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Research Article

At the Intersection of Cognition and Grammar: Deficits Comprehending Counterfactuals in Turkish Children With Specific Language Impairment

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Purpose: This study investigated the comprehension of counterfactual conditionals in monolingual Turkish children with specific language impairment (SLI) and typically developing (TD) children. Comprehending counterfactuals requires a well-developed cognitive system (Beck, Riggs, & Gorniak, 2009). Children with SLI have impaired cognitive functioning (Im-Bolter, Johnston, & Pascual-Leone, 2006), which affects their ability to comprehend counterfactuals.
Method: The sample consisted of 13 children (9 boys, 4 girls) with SLI who were matched in age and nonverbal intelligence with 13 TD children (8 boys, 5 girls; mean age 6;9 [years; months] for both groups). Each group completed a sentence comprehension and repetition task with 3 sentence conditions: nonconditional, factual, and counterfactual. Nonconditionals did not have *if*-embedding, whereas factual and counterfactual conditionals were morphosyntactically equivalent *if*-clauses, but only the latter was cognitively complex.
Results: Conditionals were more difficult to comprehend than nonconditionals for both groups. Counterfactuals were more difficult to comprehend than the morphosyntactically equivalent factual counterparts for the SLI group. There was no discrepancy between the groups for repetition of counterfactuals and factuals.
Conclusions: Children with SLI have difficulty processing counterfactuals due to morphosyntactic complexity (*if*-embedding) and the cognitive processes involved in comprehending counterfactuals. This indicates that cognitive complexity adds to sentence comprehension deficits in SLI.

A diagnosis of specific language impairment (SLI) occurs when there are significant deficits in expressive and/or receptive language skills and no evidence of neurological impairment, hearing deficits, or cognitive impairment (Bishop, 1992; Leonard, 1998). The hallmark features of SLI include profoundly impaired morphosyntactic abilities, particularly in the area of morphology (e.g., tense and subject-verb agreement; Bishop, Adams, & Norbury, 2006; Leonard, Caselli, Bortolini, McGregor, & Sabbadini, 1992; Rothweiler, Chilla, & Clahsen, 2012). The specificity of SLI to language is subject to debate, and recent studies suggest that nonlinguistic deficits often co-occur. The implication is that children with SLI may have impaired cognitive functioning and impaired language (Im-Bolter, Johnston, & Pascual-Leone, 2006).

From this point of view, the interface between morphosyntax and semantics in children with SLI is an interesting area to investigate as it allows separating morphosyntactic abilities and cognitive abilities. Although there is extensive work on morphosyntactic impairments in children with SLI (see review article by Leonard, 1998), little is known about the impact of cognitive complexity at the morphosyntax-semantics level. The present study investigated the comprehension and repetition of counterfactuals in two groups of monolingual Turkish children: children with SLI and typically developing (TD) children.

Counterfactuals provide information about what might have been. For example, if a child lost a favorite toy at the school, she or he might think "If I had not taken it to school!" In this scenario, the child generates an alternative event and outcome. The counterfactual is the scenario in

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which the child did not take the toy to the school and, hence, did not lose it.

Using and understanding counterfactuals involves complex cognitive processes, and three cognitive operations are required to process counterfactuals: (a) ignoring what actually happened; (b) maintaining factual and counterfactual representations in mind; and (c) shifting between the two representations (e.g., Beck et al., 2009; Drayton, Turley-Ames, & Guajardo, 2011; Guajardo, Parker, & Turley-Ames, 2009). Although children answer counterfactual questions correctly at approximately 4 years old, children gradually come to engage in adultlike counterfactual reasoning (see Rafetseder, Schwitalla, & Perner, 2013).

This present study manipulates morphosyntactic complexity (the presence/absence of *if*-embedding) and cognitive complexity (counterfactuality) at the morphosyntax-semantics–interface level. The two factors are separately assessed using nonconditional sentences (sentences that do not contain *if*-embedding), counterfactual sentences, and factual sentences (morphosyntactic minimal pairs of counterfactuals).

Turkish is a suitable language for this investigation for several reasons. The structure of counterfactuals in Turkish is grammatically easier than in English because Turkish does not use *if*-complements, modals, auxiliaries, or participle verbs. Counterfactuals in Turkish are semantically more transparent than in English because Turkish has a conditional morpheme (-(*y*)*sa*) "if" (i.e., embedding), and when this morpheme is to the left of the past-tense marker, the sentence is a counterfactual, and when this morpheme is to the right of the past-tense marker, the sentence is a factual. With the exception of morpheme order, in Turkish factuals and counterfactuals are generally morphosyntactically equivalent. This means that, unlike in English, where counterfactuals are more complex syntactically, researchers can control Turkish morphosyntactic complexity and investigate the impact of counterfactuals on comprehension in children with SLI.

We hypothesized that counterfactuals would be more difficult to comprehend than nonconditionals for the children with SLI because counterfactuals involve *if*-embedding, whereas nonconditionals do not. We also anticipated that counterfactuals would be more difficult to comprehend than morphosyntactically equivalent factual counterparts for the children with SLI as counterfactuals are semantically more complex and require cognitive processes to comprehend them. Accordingly, for the children with SLI, we expected counterfactuals to be difficult to comprehend due to the morphosyntactic complexity of the constructions and also due to the semantic complexity and additional cognitive processes involved in comprehending counterfactuals.

Nonverbal Deficits in SLI

Children with SLI score within the normal range on nonverbal intelligence (IQ) tests but often exhibit profound impairment in the area of morphosyntax, especially in verbal inflection (for a review, see Leonard, 1998). Although a diagnosis of SLI implies that nonverbal cognitive abilities are well preserved, a growing number of studies suggest that impairments at the level of grammar co-occur with a number of nonlinguistic deficits, such as nonverbal reasoning and inferencing (e.g., Johnston & Weismer, 1983; Newton, Roberts, & Donlan, 2010). This suggests that scores that fall within the normal range on IQ tests do not guarantee overall intact cognitive functioning. Furthermore, children with SLI present with a broad range of cognitive deficits and lag behind TD peers on nonverbal measures of executive functions (e.g., inhibition and working memory: Im-Bolter et al., 2006; Lukács, Kas, Kemény, & Krajcsi, 2010; cognitive switching: Marton, 2008).

Explanatory approaches to SLI can be broadly divided into two approaches. One approach holds that the language problems in SLI are primary (Rice, Wexler, & Cleave, 1995; van der Lely, 2005). The second approach views the language problems as secondary to general cognitive limitations. The proponents of this second approach seek to identify which nonlinguistic factors, such as reduced processing rate and capacity limitations (Bishop, 1994; Leonard, McGregor, & Allen, 1992; Norbury, Bishop, & Briscoe, 2001) or cognitive mechanisms (e.g., working memory: Gathercole & Baddeley, 1990; Montgomery, Magimairaj, & Finney, 2010), cause language deficits. Although these studies focused on explaining language deficits from a general cognitive perspective, few of the studies directly relate impairments in specific cognitive areas to impairments in specific linguistic structures. Studying counterfactuals in SLI may add to our understanding of the relationships between language and cognition.

This study investigates whether sentence comprehension deficits in SLI are solely related to language (e.g., morphosyntactic complexity) or whether counterfactuality itself (e.g., cognitive complexity) adds to comprehension problems. In our study design, morphosyntactic complexity and cognitive complexity are individually manipulated to observe the effects of both types of complexity. We focused on two groups of monolingual Turkish children: children with SLI and TD children. We are unaware of any published studies on sentence comprehension in monolingual Turkish children with SLI.

Turkish Grammar: Nonconditionals, Factuals, and Counterfactuals

Turkish is a prodrop and highly agglutinative language with a subject–object–verb (SOV) base order (Erguvanlı, 1984). This is illustrated below, where Example 1 is a nonconditional compound sentence conjoined with "and" (acc = accusative; 3sg = 3rd person singular; dat = dative).

1. Gömleğ–i ütüle–di ve dolab–a as–tı
   The shirt–acc iron–past/3sg and the closet–dat hang–past/3sg
   He ironed the shirt and hung it in the closet

In Turkish, conditional morphology is affixed to the main verb and consists of two morphemes: the past (–DI) and the conditional (–ySE). These morphemes can appear

in either conditional-first order (when the past-tense morpheme follows the conditional) or conditional-last order (when the past-tense morpheme precedes the conditional). Conditional first is counterfactual (see Example 2), and conditional last is factual (see Example 3). Unlike English, Turkish does not use combinations of *if*–complementizer, tense/aspect morphemes, modals, auxiliaries, or past participle verbs to convey a counterfactual meaning (e.g., If he had ironed the shirt, he would have hung it in the closet). Unlike English where the structure of counterfactuals is morphosyntactically more complex than factuals (e.g., If he has ironed the shirt, he will hang it in the closet), Turkish counterfactuals are morphosyntactically equivalent to their factual counterparts (compare Examples 2 and 3) in terms of complexity. The aorist in the examples behaves like a modal expressing nonfactivity (Sansa, 1986).

2. Gömleğ–i ütüle–*sey*-*di* dolab–a as-ar–dı
   The shirt–acc iron–conditional–past/3sg the closet–dat hang–aorist-past/3sg
   If he had ironed the shirt, he would have hung it in the closet

3. Gömleğ–i ütüle–*diy*–*se* dolab–a as–ar
   The shirt–acc iron–past/3sg –conditional the closet–dat hang–aorist/3sg
   If he has ironed the shirt, he will hang it in the closet

Example 2 is a counterfactual and implies that the speaker is certain that the shirt was not ironed, and therefore, it was *certainly* not hung in the closet. In Example 3, however, the speaker is ignorant of whether the shirt has been ironed or not and speculates about the consequences of the situation in which the shirt has been ironed (i.e., if the ironing has been done, the shirt will certainly be in the closet). Example 3 also has an indirect implication; that is, if the shirt has not been ironed, it may or may not be in the closet. This implication is indirect because it requires an interpretation that is opposite to what is being said or heard (e.g., original sentence: if the shirt is ironed). This sentence is ambiguous as both options are possible (the shirt may or may not be in the closet if it is not ironed). The methodology of the present study (see Method section) allows us to focus on the direct and unambiguous interpretation of Example 3; that is, children were shown picture stimuli in which the shirt was always ironed and the shirt was in the closet.

According to Iatridou (2000), the past-tense morpheme receives a temporal interpretation when it ranges over time (= factual) and a possible world interpretation when it ranges over worlds (= counterfactual). In Turkish, conditional-last clauses (see Example 3) range over time, and past inflection is interpreted as past tense. Conditional-first clauses (see Example 2) range over worlds, and past inflection adds counterfactuality to the interpretation of the structure as containing fake tense and aspect (i.e., antecedent clause is neutral with respect to tense). Accordingly, a temporal-past interpretation is absent in the antecedent clause of a counterfactual, and past-tense marking on the consequent verb form of a counterfactual (see the underlined morpheme in Example 2) gives the temporal interpretation.

Research Questions for This Study

Our research questions were: Do children with SLI show a difference between understanding and repeating counterfactual conditionals, factual conditionals, and nonconditionals? If so, is this pattern the same for TD children?

Experimental Design

TD monolingual Turkish children and monolingual Turkish children with SLI completed sentence comprehension and sentence repetition tests. The sentences varied as to (a) whether they contained an *if*-conditional and (b) the type of *if*-conditional. Table 1 provides a summary of the relevant grammatical characteristics of the sentence stimuli. The table highlights that only factuals and counterfactuals are *if*-conditionals, and only counterfactuals require the cognitive processes mentioned earlier.

In this study, nonconditionals, factuals, and counterfactuals were included to evaluate separately the effects of morphosyntactic (i.e., *if*-embedding) and cognitive complexity (counterfactuality). In other words, this study investigates how participants comprehend sentences with varying morphosyntactic complexity, with and without counterfactuality. Our experimental design provides two main advantages: (a) We can compare performance on nonconditionals and conditionals to allow evaluating the effect of morphosyntactic complexity, and (b) we can compare performance on factuals and counterfactuals to allow us to investigate whether an effect of counterfactuality exists. If conditionality is the difficulty, we would expect both factual and counterfactual conditions to be equally difficult to comprehend. If, however, the problem is also due to involvement of certain cognitive processes, then we would expect to see more difficulties in processing counterfactual sentences.

One concern that arises due to the nature of Turkish grammar is whether the morpheme-order switch of the past and the conditional (see Table 1) influences comprehension of these clauses at the morphosyntactic level. In other words, are children better at using one of these morpheme orders compared to the other, even though the same morphemes are used? We included a sentence repetition task to investigate the effect of morpheme order in Turkish conditionals. According to Friedmann and Lavi (2006), repetition tasks enable assessment of morphosyntactic skills in children, as children can only repeat sentences that they have processed and can actively reconstruct. If the children in our study have difficulty with only one of the two otherwise morphosyntactically equal sentences, this would indicate that morpheme order might pose morphosyntactic difficulties.

Children correctly answer English counterfactual questions at approximately 4 years old (Beck et al., 2009). There

Table 1. Summary of the three clause types with respect to the presence of *if*-embedding, verb morphology in the main clause, factuality, and involvement of cognitive complexity.

Clause type	*If*-embedding	Verb morphology	Factual	Cognitive complexity
Nonconditional	no[a]	past tense	yes	no
Factual	yes	past tense + *–sa*	yes	no
Counterfactual	yes	*–sa* + past tense	no	yes

[a]The sentence is not an *if*-clause, and it is a compound clause conjoined with "and" in this study.

is no empirical data on the acquisition of Turkish counterfactuals. Aksu (as cited in Aksu-Koç, 2006), however, proposed that the structural properties of Turkish allow early use of conditionals in this language at around 2;8–3;0 years rather than during the second half of the third year as in English. As the morphosyntactic structure of factuals and counterfactuals are equivalent in Turkish, one implication of Aksu's finding is that the morphosyntactic structure of counterfactuals is also acquired by this age. Thus, it is reasonable to assume that comprehending counterfactuals in Turkish may emerge at a comparable developmental timeline to comprehension in English.

In this study, we tested the comprehension of standard counterfactuals, and we did not include children under 5 years old to ensure that the required language and cognitive developments to understand standard counterfactuals had taken place at the time of testing. The two groups of children were matched for chronological age because (a) factual conditionals and counterfactual conditionals are morphosyntactically equivalent in Turkish, and (b) counterfactuals are assumed to develop as a function of age, and we investigate whether there is a delay in the SLI groups' understanding of counterfactuals.

Theories of SLI (e.g., Gathercole & Baddeley, 1990; Rice et al., 1995) do not make relevant predictions as to how Turkish children with SLI comprehend counterfactual sentences at the morphosyntax-semantics interface level. We make several predictions regarding the two tasks and the two groups based on studies on typical development (Beck et al., 2009) and the relevant characteristics of Turkish grammar.

Sentence Comprehension

We made the following three predictions regarding sentence comprehension:

1. Assuming that children with SLI have deficits processing morphosyntactic information and that conditionals are grammatically more complex than nonconditionals, we expect that conditionals will be more difficult to comprehend than nonconditionals for both groups.
2. Assuming that children with SLI have impaired cognitive functioning, we predict that counterfactual conditionals will be more difficult to comprehend than factual conditionals. However, because TD children in this age range have the cognitive ability required for processing counterfactuals (Beck et al., 2009) and factuals and counterfactuals are morphosyntactically equivalent in Turkish, we predict that there will be no difference in processing counterfactual and factual conditionals for the TD group.
3. Error data: In the test, children were shown four pictures: one target picture and three distracter pictures (one with a pure interpretation error, one with a lexical distracter, one that combines both an interpretation error and a lexical error, see Procedure). We predicted that counterfactuals would be more difficult to correctly identify than factual conditionals (see Study Prediction 2 above) for children with SLI because they, unlike TD children (see Study Prediction 2 above), would select distracter pictures with a pure interpretation error (namely, Action Unfulfilled distracter) more often in counterfactual conditionals than in factual conditionals (and nonconditionals).

Sentence Repetition

We made the following two predictions regarding sentence repetition:

4. Assuming that conditionals are morphosyntactically more complex than nonconditionals, we expect that repeating conditional sentences will be more difficult than repeating nonconditional sentences for both groups.
5. Factuals and counterfactuals are morphosyntactically equivalent. Thus, we expect no difference in repetition of factual and counterfactual sentences for either of the groups.

SLI Compared to TD: Sentence Comprehension and Sentence Repetition

We made the following prediction regarding the performance of the TD children compared to the children with SLI:

6. In both tasks, children with SLI will have lower levels of performance than TD children for conditional sentences (factuals and/or counterfactuals) because conditionals are grammatically complex, whereas on nonconditionals, no between-groups differences may emerge. The difference between the two groups is expected to be larger for counterfactuals than for factuals because counterfactuals are cognitively more

complex, and children with SLI have problems with cognitive functions.

Method

Participants

In total, 26 monolingual Turkish-speaking children participated in the study: 13 children with SLI (nine boys, four girls) and 13 TD children (eight boys, five girls; see Table 2 for an overview of participant characteristics). All the children except one child were tested with the standardized Wechsler Intelligence Scale for Children (WISC-R Turkish version: Savaşır & Şahin, 1988) by a speech and language therapist. The cutoff score for IQ was set at 80, as this is above the cutoff of 70 for mental retardation. One child with SLI was administered the Stanford-Binet Scale of Intelligence, as the child did not meet the age criteria of the WISC-R 5;6 [years; months].

Children with SLI who were recruited from two rehabilitation centers in Eskişehir, Turkey (DILKOM at Anadolu University and Birinci Rehabilitation Center), were referrals with medical reports indicating a speech-language disorder. On the basis of the information from their written records, the spontaneous speech production and evaluation of their receptive /expressive skills lagged behind TD children in terms of language skills; all passed hearing screenings at 20 dB (250, 500, 1000, 2000, 4000, and 6000 Hz), and none of the children had a history of neurological dysfunction, motor or psychiatric deficits, or any co-occurring disorders. All were receiving speech therapy at the time of testing, but their intervention goals did not include areas targeted in this study.

To ensure that children in this SLI group fit the SLI criteria, each child underwent additional testing. All children with SLI were tested with the standardized Turkish version of the Test of Language Development–Primary: Fourth Edition (TOLD-P:4-Turkish: Topbaş & Güven, 2013), adapted from the English TOLD-P:4 (Newcomer & Hammill, 2008). The results were calculated and evaluated by the third author who is also a certified speech and language therapist. With the exception of one child (SLI 2), all the children in the SLI group performed more than 1.5 *SD*s, below the mean on the total spoken composite index (range = 42–78). On the semantic composite (picture vocabulary, relational vocabulary, oral vocabulary), the range was 45–86; on the grammar composite (syntactic understanding, sentence imitation, morphological completion), the range was 49–76. Although child SLI 2's total composite index was in the average range (107), his speaking composite (oral vocabulary, morphological completion) was below average (85). For this reason, child SLI 2 was included within the study.

The TD children were recruited from primary schools in Eskişehir ($n = 4$) and Ankara ($n = 9$). A child was eligible for the study if the school records and teacher report indicated no difficulties with speech/language, neurology, vision, and hearing. There were no differences between the groups for chronological age, $t(24) = -0.111$, $p = .912$, $d = 0.2$, or nonverbal IQ, $t(24) = -1.554$, $p = .133$, $d = 0.7$.

Table 2. Overview of participant characteristics.

Participants (*N*)	Age			Performance IQ			Gender
	Range	*M*	*SD*	Range	*M*	*SD*	
SLI (13)	5;6–9;1	6;9	1;1	80–110	90	8;7	9 boys
TD (13)	6;3–8;11	6;9	0;8	89–120	97	10;6	8 boys

Note. Age is represented in years;months. *N* = number of participants; *M* = mean; *SD* = standard deviation; SLI = specific language impairment; TD = typically developing.

Materials

Sentence comprehension. We developed a sentence–picture matching task with three conditions. The vocabulary items consisted of 15 transitive verbs (e.g., to iron) matched with an object pair (e.g., shirt–dress) and a location (e.g., the closet). There were 45 stimuli per participant (15 sentences × 3 conditions). The test stimuli did not evoke (counterfactual) emotions such as contrastive psychological appraisals. All the verbs were inflected for past tense (–DI) and were in third-person singular form (zero morpheme in Turkish). Note that Turkish has no irregular verb forms. The target-verb inflection was manipulated by the presence of the conditional morpheme (–SA) in conditionals and by its absence in nonconditionals. Direct objects were in the accusative case (–I), and indirect objects were in the dative case (–A).

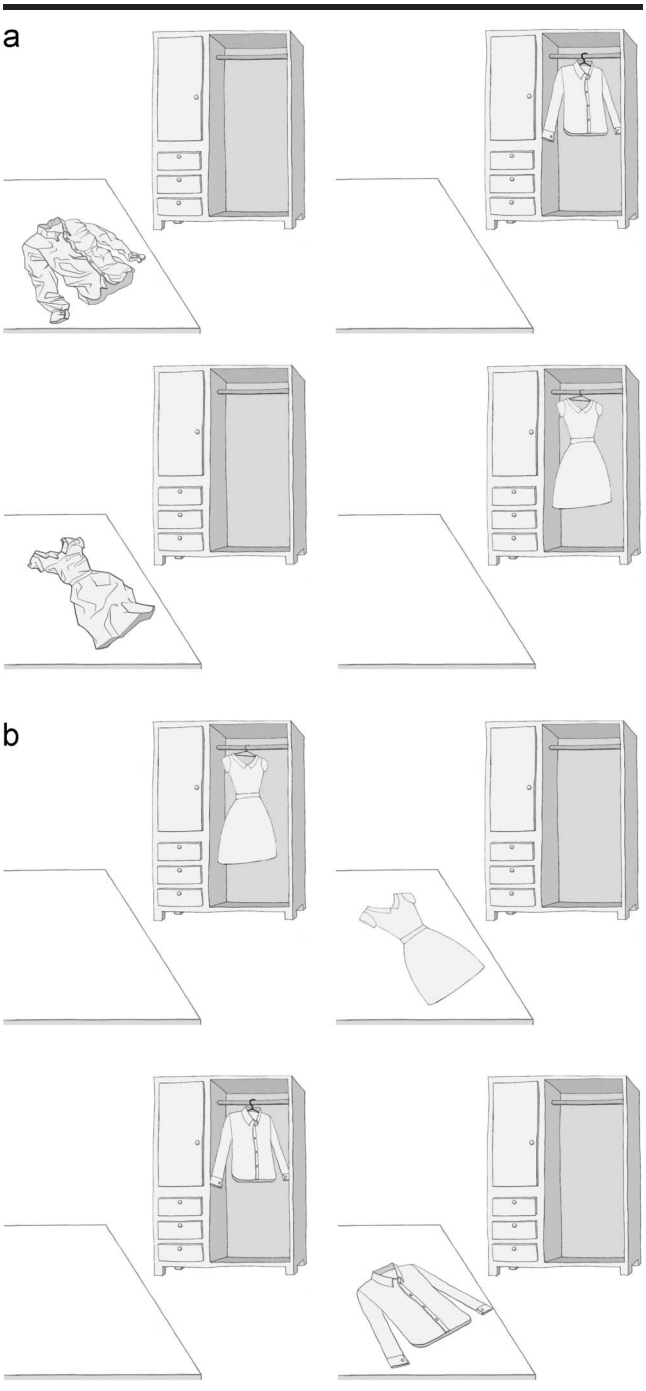
Sentence repetition. A sentence repetition test was developed with the same conditions as the sentence comprehension task, namely, nonconditionals, factual conditionals, and counterfactual conditionals. There were 15 stimuli per subject (3 conditions × 5 items). The stimuli were matched for morpheme length (nine to 11 morphemes per sentence) and for lexical items across the three conditions.

Procedure

Sentence comprehension. In a 1:1 setting, the experimenter read a sentence aloud, and the participant was asked to point to the picture that matched the spoken sentence. The participant had to select one of four pictures: (a) target picture; (b) distracter picture in which the action was not fulfilled (hereafter AU: action unfulfilled); (c) distracter picture in which action was fulfilled but the lexical item was incorrect (hereafter, LEX: lexical); or (d) distracter picture in which both the action was not fulfilled and the lexical item was incorrect (hereafter, AU + LEX: action unfulfilled + lexical). This test was used with monolingual Turkish adults with language impairments and without, in which the latter group performed at ceiling level (Yarbay Duman & Maviş, 2013).

Figure 1 provides two examples of the pictures used in the task. For the counterfactual sentence *Gömleği ütüleseydi dolaba asardı* (If he had ironed the shirt, he would

Figure 1. Panel a: Example stimuli for the counterfactual condition: *Gömleği ütüleseydi dolaba asardı* [If he had ironed the shirt, he would have hung it in the closet]. Panel b: Example stimuli for the factual condition: *Elbiseyi ütülediyse dolaba asar* [If he has ironed the dress, he will hang it in the closet].



have hung it in the closet), the target is at the left-upper corner, and next to it is the AU distracter (see Figure 1a). The LEX distracter is at the left-bottom corner, and next to it is the AU + LEX. Figure 1b shows an example of the test stimuli for the factual sentence *Elbiseyi ütülediyse dolaba asar* (If he has ironed the dress, he will hang it in the closet). Note that only the unambiguous and direct implication of factuals is tested (see Turkish Grammar section). Thus, in this condition, the participants were shown pictures in which the action of the dependent clause (X) has always been realized (e.g., ironing was done), as a consequence of which the other action (Y) needs to be realized as well (i.e., the dress has to be in the closet—because it has been ironed).

In the nonconditional condition, half of the distracters were presented with counterfactual actions (X was not realized; therefore, Y was not realized), and the other half were presented with factual actions (X was realized, and therefore Y must have been realized as well), both of which were equally plausible in this condition. The aim of this was to balance the number of picture types shown across conditions throughout the task. The order of all pictures was pseudorandomized, and the target picture in one condition was used as the distracter picture in another condition. This ensured target-picture variety throughout the test.

Each participant completed three practice trials, with each trial consisting of three items. The practice trials were repeated up to two times if necessary. If the participants made errors during the practice trials, they were provided with feedback. For example, if the participant selected the image "the milkbox was open" in response to the sentence "if he had opened the milk(box)," (counterfactual condition), the experimenter emphasized the target-verb form and pointed to the correct picture in which "the milk(box) was not open" and said that the sentence means that "he did not open it." No feedback was provided on experimental items, and the experimenter repeated the target sentence on request. No time limit was imposed.

Sentence repetition task. The repetition test followed the comprehension test. The participants were instructed to repeat the sentence spoken by the experimenter as accurately as possible. Each participant completed one practice trial. The aim of the sentence repetition task was not to investigate sentence imitation abilities in general, but to observe the use of specific morphemes (the past tense –DI and the conditional morpheme –SA). A scoring system was developed accordingly. A response was considered correct when the participant correctly repeated the sentence. Credit was awarded if the child made a lexical error: using a different object name (e.g., shirt–acc rather than dress–acc) or action name (e.g., wash–conditional–past instead of iron–conditional–past), as long as the case morphemes on the nouns and conditional and tense morphemes on the verb matched the target form. In this way, the use of critical morphemes on the verb (the conditional and the past) could be better observed for all conditions. Articulation errors (e.g., articulating ç as ş as in aşsaydı rather than açsaydı) were ignored because (a) they were not related to the ability of the child to repeat a sentence and (b) the target sentence with its critical morphemes was correctly produced. The rest of the errors were incorrect repetitions of the target sentence and/or the critical morphemes.

The Ethics Board of the University of Amsterdam approved the study, and the parents of each child signed a

consent form before the testing took place. After testing, the children were given a small toy.

Results

Sentence Comprehension

Table 3 lists the mean number (standard deviation) and proportion of correctly identified sentences in the three conditions for the two groups. Individual scores and chronological ages for the participants are listed in the Appendix.

To gain insight into possible relationships between understanding of counterfactuals and other variables, such as age, nonverbal IQ, and language scores (TOLD-P:4; the scores were available only for the SLI group), we carried out a correlation analysis. The results demonstrated that there was a significant correlation between counterfactual processing and age for the TD group, $r(13) = .712$, $p = .006$, but not for the SLI group, $r(13) = -.059$, $p = .847$. No other significant correlations were found in nonverbal IQ: TD, $r(13) = -.330$, $p = .271$; SLI: $r(13) = -.426$, $p = .146$; SLI: grammar composite, $r(13) = -.124$, $p = .687$; semantic composite, $r(13) = -.124$, $p = .687$. We carried out quantitative and qualitative data analyses.

Quantitative analysis. A repeated measures analysis of variance (ANOVA), with condition (nonconditional, factual, counterfactual) as the within-participants variable and group (SLI, TD) as the between-participants variable, was run to investigate whether the groups showed differences comprehending conditionals compared to nonconditionals (Study Prediction 1), comprehending factual conditionals compared to counterfactual conditionals (Study Prediction 2), and to explore differences between SLI and TD groups in their comprehension of the three sentence types (Study Prediction 6). The dependent variable was accuracy (number of correct responses).

There was a significant main effect for condition (nonconditional: $M = 12.62$, $SD = 3.08$; factual: $M = 11.54$, $SD = 3.03$; counterfactual: $M = 6.54$, $SD = 5.89$; $F(1, 24) = 38.02$, $p < .001$, $\eta^2 = .67$) and group (SLI: $M = 7.61$, $SD = 5.23$; TD: $M = 12.84$, $SD = 2.84$; $F(1, 24) = 48.44$, $p < .001$, $\eta^2 = .67$), and there was a significant interaction between condition and group, $F(1, 24) = 13.06$, $p = .001$, $\eta^2 = .38$. The interaction effect indicated differences between TD and SLI in how these groups performed in the three conditions. Within- and between-groups comparisons were performed to examine the interaction effect. A Bonferroni correction was applied for multiple comparisons, which led to an alpha level of decision of $\alpha = .017$ instead of .05 (e.g., .05/3 = .017, because three comparisons were made).

Paired-sample tests showed for the SLI group that performance for nonconditionals was better than for factual conditionals, but this difference did not reach statistical significance after a Bonferroni correction, $t(12) = 2.65$, $p = .02$. The children with SLI performed better with nonconditionals than counterfactual conditionals, $t(12) = 6.57$, $p < .001$. They also performed better with factual conditionals than with counterfactual conditionals, $t(12) = 6.17$, $p < .001$. In the TD group, the children showed significantly better performance with nonconditionals than with factual conditionals, $t(12) = 3.60$, $p = .004$. The TD group also performed better with nonconditionals than with counterfactual conditionals, $t(12) = 2.36$, $p = .036$, but this difference did not reach statistical significance after a Bonferroni correction. We detected no statistically significant difference between factual conditionals and counterfactual conditionals. Independent-sample t tests indicated that the TD group had higher levels of accuracy than the SLI group in all conditions, nonconditionals: $t(24) = -2.70$, $p = .012$, $d = 1.06$; factual conditionals: $t(24) = -2.96$, $p = .007$, $d = 1.14$; counterfactual conditionals: $t(24) = -7.54$, $p < .001$, $d = 2.99$.

Qualitative analysis. There were three picture distracters: AU, LEX, and AU + LEX. Table 4 presents the mean number (standard deviation) of error types in the three conditions for the two groups. A two-way mixed repeated measures ANOVA was performed to investigate if there was an interaction between Condition (within-participants factor, independent variable) and Group (between-participants factor, independent variable) on the number of AU errors (dependent variable; Study Prediction 3). Because data violated the sphericity assumption, a repeated measures ANOVA with a Greenhouse–Geisser correction was performed. The results showed that there was a significant main effect of Condition (nonconditional: $M = 1.23$, $SD = 1.88$; factual: $M = 1.50$, $SD = 1.55$; counterfactual: $M = 6.20$, $SD = 5.27$; $F(1.066, 25.583) = 28.041$, $p < .001$, $\eta^2 = .54$), Group (SLI: $M = 4.69$, $SD = 4.65$; TD: $M = 1.25$, $SD = 2.26$; $F(1, 24) = 68.144$, $p < .001$, $\eta^2 = .74$), and a significant

Table 3. The mean number (standard deviation) and proportion of correctly identified and repeated sentences in each condition.

	SLI				TD			
	Comprehension		Repetition		Comprehension		Repetition	
Clause type	*M* (*SD*)	Proportion	*M* (*SD*)	Proportion	*M* (*SD*)	Proportion	*M* (*SD*)	Proportion
Nonconditional	11.15 (3.7)	.74	4.08 (1.8)	.82	14.08 (1.2)	.94	4.92 (0.3)	.98
Factual	10.00 (3.6)	.67	2.62 (2.4)	.52	13.08 (1.2)	.89	4.92 (0.3)	.98
Counterfactual	1.69 (1.6)	.11	2.38 (2.2)	.48	11.38 (4.3)	.76	4.84 (0.4)	.97

Note. Maximum score per condition is 15 for comprehension task and 5 for repetition task. SLI = specific language impairment; TD = typically developing.

Table 4. The mean number (standard deviation) of error types in sentence comprehension.

	SLI			TD		
Clause type	**Action unfulfilled**	**Lexical**	**Action unfulfilled + Lexical**	**Action unfulfilled**	**Lexical**	**Action unfulfilled + Lexical**
Nonconditional	2.07 (2.32)	1.23 (1.23)	0.53 (0.96)	0.38 (0.65)	0.46 (0.87)	0.07 (0.27)
Factual	1.92 (1.93)	1.76 (1.16)	1.30 (1.60)	1.07 (0.95)	0.61 (0.76)	0.69 (1.70)
Counterfactual	10.07 (3.49)	1.15 (1.28)	2.15 (2.11)	2.30 (3.59)	0.30 (0.48)	0.61 (1.12)

Note. SLI = specific language impairment; TD = typically developing.

interaction between condition and group, $F(1.066, 25.583) = 12.844$, $p = .001$, $\eta^2 = .35$. In order to examine the interaction effect, a one-way repeated measures ANOVA with a Greenhouse–Geisser correction, with Condition as the within-participants factor, was performed separately for the SLI and TD groups. The mean scores for conditions in the SLI group (nonconditional: $M = 2.07$, $SD = 2.32$; factual: $M = 1.92$, $SD = 1.93$; counterfactual: $M = 10.07$, $SD = 3.49$) were statistically significantly different, $F(1.085, 13.023) = 29.027$, $p < .001$, $\eta^2 = .71$. This difference was not attested for the TD group (nonconditional: $M = 0.38$, $SD = 0.65$; factual: $M = 1.07$, $SD = 0.95$; counterfactual: $M = 2.30$, $SD = 3.59$; $F(1.025, 12.298) = 2.627$, $p = .130$, $\eta^2 = 18$). Post hoc tests using the Bonferroni correction revealed that the mean difference between counterfactuals and factuals (−8.15) and the mean difference between counterfactuals and nonconditionals (−8.00) was significant in the SLI group ($p = .001$ for both comparisons).

Sentence Repetition

The occurrence of lexical errors was rare (four times in the factual conditionals and one time in the counterfactual conditionals) and was observed only in the SLI group. Three of the children with SLI had difficulties articulating certain sounds (e.g., articulating *ç* as *ş* as in a*ş*saydı rather than a*ç*saydı). Internal consistency of the test was measured using Cronbach's alpha, which is a measure of the consistency of the results across the items of a test. The test had a high level of reliability across all items by both groups (15 items, Cronbach's $\alpha = .96$) and for each condition within the groups (>.90). Table 3 lists the number (*M* and *SD*) and proportion of correctly repeated sentences in the three conditions for the two groups. Individual scores are listed in the Appendix.

A repeated measures ANOVA, with condition (nonconditionals, factuals, counterfactuals) as the within-participants variable and group (SLI, TD) as the between-participants variable, was run to examine whether the groups exhibited differences repeating conditional sentences compared to nonconditional sentences (Study Prediction 4) and repeating counterfactual conditionals compared to factual conditionals (Study Prediction 5), and to explore differences between SLI and TD groups in this respect (Study Prediction 6). The dependent variable was accuracy (i.e., number of correct responses). There was a significant main effect for condition (nonconditional: $M = 4.50$, $SD = 1.36$; factual: $M = 3.88$, $SD = 2.02$; counterfactual: $M = 3.62$, $SD = 2.00$; $F(1, 24) = 8.18$, $p = .001$, $\eta^2 = .25$) and group (SLI: $M = 3.25$, $SD = 2.30$; TD: $M = 4.89$, $SD = 0.30$; $F(1, 24) = 11.83$, $p < .001$, $\eta^2 = .33$) and a significant interaction between condition and group, $F(1, 24) = 8.91$, $p = .006$, $\eta^2 = .27$. To examine the interaction effect, within- and between-groups comparisons were made. A Bonferroni correction was applied because multiple comparisons were made ($\alpha = .017$).

Paired-samples *t* tests indicated that only the difference between counterfactuals and nonconditionals was significant, $t(12) = 3.23$, $p < .001$, for the SLI group. The difference between factuals and nonconditionals, $t(12) = 2.66$, $p = .021$, failed to reach significance after a Bonferroni correction. The difference between factual conditionals and counterfactuals was not statistically significant for the SLI group. There were no statistically significant differences between conditions for the TD group. The results of the independent *t* tests showed that the SLI group had significantly lower accuracy on factuals and counterfactuals than the TD group, $t(24) = -.3.44$, $p = .002$, $d = 1.3$; $t(24) = -3.94$, $p < .001$, $d = 1.6$, respectively. No difference was found between the groups for the nonconditionals.

Discussion

The primary goal of this study was to investigate whether children with SLI can understand counterfactuals and whether counterfactual information in sentences increases the comprehension load due to the complex cognitive processes involved in processing these sentences. The main research questions were: Do children with SLI show a difference between understanding and repeating nonconditionals, factual conditionals, and counterfactual conditionals? If so, is this also observed in TD children? Sentence comprehension and sentence repetition tests were administered to answer these questions.

Morphosyntactic Complexity, Counterfactuality, and Morpheme Order

We first evaluate the findings with respect to the results of the correlational analysis. Then, we assess performance of the two groups for sentence comprehension (Study Predictions 1–2, including Prediction 3) and sentence repetition (Study Predictions 4–5) and compare results of the two groups (Study Prediction 6).

SLI group. There was no significant correlation between understanding counterfactuals and age, nonverbal

IQ, or TOLD-P:4 language scores. These results suggest that performance on counterfactuals was not related to age, nonverbal IQ, and language scores in the SLI group. This lack of correlation between the variables can be explained by a floor effect. That is, despite average nonverbal IQ scores, the children with SLI had low performance scores, and there was little variation in scores between the children.

In the sentence comprehension task, the group had higher scores for nonconditionals than factual and counterfactual conditionals (the former comparison yielded a marginally significant outcome). The group had significantly more difficulties comprehending counterfactual conditionals than factual conditionals, although the two sentence types were morphosyntactically equivalent. As found in the comprehension task, the group achieved higher accuracy scores repeating nonconditionals compared to repeating factual and counterfactual conditionals (the former comparison was only marginally significant). Unlike the sentence comprehension task, there was no difference in accuracy for the counterfactual and factual conditions for sentence repetition. These results were correctly predicted in points 1 and 2 for sentence comprehension and 4 and 5 for sentence repetition. The comparison of nonconditionals and factuals yielded marginal significance after statistical correction.

There are two implications of these findings. First, children with SLI had more problems comprehending and repeating *if*-conditionals than nonconditionals, indicating that *if*-conditionals are morphosyntactically complex for them. Second, the cognitive complexity involved in processing counterfactuals compounds the existing sentence comprehension difficulties for this group. Namely, we observed that counterfactual conditionals were more difficult to comprehend for children with SLI than the morphosyntactically equivalent factual counterparts. The results of the sentence repetition task support this conclusion. In sentence repetition, children with SLI were equally good at repeating factuals and counterfactuals, implying a similar stage of morphosyntax acquisition for both sentence types (Friedmann & Lavi, 2006). Therefore, it is unlikely that the performance discrepancy between the two types of conditionals stems from the switch in the ordering of the past-tense morphemes and conditional morphemes in these sentences. Error data of the present study support this conclusion (Study Prediction 3): Although children selected all types of distracters in the test, children with SLI selected AU distracters more often in the counterfactual condition compared to the factual condition. This finding indicates that the difficulties children have processing counterfactuality lie at the interpretational level. Accordingly, we conclude that the cognitive complexity involved in counterfactuals make these sentences more difficult to understand for children with SLI.

Our findings support the results of other studies that suggest that children with SLI have poor morphosyntactic abilities in both sentence comprehension and sentence production (e.g., embedding: van der Lely, 2005; subject-verb agreement: Rothweiler et al., 2012). Poor sentence production ability of children with SLI might have interfered with how efficiently they repeated simple and complex sentences in this study. In our study, children with SLI had more difficulties understanding and repeating morphosyntactically complex sentences (i.e., conditionals) than morphosyntactically less demanding sentences (i.e., nonconditionals that do not involve *if*-embedding). In conditional conditions, children who could accurately repeat factuals were also able to repeat counterfactuals at a similar level (cf. SLI 11). Children who could not repeat factuals were also unable to repeat counterfactuals.

TD group. The results of the correlational analysis indicated a significant relationship between age and understanding of counterfactuals. This finding suggests that TD children ages 6–8 years improve in their ability to process counterfactuals.

In the sentence comprehension task, TD children had higher scores for nonconditionals than factuals or counterfactuals. In the sentence repetition task, there was no difference in accuracy between the sentence types. Unlike the SLI group, the participants in the TD group comprehended and repeated counterfactuals as well as factuals, despite the cognitive processes involved in the former sentences and the difference in the morpheme order for the factuals and counterfactuals. These results were correctly predicted (Study Predictions 1, 2, and 5). We did not observe an effect for nonconditionals in the sentence repetition task (Study Prediction 4). The lack of an effect for this condition might reflect the overall high performance of TD children in nonconditionals and conditionals. It may be that their well-developed sentence production abilities assisted them in this task.

The above results lead us to two main conclusions: (a) Like TD children, sentence comprehension for children with SLI is influenced by morphosyntactic complexity for children aged around 6–8 years, and (2) unlike TD children, the comprehension ability of children with SLI is influenced by cognitive processes involved in processing counterfactuals, at least when two morphosyntactically equivalent sentences with a similar syntactic acquisition stage are tested.

Comparing the two groups. Compared to the TD group, the SLI group had lower accuracy for nonconditionals, factuals, and counterfactuals in the sentence comprehension task. This difference did not emerge in the sentence repetition task. With the exception of the prediction that nonconditionals would be more difficult to comprehend for the SLI than for the TD group, our results are in line with Study Prediction 6. Children with SLI are better able to process compound sentences than conditionals.

The SLI and TD groups had similar performance patterns when morphosyntactic complexity was controlled. This means that although performance was impaired in the SLI group, both groups had lower performance for conditionals than nonconditionals. We found, however, that the SLI group had more difficulties understanding counterfactuals compared to the TD group. The performance of children with SLI on counterfactuals was not related to age, nonverbal IQ, or language scores. Thus, more difficulties with counterfactuals may have been caused by differences between the groups in the ability to employ the complex

cognitive processes involved in processing counterfactuals. In summary, the data illustrate that children with SLI have problems at the morphosyntax-semantics interface and that processing counterfactuals is difficult for this group because of the cognitive processes required.

These findings should be interpreted with caution in terms of how much support they offer current theories of SLI, and no conclusions should be derived from the data as to whether SLI is a result of language impairment or cognitive deficits or whether the primary characteristic of SLI is a language impairment or cognitive deficit. What our study highlights is that in children with SLI, counterfactuality confounds grammatical deficiencies in comprehension, meaning there is a relationship between linguistic processing and cognitive processing when decoding counterfactuals. In this respect, our data offer support to SLI theories that consider the effect of cognitive factors (e.g., Gathercole & Baddeley, 1990; Montgomery et al., 2010). However, the findings that conditionals are generally more difficult to comprehend than nonconditionals is in line with approaches that assume language deficiencies in SLI to be primary deficiencies (Rice et al., 1995). It appears that these approaches are complementary.

Wider Implications and Future Research

The present investigation has implications for the definition and diagnosis of SLI in children. The standard definition of SLI requires profound language deficits with no impairment in nonverbal abilities. As observed in our data, this definition does not capture the full profile of SLI, as children diagnosed with SLI also show cognitive limitations (e.g., Montgomery et al., 2010). As argued by Newton et al. (2010), average nonverbal IQ scores would overestimate overall cognitive abilities of children with SLI.

We tested children's processing of counterfactuals. Counterfactual thinking ability is linked to the capacity to make causal judgments and to reason deductively (e.g., Roese & Olson, 1997). Thus, counterfactual thinking has emotional and behavioral consequences that result in the development of effective strategies to prepare the person for the future (e.g., learning from past experience: If only I had done X, maybe next time I would have . . ."; e.g., Roese, 1994). Future research should investigate whether children with SLI can produce counterfactuals or can reason counterfactually in everyday life situations.

Our results offer important insights into SLI because we included a sentence comprehension task developed to test both linguistic and nonlinguistic assumptions about the nature of language impairment in SLI. The results showed that children with SLI have problems with grammar and have difficulties processing counterfactuality expressed in language. As discussed earlier, these difficulties are not entirely the result of morphosyntactic complexity and are likely linked to cognitive limitations. The implication of this is that both morphosyntactic and cognitive factors should be taken into account to understand the characteristics of SLI. We recommend the development of linguistic tests that also include evaluation of the cognitive aspects of language production and comprehension.

In typical development, there is a relationship between performance on counterfactual thinking and ability for specific nonverbal executive functions: The inhibitory control (to ignore what actually happened), working memory (to maintain factual and counterfactual representations simultaneously), and cognitive flexibility (shifting between the two representations) has been established for 4- and 5-year-old children as a function of age (e.g., Beck et al., 2009; Guajardo et al., 2009). However, according to Rafetseder et al. (2013), counterfactual reasoning develops gradually between 6 and 12 years, and this development is not solely due to better executive functioning. Rafetseder et al. (2013) proposed that children between the ages of 6 and 12 years answer counterfactual questions correctly because they develop a counterfactual reasoning strategy, whereas younger children answer counterfactual questions correctly because they use a basic (i.e., noncounterfactual) reasoning strategy. Children with SLI have problems with the above-mentioned executive functions, implying that they show impairments in areas crucial for understanding counterfactuals (Im-Bolter et al., 2006; Marton, 2008). Our future research will investigate whether problems in understanding counterfactuals in SLI are solely due to their inability on the specific nonverbal executive functions or extend to failure in different reasoning strategies compared to the TD children.

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Appendix

Individual Scores for the Correctly Identified and Repeated Sentences.

		Sentence comprehension			Sentence repetition		
Participants	**Age**	**NC**	**FAC**	**CF**	**NC**	**FAC**	**CF**
SLI1	5;6	9	8	2	0	0	0
SLI2	6	15	13	0	5	5	5
SLI3	6;1	12	12	1	5	0	0
SLI4	6;1	6	4	3	4	0	0
SLI5	6;2	14	10	0	0	0	0
SLI6	6;6	2	2	6	5	5	4
SLI7	7;0	9	9	2	5	2	3
SLI8	7;0	12	12	0	5	5	4
SLI9	7;2	14	10	1	4	0	0
SLI10	8;1	13	11	1	5	5	5
SLI11	8;3	13	12	1	5	5	1
SLI12	8;5	13	14	3	5	5	5
SLI13	9;1	13	13	2	5	5	4
M (*SD*)	6.9 (1.1)	11.15 (3.7)	10.00 (3.6)	1.69 (1.6)	4.08 (1.8)	2.62 (2.4)	2.38 (2.2)
TD1	6;3	14	12	7	5	4	5
TD2	6;3	14	15	8	5	5	4
TD3	6;4	13	12	14	5	5	5
TD4	6;7	11	11	5	5	5	5
TD5	6;10	15	12	2	4	5	5
TD6	7;2	15	14	14	5	5	4
TD7	7;7	13	13	13	5	5	5
TD8	7;8	14	13	14	5	5	5
TD9	7;11	15	14	15	5	5	5
TD10	7;11	15	14	13	5	5	5
TD11	8;1	15	14	14	5	5	5
TD12	8;6	14	14	14	5	5	5
TD13	8;11	15	12	15	5	5	5
M (*SD*)	6.9 (0.8)	14.08 (1.2)	13.08 (1.2)	11.38 (4.3)	4.92 (0.3)	4.92 (0.3)	4.84 (0.4)

Note. Maximum score per condition is 15 for comprehension task and 5 for repetition task. Age is expressed in years;months. NC = nonconditional; FAC = factual; CF = counterfactual; SLI = specific language impairment; TD = typically developing.