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The emergence of Dutch connectives; how cumulative cognitive complexity explains the order of acquisition*

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ABSTRACT

Before they are three years old, most children have started to build coherent discourse. This article focuses on one important linguistic device children have to learn: connectives. The main questions are: Do connectives emerge in a fixed order? And if so, how can this order be explained? In line with Bloom *et al.* (1980) we propose to explain similarities in the development in terms of cumulative cognitive complexity: complex relations are acquired later than simple ones. Following a cognitive approach to coherence relations, we expect positive relations to be acquired before negatives and additives before temporals and causals. We develop a multidimensional approach to the acquisition process in order to account for the variation among children. Hypotheses were tested by analyzing data from children aged 1;5–5;6 on the emergence of Dutch connectives. The multi-dimensional approach of cognitive complexity describes both the uniformity and the diversity in the developmental sequences of Dutch-speaking and English-speaking children.

INTRODUCTION

Most children build their first multi-clause discourse before the age of three; instead of uttering one clause at a time, they start producing combined clauses (*cf.* Clark, 2003). At first, the semantic meaning relations or 'coherence relations' (Hobbs, 1979; Sanders, Spooren & Noordman, 1992) between these clauses remain implicit. For instance, the Dutch contrastive relation in (1) could have been marked with *maar* 'but', and the causal

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relation in (2) with *want* 'because'.[1] To make these coherence relations explicit, children need to learn how to use connectives (see (3) and (4)), the prototypical linguistic markers of coherence relations (Sanders & Spooren, 2007).

(1) Ik wil niet teken(en). Ik wil verven. (Josse, 2;8.18)
'I do not want to draw. I want to paint.'
(2) Even liggen. Beetje moe. (Matthijs, 2;9.15)
'Lay down for a moment. Bit tired.'
(3) Jij mag niet eh van drop, **want** dat is van mij! (Thomas, 2;10.19)
'You can't have uh licorice, because that's mine!'
(4) Ik wil geen motor. **Maar** nou wil ik een politieauto. (Josse, 2;11.23)
'I don't want a motorbike. But now I want a police car.'

The acquisition of connectives like *want* 'because' and *maar* 'but' is at the heart of the current paper, which takes up two questions concerning the acquisition of connectives in Dutch and English child language: Do connectives emerge in a fixed order? And if so, how can this order be explained? Presupposing for a moment that there is indeed a more or less fixed order of connective acquisition, at least three answers to the second question spring to mind. A first explanation is conceptual complexity: some relations are more complex than others and children will first learn to use the relatively simple relations before they acquire the more complex ones. A second explanation might be syntactic complexity: conjunctions may relate clauses in a coordinating or in a subordinating structure, and these structures vary in complexity. A third explanation is based on the frequency of use in parental input: the more frequent a linguistic item is used by parents, the earlier it will be used by the child.

As we shall see, proponents of all three answers can be identified in the acquisition literature. It is even likely that all three explanations have some role to play. In the current paper, we focus on conceptual as well as syntactic complexity, and we will argue that conceptual complexity is of primary importance. In addition to complexity, we assume parental input to be of decisive importance – following the work of, among others, Brown (1973), Brown & Hanlon (1970), Diessel (2004) and Tomasello (2003). However, a thorough discussion of parental input either as an alternative theory or as a component of an integrative theory goes beyond the scope of this paper. We present an account of cumulative conceptual complexity which is based on a cognitive theory of coherence relations and connectives (CCR – Sanders *et al.*, 1992, 1993; Sanders, 1997; Spooren & Sanders,

[1] Most examples in this paper are taken from the Dutch corpora in the CHILDES database that are analyzed here. After each fragment of child language, an indication of the age of the child is given (in years;months.days).

2008). In this theory, we take coherence relations as cognitive entities. All coherence relations share a limited set of basic semantic characteristics. For instance, all relations show polarity: they are either of a positive (*and*, *because*), or of a negative (*but*, *although*) nature. The theory predicts differences in conceptual complexity and we expect these differences to be reflected in acquisition: complex relations are expected to be mastered by children only after the simpler ones are learned. For example, positive relations will appear before negative relations.

The basic idea of cognitive complexity which 'sets the pace for acquisition, at least in part' (Clark & Clark, 1977: 338) is highly similar to earlier work (*cf.* Brown, 1973; Clark, 1973). Brown (1973: 254ff.) introduced the notion of cumulative complexity extensively, in connection with the question of why fourteen English grammatical morphemes are acquired in a particular order. He studied cumulative semantic complexity as well as cumulative grammatical complexity, and compared them, as predictors of order of acquisition, to each other and to the relative frequency of the forms in the parental input. Bloom, Lahey, Hood, Lifter & Fliess (1980; reprinted in a slightly revised version in Bloom, 1991) also give an account in terms of cumulative complexity. They found that English children follow the same route in acquiring coherence relations or – to put it in their terms – semantic relations:

(5) additive < temporal < causal < adversative

Bloom *et al.* also investigated the order of emergence of sentential connectives, which are taken to be the prototypical linguistic markers of coherence relations. For connectives, their data give a less clear picture. Although *and* always appears first, the four children in their study show a variety of developmental patterns for the connectives *and then*, *because*, *so* and *but*. In other words, for English there is 'consistency among children in acquiring content and variation in acquisition of form' (Bloom, 1991: 260).

The current study elaborates on this line of work, setting out to increase the generalizability of conceptual complexity accounts in three ways. First of all, we add cross-linguistic comparison by extending the field of connective acquisition with an analysis of data from twelve Dutch children acquiring their native language. Second, we present a multidimensional approach to the acquisition process which accounts for the diversity as well as the uniformity in the developmental sequences of Dutch-speaking and English-speaking children, improving the explanatory power of conceptual complexity accounts. Finally, we account for differences in conceptual complexity in terms of general cognitive principles that are not just relevant for acquisition data; rather, these cognitive principles explain how humans lexicalize linguistic categories across languages (*cf.* Knott & Sanders, 1998; Sweetser, 1990), how they understand inter-clausal relations (Costermans &

Fayol, 1997; Noordman & Vonk, 1998) and how they process these relations on-line (Sanders & Noordman, 2000). For instance, the finding that negative relations are harder to process than positive ones is classical (Clark, 1974; Wason & Johnson-Laird, 1972). From the point of view of a cognitive theory of coherence relations it is likely that such principles also account for the way in which children learn to build discourse by relating propositions. After we have elaborated on this cumulative conceptual complexity account, we discuss syntactic complexity as a possible additional account.

CUMULATIVE CONCEPTUAL COMPLEXITY

Our cumulative complexity approach can be regarded as a multidimensional elaboration of the explanation that Bloom *et al.* (1980: 258) give for the uniformity in the development of coherence relations. They explain the similarity in the development of coherence relations on the basis of cumulative semantic or conceptual complexity: children first acquire a certain relation, and only later on start producing coherence relations that can be characterized in terms of that same relation plus something more. For example, 'adversative sentences were all additive in that two events or states were joined; causal was both additive and temporal; some of the adversative sentences were both additive, temporal and quasi-causal' (Bloom *et al.*, 1980: 258). Although their theory accounts for similarities in the orders of emergence, it does not give an account of the variation among children.

Our theory starts from the idea that there is no inherent need for one fixed order of emergence. Contrary to Bloom *et al.* – who order the conceptual notions additive, temporal, causal and adversative along a single dimension – we propose that each connective can be characterized on the basis of several conceptual dimensions. Per dimension, one relatively simple and one relatively complex value can be distinguished. The interaction between these dimensions themselves leaves room for variation in the course of acquisition.

We base our approach on the cognitive approach to coherence relations developed in Sanders *et al.* (1992, 1993). They categorize coherence relations with a restricted set of cognitive primitives. The saliency of their categorization has been shown in various experiments (Sanders, 1997; Sanders *et al.*, 1992, 1993). Furthermore, these cognitive primitives are relevant to discourse processing and representation: they affect on-line processing as well as memory representations (Sanders & Noordman, 2000). It is likely that a cognitively plausible classification of coherence relations can also be used for connectives, the linguistic counterparts of these cognitive entities. And indeed, there is a vast amount of (text-)linguistic literature that shows how very similar distinctions are useful in describing

the differential meaning of connectives and lexical cue phrases expressing coherence relations (*cf.* Knott & Dale, 1994; Knott & Sanders, 1998; Sweetser, 1990). Hence, we will use three of these primitives to categorize connectives, and discuss how they 'produce' differences in conceptual complexity.

Hypotheses based on cumulative conceptual complexity

The first primitive, the basic operation, distinguishes between additive (weakly connected) and causal (strongly connected) relations, such as (6) and (7). An additive operation exists if a relation of logical conjunction (P & Q) can be deduced between the two discourse segments. A causal operation exists if an implication relation ($P \rightarrow Q$) can be deduced (*cf.* Sanders *et al.*, 1992: 7).

(6) Kim is een meisje. **En** jij bent een jongetje he? (Thomas, 2;8.23)
'Kim is a girl. And you are a boy, aren't you?'

(7) Ik heb (een) beetje griep. **Want** ik ben laat gaan slapen. (Abel, 3;3.8)
'I've got a touch of flu. Because I went to bed late.'

A causal implication relation presupposes an additive relation; causal relations add more information to the additive relation and are therefore regarded as more complex than additive relations. This analysis can be represented in terms of features: an additive connective like *en* 'and' is underspecified for the feature 'causal' (represented as [α causal]), whereas a causal connective like *want* 'because' is positively specified for the same feature (represented as [+causal]). This idea of an underspecification in features is in line with the observation that certain 'underspecified' connectives can occur in more specific coherence relations (e.g. additive *and* can be used to express temporal relations). In line with the difference in conceptual complexity, the following prediction can be made concerning the acquisition of additive versus causal connectives: the first causal connective should not appear before an additive connective has occurred. In (8), this acquisition order is indicated by placing causal below additive.

(8) Prediction based on the basic operation:
additive [α causal]
↓
causal [+causal]

The second primitive is polarity, which distinguishes between positive ([α negative]) relations as in (9) and negative ([+negative]) relations such as the one in (10). A relation is positive if the two discourse segments S_1 and S_2 function in the basic operation as P and Q respectively. A relation is negative if not S_1 or S_2 but their negative counterparts, not-S_1 or not-S_2, function in the basic operation (Sanders *et al.*, 1992: 10–11).

(9) PARENT: Nou rijdt 'ie.
'Now it (lit. 'he') drives.'
PETER: **En** nou gaat 'ie in het schuur. (Peter, 2;3.7)
'And now it goes into the barn.'

(10) 'k Wou bij oma een molen maken, **maar** dat kon ik niet. (Laura, 4;9.10)
'I wanted to make a mill at grandma's, but I couldn't.'

Negative relations can be classified as more complex than positive ones, a prediction that goes back to Clark & Clark (1977), who summarize effects of negation on processing and acquisition. Both clause complexes in (9) and (10) state something; in addition, the negative relation denies a relation between the propositions contained in (10), and is therefore more complex than the positive relation. For connectives, this results in prediction (11): the first negative connective should not appear before a positive connective has occurred.

(11) Prediction based on polarity:
positive [α negative]
↓
negative [+negative]

The third primitive, temporality, distinguishes between clause complexes that either do or do not show a temporal ordering of the segments S_1 and S_2. The utterances in (12) give an example of a temporal causal relation (in this case marked with *and*), whereas (13) shows a 'non-temporal' causal relation marked with *cause* (=(13) and (12) in Bloom *et al.*, 1980: 244). The semantic relation in (12) involves a causal link at the locutionary level; it describes two real-world events that show a specific temporal order: S_1 precedes S_2. The pragmatic relation in (13) involves a causal link at the illocutionary level; Eric gives a motivation for performing his speech act 'get them'. In this case, the temporal order of the segments is irrelevant (Sanders *et al.*, 1992).

(12) She put a band-aid on her shoe **and** it maked it feel better. (Peter, 3;2)

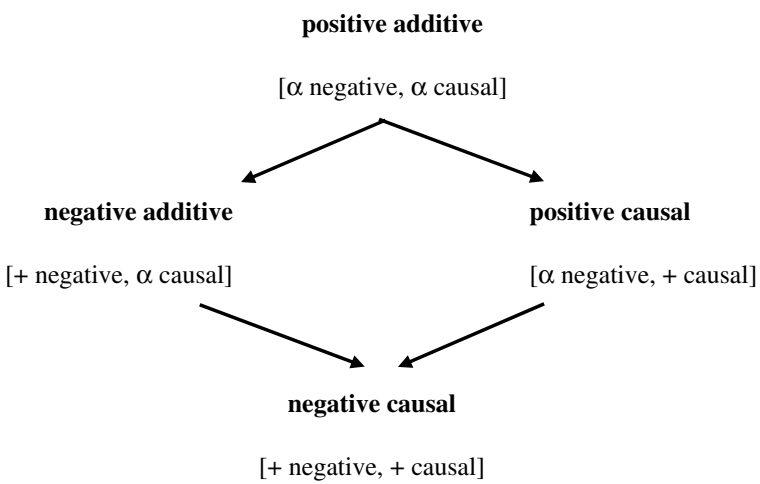
(13) Get them **cause** I want it. (Eric, 2;5)

For connective acquisition, we predict (see (14)) that the first temporal connective should not appear before a non-temporal connective has occurred.

(14) Prediction based on temporality:
non-temporal [α temporal]
↓
temporal [+temporal]

Looking at the three primitives separately, the conceptual complexity account seems to result in relatively strong claims, which predict uniformity in the acquisition processes. The diversity arises when the interaction between these factors is taken into account. For instance, the primitives basic operation and polarity do not operate independently, since each connective can be characterized by both primitives: a positive additive relation is unspecified for both features, whereas a negative causal one is positively specified for both features. Our prediction is that negative causals (e.g. English *although*) are the most complex (*cf.* also Piaget, 1969; Spooren & Sanders, 2008), given their double specification, and so should appear last, after negative additives (e.g. *but*) and positive causals (e.g. *because*), which are both only specified for one feature. This is depicted in the diagram in (15) by placing the negative causal use below both negative additive and positive causal use.

(15) Predictions based on the interaction between basic operation and polarity:

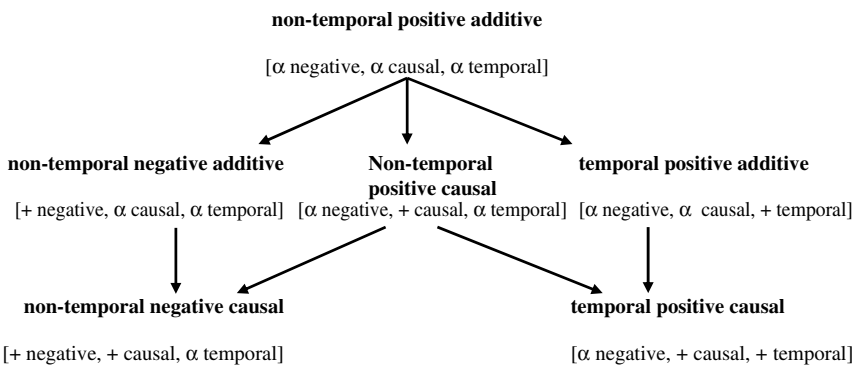


Negative additives and positive causals are placed on the same level: they are not ordered in relation to one another, because our complexity theory does not make predictions about the relative complexity of the feature 'negative' versus the feature 'causal'. Of these two, children can first acquire either a negative additive connective or a positive causal connective. However, they should both occur only after a positive additive connective has entered the language of the child, since positive additive is unspecified for both features. The diagram in (15) shows that our complexity theory leaves room for variation in the developmental sequence.

A similar story holds for the interaction between basic operation and temporality. Additive relations may or may not show a temporal ordering of the segments. Similarly, causal relations are not necessarily based on a temporal ordering of the segments. From the point of view of cumulative complexity we predict that both temporal additives and non-temporal causals will appear after the first use of a purely (non-temporal) additive connective. In addition, the emergence of temporal additives and non-temporal causals is ordered with respect to the emergence of temporal causals, but not in relation to one another. Again, the interaction between the two primitives predicts both uniformity and variety in the developmental sequences of individual children.

Our hypotheses can be summarized as in (16). Again, placement on the same level implies indeterminacy in order of emergence, whereas placement on a lower level implies that the connective should emerge later than connectives on a higher level.

(16) Hypotheses based on the interaction between the three primitives:



In this diagram, the combination temporal negative additive (which would be placed on the lowest row) is omitted. An example of a connective involving both a negative and a temporal relation is Dutch *terwijl* 'while'. The temporal relation it expresses is one of simultaneity instead of sequence (which is discussed here). It appears that children acquire this connective relatively late: it is not attested to at all in any of the Dutch corpora for children up to five years old.

Another combination that is omitted in this diagram is the combination temporal negative causal (with a positive specification of all three features). This would be the most complex combination. We do not know of any Dutch or English connectives that force this specific interpretation.

For ease of reference, we have split the diagram in (16) into four separate hypotheses (see (17)). The notation A⩾B means that A will not emerge

TABLE 1. *Dutch connective selection*

Connective	English equivalent	Basic operation	Polarity	Temporality
en	and	additive	positive	temporal/non-temporal
maar	but	additive/causal	negative	non-temporal
toen	then/when	additive	positive	temporal
want	because/for	causal	positive	temporal/non-temporal

before B has occurred. Sentence symbols separated by commas (e.g. A, B) are to be read as not ordered relatively to one another. The first two hypotheses predict uniformity in the developmental sequences; the other two hypotheses leave room for variation among children.

(17) Hypotheses based on increasing cumulative complexity:
  (a) first causal connective ⩾ additive connective
  (= the first causal does not appear before an additive has occurred)
  (b) first negative connective ⩾ positive connective
  (c) first negative causal ⩾ positive causal connective, negative additive connective
  (d) first temporal causal ⩾ (non-causal) temporal ⩾ non-temporal additive connective

In order to test these hypotheses, we have analyzed data on the acquisition of Dutch connectives by very young children (with ages ranging from 1;5 to 5;6). This longitudinal analysis complements previous experimental analyses of the connective used by Dutch children aged six and older (see Roelofs, 1998; Spooren, 1997; Spooren & Sanders, 2008; Van Hell, Verhoeven & Wengelin, 1999).

Dutch connective selection and materials

Our research focuses on four of the most frequent Dutch connectives (in adult language, *cf.* Uit den Boogaart, 1975), which represent all the conceptual primitives mentioned above (see Table 1). These Dutch connectives are similar to the earliest connectives mentioned in the studies that focus on English connectives (*cf.* Bloom *et al.*, 1980; Braunwald, 1985; Diessel, 2004), which makes it possible to compare the Dutch results to the English data. There are some relevant differences between the languages, too. For example, Dutch *toen*, which can be used either as an adverbial or as a subordinator, can only refer to past tense events.

We have examined transcripts of spontaneous speech data of twelve monolingual Dutch-speaking children. All these materials are available

TABLE 2. *Dutch corpus data* (*with ages in years*;*months.days*)

Child	Age range	Number of utterances	Corpus
Abel	1;10.30–3;04.01	11 883	Groningen (Bol, 1996; Wijnen & Verrips, 1998)
Daan	1;08.21–3;03.30	15 229	Groningen
Hein	2;04.11–3;01.24	12 781	Utrecht (Elbers & Wijnen, 1992)
Iris	2;01.01–3;06.15	8771	Groningen
Josse	2;00.07–3;04.17	12 651	Groningen
Laura	1;09.04–5;06.12	22 323	Van Kampen (Van Kampen, 1997)
Matthijs	1;10.13–3;07.02	19 864	Groningen
Niek	2;07.00–3;10.17	15 151	Wijnen (Elbers & Wijnen, 1992)
Peter	1;05.09–2;08.22	8578	Groningen
Sarah	1;06.16–5;02.13	17 458	Van Kampen
Thomas	2;03.22–2;11.22	12 670	Utrecht
Tomas	1;07.05–3;01.02	9126	Groningen

through CHILDES (MacWhinney, 2000). The transcripts in these longitudinal corpora are based on audiotape recordings made at home, in an unstructured home setting. The recordings were made at relatively small (often two-week) intervals. This is a significanlyt more dense sample compared to the English study by Bloom *et al.*, in which approximately eight-week and twelve-week intervals separated each of the observations that provided the data for analysis (Bloom *et al.*, 1980: 259). The relatively high density allows us to give a more precise characterization of the development, probably with fewer connectives emerging at the same time. The children's age ranges are given in Table 2, which also shows the total number of utterances produced by each child.

METHOD

To determine the Dutch orders of emergence, a method is needed to establish whether a connective has been 'acquired'. Bloom and her colleagues try to guarantee the quality of the early connective usage by applying a quantitative criterion (*cf.* also Brown & Hanlon, 1970). With five occurrences they avoid the risk of basing their order of emergence on utterances that do not necessarily presuppose knowledge of the meaning represented by the connective. In our view, however, it is not necessary to use a quantitative approach to rule out such so-called non-productive utterances. By setting qualitative criteria in advance, it is equally possible to guarantee the productivity of the first usage.

In order to establish the Dutch order of emergence, it seems reasonable, then, to stay as close as possible to the earliest emergence by using first occurrence complemented with certain qualitative criteria, as mentioned in (18).

(18) Method used to establish the emergence of a connective:
First occurrence in which the connective is used
(a) in a correct way
(b) as a word combining two clauses
(c) in a creative way.[2]

The first criterion is needed to avoid establishing the acquisition of a connective on the basis of a fragment that is not grammatical from an adult perspective. First, this implies that only connective fragments in which the related utterances are intelligible are considered 'correct'. Second, it implies that it is possible to interpret the connective in its particular context as expressing an appropriate coherence relation that we know from adult language users. For the connective *maar* 'but', the first criterion demands that utterances such as in (19), in which this word does not clearly mark a contrastive relation, are disregarded.

(19) MOTHER: Er ligt nog (ee)n stukje koekje op jouw beker. Dat is van jou.
'There is still a cookie on your mug. That's yours.'
MATTHIJS: Eh! **Maar** ik lus(t) ook ee(n) koekje! (Matthijs, 2;10.8)
'Uh! But I also like a cookie!'

The second criterion excludes the contextual use of connectives, in which the child chains the utterance to a non-linguistic event that was either something the child did or saw in the context (e.g. (20)). The second criterion also excludes the phrasal use of *en* and *maar* (as in (21) and (22)), in which the child connects two constituents instead of two clauses. Only connective clauses containing a subject and a verb are taken into account. These connective clauses may be linked to either an utterance in the child's speech or to a previous utterance in the parent's speech. The previous clause need not be a full clause; the crucial point is that it can be interpreted as a proposition. For example, the *maar*-clause in (23) is linked to the interactive expression *ja* 'yes', which takes up the propositional content of the mother's utterance. This example is disregarded, however, because of the first criterion: there is no clear local contrastive relation between *ja* and the *maar*-clause.

(20) [*Picking up a box of furniture.*] And let's see this.
(Bloom *et al.*, 1980: 240)

(21) Slak. **En** een hond. (Sarah, 2;0.17)
'Snail. And a dog.'

[2] In order to avoid confusion we have chosen to use the term 'creative' for the qualitative criterion we propose here; the term 'productive' often refers to quantitative emergence criteria. At this very early stage of the acquisition process children will not be fully 'productive' in their use of connectives anyway, since they are not yet able to use a connective in a variety of meanings and in a variety of contexts.

TABLE 3. *Dutch orders of emergence per child* (*with ages in years*;*months.days*)

Child	1st connective	2nd connective	3rd connective	4th connective	not acquired
Daan	en (2;4.0)	maar (2;5.11)	toen/want (3;1.14)		
Josse	en (2;8.04)	maar (2;11.9)	toen/want (3;0.20)		
Laura	en (2;2.10)	maar (2;7.19)	toen (3;4.21)	want (3;4.25)	
Niek	en (3;4.9)	maar (3;8.2)	toen (3;8.30)		want (>3;10.17)
Peter	en (2;3.7)	maar/toen (2;4.12)		want (2;8.22)	
Iris	en (3;1.0)	maar (3;1.14)	want (3;2.11)	toen (3;3.23)	
Abel	maar (2;3.23)	en (2;4.9)	want (2;10.0)	toen (2;11.10)	
Matthijs	en (2;4.24)	want (2;11.19)	maar (3;0.9)	toen (3;0.20)	
Tomas	en (2;5.7)	want (2;10.10)	maar (2;10.24)		toen (>3;1.2)
Hein	en (2;4.14)	toen (2;5.19)	maar (2;6.10)	want (2;8.28)	
Thomas	en (2;3.23)	toen (2;7.1)	maar (2;7.20)	want (2;10.19)	
Sarah	en (1;11.15)	toen (2;4.2)	want (2;9.7)	maar (3;0.19)	

(22) Die niet hè? **Maar** deze. (Hein 2;8.10)
'Not that one, right? But this one.'

(23) MOTHER: Is de trompet op de slaapkamer?
'Is the trumpet in the bedroom?'
THOMAS: Ja, **maar** Loekie wil zoeken. (Thomas, 2;7.2)
'Yes, but Loekie wants to look.'

The third criterion excludes fixed expressions (e.g. lines from a song or frequent utterances from an adult conversation partner) and direct imitations from the analysis. This criterion of creativity should lead to the exclusion of utterances that might be regarded as memorized wholes.

RESULTS

Table 3 shows the Dutch acquisition orders per child based on first correct and creative clausal connective use, together with the ages at which these connectives emerge. The ordering of the children is such that children following the same route are grouped together. Connectives that occur at the same age are placed in-between columns. For example, Daan starts using *toen* and *want* at the same time (3;1.14).

How do these results relate to the hypotheses we formulated? Our first prediction – based on the basic operation – is that the first causal connective does not appear before an additive connective has occurred. This prediction is borne out: all children use the additive *en* before they come up with the causal connective *want* (compare as an illustration Thomas' ages at his first production of *en* (24) and *want* (25)).

(24) MOTHER: Ja in mijn bord zit pap.
'Yes in my plate there's porridge.'
THOMAS: **En** Loek eet de appelsap. (Thomas, 2;3.23)
'And Loek eats the apple juice.'

(25) Jij mag niet eh van drop **want** dat is van mij. (Thomas, 2;10.19)
'You may not uh have licorice because it's mine.'

The second prediction – based on polarity – claims that the first negative connective does not appear before a positive connective has occurred. Most of the data are in line with this prediction: eleven children start with the positive *en*, and only later on produce the negative connective *maar*. Abel forms a remarkable exception to this acquisition pattern; contrary to our prediction, his first connective is *maar* (for example, compare Abel's ages at the time of his first *maar* in (26) and his first clause combining *en* in (27): 2;3.23 versus 2;4.9). In (26), Abel's *maar*-utterance can be seen as a negation of the adult's claim that 'Abel can leave the radio where it is': the fact that Abel wants to build a tunnel in that place, implies that he CANNOT leave the radio over there. In this fragment, then, *maar* marks a real contrastive relation.

(26) ADULT: Je kan hem (=een radio) toch gewoon laten staan?
'Can't you just leave it (=a radio) there?'
ABEL: Nee.
'No.'
ADULT: Jawel.
'Yes.'
ABEL: Nee.
'No.'
ADULT: Nou.
'Well …'
ABEL: **Maar** ik moet even daar ee(n) tunnel bouwen. (Abel, 2;3.23)
'But I just have to build a tunnel there.'

(27) MOTHER: En het nijlpaard ging ook onder de douche, hè Abel? Ging 'ie drinken.
'And that hippo also took a shower, didn't he Abel? He drank.'
MOTHER: (Two side remarks to the researcher, who is also present.)
ABEL: En [/] **en** die nijlpaard moet poetse(n). (Abel, 2;4.9)
'And the hippo has to brush.'

This implies that our second prediction is not completely borne out, since there is one counter-example we cannot explain, (26).

A third prediction is that – because of different interactions between the basic operation and polarity – there is room for variation in the developmental sequences: after the first positive additive it is possible to encounter either a negative additive or a positive causal. Negative causals, however, should occur last. Nine children acquire the negative additive *maar* before

the positive causal *want*, while only three children show the reverse sequence. Considering this fact, the conclusion can be drawn that variation due to different interactions can be borne out. A more detailed analysis of the early occurrences of *maar* reveals that these are all instances of negative additive use, as in example (28). The negative causal use of *maar* (as in (29)) only emerges after the first positive causal (or in the same file, as is the case for Peter). In example (29) a causal relation can be derived between S_1 and the negative counterpart of S_2: 'because the barrier does not open, he cannot go through'. This relation is a negative causal one, because not S_2 but its negative counterpart, not-S_2, functions in the basic operation. The negative causal nature of (29) can also be attested by reformulating the relation with the negative causal connective 'although' ('Although the barrier does not open, he can go through').

(28) Ik wil geen motor. **Maar** nou wil ik een politieauto. (Josse, 2;11.23)
'I don't want a motorbike. But now I want a police car.'

(29) Slagboom gaat niet open. **Maar** hij kan wel erdoor. (Peter, 2;8.22)
'Barrier does not open. But he can go through.'

Our fourth prediction concerns the interaction between the basic operation and temporal order: purely additive connectives should occur first. Additive relations which also show a temporal order will appear later and causal relations based on temporal order will appear last. The prediction that pure additives appear before temporal additives is borne out for all twelve children; all children only come up with *toen* after they have produced *en*. Compare, for example, Matthijs' ages at the moment of his first production of *en* and *toen*.

(30) **En** eh dat is een schoen. (Matthijs, 2;4.24)
'And uh that is a shoe.'

(31) En **toen** waren dieren wakker en **toen** waren dieren slaap. (Matthijs, 3;0.20)
'And then animals were awake and then animals were asleep.'

However, there is variation in the acquisition order of temporal versus causal. Eight children show the developmental sequence *toen–want* (this includes Daan and Josse, who start producing *toen* and *want* at the same time), whereas four children produce *want* before *toen*. Whether these last findings run counter our hypothesis depends on the type of relation marked by *want*. In cases where the causal relation is not based on a temporal relation, the cumulative complexity predicted for the relations ordered as non-temporal additive–temporal additive–temporal causal does not hold. This seems a plausible explanation: three of the four children who produce *toen* after their first *want* start with a causal relation that is not based on a temporal relation. For example, the *want*-clause in (32) is a pragmatic

one: it provides the reason for asking the question. Hence, the *want*-clause does not function at the semantic level, but at the pragmatic level, where temporal order of the clauses is irrelevant.

(32) Wil je even m'n haar borstelen? **Want** ik heb slordig haar. (Iris, 3;2.11)
'Could you brush my hair? Because I have messy hair.'

Again, Abel is the remarkable exception. He is the only child who produces a temporal causal *want* before he utters his first creative temporal additive *toen*. In other words, in terms of complexity it seems as if he skips a step in the acquisition process. This is probably too strong a claim, since there are two earlier instances of *toen* (see (33) and (34)), which both appear before the occurrence of Abel's first *want*. Although these occurrences are only semi-creative, since Abel repeats the connective *toen* from the question previously uttered by the adult, they indicate that Abel must have some idea of the notion temporal order at an earlier age.

(33) ADULT: En toen?
'And then?'
ABEL: **Toen** ga voetballen. (Abel, 2;4.23)
'Then go (and) play football.'

(34) ADULT: En toen?
'And then?'
ABEL: En **toen** is eh ijs op. (Abel, 2;7.29)
'And then there's no ice left.'

It seems as if Abel's acquisition route deviates in more than one respect from those of the other eleven children. Further research is needed to identify whether some other factor triggers his remarkable developmental sequences. The acquisition data of the other children seem to provide ample support for the four hypotheses we put forward. We can conclude that cumulative conceptual complexity seems to offer a solid explanation for the Dutch findings.

CUMULATIVE SYNTACTIC COMPLEXITY

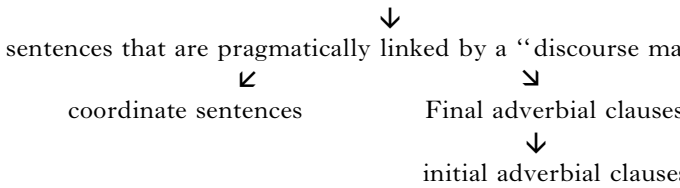
In the first part of this paper, the regularities in the order of emergence of connectives have been linked to cumulative semantic or conceptual complexity. However, Brown (1973) and Slobin (1973) have demonstrated before that even when a meaning is potentially accessible to a child, he may be delayed in expressing it, at least in a conventional way, because of complexity in the formal linguistic mechanism used to encode it (*cf.* Bowerman, 1979: 298). Therefore, it has been argued that semantic or conceptual complexity must be distinguished from grammatical, formal or

syntactic complexity – the complexity of the linguistic devices each language has for the expression of ideas (*cf.* Clark & Clark, 1977: 337–39).

In order to study the influence of structural or syntactic complexity, an independent criterion is needed to establish the degree of syntactic complexity. We define syntactic complexity in a cumulative way: a sentence Y is considered syntactically more complex than another sentence X, if the production of Y involves all the syntactic abilities that the production of X requires, plus at least one more. We will use Diessel's (2004) theory about different degrees of clause integration as a variant of this cumulative syntactic complexity approach that can be applied to the acquisition of connectives. We will first present his ideas, and then show how those can be related to syntactic complexity.

Diessel (2004: 149) argues that different types of English conjoined clauses develop from simple non-embedded sentences. He regards the development of conjoined clauses as a process of clause integration: starting from multiple-clause structures that consist of juxtaposed clauses, children gradually learn the use of complex structures in which two or more clauses are integrated in tightly organized grammatical constructions (*cf.* (35)).

(35) The development of conjoined clauses (Diessel 2004: 171, Figure 7.5)



The earliest multiple-clause utterances consist of juxtaposed clauses (compare example (1) and (2) at the beginning of this paper), i.e. clauses in which the link between two semantically associated utterances is not expressed overtly by a connective (Diessel, 2004: 158). In Braunwald's (1985) terms this first developmental step involves 'the conjoining of two thoughts in a single context of use' (p. 513).

The earliest conjoined clauses with an explicit connective are pragmatically combined with an utterance in the previous discourse. The majority of these clauses are linked to a clause that constitutes a separate intonation unit (indicated by an utterance with a period). Moreover, they are often associated with an utterance across speaker turns (see (36) and (37), from Diessel, 2004: 159).

(36) CHILD: Nina has dolly sleeping.
ADULT: The doll is sleeping too?
CHILD: **And** the man's sleeping on the big bed. (Nina, 2;2)

(37) ADULT: Flipper's on TV yeah.
CHILD: **And** Shaggy's not on TV. (Sarah, 3;8)

Diessel labels the intonationally unbound use of *and* the 'discourse marker' use, in order to distinguish it from its use as a coordinating connective.[3] In coordinate constructions marked with *and*, the conjoined clauses are intonationally bound and linked to a clause within the same utterance. The final development involves the ordering of the conjoined clauses: while children's early adverbial clauses always follow the associated utterance, their later conjoined clauses can also precede the associated clause.

The developmental pattern observed by Diessel can be regarded as a syntactic extension of the cumulative complexity approach presented in the first part of this paper. First, producing two syntactically and intonationally integrated clauses is more complex than producing each clause separately. Second, the production of integrated final adverbial clauses can be regarded as more complex than the production of integrated coordinate sentences. In order to produce final adverbial clauses the child needs to order the related clauses in a hierarchical way. Such a hierarchical ordering is not needed in the production of coordinate sentences. Finally, initial adverbial clauses are cognitively more complex – at least in terms of processing cost – than final adverbial clauses: they require children to plan two clauses at a time, instead of one clause after another.

In line with Diessel, we predict that the relative syntactic complexity of a coherence relation will influence children's acquisition route of connectives. However, we expect this influence of syntactic complexity on the course of connective acquisition to be restricted. Syntactic complexity is expected to influence the acquisition order of the different syntactic variants of each coherence relation, i.e. we predict that young children will follow Diessel's scheme in their acquisition of each connective. In addition, we expect that two connectives expressing (nearly) the same coherence relation will be acquired in an order that reflects increasing syntactic complexity. However, we do not expect syntactic complexity to influence the acquisition order of different types of coherence relations. Understanding the semantics of a coherence relation appears to be a necessary prerequisite for producing that coherence relation in any of the syntactic variants mentioned above; hence, syntactic complexity seems to be of secondary importance in determining the acquisition order of connectives. Next, we will investigate whether the development of Dutch connectives is in line with these predictions based on cumulative syntactic complexity.

[3] In fact, Diessel (2004: 159) uses the term 'discourse connective' instead of 'discourse marker'. In order to prevent confusion with the term 'connective', we have chosen to use a different label, a label that covers the use Diessel is talking about.

Connective selection, materials and methodology

The role of cumulative syntactic complexity has only been examined for three Dutch connectives: *want*, *omdat* 'because' and *toen*. Since three of the four connectives selected in the conceptual complexity study exhibit a similar syntactic complexity in that they are all coordinators (*en*, *maar* and *want*), we do not expect their relative syntactic complexity to cause differences in their age of emergence. However, syntactic complexity may be a major determinant in accounting for the relative order of acquisition of the Dutch coordinator *want* versus the subordinator *omdat*, which is semantically almost equivalent to *want*. An important difference between Dutch coordination and subordination is that coordinated clauses show verb second, as in *want hij* IS *ziek* 'because he is ill', whereas subordinate clauses show verb final, as in *omdat hij ziek* IS 'lit. because he ill is'.

In addition, syntactic complexity may be relevant in the acquisition order of the adverbial use (*cf.* (38)) versus the complementizer use of the temporal connective *toen* (see (39)). The adverb *toen* occurs in clauses that are juxtaposed or coordinated to a preceding clause; the complementizer *toen* occurs in subordinating clauses. This complementizer use of *toen* is syntactically more complex than the adverbial use of *toen*, since it requires a hierarchical ordering of the combined clauses. The verb-second word order in (38) indicates the main clause status of the *toen*-clause. The verb-final word order of the *toen*-clause in (39) marks this clause as subordinate to the main clause in Niek's previous utterance.[4]

(38) [Talking about a door handle.] (Niek, 3;8.30)
Moest ik even vasthouden. Dat moest van garage. En **toen** ging ikke boos worden.
'I had to hold (it) for a minute. The garage told me so. And then I got angry.'

[4] It is likely that the complementizer use of *toen* is also conceptually more complex than the adverbial use of *toen*. In both cases the child has to order the times of the events or situations in the combined clauses relative to each other. However, using the complementizer *toen*, the child also needs to establish a link between the time of the *toen*-clause and the time of producing the entire utterance. In Reichenbach's (1947) terms, the adverbial *toen* links the time of the event or situation described in the *toen*-clause (the Event Time, E) to the Reference Time (R) in the previous clause, which in turn is ordered relative to the Speech Time (S), the time at which both clauses are uttered. In other words, adverbial *toen* introduces a new E and ties that to a given R, which has previously been tied to S. In contrast, the complementizer *toen* introduces a Reference Time for the Event Time of the preceding clause. Introducing a new R implies that this R has to be ordered relative to S. Hence, using a complementizer *toen* not only involves the linking of R and E, but also the linking of R and S. This is more complex than using an adverbial *toen*, which only involves the linking of R and E.

TABLE 4. *Data on the Schlichting Corpus* (*with ages in years*; *months.days*)

Child	Age range	Number of utterances	Corpus
Carl	3;06.01–5;03.22	5195	Schlichting
Maike	3;06.26–5;04.00	4854	Schlichting
Sanne	3;05.21–5;04.01	4640	Schlichting
Tinke	3;05.21–5;03.02	5269	Schlichting

(39) NIEK: Ik ben al in het ziekenhuis (ge)legen.
'I have already been in hospital.'
FATHER: Ja.
'Yes.'
NIEK: **Toen** ik nog baby was. (Niek, 3;10.3)
'When I was still a baby.'

We have examined the longitudinal data of the twelve children that were mentioned in the previous section. These data were used to establish orders of acquisition. However, because the subordinators *omdat* and *toen* hardly occurred in these data, we also analyzed the data of four older children (see Table 4) in order to obtain a more general developmental picture. These data were gathered by Schlichting (1996) with three-month intervals. The transcriptions in these corpora are based on audiotape recordings made at home, in three different settings (telling a story on the basis of four pictures, free conversation, and conversation during an activity like drawing or making a jigsaw puzzle).

We tested our hypotheses: (a) by establishing per connective pair (*want* vs. *omdat* and adverbial *toen* vs. complementizer *toen*) in which order the two variants were acquired; and (b) by comparing per connective the degrees of clause integration to the acquisition pattern proposed by Diessel (2004). In performing the latter analysis, we relied on punctuation in the transcripts: CHILDES data are transcribed according to the convention that each utterance ended with a period reflects a separate intonation unit. Two clauses separated by a comma are regarded as one intonation unit. So, if S_1 and S_2 are transcribed as one sentence, they are considered integrated. If they are transcribed as two separate sentences, they are considered non-integrated. This non-integrated character of utterances is very often confirmed by intermediating remarks by adults involved in the conversation (*cf.* (39)).

Results for want *and* omdat

Our analyses reveal that only four of the twelve younger children used *omdat* creatively during the period in which they were recorded, whereas all

TABLE 5. *Age of first emergence of* want *and* omdat

Child	First *want*	First *omdat*
Hein	2;08.28	2;10.15
Josse	3;00.20	3;02.15
Laura	3;04.25	5;01.21
Sarah	2;09.07	3;03.21

these children, except for Niek, used *want*. The four older children – Carl, Maike, Sanne and Tinke – all produced both connectives. As Table 5 shows for the four younger children who use both connectives, the emergence of the coordinator *want* always precedes the acquisition of the subordinator *omdat*.

The qualitative analysis of *want* shows that the earliest *want*-clauses appeared in separate utterances (*cf.* (40)). Only later on did integrated use of *want* develop (*cf.* (41)).

(40) ADULT: Past die er niet in?
'Doesn't that one fit in it?'
ABEL: Nee, die past er niet in. **Want** die te groot voor. (Abel, 3;3.8)
'No, that one does not fit in it. Because that one (is) too big for (it).'

(41) Ze kunnen ook niet praten **want** het zijn geen mensen. (Carl, 5;1.3)
'They also cannot talk because they are not human.'

A quantitative analysis of the *want*-clauses in the final two recordings of the four older children shows that sixteen *want*-clauses were integrated intonationally into their matrix clause, whereas forty *want*-clauses were produced in independent utterances. Even around their fifth birthday, children still preferred to produce *want*-clauses separately. The increasing degree of clause integration in the use of *want* is in line with Diessel's findings.

The developmental data on *omdat* reflect Diessel's acquisition pattern as well. The earliest *omdat*-clauses appeared in separate utterances. In the data of the younger children, sixteen of the twenty-one interpretable *omdat*-clauses that were produced separately were responses to why-questions from the parents (*cf.* (42)). Only five interpretable *omdat*-clauses were intonationally integrated into their matrix clause. These five utterances came from Laura's data: three with a postposed *omdat*-clause (*cf.* (43)), and two with a preposed *omdat*-clause (see (44)).

(42) ADULT: Waarom wil jij mij niet helpen?
'Why do you not want to help me?'
HEIN: **Omdat** ik niet zin heb. (Hein, 3;0.11)
'Because I don't feel like it.'

TABLE 6. *First emergence of adverbial and complementizer* toen

Child	Age range	First adverb	First complementizer
Abel	1;10.30–3;04.01	2;04.23	2;11.10
Daan	1;08.21–3;03.30	3;01.14	3;03.30
Hein	2;04.11–3;01.24	2;05.19	after 3;01.24
Iris	2;01.01–3;06.15	3;03.23	after 3;06.15
Josse	2;00.07–3;04.17	2;02.08	2;11.23
Laura	1;09.04–5;06.12	3;04.21	3;11.16
Matthijs	1;10.13–3;07.02	3;00.20	3;05.13
Niek	2;07.00–3;10.17	3;08.30	3;10.03
Peter	1;05.09–2;08.22	2;04.12	after 2;08.22
Sarah	1;06.16–5;02.13	2;04.02	3;02.13
Thomas	2;03.22–2;11.22	2;07.01	after 2;11.22
Tomas	1;07.05–3;01.02	2;07.10	after 3;01.02

(43) Die hebben allemaal dekens gepakt, **omdat** ze [//] ik hun bedje moet maken.
'They all took blankets, because I have to make their beds'
(Laura, 5;2.21)

(44) **Omdat** je niet zoveel gedrinkt heb, moet je nog een keer (…)
(Laura, 5;2.21)
'Because you did not drink so much, you have to go one more time (…)'

The number of integrated *omdat*-clauses hardly increases with age. A quantitative analysis of the *omdat*-clauses in the final two recordings of the four older children shows that only five of the twenty-nine interpretable *omdat*-clauses were integrated intonationally into their matrix clause. It can be concluded that children aged five still prefer to produce *omdat*-clauses separate from the matrix clause to which they relate.

Results for toen

The first use of *toen* is restricted to the adverbial use, as illustrated in (45).

(45) **Toen** was ik ook mee, hoor. (Laura, 3;4.21)
'Then I also came along.'

As Table 6 shows for the younger children in this study, the emergence of adverbial *toen* always precedes the emergence of complementizer *toen*. In addition, the adverbial use of *toen* remains the more frequent of the two throughout the development.

The complementizer use of *toen* is illustrated in (46) to (48), in which square brackets denote overlap. The first complementizer *toen*-clauses

always occur in a separate clause, functioning as an afterthought or a postmodification (*cf.* (46)). Only later on do children really integrate the *toen*-clause into the matrix clause (*cf.* (47) and (48)). This is in line with Diessel's observations that intonationally and syntactically unintegrated clauses precede adverbial clauses that are intonationally bound to their matrix clause.

(46) ADULT: Oh, heb je die van Rosie gekregen?
'Oh, did you get that one from Rosie?'
JOSSE: Ja.
'Yes.'
ADULT: Dat is ook een [hele mooie].
'That's also a very pretty one.'
JOSSE: [**Toen** we in Sloten] waren. (Josse, 3;1.10)
'When we were in Sloten.'

(47) Maar deze was kapot **toen** ik hem vond. (Sanne, 5;4.1)
'But this one was broken when I found him.'

(48) **Toen** ik jarig was dan komt zwarte piet. (Laura, 4;0.20)
'When I had my birthday 'zwarte piet' came.'

The acquisition of complementizer *toen*-clauses in postposition precedes the acquisition of *toen*-clauses in preposed position in the recordings of six of the seven children who acquire the complementizer *toen* during the period in which they are recorded. Furthermore, the postposed *toen*-clauses outnumber the preposed ones. Only twenty-four of the seventy-four fragments with complementizer *toen* have the *toen*-clause in preposed position. Sarah's developmental sequence is the exceptional one: her first *toen*-clause in which *toen* functions as a complementizer is in preposed position (age 3;2.13). Her first postposed *toen*-clause occurs two months later, at the age of 3;4.13. The data of the other six children are in line with Diessel's claim that the acquisition of final adverbial clauses precedes the acquisition of initial clauses.

It can be concluded that children start with the adverbial use of *toen*, which is used mainly in topic position, and only later acquire the complementizer use of *toen*. The developmental patterns of the complementizer use of *toen* – except that of Sarah – are in line with Diessel's acquisition route.

Conclusions on cumulative syntactic complexity

Our analysis shows that the connective clauses are all first used in intonationally unbound clauses and only later occur in syntactically and intonationally integrated clause combinations. That is, in their use of

connectives under investigation, children adhere to the developmental pattern observed by Diessel. With age, children become more and more proficient in integrating conceptual ideas in syntactic constructions that are more complex in terms of processing cost or the amount of planning that is needed.

These findings imply that the cognitive complexity approach can be maintained, but that it needs to be extended with a syntactic complexity component. The degree of syntactic complexity influences the relative order of emergence of different connectives (*cf.* the results on *want* and *omdat*), but it also affects the order of emergence of the different uses of one and the same connective (*cf.* the results on *toen*).

DISCUSSION AND CONCLUSION

Returning to the questions asked at the beginning of this paper, we can now conclude that there is indeed an order of acquisition that has some cross-linguistic validity. More specifically, for the Dutch connectives *en, maar, toen* and *want*, as well as for their English counterparts, we found that children vary in their acquisition route, but that this variation obeys specific boundaries: conceptually more complex connectives only occur after relatively simple ones are acquired. The Dutch order we found, as well as the English order of emergence mentioned in Bloom *et al.* (1980), can be explained on the basis of our multidimensional approach to conceptual complexity. Thereby, we have improved the generalizability of conceptual complexity as an explanation for connective acquisition.

Our approach to cumulative cognitive complexity is not completely new. It builds on the cumulative complexity approach proposed by Bloom and her colleagues. It differs from that approach in that the conceptual notions are not ordered along one dimension (additive < temporal < causal < adversative), but rather so that each connective is defined on the basis of several conceptual primitives that are of a general cognitive nature, such as polarity (positive versus negative) or relation type (additive versus causal) (following Sanders *et al.*, 1992). The fixed routes are explained by reference to the relative complexity of different values on the same primitive (e.g. [α causal] vs. [+causal]), whereas the variation among acquisition routes of Dutch-speaking and English-speaking children can be explained by reference to the different interactions between the conceptual primitives that characterize each connective.

All in all, cumulative conceptual complexity seems to offer a solid explanation for the findings both on Dutch and English connective acquisition. Our multidimensional approach accounts both for the uniformity and for the diversity in this acquisition. However, this approach needs to be extended in order to give an account of the emergence of other

connectives as well. For example, within the temporal domain a distinction between priority and anteriority is needed to account for differences between connectives expressing sequentiality. Adding more primitives will make the model much more restrictive, and hence, more attractive.

Our study has shown that a syntactic complexity component should be added to the overall model. The degree of syntactic complexity influences the relative order of emergence of different connectives expressing (nearly) the same coherence relation (*cf.* the results on the causal connectives *want* and *omdat*). In addition, it affects the order of emergence of the different uses of one and the same connective (*cf.* the results on adverbial and complementizer *toen*). However, we do not expect syntactic complexity to influence the acquisition order of different types of coherence relations. Understanding the semantics and pragmatics of a coherence relation appears to be a necessary prerequisite for producing that coherence relation in any of its syntactic variants; hence, syntactic complexity seems to be of secondary importance in determining the acquisition order of connectives.

We believe we have significantly increased the explanatory power of cumulative complexity to account for connective acquisition. Needless to say, several crucial issues require further empirical investigation. The most prominent one is arguably the fundamental debate in current studies of language acquisition: Is the course of acquisition of linguistic elements largely determined by the inherent complexity of linguistic and conceptual structures or rather (also) by the language input children receive, as increasingly influential usage-based accounts propose? A comprehensive theory of connective acquisition needs to take both factors into account simultaneously and deepen our understanding of how they interact. Given the limitations of time and space, this was not possible in the current paper. One way to determine the relative contribution of these factors is to analyze connective use in relatively dense corpora, linking the children's output to their increasing cognitive abilities as well as to their parents' connective input, and see to what extent both factors predict the data. Van Veen, Evers-Vermeul, Sanders & Van den Bergh (2008) have performed this type of analysis for one German child. Their data show that both factors are needed to correctly predict the frequency of use by the child. However, research comparing data from several children is required to establish the relative contribution of parental input and cognitive complexity. It will be fascinating to find out whether our cognitive complexity approach will survive this type of test. Luckily, such research, in which the contribution of 'inherent complexity' can be compared to 'input factors' is within reach, thanks to the dense data that researchers like Tomasello (2003) and Behrens (2006) provide us with. Only this type of interaction between data, theory and empirical testing will reveal the way in which children learn to build discourse by connecting clauses.

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