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Research Article

Grammatical Morphology in Monolingual and Bilingual Children With and Without Language Impairment: The Case of Dutch Plurals and Past Participles

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Purpose: Grammatical morphology is often a locus of difficulty for both children with language impairment (LI) and bilingual children. In contrast to previous research that mainly focused on verbal tense and agreement markings, the present study investigated whether plural and past participle formation can disentangle the effects of LI and bilingualism and, in addition, can point to weaknesses of LI that hold across monolingual and bilingual contexts.
Method: Monolingual and bilingual children with and without LI (n = 33 per group) were tested at 2 waves with a word formation task that elicited Dutch noun plurals and past participles. The quantity and quality of errors as well as children's development over time were examined.
Results: The plural formation task discriminated between monolingual children with and without LI, but a less differentiated picture emerged in the bilingual group. Moreover, plural accuracy showed fully overlapping language profiles of monolinguals with LI and bilinguals without LI, in contrast to accuracy scores on the past participle formation task. Error analyses suggested that frequent omission of participial affixes may be indicative of LI, irrespective of lingual status.
Conclusion: The elicited production of past participles may support a reliable diagnosis of LI in monolingual and bilingual learning contexts.
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Children with specific or primary language impairment (further on called LI) are characterized by weaknesses in various language domains, but their deficit in grammatical morphology is particularly prominent (see Leonard, 2014). For example, one of the hallmarks of LI in English is the inconsistent use of verbal tense and agreement markings, which has been proposed to serve as a clinical marker (Rice & Wexler, 1996). Grammatical morphology is also a locus of difficulty for bilingual children, who show striking similarities with children with LI in this respect (Grüter, 2005; Paradis, 2005). Such overlap between language profiles raises the question whether grammatical morphemes can also be used as clinical markers to identify LI in bilingual contexts. As an illustration, the bilingual participants of Paradis (2005) scored in the clinical range on a standardized test assessing grammatical morphology, even though there was no reason to suspect the presence of LI in any of these children. Grammatical morphology thus appears to be a domain that is influenced by differences in language experience and may therefore not be suitable for the clinical assessment of bilingual children.

However, recent research across several languages suggests that grammatical morphology can be used to differentiate bilingual children with a typical development (TD) from both monolingual and bilingual children with LI. Looking beyond accuracy scores, considering the types of errors that children make or following their development over time, may support this differentiation. Several studies indicate that bilingual TD children tend to make relatively many commission errors compared with monolingual (Armon-Lotem, 2014; Paradis, 2010) and bilingual (Blom & Paradis, 2013; Jacobson & Schwartz, 2005; Verhoeven, Steenge, & van Balkom, 2011) children with LI, who are more likely to omit grammatical morphemes, signaling a less productive use of language. Moreover, in terms of development, Hamann and Belletti (2006) found a clear rise in the correct use of complement clitics by bilingual

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TD children, in contrast to a slower development of monolingual children with LI. Bilingual TD children may thus benefit more from accumulating input over time than peers with LI, indicating that the timing of assessment with respect to a child's age and amount of previous exposure may be an important factor to consider (Paradis, 2008). The present study also examined grammatical morphology in children with LI and bilingual children, taking into account both the quantity and quality of errors as well as children's development over time.

More specifically, the current study investigated Dutch plural and past participle formation within a sample of monolingual and bilingual children with and without LI. The use of verbal tense and agreement markings has been the primary focus of previous work that studied grammatical morphology in this population, for example demonstrating that both monolingual and bilingual children with LI are limited in reliably encoding subject-verb agreement in German (Rothweiler, Chilla, & Clahsen, 2012) and Dutch (Blom, de Jong, Orgassa, Baker, & Weerman, 2013; Verhoeven et al., 2011). Castilla-Earls et al. recently extended this work to other grammatical markers in Spanish, suggesting that articles (Castilla-Earls et al., 2016) and the subjunctive in temporal clauses (Castilla-Earls, Perez-Leroux, Restrepo, Gaile, & Chen, 2016) may have the potential to discriminate between TD and LI in bilingual settings due to being sensitive to LI and relatively insensitive to bilingual proficiency. The current study continued these lines of research by asking whether the production of plurals and past participles can disentangle the effects of LI and bilingualism and, in addition, can point to weaknesses that are indicative of LI in both monolingual and bilingual learning contexts. Below, we review previous work on plural formation in children with LI and bilingual children, including a separate section on pluralization in Dutch. Subsequently, the same is done for past participles.

Plural Noun Formation in Children With LI and Bilingual Children

Research across several languages indicates that children with LI have difficulties forming noun plurals, particularly in comparison with age-matched controls and when probed elicitation is used (e.g., Kuwaiti-Arabic: Abdalla, Aljenaie, & Mahfoudhi, 2013; Spanish: Bedore & Leonard, 2001; German: Kauschke, Kurth, & Domahs, 2011; English: Oetting & Rice, 1993). The most common documented error type in these studies was the omission of the plural marker. In contrast to elicitation tasks, high levels of accurate plural inflections in the spontaneous speech of children with LI are reported, with differences between children with TD and LI reaching significance in some studies (Bedore & Leonard, 2005; Rice & Oetting, 1993), but not in others (Clahsen, Rothweiler, Wöst, & Marcus, 1992; Rice, Wexler, & Hershberger, 1998). Coupled with the observation that children with LI and younger language-matched TD children often mark noun plurals similarly, these findings may suggest that "plural formation is neither an area of specific difficulty, nor an area of specific strength" in children with LI (Kauschke et al., 2011, p. 13; see also Leonard, 2016).

Previous work has shown that bilingual TD children are also delayed in the acquisition of noun plurals compared with monolingual TD peers. A German study by Zaretsky, Lange, Euler, and Neumann (2013) showed that patterns of plural usage in bilingual immigrant children corresponded to those in younger monolingual children, with suffix omissions dominating the errors in both groups. The amount of exposure may be an important determinant of this delay, as indicated by Thomas, Williams, Jones, Davies, and Binks (2014). These authors compared three groups of bilingual English-Welsh children and found that children who had only been exposed to Welsh before the age of 3 formed Welsh plurals more accurately than bilingual children who had also or only been exposed to English before that age. Furthermore, a delay in the production of noun plurals appears to be especially prominent for irregular plural forms. Schwartz, Kozminsky, and Leikin (2009) found that their monolingual and bilingual participants scored similarly on regular plurals in Hebrew, while the bilinguals were less accurate on irregular forms. Regular forms may be more easily acquired with a limited amount of exposure than irregular forms, due to their high type frequency, which supports fast generalization to new forms. The acquisition of irregular noun plurals is more dependent on repeated exposure to the same plural form (token frequency) (Bybee, 2007), and may thus take bilinguals longer to master.

The Acquisition of Dutch Plurals

Dutch nouns are pluralized through suffixation.[1] In contrast to English which has a single regular plural suffix, two regular suffixes exist in Dutch. Governed by phonological factors of stress and sonority, the suffix *–en* [ən] (*bloem-bloemen* [flower-flowers]) or the suffix *–s* [s] (*appel-appels* [apple-apples]) is attached to the stem of the noun. Both suffixes are productive, but the *–s* suffix is used with fewer nouns, having a type frequency of about 31% (Baayen, McQueen, Dijkstra, & Schreuder, 2003). Although a large majority of nouns are pluralized regularly, a limited number of plurals can be considered irregular. For example, some noun plurals take the regular suffix *–en,* but require a stem change, such as lengthening of the stem vowel (*dak* /dɑk/ - *daken* /dakən/ [roof-roofs]). Moreover, a closed set of 15 nouns is pluralized with a different suffix (*–eren*).

A number of studies have investigated the typical acquisition of Dutch noun plurals (e.g., Bol & Kuiken, 1988; Zonneveld, 2004). These studies indicate that plurals typically appear early in the speech of children, comparable to what has been reported for English (Brown, 1973) and German (Clahsen et al., 1992). Research on the atypical or bilingual acquisition of Dutch plural formation is

[1]For detailed information on plural and past participle formation in Dutch, see Booij (2002).

sparse, but findings correspond to previous work on plural formation in other languages (reviewed above). De Bree and Kerkhoff (2010) showed that 5-year-old monolingual children with LI produced fewer correct noun plurals in their elicited speech compared with an age-matched control group, and, instead, produced markedly more singular forms. Similar results have also been found for toddlers with LI (Van Alphen et al., 2004). Bol and Kuiken (1988) investigated Dutch plural formation in the spontaneous speech of children with LI and found no significant differences with TD children. Their TD participants were, however, on average two years younger than the participants with LI, complicating the comparison with other studies.

Our knowledge on Dutch plural formation in bilingual children is largely based on Verhoeven and Vermeer (1985) and Lalleman (1986) who both investigated the Dutch language proficiency of Turkish-Dutch school-aged children. These authors showed that, in comparison with monolingual Dutch peers, these bilingual TD children significantly lagged behind in Dutch morphology, including noun pluralization. With respect to error types, Lalleman (1986) reported that, although both groups of children made similar types of errors, the bilingual group more often omitted the plural suffix in their elicited speech than the monolingual group.

Past Participle Formation in Children With LI and Bilingual Children

Studies investigating participle inflection in children with LI are sparse and they yield mixed results. For German, Clahsen et al. argued that participle morphology is not severely impaired in the spontaneous speech of monolingual (Rothweiler & Clahsen, 1993) nor bilingual (Clahsen, Rothweiler, Sterner, & Chilla, 2014) children with LI, although the bilingual children with LI did omit more participial suffixes than younger bilingual TD peers. Kauschke, Renner, and Domahs (2016), however, demonstrate that elicited participle formation is problematic for German children with LI. For English, mixed results are also found. Redmond (2003) found that 5- and 6-year-old children with LI accurately marked past participles with the suffix *–ed* in obligatory contexts, both in elicited and spontaneous speech. On the other hand, Leonard et al. (2003) report that their 4- to 6-year-old participants with LI had significant difficulties with passive participle formation relative to age- and language-matched controls. These difficulties were, however, only observed for regular participles and not for irregular forms. A discrepancy between regular and irregular morphology has also been found in other studies looking at past tense (see Krok & Leonard, 2015), and it presents an interesting contrast with bilingual TD children who, as described above, were found to have particular difficulties with irregular morphology. Based on this observation, regularity may be considered a factor that can contribute to the differentiation of bilingual TD children and monolingual children with LI.

Few studies have examined participle formation in bilingual children. In a longitudinal study, Sterner (2013) followed four successive Turkish-German bilingual TD children between 3 and 5 years of age and recorded their spontaneous production of past participles. The results indicated that the acquisition of past participles in bilingual children largely corresponds to acquisition patterns of younger monolingual children, with the exception that the bilingual children hardly ever omitted the prefix *ge–,* which is, together with a suffix, attached to the stem of the verb to form a past participle in German (and in Dutch). In early stages of acquisition, monolingual German children have been found to omit the participial prefix (Szagun, 2011), possibly due to the fact that it is an unstressed syllable in the first position of a word, preceding a stressed syllable. Previous work has shown that such "unfooted" syllables are often not realized by young children (e.g., Wijnen, Krikhaar, & den Os, 1994). However, Sterner (2013) argued that her bilingual participants already had a sufficiently advanced prosodic-phonological development due to maturation and previous experience with unfooted syllables in their first language, leading to the limited number of prefix omissions.

The Acquisition of Dutch Past Participles

The formation of the past participle in Dutch is dependent on the regularity of the verb. The past participle of regular verbs, including over 80% of Dutch verbs (based on Tabak, Schreuder, & Baayen, 2005), is formed by attaching the prefix *ge–* [ɣə] and the suffix *–t* [t] (*werk-gewerkt* [work-worked]) or *–d* [t] (*speel-gespeeld* [play-played]) to the verb stem. Irregular verbs are inflected in several ways. The participles of one class of irregular verbs take the circumfix *ge_en* [ɣə_ən] in combination with a change in the stem vowel (*kijk-gekeken* [look-looked]). These verbs are termed strong (or ablauting) verbs in the current study, following Verhoeven and Vermeer (2001) who developed the instrument used in this research. In addition, more complex forms with a lower type frequency exist which either take the circumfix *ge_t/d* or *ge_en* in combination with a stem alternation that goes beyond the stem vowel (*koop-gekocht* [buy-bought], *vriez-gevroren* [freeze-frozen]). In the present study, these verbs are called irregular (Verhoeven & Vermeer, 2001). Both regular, strong, and irregular participles select the prefix *ge–*, except if their verbal stem begins with an unstressed prefix (e.g., *er–* [ɛr], *be–* [bə], *ver–* [vɛr]). No participial prefix is added in those cases (*erken-erkend* [acknowledge-acknowledged], *begrijp-begrepen* [understand-understood], *verliez-verloren* [lose-lost]).

In Dutch, past participles, like noun plurals, typically appear early in children's speech (Bol & Kuiken, 1988; Schaerlaekens, 1980). Similar to German children, Dutch TD children also tend to omit the participial prefix in early stages of acquisition (van Kampen & Wijnen, 2000), but most TD children have acquired the knowledge needed for the formation of the participle around the age of 3 (Wilsenach, 2006). The finding that past participles are acquired early in Dutch, in contrast to English (e.g., Fletcher, 1981), may be explained by their high frequency in the input (De Houwer, 1990). Past time events in nonnarrative discourse are often expressed by the present perfect in Dutch,

while English would require the simple past tense in similar contexts (Boogaart, 1999). Although past participles are thus frequently used in Dutch, only a few studies have examined the atypical and bilingual acquisition of Dutch participles, calling for further research. Wilsenach (2006) administered an elicited imitation task and showed that 4-year-old children with LI were more likely to omit the prefix *ge–* in comparison with TD peers who were on average 4 months younger. On the other hand, Bol and Kuiken (1988) did not find significant differences between children with LI and younger TD children in the spontaneous production of past participles. Their control group was on average 2 years younger than the participants with LI, presumably explaining the mixed findings. With respect to bilingual acquisition, Lalleman (1986) found that errors in the elicited past participle production of her school-aged bilingual participants were still common and indicated that they were developmentally behind their monolingual peers. These findings correspond to the results from Verhoeven and Vermeer (1985).

The Present Study

In contrast to previous research that mainly focused on verbal tense and agreement markings (e.g., Blom et al., 2013; Paradis, 2010; Rothweiler et al., 2012; Verhoeven et al., 2011), the present study investigated if and how the elicited production of Dutch noun plurals and past participles can discriminate between monolingual and bilingual children with and without LI. To this end, the quantity and quality of errors as well as children's development over time were examined. In previous work on German participial inflection in spontaneous speech, Clahsen et al. (2014) concluded that bilingual children with LI were not different from monolingual age-matched peers with LI and younger bilingual TD peers in terms of accuracy and error patterns. This may indicate that participle inflection cannot support the identification of LI in a bilingual context. However, important methodological differences between the work of Clahsen et al. (2014) and the current study can lead to diverging results. First, as a reflection of clinical reality, we compared groups of children that were all matched on chronological age, likely resulting in larger differences between children with TD and LI. Second, we examined past participle formation in children's elicited speech. This may be more discriminating than spontaneous speech, because in conversational speech samples "children have greater control of the vocabulary and the sentence constructions to use, enabling them to make greater use of well-practiced (and possibly memorized) linguistic forms" (Krok & Leonard, 2015, p. 1337) and allowing them to avoid constructions that they have not yet mastered. Elicitation is thus a more stringent method to test children's competence.

Based on previous work using probed elicitation (e.g., De Bree & Kerkhoff, 2010; Kauschke et al., 2016; Lalleman, 1986), we hypothesized that bilingual TD children as well as monolingual and bilingual children with LI would form noun plurals and past participles less accurately than their monolingual age-matched TD peers. However, the bilingual TD children may differ from the children with LI with regard to their error patterns. Due to the limited productivity of children with LI, we expected a higher proportion of commission errors in TD bilinguals in contrast to a higher proportion of omission errors in children with LI (e.g., Armon-Lotem, 2014; Paradis, 2010). Studies that specifically looked at past participles provide support for this expected difference in error patterns. Both monolingual and bilingual (pre)school-aged children with LI have been observed to avoid participial markings more often than TD peers (Clahsen et al., 2014; Kauschke et al., 2016; Wilsenach, 2006), while Sterner (2013) showed that bilingual TD preschoolers hardly omitted participial prefixes. On the other hand, for plurals, the anticipated difference in error patterns is not substantiated by previous work. Both monolingual children with LI (De Bree & Kerkhoff, 2010) and bilingual TD children (Lalleman, 1986), with a similar age (5–6) and language background as the participants in the current study, have been found to omit more plural suffixes than their monolingual TD peers. In the plural formation task, we may therefore not only find overlap in the accuracy scores of bilingual TD children and monolingual children with LI, but also in the error types. Last, due to combined effects of LI and bilingualism, omissions are expected to dominate the error pattern of the group of bilingual children with LI.

In addition, we predict differences between bilingual TD children and children with LI with respect to regularity. Bilingual TD children may have more difficulty with irregular forms due to their low type frequency (e.g., Schwartz et al., 2009), whereas monolingual children with LI are expected to perform particularly weak on regular forms (e.g., Leonard et al., 2003). Bilingual children with LI may, in comparison with bilingual TD peers, also have specific difficulty with regular items (Blom & Paradis, 2013), although this has not yet been confirmed in the context of plural or participle morphology. Finally, differences in terms of development over time are hypothesized. Bilingual TD children may benefit more from accumulating input over time than monolingual children with LI and may thus show greater improvement (Hamann & Belletti, 2006). We have no specific hypothesis about the development of monolingual TD children and bilingual children with LI.

Methods

Participants

This study included 132 participants: 33 monolingual TD children (MOTD), 33 monolingual children with LI (MOLI), 33 bilingual TD children (BITD), and 33 bilingual children with LI (BILI). Children were tested around age 5 or 6 (Wave 1), and one year (mean = 11 months) later around age 6 or 7 (Wave 2). Group characteristics are presented in Table 1. The groups of children were matched on age in months and did not differ in age at Wave 1, $F(3,128) = .11$,

Table 1. Demographic characteristics of the participants.

		Age in months Wave 1		Age in months Wave 2		Nonverbal intelligence		Socioeconomic Status		Gender		% Exposure to Dutch before the age of 4		% Current exposure to Dutch at home	
Group	*N*	Mean (*SD*)	Range	Mean (*SD*)	Range	Mean (*SD*)	Range	Mean (*SD*)	Range	Nr. of boys (%)	Nr. of girls (%)	Mean (*SD*)	Range	Mean (*SD*)	Range
MOTD	33	71.6 (6.4)	59-84	83.4 (6.3)	72–94	103.4 (14.4)	81–128	6.5 (2.0)	2-9	21 (64)	12 (36)	n/a	n/a	n/a	n/a
MOLI	33	71.8 (7.1)	59-87	83.1 (7.3)	70–100	97.2 (13.1)	72–118	5.7 (2.0)	2-9	25 (76)	8 (24)	n/a	n/a	n/a	n/a
BITD	33[a]	71.5 (7.1)	54-83	83.0 (6.9)	69–96	96.5 (14.5)	70–126	4.8 (2.4)	1-9	15 (45)	18 (55)	42.8 (8.2)	25-57	51.0 (14.1)	23–83
BILI	33	72.5 (8.5)	58-86	83.0 (8.8)	67–97	94.5 (15.1)	71–124	5.7 (2.2)	2-9	23 (70)	10 (30)	40.7 (11.0)	20-67	45.6 (17.1)	14–100[b]

Note. Nonverbal intelligence was tested with the Wechsler Nonverbal Scale of Ability (WNV-NL; Wechsler & Naglieri, 2008); socioeconomic status and exposure to Dutch were based on parental response to the Questionnaire of Parents of Bilingual Children (PaBiQ; Tuller, 2015). MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired.

[a]Parents of one BITD child were not willing to give information about their education level. [b]One BILI child received 100% of his current input at home in Dutch, because parents decided to consistently speak Dutch to their child when he entered elementary school at age 4. Before the age of 4, his parents spoke their native tongue with the child and he was exposed to Dutch 50% of the time.

$p = .95$, $\eta_p^2 < .01$, nor at Wave 2, $F(3,128) = .02$, $p = .99$, $\eta_p^2 < .01$. Groups were also matched in the best way possible on nonverbal intelligence and socioeconomic status (SES). Nonverbal intelligence was measured with the Wechsler Scale of Ability (WNV-NL; Wechsler & Naglieri, 2008), and SES was indexed by the average educational level of both parents of the child, based on the Questionnaire of Parents of Bilingual Children (PaBiQ; Tuller, 2015). No significant group difference in nonverbal intelligence emerged, $F(3,128) = 2.4$, $p = .07$, $\eta_p^2 = .05$, although pairwise comparisons showed marginally higher scores of the MOTD group relative to the BILI group ($p = .07$). A group difference did emerge on SES, $H(3) = 9.3$, $p = .03$, as a result of a lower SES in the BITD group compared with the MOTD group ($p = .004$). In addition, the large proportion of boys in the groups of children with LI produced a marginally significant group difference in terms of gender, $\chi^2(3, N = 132) = 7.3$, $p = .06$.

All children were born in the Netherlands and, as elementary school starts at age 4 in the Netherlands, most had received Dutch education for at least one year prior to the first wave of testing. The PaBiQ (Tuller, 2015) provided information on the home language environment of the children. Following Kohnert's (2010, p. 456) definition of bilingualism, children were considered bilingual if they received "regular input in two or more languages during the most dynamic period of communication development." At least one parent of the child had to be a native speaker of another language than Dutch, the majority language, and speak their native tongue with the child for an extensive period of the child's life. The sample of children that met these criteria included children who all learned Dutch as a second language, with varying degrees of exposure to Dutch, which is representative for the diverse groups of immigrants in the Netherlands (Centraal Bureau voor de Statistiek [Statistics Netherlands], 2015). The BITD and BILI groups were therefore matched on exposure to Dutch (Table 1) based on the PaBiQ (Tuller, 2015). There were no significant differences between the bilingual groups in terms of exposure to Dutch before the age of 4, $F(1,64) = .77$, $p = .38$, $\eta_p^2 = .01$, or current exposure to Dutch at home, $F(1,64) = 1.9$, $p = .17$, $\eta_p^2 = .03$. Exposure to Dutch before the age of 4 was measured as the amount of Dutch input relative to the total amount of language input that the child received before this age (both inside and outside home context). Current exposure to Dutch at home was measured as the amount of Dutch input relative to the total amount of language input that the child heard from its mother, father, siblings, and other adults that had frequent contact with the child. The first languages of the bilingual TD children included Turkish ($n = 14$), Tarifit-Berber ($n = 13$), and Moroccan Arabic ($n = 6$). The first languages of the bilingual children with LI were Turkish ($n = 10$), Moroccan Arabic ($n = 7$), Egyptian Arabic ($n = 3$), Tarifit-Berber ($n = 2$), Dari ($n = 2$), Chinese ($n = 2$), Pashto ($n = 1$), Suryoyo ($n = 1$), Kirundi ($n = 1$), Russian ($n = 1$), Portuguese ($n = 1$), Danish ($n = 1$), and Frisian ($n = 1$).

The participants with LI were recruited through two national organizations in the Netherlands that provide diagnostic, care and educational services for children with language difficulties (Royal Dutch Kentalis and Royal Auris Group). These children were already diagnosed with LI by licensed clinicians before the start of this research and they were selected to participate in the current study on the basis of their diagnosis. All children thus met the criterion for LI that is officially used in the Netherlands. This means that they obtained a score of at least 2 standard deviations (*SD*) below the mean on an overall score of a standardized language assessment test battery, or a score of at least 1.5 *SD* below the mean on two out of four subscales, including speech production, auditory processing, grammatical knowledge and lexical-semantic knowledge (Stichting Siméa, 2014). Delays on these subscales were determined with at least two appropriate tests per subscale. The specific tests that are used by clinicians differ per child, but common test batteries include the Dutch version of the Clinical Evaluation of Language Fundamentals–Fourth Edition (CELF-4-NL; Kort, Schittekatte, & Compaan, 2008), the Schlichting Test for Language Production and Comprehension (Schlichting & Lutje Spelberg, 2010a, 2010b) and the Dutch Language Proficiency Test for All Children which has bilingual norms (Taaltoets Alle Kinderen [TAK]; Verhoeven & Vermeer, 2001). In addition, a guideline focusing on the specific assessment of bilingual children is provided by Stichting Siméa (2016), stating the need for a bilingual anamnesis and, if possible, evaluation of the first and second language.

Children with an intellectual disability (nonverbal intelligence < 70), hearing impairment, neurological damage, or severe articulatory difficulties were excluded. At Wave 1, 64 children with LI attended special education and two children (one bilingual child and one matched monolingual child) attended regular education with ambulatory care. At Wave 2, five children with LI (four monolingual and one bilingual) transferred from special education to regulareducation with ambulatory care. Thus, 59 children continued to attend special education schools at Wave 2 and seven children received ambulatory care at regular elementary schools. All children with TD were recruited via regular elementary schools and did not have reported language problems. A standardized sentence repetition test (subtest of the TAK; Verhoeven & Vermeer, 2001) gave background information on the Dutch language abilities of the participants. For this test, norms are available for monolingual and bilingual children. Comparing the scores of the monolingual and bilingual TD participants to monolingual and bilingual norms, respectively, indicated that the clear majority (around 85%) performed in the high or average norm categories, both at Wave 1 and Wave 2. In contrast, the large majority (around 90%) of the monolingual and bilingual children with LI scored well below average at both time points.

Materials

The present study used the TAK Word Formation to elicit noun plurals and past participles. The TAK Word Formation is a subtest of the Dutch Language Proficiency

Test for All Children (Verhoeven & Vermeer, 2001), a standardized test battery that was developed to assess the Dutch language abilities of monolingual and bilingual children. The subtest Word Formation includes 24 items of which half target noun plurals and half target past participles. The test is only normed on the total score, combining the number of correctly formed plurals and the number of correctly formed participles. Norms are not available for the two parts of the test separately. When this test is administered, the total score is therefore commonly used.

The items that elicit noun plurals fall into three classes which differ according to regularity. The noun classes contain regular plural forms ending in *–en* (*bril-brillen* [glass-glasses]), regular plural forms ending in *–s* (*emmer-emmers* [bucket-buckets]), and irregular plural forms with stem vowel lengthening ending in *–en* (*dak* /dɑk/ - *daken* /dakən/ [roof-roofs]). Each noun class contains four items. The items that elicit past participles also fall into three classes that differ according to regularity. The verb classes comprise regular past participles with the circumfix *ge_t/d* (*kook-gekookt* [cook-cooked]), strong past participles with the circumfix *ge_en* and alternation of the stem vowel (*vlieg-gevlogen* [fly-flown]), and irregular past participles with the circumfix *ge_t* or *ge_en* (except for one item that had no participial prefix) and a significant stem change, beyond the stem vowel (*breng-gebracht* [bring-brought]). Each verb class contains four items. All items of the test are listed in the Appendix.

Procedures and Scoring

The current study is part of a large-scale project that aims to investigate the linguistic and cognitive development of children with diverse language backgrounds in the Netherlands. The Standing Ethical Assessment Committee of the Faculty of Social and Behavioral Sciences at Utrecht University approved this research and parents of participants signed an informed consent form. Next to the TAK Word Formation that was used in the present study, children completed a larger battery of tests, including memory and attention measures, which are not reported here. Similar procedures were used for Wave 1 and Wave 2. All children were tested in a quiet room at their school. A native speaker of Dutch tested them individually in two separate sessions, each lasting approximately one hour. The TAK Word Formation was the third test in the second session. Children were presented with a picture on a laptop screen and were asked to finish an incomplete sentence uttered by the experimenter, hereby eliciting the plural of a noun (Example 1) or the past participle of a verb (Example 2).

1) Dit is één lepel, dit zijn twee…? Lepels.
This is one spoon, these are two…? Spoons.
"This is one spoon, these are two…? Spoons."

2) Hier zie je Hans in het zand spelen.
Here see you Hans in the sand play.INFINITE.
"Here you see Hans playing in the sand."

Gisteren heeft hij ook al in het zand…? Gespeeld.
Yesterday has he also already in the sand…? Played.
"Yesterday he has also … in the sand? Played."

Noun plurals were elicited in the first half of the test and past participles in the second half. Each half was preceded by three practice items, which familiarized the children with the procedure.

Children's answers were recorded with a highly sensitive microphone and were scored offline by a native speaker of Dutch. Final *–n* deletions were not considered incorrect because the final *–n* in syllabic suffixes is often not pronounced in Dutch, resulting in a suffix *–e* [ə] instead of *–en* [ən]. A second independent rater scored 25% of the data for accuracy. Scores of the two raters overlapped in 99% of the cases for both plurals and past participles. Cohen's Kappa was .98 ($p < .001$) for both plurals and participles. Next, children's incorrect answers were transcribed, allowing for categorization according to type of error. A second independent rater transcribed 25% of the errors that children made. The transcriptions of the two raters completely corresponded in 96% of the cases for the plural formation task and 95% of the cases for the past participle formation task. Interrater reliabilities were excellent; Cohen's Kappa was .96 ($p < .001$) and .88 ($p < .001$) for the plurals and past participles, respectively.

For noun plurals, errors fitted into six categories: (1) omission of a plural suffix (e.g., "*bril*" for "*brillen*"), (2) substitution of a plural suffix (e.g., "*brils*" for "*brillen*"), (3) addition of a plural suffix (e.g., "*brillens*" for "*brillen*"), (4) no vowel lengthening in the stem, but the use of a correct suffix (e.g., "*dakken*" /dɑkən/ - for "*daken*" /dakən/; only applicable to the irregular forms), (5) use of a nontarget noun plural (e.g., "*huizen*" [houses] for "*daken*"), and (6) other (e.g., "don't know," no or irrelevant response, and uncommon forms as "*lennens*" for "*emmers*"). Instances of nontarget nouns that were not correct plural forms ($n = 7$) were scored within one of the other error categories (e.g., "*huis*" [house] for "*daken*" was scored as an omission of plural suffix). For past participles, errors of children fitted into seven categories: (1) omission of a participial affix (e.g., "*fietst*" for "*gefietst*"), (2) substitution of participial affix (e.g., "*gefietsen*" for "'*gefietst*"), (3) addition of participial affix (e.g., "*gefietsend*" for "*gefietst*"), (4) substitution of root, but the use of correct affixes (e.g., "*gekoopt*" for "*gekocht*"), (5) infinitival form + durative or modal verb (e.g., "*aan het fietsen*'" for "*gefietst*"), (6) use of a nontarget past participle (e.g., "*gemaakt*" [made] for "*gekookt*"), (7) other (e.g., "don't know," no or irrelevant response). Instances of nontarget verbs that were not correct participial forms ($n = 31$) were scored within one of the other error categories (e.g., "*maak*" [make] for "*gekookt*" was scored as an omission of participial affix). Some incorrect answers to items targeting past participles contained multiple errors, e.g., including both an omission of the participial prefix and a substitution of the suffix (e.g., "*fietsen*" for "*gefietst*").

Such answers with multiple errors were coded in only one of the abovementioned categories. If omission and substitution co-occurred, the answer was coded as an omission error to capture the difference between forms that only contained a substitution error (e.g., "*gefietsen*").

Data Analysis

Children's responses on the plural and past participle formation task were analyzed with mixed logistic effects modelling in R (R Core Team, 2015), which is suitable for binary outcome variables and allowed for the inclusion of both fixed and random effects within the same model. Random intercepts for subjects and items were included in all analyses to be able to generalize the findings to the populations of children, nouns, and verbs. To reflect the longitudinal nature of the data, a random slope for Wave was furthermore included in the models analyzing accuracy scores. The smaller number of data points in the models analyzing error types did not allow for this increase in model complexity.

Group (MOTD, MOLI, BITD, and BILI) was the main fixed-effects factor of interest, as we aimed to investigate whether plural and past participle formation could discriminate between the four groups of children, and, in addition, could point to weaknesses of LI that hold across monolingual and bilingual contexts. Furthermore, Wave (1 and 2) was included as fixed factor in the models to examine children's development over time and its interaction with Group. Some groups may improve more over time than other groups, thereby possibly supporting reliable differentiation. Finally, Regularity (plurals: regular *–en,* regular *–s,* and irregular; participles: regular, strong, irregular) was a relevant fixed factor, as differential effects of LI and bilingualism on regular and irregular forms may emerge. Due to a limited number of errors (and thus data points) in some groups and noun/verb classes, Regularity was not entered as fixed factor in the error analyses. Only the accuracy data allowed for the inclusion of this third fixed factor. Frequency of the items was not analyzed in this study, as information from existing databases is either based on small corpora or does not properly reflect the input of the children in our sample. Nonsignificant predictors were removed through backward elimination, resulting in a simple model with only significant main effects. Subsequently, interaction effects with Group were included. Likelihood ratio tests were conducted to compare the different nested models and to obtain the optimal model which was most accurate but least complex. Model estimates and model comparisons are provided in Supplemental Material S1.

Two binary outcome variables were analyzed for the purpose of this study. First, accuracy was examined in terms of correct versus incorrect responses, and thus included all of the children's responses (12 for both noun plurals and past participles). Second, error analyses targeted all errors that were made with a plural suffix or a participial affix (error categories 1–3 as described above under procedures and scoring). Other errors (categories 4–7 as described above under procedures and scoring) were only reported on descriptively and not further analyzed. We chose to focus on children's affix errors, as grammatical affixes have been proposed to be particularly difficult for children with LI due to their brief duration alongside their grammatical function (Leonard, Eyer, Bedore, & Grela, 1997). Moreover, the affix errors enabled us to contrast productive (commission) and nonproductive (omission) errors, which is shown to differentiate children with LI from children with TD (e.g., Armon-Lotem, 2014; Blom & Paradis, 2013). The two levels of our binary outcome variable for the error analyses were thus commission errors, including substitution and addition of affixes (error categories 2 and 3 as described above under procedures and scoring), versus omission errors (error category 1 as described above under procedures and scoring).

Results

The mean numbers of errors of the four groups of children on the plural formation task and the past participle formation task are presented in Table 2. In addition, the numbers of errors per error type are displayed in Tables 3 and 4 for the plural formation task and past participle formation task, respectively. For the error analyses, we focused on the errors with plural suffixes and participial affixes (printed in roman font in Tables 3 and 4), as was explained above.

Plurals

Accuracy Scores

Binary mixed logistic effects modelling was used to analyze the effects of Group (MOTD, MOLI, BITD and BILI), Wave (1 and 2), and Regularity (regular *–en,* regular *–s,* and irregular) on the dependent variable plural accuracy, which denoted correct versus incorrect responses on the plural formation task. Results from the model with only main effects showed significant effects of Group, Wave, and Regularity. A more complex model including the two-way interaction Group × Wave was preferred over the simple model with only main effects, $\chi^2(3) = 13.0$, $p < .01$, while including the interaction Group × Regularity did not improve model fit. Models with both two-way interactions or the three-way interaction Group × Wave × Regularity were not preferred over the optimal model that only included the Group × Wave interaction (see Figure 1 for the partial effects).

This optimal model showed that the MOTD group outperformed the MOLI ($p < .01$), BITD ($p < .001$) and BILI ($p < .001$) groups, at both waves and on all regularity levels. In addition, the MOTD group improved more over time than the MOLI and BITD groups ($p < .05$), as indicated by the significant Group × Wave interaction. Further inspection of the data revealed that the growth of the MOTD group was especially due to the irregular plural forms. These irregular forms remained very difficult for the other three groups of children, who demonstrated floor performance at both Wave 1 and Wave 2. Results furthermore showed that the BILI group scored weaker than the

Table 2. Mean number of errors on the plural formation task and the past participle formation task.

			Noun plural formation					Past participle formation				
			Total (max. 12)		Regular *-en* (max. 4)	Regular *-s* (max. 4)	Irregular (max. 4)	Total (max. 12)		Regular (max. 4)	Strong (max. 4)	Irregular (max. 4)
Wave	Group	*N*	Mean (*SD*)	Range	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Range	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
1	MOTD	33	3.70 (1.78)	0–8	.33 (.69)	.15 (.44)	3.21 (1.17)	3.85 (3.13)	0–11	.97 (1.24)	.76 (.87)	2.12 (1.54)
	MOLI	33	5.03 (2.14)	2–11	.55 (1.00)	.79 (1.27)	3.70 (.64)	8.61 (2.21)	2–12	2.48 (1.18)	2.45 (1.12)	3.67 (.74)
	BITD	33	5.45 (2.33)	3–12	.82 (1.31)	.76 (1.23)	3.88 (.42)	6.88 (3.44)	1–12	1.91 (1.44)	2.06 (1.39)	2.91 (1.21)
	BILI	31[a]	7.71 (3.19)	3–12	1.71 (1.74)	2.06 (1.69)	3.94 (.25)	9.71 (2.19)	5–12	2.87 (1.34)	3.10 (1.14)	3.74 (.68)
2	MOTD	33	2.09 (1.44)	0–4	.00 (.00)	.06 (.24)	2.03 (1.38)	2.30 (2.66)	0–9	.48 (.94)	.42 (.94)	1.39 (1.44)
	MOLI	33	4.15 (1.56)	0–8	.15 (.57)	.39 (.97)	3.61 (1.00)	7.21 (2.72)	0–11	2.15 (1.42)	1.76 (1.32)	3.30 (.95)
	BITD	33	4.61 (1.50)	3–10	.30 (.68)	.52 (.87)	3.79 (.49)	4.09 (3.24)	0–10	1.18 (1.13)	1.33 (1.24)	1.58 (1.42)
	BILI	33	4.91 (1.89)	1–12	.42 (1.06)	.67 (1.08)	3.82 (.58)	8.18 (2.72)	1–12	2.36 (1.34)	2.36 (1.30)	3.45 (1.00)

Note. MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired

[a]Data from Wave 1 were not available for two BILI children, due to their refusal to cooperate.

Table 3. Types of errors on the noun plural formation task.

Wave	Group	*N*	Total	Omission of suffix *N* (%)	Substitution of suffix *N* (%)	Addition of suffix *N* (%)	*No vowel lengthening in stem (correct suffix)* *N* (%)	*Nontarget like plural* *N* (%)	*Other* *N* (%)
1	MOTD	33	122	17 (13.9)	6 (4.9)	0 (0)	*95 (77.9)*	*4 (3.3)*	*0 (0)*
	MOLI	33	166	48 (28.9)	16 (9.6)	1 (0.6)	*87 (52.4)*	*8 (4.8)*	*6 (3.6)*
	BITD	33	180	64 (35.6)	12 (6.7)	0 (0)	*102 (56.7)*	*1 (0.6)*	*1 (0.6)*
	BILI	30[a]	236	157 (66.5)	9 (3.8)	0 (0)	*57 (24.2)*	*6 (2.5)*	*7 (3.0)*
	Total		**704**	**286 (40.6)**	**43 (6.1)**	**1 (0.1)**	***341 (48.4)***	***19 (2.7)***	***14 (2.0)***
2	MOTD	33	69	3 (4.3)	6 (8.7)	0 (0)	*59 (85.5)*	*1 (1.4)*	*0 (0)*
	MOLI	33	137	23 (16.8)	5 (3.6)	2 (1.5)	*106 (77.4)*	*1 (0.7)*	*0 (0)*
	BITD	33	152	24 (15.8)	13 (8.6)	0 (0)	*113 (74.3)*	*1 (0.7)*	*1 (0.7)*
	BILI	33	162	39 (24.1)	9 (5.6)	4 (2.5)	*110 (67.9)*	*0 (0)*	*0 (0)*
	Total		**520**	**89 (17.1)**	**33 (6.3)**	**6 (1.2)**	***388 (74.6)***	***3 (0.6)***	***1 (0.2)***

Note. Error categories not included in the error analyses are in italics. MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired.

[a]Data from Wave 1 were not available for two BILI children, due to their refusal to cooperate. In addition, for one BILI child only accuracy scores were available at Wave 1.

MOLI ($p < .001$) and BITD ($p < .01$) groups at Wave 1, but caught up at Wave 2. At Wave 2, the difference between performance of the BILI and MOLI groups was only marginally significant ($p = .05$), and no difference emerged between the BILI and BITD groups. Similar to the MOTD group, the BILI group thus also improved more over time than the MOLI and BITD groups ($p < .05$), but their performance showed a steeper learning curve on the regular forms instead of the irregular forms. While the MOTD, MOLI, and BITD groups already performed near ceiling on the regular forms at Wave 1, these forms were still difficult for the BILI group at that time, leaving much room to grow. Finally, there was full overlap in accuracy scores of the BITD and MOLI on the plural formation task. At all waves and on all regularity levels, no significant differences emerged between these two groups.

Error Types

A second binary mixed logistic effects analysis was conducted to analyze the effects of Group (MOTD, MOLI, BITD, and BILI) and Wave (1 and 2) on the dependent variable error type, which denoted the omission versus the substitution/addition of plural suffixes. The model with only main effects of Group and Wave showed poorer fit compared with a more complex model including the interaction Group × Wave, $\chi^2(3) = 9.7$, $p < .05$, which was thus considered optimal (see Figure 2 for the partial effects). The optimal model showed that the MOLI group made less omission errors and more substitution/addition errors at Wave 1 than the BILI group ($p < .05$). However, this difference disappeared at Wave 2. The Group × Wave interaction indicated that the MOLI group developed differently over time in terms of error types compared with the BILI

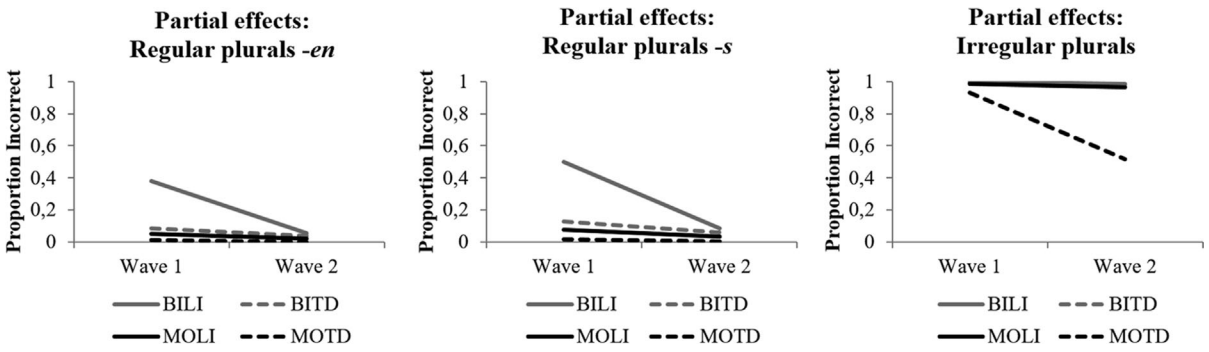
Table 4. Types of errors on the past participle formation task.

Wave	Group	*N*	Total	Omission of affix *N* (%)	Substitution of affix *N* (%)	Addition of affix *N* (%)	*Substitution of root (correct affix)* *N* (%)	*Infinitival form + durative/modal* *N* (%)	*Nontarget like participle* *N* (%)	*Other* *N* (%)
1	MOTD	33	127	3 (2.3)	61 (48.0)	4 (3.1)	*40 (31.5)*	*14 (11.0)*	*4 (3.1)*	*1 (0.8)*
	MOLI	33	284	76 (26.8)	100 (35.2)	13 (4.6)	*63 (22.2)*	*3 (1.1)*	*14 (4.9)*	*15 (5.3)*
	BITD	33	227	14 (6.2)	115 (50.7)	9 (4.0)	*65 (28.6)*	*8 (3.5)*	*9 (4.0)*	*7 (3.1)*
	BILI	30[a]	291	67 (23.0)	85 (29.2)	5 (1.7)	*53 (18.2)*	*5 (1.7)*	*20 (6.9)*	*56 (19.2)*
	Total		**929**	**160 (17.2)**	**361 (38.9)**	**31 (3.3)**	***221 (23.8)***	***30 (3.2)***	***47 (5.1)***	***79 (8.5)***
2	MOTD	33	76	2 (2.6)	36 (47.4)	2 (2.6)	*25 (32.9)*	*9 (11.8)*	*1 (1.3)*	*1 (1.3)*
	MOLI	33	238	18 (7.6)	127 (53.4)	12 (5.0)	*73 (30.7)*	*2 (0.8)*	*5 (2.1)*	*1 (0.4)*
	BITD	33	135	9 (6.7)	60 (44.4)	3 (2.2)	*40 (29.6)*	*10 (7.4)*	*12 (8.9)*	*1 (0.7)*
	BILI	33	270	62 (23.0)	105 (38.9)	16 (5.9)	*64 (23.7)*	*2 (0.7)*	*16 (5.9)*	*5 (1.9)*
	Total		**719**	**91 (12.7)**	**328 (45.6)**	**33 (4.6)**	***202 (28.1)***	***23 (3.2)***	***34 (4.7)***	***8 (1.1)***

Note. Error categories not included in the error analyses are in italics. MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired.

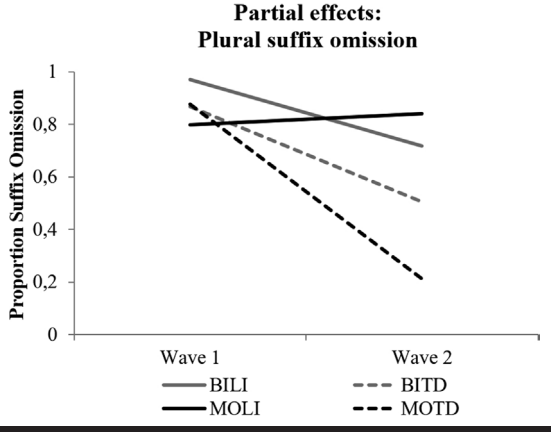
[a]Data from Wave 1 were not available for two BILI children, due to their refusal to cooperate. In addition, for one BILI child only accuracy scores were available at Wave 1.

Figure 1. Partial effects of the optimal mixed model predicting plural accuracy scores with Wave, Regularity, and Group as fixed effects and Group × Wave as interaction effect. MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired; reference level for Group = BITD; model estimates are provided in Supplemental Material S1.



($p < .01$), BITD ($p < .05$), and MOTD ($p = .05$) groups. Figure 2 shows that the proportion of omission errors did not decrease over time in the MOLI group, in contrast to the other groups. Consequently, a marginally significant difference between the MOLI and MOTD group emerged at Wave 2 ($p = .06$). At Wave 2, the MOLI group omitted relatively more plural suffixes than the MOTD group, while there was no difference in error types between the two groups at Wave 1. Other group differences were not significant, which may have partly been the result of the relatively small number of substitution and addition errors that were actually made with a plural suffix. Moreover, the total number of plural suffix errors at Wave 2 was also small (see Table 3). This context has to be taken into account when interpreting the results.

Figure 2. Partial effects of the optimal mixed model predicting plural suffix omissions with Wave and Group as fixed effects and Group × Wave as interaction effect. MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired; reference level for Group = MOLI; model estimates are provided in Supplemental Material S1.



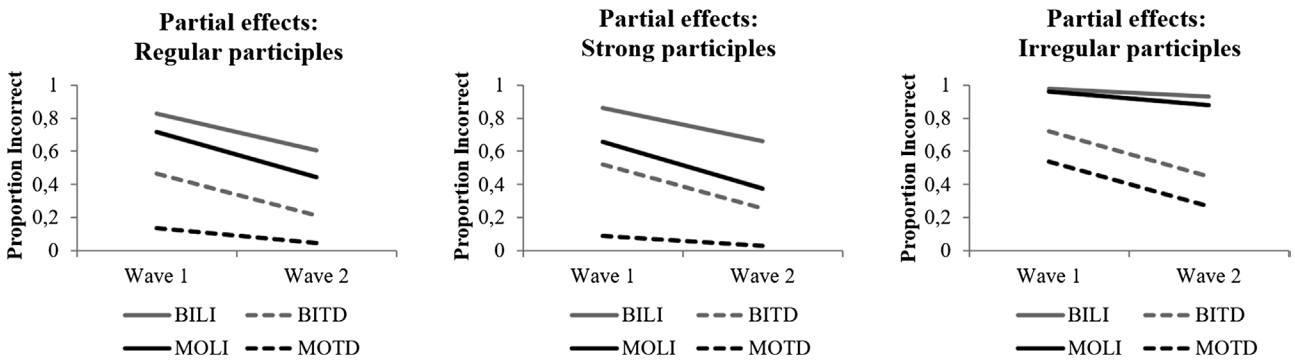
Past Participles

Accuracy Scores

Binary mixed logistic effects modelling was used to analyze the effects of Group (MOTD, MOLI, BITD, and BILI), Wave (1 and 2), and Regularity (regular, strong, and irregular) on the dependent variable past participle accuracy, which denoted correct versus incorrect responses on the past participle formation task. Results from the model with only main effects showed significant effects of Group, Wave, and Regularity. A more complex model including the two-way interaction Group × Wave was marginally preferred over this simple model with only main effects, $\chi^2(3) = 7.2$, $p = .07$, indicating that the BITD group showed more improvement over time than the MOLI group ($p < .05$). However, a model including the Group × Regularity interaction also improved model fit, $\chi^2(6) = 33.5$, $p < .001$, and was preferred over models with the two-way interaction Group × Wave or the three-way interaction Group × Wave × Regularity. The model that only included the Group × Regularity interaction was therefore considered optimal (see Figure 3 for the partial effects).

This optimal model showed that the MOTD group outperformed the MOLI and BILI group on all regularity levels ($p < .001$). The MOTD group also had significantly higher accuracy scores than the BITD group on the regular and strong participles ($p < .001$), but on the irregular forms the difference was only marginal ($p = .06$). This pattern can be explained by the significant Group × Regularity interaction. This interaction demonstrated that the BITD group performed relatively better on the irregular verbs than on the strong and regular verbs compared with the other groups ($p < .01$). Moreover, it also indicated that both the BITD and the BILI groups achieved lower accuracy scores on the strong forms than on the regular forms in comparison with the MOTD group ($p < .05$), and, although not significantly, with the MOLI group ($p = .10$). This relatively weak performance of the bilingual groups on the strong forms may explain why the BILI group was outperformed by the MOLI group on the strong forms ($p < .01$),

Figure 3. Partial effects of the optimal mixed model predicting participle accuracy scores with Wave, Regularity, and Group as fixed effects and Group × Regularity as interaction effect. MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired; reference level for Group = BITD; model estimates are provided in Supplemental Material S1.



whereas no differences between the two groups emerged on the regular and irregular participles. The opposite pattern was found for the BITD group: While the MOLI group performed worse than the BITD group on the regular ($p < .05$) and irregular verbs ($p < .001$), the difference on the strong verbs did not reach significance. Finally, comparisons of the BITD and BILI groups demonstrated higher accuracy of the BITD group on all regularity levels ($p < .001$).

Error Types

A fourth binary mixed logistic effects analysis was conducted to analyze the effects of Group (MOTD, MOLI, BITD and BILI) and Wave (1 and 2) on the dependent variable error type, which denoted the omission versus the substitution/addition of participial affixes. The model with only main effects of Group and Wave showed poorer fit compared with a more complex model including the interaction Group × Wave, $\chi^2(3) = 12.5$, $p < .01$, which was thus considered optimal (see Figure 4 for the partial effects). The optimal model showed that the MOLI group made more omission and fewer substitution/addition errors than the MOTD ($p < .001$) and BITD ($p < .01$) groups at Wave 1. The same was true for the BILI group when compared with both TD groups ($p < .001$). These differences between the TD and LI groups disappeared at Wave 2. This pattern can be explained by the significant interaction of Group × Wave, which showed that the MOLI and BILI groups developed differently over time in terms of error types in comparison with the BITD group ($p < .01$), and, albeit not significantly, with the MOTD group ($p = .06$). Figure 4 shows that the MOLI and BILI groups made fewer omission errors over time, whereas this was not the case for the MOTD and BITD groups, who already rarely omitted affixes at Wave 1. Prefix omissions were much more frequent than suffix omissions (85% versus 15%, respectively).

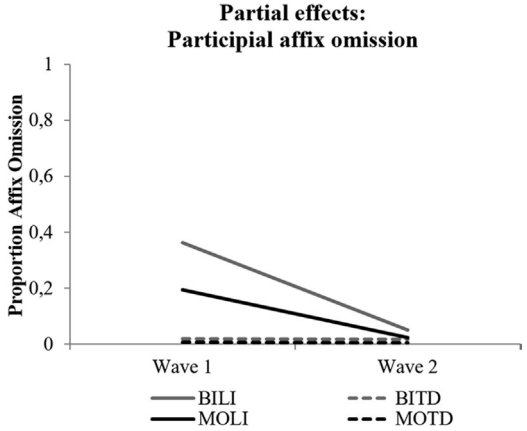
Discussion

Grammatical morphology is a locus of difficulty for both children with LI and bilingual children, complicating the diagnosis of LI in bilingual settings. The present study investigated if and how the elicited production of two highly frequent and early acquired Dutch forms, noun plurals and past participles, can discriminate between monolingual and bilingual children with and without LI. To this end, we examined children's accuracy scores, as well as their error types and development over time, as such a comprehensive analysis may add to reliable differentiation (e.g., Hamann & Belletti, 2006; Paradis, 2010; Verhoeven et al., 2011).

Plural Formation

The plural formation task discriminated between TD and LI in the monolingual group of children, in agreement with previous work using age-matched groups and probed elicitation (e.g., De Bree & Kerkhoff, 2010;

Figure 4. Partial effects of the optimal mixed model predicting participial affix omissions with Wave and Group as fixed effects and Group × Wave as interaction effect. MOTD = monolingual typically developing; MOLI = monolingual language impaired; BITD = bilingual typically developing; BILI = bilingual language impaired; reference level for Group = BITD; model estimates are provided in Supplemental Material S1.



Kauschke et al., 2011). Monolingual children with LI had lower accuracy scores in comparison with monolingual TD peers, and, in addition, they showed limited development over time in terms of both error quantity and quality. On the other hand, a less differentiated picture emerged for the bilingual group. Due to considerable improvement in accuracy on the regular plural forms, the bilingual children with LI caught up with their bilingual TD peers at Wave 2. Moreover, although this might be partly due to a power problem, error patterns of the two bilingual groups were not significantly different. Another complicating factor for clinical use is the overlap between the accuracy scores of the bilingual TD children and monolingual children with LI on the plural formation task, consistent with other studies looking at grammatical morphology (e.g., Paradis, 2005). Together, these findings suggest that the elicited production of noun plurals may not be suitable for the identification of LI in bilingual contexts.

Bilingualism seemed to have a substantial effect on children's performance on the plural formation task, leading to similarities between the language profiles of the bilingual TD children and the monolingual children with LI. It is possible that interference from the first language of the bilingual children partly explains their low group scores on this task. In the present study, the first language of a considerable number of bilingual participants was Turkish, which does not require a pluralized noun in contexts where a marker for quantity is specified (e.g., two/three/many). In those contexts, the singular form of the noun is produced instead (Göksel & Kerslake, 2011). The items included in the task that was used in the current study all contained markers of quantity, which thus could have influenced the results. This suggests that, at least for Turkish children, alternative methods to test plural formation skills have to be considered.

Past Participle Formation

This conclusion may be different for the past participle formation task. The elicited production of past participles differentiated TD from LI in both the monolingual and bilingual group of children. Bilingual TD children were still delayed in comparison with monolingual TD peers, as expected (e.g., Lalleman, 1986), but they outperformed monolingual as well as bilingual children with LI and there were indications that they even showed a sharper increase in accuracy scores than the monolinguals with LI, analogous to what Hamann and Belletti (2006) found with clitics. In addition, error analyses demonstrated that the frequent omission of participial affixes may be a valuable indicator of LI in young children, irrespective of their lingual status. In contrast to the groups of TD children, omission errors were common at Wave 1 in both the monolingual and bilingual group of children with LI, showing an error pattern that has been found various times before in this population (e.g., Armon-Lotem, 2014; Jacobson & Schwartz, 2005; Paradis, 2010) and illustrating the difficulty of children with LI with grammatical affixes (Leonard et al., 1997).

While LI and bilingualism appeared to affect performance on the plural formation task to a similar extent, effects of LI were relatively more prominent on the past participle formation task, bearing important implications for clinical use. One participial element that influenced the accurate production of past participles of children with LI is the prefix, which is needed to form a correct Dutch participle. The large majority of participial affix omissions that were made, mostly by children with LI, were omissions of the prefix, an unstressed syllable in initial position of the participle. As was described in the introduction, it is known that such weak initial syllables are often omitted by young TD children (Wijnen et al., 1994), but they are also profoundly difficult for older children with LI (Gerken & McGregor, 1998). In the context of participle morphology, Wilsenach (2006) confirmed this difficulty in monolingual Dutch children with LI and the current study extends this to bilingual children with LI. The bilingual TD children, like the participants of Sterner (2013), did not show these problems, indicating that the elicited production of participial prefixes may be able to disentangle the effects of LI and bilingualism and therefore contribute to a reliable diagnosis of LI in bilingual learning contexts.

It is important to further study past participle formation at different ages, as effects of LI and bilingualism differ depending on a child's age (Paradis, 2008). For example, the data of the present study showed that the difficulties of the children with LI with participial affixes were prominent at Wave 1, when children were around 5 and 6 years old, but less at Wave 2. In this case, effects of LI seem to diminish with age, suggesting that participial affix omissions may thus be particularly useful for the identification of LI in young children. Future work, however, needs to confirm this in a sample of children younger than 5 years of age. Based on the performance of the 3- to 5-year-old bilingual TD participants of Sterner (2013), who correctly produced the participial prefix in German with relatively little exposure, it is conceivable that our findings can be extended to children younger than 5 as well. As LI is ideally diagnosed at an early stage of development, when it is especially challenging to determine the cause of a bilingual child's language problems, clinical implications would be significant.

Regularity

The present study also investigated regularity effects of both noun plurals and past participles on children's accuracy scores. We tentatively predicted that the effects of regularity would be different for bilingual children and children with LI, possibly supporting differentiation. These predictions were, however, only partially borne out. The bilingual children had expected difficulties with the irregular plural forms, demonstrating floor performance at Wave 1 and Wave 2. The very low type frequency of these irregular forms, which are known to remain problematic for monolingual TD children until the age of 6 (Schaerlaekens, 1980), may be a reason for this finding. In addition, the bilingual children (both TD and LI) had relatively more problems

with the strong past participles than with the regular participles in comparison with the monolingual children, supporting our prediction based on Schwartz et al. (2009) that regular forms may be more easily acquired with a limited amount of exposure. However, the performance of the bilingual TD children on the irregular past participles did not match this prediction. Instead of the expected weaker performance on the irregular participles, the bilingual TD children scored better on the irregular forms than on the regular forms in comparison with the other groups. It is possible that the high token frequency of these irregular participles played a role here, but more research, systematically manipulating the items' type and token frequencies, is needed to fully understand these findings. Finally, results from the current research did not point to an exceptional difficulty of children with LI with regular morphology, unlike the findings from Leonard et al. (2003). Contrary to our expectations, regular morphology was thus not a relative weakness of children with LI nor a convincing relative strength of bilingual children in the current study. Future research with a larger number of carefully selected grammatical forms is necessary in order to draw more definite conclusions in this respect.

Limitations and Conclusions

The results from the current study indicate that noun plural formation only properly differentiates TD from LI in a group of monolingual children and seems less appropriate for clinical use in bilingual contexts. We discussed the possibility that interference from the first language of the bilingual children may have affected their performance on the plural formation task. Such effects of cross-linguistic influence have been found in previous work on grammatical morphology in bilinguals (e.g., Blom, Paradis, & Duncan, 2012), indicating that it is essential to take characteristics of the first language of bilingual children into account. This is a limitation of the present study as our bilingual sample was heterogeneous in terms of language background, especially our bilingual participants with LI. Although this is a reflection of the caseloads in clinical practice, it is important to further study plural and past participle formation in more homogeneous samples of bilingual children, allowing to examine effects of first language interference and transfer as well as strengthening the reliability of group comparisons.

In contrast to noun plural formation, this study showed that the production of past participles can support the identification of LI in both monolingual and bilingual settings. While past participle formation in spontaneous speech was not notably problematic for children with LI (Clahsen et al., 2014), this was found to be different for the production of past participles in elicited speech, confirming that probed elicitation may be more discriminating than conversational samples (Krok & Leonard, 2015). The omission of participial affixes, in particular the prefix, was identified as a reliable indicator of LI in monolingual and bilingual children around age 5 and 6. Limited by the wide age range of the participant sample, the current study could not draw reliable conclusions about the exact age at which this marker may be most useful for clinical purposes. Future research with larger groups of children in restricted age categories is therefore needed to reinforce the promising results of the present study, which illustrate that, with a comprehensive analysis, grammatical morphology can support clinical language assessment in bilingual contexts.

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Appendix

Items of the TAK Word Formation Test (Verhoeven & Vermeer, 2001)

Noun plurals		
Regular *-en*	**Regular *-s***	**Irregular**
bril-brillen [glass-glasses]	vlinder-vlinders [butterfly-butterflies]	weg /wɛx/-wegen /wɪɣən/ [road-roads]
oor-oren [ear-ears]	lepel-lepels [spoon-spoons]	dak /dɑk/-daken /dakən/ [roof-roofs]
krant-kranten [newspaper-newspapers]	emmer-emmers [bucket-buckets]	slot /slɔt/-sloten /slotən/ [lock-locks]
oog-ogen [eye-eyes]	trommel-trommels [drum-drums]	gat /ɣɑt/-gaten /ɣatən/ [hole-holes]
Past participles		
Regular	**Strong**	**Irregular**
kook-gekookt [cook-cooked]	zit-gezeten [sit-sat]	breng-gebracht [bring-brought]
plak-geplakt [paste-pasted]	vlieg-gevlogen [fly-flown]	zoek-gezocht [seek-sought]
speel-gespeeld [play-played]	kijk-gekeken [look-looked]	verliez-verloren [lose-lost]
fiets-gefietst [bike-biked]	drink-gedronken [drink-drunk]	koop-gekocht [buy-bought]