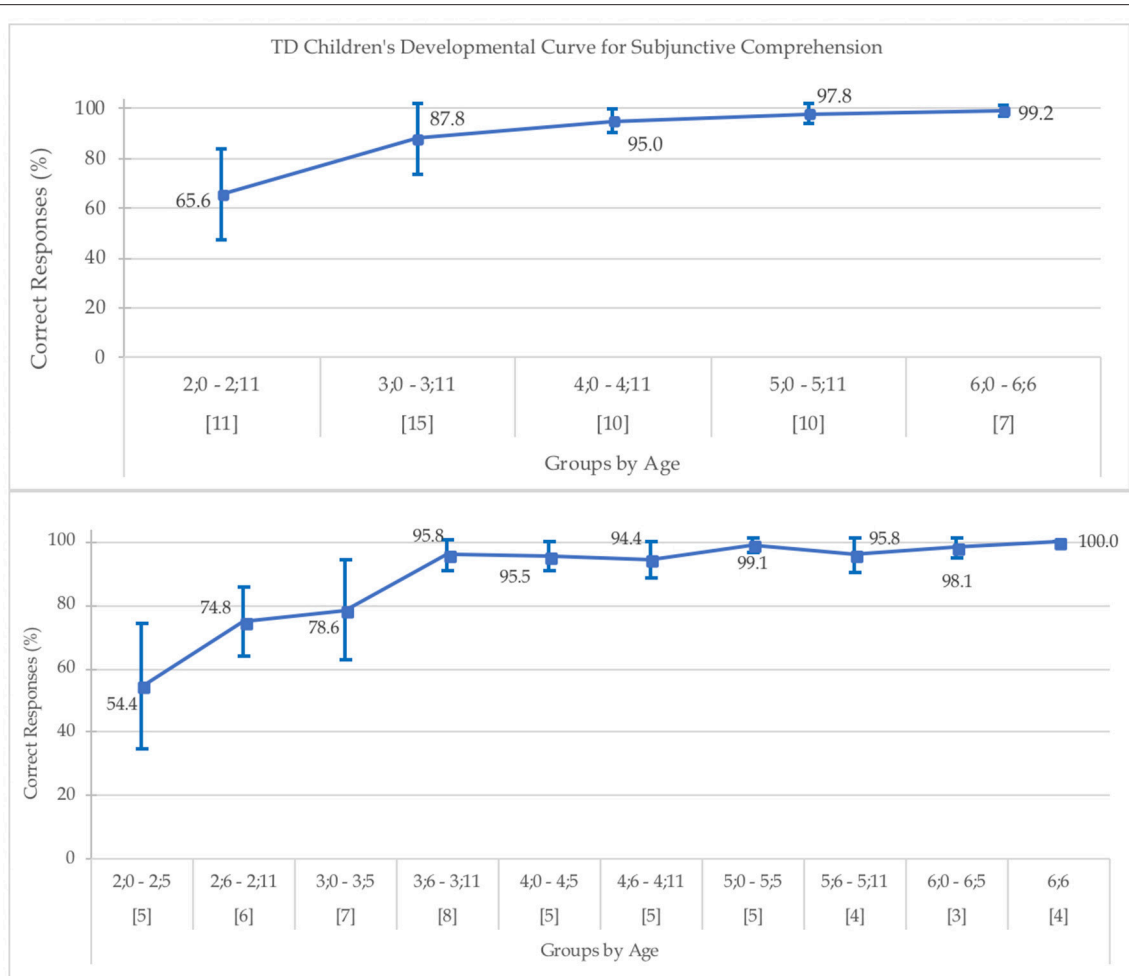


FIGURE 5 | Developmental Trajectory of the comprehension of subjunctive clauses in TD children.

performance. The present results also are at odds with results from Stathopoulou (2009), where DS presented poor comprehension of clitics and reflexives in subjunctive clauses, with accuracy at much lower rates than any of the other complex structures examined.

Our second objective was to compare participants with DS to young typically developing children and determine whether the two groups present parallel development. Differences across the two groups were not statistically significant, even though slightly higher accuracy rates were recorded for the TD children (83.3% vs. 87.8%). Even though there is a large chronological age gap between the two groups, results suggest that full acquisition of this complex syntactic structure is possible for individuals with DS, even if it does not happen until their teenage years, much later than for TD children. As an introduction to the next steps of this research program, we also presented results from a small subgroup of participants (5 + 5). Results indicate higher accuracy rates with the comprehension over the production of subjunctive clauses which may suggest that both groups have grammatical knowledge of the subjunctive structure but do not

always follow in performance (as means of production were slightly lower). However, given the number of participants for which both production and comprehension data were analyzed, no generalized conclusions can be drawn.

Our third and fourth objectives concerned age of acquisition. Initially, we wanted to determine what is the age by which we can safely say that the two populations present full comprehension of subjunctive clauses. We thus aimed to provide a developmental curve for the comprehension of subjunctive clauses in our two populations. The developmental trajectories constructed when plotting participants' performance across various age groups revealed that, even though both groups showed signs of near-ceiling performance at younger ages, we determined the full acquisition age to be 18 for individuals with DS and 6;6 for TD children. A gradual increase of accuracy means was noted when moving from younger to older ages, suggesting that the two groups may follow a developmental trajectory where their abilities improve with age. However, a closer look at the results, with a more detailed breakdown by age, showed variation within subgroups, with higher means for younger ages, who

exhibited higher linguistic and cognitive abilities overall, and lower performance for children whose age group was somewhere in the middle. This was more evident for the DS group, though the small number of participants per subgroup on the finer breakdown may best explain this seeming individual variation. While there still is a significant age gap between the two groups, matched on *MA* and other factors, the present results show that even with individual variation, the performance of individuals with DS matched that of TD children at a much older age than previously argued. Specifically, 5-year-old children with DS had a higher performance than 3-year-old TD children, reaching full acquisition at age 18 and 6;6, respectively, and therefore contradicting previous studies on adults with DS suggesting that their linguistic abilities do not surpass those of 3-year-old TD children (Fowler et al., 1994; Chapman et al., 1998). Our findings are in agreement, though, with previous results on CG-speaking adults with DS, who presented high accuracy rates not only for inflectional marking (Christodoulou, 2011, 2013; Christodoulou and Wexler, 2016), but also the comprehension of complex syntactic structures like *wh*-questions (Christodoulou and Grohmann, 2014).

As noted, our participants are raised in a bilingual environment, which—pending further research—may be taken to indicate confusion due to variable inputs related to phonetic/phonological, morphosyntactic, and structural differences and therefore possibly create confusion in early language development. Yet, the participants in this study exhibited high accuracy rates, with gradual progression toward full acquisition. This finding may suggest that these differences on the multiple linguistic levels of language analysis between Cypriot and Standard Modern Greek do not create any such confusion for the learner in the case of subjunctive clauses. It thus stands in contrast to other instances of linguistic differences such as clitic placement (Grohmann et al., 2017). The fact that this complex syntactic structure is formed in a parallel manner across both varieties of Greek eliminates any potential confusion or complication.

Clinical Implications

Efficacy in both diagnosis and intervention plans are prospective clinical implications of this study. Given that when intervention for DS is delayed even by 2 months it can have less successful results (Sanz and Menendez, 1995), prior knowledge of what needs to be addressed and by what age can be critical. The current developmental trajectories show not only the level of acquisition per age for individuals with DS but also for TD children. Creating a developmental trajectory of production as well will help us document potential developmental levels for each group, from the initial steps of production to full acquisition, as with the one on comprehension presented in the current paper. Therefore, these trajectories will not only be invaluable for diagnosis for children with DS, but also a potential language impairment in children not diagnosed with a language disability or diagnosed with any other language difficulty. Clinicians will now have a clear indication as to what level of acquisition a TD child is expected to have at what age. Being able to determine whether the subjunctive is fully acquired or not, may help clinicians

with rehabilitation plans, as they will be able to determine whether, in the case of inaccurate performance, the subjunctive construction is fully acquired, or there are other elements in a structure that may cause incorrect production. This will facilitate more targeted and efficient intervention plans, avoiding loss of invaluable time.

CONCLUSIONS

The results of this paper add to the growing body of cross-linguistic literature investigating the acquisition of complex syntactic structures across children with DS and TD children and provide the first ever developmental trajectories on subjunctive comprehension in children with DS and TD children. The fact that these results show high accuracy levels with the comprehension of subjunctive clauses, compared to results from other languages, raises a number of questions on the linguistic abilities of individuals with DS in general, and especially arguments of severe syntactic impairment, as well as issues related to the theoretical complexity of this syntactic structure and what may be proven complex for individuals with DS. Additional issues regarding why results from the current study contradict results from previous work concern the methodology used in testing complex structures and language-specific characteristics that might create an added difficulty in the comprehension and production of these structures. Phonetic, morphosyntactic, and structural diversities across the two linguistic varieties did not appear to affect the acquisition of this complex syntactic structure. The fact that subjunctives are formed in a parallel way across the two varieties of Greek spoken in Cyprus could have facilitated a better understanding of the mechanisms involved in the formation of the structure and, in consequence, its more timely acquisition, thus eliminating any potential confusion caused by variable inputs.

Moving forward, after full transcription and subsequent analysis of the production data, a parallel attempt to construct a developmental trajectory of production results might provide a better understanding on whether the development of subjunctive clauses improves with age or whether it depends on each participant's overall linguistic abilities. We will also be able to compare the trajectory of production to that of comprehension one and determine whether there is a consistent gap between production and comprehension and whether that becomes narrower as participants are getting closer to full acquisition. Further categorization with transitive and intransitive verbs may determine whether transitivity has a significant effect on the participants' comprehension or production of the subjunctive clauses. The study of the theoretical implications this work has along with additional complex syntactic structures, such as imperative constructions, *wh*-questions and relative clauses, would provide a clearer insight into the level of grammatical abilities these two groups may reach and potentially address the issue of overall, severe syntactic impairment in individuals diagnosed with Down syndrome. However, we maintain that the small piece of the puzzle presented in

this paper is a significant one, given the complex structural and morphosyntactic processes involved in the formation of subjunctive clauses.

AUTHOR CONTRIBUTIONS

CC conceived of and carried out the study as a Marie Curie postdoctoral research fellow under KG's supervision. She also wrote a first draft of the paper, which both authors then equally

contributed to for the original submission, and was in charge of the revision process.

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