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Research Report

Epistemic uncertainty: Turkish children with specific language impairment and their comprehension of tense and aspect

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Abstract

Background: Impairments in tense morphology are characteristic of English-speaking children with specific language impairment (SLI). Recent studies have investigated the role that aspect plays in the difficulties found in tense morphology. It has been suggested that children with SLI are less sensitive to aspect and its interaction with tense than typically developing (TD) children. Profound impairment in past tense morphology compared with the present in this population was explained by a breakdown in the association between event completion information and past tense. To date, research on tense morphology in this population has not examined all three tense conditions in a single study.
Aims: To examine whether monolingual Turkish-speaking children with SLI exhibit deficits in comprehending tense and aspect morphology, and, if so, whether these deficits are restricted to completed events (past tense) or also occur for incomplete non-past events (future and present tense).
Methods & Procedures: A sentence–picture matching task was administered to 36 monolingual Turkish-speaking children: 13 with SLI (mean age = 6;9 years) and 23 age-matched TD children (mean age = 6;5 years). Upon hearing a sentence, each child had to select between a target (past, present or future) and a distracter picture. Tense and aspect information could only be established from verb morphology.
Outcomes & Results: The SLI group had lower accuracy than the TD group on all test conditions. For both groups, present tense had the highest accuracy scores. Performance scores within the SLI group showed the following hierarchy from easy to difficult: present > future > past.
Conclusions & Implications: Turkish children with SLI have deficits in comprehending tense and aspect morphology. Although comprehending past was more difficult than non-past (present and future), future was more difficult to comprehend than the present. This disassociation between two non-past incomplete events indicates that the underlying difficulties comprehending (past) tense–aspect is not restricted to event completion in past tense contexts. This finding raises the possibility that in children with SLI, non-temporal epistemic functions of verb morphology (i.e., certainty, probability or possibility of an event occurring) might play a role in efficient understanding of tense and aspect morphology. If so, children with SLI may benefit from language therapy focused on the epistemic functions of verb morphology to improve comprehension of tense and aspect.

Keywords: tense, aspect, specific language impairment (SLI), Turkish, morphosyntax–semantics interface, epistemic uncertainty.

What this paper adds

What is already known on this subject?

Impairments in tense morphology are characteristic of English-speaking children with SLI. Recent studies investigated the role that aspect plays in the difficulties found in tense morphology. It has been suggested that children with SLI are less sensitive to aspect and its interaction with tense than TD children. Profound impairment in past tense

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morphology compared with the present in this population was explained by a breakdown in the association between event completion information and past tense. To date, research on tense morphology in this population has not examined all three tense conditions (past, present and future) in a single study.

What this study adds?
This is the first investigation of comprehension of tense and aspect morphology in monolingual Turkish children with SLI. It is unique as it tests all three tense conditions (past, present and future) in one study. The results showed that Turkish children with SLI have deficits in comprehending tense and aspect morphology. Although comprehension of past (completed event) was more difficult than non-past (present and future: both are incomplete events), comprehension of future was more difficult than comprehension of the present. This suggests that the difficulty with (past) tense–aspect for children with SLI may *not* be related to event completion because (1) a dissociation between the two non-past incomplete events exist in SLI (this study) and (2) children with SLI are sensitive to event completion in the simple past tense context (results of a recent study on English). These findings raise the possibility that in children with SLI, non-temporal epistemic functions of verb morphology (i.e., certainty, probability or possibility of an event occurring) might play a role in efficient understanding of tense and aspect morphology. If so, children with SLI may benefit from language therapy focused on the epistemic functions of verb morphology to improve comprehension of tense and aspect.

Introduction

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 deficit or cognitive impairment (Bishop 1992, Leonard 1998). The hallmark features of SLI include profoundly impaired morphosyntactic abilities, particularly in the area of tense morphology and subject–verb agreement (Bishop 1992, Leonard *et al.* 1992, Rothweiler *et al.* 2012).

Impairments in tense morphology, which provide information about when an event happens or happened, are characteristic of English-speaking children with SLI; these children often omit the past tense *-ed*, third person singular *-s*, and auxiliary verbs *be* and *do* (Rice *et al.* 1995). In grammaticality judgement tasks, children with SLI judge sentences with correct tense morphology and sentences with missing tense morphology as acceptable (Rice *et al.* 1999, van der Lely and Ullman 1996, Miller *et al.* 2008). Problems with tense morphology may persist into adolescence.

There is, however, no consensus on the origin of this difficulty with tense morphology. According to Jakubowicz (2003), the difficulties children with SLI experience in tense morphology are not due to a deficit in tense per se but stem from an inability to produce and to understand computationally complex sentence structures. Jakubowicz showed that unlike their typically developing (TD) peers, French-speaking children with SLI were more accurate in tasks involving present tense than past tense (*passé composé*) and were more accurate in tasks involving past tense than past perfect tense (pluperfect). In French, past tense is more complex than present tense because present tense requires a single Inflectional Phrase (IP) whereas past tense requires an additional functional projection, termed PastP (i.e., the auxiliary receives its past meaning despite its actual present form in a past tense sentence). Past perfect is more complex than past tense because it requires a PastP projection and it is computed in relation to the main event, which is in the past tense. Accordingly, Jakubowicz proposed that the difficulties French-speaking children with SLI experience with tense stem from merging additional functional projections, which is a computationally complex operation.

Although there is extensive work on morphosyntactic impairments in children with SLI (see the review by Leonard 1998), little is known about the impact of semantics at the morphosyntax–semantics level. Yarbay Duman *et al.* (2015) have shown that semantic and cognitive complexity adds to sentence comprehension deficits in monolingual Turkish children with SLI. In Turkish, factual and counterfactual conditionals are formed by past tense and conditional morphemes (-DI and -SE, respectively). When the past tense morpheme precedes the conditional, the sentence is a factual (e.g., *gel-di-yse ara-r*; come-past-conditional/3prs call-aorist/3prs; 'if he has come, he will call') and when the past tense morpheme follows the conditional, the sentence is a counterfactual (e.g., *gel-se-ydi ara-r-dı*; come-conditional-past/3prs call-aorist-past/3prs; 'if he had come, he would have called'). In other words, Turkish factual and counterfactual conditionals are morphosyntactically equivalent *if*-clauses, but the latter is semantically and cognitively complex (i.e., processing counterfactuals requires ignoring what actually happened; maintaining factual and counterfactual representations in mind; shifting between the two representations). Unlike their TD peers, Turkish-speaking children with SLI, have more difficulty processing counterfactuals than factuals. This suggests that the ability to interpret past tense morphology is

affected by the semantic and cognitive complexity of a sentence.

Recent studies have examined the interaction between aspect (the semantic specification of temporal relationships indicating whether an event is complete or ongoing) and tense in relation to the difficulties that children with SLI exhibit in tense morphology (Leonard *et al.* 2007, Leonard and Deevy 2010). It has been suggested that English-speaking children with SLI are insensitive to aspectual distinctions, in particular to the association between completion and past tense. This then makes past tense more difficult for these children to comprehend than present tense (Leonard and Deevy 2010).

As there is no research on present tense and past tense morphology in monolingual Turkish-speaking children with SLI, it is unclear whether this group's profile reflects that of monolingual English-speaking children with SLI. The present study tested the comprehension of simple tense and aspect morphology in two groups of monolingual Turkish-speaking children: children with SLI and TD children. The aim of the study was to examine whether monolingual Turkish-speaking children with SLI exhibit deficits in comprehension of tense and aspect morphology and if so, whether these deficits are restricted to completed events (past tense) or extend to incomplete non-past events (future tense).

Unlike earlier studies, this study investigated the comprehension of tense and aspect for the past tense, present tense, and future tense in a single study. We consider the contrasts between completed events (past tense–perfective aspect), ongoing incomplete events (present tense–imperfective aspect), and non-progressive incomplete events (future tense–imperfective aspect). The test stimuli did not involve temporal adverbs to ensure that understanding of tense and aspect could only be established from the verb morphology.

Examining performance across three time frames in a single study allows us to investigate the ability of children with SLI to comprehend specific tense–aspect morphology in relation to aspectual characteristics of an event. To our knowledge, only one study has published data on the spontaneous expressive use of these time frames (Paradis and Crago 2000). We are unaware of any studies in children with SLI investigating sentence comprehension across all three time frames.[1]

Turkish is a suitable language for this investigation because all tense and aspect combinations for the past, present and future are affixed on the lexical verb. Unlike English, no periphrastic forms or auxiliaries are used in Turkish and, unlike in French, in Turkish these combinations are equally complex in terms of the functional projections required (see the section on tense–aspect–modality in Turkish grammar). This means that researchers can control Turkish morphosyntactic complexity and investigate comprehension of tense and aspect morphology.

Tense and aspect deficits in SLI

Children with SLI are slower than TD children in the onset verb morphology, particularly the past tense *-ed* (Rice *et al.* 1995). Their ability to produce *-ing* inflected verbs (progressive aspect), however, is not delayed (Leonard *et al.* 2003).

Leonard and Deevy (2010) investigated aspect and its interaction with tense in English-speaking children with SLI. The authors found that unlike their TD peers, the children with SLI performed worse when responding to requests that described completed actions in the past than they did responding to requests that described actions completed in the present. This led Leonard and Deevy (2010) to conclude that children with SLI develop past tense more slowly than present tense, partly because children with SLI are relatively insensitive to the association between event completion and past tense.

Although researchers seem to agree that aspectual distinctions can be difficult for children with SLI to acquire (Penner *et al.* 2003 for German, Fletcher *et al.* 2005 for Cantonese, Stuart and van der Lely 2015 for English, but see Stavrakaki *et al.* 2012 for Greek), there is no consensus on event completion and its relevance to the past tense. Stuart and van der Lely (2015) tested the contrast between perfective aspect (i.e., completed events using the past tense *-ed*/irregular) and imperfective aspect (i.e., ongoing events using the past progressive). They found that imperfective aspect was problematic for English-speaking children with SLI. In Cantonese (a language with no tense system), Cantonese-speaking children with SLI had difficulties with all aspectual morphemes that indicated completeness or incompleteness of an event (Stokes and Fletcher 2003, Fletcher *et al.* 2005). The results of these English and Cantonese studies have two implications. Firstly, incompleteness of the event can pose difficulties for children with SLI when past tense is used. Secondly, difficulties with aspectual morphology are observed independent of tense morphology, that is, in the absence of a tense system.

Studies on tense and aspect are scarce in SLI and existing studies focus on the contrast between past tense and present tense. The present study includes these two tenses in addition to future tense.

Research question for the study

Do monolingual Turkish-speaking children with SLI show a difference understanding tense and aspect morphology when reference is made to the past (perfective completed event), present (imperfective incomplete

event), and future (imperfective incomplete event), and if so, is this pattern similar to Turkish-speaking TD children?

Tense–aspect–modality in Turkish

Grammar

Turkish is an agglutinating language with a subject–object–verb base order. For example, a main clause can have the finite verb in the past tense/perfective aspect (see example 1, -DI), present tense/ imperfective aspect (see example 2, -Iyor) and future tense/imperfective aspect (see example 3, -EcEK). In these three examples, all objects are in the accusative (acc) case and all verbs are inflected for third person singular agreement (3sg), which is a zero morpheme in Turkish. The inflections introduced (-DI, -Iyor, -EcEK) are all subject to Turkish morphophonemic rules:

(1) *Past tense*
Adam süt-ü iç-ti
The man-nom milk-acc drink-past tense/ perfective aspect
'The man has drunk/drank milk.'

(2) *Present tense*
Adam süt-ü iç-iyor
The man-nom milk-acc drink-imperfective aspect/present tense
'The man is drinking milk.'

(3) *Future tense*
Adam süt-ü iç-ecek
The man-nom milk-acc drink-modal: imperfective aspect/future tense
'The man will/is going to drink milk.'

Table 1 summarizes the relevant characteristics of these verb inflections. These three verb inflections are multifunctional and they differ in terms of their primary and secondary tense, aspect and modality functions: -DI is a past tense morpheme implying the perfective (i.e., temporarily completed event); -Iyor is an imperfective aspect morpheme implying the present tense (i.e., temporarily incomplete/ongoing event); and -EcEK marks immediate intention, implying imperfective aspect and the future tense (i.e., temporarily incomplete/non-progressive event) (Aksu-Koç 2006).

Inflections for the past and the future encode non-temporal epistemic functions and the degree of certainty of an event. In other words, they express the certainty, probability or possibility of an occurrence. The inflections used in our study mark the certainty that an event has happened (-DI), mark the probability or possibility that an event is likely to happen (-EcEK) and mark that an event is in the process of happening (-Iyor). Note that the present progressive morpheme conveys no information itself on the degree of certainty; the event time and utterance time generally overlap while the speaker witnesses an event occurring. Thus, the epistemic nature of present progressive tense only relates to factual information.

These inflections (-DI, -Iyor, -EcEK) uniformly receive their past, present or future meaning at the syntactic level. The hierarchy of functional categories in Turkish is complementizer phrase (CP)—tense phrase/inflection (TP/INFL)—aspect phrase (AspP)—verb phrase (VP). As in examples 1–3, all Turkish finite verbs move to T/INFL to check their inflectional features (i.e., tense and aspect). Therefore, these inflections are equally complex in terms of the syntactic derivations (i.e., functional projections) they require. We refer the reader to Yarbay Duman and Bastianse (2009) for the syntactic tree representations of these forms.

Turkish is a suitable language for this investigation because, unlike English, Turkish has no periphrastic forms and all Turkish verb forms are regular. In English, a tensed verb can be used in simple past (e.g., *wrote*) and in present with verb agreement (e.g., *writes*) to express temporal reference and all other verb forms are 'periphrastic forms' referring to the past (e.g., *has written*, *has been writing*, *had been writing*, *was writing*), present (e.g., *is writing*, *can write*) or future (e.g., *will write*, *shall write*, *is going to write*). In *the man has drunk/drank milk* (see example 1), the finite verb (*has*) is in the present tense, whereas the periphrastic verb form as a whole (*has drunk*) refers to an event in the past. Accordingly, there is no one-to-one relationship between tense, temporal reference and verb regularity in English (van der Lely and Ullman 2001). For children with a language impairment, this lack of a direct relationship can interfere with comprehending and using tense and aspect correctly.

In *the man is drinking milk* (see example 2), the periphrastic forms interfere with referring to the present because tense is on the auxiliary (*is*) and aspect (*-ing*) is on the lexical verb. This means that as a whole, the periphrastic form (*is drinking*) expresses the present progressive. In, *the man will/is going to drink milk* (see example 3), tense is on the modal (*is going to/will*) and the verb is infinitive (*drink*) and is not overtly inflected. Unlike English, it is possible to control morphological complexity while manipulating tense and aspect in Turkish. However, careful examination of the effect of each function of the relevant verb inflection is required in Turkish, because tense and aspect are fused in a single verb form.

Acquisition

It has been suggested that the first function of tense markers in child language is to indicate aspect rather

Table 1. Relevant characteristics of verb morphology tested

	Tense	Aspect	Event completeness	Degree of epistemic certainty
-DI	Past	Perfective	Completed	Certainty that the event has happened
-Iyor	Present	Imperfective	Incomplete and ongoing	None: present progressive morpheme itself conveys no information on the degree of certainty
-EcEK	Future	Imperfective	Incomplete and non-progressive	Possibility/probability that the event is likely to happen

than indicate the temporal order of events (e.g., Bloom *et al.* 1980, Wagner 2009, Aksu-Koç 2006). Aksu-Koç (2006) proposed that complete acquisition of the Turkish tense–aspect–modality system develops over four stages during the ages 2;0–3;0 years:

- Stage 1 involves differentiating STATIVE (i.e., describing a state of being) and NONSTATIVE (i.e., describing an action) situations (e.g., *bil-iyor-um*; know-progressive-1sg; 'I know' to express stativity).
- Stage 2 involves using -DI and -Iyor to comment on COMPLETED versus ONGOING events within the boundaries of the *immediate present*. Utterances with -DI refer to events that took place in the immediate context and are punctual transformations yielding a change in state or location (e.g., child moves doll from one spot on the floor to another and says *bu git-ti*; this go-past/3sg; 'this went'), whereas utterances with -Iyor are used in contexts of ongoing activities or internal and physical states (e.g., a child sees a doll that opens and closes its eyes and says *aç-ıyor*; open-progressive/3sg; 'it's opening'). The function of -DI and -Iyor is assumed to be aspectual rather than temporal-deictic for three reasons: (1) a child's predominant context of reference is the immediate present where anteriority is indicated by completion and co-temporality is indicated by an ongoing aspect; (2) the types of verbs these inflections occurred with (-DI for a change of state versus -Iyor for an activity); and (3) the lack of future -EcEK or any contrastive use of inflections indicating temporal relations (e.g., between past -DI and future -EcEK or present -Iyor).
- Stage 3 involves an EPISTEMIC MODAL DISTINCTION between REAL and NON-ACTUAL (yet possible) events. During this third stage, children begin acquiring epistemic modal distinctions and are able to make different kinds of assertions. The inflection -DI indicates certainty that an event has happened; -EcEK is used for predicting events that are probable/possible to happen. Acquisition of this semantic distinction enables the extension of the scope of inflectional reference to past time because the child has mastered a distinction between past and non-past. During this stage, -DI is used to refer to *past* events (e.g., the child notices that the scarf the doll had two months ago is missing and says *bu-nun mendil-i var-dı*; this-genitive scarf-possessive exist-past; 'this one had a scarf'). -EcEK is used to refer to future events and can be used in contrast with -DI to mark temporal relationships (e.g., asking for a pen that the adult took from the child a few minutes ago, the child says *yaz-acak-tı-m*; write-future-past-1sg; 'I was going to write').
- Stage 4 is when all tense and aspect modality inflections are fully mastered and the child can express complex temporal relationships and express different PERSPECTIVES on events (e.g., perceptual evidence: *kedi kaç-tı*; cat-nom run away-past/3sg; '[I saw that] the cat ran way' versus hearsay: *kedi kaç-mış*; cat-nom run away-past/3sg; '[I heard that] the cat ran away').

Considering the results from previous studies on SLI, we made several predictions as to how Turkish-speaking children with SLI would perform in a comprehension task involving tense and aspect morphology.

SLI

- Assuming that Turkish-speaking children with SLI have deficits processing semantically complex information at the morphosyntax–semantics interface (Yarbay Duman *et al.* 2015) and that past tense is epistemically more complex compared with the present tense (i.e., past tense is used to indicate epistemic certainty that an event has happened), we expect tense and aspect morphology referring to the past to be more difficult to comprehend than tense and aspect morphology referring to the present for Turkish-speaking children with SLI.
- Considering that future tense is epistemically more complex compared with the present tense (i.e., future tense is used to mark the probability or possibility that an event is likely to happen), we expect tense and aspect morphology referring to the future to be more difficult to comprehend than tense and aspect morphology referring to the present for Turkish-speaking children with SLI.

TD

- As TD children are expected to have developed the morphosyntactic and semantic abilities required for processing simple tense–aspect morphology, we predict high accuracy levels on all test conditions and no significant differences in performance between conditions.

SLI compared with TD

- We predict that children with SLI will have lower levels of accuracy on all test conditions compared with their TD peers.

Method

Participants

In total, 36 monolingual Turkish-speaking children participated in the study: 13 children with SLI and 23 TD children (see table 2 for an overview of participant characteristics). There was no statistical difference between the groups for chronological age ($t(34) = 1.270$, $p = .213$). As understanding tense and aspect develops as a function of age (Aksu-Koç 2006), children with SLI were age-matched with TD children. We did not match the groups for language because we were not investigating the language deviance between the groups.

Maternal education levels were used to identify socioeconomic status (SES) (for the usefulness of this criterion, see Calvo and Bialystok 2014). Following Calvo and Bialystok (2014) and Stevens *et al.* (2009), high school education was used as the criterion difference to distinguish between the two SES group: Mothers who had completed some post-secondary education were classified as middle class (MC) (SLI: $n = 1$; TD: $n = 1$) and those who had only completed or partially completed secondary school were classified as working class (WC) (SLI: $n = 12$; TD: $n = 22$). The SLI and TD groups were similar in terms of SES with the majority of children being from families classified as WC (12 (93%)) in the SLI group and (22 (96%)) in the TD group. We discuss the characteristics of the children in the SLI group and the age-matched TD group in the next section.

SLI group

All the children with SLI except one child were tested with the standardized Wechsler Intelligence Scale for Children (WISC-R Turkish version: Savaşır and Şahin 1988) by a speech and language therapist. The cut-off score for IQ was set at 80, as this is above the cut-off of 70 for mental retardation (see Miller and Gilbert 2008 for appropriateness of this cut-off score). The remaining 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).

Children with SLI who were recruited from two rehabilitation centres in Eskişehir, Turkey (Education, Research & Training Center for Speech and Language Pathology DILKOM, Anadolu University; 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 and Güven 2013), adapted from the English TOLD-P:4 (Newcomer and Hammill 2008). The results were calculated and evaluated by the second 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 SDs, below the normal mean (90–110) 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) due to performance within normal limits on the semantic composite and grammar composite (110 and 104 respectively), his speaking composite (oral vocabulary, morphological completion) was below average (85). For this reason, child SLI 2 was included within the study. This group of children with SLI participated in another study (Yarbay Duman *et al.* 2015) a few days after data collection for the present study.

TD group

The TD children were recruited from primary schools in Eskişehir ($n = 8$) and Ankara ($n = 15$). A child was eligible for the study if the school records and the teacher report indicated no difficulties with speech/language, neurology, vision, and hearing. The teachers classified all the children in this group as 'average/middle level' students. Parents of each child confirmed that their

Table 2. Overview of participant characteristics

	Age				TOLD-p:4		
Participants (*N*)	Range	Mean	SD	Gender	Total spoken composite	Semantic composite (picture, relational, oral vocabulary)	Grammar composite (syntactic understanding, sentence imitation, morphological completion)
SLI (13)	5;6–9;1	6.9	1.13	9 boys	< 1.5 SD (range = 42–78)	< 1.5 SD (45–86)	< 1.5 SD (49–76)
TD (23)	6;0–8;9	6.5	0.67	16 boys	–	–	–

Note: *N* = number of participants; SLI = specific language impairment; TD = typically developing; SD = standard deviation; age is represented in years;months; TOLD-p:4 = standardized Turkish version of the Test of Language Development—Primary: Fourth Edition; < = below the mean.

child had not been referred to a speech therapist for speech or language concerns.

Experimental design

The Turkish version of the *Test for Assessing Reference of Time* (TART; Bastiaanse *et al.* 2008; Turkish version: Yarbay Duman and Bastianse 2008) was administered to all participants. This test has been used to investigate the comprehension of tense and aspect morphology (past, present and future) in individuals with Broca's aphasia. We refer the reader to Bastiaanse (2013) for an overview of published results on monolingual Turkish, English, Dutch, Chinese, Indonesian and Swahili–English bilingual speakers.

The TART is a sentence–picture matching task with three conditions in which 20 transitive verbs (e.g., *to drink*) are matched with an object (e.g., an image of a glass of milk). Each verb and object pair can be manipulated to represent the past, future, or present timeframe.

There were 60 stimuli per participant (20 sentences × 3 conditions). The target timeframe was manipulated for the three time conditions: -DI for past tense/perfective aspect, -Iyor for present tense/ongoing imperfective aspect, and -EcEK for future tense/non-progressive imperfective aspect. Note that the test stimuli did not involve temporal adverbs to ensure that tense and aspect could only be established on the basis of verbal morphology and that all verbs were third person singular (3 sg, zero morpheme in Turkish). None of the verbs were irregular as Turkish has no irregular verb forms. See appendix A for a list of the verb and object pairs used in the test.

Procedure

Each child was tested individually. The TART was administered in a quiet room at the child's rehabilitation centre (for children in the SLI group) and in a quiet room at the child's school (for TD children). The experimenter read a sentence aloud and the child was asked to point to the picture that matched the spoken sentence.

Figure 1a. Example stimuli for *adam sütü içiyor*: the man is drinking milk.

The participant had to select between the target picture and a distracter picture. The distracter depicted the correct action but was incorrect with respect to event completeness and aspectual characteristics (completed and perfective; incomplete ongoing and imperfective; incomplete non-progressive and imperfective).

The TART is a binary choice task in which the future and the past are tested using the present tense picture as a foil. The present was tested using the past tense picture as a foil. Figure 1 displays examples of the picture stimulus for the 'drink-milk' pairs for the three conditions: *Adam sütü içiyor* ('the man is drinking milk'; figure 1a), *Adam sütü içti* ('the man drank milk'; figure 1b), and *Adam sütü içecek* ('the man will drink milk'; figure 1c).

Each child completed two practice trials with each trial consisting of three items. The practice trials were repeated up to two times if necessary. If the child made errors during the practice trials, s/he was provided with feedback. For example, if the child selected the photo of a man drinking milk in response to 'the man

Figure 1b. Example stimuli for *adam sütü içti*: the man drank milk.

Figure 1c. Example stimuli for *adam sütü içecek*: the man will drink milk.

drank milk' (past tense–perfective aspect condition), the experimenter emphasized the target verb form (*iç-ti*; drink-past/3sg) and pointed to the picture containing an empty glass with milk stains on the hands of the man while telling the child that the sentence means that 'he finished drinking'. No feedback was provided on experimental items. Children were instructed that they could ask for a repeat of the target sentence once and the experimenter repeated the target sentence once on request. No time limit was imposed. The order of all test sentences and pictures was pseudo-randomized, meaning that left/right presentation of the target picture alternated between items.

Table 3. Mean number (SD) and range of correctly identified sentences in each condition

	SLI		TD	
	Mean (SD)	Range	Mean (SD)	Range
Past	12.15 (2.93)	6–15	17.56 (2.50)	11–20
Present	16.46 (2.53)	14–20	19.04 (1.39)	16–20
Future	14.15 (3.28)	8–19	17.95 (2.07)	14–20

Note: SLI = specific language impairment; TD = typically developing; SD = standard deviation. Maximum score per condition is 20.

The Ethics Board of the University of Groningen (Netherlands) approved this study design. Administrators at the participating rehabilitation centres and schools also approved the study's methodology. The parents of each child signed a consent form before the testing took place. Each child was given a small toy at the end of testing.

Results

Table 3 lists the mean (SD) and proportion of correctly identified sentences in the three conditions for the two groups. We completed a qualitative analysis of the three time frames.

A repeated-measures analysis of variance (ANOVA) with Condition (present, past, future) as the within participants variable and Group (SLI, TD) as the between participants variable was run to investigate whether the groups showed differences comprehending (1) past versus present; (2) past versus future; and (3) present versus future, and to explore differences between SLI and TD groups in their comprehension of the three sentence types. The dependent variable was accuracy (number of correct responses).

There was a significant main effect for Condition (past: mean = 15.61; SD = 3.72; present: mean = 18.11; SD = 2.23; future: mean = 16.58; SD = 3.13) ($F(2, 34) = 33.26$, $p < .001$, $\eta^2 = .50$) and Group (SLI: mean = 14.25; SD = 3.36; TD: mean = 18.34; SD = 2.08) ($F(2, 34) = 29.59$, $p < .001$, $\eta^2 = .47$) and there was a significant interaction between Condition and Group ($F(2, 34) = 7.93$, $p = .001$, $\eta^2 = .19$). Pairwise *t*-tests within each group and independent *t*-tests between groups were performed to investigate the interaction.

In the SLI group, present tense comprehension scores were significantly higher than past tense comprehension scores ($t(12) = -6.31$, $p < .001$) and scores for future tense were significantly higher than those for the past tense ($t(12) = -3.12$, $p = .009$) but were lower than the present tense ($t(12) = 3.17$, $p = .008$). All these comparisons were statistically significant after a Bonferroni correction for multiple comparisons (three comparisons were made, $\alpha = .017$).

In the TD group, present tense comprehension scores were significantly higher than both the scores for past tense ($t(22) = -3.77$, $p = .001$) and future tense ($t(22) = 4.64$, $p < .001$). These comparisons were statistically significant after a Bonferroni correction for multiple comparisons (three comparisons were made, $\alpha = .017$). There was no significant difference in performance between comprehension for the past and for the future tenses ($t(22) = -.86$, $p = .401$).[2]

Independent samples *t*-tests indicated that the TD group had higher levels of accuracy than the SLI group in all conditions (present: $t(34) = -3.95$, $p < .001$; past: $t(34) = -5.85$, $p < .001$ and future: $t(34) = -4.26$, $p < .001$).

Discussion

This study is the first investigation of how monolingual Turkish-speaking children with SLI comprehend simple tense and aspect morphology. A sentence–picture matching test was administered to assess their comprehension of the past, future, and the present tense and aspect. The main research question was: Do monolingual Turkish-speaking children with SLI show a difference understanding tense and aspect morphology when reference is made to the past (perfective completed event), present (imperfective incomplete event), and future (imperfective incomplete event), and if so, is this pattern similar to Turkish-speaking TD children?

We discuss the findings with respect to the performance for sentence comprehension in relation to our study predictions on epistemic–semantic complexity: predictions I and II for the SLI group, prediction III for the TD group and prediction IV for comparing the results of the two groups.

SLI group

The group had higher scores for present than past and future tense conditions. These results were correctly predicted in study predictions I and II. The group also had higher scores for the future than past tense. Accordingly, the following order of difficulty was observed: (most difficult) past–future–present (most easy).

On the basis of the results above, there are three main findings. First, monolingual Turkish children with SLI exhibit deficits in their comprehension of sentences with simple tense and aspect morphology, which is similar to non-Turkish speaking children with SLI. Second, although the tense–aspect morphemes tested are similar in terms of morphosyntactic complexity (i.e., they are all single morphemes suffixed to the lexical verb and are equally complex in terms of functional projections they require), monolingual Turkish children with SLI have more difficulties comprehending morphology referring to the past compared with the non-past. Finally, the future was more difficult to comprehend than the present tense and aspect. There are two implications for these findings: (1) tense and aspect deficiency in SLI is not purely morphosyntactic in nature and (2) this deficiency is not limited to past tense contexts, i.e., future is affected as well. The next section discusses problems with tense and aspect in SLI with regard to the theories mentioned in Introduction.

Problems with tense and aspect in SLI

Problems with past tense compared with the present in SLI could be a problem with additional functional projections involved in past tense (Jakubowicz 2003). Such an explanation could account for the French data; however, it is incompatible with the Turkish data. In Turkish, the number of functional projections required for the past and present (as well as the future) are the same. Because past tense was still more difficult to comprehend than other tenses for Turkish-speaking children with SLI, the increased difficulties comprehending the past in Turkish cannot be explained by the complexity of the functional projections. Yet, the findings of the present study do not contradict those reported in Jakubowicz (2003): in French, additional functional projections in past tense are triggered at the semantic level: that is, to attribute past meaning to an auxiliary in present form. It could be that when this semantic complexity results in more complex syntactic computations, those syntactic computations are particularly demanding for children with SLI. Congruent with Jakubowicz's argument, our results that tense forms are differentially impaired indicates that tense per se is not the source of difficulties with (past) tense morphology in SLI.

According to Leonard and Deevy (2010) problems with past tense compared with the present in SLI could be due to an aspectual deficit: that is, English-speaking children with SLI suffer from a breakdown in the association between event completion and past tense. In their study, English-speaking children with SLI had difficulties interpreting the *past progressive* and their comprehension did not improve when the past event was completed. Leonard and Deevy concluded that children with SLI do not focus on completion information. It remains yet to be investigated, however, whether an insensitivity to event completion in the past progressive in children with SLI stems from a deficiency in event completion in the past tense context. There are three reasons for assuming that this might not be the case.

First, recent studies have shown that English-speaking children with SLI are sensitive to event completion in *simple past* tense contexts (e.g., *the girl built a Lego house on the table*), which means that these children did not exhibit any difficulty associating

completed and non-progressive events with the simple past (Stuart and van der Lely 2015). The implication of this finding is that in the simple past tense context, children with SLI are sensitive to event completion cues.

Second, the source of difficulty with event completion in the past progressive in SLI is unclear. It could be that the children with SLI in the study by Leonard and Deevy (2010) did not associate completed and non-progressive event completion cues (i.e., *Minnie emptied the cup located at Point A*) with *the same* ongoing actions in the test sentences (i.e., *show me where Minnie was emptying the cup*) when continuation process of an event within past time was obscure (i.e., children with SLI selected an incorrect scene with ongoing present actions). According to Stuart and van der Lely (2015), the continued process of an event within past time can be absent in current study designs investigating the past progressive in isolation. When past progressive is used in isolation, it emphasizes the ongoing action itself (e.g., *walking* as in *I was walking*) whereas its use with an anchor or reference time (e.g., *I was walking when it started to rain*) entails continuous process of the action within past time. Note that the TD children in Leonard and Deevy (2010) scored significantly lower on the past progressive than on present progressive, since they associated past progressive sentences with *ongoing present actions* rather than *ongoing past actions* in the scenes. Similarly, in Stuart and van der Lely (2015), it was not until TD children were 9 years of age that they understood that sentences in the past progressive refer to the past. Kazanina and Phillips (2007) found that TD Russian-speaking children aged 3 to 6 years old performed better when the past progressive contained an explicit temporal modifier (e.g., *while*) that provide children with reference time for the event described. Consequently, more research on the past progressive is needed to understand whether inaccuracy in the past progressive is due to an aspectual event completion deficit in SLI.

Finally, the results of the present study showed that incomplete non-past events (i.e., future) are also hard to interpret for children with SLI. That is, the difficulty with tense and aspect in SLI is not limited to the past tense context. Paradis and Crago (2000) also found that French-speaking children with SLI were less accurate in providing answers to questions asked in future tense (64% accuracy) than questions asked in present tense (89% accuracy), which supports our findings for future tense–aspect. In summary, children with SLI are sensitive to event completion in the simple past tense context and the difficulties with tense and aspect extend to non-past tense in SLI.

An important question that remains is what makes tense–aspect morphology, in particular the past and future, difficult to comprehend for children with SLI. Based on the results of the present study and earlier reported data on tense and aspect, we argue that children with SLI suffer from an underlying difficulty in understanding epistemic implications in sentences, which may negatively impact their understanding of tense and aspect.

Epistemic uncertainty in SLI

We assume that sentences that refer to the past or future are epistemically more complex than sentences that refer to here and now (see the section 'Tense–aspect–modality in Turkish-acquisition'). TD Turkish children acquire *epistemic modal functions* of verb inflections in developmental Stage 3 (Aksu-Koç 2006). For example, -DI marks *epistemic certainty* that an event has happened (see also Lyons 1977 for analysis of tense as an epistemic modality marker). It is plausible that monolingual Turkish children with SLI have difficulties receiving adequate information from verb morphology because they are unable to decipher the certainty of an event. In other words, they might be *uncertain* whether the event has occurred or not upon hearing the morpheme -DI that normally indicates certainty for past (see Yarbay Duman and Bastianse 2009 for a similar proposal for Turkish-speaking monolingual adults with Broca's aphasia who exhibit a similar pattern).

If children with SLI are *uncertain* as to whether the event *has* happened or *will* happen, they will be unable to make distinctions on the past and non-past tense aspect morphology as TD children would. Children with SLI would then be forced to search for clues whether the event has happened at all. In this respect, interpretation of the present progressive would be the easiest because children, as with all speakers or hearers, are often the *witness* to the event. Finding evidence for an event that happened in the past is more difficult, particularly in everyday conversations and in presence of memory limitations. As morphology for the future marks probability/possibility through prediction (e.g., thinking that it is likely to rain upon seeing black clouds), it might be relatively easier for a listener to find evidence for the happening of a future event compared with finding evidence of a past or, to a lesser extent, present event. This would explain the intermediate status of future in terms of comprehension complexity for children with SLI. This, at the same time, means that performance differences between the past, present and the future in SLI will be affected by saliency of physical cues provided to children in study designs.

Note that in children with SLI there is an *interaction* between sensitivity to event completion cues and ability for attributing epistemic certainty to past (or future) events: Cues unambiguously showing that an event has been completed (completion cue) are simultaneously cues that inform that the event has happened (epistemic

certainty). It appears that children with SLI are aware of this interaction during sentence processing: In Stuart and van der Lely (2015), children with SLI performed well on simple past tense when they witnessed the completion of the event. That is, knowing that the event has happened might have directed children's attention to simple past tense. The fact that children with SLI did not underestimate the completion information in Leonard and Deevy (2010) indicates that these children are more focused on completion information than their TD peers; children with SLI need to collect this information to monitor the occurrence of the event in the first place. Note that children in the current study did not explicitly see the event's completion in the past tense condition but had to infer it from evidence in the pictures. The results showed that children with SLI had difficulties interpreting the simple past on the basis of verb morphology. Future research on past tense in Turkish should investigate whether performance on simple past improves if children witnessed the completion of the event (rather than infer it).

Although these ideas should be investigated in future research, it is crucial to note that a relationship between interpretation of past tense forms and degrees of epistemic certainty has been established for healthy Turkish adults (Tosun *et al.* 2013).

TD group

TD children had higher scores for the present than future or past tense and aspect. The performance scores for the past and future were similar. This level of performance for the present was not foreseen for TD children (Study prediction III). Considering the high accuracy scores for each test condition (88–95%), it could be that past tense and future tense morphology are cognitively and epistemically demanding and require a longer period to master.

Comparing the two groups

Compared with the TD group, the SLI group had lower performance scores for all three time conditions (the present, past, and future). Unlike the TD group, the SLI group had more difficulty comprehending past tense–aspect morphology than future tense–aspect morphology. With the exception of this difference, the SLI and TD groups exhibited similar performance patterns. This means that although performance was deficient in the SLI group, both groups had lower performance for past and future tense–aspect morphology compared with present tense–aspect morphology.

These results have two implications: first, similar to TD children, sentence comprehension for children with SLI aged 6–8 years is influenced by the semantic characteristics of verb inflections at the morphosyntax–semantics level. That is, children with SLI are unable to attribute epistemic meaning to an inflection at the sentence level. Second, unlike TD children, children with SLI experience most difficulty interpreting tense–aspect morphology when sentences refer to the past.

One might argue that performance discrepancies between the test conditions could stem from children (both SLI and TD) pointing at an incorrect picture (the present) in past and future conditions if the child ignored verb morphology and selected the only picture (the present condition) depicting the action itself. There are three counterarguments for why we believe this is not the case. First, if children were ignoring verb morphology and responses were based on selecting pictures illustrating the verb in present tense, we would expect the TD group to be inaccurate on the past and the future conditions; however, this was not the case (88–90% accuracy). Second, we would expect children with SLI to be as accurate as the TD children at least on the present condition (i.e., picture depicted the action itself). Children with SLI were, however, less accurate than the TD group on the present tense condition. Finally, we would not expect to find a discrepancy between past and the future in the SLI group since the present was used as a foil for both. Nevertheless, a discrepancy was present.

Note that this study presented children with clear visual evidence to differentiate between the tenses (e.g., the process of drinking for the present; an empty glass with milk stains on the man's hands for the past; a man looking at a full glass of milk but not touching it for the future). It would appear that children with SLI who do not receive adequate information from verb morphology are unable to reason efficiently at the morphosyntax–semantics level.

Conclusions

The present study tested the comprehension of simple tense and aspect morphology in two groups of monolingual Turkish children: children with SLI and TD children. The first finding is that monolingual Turkish-speaking children with SLI, similar to English-speaking children with SLI (e.g., Leonard and Deevy 2010), show deficits in their interpretation of tense and aspect morphology. The second finding is that monolingual Turkish-speaking children with SLI exhibited more difficulty interpreting tense–aspect morphology when sentences referred to the past than when sentences referred to the non-past (i.e., present and future). Finally, there were performance differences between the future and present conditions, both imperfective incomplete events. We suggested that problems with tense and aspect morphology in children with SLI are due to their epistemic uncertainty.

Possible topics for future research include an investigation of the relationship between the ability to interpret epistemic information and tense–aspect morphology. Data on the acquisition of modal terms and lexical adverbs (e.g., *must*, *might*, *could*, *probably*, *maybe*) in TD children aged approximately 4 years of age showed that children start to differentiate terms encoding a high level of certainty from those expressing lesser degrees of certainty (e.g., *must* versus *might*; *must* versus *could*; *probably* versus *maybe*) by this age (Moore *et al.* 1990). If a relationship between the development of epistemic modality and verb morphology for tense–aspect exists, the results could have implications on language therapy: children with SLI can be taught the epistemic certainty continuum (certainty, probability and possibility) for the happening of an event (e.g., simple past marks certainty that an event has happened whereas simple future marks probability/possibility that an event is likely to happen) to reveal whether better processing of epistemic information would result in better use of verb morphology in children with SLI.

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Notes

1. The study design by Grinstead *et al.* (2013) involved sentences in past, present and future tense and aspect. However, only children with SLI, who said by using verb inflections or in other ways, that the test pictures/sentences represented the time before the event happened (past), the event in progress (present) and the aftermath of the event (future) were included in their study. Accordingly, no conclusions were drawn as to the ability to comprehend a specific time frame over the other. Jakubowicz (2003) tested the past, present and future tense. However, results for the future were not reported.
2. The TD sample ($N = 23$) is larger than the SLI sample ($N = 13$) in this study. However, we computed the same statistical analysis (paired samples *t*-tests and independent samples *t*-tests) with a subgroup of 13 age-matched TD children who participated in this study (SLI: $N = 13$; mean = 6.86; SD = 1.13; TD: $N = 13$; mean = 6.66, SD = 0.78) ($t(24) = 524$, $p = .605$). All the results were the same, except that the difference between past and present in the TD group was only marginally significant ($t(12) = -2.592$, $p = .024$), meaning that the difference failed to reach significance after Bonferroni correction.

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Appendix A

Table A1. Verb pairs and objects used in the test

Practice	
okumak—yazmak (to read—to write)	mektup (the letter)
Test items	
yemek—soymak (to eat—to peel)	elma (the apple)
ütülemek—katlamak (to iron—to fold)	kazak (the sweater)
içmek—dökmek (to drink—to pour)	süt (the milk)
silmek—süpürmek (to mop—to sweep)	yer (the floor)
boşaltmak—doldurmak (to empty—to fill)	dosya (the folder)
örmek—dikmek (to knit—to sew)	kıyafet (the cloth)
boyamak—çizmek (to paint—to draw)	kare (the square)
sivritmek—kırmak (to sharpen—to break)	kalem (the pencil)
itmek—çekmek (to push—to pull)	elarabası (the trolley)
yırtmak—yapıştırmak (to tear—to glue)	kağıt (the paper)

Note: -mAk is the infinitive inflection in Turkish.