8 Acquiring Connectives in a First Language

8.1 INTRODUCTION

In this chapter, we first introduce the questions of when and how children start using connectives and discourse relations during their first years of life, and discuss the reasons as to why these early productions do not reflect a fully mature usage. We will see more specifically that mastering the form–function mappings involved in the understanding of many connectives is a complex task for young children. In addition, we will present research investigating school-age children's comprehension of connectives and show that it is only around the end of their primary school years that they fully understand frequent connectives like *because, but, before* and *after* in English. We will explore the causes of these difficulties and discuss the differences between various connectives and discourse relations, emphasizing the importance of children's cognitive and linguistic competences, as well as the input that they receive, as factors helping them to develop an adult-like mastery of connectives. We will then move on to other studies analyzing the way older children understand connectives, and see that their acquisition is not fully in place after primary school years, as teenagers keep developing their competence with connectives, especially those bound to the written mode such as *nevertheless* and *therefore*. We will argue that the difficulties encountered by teenagers stem from different causes than those limiting younger children's comprehension. Finally, we will briefly discuss the acquisition of connectives and discourse relations by children suffering from linguistic or cognitive impairments such as Specific Language Impairment (SLI) and autism, and argue that their developmental patterns do not match those of typically developing children with a delay, but rather show evidence of specific difficulties. We will conclude that analyzing these difficulties provides important insights for understanding the complex array of linguistic, cognitive and social skills involved in the mastery of connectives.

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8.2 EARLY SPONTANEOUS PRODUCTIONS

By the age of three and often even earlier, children are able to produce several consecutive utterances. These early productions are not randomly put together. In fact, most of the time, they convey various types of identifiable discourse relations. As an illustration, consider these productions from Sarah and Adam,[1] two children recorded in the CHILDES English Brown[2] corpus (Brown, 1973).

(1) He not little. He big.
(Sarah, 3;0.18)

(2) I going take it outside. That's fun.
(Adam, 3;0.25)

(3) You find them. I can't find them.
(Sarah, 3;2.10)

(4) I can't. I a boy. You a girl.
(Adam, 3;2.21)

As these examples illustrate, young children already produce a wide array of different discourse relations, such as corrections in (1), elaborations in (2), causality in (3) and (4) between the first two sentences, and contrast in (4) between the last two sentences. It is also noticeable that in all these examples, the relations are conveyed without using a connective. This pattern is quite typical of what has been observed in the literature, as children often start by producing mostly implicit relations before using connectives (e.g., Evers-Vermeul & Sanders, 2009). Yet, by the age of three, most children already produce some frequent connectives such as *and*, *but*, *because* and *when* in English, as illustrated in (5) to (9), also from the Brown corpus.

(5) But you find them. You could find them.
(Sarah 3;0.27)

(6) Because I always step on the flowers.
(Sarah 3;0.27)

(7) I can't get them out because my hand is too big.
(Adam 3;3.18)

[1] In language acquisition research, children's age is indicated in the following format: years;months.days.
[2] https://childes.talkbank.org/access/Eng-NA/Brown.html.

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(8) I swallow water when I drink and I cough and cough.
(Adam 3;5.01)

(9) Mommy, we haven't got there but we landing.
(Adam 3;9.16)

These early productions raise two important questions. First, in what order do connectives typically emerge in children's productions? And second, if there is a fixed order, what factors account for it? These questions were first addressed using corpus data by Bloom et al. (1980) who reported that children in their sample always followed the same acquisition sequence in their productions of discourse relations. First, they produced additive relations, followed by temporal ones, then causal ones and finally adversative ones (i.e., concession and contrast). They explained this order of acquisition by the fact that relations seem to build on one another. For example, a temporal relation includes an additive relation plus something else (temporal order). Similarly, a causal relation involves an additive and a temporal component plus something else (an implication relation). It is therefore logical that relations that include more components of meaning should be acquired later than those that include fewer ones.

However, in their study, while the observed order of acquisition for the different relations was consistent for all the children, the order of acquisition for connectives was more variable. The only consistent finding was that *and* always appeared first in children's speech. But the other connectives from their study, namely *and then*, *so*, *because* and *but* appeared in a variety of developmental patterns. Bloom and colleagues concluded that while children's conceptual development could explain the order in which they acquired the various discourse relations, the linguistic forms used to convey them was not similarly influenced.

Yet, Evers-Vermeul and Sanders (2009) have shown that this somehow inconsistent finding can be explained by resorting to a different view of conceptual development. They analyzed the early productions of Dutch connectives in relation to their degree of cognitive complexity, using the Cognitive approach to Coherence Relation (CCR) model put forward by Sanders, Spooren and Noordman (1992; see Chapter 2). Following this model, connectives encoding more cognitively complex relations require more advanced conceptual knowledge than easier ones, and should therefore appear later in children's speech. Recall that in the CCR model, all relations can be decomposed into a set of four primitives. For each primitive, a relation can take one of two different values, or be unspecified (cf. Chapter 2). From a cognitive perspective, one of the alternatives is always deemed to be

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more complex than the other. For example, the dimension of basic operation separates relations with an additive component from those with a causal component. Additive relations are weaker in that they only involve logical conjunction, while causal relations additionally require that an implication relation is inferred between the segments. Thus, relations with a causal value are cognitively more complex than relations with an additive value. The same reasoning applies to the other dimensions as well. It is therefore possible to compute a score of cognitive complexity for each connective by adding their level of complexity in each dimension. For example, connectives conveying an addition are the easiest, as they are not causal and do not involve a fixed order of the segments. As in Evers-Vermeul and Sanders (2009), we do not consider for the time being the dimension of source of coherence (but see Section 8.3).

It follows from this classification that while some connectives typically encode relations that are easier than others, there are also connectives that have the same degree of cognitive complexity while being different, because the source of complexity is different in each case. For example, additive temporal positive connectives have one source of complexity (the temporal order of the segments) and positive causal nontemporal connectives have another one (the implication relation involved in causality). It is therefore predicted that children should acquire both types of connectives at around the same time. When connectives differ in terms of cognitive complexity, the prediction is that they should be acquired in sequence. For example, the first causal connective is predicted to occur after the first additive one. Similarly, the first negative connective is expected to occur after the first positive one. Following the same logic, the first negative causal connective is expected to occur after both the first positive causal and the first negative additive connectives, which are in turn expected to occur simultaneously. Evers-Vermeul and Sanders (2009) have assessed these hypotheses by tracking the first occurrences of common Dutch connectives in the language of children aged 1;5 to 5;6 in corpus data. They considered that a connective was acquired as soon as children had produced it once, as long as it was used to conjoin two clauses (as in examples 7–9 above but not in 5 and 6) and in a creative way (not as an immediate imitation of adult speech). Their results indicate that for eleven out of the twelve studied children, the predictions based on the CCR model were borne out, thus providing solid evidence in favor of the role of cognitive complexity for the early acquisition of connectives.

Yet, in addition to their semantic components, connectives are typically used in various types of syntactic structures, such as coordinating

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and subordinating clauses, and some of them are more complex than others (Diessel, 2004). Evers-Vermeul and Sanders (2009) have also assessed the role of syntactic complexity by comparing the acquisition of connectives used as coordinating and as subordinating conjunctions. They found that this factor does play a role, as, for example, children always produced a causal relation with a subordinating conjunction (*omdat*) after they produced it with a coordinating conjunction (*want*). Yet, they found that this factor is only secondary to that of cognitive complexity, as it does not determine the whole pattern of acquisition across various connectives. In other words, a cognitively complex connective used in a simple syntactic structure does not appear earlier than a cognitively simpler connective.

In addition to conceptual and syntactic development, the order of acquisition for connectives could also be influenced by the frequency with which they are used in children's input. Indeed, in usage-based models of language acquisition (e.g., Tomasello, 2003; Kidd, Lieven & Tomasello, 2006), the input that children receive from their environment is thought to be of primary importance to explain the order of acquisition between various elements. Van Veen et al. (2009) measured the role of two types of input (local and global), as well as that of conceptual development, to explain the order of acquisition between various German connectives in the language of one child aged 1;11 to 2;11 in a dense longitudinal corpus. The factor of local input measured the influence of connectives heard by the child in the same recording as their own productions of this connective. The factor of global input estimated the influence of the cumulated number of occurrences heard by a child at a given age on their own productions. Finally, conceptual development was operationalized simply by recording the age of the child in each sample, given that children's conceptual competence matures as they grow older. All three factors were then included in a growth curve analysis.

Results indicated that all three factors play a role for the acquisition of connectives. The child's use of a connective significantly increased with age, indicating an effect of conceptual development. Parental input also mattered greatly, both in the short and in the long term. In the short term, parental use of a connective in a given sample significantly influenced the child's propensity to also use it in the same sample. In the long term, the effect of parental usage was also apparent. The more parents had used a connective in previous samples, the more it was used by the child in a given sample. Parental input additionally seems to have a variable effect over time. In a first acquisition phase, it does not seem to have any influence, as children do not

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immediately react to it. In a second phase, it has a major influence on children's productions, before having little influence again in a third phase. This last phase may reveal that the connective has been acquired and is used autonomously by the child.

The fact that parental input does not have an influence in the first phase may reflect the fact that parents adapt their speech to the perceived level of competence of their children. In other words, they may use more complex language with older children when they feel that they will be understood. This phenomenon of parental adaptation is known as "audience design" (Clark & Murphy, 1983). Van Veen and colleagues looked for traces of audience design in their data but did not find any evidence of it. To put it differently, parents made a similar use of connectives throughout the corpus. However, parental adaptations were found in another growth curve analysis conducted by van Veen et al. (2013), in which they analyzed the speech of five German-speaking and five English-speaking children aged 0;10 to 4;3. In this study, children produced a lot of causal connectives (*weil* and *because*) in response to parents' elicitations in the form of *why/warum* questions. In return, children also received a lot of input on the use of these causal connectives in response to their own productions of *why/warum* questions. This result shows that children not only reacted to parents' linguistic input, but also played an active role in influencing the type of input they received.

In sum, the studies presented in this section provide evidence that children start using connectives to convey all sorts of discourse relations early in their development. The order of acquisition between them is dependent on several factors such as the degree of cognitive and syntactic complexity involved, as well as the frequency with which connectives are used in the input that children hear. Of course, these studies are limited in that they included only a handful of children, growing-up in three closely related languages (English, Dutch and German). As is the case with language acquisition research in general, further studies are still needed to determine if the acquisition pattern observed in these Germanic languages is also found for children exposed to languages from other families, and who grow up in contexts in which adults use different socialization routines.

8.3 ACQUIRING COMPLEX FORM–FUNCTION MAPPINGS BETWEEN RELATIONS AND CONNECTIVES

In the previous section, we reviewed the order of acquisition between connectives by taking a quantitative perspective and looking at the

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number of connectives that children produce at a given age. This approach is very useful to determine when children start producing various connectives conveying different types of discourse relations, but it is also limited in several ways. First, it does not prove that children produce these connectives correctly in the same broad variety of contexts as adults. Second, connectives are very often polyfunctional, and can be used to express different discourse relations or various nuances of meaning within the same relation (see Chapter 3). In this section, we will take a qualitative perspective to analyze the way children progressively learn to use the same connective to express a variety of different meanings depending on context.

For this, we will first look at a specific case study: the acquisition of the capacity to express various types of causal relations (see Chapters 2 and 3). We will investigate more specifically the distinction between the three causal domains identified by Sweetser as the content domain (10), the speech act domain (11) and the epistemic domain (12). All examples were produced by Ross, a child recorded in the MacWhinney corpus (1991), also on the CHILDES database.[3]

(10) I did it because you got mad.

(2;10.17)

(11) Don't carry Marky because Marky might get snow on Marky's socks.

(2;10.1)

(12) But it isn't dark now because I have to get up.

(3;2.13)

Recall that causal relations in the content domain link events or states happening in the real physical world. For example, in (10), the reason why Ross did something in the real world is that someone else got mad, again in the real world. By contrast, in (11), the fact that Marky might get snow on his boots causes Ross to produce a directive speech act in the form of an imperative. And finally, in (12), the fact that Ross has to get up leads him to conclude that it is probably not dark, but it does not cause the absence of darkness in the real world.

Several studies aimed to determine the order of acquisition between these various types of causal relations. First, Kyratzis, Guo and Ervin-Tripp (1990) analyzed the productions of the connectives *because* and *so* by 21 English-speaking children from the age of 2;4 to 12;0 in the

[3] https://childes.talkbank.org/access/Eng-NA/MacWhinney.html.

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Ervin-Tripp family corpus. Their findings indicate that children first start producing causal relations in the speech act domain, followed by the content domain. The epistemic domain comes last and remains infrequent throughout the corpus. The explanation provided by the authors reflects a socio-pragmatic account of language acquisition: children first learn to use connectives to produce speech acts enabling them to perform actions and interact with others, before moving on to less interactive functions later on in their development. Evers-Vermeul and Sanders (2011) pointed out, however, that several methodological choices could have influenced the outcome of these observations. First, by limiting themselves to a corpus containing social interactions within the family, the authors could not observe the way children use connectives in other contexts. Second, when coding children's productions of causal connectives, Kyratzis and colleagues have excluded all occurrences in which children only produced part of the causal relation themselves, as in Sarah's production in (6) above. This limitation has likely affected the number of content relations observed, as many of them are at first produced in answers to *why*-questions (Braunwald, 1997; Diessel, 2004).

To avoid these problems, Spooren and Sanders (2008) have analyzed the order of acquisition between various types of causal relations in Dutch, using an experimental approach. In two elicitation tasks, they asked children aged 6–7 and 11–12 to either describe pictures (to elicit content relations) or to formulate their opinions on various topics (to elicit speech-act and epistemic relations). They monitored not only the use of connectives but the production of implicit causal relations as well. Their results indicate that the younger children produced more content relations overall compared to the older children. There was also a significant influence of context on children's productions, as children from both groups produced more speech-act and epistemic relations in the conversation task, while in the description task they produced more content relations. Spooren and Sanders concluded that children likely acquire content relations first, based on evidence that younger children used them more often. However, they only had indirect evidence of this phenomenon, as children from both age groups produced all kinds of relations.

Evers-Vermeul and Sanders (2011) also investigated this question, combining corpus and experimental data. First, they used two elicitation tasks similar to that of Spooren and Sanders (2008) but including younger children. The first task compared children aged 4 and 6 on tasks aimed at eliciting speech-act and epistemic relations. The second task compared children aged 3 and 4 on tasks aimed at eliciting all

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three relation types. Even though children aged 3 produced fewer epistemic relations, the authors found that overall, from the age of 3, children were able to produce all types of causal relations. To determine the order of acquisition between domains, they resorted to data from younger children recorded in corpora. They analyzed the speech of 12 Dutch children recorded from the age of 2 to 3;6, and searched for their uses of four Dutch causal connectives: *want*, *omdat*, *dus* and *daarom*. These connectives vary in the order of the segments they involve (*want* and *omdat* involve a backward order and *dus* and *daarom* a forward one), and belong to a different grammatical category (coordinator, subordinator or adverb), but also on the type of domain in which they are typically used by adults (*omdat* and *daarom* are mostly used in the content domain while *want* and *dus* are used in the epistemic domain). Results from this corpus analysis indicated that children do not all produce content and speech act relations in the same order, but epistemic relations were always acquired later. In addition, at the age of 3;0, children already preferred to use *dus* in epistemic relations and *daarom* in content ones, thus showing a sensitivity to the mapping of each relation type with a specific connective. They did not show a similar preference, however, for the backward connectives *omdat* and *want*. A similar sequence of acquisition was found by Zufferey (2010) who studied the acquisition of the French causal connective *parce que*. She found that children start producing this connective to convey content and speech act relations shortly after 2;6, but start producing epistemic relations only by the age of 3;0. According to both studies, the observed acquisition sequence can be explained in terms of cognitive complexity, as epistemic relations require the ability to reason and draw conclusions on the basis of subjective claims.

The studies summarized so far investigated natural or elicited productions. Other studies have analyzed young children's intuitive comprehension of causal relations. In an eye-tracking study in which children aged 2;0 and 3;4 had to look at images that were causally linked to auditory stimuli either in the content or in the epistemic domain, van Veen (2011) found that the two age groups did not differ in their ability to create causal links in the content domains, but that three-year-old children were better at creating links in the epistemic domain. This comprehension study thus complements corpus data and elicited observations, and confirms that epistemic relations involve a greater degree of cognitive complexity compared to content relations. Another comprehension experiment involving older children aged 5–8 was conducted in French and Dutch by Zufferey, Mak and Sanders

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(2015). It involved an offline comprehension task in which children had to answer a series of *why*-questions following short stories. They found that epistemic relations were acquired later than content relations, as children did not score at ceiling for these relations even at the age of 8 in the more complex task involved in their experiment, contrary to content relations. In addition, no difference was found between the two languages, even though Dutch typically uses different connectives to express each type of backward causal relation (*omdat* and *want*) while there is only one backward causal connective used in spoken French (*parce que*, see Chapter 7). The authors concluded that children's cognitive development sets the pace of the acquisition of causal relations, independently of the way these relations are encoded in the input language, whether with one ambiguous connective or with two different ones.

Another interesting case study to analyze the way children progressively master various uses of the same connective comes from their productions of connectives like *but* in English. Indeed, in many languages, *but* and its translation equivalents can have several different meanings, like expressing a concession (13), a semantic contrast (14), a contrast at a pragmatic level (15, see Chapter 3), and finally a discourse marker used for topic management (16). All examples are again from Ross, the child recorded in the MacWhinney corpus (1991).

(13) I'm not cold but sometimes my feet get cold on here.
(2;11.14)

(14) In other words, you can salt your peas but don't do mine.
(2;8.5)

(15) That shirt's [= Spiderman shirt] not for girls but I like it.
(2;7.18)

(16) Father: Will you go?
Child: But why can't mummy come with us?
(3;5.12)

Gülzow et al. (2018) have investigated the order in which two English-speaking and two German-speaking children started producing the various uses of *but* in English and respectively *aber* in German. Their results showed a relation between the type of use (monologic and dialogic) and the functions of *but* that are prevalent in children's speech. While concessions and semantic contrasts are mostly found in monologic contexts, pragmatic contrasts (what the authors call

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"illocution") and topic management are mostly found in dialogic contexts. Their results are in line with those of Peterson (1986) who also found that children mostly used semantic contrasts and concessions when narrating a story. The study by Gülzow et al. (2018) thus underlines the fact that the speech context (monologic or dialogic) greatly influences the uses that are observed in children's speech, even for the same connective. In their study of causal domains, Evers-Vermeul and Sanders (2011) also found that excluding dialogic contexts, in which children used a causal connective in response to a *why*-question, strongly biased the observed order of acquisition. This factor should therefore be taken into account when analyzing the order of acquisition for various functions of a connective, as children usually start producing more dialogic uses of connectives at the beginning of the acquisition process (Diessel, 2004).

In sum, while children start using frequent connectives early, there is still an observable sequence of acquisition between the various functions of each connective, which can be explained based on their degree of cognitive complexity. Moreover, young children already use connectives differently according to each speaking situation. Acquisition studies should therefore strive to include as many different contexts as possible when evaluating the early productions of connectives in children's speech.

8.4 THE COMPREHENSION OF CONNECTIVES DURING PRIMARY SCHOOL YEARS

So far, we have discussed the early acquisition of connectives in spontaneous productions and in elicitation tasks. However, the fact that children can produce some connectives appropriately does not mean that they understand all the functions of these connectives when they appear in written sentences. In fact, experimental research with primary school children reveals a wide gap between these earlier productions and children's understanding of the same connectives when they appear in writing (e.g., Irwin & Pulver, 1984). In this section, we will discuss studies that have assessed the way primary school children understand connectives that are frequent in spoken language when they are used in written sentences or texts.

One of the first studies that has systematically compared children's comprehension of connectives across online and offline tasks was conducted by Cain and Nash (2011) who analyzed 8- and 10-year-olds'

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comprehension of frequent connectives used to convey causal, temporal and concessive relations. In the first offline task, children had to insert the correct connective to fill in the blanks between two sentences. Connectives were chosen amongst the most frequent ones in spoken English, namely: *after, although, because, before, but* and *so*. For each sentence, children were given a choice between the appropriate connective, an inappropriate connective and the underspecified connective *and*. The results from this offline task revealed a difference between relations. While the 8-year-olds and the 10-year-olds did not differ for causal relations, 10-year-olds reached higher scores for temporal and adversative relations. In addition, even though the children's number of correct answers was high, they did not perform on par with adults for any of the relations. Children also had a higher tendency than adults to resort to the underspecified connective *and*, suggesting that they have a lesser knowledge of the meanings of the more specific connectives. In a second offline task, children had to evaluate the coherence of sentences linked by appropriate or inappropriate connectives. In this task, children gave higher ratings to coherent than incoherent sentences, indicating some sensitivity to their meaning. However, adults rated coherent sentences higher than both groups of children, and 10-year-olds gave higher ratings than 8-year-olds. At the age of 10, children only differed from adults on their rating of temporal relations, whereas at the age of 8, children gave lower ratings for all relations. Taken together, these offline tasks – which reflect the level of children's comprehension after they have processed sentences with connectives – seem to indicate that children are not yet adult-like in the comprehension of connectives.

In order to complement these results, Cain and Nash (2011) ran two self-paced reading experiments assessing online comprehension, as it occurs while children read sentences. In these experiments, 8- and 10-year-old children read short texts with sentence pairs linked by connectives: either appropriate, inappropriate or underspecified ones (*and*). Then, they indicated if the sentences made sense after reading them. Results from these judgments confirmed that children were more likely to accept coherent than incoherent sentences, and that 10-year-olds had more correct judgments than 8-year-olds for all relation types. Results from the reading times indicated that children from both age groups read sentences following an appropriate connective more quickly compared to either an inappropriate or an underspecified one. This effect was identical for the two age groups, indicating that 8-year-olds also benefit from the presence of connectives during reading. In a fourth experiment, children read sentences linked with

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connectives more quickly compared to implicit relations, thus confirming the importance of connectives as processing signals for young readers. In a nutshell, the study by Cain and Nash indicates that primary school children already benefit from the presence of connectives during reading, even though they are not yet able to use them appropriately in offline tasks.

In similar offline experiments involving 184 Turkish-speaking children aged 8–9 and 9–10, Oğuz and Özge (2020) also found that temporal connectives are particularly challenging for children compared to causal and concessive ones. This study also revealed important individual differences between high-achieving and low-achieving children at the age of 9–10. Indeed, only high-achieving children had a similar performance to adults. However, the evaluation of children's level of academic competence was solely based on teachers' evaluations and was not measured in the study. We will come back to the question of individual differences and their sources below.

Other studies involving primary school children have focused more specifically on the comparison between causal and concessive relations. According to studies of processing by adult speakers, concessive relations are more complex than causal relations (see Chapter 6). In the early acquisition studies, adversative (i.e., contrastive and concessive) relations were also found to appear later in children's speech than causal ones. Yet, this difference did not clearly appear in the experiments of Cain & Nash (2011), as children used both types of connectives during reading, and performed similarly for both relations in the offline tasks. It is possible, however, that this similarity was due to the specificities of their experiments and to the connectives tested. Indeed, Cain and Nash (2011) also conclude that instead of investigating the acquisition of a given discourse relation, it would be more fruitful to analyze the acquisition of specific connectives, as they usually differ in many ways that have an influence on their degree of cognitive complexity (for example, the order of the segments, their register, frequency, etc.). In line with this observation, among the other studies that have specifically assessed the acquisition of causal and concessive connectives, many of them show evidence that concessive connectives are more challenging for primary school children than causal ones.

For example, several studies in French, German and Dutch have found that children have difficulties separating correct from incorrect uses of concessive connectives (Kail & Weissenborn, 1984; Dragon et al., 2015) and choosing an appropriate conclusion for a sentence containing a concessive connective (Janssens, Drooghmans & Schaeken, 2015). In one of the studies, Knoepke et al. (2017) compared children's

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evaluation of concessive sentences like (17) and (18) to causal ones in German:[4]

(17) Sandra war nicht müde. Trotzdem ging sie ins Bett.
'Sandra was not tired. Nevertheless, she went to bed.'

(18) Das Wetter war gut. Trotzdem setzte Laura eine Sonnenbrille auf.
'The weather was good. Nevertheless, Laura put on her sunglasses.'
[from Knoepke et al., 2017: 10]

Children aged 6;9 to 11;4 performed almost on par with adults when shown positive causal relations conveyed by the connectives *darum, daher, deshalb* and *denn* (corresponding to English 'that's why/for'). But with sentences like (17) and (18), always conveyed with *trotzdem* ('nevertheless/anyway') in German, their judgments were quite different, as they systematically judged coherent items like (17) as incoherent and incoherent ones like (18) as coherent. This behavior might indicate that children treat concessive connectives like positive causal links. In the filler items of this experiment, children were shown sentences where the segments were not causally related and contained either a positive (19) or negative (20) causal connective. If children based their judgments on the plausibility of the causal link, they should reject all these items. However, they accepted sentences with the negative connective (20) while correctly rejecting the sentences with a positive connective (19).

(19) Die Löwen brüllen laut. Dann wiegt es weniger.
'The lions roar loudly. Then it weighs less.'

(20) Sina isst ein Stück Kuchen. Trotzdem fallen die Blätter im Herbst.
'Sina is eating a piece of cake. Nevertheless, the leaves fall in autumn.'
[from Knoepke et al., 2017: 13]

This led the authors to conclude that at least part of children's difficulty comes from their lack of understanding of the negative connective itself. This conclusion is further corroborated by Spenader (2018) who conducted a context choice task (see also Champaud & Bassano, 1994) in which Dutch-speaking children aged 7–10 had to choose either a positive oriented or a negative oriented generalization on the basis of a sentence containing either a positive connective (*want*) or a negative

[4] The German connective used in this experiment (*trotzdem*) belongs to a less formal register than the English *nevertheless*.

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one (*maar*) as in (21). The sentences were designed in such a way that children could not resort to world knowledge to provide their answers.

(21) Sven comes from Sweden, but he's not good at hopscotch.
Conclusion 1: Swedes are usually good at hopscotch.
Conclusion 2: Swedes are usually not good at hopscotch.
[from Spenader, 2018: 621]

In this task, children were very competent in choosing the correct conclusion when sentences contained the positive connective (*want*) but performed far below chance level when they contained the negative one (*maar*). These results indicate that children do not perceive the fact that concessive connectives involve a denial of expectation. Taken together, these studies thus confirm that causal and concessive relations do not raise the same challenges for children, and that the greater complexity of concessive relations is reflected in the later age at which they are acquired.

In the experiments of Cain and Nash (2011), temporal relations seemed to be particularly complex for children, as even 10-year-olds did not perform on par with adults in the offline tasks. Other studies have more specifically investigated the reasons for this complexity. Pyykkönen and Järvikivi (2012) tested the ability of Finnish-speaking children aged 8, 10 and 12 to understand temporal relations in which the two segments did not contain a typical sequence of events that could be established based on world knowledge (e.g., falling and getting hurt). They assessed two factors that could potentially influence children's ability to infer the correct temporal order between two events. First, whether the order of the segments in the relation corresponded to the order in which they happened in the world as in (22) and (24), or to the reverse order as in (23) and (25). Second, whether the temporal indication was given at the beginning of the sentence, before children had started building a mental model of the discourse, as in (24) and (25), or sentence-medially as in (22) and (23), thus requiring a revision of the mental model when the connective did not indicate an order of the segments iconic to the order of events in the world, as in (23).

(22) Ilkka luki kirjeen ennen kuin meni kouluun.
'Ilkka read the letter before he went to school.'

(23) Ilkka luki kirjeen sen jälkeen kun meni kouluun.
'Ilkka read the letter after he went to school.'

(24) Ennen kuin Ilkka luki kirjeen, hän meni Kouluun.
'Before Ilkka read the letter, he went to school.

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(25) Sen jälkeen kun Ilkka luki kirjeen, hän meni kouluun.
'After Ilkka read the letter, he went to school.'
[from Pyykkönen & Järvikivi, 2012: 523]

Comprehension was assessed by asking children to indicate which event occurred first, or if they thought the two events occurred simultaneously. Results from this experiment clearly indicated that both the placement of the connective and the order of the segments play a role, as children had a lower performance with the connective *after* for which the textual order of the segments is reversed with respect to the order of events in the world. In addition, the placement of the connective in the sentence also greatly mattered, as children reached a lower performance when the connective occurred sentence-medially than sentence-initially. A likely reason is that in this case, children have to revise their mental model of the discourse mid-sentence, while in the sentence-initial position, they start building it with the correct representation in mind. In addition, this effect was visible even when children had to decode linguistic elements in a reversed chronological order (with *after*). Children's performance was also found to improve with age. While 8-year-olds performed only slightly above chance level in sentences like (23), the older children performed better, even though their scores remained lower in this condition. Even at the age of 12, children did not perform on par with adults on these sentences. This provides a strong indication that dealing with temporal relations is complex when the discourse does not follow the chronological order of events, and even more so when children have to revise their representation of an event in their mental model.

Blything, Davies and Cain (2015) assessed children's comprehension of temporal relations in English, using a simplified task to evaluate the comprehension of younger children, aged 3–7. In their experiment, they used short videos, and children were simply asked at the end to choose which of two images corresponded to the thing that the character did first by touching the corresponding image on the computer screen. They assessed the role of the connective (*before* or *after*), the role of the order of events (chronological or nonchronological) and the placement of connectives (sentence-initial or sentence-medial). They also included in their design the factor of world knowledge (i.e., whether it allowed children to infer the order of events) as young children have been found to resort to it in previous studies (e.g., French & Brown, 1977). In addition, they included a test of working memory capacity. Their results indicate that young children at the age of 3–4 have a limited knowledge of the meanings of these two connectives, and resort to the order of presentation of the two segments to infer temporality.

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In contrast, the factor of world knowledge did not play a role. Children's performance increased with age, but children aged 4–6 still performed worse than 7-year-olds. Working memory capacity was also a significant predictor of performance. These results led the authors to conclude that the comprehension of temporal relations may fail when processing demands are high (reverse chronological order, sentence-medial connective). Still, this research also indicated that children show evidence of understanding temporal relations sooner than expected when the task is made simple enough for them.

In addition to comparing the order of acquisition between connectives and relations, another important issue in the developmental process of connectives during primary school years is the degree of individual variation during this period. Volodina and Weinert (2020) assessed the comprehension of a variety of connectives conveying the main types of discourse relations by German-speaking primary school children, and assessed the contribution of a variety of factors on their acquisition, such as the family's socioeconomic status, parents' joint activities with the child, as well as their language background and general language skills. Using growth curve models, they found that the socioeconomic status of families as well as children's level of receptive grammar have the greatest impact on their mastery of connectives. These factors were important both to explain children's initial level, and the subsequent growth rate of connective comprehension. We will come back to individual variations in the next section, when discussing the competence of teenagers.

To summarize, we have illustrated in this section the way children progress in their comprehension of various types of discourse relations and connectives during primary school years, emphasizing important differences between relation types, and between subtypes of a given relation (e.g., temporal relations), depending on their degree of cognitive complexity. A recurrent finding was that children do not show evidence of a fully adult-like comprehension at the end of the primary school years. This leads us to examine the ways in which children continue developing their understanding of connectives during their teenage years in the next section.

8.5 MASTERING MORE DIVERSE CONNECTIVES DURING THE TEENAGE YEARS

Although children show evidence of mastering frequent connectives in simple tasks at the end of their primary school years, a number of

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open questions remain about the way their competence continues to develop. First, do teenagers equally benefit from connectives in all types of texts? Are there differences between teenagers depending on their level of reading skills? These questions are all the more relevant given that connectives are used differently across genres (see Chapter 7), and that they seem to benefit adult readers differently depending on their degree of prior knowledge on a topic (see Chapter 6).

Van Silfhout, Evers-Vermeul and Sanders (2015) analyzed the effects of connectives on how secondary school students in grade eight (aged 13–14) with various levels of reading competence process and understand connectives across narrative and expository texts. Using eye-tracking, the authors studied the processing differences between texts with and without connectives, in particular, the speed with which the second segment of a relation was read, and the duration of regressions to previous portions of the text for rereading. They also measured the role of connectives for local comprehension by asking comprehension questions involving bridging inferences, and for global comprehension by using a sentence ordering task. In the experimental materials, they manipulated the presence or absence of additive, temporal and causal Dutch connectives. Their results reveal that connectives are useful for the online processing of discourse relations in texts, as all teenagers read the segments immediately following a connective more quickly and spent less time rereading previous regions. This study thus further confirms that connectives give processing instructions that facilitate reading, even for young readers. In addition, connectives were also found to enhance local comprehension, independently of the reading skills, as evidenced by the ability of all readers to derive bridging inferences. In contrast, connectives did not seem to play a role for global comprehension, as they did not help readers organize sentences in the correct order after reading. All these effects were similar across narrative and expository texts, indicating that young readers equally benefit from connectives in both genres. This study does not however provide information about potential differences between discourse relations, as they were not analyzed separately.

In a larger-scale study involving 794 Dutch-speaking teenagers aged 13–16, Kleijn, Pander Maat and Sanders (2019) tested the role of additive, temporal, causal and contrastive connectives that were either added or removed from expository texts originally intended for teenagers. The texts were of two types: educational texts and public information texts on topics of interest for teenagers. The task involved a cloze test in which teenagers had to restore previously deleted words.

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Just like van Silfhout et al. (2015), the authors did not find differences between teenagers depending on their reading skills or academic level, as for all teenagers, connectives helped local comprehension. They also found an effect on global comprehension, limited to the more difficult texts. In this study, the role of each type of discourse relation was also assessed separately. Results indicate that connectives are useful to help the comprehension of concessive and causal relations, but that they conversely diminish the comprehension of additive relations. Temporal relations were not frequent enough to draw solid conclusions. The authors explain the striking difference between relations by the fact that concessive and causal relations, being the most cognitively complex ones, are also the most informative. In such relations, connectives help readers to integrate the upcoming segment, and construct a coherent interpretation. In the case of additive relations, it is possible that the connective drew excessive attention to the intended relation, and invited readers to look for a more sophisticated interpretation than a simple conjunction. In that sense, they may have made the relations appear more complex, thus decreasing comprehension.

In sum, both studies summarized so far indicate that connectives are helpful for all teenagers and should therefore be used as much as possible in teaching materials destined to this age group. The situation appears to be somewhat different, however, for primary school children and teenagers coming from language-minority backgrounds, who have to read school materials in what is for them a second language. In a study assessing the competence of fourth grade language minority children in the United States, who spoke Spanish at home and read English only as a second language, 10-year-old children were found not to benefit from connectives in the way native English-speaking teenagers do (Crosson, Lesaux & Martiniello, 2008). In addition, while for English-speaking children, connectives made a specific contribution with respect to general vocabulary skills to explain text comprehension, this was not the case for language-minority children in fifth grade (Crosson & Lesaux, 2013). Overall, this seems to indicate that connectives pose a specific challenge for non-native speakers (see Chapter 9). Interestingly, in fourth grade, two factors explained the specific difficulty of some of the connectives inserted in the experiment. First, the cognitive complexity of the relation they encoded, and second their degree of familiarity, for example, frequent connectives like *because* or *but* or less frequent ones like *furthermore* or *however* (Crosson & Lesaux, 2008). In fifth grade however, the role of cognitive complexity disappeared, and the comprehension of connectives was only predicted by their degree of familiarity (Crosson & Lesaux, 2013). This seems to

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indicate a shift from the early acquisition period, when cognitive complexity is a major factor explaining children's difficulties, to a later acquisition phase in teenage years when the difficulty of understanding connectives is linked to their familiarity.

The importance of the mode in which connectives are typically used, and more generally their frequency in language use, was underlined in other experiments focusing on populations of teenagers. Nippold, Schwarz and Undlin (1992) specifically assessed the comprehension of connectives used in the written mode in English, such as *moreover*, *furthermore*, *nevertheless* and *conversely* by teenagers aged 12;9 and 15;10, and young adults attending respectively college and university, and aged on average 19;2 and 23;8. Across a sentence-continuation task and a connective insertion task in short texts, they compared the comprehension of continuous (that they call "concordant") and discontinuous (that they call "discordant") connectives (see Chapter 6). Their results indicate that teenagers and young adults understand connectives encoding continuous and discontinuous relations equally well, thus adding further support to the claim that during the teenage years, cognitive complexity is no longer a relevant factor to explain offline comprehension. However, they also found a progression from the teenage years to young adulthood (especially between the 15-year-olds and the 19-year-olds) in the mastery of connectives in general, indicating that the full mastery of connectives from the written mode keeps developing until early adulthood and possibly beyond. Finally, their results show a discrepancy between the connective insertion task, in which teenagers performed better, and the sentence continuation task. This seems to indicate that while teenagers understand connectives rather well, they still experience difficulties using them appropriately.

A similar discrepancy was found by Zufferey and Gygax (2020b) who studied the acquisition of four French connectives bound to the written mode, which convey four types of discourse relations (*en outre* 'in addition', *aussi* 'therefore', *en effet* 'for', *toutefois* 'however') by 16-year-old teenagers from two different academic levels. They also found that the degree of cognitive complexity of the relation conveyed by a connective did not impact students' ability to use it in a connective insertion task. The difficulty of connectives was related instead to their frequency in language use, as all teenagers performed less well with the two less frequent connectives (*en outre* and *aussi*). In addition, the academic level of teenagers was found to play a role, thus testifying to the existence of individual variations during the teenage years. Tskhovrebova, Zufferey and Gygax (2022) tested the comprehension

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of the same four French connectives in a larger sample of 191 teenagers at secondary school level (aged 12–15 on average), and from high school level (aged 16–18 on average). Various levels of academic competence were represented in each age group. They also compared teenagers' ability to use these connectives across two insertion tasks: one between two sentences and the other within short texts. Their results confirm that the two less frequent connectives are mastered less well among teenagers from both age groups. They also found a progression from secondary school to high school, but only for the two more frequent connectives (*en effet* and *toutefois*) thus underlining again the role of frequency as a factor influencing teenagers' level of competence with connectives. In both age groups, important differences were found depending on teenagers' academic level, thus confirming the existence of individual variations. The latter were found to persist even among adults (see Chapter 6). Finally, they found that inserting connectives in short texts was more challenging than inserting them between sentences. They explain this discrepancy by the fact that interpreting discourse across several sentences is cognitively more demanding, thus decreasing teenagers' ability to identify the relevant segments, and to infer the correct relation.

In sum, the studies presented in this section clearly indicate that the acquisition of connectives, while starting very early, spans over a long period of time. While cognitive complexity limits young children's ability to understand connectives until the end of their primary school years, the frequency of connectives is a better predictor of teenagers' difficulties with some connectives.

8.6 CONNECTIVES IN CHILDREN WITH LANGUAGE AND COGNITIVE IMPAIRMENTS

In this last section, we will take a brief look at the way children with specific language impairment and autistic children use and understand connectives, as a way to shed further light on the cognitive and linguistic skills required for their acquisition.

Children with specific language impairment (SLI) typically exhibit a form of linguistic impairment without other cognitive, hearing or affective impairments (Leonard, 1998). One of the main aspects of language that is impaired in SLI is inflectional morphology, yet other forms of lexical deficits have also been found in this population (e.g., Leonard & Deevy, 2004). Difficulties at the discourse level, although less often investigated, have also been found, such as a generally poor

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ability to use cohesion markers (Norbury, Gemmel & Paul, 2014). In the case of connectives, a study with Portuguese-speaking children showed that children with SLI tend to underuse connectives compared to typically developing children (Gonsalez et al., 2012), and another one involving Mandarin-speaking children found that children with SLI underuse connectives indicating temporal and causal relations, and tend to overuse sequential connectives such as the equivalent of 'and then' in English (Tsai & Chang, 2008). Other studies have found that children with SLI tend to misuse connectives more often than typically developing children (Purcell & Liles, 1992). All these studies focused mostly on quantitative properties of connective use, yet there is also evidence that children with SLI are not sensitive to all the semantic nuances between closely related connectives. Tribushinina, Dubinkina and Sanders (2015) compared the uses of two Russian additive connectives (*i* 'and' and *a* 'and/but') by 7-year-old SLI and typically developing children. Their results indicate that while the two groups use these connectives equally as often, there are subtle qualitative distinctions between them. Namely, children with SLI used the connectives more often in a way that was not compatible with the causal link present in the story they were asked to narrate based on pictures. In a follow-up experiment 16 months later, the errors remained high in the group of children with SLI. These errors were, however, not due to their misunderstanding of the causal links between elements of the story, as they were able to answer *why*-questions appropriately. Rather, their difficulties stemmed from their lack of understanding of the subtle semantic nuances encoded in these connectives.

Many bilingual children do not have the same level of linguistic skills as monolingual children in one or two of their languages. As a result, these children have sometimes been mixed up with children suffering from SLI (Armon-Lotem, De Jong & Meir, 2015). For example, in a production study, bilingual Dutch-Russian children with Dutch as a dominant language and Russian-speaking SLI children were both found to have difficulties distinguishing between the two additive connectives discussed above, as the two groups were indistinguishable in terms of error rates and types (Tribushinina et al., 2015). Yet, other studies have revealed that bilingual children and children with SLI have distinct linguistic profiles with regard to their use and understanding of connectives. For example, Mak et al. (2017) compared the online processing of sentences with the two Russian connectives *i* and *a* across monolingual Russian-speaking children, Russian-Dutch bilingual children and Russian-speaking children with SLI. They found that the monolingual typically developing children and the bilingual children

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have similar processing patterns for these connectives, indicating that they integrated their meaning very rapidly during sentence processing. In contrast, children with SLI did not similarly integrate their meaning. Therefore, surface similarities between SLI and bilingual children in production tasks do not necessarily mean that their understanding of connectives is similar. Kupersmitt and Armon-Lotem (2019) reached the same conclusion when comparing the expression of causal relations in a narrative task between monolingual and bilingual children, with and without language impairments. Monolingual and bilingual typically developing children made a similar use of causal relations, while children with language impairments had a lower ability to express them. These results thus confirm that having a form of language impairment matters more than the level of linguistic proficiency to explain difficulties in expressing and understanding connectives.

In addition to SLI, the mastery of connectives and discourse relations has been assessed in autistic children. Contrary to children with SLI, autistic children suffer more from communicative or pragmatic deficits rather than from language impairments (Frith, 1989). Several studies have assessed the ability of autistic children to use causal relations in narratives. A study in English found that autistic children spontaneously produce fewer causal statements than typically developing children (Hallin, Garcia & Reuterkiöld, 2016). Another involving Mandarin-speaking children (Wen-hui & Pao-chuan, 2015) found that autistic children produced narratives that were less causally connected and less coherent. In a study assessing the comprehension of temporal relations in Dutch, Overweg, Harman and Hendriks (2018) found that autistic children had difficulties understanding the order of events, but contrary to typically developing children, their difficulties were not more pronounced when the order of events in discourse were not iconic to their order in the world. In addition, this study revealed that autistic children's competence was correlated with their IQ, working memory, verbal ability and theory of mind. Working memory capacities and verbal ability probably helped them to understand the complex sentences conjoined by temporal connectives. The role of theory of mind ability was more specifically linked to the understanding of sentences in which temporality in discourse was not congruent with world order. The authors conclude that understanding these sentences requires the ability to shift from one's own perspective to another temporal frame, an ability which typically pertains to theory of mind skills.

In sum, since studies are still too limited to draw final conclusions on the role of linguistic and cognitive impairments for the use and

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understanding of connectives, analyzing these populations is a fruitful area of investigation, as they present specific deficits that shed more light on the competences required to master them.

8.7 SUMMARY

This chapter opened with a presentation of young children's early productions of discourse relations and connectives. We have seen that while most children start producing a variety of relations by the age of three, all connectives do not appear simultaneously in their speech. The observed order of acquisition matches chiefly the degree of complexity of each connective, and to a lesser extent its syntactic complexity. We have also seen that parental input greatly matters, both to foster productions locally, and also in the long run to help the development of connective usage. Yet, a puzzling result from the acquisition literature is that children's early productions are not matched by a mature comprehension of connectives. Part of the reason for this discrepancy is that understanding connectives requires the ability to process written language, and the latter typically contains longer and more complex sentences than spoken language. In addition, children's own early productions of connectives do not cover all the contexts in which they are used by adults. We have argued in particular that important differences in the age of acquisition can be observed between various functions of the same connectives, or between different subtypes of the same discourse relation. During the teenage years, children's repertoire of connectives continues to increase to include connectives from the written mode, but it is not until early adulthood that these connectives are fully mastered. Another important finding from this chapter is that important individual differences between children are found throughout the acquisition process, in relation to different environmental factors such as the socioeconomic status of families, the degree of exposure to print that children have had, and their academic background. Research on children with language impairments and bilingual children additionally revealed that a lower proficiency does not always prevent bilingual children from understanding connectives, contrary to children with language impairments. Yet, research on language minority children indicates that the level of linguistic proficiency can also matter, as these children typically possess a smaller repertoire of connectives and benefit less from their presence in texts. We explore the mastery of connectives by non-native speakers in more detail in the next chapter.

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DISCUSSION POINTS

- What are the advantages and limitations of studying children's production of connectives versus their comprehension of them?
- What is the order of acquisition between discourse relations and how can this order be explained?
- Why would one think that the factors that best explain children and teenagers' difficulties with connectives evolve with age? (See in particular the studies involving teenagers.)

FURTHER READING

Evers-Vermeul and Sanders (2009) provide an excellent overview of the early acquisition of connectives. The distinction between the acquisition of objective and subjective causal relations across languages is discussed by Zufferey, Mak and Sanders (2015). For the primary school years, the study by Cain and Nash (2011) is a complete and accessible reference for both online and offline comprehension. The role of connectives for text comprehension is analyzed in a comprehensive large-scale study by Kleijn, Pander Maat and Sanders (2019). The distinction between SLI and bilingual children's comprehension of connectives is discussed in an eye-tracking study by Mak et al. (2017).

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