



Use of morphological and contextual cues in children's lexical inferencing in L1 and L2

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Abstract

In an experimental design, we investigated how fifth-grade readers use morphological and contextual information to infer the meaning of unknown words, and to what extent this is related to their cognitive and linguistic skills. A group of 166 fifth-grade Dutch children (59 L1, 107 L2) performed a lexical inferencing task in which the availability of morphological and contextual information was manipulated. Readers used both morphological and contextual information in lexical inferencing. Good decoding skill was related to more use of morphological information. Reading comprehension skill was associated with the use of morphological and contextual cues. L1 and L2 readers did not differ with respect to the use of morphological information. L2 readers used contextual information less in their inferences than L1 readers did. This difference was driven by L2 readers with weak vocabulary. The use of contextual information was especially high in L1 readers with good reading comprehension skills, and especially low in L2 readers with low vocabulary. Results indicate that to access morphological information, decoding is crucial, whereas for contextual inferencing, a minimum of linguistic competence is needed, which makes it more challenging for L2 readers.

Keywords Reading acquisition · Lexical inferencing · Morphological inferencing · Contextual inferencing · Bilingualism

Introduction

As children progress through primary school, they increasingly read to learn about the world rather than to practice reading. This means that they will encounter more and more unfamiliar words in texts, which could cause comprehension problems, especially for minority language children who learn to read in their second language

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(L2 readers). These children often have smaller vocabularies in the school language than their monolingual peers (L1 readers), and consequently lag behind on reading comprehension (Melby-Lervåg & Lervåg, 2014). A strategy that can be useful to maintain the comprehension of the ongoing text, as well as to acquire new vocabulary through reading, is to make informed guesses about the meaning of unknown words—a process also known as lexical inferencing (Haastrup, 1991). For successful lexical inferencing, readers can rely on the morphological structure of words, as well as on cues provided by the surrounding context (Haastrup, 1991). Morphological and contextual inferencing have largely been investigated separately in the literature on reading development, and both have been found to be related to decoding, vocabulary, and reading comprehension skills (e.g., Cain, Oakhill, & Elbro, 2003; McCutchen & Logan, 2011; Zhang & Shulley, 2017). During normal reading, however, children will often have both types of cues at their disposal. This raises the question, then, whether young readers make use of both of these cues simultaneously, and what cognitive and linguistic skills are needed to do this. This question is even more relevant for L2 readers. For them, lexical inferencing is a crucial skill to extend their vocabulary (Kieffer & Lesaux, 2012a). Lexical inferencing might be aided by L2 readers' relative strength in morphological knowledge (Shahar-Yames, Eviatar, & Prior, 2018) and metalinguistic awareness (Adesope, Lavin, Thompson, & Ungerleider, 2010). However, their lower language proficiency might make it more challenging (Shahar-Yames & Prior, 2018). In particular, contextual inferencing is likely challenging if a small vocabulary limits what can be gathered from context. The present study aims to investigate to what extent L1 and L2 readers differ in their use of morphological and contextual cues and how this is related to their linguistic skills in the target language.

Processes and precursors of lexical inferencing

A seminal model of reading comprehension, the reading systems framework by Perfetti and Stafura (2014), posits that as readers move through a text, they need to identify each word and integrate it into the mental representation of the text built up so far. This process is referred to as word-to-text integration. In order for word-to-text integration to go smoothly, readers need to be able to decode quickly, and to have the word at their disposal in their mental lexicon. Efficient word recognition frees up cognitive resources for higher-level integration processes, supporting comprehension of the ongoing text. In a real-world reading situation, however, young readers will often encounter unknown words. This poses a problem for word-to-text integration, because for an unknown word, lexical retrieval fails by definition. Especially readers with a minority language background are likely to encounter unknown words often, as they tend to have smaller vocabularies in the school language, their L2. For both L1 and L2 readers, it can be useful to make an informed guess as to the meaning of the unknown word, a process known as lexical inferencing. In order to make a lexical inference, readers can make use of both word-internal cues, such as morphological information, and word-external cues, such as the surrounding context

(Haastrup, 1991). This mirrors the processes of identification and integration of known words as described in the reading systems framework.

In order to utilize the meaning cues that morphological structure provides, several skills play a role: the reader needs to be aware of the existence of morphemes as meaningful units in language (morphological awareness), and use knowledge of morphemes to infer the meaning of novel complex terms (morphological analysis) (Deacon, Tong, & Francis, 2017; Levesque, Kieffer, & Deacon, 2019). Accurate decoding is necessary to access the morphemes. Through spreading activation, a morpheme that has been decoded activates related words on the basis of which a hypothetical meaning can be constructed. This is facilitated if many words are represented in the mental lexicon with high quality, including morphological and orthographic information (Frishkoff, Perfetti, & Westbury, 2009). The unknown word also needs to be integrated into the surrounding context. For this to be successful, it is essential that the surrounding context has been understood well and is available for integration. Contextual inferencing thus likely relies on good working memory and language skills.

Reading comprehension theory thus suggests that lexical inferencing is supported by the same precursors as skilled reading comprehension in general. It can be assumed that readers with a high level of decoding, vocabulary, and grammar knowledge are better able to infer the meaning of unknown words than readers with lower language and reading proficiency. High working memory is also likely to help in this process. A question that remains is how these precursor skills contribute to inferencing when information from the morphological make-up of words and from the context around these words can be processed simultaneously. It is possible, for example, that readers do not rely on morphological information when an informative context is present, due to processing constraints. This might be the case especially for readers who have fewer linguistic resources to fall back onto, such as L2 readers.

Role of morphological cues

Morphological awareness has long been known to influence reading comprehension outcomes, and has received interest as a potential target for literacy interventions (Bowers & Kirby, 2010; Goodwin & Ahn, 2013). One of the key ways in which morphological awareness impacts reading comprehension outcomes is through lexical inferencing on the basis of morphological cues, also referred to as morphological analysis (Levesque, Breadmore, & Deacon, 2020). While morphological awareness has received much attention in the literature on reading acquisition, there are far fewer studies on morphological analysis (Deacon et al., 2017). Existing studies showed that the extent to which morphological information is used in meaning inference is related to vocabulary and reading comprehension. For example, Zhang and Shulley (2017) found that poor comprehenders in fourth and fifth grade used morphological information less in meaning inference than did better comprehenders. McCutchen and Logan (2011) reported that the extent to which fifth- and eighth-graders used morphological information in inferring the meaning of unfamiliar words was related to their vocabulary and reading comprehension. A limitation in

previous research on morphological inferencing is that items are usually morphologically complex words of low frequency, or novel compounds of existing base words. Therefore, it is difficult to disentangle effects of vocabulary knowledge and morphological analysis. To tease apart effects of vocabulary and morphology, a promising approach would be to investigate how readers use meaning components of morphemes to infer the possible meaning of pseudowords, which are, by definition, unknown. This would be most interesting for derivational morphemes, which carry more semantic weight and are acquired later than inflectional morphemes (e.g., Deacon & Kirby, 2004).

For L2 readers, despite their lower L2 vocabulary, morphological inferencing might be an unexpected strength. Kieffer and Lesaux (2012b), when investigating dimensions of word knowledge, found that L2 children were disadvantaged in their vocabulary knowledge overall, but less so on the dimension of morphological awareness. Similarly, Shahar-Yames et al. (2018) found that L2 children may have equivalent abstract morphological knowledge to their L1 peers, despite having lower vocabulary knowledge. This was attributed to different learning mechanisms for morphological rules and vocabulary. In addition, it might be a result of morphological awareness transferring between languages, at least to some extent. De Zeeuw et al. (2012) found that in a lexical decision task, L1 and L2 students showed similar morphological family size effects, despite lower vocabulary in the L2 students, and despite a large typological distance between the bilinguals' L1 (Turkish) and the L2 (Dutch), which might be explained by cross-language activation. Ramirez, Chen, Geva, and Kiefer (2010) found evidence that indeed, children profit from morphological awareness in their L1 during word reading in their L2. Koda and Miller (2018) qualified this finding by evidence that a threshold of L2 competence has to be met before L1 skills can be transferred.

Role of contextual cues

For children reading in their L1, there is ample evidence that they are able to infer the meaning of novel words from context, and that their ability to do so is related to decoding, vocabulary, reading comprehension, and working memory. For example, Cain et al. (2003) asked 7- to 8-year-old children with or without reading comprehension difficulties to define the meanings of nonwords encountered in narrative contexts. They found that weak comprehenders were less likely to use information from the context in their inferences when processing demands were high. Similarly, Ricketts, Bishop, Pimperton and Nation (2011) found that 7- to 8-year-old children were able to infer the meaning of novel words from informative surrounding context. The extent to which children remembered the meaning of those novel words was predicted by oral vocabulary and text reading accuracy. In a recent eye-tracking study, Joseph and Nation (2018) found that 10- to 11-year-olds were able to learn about the meaning of novel verbs from sentence contexts through repeated exposure. Semantic learning was better in children with better comprehension skills. In addition, children modified their reading behaviour according to the informativeness of sentence contexts.

There is evidence that the same precursors are important in L2 lexical inferencing, although research on L2 lexical inferencing in children is sparse. Previous research on adult foreign language learners has shown L2 lexical inferencing to be dependent on L2 vocabulary knowledge and L2 reading comprehension skills (Elgort, Perfetti, Rickles, & Stafura, 2015; Elgort & Warren, 2014; Nassaji, 2006; Pulido, 2007). For low-proficiency adolescents, L2 lexical inferencing from context is predicted by reading comprehension, vocabulary, and decoding accuracy (Prior, Goldina, Shany, Geva, & Katzir, 2014). Considering the importance of vocabulary for lexical inferencing from context, it would be expected that L2 readers perform more poorly on this skill than L1 readers. Surprisingly, in a study on fifth-grade L1 and L2 readers, Shahar-Yames and Prior (2018) found that L2 readers did not differ from their L1 reading peers in their ability to produce a definition of a nonword after reading the novel word in a narrative context. For L1 readers, lexical inferencing was predicted by decoding and reading comprehension, while for L2 readers, lexical inferencing was predicted by nonverbal reasoning and vocabulary in addition to decoding and reading comprehension. This is taken as evidence that L2 readers arrive at higher levels of lexical inferencing than would be expected on the basis of their vocabulary by recruiting higher-level cognitive resources. However, the interactions of language background and predictors of lexical inferencing were not tested statistically.

Combining morphological and contextual cues

Previous research has shown that skilled adult readers are able to consider both morphological and contextual cues at the same time when encountering an unknown word while reading. As a case in point, Brusnighan and Folk (2012) found that adult native speakers of English processed novel compound words faster when morphological and contextual information was available and congruent with each other, while processing was slower when cues were less informative or contradictory. Studies on adult foreign language learners indicated that learners were most likely to make an accurate guess when they combined morphological and contextual information (Mori, 2003), but that lower-proficiency learners were likely to rely more on morphology and less on context (Hamada, 2014; Mori & Nagy, 1999). This raises the question whether developing readers, too, are able to combine morphological and contextual cues in their lexical inferences, and whether young L2 readers also are less disadvantaged in their ability to make morphological than contextual inferences. Previous research on lexical inferencing in L1 and L2 reading children has not considered these information sources at the same time, while in a real-world reading situation, readers need to process and integrate both types of cues.

Current study

The present study aimed to examine to what extent L1 and L2 readers in fifth grade differ in their use of morphological and contextual cues when inferring the meaning of novel words and how this is related to their linguistic skills in the target language.

Therefore, we conducted an experiment to investigate children's ability to use morphemic and contextual cues in inferring the meaning of an unknown word. In order to make sure none of the children knew the target words' meaning, we used pseudowords as targets in two variants: containing an existing Dutch morpheme or not. For each item, a semantically constraining sentence frame was also constructed with the target item in final position. To uncover the role of morphological and contextual cues in word learning, each target item was thus presented in one of four conditions: without any meaning clue, with morphological information only, with contextual information only, and with both morphological and contextual information. The experimental outcomes were also related to children's working memory, pseudoword decoding efficiency, vocabulary, grammar knowledge, and reading comprehension skill. This allowed us to address the following research questions:

1. Do children make use of morphological and contextual information simultaneously when inferring the meaning of unknown words?
2. Which precursor skills are related to inferencing on the basis of morphological and contextual information?
3. Does the use of morphological and contextual information and its precursor skills differ between L1 and L2 readers?

Concerning the first question, we predicted that fifth-grade readers would be able to use morphological and contextual information for lexical inference, both in isolation and simultaneously. With respect to the second question, we expected both morphological and contextual inferencing to be associated with higher working memory, decoding efficiency, vocabulary, grammar, and reading comprehension. As regards the third question, we expected L2 readers to perform more poorly on contextual inferencing than L1 readers. We anticipated L2 readers to perform equally to L1 readers on morphological inferencing, but to use morphological information to a larger extent than L1 readers when contextual information is also present.

Method

Participants

Participants in this study were 166 fifth-grade children in ten classrooms (seven schools) in urban areas in the Netherlands (83 boys, 83 girls, mean age = 11 years, $SD = 5.3$ months). We recruited L1 and L2 children from the same classrooms, from schools mostly attended by children from the same neighborhoods, in order to minimize possible differences in socio-economic status between groups. In the participating classrooms, all children were included in the study, unless they had a diagnosis of dyslexia, or their parents declined consent for participation. Children who were born outside of the Netherlands were also excluded from participation, as their exposure to Dutch can be assumed to be different from the other participants. Of all participants, 59 reported to only speak Dutch, while the other 107 spoke Dutch and

at least one other language. Of those bilingual participants, the largest groups spoke Moroccan Arabic (20%), Turkish (16%), or Berber (13%) as their home language, with 24 other languages also represented in the sample. Bilingualism status was assessed by means of an oral questionnaire in which children were asked what languages they spoke with their mother, father, siblings, friends, and extended family. Answers were coded as 1 (*only Dutch*), 2 (*mostly Dutch, sometimes other language*), 3 (*mostly other language, sometimes Dutch*), or 4 (*only other language*). Children scoring higher than 1 on any of the language usage questions were considered bilingual (following e.g. Babayiğit, 2014; Cremer & Schoonen, 2013; Melby-Lervåg & Lervåg, 2014). The data reported in this study were collected as part of a longitudinal study. Other results from the same participants are reported in Raudszus, Segers, and Verhoeven (2018), Raudszus, Segers, and Verhoeven (2019) and Raudszus, Segers, and Verhoeven (2021).

Materials

Working memory

Working memory was assessed by the backward digit span of the Wechsler Intelligence Scale for Children III, Dutch version (WISC-III-NL, Kort et al., 2005). In this task, children were asked to repeat sequences of digits in reverse order, starting with a sequence of two digits. The length of the sequence was increased by one digit on every two trials, until the child failed to correctly reverse two sequences of the same length. Each sequence that was repeated backwards correctly was awarded one point, with a maximum of 16 points. Cronbach's α for this test is 0.64 (Kort et al., 2005).

Decoding

Pseudoword decoding efficiency was assessed by the Klepel test version B (van den Bos, Lutje Spelberg, Scheepstra & de Vries, 1994). Participants read out loud as many pseudowords as possible within two minutes. The pseudowords were read from a list with pseudowords increasing in orthographic complexity. The score was the number of items read within two minutes, minus items read incorrectly. The maximum score was 116. Parallel test reliability ranges from 0.89 to 0.92 (Brus & Voeten, 1999).

Vocabulary

Vocabulary in Dutch was assessed by the Word Definition Task of the Taaltoets Allochtone Kinderen Bovenbouw [Language Test for Minority Children Grades 4–6] (Verhoeven & Vermeer, 1993). In this task, the experimenter named words which the child was asked to define. Complete formal definitions were awarded 2 points, and functional definitions 1 point, in accordance with the scoring guidelines. With 25 items, the resulting maximum score was 50. Cronbach's α for this test is

0.90 (Verhoeven & Vermeer, 1996). The items of the vocabulary test were largely monomorphemic, with three morphologically complex but highly opaque items. It is therefore unlikely that participants engaged in morphological analysis for unknown items.

Grammar

Knowledge of Dutch grammar was assessed by the Sentence Reading Task of the Taaltoets Allochtone Kinderen Bovenbouw [Language Test for Minority Children Grades 4–6] (Verhoeven & Vermeer, 1993). Children read sets of three sentences and had to indicate which sentence was incorrect, or whether all sentences were correct. Incorrect sentences contained violations of difficult features of Dutch grammar, such as verbal morphology, word order, and gender agreement. Each correct answer was awarded one point, with a maximum of 40 points. Cronbach's α for this test is 0.86 (Verhoeven & Vermeer, 1996).

Reading comprehension

Reading comprehension in Dutch was assessed with the Text Reading Task 2 of the Taaltoets Allochtone Kinderen Bovenbouw [Language Test for Minority Children Grades 4–6] (Verhoeven & Vermeer, 1993). Children read two expository texts with gaps, and had to choose from three options which one would fill the gap best by circling that option. In order to correctly identify the missing word, information from surrounding sentences and world knowledge had to be combined. Each correct answer was awarded one point, with a maximum of 40 points. Cronbach's α for this test is 0.75 (Verhoeven & Vermeer, 1996).

Lexical inferencing

Lexical inferencing was assessed by an experimental task inspired by Brusnighan and Folk (2012), McCutchen and Logan (2011), and Zhang and Shulley (2017). The task had the aim of investigating children's ability to use morphemic and contextual cues in inferring the meaning of an unknown word. In order to make sure none of the children knew the target words' meaning, we used pseudowords as targets. We constructed 48 items, which each consisted of a pseudoword item and four definition options. Of each pseudoword item, two variants were constructed: either containing no morphological information, or containing an existing Dutch morpheme. Of the pseudoword items, 18 were noun-like, 20 were adjective-like, and 10 were verb-like, as indicated by their slot in the target sentence and/or morphological information. The morphemes used were selected to cover a broad sample of Dutch derivational morphemes, in order to include all types of morphemes that children might encounter in their reading. Nine prefixes and fifteen suffixes were selected. Morphemes from all nine groups of Booij's (2002) classification of Dutch derivational morphemes were included (A–N, V–N, N–N, A–V, N–V, V–V, V–A, N–A, A–A),

as well as three adjectival and three nominal loan morphemes. Each morpheme occurred in two different items.

All pseudoword items were checked against the Dutch CELEX corpus using WordGen (Duyck, Desmet, Verbeke, & Brysbaert, 2004) and were found to be non-existing words. Although numerically, pseudoword item versions without morphological information had somewhat lower bigram frequencies, this difference was not statistically significant ($p=0.075$; $d=0.37$).

For each item, a semantically constraining sentence frame was also constructed, in which the target items occurred in final position. Each target item could therefore be presented in one of four conditions: without any meaning clue, with morphological information only, with contextual information only, and with both morphological and contextual information. For each item, there were four answer options: one answer fit into the context but not with the morphological information, one was congruent with both morphological and contextual information, and two were unrelated distractors. Concerning the semantically constraining context frames, answer options were written such that all options were of a word class fitting in the sentence, but that the two distractor options were highly unlikely given the sentence context, see e.g. the example item in Fig. 1: *Aya had to wait in front of the door of the head of school/muscle doctor/fruit bowl/chandelier*. Semantic (im)plausibility was checked with several adult native speakers of Dutch. Sentence frames were designed to use vocabulary and address situations that children in primary school are very likely to be familiar with, such as visiting a doctor's office, liking/disliking doing something or taking an exam.

Figure 1 shows all four conditions for an example item: in the condition with no information, a participant would be presented with the pseudoword *felioreek*. This allowed us to control whether any of the answer options was more likely to be chosen due to factors other than morphological and contextual information. In the condition with only morphological information, a participant would read the pseudoword *feliologist*, in which the morpheme *-ologist* would indicate the most likely meaning to be related to a specialized field of expertise (pointing to the answer

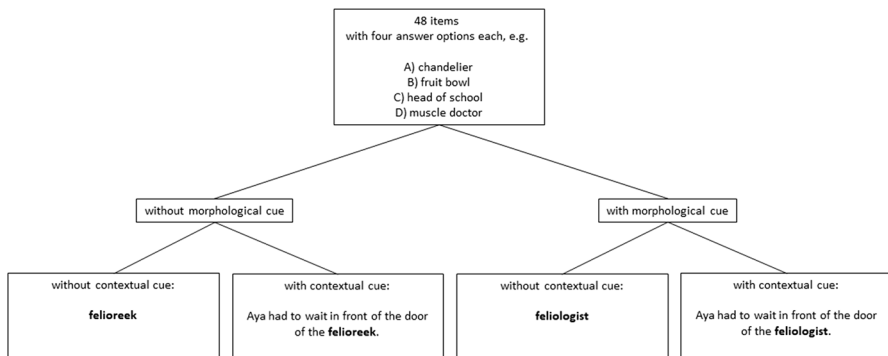


Fig. 1 Overview of experimental conditions with sample stimuli (approximate English translation). In this example, answers A and B are the unrelated distractors. Answer C fits the contextual but not the morphological cue. Answer D fits both the morphological and the contextual cue

option *muscle doctor*). If participants are more likely to choose *muscle doctor* in response to *feliologist* than in response to *felioreek*, this means they recognize the morpheme *-ologist* and are able to use it in their inference. In the condition with only contextual information, the pseudoword *felioreek* would be embedded in the sentence *Aya had to wait in front of the door of the...*, which points to an answer option related to a person in front of whose door one would normally wait (*head of school, muscle doctor*). We could investigate whether children use the context in their inferences by examining how much more likely are participants were to choose *head of school* or *muscle doctor* over *fruit bowl* or *chandelier* when presented with contextual information as opposed to the pseudoword in isolation. In the condition with both contextual and morphological information, the pseudoword *feliologist* would be embedded in the carrier sentence. Comparing how likely participants are to choose *muscle doctor* over *head of school* in response to *feliologist* versus *felioreek* in a carrier sentence allowed us to investigate whether they make use of morphological information in their inferences even when an informative context is present.

Stimuli were pseudo-randomized such that each participant saw each item in one condition only. Stimuli were presented in six blocks of eight items, alternating between having a contextual cue and having no contextual cue. Morphological cue condition was pseudo-randomized such that there were never more than three consecutive items in the same morphological cue conditions. Answer options were pseudo-randomized such that the morphologically or contextually correct answers were never in the same place more than three times in a row.

The lexical inferencing test was administered as a classroom-wise pencil-and-paper task. After receiving a test booklet, children were instructed that they would read non-existing words, and were asked to indicate which of four meanings they found to fit the word best. They were told that they should read each item and the answer options carefully, and then rely on their intuition when choosing, guessing when necessary. Children then had 30 min to complete the test.

For the analyses described below, two binary outcome variables were created: morphological correctness of the chosen answer option (1 if the morphologically correct answer was chosen, 0 otherwise) and contextual correctness of the chosen answer option (1 if a contextually correct answer option was chosen, 0 otherwise).

Procedure

After the study was approved by the Ethics Committee of the Faculty of Social Sciences at Radboud University, the first author contacted schools with a high proportion of minority language students, of which seven agreed to participate. Schools received information about the findings of the study and individual results in exchange for their collaboration.

Children were tested in the second half of fifth grade. Tests were administered by the first author and five trained undergraduate students of Educational Science. Bilingualism status, nonword decoding, working memory, and vocabulary were assessed during an individual session that also included other assessments used for

another study and lasted 30–45 min. The reading comprehension and grammar task were assessed in a classroom session of two times 30 min with a break in between. The lexical inferencing task was administered in a 30-min classroom session on a different day.

Analyses

The data were analyzed using mixed logit models with crossed random effects for subjects and items using R version 3.6.1 (R Core Team, 2019). Two separate models were fitted, one with contextual correctness of the chosen answer option as an outcome variable, one with morphological correctness as an outcome variable (both contrast coded: 1 = incorrect, -1 = correct). Models were estimated using the `glmer` function of the `lme4` package version 1.1–21 (Bates, Maechler, Bolker, & Walker, 2015). *P*-values were calculated using the `mixed` function of the `afex` package version 0.25–1 (Singmann, Bolker, Westfall, & Aust, 2018), using parametric bootstrapping with type 3 sums of squares. Interaction effects were further explored using the `emmeans` package version 1.4.1 (Lenth, 2019). For all post-hoc analyses of interaction effects, we used estimated marginal means at +1/-1 SD of the mean of the moderating variable.

Both analyses included contrast-coded fixed effects for morphological information (1 = present, -1 = absent) and contextual information (1 = present, -1 = absent) in a 2 × 2 factorial design. Fixed effects of language status (contrast-coded: 1 = monolingual, -1 = bilingual), working memory, pseudoword decoding, vocabulary, grammar, and reading comprehension (all continuous and standardized) were also investigated. Our initial model included a maximal random effects structure (Barr, Levy, Scheepers, & Tily, 2013), which resulted in a singular model fit, indicative of overfitting. Therefore, we followed the steps outlined in Bates, Kliegl, Vasishth, and Baayen (2018) to arrive at a parsimonious model. The fit of the final models was checked by inspecting normality and heteroscedasticity of residuals visually using the `DHARMA` package version 0.2.0 (Hartig, 2018). All checks showed satisfactory results for the models presented below.

Results

Background measures

Descriptive statistics for all background variables are presented in Table 1. L2 and L1 readers did not differ significantly in their working memory ($t(135.99) = -0.72$, $p = 0.476$, $d = -0.11$) or pseudoword decoding efficiency ($t(150.14) = -1.45$, $p = 0.150$, $d = -0.22$). L1 readers scored significantly higher than L2 readers on vocabulary ($t(149.71) = 5.48$, $p < 0.001$, $d = 0.84$), grammar ($t(138.69) = 2.67$, $p < 0.01$, $d = 0.42$), and reading comprehension ($t(149.46) = 2.68$, $p < 0.01$, $d = 0.41$). Differences between L1 and L2 readers on vocabulary were large, whereas differences on grammar and reading comprehension were moderate.

Table 1 Mean scores on cognitive and linguistic measures for L1 and L2 children

	L1			L2		
	<i>n</i>	<i>M</i> (<i>SD</i>)	Range	<i>n</i>	<i>M</i> (<i>SD</i>)	Range
Working memory	64	4.5 (1.5)	2–9	102	4.7 (1.5)	2–8
Pseudoword decoding	64	62.8 (14.5)	28–104	102	66.4 (17.2)	30–107
Vocabulary	64	29.8 (6.0)	16–42	101	24.1 (7.0)	4–39
Grammar	64	23.5 (6.3)	8–36	102	20.8 (6.6)	4–32
Reading comprehension	64	26.9 (4.4)	11–35	102	24.8 (5.2)	10–32

Table 2 Correlations between fixed effects predictors in the regression analysis for L1 (below the diagonal) and L2 (above the diagonal)

L1 \ L2	1.	2.	3.	4.	5.
1. Working memory	–	.34***	-.02	.30**	.13
2. Pseudoword decoding	.18	–	.03	.26**	.22*
3. Vocabulary	.19	.05	–	.46***	.62***
4. Grammar	.26*	.21	.35**	–	.55***
5. Reading comprehension	.21	.01	.48**	.56***	–

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

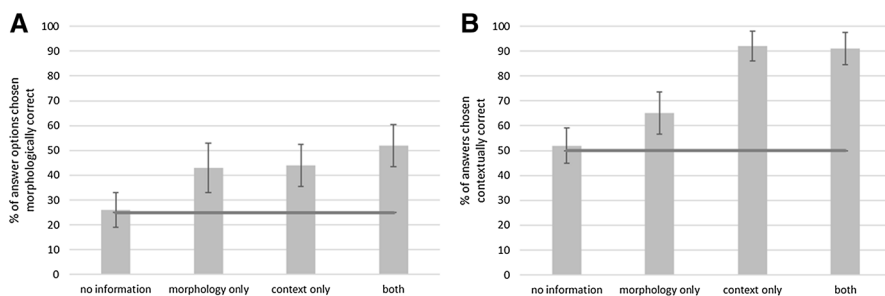
**Fig. 2** Percentage of answer options chosen by condition. Line indicates chance level. Error bars represent one standard deviation above and below the mean. **a** Mean percentage of answer options chosen that were morphologically correct. (Note: The morphologically correct option was always also contextually correct.) **b** Mean percentage of answer options chosen that were contextually correct

Table 2 shows the correlations between covariate variables for L1 and L2 participants. For both L1 and L2 readers, reading comprehension, grammar, and vocabulary were significantly correlated with each other. Working memory was correlated with grammar in both L1 and L2 readers. Pseudoword decoding was not correlated with other predictors in L1 readers, and was correlated with grammar, reading comprehension, and working memory in L2 readers.

Manipulation check

As Fig. 2 shows, when the target contained no meaningful information, participants chose their answer based on chance, as one would expect. When only morphological information was present, the morphologically correct answer option was chosen significantly more often than in the absence of information ($t(165) = -8.81, p < 0.001, d = 0.97$). When contextual information was present, the contextually correct options were chosen significantly more often for words in isolation ($t(165) = -26.04, p < 0.001, d = 2.89$). Adding morphological information on top of contextual information led to more participants choosing the morphologically correct answer item ($t(165) = -4.93, p < 0.001, d = 0.47$).

Use of morphological information

In order to answer our research questions with respect to the use of morphological information in lexical inferencing, we constructed a mixed-effects model with morphological correctness of the chosen answer option as the outcome variable. The final model's random effects structure consisted of uncorrelated random intercepts and slopes for morphological cue condition and contextual cue condition by subject, and correlated intercepts and slopes for morphological and contextual cue condition, as well as for the interaction between morphological and contextual cue condition, by item. All fixed effects estimates for this model are shown in Table 3. In the following, we will present the effects that are relevant to our research questions.

Model results show that participants were more likely to choose the morphologically correct answer option in response to a pseudoword with a morphological cue than in response to a pseudoword without morphological information ($OR = -0.30, SE = 0.05, p < 0.001$). This effect was smaller, but still significant, if contextual information was also given ($OR = -0.08, SE = 0.03, p = 0.021$). The effect of morphological information was smaller for poorer decoders ($OR = -0.10, SE = 0.03, p = 0.002$), as well as for participants with lower reading comprehension skills ($OR = -0.11, SE = 0.04, p = 0.007$). Post-hoc tests showed that better decoders and better comprehenders were more likely to choose the morphologically correct answer option than poorer decoders and poorer comprehenders when morphological information was available (decoding: $OR = 0.81, SE = 0.08, p = 0.029$; reading comprehension: $OR = 0.53, SE = 0.06, p < 0.001$).

In the presence of contextual information, participants with lower vocabulary knowledge showed smaller effects of morphological cues than participants with higher vocabulary scores ($OR = 0.11, SE = 0.04, p = 0.002$). Post-hoc tests showed that both high- and low-vocabulary participants showed an effect of morphological information in the absence of contextual information (high vocabulary: $OR = 0.52, SE = 0.08, p < 0.001$; low vocabulary: $OR = 0.43, SE = 0.08, p < 0.001$), but only high-vocabulary participants also showed an effect of morphological information in the presence of contextual information (high vocabulary: $OR = 0.45, SE = 0.07, p < 0.001$; low vocabulary: $OR = 0.92, SE = 0.15, p = 0.957$).

Table 3 Fixed effect coefficients for the mixed model with morphological correctness of the chosen answer as outcome variable

Fixed effect	Estimate	SE	z	p
(Intercept)	-0.47	0.11	-4.38	<.001***
Morphological cue condition	-0.30	0.05	-5.85	<.001***
Contextual cue condition	-0.33	0.08	-4.23	<.001***
Bilingualism	-0.03	0.04	-0.96	.335
Working memory	0.14	0.03	3.99	<.001***
Nonword decoding	0.00	0.04	0.11	.910
Vocabulary	0.04	0.04	0.87	.384
Grammar	-0.00	0.04	-0.17	.865
Reading comprehension	0.20	0.05	4.56	<.001***
Working memory * bilingualism	-0.04	0.03	-1.28	.200
Nonword decoding * bilingualism	-0.07	0.04	-2.03	.043*
Vocabulary * bilingualism	-0.04	0.04	-0.94	.345
Grammar * bilingualism	0.07	0.04	1.74	.083
Reading comprehension * bilingualism	0.04	0.05	0.82	.413
Morphological cue condition * contextual cue condition	-0.08	0.03	-2.30	.021*
Morphological cue condition * bilingualism	0.01	0.03	0.45	.655
Morphological cue condition * working memory	-0.04	0.03	-1.33	.184
Morphological cue condition * nonword decoding	-0.10	0.03	-3.05	.002**
Morphological cue condition * vocabulary	-0.06	0.04	-1.62	.105
Morphological cue condition * grammar	0.06	0.04	1.63	.102
Morphological cue condition * reading comprehension	-0.11	0.04	-2.68	.007**
Contextual cue condition * bilingualism	-0.06	0.03	-2.02	.044*
Contextual cue condition * working memory	0.02	0.03	0.77	.443
Contextual cue condition * nonword decoding	-0.05	0.03	-1.51	.132
Contextual cue condition * vocabulary	0.04	0.04	0.98	.328
Contextual cue condition * grammar	0.03	0.03	0.79	.427

Table 3 (continued)

Fixed effect	Estimate	SE	z	p
Contextual cue condition * reading comprehension	-0.02	0.04	-0.53	.595
Morphological cue condition * working memory * bilingualism	0.02	0.03	0.57	.571
Morphological cue condition * nonword decoding * bilingualism	-0.04	0.03	-1.26	.207
Morphological cue condition * vocabulary * bilingualism	0.02	0.04	0.39	.695
Morphological cue condition * grammar * bilingualism	0.05	0.04	1.20	.231
Morphological cue condition * reading comprehension * bilingualism	-0.04	0.04	-1.00	.316
Contextual cue condition * working memory * bilingualism	-0.01	0.03	-0.20	.844
Contextual cue condition * nonword decoding * bilingualism	-0.07	0.03	-2.48	.013*
Contextual cue condition * vocabulary * bilingualism	0.05	0.04	1.29	.197
Contextual cue condition * grammar * bilingualism	0.03	0.03	0.89	.371
Contextual cue condition * reading comprehension * bilingualism	0.02	0.04	0.42	.674
Morphological cue condition * contextual cue condition * bilingualism	-0.04	0.03	-1.31	.191
Morphological cue condition * contextual cue condition * working memory	0.01	0.03	0.41	.684
Morphological cue condition * contextual cue condition * nonword decoding	-0.02	0.03	-0.82	.412
Morphological cue condition * contextual cue condition * vocabulary	0.11	0.04	3.07	.002**
Morphological cue condition * contextual cue condition * grammar	-0.10	0.03	-2.98	.003**
Morphological cue condition * contextual cue condition * reading comprehension	-0.07	0.04	-1.85	.065
Morphological cue condition * contextual cue condition * bilingualism * working memory	-0.02	0.03	-0.56	.574
Morphological cue condition * contextual cue condition * bilingualism * nonword decoding	0.01	0.03	0.43	.665
Morphological cue condition * contextual cue condition * bilingualism * vocabulary	0.03	0.04	0.69	.491
Morphological cue condition * contextual cue condition * bilingualism * grammar	-0.03	0.03	-1.00	.320
Morphological cue condition * contextual cue condition * bilingualism * reading comprehension	-0.02	0.04	-0.66	.574

*** $p < .001$, ** $p < .01$, * $p < .05$

In the presence of contextual information, participants with lower grammar knowledge showed a larger effect of morphological cues than participants with higher grammar knowledge ($OR = -0.10$, $SE = 0.03$, $p = 0.003$). Post-hoc tests showed an effect of morphological information for both high- and low-grammar individuals for words in isolation (high grammar: $OR = 0.44$, $SE = 0.07$, $p < 0.001$; low grammar: $OR = 0.51$, $SE = 0.09$, $p < 0.001$), and effects of morphological information in the presence of contextual information for low-grammar participants ($OR = 0.46$, $SE = 0.07$; $p < 0.001$). However, there was no effect of morphological information in the presence of contextual information for high-grammar participants (high grammar: $OR = 0.90$, $SE = 0.13$, $p = 0.890$; low grammar: $OR = 0.51$, $SE = 0.09$, $p < 0.001$).

There were no interactions of morphological or contextual cue condition with working memory. There were also no interactions between bilingualism and morphological cue condition, nor between bilingualism, morphological cue condition and any of the background variables.

Use of contextual information

In order to answer our research questions with respect to the use of contextual information in lexical inferencing, we constructed a mixed-effects model with contextual correctness of the chosen answer option as an outcome variable. The final model's random effects structure consisted of uncorrelated intercepts and slopes for contextual cue condition by subject, and uncorrelated intercepts and slopes for morphological and contextual cue condition, as well as the interaction between morphological and contextual cue by item. All fixed effects estimates for this model are shown in Table 4. In the following, we will present the effects that are relevant to our research questions.

Analyses showed that participants were more likely to choose a contextually correct answer option when contextual information was present than when presented with target words in isolation ($OR = -1.28$, $SE = 0.07$, $p < 0.001$). When the target word contained morphological information, the effect of contextual information was smaller, but still significant ($OR = -0.19$, $SE = 0.05$, $p < 0.001$). Participants with good reading comprehension showed larger effects of contextual information than participants with poor reading comprehension ($OR = -0.27$, $SE = 0.06$, $p < 0.001$). Post-hoc tests showed that better comprehenders chose a contextually correct answer option more often than poorer comprehenders when contextual information was available ($OR = -1.29$, $SE = 0.21$, $p < 0.001$).

There was a significant interaction between contextual cue availability and language status ($OR = -0.13$, $SE = 0.05$, $p = 0.014$). This interaction was qualified by two three-way-interactions, however. First, there was an interaction between contextual cue availability, language status, and vocabulary ($OR = 0.15$, $SE = 0.06$, $p = 0.012$). Post-hoc tests showed that L2 readers with low vocabulary knowledge had significantly lower odds of choosing the contextually correct answer when contextual information was present than L2 readers with high vocabulary knowledge ($OR = -0.62$, $SE = 0.21$, $p = 0.018$) and than L1 readers with low vocabulary

Table 4 Fixed effect coefficients for the mixed model with contextual correctness of the chosen answer as outcome variable

Fixed effect	Estimate	SE	z	p
(Intercept)	1.63	0.08	19.61	<.001***
Morphological cue condition	-0.10	0.06	-1.72	.085
Contextual cue condition	-1.28	0.07	-19.20	<.001***
Bilingualism	0.05	0.06	0.86	.388
Working memory	0.08	0.05	1.65	.099
Nonword decoding	0.05	0.05	0.96	.340
Vocabulary	0.07	0.06	1.08	.278
Grammar	0.09	0.06	1.52	.128
Reading comprehension	0.37	0.06	5.89	<.001***
Working memory * bilingualism	0.04	0.05	0.74	.463
Nonword decoding * bilingualism	-0.12	0.05	-2.55	.011*
Vocabulary * bilingualism	-0.12	0.06	-1.92	.055
Grammar * bilingualism	0.00	0.06	0.03	.974
Reading comprehension * bilingualism	0.17	0.06	2.80	.005**
Morphological cue condition * contextual cue condition	-0.19	0.05	-3.72	<.001***
Morphological cue condition * bilingualism	0.02	0.05	0.49	.628
Morphological cue condition * working memory	-0.11	0.04	-2.57	.010*
Morphological cue condition * nonword decoding	-0.05	0.04	-1.12	.262
Morphological cue condition * vocabulary	-0.01	0.05	-0.16	.878
Morphological cue condition * grammar	0.06	0.05	1.35	.178
Morphological cue condition * reading comprehension	-0.02	0.05	-0.48	.645
Contextual cue condition * bilingualism	-0.12	0.05	-2.32	.020*
Contextual cue condition * working memory	-0.01	0.05	-0.11	.910
Contextual cue condition * nonword decoding	-0.07	0.05	-1.45	.146
Contextual cue condition * vocabulary	0.03	0.06	0.48	.629
Contextual cue condition * grammar	-0.05	0.05	-0.87	.383

Table 4 (continued)

Fixed effect	Estimate	SE	z	p
Contextual cue condition * reading comprehension	-0.27	0.06	-4.76	<.001***
Morphological cue condition * bilingualism * working memory	-0.01	0.04	-0.21	.834
Morphological cue condition * bilingualism * nonword decoding	0.01	0.04	0.21	.837
Morphological cue condition * bilingualism * vocabulary	0.02	0.05	0.30	.763
Morphological cue condition * bilingualism * grammar	-0.01	0.05	-0.22	.828
Morphological cue condition * bilingualism * reading comprehension	0.01	0.05	0.20	.843
Contextual cue condition * bilingualism * working memory	-0.07	0.05	-1.45	.148
Contextual cue condition * bilingualism * nonword decoding	0.00	0.04	0.02	.981
Contextual cue condition * bilingualism * vocabulary	0.15	0.06	2.51	.012*
Contextual cue condition * bilingualism * grammar	0.10	0.05	1.92	.054
Contextual cue condition * bilingualism * reading comprehension	-0.18	0.06	-3.14	.002**
Morphological cue condition * contextual cue condition * bilingualism	-0.08	0.05	-0.59	.556
Morphological cue condition * contextual cue condition * working memory	0.03	0.04	0.74	.459
Morphological cue condition * contextual cue condition * nonword decoding	-0.02	0.04	-0.50	.616
Morphological cue condition * contextual cue condition * vocabulary	-0.01	0.05	-0.14	.890
Morphological cue condition * contextual cue condition * grammar	-0.07	0.05	-1.36	.173
Morphological cue condition * contextual cue condition * reading comprehension	-0.05	0.05	-0.88	.380
Morphological cue condition * contextual cue condition * bilingualism * working memory	0.04	0.04	0.93	.351
Morphological cue condition * contextual cue condition * bilingualism * nonword decoding	0.04	0.04	0.99	.321
Morphological cue condition * contextual cue condition * bilingualism * vocabulary	0.01	0.05	0.18	.854
Morphological cue condition * contextual cue condition * bilingualism * grammar	-0.03	0.05	-0.65	.515
Morphological cue condition * contextual cue condition * bilingualism * reading comprehension	-0.02	0.05	-0.42	.673

*** $p < .001$, ** $p < .01$, * $p < .05$

knowledge ($OR=0.88$, $SE=0.33$, $p=0.035$). There was no difference between L1 readers with high and low vocabulary knowledge ($OR=0.46$, $SE=0.37$, $p=0.598$).

Secondly, there was an interaction between contextual cue availability, language status, and reading comprehension ($OR=-0.18$, $SE=0.06$, $p=0.002$). Post-hoc tests showed that L1 good comprehenders had significantly higher odds of choosing the contextually correct answer when contextual information was present than L2 good comprehenders ($OR=1.05$, $SE=0.33$, $p=0.007$). There was no difference between L1 and L2 poor comprehenders ($OR=-0.38$, $SE=0.23$, $p=0.341$).

Discussion

The present study extended previous research on lexical inferencing, by investigating how children use both morphological and contextual information to infer the meaning of unknown words, how these processes relate to other cognitive and literacy skills, and whether this differs between monolingual (L1) and language minority (L2) readers. Results showed that fifth-grade readers made use of morphological and contextual cues, both in isolation and combined. The ability to use morphological cues did not differ between L1 and L2 readers. Morphological cue use was better in participants with good decoding and reading comprehension skills. Participants profited from high vocabulary knowledge for the use of morphological cues when contextual information was also present. On the contrary, high grammar knowledge was associated with less use of morphological information when contextual cues were also present. The use of contextual information was especially high in L1 readers with good reading comprehension skills, and especially low in L2 readers with low vocabulary.

Our first research question concerned the use of morphological and contextual information in fifth-graders' lexical inferences. We found that when inferring the meaning of a novel word, children were able to use morphological information. Similarly, children were able to use information from the context in their lexical inferencing. Children made use of morphological information whether or not the novel words were embedded in an informative sentence context. They also utilized an informative sentence context whether or not the target word was morphologically complex. Thus, although children can use both sources of information independently, they can also combine information from word-external and word-internal sources. Our research confirms findings from the literature that young readers can use context and morphology in their word meaning inferences (e.g., Cain et al., 2003; Joseph & Nation, 2018; McCutchen & Logan, 2011; Ricketts et al., 2011; Zhang & Shulley, 2017), and extends it by demonstrating that each of the information sources is also used in the presence of the other, in line with findings on skilled adult readers (Brusnighan & Folk, 2012). This means that in children's lexical inferencing both word-internal and word-external information is considered and integrated.

Our second research question was what role linguistic abilities play in children's use of different information sources for lexical inferencing, and our third whether this differs for L1 and L2 readers. Concerning the use of morphological

information, higher pseudoword decoding efficiency was associated with more use of morphological information. The association between decoding skills and morphological analysis has often been interpreted as morphological awareness facilitating fast decoding due to efficient chunking (e.g., Deacon, Kieffer, & Laroche, 2014). However, given the high transparency of Dutch orthography, in this study it is more likely that readers with good pseudoword decoding were more accurately decoding the novel words in the experiment, allowing them to discover morphological structure. Our results also show that children with good reading comprehension skills were better at morphological inferencing than children with poorer reading comprehension, in line with earlier research (McCutchen & Logan, 2011; Zhang & Shulley, 2017). This can be explained in two ways: First, linguistic reasoning is likely an underlying skill for both morphological inferencing and comprehension. Secondly, better morphological inferencing leads to better reading comprehension, because gaps in word-to-text integration can be patched better. It is striking that despite the lower language proficiency in part of our bilingual sample, L2 readers did not show differences from L1 readers in morphological inferencing. This is in line with earlier findings of morphological analysis being a relative strength in L2 readers (de Zeeuw et al., 2012; Shahar-Yames et al., 2018). Possibly, this can be attributed to the recruitment of L1 vocabulary (Ramirez et al., 2010) as well as enhanced metalinguistic awareness (Adesope et al., 2010) and good decoding skills (Raudszus et al., 2018).

Different precursor skills seem to come into play when morphological inferencing takes place with or without contextual support: When the novel words were presented in context, children with large vocabularies were better able to use morphological information on top of the contextual information. This is unlikely to be an effect of children with larger vocabularies knowing more morphemes, as the influence of vocabulary was not apparent for morphological information in isolation. Rather, good lexical quality likely allows integration of the novel word into the surrounding context to happen more efficiently, leaving cognitive resources for morphological inferencing. For readers with poorer vocabulary, parsing the context might take up so many resources that morphological information is not attended to as much anymore, in line with the lexical quality hypothesis (Perfetti, 2007).

For meaning inferences for words presented in isolation, children with high and low grammar knowledge used morphological information to the same extent. When contextual information was also present, however, only participants with low grammar knowledge showed an additional effect of morphological information. This might be an instance of “good-enough processing” (Traxler, 2014): Participants with high grammar knowledge, after parsing the contextual sentence, might not have looked for morphological information to confirm or extend their meaning hypothesis. Considering that effects of vocabulary and grammar knowledge unexpectedly acted in different directions, and that this three-way interaction concerns an exploratory analysis in a sample of limited size, these effects are in need of further research.

Concerning lexical inferencing from context, better reading comprehension was associated with better use of contextual information. This is in line with earlier research showing an association between contextual inferencing and reading comprehension (e.g., Cain et al., 2003; Ricketts et al., 2011). Readers who can infer the

meaning from context when they encounter an unknown word are more likely to be able to build a successful mental model of the text. It should be noted that our measure of reading comprehension was a cloze task, which means it also relies on inferencing about possible word meanings given the context. However, as previous research has found an association between open-ended reading comprehension questions and lexical inferencing (Cain et al., 2003; Ricketts et al., 2011), conceptual overlap between the tasks is unlikely to fully explain the association.

We found that L2 readers used contextual information less in their inferences than L1 readers did, and this was driven by the group of L2 readers with weak vocabulary. Further examination of the data shows that the lower end of the distribution of vocabulary scores includes relatively more L2 than L1 participants. When the context surrounding the unknown word also cannot be comprehended successfully due to vocabulary gaps, lexical inferencing cannot be helped by the context. Lower contextual inferencing skills in L2 readers are thus not a result of their language status, but of their lower linguistic ability in the target language. This confirms findings on other reading skills (Lervåg & Aukrust, 2010; Raudszus et al., 2019; van den Bosch, Segers, & Verhoeven, 2018), and is in line with findings on adult L2 learners (Hamada, 2014; Mori & Nagy, 1999). Another possible difference between L1 and L2 readers concerns background knowledge. While our stimuli were designed to address situations that all primary school children are familiar with, we cannot exclude the explanation that L2 and L1 participants differed not only in their vocabulary, but also in their background knowledge. As research has shown background knowledge to influence reading comprehension in L2 readers (e.g., Droop & Verhoeven, 1998), its role in L2 lexical inferencing is a relevant issue for future research.

Finally, we did not find any association between lexical inferencing on the basis of morphological or contextual information and verbal working memory, as measured by a digit span task. This is surprising, considering that in order to make a lexical inference, verbal material needs to be held in memory until all cues are combined. Because of the heterogeneous language background of our participants, we did not assess working memory in the bilingual children's L1. It is therefore possible that for the L2 participants, the Dutch digit span measure underestimated their working memory, resulting in less reliable results with respect to working memory. However, previous research found no difference in digit span performance assessed in L1 and L2 in children whose L2 was also their language of schooling (Chincotta & Underwood, 1996). A more plausible explanation is that our lexical inferencing task was untimed, and consisted of words in a sentence rather than a text, which might have decreased working memory demands. Also, the role of memory in inferencing might be a passive resonance process rather than active construction (Bolger, Balass, Landen, & Perfetti, 2008), and the digit span task does not tap into those processes. It should also be noted that reliability of the working memory task (as reported in the manual) was quite low. This, in addition to our limited sample size, could be another reason for the null results with respect to working memory.

At this point, several limitations of our study need to be acknowledged. First, in order to investigate whether children were able to use morphological and contextual cues simultaneously, we explicitly prompted meaning inference by asking children to make a guess what the word could mean for every single item. In realistic reading, a

problem is not only whether readers can make inferences, but also whether they even notice the need to do so (Haastrup, 1991). A next step would be to investigate whether and how information sources are used when not explicitly prompted while reading. Secondly, the morphological and contextual cue conditions differed in their base rate for guessing. Therefore, it is not possible to directly compare effect sizes for morphological and contextual cue use in our study. Thirdly, in our design, morphological and contextual cues never provided conflicting information, which means that their relative contribution cannot be fully distinguished. Brusnighan and Folk (2012) showed processing time disadvantages even in skilled adult readers when conflicting information was provided. It remains to be investigated how children resolve inferencing tasks with conflicting information. Also, while we investigated lexical inferencing in L1 and L2 readers, we did not take into account L2 readers' L1 skills. Future studies should investigate which role factors such as typological distance between L1 and L2 and lexical quality including morphological knowledge in the L1 play in L2 lexical inferencing. Finally, no data about individual students' socio-economic status were available. It is possible that even if L1 and L2 students were recruited from the same classrooms, they differed in their socio-economic background in addition to their linguistic profile.

Conclusion and educational implications

Both L1 and L2 readers in fifth grade are able to combine information from the context and morphology to make inferences about the meaning of novel words. In order to access information from the context, a minimum of linguistic competence is needed, and L2 readers do not always reach that threshold. Information from derivational morphology, on the other hand, seems to be equally accessible to L1 and L2 readers. In order to use morphological information, accurate decoding is crucial. In a realistic reading context, children will often face the task of using morphological information when a surrounding context is also present. In this situation, low vocabulary can lead to readers not being able to process all cues effectively. Overall, the ability to use morphological and contextual information effectively is associated with better reading comprehension.

The findings of the present study have several implications for instructional research and practice. The finding that decoding predicted morphological inferencing implies that children profit from strong decoding in accessing the meaning of new words. Decoding development, therefore, needs to be maintained even in the upper grades of primary school. Considering contextual inferencing from context, L2 children with small vocabularies might be less effective at this skill. Further instructional research is needed to determine how teachers can best support these children in their reading development. Possible avenues are additional vocabulary instruction, and teacher modelling of inferencing strategies.

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