Iconic Sentences Are Not Always Easier: Evidence from Bilingual Greek-German Children

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1. Introduction

Iconicity refers in its most general sense to a relationship of similarity between the two dimensions of a sign: its form and its meaning. At the discourse level, iconicity means that the sequence of sentences reflects the order of events in the real world; what happens first is said or written first. In the case of complex sentences, iconicity requires the order of main and subordinate clause to follow the chronological (or logical) order of the events encoded by the clauses (Diessel 2008). However, language provides us with means of sidestepping the principle of iconicity. Specific tense marking, for example, can indicate that the event in a subsequent sentence actually happened before the event in the preceding sentence (Hamann, Lindner & Penner 2001). Furthermore, the temporal conjunctions before and after can be used in a non-iconic way, and this is the focus of our study.

Complex sentences containing the temporal conjunctions before and after can describe a sequence of two events in an iconic way, i.e., the clause order is congruent with the order of the events, or in a non-iconic way, i.e., the clause order is the reverse of the order of the events. In the case of before, the clause order is iconic when the main clause precedes the subordinate clause, as illustrated in (1a), and non-iconic when the main clause follows the subordinate clause, as shown in (1b). In the case of after, the clause order is iconic when the main clause follows the subordinate clause, as shown in (2a), and non-iconic when the main clause precedes the subordinate clause, as illustrated in (2b).

(1)  
a. She closed the window before she put the plate on the table.  
b. Before she put the plate on the table, she closed the window.

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(2) a. After she put the plate on the table, she closed the window.
   b. She closed the window after she put the plate on the table.

The (in)congruence between clause and event order is assumed to mediate the comprehension of sentences with before and after. Clark (1971) proposed that young children’s understanding of iconic sentences develops earlier than that of non-iconic sentences. Early in development, children have difficulty incorporating the meaning of the conjunctions before and after into their interpretation of the sentences and therefore tend to equate the order in which the events are mentioned with the order in which they occurred; Clark calls this an order-of-mention strategy. Much subsequent research has supported this claim, showing that children understand complex sentences better if the clause order follows the sequence of events (e.g., Feagans 1980, Trosborg 1982, Blything & Cain 2016). In addition, adult studies have provided confirming evidence for the order-of-mention strategy. While off-line interpretation was reported to be at ceiling as expected, non-iconic sentences with before and after lead to increased processing costs during reading, evidenced for example by the greater negativity in event-related brain potentials for non-iconic compared to iconic sentences (e.g., Politzer-Ahles, Xiang & Almeida 2017).

However, it remains unclear whether iconicity (here: “What you hear first, happens first”, see Clark 1971) is indeed a universal principle guiding comprehension and production of complex sentences. For one, some child studies on comprehension failed to find iconicity effects (e.g., de Ruiter et al. 2019, Papakonstantinou 2015). Moreover, data from corpus studies suggest that in right-branching languages both child and adult speakers prefer to produce complex sentences in which the main clause precedes the subordinate temporal clause, irrespective of iconicity (Diessel 2004, 2008). Diessel argues that in the order main – subordinate the sentence can be constructed in an incremental, one-clause-at-a-time fashion. The speaker first plans and produces the main clause and then the conjunction, which provides information on the sequential ordering of the events. In contrast, in the order subordinate – main the speaker has to conceptualize the complex sentence as a bi-clausal unit from the beginning, which increases the costs of discourse planning.

The present study contributes to the iconicity debate by examining bilingual children growing up with two languages for which conflicting results have been found: German and Greek. The comprehension of before/after sentences was assessed in Greek-German bilingual children aged 6 to 12 in both languages, employing the same design. If iconicity is a universal principle, bilingual children should find iconic sentences with before and after easier in both languages.

The paper is structured as follows: Section 2 summarizes the findings of previous acquisition studies of before and after across languages and methods. Section 3 describes the research questions, participants and methods of the current study and presents the results. Section 4 offers a discussion of the findings and issues for further research.
2. Previous comprehension studies on sentences with before and after

One of the first studies to examine young monolingual children’s comprehension of sentences containing the temporal conjunctions before and after was undertaken by Clark (1971). Three- to five-year-old English-speaking children were asked to act out sentences such as “The girl jumped the gate before she patted the horse” with toys. As mentioned above, performance was in general better on iconic compared to non-iconic sentences because children tended to act out the events in their order of mention. Clark (1971) proposes different acquisition stages, with mastery of before emerging earlier than mastery of after, which was especially difficult for children in the non-iconic condition. Notably, after and before sentences in the order main – subordinate were not generally easier than their counterparts with subordinate – main order. This finding supports the view that children’s comprehension is guided by iconicity and not by the position of the subordinate clause. Clark argues that before is acquired earlier than after because of its semantic features, namely that the temporal relation expressed by before is more accessible compared to after.

A large number of studies tested Clark’s (1971) assumptions using either act-out or forced-choice picture tasks. Let us turn to the results from the act-out tasks first. Some studies were very similar to Clark’s design in that the events to be acted out were described as statements (French & Brown 1977, Coker 1978, Feagans 1980); their results confirmed the iconicity effect. As for the acquisition order of the conjunctions, Coker (1978) and Feagans (1980) found before to be mastered earlier than after, whereas French and Brown (1977) found no difference. Other act-out studies used test prompts in the form of commands such as “After you move a blue plane, move a red plane!” (Amidon & Carey 1972, Amidon 1976, Gorrell, Crain & Fodor 1989). Notably, these studies found no effects of iconicity and no advantage of before over after; in fact, Amidon (1976) reported better performance on after than on before. These differences suggest that the type of act-out task crucially impacts children’s comprehension patterns.

Two act-out studies explicitly set out to compare both types of tasks (Johnson 1975, Stevenson & Pollitt 1987), with mixed results. Using the tasks of Clark (1971) and Amidon and Carey (1972) as well as a third command task, Johnson (1975) found performance to be more accurate in iconic sentences. Across the three tasks, before had an advantage over after, which was restricted to the iconic condition. Stevenson and Pollitt (1987), on the other hand, found that Clark’s task but not the command task pointed to iconicity effects.

The few act-out studies in languages other than English (Danish: Trosborg 1982, Greek: Natsopoulos & Abadzi 1986, Papakonstantinou 2015) confirm this diverse picture. In the study of Trosborg (1982), monolingual Danish children completed an act-out task with commands and a verbal judgement task in which they listened to sentences like “Mette drank the milk, after she ate the cake” and had to tell the experimenter which event happened first. In both tasks, iconic sentences were comprehended better than non-iconic ones, suggesting that the iconicity effect was independent of specific task features. Regarding the relative
difficulty of *before* and *after*, the findings were inconclusive: in the act-out task *before* was easier than *after* in both conditions of iconicity, in line with Clark (1971); in the verbal judgement task *before* was easier than *after* in the iconic condition, but more difficult in the non-iconic condition.

Most relevant for our study are the results from Greek involving monolingual children of different age ranges (Natsopoulos & Abadzi 1986: 4 to 7 years; Papakonstantinou 2015: 5 to 11 years). Natsopoulos and Abadzi (1986) used test sentences in form of statements and found that iconic sentences were easier for both conjunctions and that *before* was understood better than *after*. The study of Papakonstantinou (2015) replicated the advantage of *before* over *after* but did not indicate any iconicity effect. Instead, performance on *after* in the non-iconic condition (i.e. main – subordinate order) was higher than in the iconic condition (i.e. subordinate – main order). Note that this pattern is in line with Diessel’s (2004, 2008) account, which favors the order main-subordinate, albeit in production (see Section 1). The discrepancy between the two Greek studies remains also when considering only the results of the children within the same age range, 5 to 7.

Another set of comprehension studies employed different variants of forced-choice picture tasks. In one variant, participants are presented with two pictures that appear one by one on a screen and depict the same actor performing a different action. Children hear a sentence that describes the order of the two events using *before* or *after* and then they have to identify the action that the actor performed first/last. Using this variant, Blything, Davies and Cain (2015) asked 3- to 7-year-old English-speaking children what the actor did *first*. Their results showed that 3- and 4-year-olds adopted the order-of-mention strategy for both conjunctions, giving more correct responses to iconic sentences. The 5- and 6-year-olds showed iconicity effects with *before*, but not with *after*, resulting in better performance on *before* than *after* in the iconic condition only. Finally, 7-year-olds showed high performance across all conditions, with neither iconicity nor conjunction type playing a significant role. In a follow up study, Blything and Cain (2016) asked 3- to 7-year-old English-speaking children to point to the action that was performed *last*. This time, all age groups showed an iconicity effect, but had no preference for *before* over *after*. In a recent study with 6- to 12-year-old monolingual Dutch children, Overweg, Hartman and Hendriks (2018) required children to point to the action that was performed *first*. They found an advantage of *before* over *after*, but no effect of iconicity.

In a second variant of picture selection tasks, participants first listen to a *before* or *after* sentence describing a sequence of two events. Then, they see two contrasting picture sequences on a screen and have to choose which of them matches the sentence. This design was used by de Ruiter and colleagues (2018a, 2018b, 2019, 2020) across typologically different languages, allowing for close cross-linguistic comparisons. English children at age 4 were at chance in all conditions, while at age 5 they showed an iconicity effect for both conjunctions and performed better on *before* than on *after* (de Ruiter et al. 2018a). The same pattern was found for German-speaking children aged 5 and 7 (de Ruiter et al.
In Tamil (de Ruiter et al. 2019) and Mandarin Chinese (de Ruiter et al. 2020), however, 5-year-olds understood sentences in subordinate – main clause order better than in main – subordinate order, independent of iconicity. In addition, after sentences were overall easier than before sentences. The authors consider these cross-linguistic findings as evidence that the preference for iconic descriptions can be overridden by language-specific syntactic constraints. De Ruiter and colleagues argue that Tamil and Mandarin Chinese, but not German and English, exhibit a strong tendency for adverbial clauses to precede the main clause. Accordingly, children acquiring Tamil and Mandarin Chinese encounter before- and after sentences in subordinate – main order more frequently than in main – subordinate order. In the case of before, the clause order subordinate – main is more frequent, but non-iconic. Accordingly, the high performance of children in this condition suggests that frequency outweighs iconicity.

Finally, one study (Pyykkönen & Järvi-kivi 2012) used a written test variant. In this study, monolingual Finnish 8- to 12-year olds had to read before and after sentences (e.g., “Ilkka read the letter before he went to school.”) and circle the verb describing the event that happened first. Non-iconic sentences were more difficult than iconic sentences for after but not for before. Moreover, after was more difficult than before in the non-iconic condition only. According to the authors, these results suggest that the effect of iconicity is mediated by the position of the conjunction in the sentence. In the clause order main – subordinate, the conjunction appears in sentence-medial position. In this case, reversing the order of the events, as required by sentence-medial after, is cognitively challenging for children. In the subordinate – main clause order, in contrast, the conjunction is the first element in the sentence and provides information on how to order the two events before processing of the events begins; this holds for before and after equally. Note that Pyykkönen and Järvi-kivi’s (2012) task allowed rereading and thinking about the sentences. Therefore, their findings cannot be directly related to the comprehension demands in spoken language.

To sum up, previous research does not provide a clear picture with respect to the impact of iconicity on the comprehension of two-clause sentences with before and after and on the acquisition order of the two conjunctions. The majority of acquisition studies found some effect of iconicity and earlier mastery of before, rather than of after, across different languages, including German. Importantly for the present study, contradicting results have been reported for Greek regarding iconicity.

3. The present study

The study is part of a larger project involving a battery of tasks on age effects in the bilingual acquisition of complex sentences. Here we focused on a sentence-picture matching task assessing comprehension of before and after and asked:

(Q1) Does iconicity affect bilingual children’s interpretation of complex sentences with before and after in both of their languages in the same way?
(Q2) Are *before* sentences easier to understand than *after* sentences in both languages?

Our rationale was as follows: when bilingual children are tested in both of their languages with the same task, overarching cognitive factors can be teased apart from language-specific factors. Consequently, if the preference for iconicity is universal and *before* is developmentally more accessible than *after* because of its semantic features (see Clark 1971), bilingual children should find iconic sentences and sentences with *before* easier in both languages. If language-specific factors affect performance, then comprehension patterns could differ across the two languages.

3.1. Participants

Sixty-four typically developing Greek-German bilingual children aged 6;0 to 12;10 years (Mean=9;5 years) were recruited from schools in the Frankfurt metropolitan area. Typical development was ensured via parental and teacher information and, where norms are available, via the LiSe-DaZ language test, which is normed for early L2 German (Schulz & Tracy 2011). All children had regular contact with Greek from birth.

Due to the project aims, we deliberately recruited children with different ages at their first systematic exposure to German (Age of Onset/AoO). Thirty children were simultaneous bilinguals (2L1), with an AoO between 0;0 and 1;11 years (Mean=0;5), 17 children were early second language learners of German (eL2), with an AoO between 2;0 and 3;11 years (Mean=2;9), and another 17 children were child late second language learners of German (cL2), with an AoO between 4;0 and 10;11 years (Mean=6;10).¹ Note that the predictive role of AoO for children’s performance is not the focus of this paper; results are reported for each AoO-group separately to avoid confounds that may result from AoO-effects.

3.2. Materials and procedure

In order to assess children’s comprehension of sentences with the temporal conjunctions *before* and *after* in German and Greek, a sentence-picture matching task was developed. The German and Greek version of the task had the same design and contained the same test items. The task consists of 24 test sentences, half of which contained *before* (German: *bevor*, Greek: *prin*) and half *after* (German: *nachdem*, Greek: *afu*). Half of the sentences with each conjunction were in the order main – subordinate and half in the order subordinate – main, which resulted in half of the sentences being iconic and half non-iconic. Consequently, the task comprised four conditions (see examples (1) and (2) in Section 1), with

¹ Pairwise comparisons with Bonferroni correction showed that the cL2 group was older than the 2L1 (*p*<.001) and the eL2 group (*p*=.042). The 2L1 and the eL2 group did not differ in age (*p*=.161).
six test items in each condition. Another eight sentences acted as fillers. These consisted of a main clause (e.g., “He turned the light on.”). An example of a test item (after-non-iconic) in German and Greek is given in (3a) and (3b), respectively:

(3)  

a. Sie hat das Fenster zugemacht,  
She has the window closed-PTCP  
nachdem sie den Teller auf den Tisch gestellt hat.  
after she the plate on the table put-PTCP has  

b. Eklise zu parathiro  
Closed-PST.PFV.3SG the window  
aflu evale to pjato sto trapezi.  
after put-PST.PFV.3SG the plate on-the table  

‘She closed the window, after she put the plate on the table.’

In the test sentences, the chronological order of the two events cannot be inferred based on world knowledge, either because the events are logically unrelated and/or because both orders are equally plausible. The agent of the events is the same in both clauses of the sentence. In German, subjects are referred to with a personal pronoun; in Greek subjects are omitted due to the pro-drop property of the language. All German subordinate clauses had the order SOV; Greek subordinate clauses had the order VO, although Greek allows other word orders as well. The verbs used were transitive and either inherently or optionally telic (see Schulz 2018). To facilitate the sequential interpretation of the events, the perfect tense was used in German, which in spoken language expresses completion of the events encoded by the telic verbs. In the Greek version, main clauses and subordinate clauses with *afu* ‘after’ contain forms of the Aorist (past perfective), whereas subordinate clauses with *prin* ‘before’ contain the so-called dependent form, which is specified for the features non-past and perfective, but does not constitute an independent tense (see Holton, Mackridge & Philippaki-Warburton 1999). Filler items had the same grammatical characteristics as the main clauses of test items. The sentences were prerecorded by a female native speaker of German and Greek, respectively, who were not present at the testing.

The sentences were organized in four blocks of six test items and two fillers each. Each block contained all four conditions, in pseudorandomized order, and corresponded to a specific actor. A second list of sentences was created in both languages, substituting *before* with *after* and vice versa, to ensure that features of the specific sentences containing each conjunction did not affect the results.

The task was administered via a Power-Point presentation. The test procedure consisted of a main test session preceded by a familiarization and a practice phase. The main test ran as follows: four child characters appeared on the screen (two boys and two girls). The experimenter told the child that she would listen to stories about these children and then choose which picture sequence matched the stories.
After the child chose the character she wanted to start with, the presentation started. First, the test sentence was played while the screen was blank. After a short pause, two contrasting picture sequences appeared simultaneously on the screen, as illustrated in Figure 1 for example (3). In half of the slides, the correct sequence appeared at the top of the screen and in the other half at the bottom; the order was pseudorandomized within each block. The filler items were presented in the same way, except that the two options consisted of one picture each.

Figure 1. Layout of slides with test sentences

After 1.5s the test sentence was repeated once and the child was asked to point to the sequence she considered to depict the sentence (“Which order matches the story?”). No response-contingent feedback was given. When the block was completed, the initial slide with the four children appeared again and the participant could choose with which character to continue.

The test phase was preceded by a familiarization phase in which children saw all test pictures on separate cards and had to name the depicted actions (e.g., ‘close the window’). If they failed to do so, the experimenter provided the answer. Subsequently, five practice items introduced the child to the make-up of the task. The first two items had the same structure as the fillers. The other three items established the left-to-right interpretation of the picture sequences. The layout of the slides was the same as in the test items, but the sequence of the events was described with two main clauses beginning with first (German: zuerst, Greek: prota) and then (German: danach, Greek: meta), respectively. If the child did not choose the correct sequence, the experimenter said: “Look, did it happen this way or this way?”, moving his finger across each two-picture-sequence from left to right. If necessary, a practice item was repeated up to two times; one child failed to answer the practice items correctly and was excluded from the main test.

German and Greek were tested in separate sessions with an interval of one to two weeks in between. The Greek version was administered by the first author and the German version by a trained student assistant who was a native speaker.
of German. Half of the children were tested first in German and half first in Greek; half of the children were administered List 1 and half List 2.

3.3. Results

First, a one-way independent ANOVA was conducted in each language with List as the between-subjects factor and scores in the four test conditions (before_iconic, before_non-iconic, after_iconic, after_non-iconic) as dependent variables. Neither Greek nor German revealed an effect of List for any condition. Accordingly, the two lists were collapsed.

Figure 2 and 3 present the mean accuracy per condition in German and Greek, respectively, for each bilingual group separately. Accuracy was above chance across conditions and groups, except for non-iconic sentences with after: here the three groups preformed generally at chance in both languages (the 2L1 group performed below chance in Greek). In the eL2 group, mean overall accuracy in the two languages did not differ ($p=.954$; German: 76.2%, Greek: 76.5%). In the 2L1 group, mean overall accuracy was significantly better in German than in Greek ($p=.001$; German: 78.6%, Greek: 67.0%) and the reverse pattern was found for the cL2 group ($p=.010$; German: 70.0%, Greek: 85.3%).

![Figure 2. Mean accuracy in % per condition and bilingual type in German](image)

To examine the effect of iconicity, a repeated measures ANOVA was conducted in each language, with Conjunction (before, after) and Order (iconic, non-iconic) as within-subjects factors and Bilingual type (2L1, eL2, cL2) as between-subjects factor. In German, there were main effects of Conjunction ($F_{(1,61)}=14.067, p<.001$, partial $\eta^2=.187$) and Order ($F_{(1,61)}=16.715, p<.001$, partial $\eta^2=.215$) and a significant interaction between Conjunction and Order ($F_{(1,61)}=21.599, p<.001$, partial $\eta^2=.261$). Bilingual type exhibited no main effect and was not involved in any significant interaction. The interaction between Conjunction and Order was further explored through post-hoc comparisons with Bonferroni correction, which revealed that in the iconic order after and before did
not differ \((p=.783)\), but in the non-iconic order \(after\) was more difficult than \(before\) \((p<.001)\). There was no difference between iconic and non-iconic order for \(before\) \((p=.135)\), but for \(after\) accuracy was lower in the non-iconic than in the iconic order \((p<.001)\).

The pattern in Greek was very similar, with main effects of Conjunction \((F_{(1,60)}=21.096, p<.001, \text{partial } \eta^2=.260)\) and Order \((F_{(1,60)}=21.757, p<.001, \text{partial } \eta^2=.266)\) and a significant interaction between the two factors \((F_{(1,60)}=32.308, p<.001, \text{partial } \eta^2=.350)\). As in German, Bilingual type was not involved in any significant interaction. Post-hoc comparisons with Bonferroni correction revealed no difference between the conjunctions in the iconic order \((p=.882)\), but a significant difference in the non-iconic order, with \(after\) being more difficult than \(before\) \((p<.001)\). Moreover, performance did not differ between the two orders with \(before\) \((p=.389)\), but with \(after\) non-iconic sentences were more difficult than the iconic ones \((p<.001)\).

![Figure 3. Mean accuracy in % per condition and bilingual type in Greek](image)

### 4. Discussion and conclusion

Dating back to the seminal work by Clark (1971), iconicity has been proposed as a universal principle guiding children’s interpretation of complex sentences, which should result in an advantage for iconic compared to non-iconic sentences. And because of its semantic features, the temporal conjunction \(before\) should be developmentally more accessible than \(after\), cross-linguistically. The present

\[2 \text{ In Greek, Bilingual type had a main effect } (F_{(2,60)}=6.485, p=.003, \text{partial } \eta^2=.178), \text{ which was due to the cL2 group outperforming the 2L1 group } (p=.002) \text{ in overall accuracy. This effect is not considered further here because error patterns were the same across groups as indicated by the absence of significant interactions involving Bilingual type. For an extensive discussion of the predictive role of chronological age and AoO for children’s performance in Greek and German see Makrodimitris (in prep.).} \]
study is the first to investigate these assumptions in bilingual children in both of
their languages. A newly developed sentence-picture matching task was
administered to Greek-German bilingual children aged 6 to 12 in German and in
Greek, two languages for which conflicting results had been reported previously.
We asked whether iconicity influences bilingual children’s comprehension of
complex sentences with before and after in the same way in both of their
languages (Q1) and whether before sentences are easier to comprehend than after
sentences in both languages (Q2).

Our data revealed striking parallels between the two languages. First,
iconicity affected children’s comprehension of after, but not of before, in Greek
and in German. Children found non-iconic after sentences more difficult than
their iconic variant; it was the most challenging condition, with no group scoring
above chance in either language. Comprehension of before sentences was not
mediated by iconicity; children performed above chance in both clause orders in
both languages. Second, the relative difficulty of the two conjunctions was the
same in Greek and in German: before was easier than after only in the non-iconic
condition.

These results suggest that iconicity affects children’s interpretation of
complex sentences in the same way in Greek and German, despite typological
differences between the two languages (i.a. overt subject pronouns in German vs.
null pronouns in Greek, SOV in German subordinate clauses vs. VO in Greek,
and fully tensed verb forms in all clauses of German vs. ‘dependent’ forms in
Greek before clauses, see Section 3.2). Note that, unlike Tamil and Mandarin
Chinese, German and Greek have in common that they freely allow temporal
clauses to precede or to follow the main clause3 and that the subordinating
conjunction is located in the left periphery of the temporal clause (an issue we
return to below).

Our main findings, a partial preference for iconic sentences and a partial
advantage of before compared to after, do not fully align with previous findings
from monolinguals: some studies found iconicity to influence comprehension of
both conjunctions (e.g., German: de Ruiter et al. 2018b, Greek: Natsopoulos &
Abadzi 1986), and one study in Greek found no iconicity effect (Papakonstantinou
2015). We suggest that differences in method and age may be responsible for the
discrepancies.4 The Greek studies used the method of act-out, which has been
found to provide varying results (see Section 2). And while our sentence-picture
matching task is similar to the one used by de Ruiter and colleagues, the children
in our study were much older than their participants (ages 5 to 7). If we assume
that the strength of the iconicity principle changes as children grow older,

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3 In a German corpus analysis, 75% of the before clauses followed the main clause and
after clauses appeared equally often first and last (Blühdorn 2004). To our knowledge there
is no similar study in Greek.

4 At this point we cannot exclude that our results are specific to bilingual learners. We are
currently testing 6- to 12-year-old monolingual Greek and German children as well as
younger monolinguals.
different results are expected. This would also substantiate Clark’s (1971) finding that after an initial stage of an order-of-mention strategy, English-speaking preschoolers interpreted before sentences correctly, but still had difficulty with non-iconic after sentences.

In the following, we outline our account of the differential effect of iconicity, which rests on the position of temporal conjunctions in bi-clausal sentences (see Pyykkönnen & Järvikivi 2012, for an earlier account for reading). Temporal conjunctions in Greek and German appear in the left periphery of the subordinate clause; hence, their position in the complex sentence can be sentence-initial (see (1b), (2a) in Section 1) or sentence-medial (see (1a), (2b)). If before or after appear sentence-initially, children receive information about the order of events already at the outset of building the event representation of the complex sentence. To illustrate, imagine two events A and B that happen in the order A, B. Sentence-initial after (a) signals that the sequence of the events is “A, B”, in line with iconicity. Sentence-initial before (b) signals that reordering is required to build the correct event representation of the complex sentence, i.e. “B, A =⇒ “A, B”. In this case, the clause order violates iconicity, but the cue occurs early, so no reanalysis is needed.

If the conjunction appears sentence-medially, explicit information about the order of the events is provided after the main clause has been processed. Sentence-medial before requires subordinating this clause under the main clause; the order of events “A, bB” remains unchanged and is in line with iconicity. Sentence-medial after, in contrast, requires revision of the initial event representation “B, aA =⇒ A, B”. We suggest that children find revision of an initial event representation difficult. When encountering after, they may ignore the conjunction, which would result in an incorrect iconic reading. Later in development, they fluctuate between the correct and the incorrect reading, which amounts to chance performance. This reasoning is similar in spirit to the ‘kindergarten-path effects’ documented for children’s processing of temporary syntactic ambiguities (e.g., Trueswell et al. 1999), extending it to event representations.

If our account is on the right track, the developmental advantage of before would result from the interaction of its semantics and its position in the sentence rather than from its semantic features per se, as first suggested by Clark (1971). Furthermore, our account could also offer an explanation as to why comprehension of before in Tamil and Mandarin Chinese has not been found to develop earlier than after (see de Ruiter et al. 2019, 2020). In these languages, the meaning of before and after is not expressed with conjunctions but by means of clause-final morphemes (either bound or free). Accordingly, information about how to build the event representation of the complex sentence is never provided sentence-initially; the morpheme appears either in sentence-medial or in sentence-final position, i.e., after parts of the sentence have been processed. Comprehension of non-iconic before in Tamil and Mandarin requires reanalysis, very similar to non-iconic after, resulting in similar performance for both conditions. The study of bilingual children who acquire a language like German
or Greek, where event ordering information is expressed via clause-initial conjunctions, and a language like Tamil or Mandarin Chinese, which uses clause-final morphemes, could shed light on whether both systems are acquired at the same age.

References


