Learning to categorize verbs and nouns: studies on Dutch

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2 Linguistic theories and their predictions for category acquisition

Proposals for the defining properties of verbs and nouns in adult grammar should result in learnable representations of these categories and lead to predictions for acquisition. This chapter investigates a number of linguistic theories that are based on different frameworks in terms of whether they meet these preconditions. In order to be able to evaluate each linguistic theory with respect to its compatibility with child language production data, it will be established whether the verbal and nominal representations proposed by the theory can be learned and whether the theory leads to predictions for early language utterances. A third aspect previously mentioned, namely, the testability of resulting predictions, will be addressed in Chapter 3. Whereas the description of the ideas about verb-noun categorization is based on the existing literature on each theory, the description of the predictions is largely based on my own interpretation of this literature.

2.1. Introduction

Verbs and nouns have been central notions in linguistics ever since Plato. As discussed in the previous chapter, the notions verb and noun involve a considerable number of linguistic properties. The ancient origin of verbs and nouns and their influence on almost every part of the grammar make verbs and nouns basic building blocks of linguistic theory. As a consequence, it is expected that every theory on language has a view as to how verbs and nouns are represented in the adult grammar. This chapter addresses a number of fundamentally different theories and examines their central ideas about verbs and nouns.

The six theories described in this chapter were selected for their common focus on syntactic structure in defining the grammatical properties of verbs and nouns. As already mentioned in Chapter 1, there is a tendency to formulate ideas about verbs and nouns in terms of syntactic rather than lexical properties, and this is true for the many different types of theory. I use the term ‘syntactic’ to indicate the larger sentence context, including ‘constructions’ (Goldberg, 1995). A number of very different theories that play an important role in the field’s present-day discussion of

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2 Plato introduced the terms onomata ‘nouns’ and rhemata ‘verbs’ in his Cratylus, see Vinokurova (2005: 1-2) for a citation and discussion.
categories all propose a representation of verbhood and nounhood that is formulated at the level of syntactic properties, rather than at the level of the word.

Important differences between the theories relate primarily to the way categories are represented in the adult grammar. They provide different answers to the question of where adult intuitions about categories come from (e.g., the intuition that *apple* is a noun). Some theories posit that these intuitions result from a well-defined mental representation of the categories VERB and NOUN, whereas others hold that these intuitions result from analogical reasoning based on all stored prior experiences with the language, without clearly specified mental representations of verbs and nouns. The syntactic theories of verbs and nouns can be placed on a scale with respect to their assumptions about the mental representation of these categories in adult grammar. At one end of the scale are theories that posit that the categories VERB and NOUN are discrete mentally represented categories. At the other are theories that assume prototype-like mental representations of the categories VERB and NOUN resulting from storage of earlier attested similar word combinations. The discussion of theories in this chapter is more or less ordered according to this representation scale: the proposals with discretely defined grammatical representations are presented first and those assuming more prototype-like representations last. It will become clear that three of the discussed theories propose discrete syntactic categories (Marantz, 1997; Baker, 2003; Borer, 2003), two propose prototype-like categories (Croft, 2000; Goldberg, 2006), and only one, Hengeveld (1992b), is more or less in between in that he defines discrete syntactic functions, but language-specific lexical classes to express these syntactic functions. The internal ordering of the theories that score similar on the scale is therefore motivated by the predictions they make, as will be shown in §2.6.

The two requirements of covering linguistic facts and the learnability of representations can conflict. To explain all details of a phenomenon a clearly specified mental representation of the category VERB is beneficial, but such a representation would be difficult to learn. Any explanation of the linguistic facts concerning categories must include the notion of learnability (Hornstein & Lightfoot, 1981: 95). The theories reviewed in this chapter deal with this issue in different ways. Some scholars attach more value to accurately covering the linguistic facts, whereas others attach more value to the learnability of the representations proposed by them. In the discussion of their ideas I will first consider how the linguistic facts about verbs and nouns are explained. The central question in this consideration is how the categories are represented in the different grammars. It will also be considered whether, according to the scholars themselves, these proposed representations are learnable.
If theories differ substantially in their underlying tenets, it is expected that they result in different predictions. This then makes it possible to discriminate between them. Otherwise, the theories cannot be tested against one another for their compatibility with child language data. Since child language utterances are often incomplete, we need a method to interpret the data in such a way that the predictions made by the theories can be tested. The present chapter considers the predictions, whereas Chapter 3 tests these predictions. If no clear predictions about a particular theory are available from the literature, I will try to derive predictions on the basis of an interpretation of the theory’s tenets.

To sum up, the aim of this chapter is to establish how theories of verbs and nouns differ and which predictions they make for child language production data. This aim will be met by presenting syntactic theories about the categories verb and noun and discussing:

1. Their central idea of how the categories verb and noun are structurally represented in the adult grammar and whether these representations are learnable.
2. Their predictions for the acquisition of verbs and nouns by children.

Sections 2.2 and 2.3 examine the generative theories of Marantz (1997), Borer (2003), and Baker (2003). These theories all propose discretely defined grammatical representations of the categories in adult grammar. The internal ordering in which the discussion of Marantz and Borer precedes that of Baker is arbitrarily chosen and not motivated by the representation scale. Section 2.4 considers Hengeveld’s (1992b; Hengeveld & Mackenzie, 2008) functional theory, which in fact also assumes discrete syntactic categories, but posits that the grammatical representations of lexical classes expressing these syntactic functions vary according to language type. Section 2.5 describes the constructionist theories by Croft (1991, 2000) and Goldberg (1995, 2006), which assume only general cognitive representations with prototype-like structure. The description of each theory is followed by a discussion of the predictions for acquisition made by the theory itself or following from a motivated interpretation of the assumptions put forward by the theory. At the end of the chapter a summary will be provided of the theories presented and their predictions for child language data (see §2.6).

2.2. Verbs and nouns as functional syntactic notions

The views advocated by Marantz (1997) and Borer (2003) will be discussed together, since they both consider the syntactic notions of verb and noun as functional notions, existing independently of the lexical items of a language. This
separation of the category information and the lexical items has specific consequences for the predicted path of development, which is similar for both theories.

2.2.1. Marantz (1997) and Borer (2003)

Marantz (1997) specifically tries to account for the linguistic facts alluded to in §1.1: that whereas certain lexical items can be used in nominal syntactic structures (e.g., *apple*, see (1) in Chapter 1), other lexical items can be used in verbal syntactic structures (e.g., *destroy*, see (3) in Chapter 1), and still other lexical items can be used in both (e.g., *walk*, see (5) in Chapter 1). He attributes the information about category not to words in the lexicon but to syntactic nodes in the underlying structure of a sentence. His proposal is in accordance with the Distributional Morphology framework (Halle & Marantz, 1993). Within Distributed Morphology (henceforth: DM), the traditional lexicon as the place where sound and meaning are linked (e.g., Lieber, 1981) does not exist anymore. It has been replaced by a number of lists that contain the atomic elements of a language. The first list contains the elements needed for the syntax to operate on: roots and grammatical features. Crucially, these elements are not listed with a phonological form or meaning. The insertion of a root in syntax precedes the combination of that root with a phonological form and a meaning. Words only exist in a spelled-out syntactic structure, not as autonomous elements. This general architecture of DM has far-reaching consequences for the theory about verbs and nouns. Since words are computed by the syntax, a verbal or nominal category is not a property of a word, but a property of the syntactic structure. Being a verb or a noun has nothing to do with a lexical item. The category status of an item is determined by the functional syntactic structure in which the root is inserted. Verbal and nominal features are given by the syntactic structure and are functional (as opposed to lexical) in nature. Any root that is inserted into a functional syntactic node with verbal properties will be a verb. If the same root is inserted into a functional syntactic node with nominal properties, it will be a noun. The fact that words do not have a special status for Marantz thus has consequences for his central idea of verbs and nouns. The categories verb and noun only exist as features connected to a functional syntactic node.

Borer (2003) has a highly similar approach to the relationship between lexical items and syntactic structure, although the details of her proposal differ from those of Marantz. In both proposals the roots, or items, are underspecified with respect to a number of features, including the category. Categories are provided by the functional syntactic structure and, as such, are actually functional properties.
means that to gain a good insight into the central idea of verbs and nouns we have to focus on the specific proposals Marantz and Borer make for the syntactic structures representing the categories verb and noun.

The relevant syntactic structures for the categories noun and verb proposed by Marantz (1997) are the functional heads D (determiner) and v ('LITTLE v': the functional head that projects the external verbal argument). By defining the syntactic structures required for categorization in terms of functional heads and projections, Marantz adopts an extended version of X-bar grammar (Chomsky, 1970). According to Marantz, the difference between the grammatical representations of verbs and nouns is the functional material higher up in the underlying structure. An example of a nominal syntactic structure could be (1), whereas the same structure would be verbal in the case of (2).

(1)

```
DP
  \   \  
D  rootP
    \   
  root (complement)
```

(2)

```
vP
  \   \  
v  rootP
    \   
  root (complement)
```

The functional projection of the syntactic structure in which a root is inserted thus determines the categorization of that root. Roots are atomic elements without a phonological form and with a very general meaning, notated in capitals preceded by the root symbol \( \sqrt{} \). An example of an English root that can be inserted in both structure (1) and structure (2) is the root \( \sqrt{\text{DESTROY}} \). Remember that this root does not yet have a phonological form, or a specific meaning. The upper case word is just a way to indicate some abstract properties of this root, such as the number of arguments it takes if it is inserted a syntactic environment (see the discussion of roots like \( \sqrt{\text{GROW}} \), roots like \( \sqrt{\text{DESTROY}} \), and roots like \( \sqrt{\text{BREAK}} \) in Marantz,
This root can be inserted into the different syntactic structures. In the case of (1) the root will be merged with the determiner-head, resulting in a noun phrase meaning something like ‘the destruction’. In the case of (2), however, the root will be merged with the verbal head, resulting in a verb phrase meaning ‘to destroy’. How exactly roots are merged with the syntactic structure and receive a phonological form and a meaning is not relevant for this discussion. The main point is that the smallest elements of language are underspecified for category and can, in principle, all be used in both verbal and nominal environments. According to Marantz, the categories verb and noun are represented in the adult grammar as the functional heads v and D of the syntactic structure.

Borer (2003) defines verbal and nominal syntactic environments in terms of functional structure from a separate functional reservoir with grammatical formatives. The assignment of category information according to Borer works in a similar way as Marantz’s functional structures described above. Although she does not adhere to the DM framework, she also separates the basic elements of language (Encyclopedic Items in her terminology) from the syntactic structure with which they can be merged. The category of the items is determined by the functional formatives with which they are merged in a syntactic utterance. This is comparable to the insertion of a root into a predetermined functional syntactic structure in Marantz’s proposal. In Borer’s model, the grammaticality of phrases is determined by the inventory of phonological forms. If the language has no phonological material to express a certain merger of an item and a functional formative, the utterance is ungrammatical and will not be used by an adult native speaker of that language. In principle, all combinations of encyclopedic items and functional formatives are possible. Just as in Marantz’s view, Borer assumes that every item can, in principle, be used in every category, be it verbal or nominal. Whether the combination of a certain root or encyclopedic item with verbal or nominal structure is grammatical is determined by the availability of a phonological form and a semantic interpretation for the combination in the language.

Both proposals posit that categorization is determined by the functional syntactic structure, but restricted by language-specific word formation processes. The functional syntactic structure that determines verbhood or nounhood is the same for all languages over the world. Verbs and nouns are thus discrete functional categories represented in mental grammar. Since they are universally valid, it is possible to assume that they are innate. What has to be learned, according to Marantz and Borer, is how language-specific lexical items can be used in these pre-given verbal and nominal syntactic structures. Hence, the grammatical structure is supposed to be in place before word learning commences.
2.2.2. Predictions

Although Marantz does not mention any predictions for development, Borer makes a quite specific prediction about how learners map vocabulary items to syntactic structure, and this could in my opinion be extended to Marantz’s theory as well. Borer (2004) predicts that the development of vocabulary (i.e., the mapping of phonological forms to meanings) takes place independently of the development of syntactic structure. Since, according to Borer, the inventory of encyclopedic items and the functional lexicon are two independent linguistic constructs, it is not expected that the acquisition of both parts influences each other. Borer (2004) shows that her view predicts a stage in which the syntactic event structures are in place, but the knowledge of vocabulary items is still developing. Using Hebrew child language data, she shows that such a stage is evidenced in argument structure. Hebrew-speaking two-year-olds are able to produce argument structures of different valences (e.g., transitive, intransitive). However, the choice of the specific vocabulary item in Hebrew is dependent upon the syntactic structure. Some items cannot be used grammatically in a transitive structure, although their meaning can be interpreted. Borer shows that Hebrew-speaking children make errors such as (3), in which the child means to say ‘I want daddy to feed me now’.

\[(3) / anı roça še-\text{āba} yoxal / ōtî ŕaxǎv \]

\[
\begin{aligned}
\text{I} & \quad \text{want} & \quad \text{that-daddy} & \quad \text{eat.FUT.3-SG} & \quad \text{me} & \quad \text{now} \\
\end{aligned}
\]

‘I want daddy to eat me now’

(Borer, 2004: 298, example (8) b)

Instead of using the Hebrew vocabulary item for ‘eat’ (the base form $y\acute{x}l$) in the correct adult syntactic structure from the causative binyan ($y\acute{a}’\acute{x}l$) ‘feed’, the child in this example uses this vocabulary item in a simple transitive syntactic structure, saying ‘I want daddy to eat me now’. The child has not yet learned that some combinations of stems and syntactic structures render outputs that are non-adult-like. The inventory of phonological forms is not yet adult-like and as a consequence ungrammatical deep-level phrases are allowed to receive a phonological form. If we apply this prediction to the acquisition of categories in Dutch, we would expect a stage in which children have acquired the functional formatives with their categorization features, whereas their vocabulary knowledge is still impaired. Young children in an early stage of language development are predicted to produce errors in

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\[^{3}\] I have adjusted the orthography of the example according to the most regular way of notating Hebrew sounds. The ‘ symbol represents a glottal stop and the ŕ symbol a pharyngeal stop.
which stems that can only be merged with a nominal formative in adult language are merged with a verbal one, such as *Mummy trousers me*, reported for English (Clark, 1982: 406).

The predicted pattern of child language data based on these theories for an initial stage in development is characterized by the presence of categorization errors. These categorization errors are interpreted as reflections of mismatches between vocabulary items and syntactic structures that are pre-defined for category. Borer expects that young children’s knowledge of vocabulary items is still impaired whereas the functional structure is available to children from birth onwards. As a result, it is likely that children use items in syntactic structures in which they are ungrammatical in the adult grammar. Marantz’s and Borer’s theories predict that the relevant functional syntactic structures for verbs and nouns are part of the innate grammar. Children have to find out which vocabulary items can be combined with these structures. It is predicted that they make errors in a first stage of vocabulary development, but the syntactic structures are in place, and therefore are already fully developed. However, since this prediction only holds for the first stage of development, it is possible that the children have already passed this stage once they produce sentences. If there are no errors in child production data, this may still be compatible with these theories because the error stage took place at an earlier point in development.

2.3. Universally valid structures for verbs and nouns

Baker (2003) aims to put forward a formal theory of the distinctions among lexical categories that is “adequately grounded in empirical fact” (Baker, 2003: 15). As will be shown in §2.3.1 below, Baker separates the notions of linguistic explanation and learnability. His focus is on the former notion, which has consequences for the nature of the representations proposed and the learnability of these representations. Baker presents his definitions using X-bar theory (Chomsky, 1970). In what follows, his explanation of the linguistic facts concerning verbs and nouns and the learnability of the resulting grammatical representations are discussed and the predictions that can be deduced are evaluated.


Baker (2003) defines the lexical category verb as in (4).

(4) X is a verb if and only if X is a lexical category and X has a specifier
This definition holds that a lexical head (and not a functional head\(^4\)) is a verb if it has a specifier in the phrase of which it is the head, as in (5).

\[(5)\]

```
\[ X \]
\[ \text{specifier} \]
\[ X \text{ lexical complement} \]
```

Defining the distinguishing property of verbs in relation to other lexical categories as “having a specifier” follows from several considerations. A specifier is the syntactic position for the external argument (subject) of a sentence in X-bar theory. According to Baker, what distinguishes verbs from other lexical categories in the syntactic structure is not their ability to have complements (nouns can also take complements, e.g., a prepositional complement as in \textit{a box of chocolates}), but their ability to head a phrase containing both a complement and a specifier as in (6).

\[(6)\]

```
\[ VP \]
\[ \text{john} \]
\[ \text{eats} \text{ fish} \]
```

Verbs can be the predicate of a subject without an extra piece of functional structure, whereas nouns cannot. This implies a difference in the assignment of theta roles between verbs and nouns. Baker suggests that this difference is caused by the presence of a specifier in the underlying syntactic structure. Nouns cannot assign theta roles to the grammatical subject function, but they need an extra (often covert) functional head which Baker calls ‘Pred’; Pred assigns a theta role to the subject of the sentence. The underlying structure of nouns, when used predicatively, is shown in (7).

\(^4\) Most functional heads can have a specifier in their phrase; see the functional head ‘Pred’ in example (7) later on.
In some languages (e.g., Edo, Chichewa) this functional ‘Pred-head’ is indeed visible in the surface form. Furthermore, Baker shows that previous claims about the differences between verbs and other lexical categories follow directly from the property of having a specifier – namely that these differences are determined by properties such as having tense, or having certain causative morphemes. It is acknowledged in Baker’s proposal that nouns can also have these properties in some languages and certain environments. It is assumed in Baker’s theory that in these cases the PredP contains the specifier, as in (8).

According to Baker, the universal, distinctive, syntactic property that distinguishes verbs from all other lexical categories is the specifier directly heading the verb in its underlying syntactic structure. This claim is based on several syntactic operations distinguishing verbal and non-verbal structures that can be explained by the presence or absence of a specifier.

Baker presents his definition of nouns in two versions, as in (9).
(9) a. Semantic version: nouns and only nouns have criteria of identity, whereby they can serve as standards of sameness.
b. Syntactic version: X is a noun if and only if X is a lexical category and X bears a referential index.  

Both the semantic and the syntactic version provide the same definition of nouns: they can bear a referential index as a result of their logical semantic standard (criterion of identity) by which it can be seen whether the entity designated by the noun is the same as another entity. Baker explains this criterion of identity with the following example (Baker, 2003: 147). Suppose there is a little boy named Nicholas who built a castle from a set of blocks. The building could be described with both sentence (10a) and (10b), and the event could be described with sentence (10c). However, (10d) cannot be inferred from (10a-c).

(10) a. That is a block set.
b. That is a castle.
c. Nicholas made the castle.
d. Not: Nicholas made the block set.

The impossibility of the inference in (10d) follows from the different identity criteria of the castle and the block set; they refer to different identities. Having these ‘criteria of identity’ or ‘referential indices’ makes it possible for nouns to be counted, because only referential concepts can be counted, hence the possibility of numerals or quantifiers with count nouns. According to Baker, nouns can be substituted by pronouns, but verbs not by “pro-verbs”.  

5 In Baker’s original definition an addition is made: “… expressed as an ordered pair of integers” (Baker, 2003: 95). Since this paired expression follows from several theoretical considerations that are irrelevant for the purposes of this thesis, I left out this addition and refer the interested reader to Baker’s motivation for these pairs (Baker, 2003: 104).

6 Note that the English auxiliary ‘do’ has often been called a “proverb”, as in ‘John hit Harry and so did Bill’, but Baker apparently does not adhere to this analysis.
Crucially, the definitions of verbs and nouns presented by Baker follow from the general intuition that verbs are inherently good predicators and nouns are inherently good referrers. The specific part of Baker’s proposal is the formalization of these intuitions into details of underlying syntactic structures. Verbs are good predicators because they have a specifier in their syntactic structure, while nouns are good referrers because they have referential indices in their syntactic structure. According to Baker, these detailed syntactic properties of verbs and nouns are represented in the adult grammar.

Whether these grammatical representations are learnable does not seem to interest Baker, as can be deduced from some of his remarks in the final chapter of his book (Baker, 2003: 290-298). He rejects a role for prototypical notional characterizations of verbs and nouns in a grammatical model (see also Newmeyer, 1998). However, he adds that those prototypical notional characterizations are likely to play a role in the categorization of words as verbs and nouns by children. According to Baker, prototypical semantics can play a role in language acquisition, but not in defining the categories of verbs and nouns. Baker makes a sharp distinction between a formal theory of the mental categories VERB and NOUN and learning these categories. With his formal theory of categories he describes how languages organize their content words and explains the differences between categories from differences in underlying syntactic structures. His theory aims to provide an adequate explanation of the typological data. However, he does not consider the learnability of the grammatical structures proposed by this theory, because he assumes that child language data represent language performance rather than language competence. In his own words:

“That statistical, imperfect, notional characterizations of the lexical categories should play a role in language acquisition (as opposed to grammar) should come as no great surprise, since language acquisition is a messy, statistically driven, heuristic process even for the generative linguist. It is an issue of linguistic performance par excellence, not an issue of linguistic competence.” (Baker, 2003: 297)

This quote is followed by his prediction that the earliest words acquired by children are those whose category membership is most consistent across languages (i.e., the most prototypical verbs and nouns). This prediction does not follow from his syntactic definitions of verbs and nouns, but from the process of language acquisition that is, to his opinion, just performance. Baker claims that the meaning of words does not play a role in the definition of verbs and nouns, but can play a role
in their acquisition since this is an issue of performance. Therefore, he predicts that children start categorizing prototypical events and objects, although this behavior has nothing to do with the grammatical representation of verbs and nouns. As Marantz (2003) has remarked, such a strict division between competence and performance has to be criticized. Any theory of linguistic knowledge should involve an account of all language data, including child language data. Baker does not make any attempt to relate his theory to child language data, thereby ignoring learnability as a relevant criterion. Baker presents a more detailed proposal of the defining syntactic properties of verbs and nouns than Marantz and Borer, but does not address how these proposed representations can be learned.

2.3.2. Predictions

As stated earlier, Baker’s proposal does not make predictions about how children learn to categorize the words in language acquisition. Nevertheless, it is possible to derive predictions from Baker’s syntactic definitions of verbs and nouns. The generative tradition in general makes certain predictions for the path of syntactic development, and since Baker works in this tradition, we can apply this line of reasoning to the acquisition of his underlying syntactic structures defining verbs and nouns.

As shown with respect to the proposals by Marantz and Borer in §2.2, it is plausible to assume the grammatical representations of verbs and nouns to be innate if they are universally valid. Baker proposes that the categories verb and noun are indeed universal. It may therefore be assumed that the structures he proposes for verbs and nouns are part of an innate Universal Grammar. As a consequence, children never have a grammar in which the structure for verbs and nouns is qualitatively different from the universal structures. The subsequent prediction is that children have to learn which words belong to which lexical category.

The predicted pattern of child language utterances based on my interpretation of Baker’s theory is that children assign content words to either the verbal or nominal category from an early age onwards and use these words accordingly. Since the central syntactic property of verbs is predication and the central property of nouns is reference, it is predicted that if children use verbs, they use them predicatively and if they use nouns, they use them referentially at an early stage of language development. After all, the predicative use of nouns requires more functional structure and is thus more marked than the referential use of nouns. Once the child encounters enough evidence for the predicative use of nouns, she should retreat from this strict division and gradually use more nominal words in a predicative structure with an underlying predicative functional head.
2.4. Possible classes of verbs and nouns based on typology

Hengeveld (1992b) proposes a typological theory of verbs and nouns, among other ‘parts of speech’, from a different theoretical perspective, but with a similar approach to the relevance of syntactic properties in category assignment. This proposal takes the perspective of Functional (Discourse) Grammar (Dik, 1997; Hengeveld & Mackenzie, 2008). Hengeveld distinguishes the notion of ‘lexeme’ from the notion of ‘syntactic function’. The categories of verbs and nouns in a certain language can be defined by investigating the possible links between verbal and nominal lexemes and their syntactic possibilities. This separation of lexemes and syntactic functions is comparable to the separation of roots (§2.2.1, Marantz, 1997) or encyclopedic items (§2.2.1, Borer, 2003) from syntactic structure. However, an important difference between this theory and the previously discussed theories is that a certain class of lexemes may be used in more than one syntactic function (predication or reference), which means not all languages need to have the same number of categories.

2.4.1. Hengeveld (1992)

Hengeveld (1992a, 1992b) distinguishes four functions in a sentence that can be expressed with content words. The function of a word in a sentence is determined by its function in a syntactic phrase. The four functions in a sentence are divided over two different types of syntactic phrases: the predicate phrase and the referential phrase (i.e., the ‘argument phrase’), comparable to the Verb Phrase and the Noun Phrase of generative grammar, respectively. The main difference is that, by using the terminology ‘predicate’ and ‘referential’, Hengeveld allows different possible heads of phrases. This is relevant because Hengeveld emphasizes the importance of separating syntactic phrases from the lexemes that can express them. Within these phrases, lexemes can function either as the head of the phrase or as a modifier in the phrase. This results in the following four possible syntactic functions that can be expressed in a sentence:

- Head of a Predicate phrase (henceforth HP)
- Head of a Referential phrase (henceforth HR)
- Modifier in a Referential phrase (henceforth MR)

Hengeveld and Mackenzie (2008) make the same distinction in syntactic phrases as Hengeveld (1992), but their terminology differs, as the predicate phrase is called ‘ascriptive subact’ and the referential phrase is called ‘referential subact’. Here, I will use the terminology from Hengeveld’s earlier work, as the distinction remains the same.
Modifier in a Predicate phrase (henceforth MP)

These functions are illustrated in (11) for English.

Classes of lexemes can lexically express one or more of these syntactic functions. Languages differ from each other in the number of content word classes they have. Multiple syntactic functions can be expressed by a single word class in a language, so there need not be as many word classes as there are syntactic functions to be expressed. English has four content word classes, each of which can be used in one of the four syntactic functions, as shown in example (11), taken from Hengeveld (1992b: 37, function indications added, ME).


However, a lexeme such as *president* can also be used in HP and MR, as shown in examples (12) and (13), both taken from Hengeveld (1992b: 37, function indications added, ME).

(12) [John]HR, Ref. phrase [is [president]HP ]Pred. phrase
(13) [John]HR, Ref. phrase [has [a [presidential]MR [style]HR ]HP, Ref. phrase ]Pred. phrase

The crucial difference between these two examples is that in (13), the lexeme *presidential* is a derived form, construed by the addition of the derivational morpheme –ial. Such derivational morphology falls under Hengeveld’s umbrella term ‘further measures’ and results in a different lexeme. It is not the lexeme *president* that is used in MR in (13) but the lexeme *presidential*. The lexeme *presidential* belongs to the class of adjectives in English. Although the copula *is* in (12) also falls under ‘further measure’, the lexeme *president* itself does not change. Based on these observations, Hengeveld defines verbs in English as lexemes that can only be used as the head of a predicative phrase, whereas nouns are lexemes that have the unique possibility of being used as the head of a referential phrase. Nouns may also have other possible uses in a language, such as the predicative use in English. Note that Hengeveld’s analysis of nouns functioning as the heads of predicative phrases differs principally from Baker’s analysis (§2.3.1), according to which nouns never function as a predicative heads. Baker assumes an empty functional predicating head, whereas Hengeveld assumes that the noun itself is the head of the predicate phrase.

In sum, the crucial notions for distinguishing lexeme classes as verbs and nouns in Hengeveld’s theory are their different possibilities to fulfill syntactic functions. Whereas verbs are lexemes that can only function as the head of the predicate
phrase, nouns are lexemes that are able to function as the head of a referential phrase (and possibly have additional functions depending on the language). Here, Hengeveld’s proposal differs from the proposals discussed in previous sections since these proposals define specific distinct structures for verbs and nouns. Hengeveld only defines syntactic functions; the possibility for verbs and nouns to fulfill these syntactic functions differ per language. According to Hengeveld, the representations of the categories VERB and NOUN in the adult grammar thus consist of the language-specific mappings of lexemes to the syntactic functions HP, HR, MR, and MP.

The learnability of these representations depends upon the learnability of the syntactic functions HP, HR, MR, and MP. Since the language-specific properties of verbs and nouns are defined by the ability of lexeme classes to express these syntactic functions, the availability of the syntactic functions seems a prerequisite for acquiring the categories verb and noun. It is not clear from Hengeveld’s proposal whether these syntactic functions are learned or pre-given, but since they are universally valid, it is plausible to assume that they are innate.

2.4.2. Predictions

Hengeveld does not explicitly predict child language patterns that follow from his theory. However, he formulates predictions for typological patterns, from which predictions for child language can be deduced. Berwick (1985) proposed that there is a relationship between typological patterns and child language acquisition that is characterized by the Subset Principle. If there is an implicational relationship between different types of languages, children will start with the most minimal option, that is, the option present in all types of languages. According to Hengeveld (1992b; repeated in Hengeveld & Mackenzie, 2008), the way in which languages divide their lexemes into word classes with distinct syntactic possibilities indeed displays an implicational relationship. Languages that do not have four different classes of content words, but instead have one, two, or three, seem to combine syntactic functions in a fairly systematic manner. Hengeveld investigated a sample of 50 languages for the kind of syntactic functions they express with distinct content word classes. This typological study led Hengeveld to propose the hierarchy of syntactic functions with respect to word classes presented in (14).

\[(14) \text{HP} < \text{HR} < \text{MR} < \text{MP}\]

This hierarchy indicates that the further to the right a syntactic function is situated, the more likely it is that a language does not have a separate class of content words
that expresses only this syntactic function. That is, if a language combines the expression of two syntactic functions in one word class, it is most likely to combine the MR and the MP. In its strongest form, this hierarchy states that the implication of having a separate class of content words to express the MR is to have content word classes that typically express the HR and the HP, since they are further to the left in the hierarchy. Hengeveld based this hierarchy on what he found in his sample of languages, and predicts that this implicational hierarchy will hold for languages across the world. The largest group of languages in the sample (20 out of 50) expresses all four syntactic functions with a separate word class. Two languages have only one word class, 10 languages have two word classes, and 18 languages have three word classes. If a language did not have a separate word class to express the HR, it also did not have separate word classes for MR and MP. For typology, the prediction is thus that the hierarchy of syntactic functions determines the number and nature of possible word classes in languages. Applying this prediction to language acquisition, we can predict that the hierarchy of syntactic functions determines the word classes used at different stages of acquisition, starting with the minimal option (i.e., the leftmost one). Thus, children should learn to use lexical words to express these syntactic functions from left to right in the hierarchy.

If the prediction that the hierarchy of syntactic functions determines the use of lexical words by language-learning children is borne out, specific child language patterns should be observed. Since children need to find out how many different word classes their mother tongue has to express the different syntactic functions, they may start by using the lexemes of their language only to express the HP. This means they use content words only predicatively in the first stage of language development. Since all word classes can be used predicatively in the languages investigated by Hengeveld, such a development would not result in ungrammatical utterances. The child language production pattern therefore does not differ qualitatively from the adult pattern, but the prediction is that children use relatively fewer content words in HR (as a percentage of their total content word production) than adults. If children receive evidence from the input that a specific class of words is used as the head of referential phrases, they may expand their pattern accordingly. It is predicted that the child will not use content words referentially until she receives enough evidence from the input to do so. Depending on the language learned, this expansion process continues with the modifying functions until the

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8 Recently, weaker versions of this hierarchy have been proposed (Hengeveld & Van Lier, 2008), in which the hierarchy is an interacting system of two different implications rather than a true implicational hierarchy. However, Hengeveld & Mackenzie (2008: 227) still use a strict implicational interpretation. This implicational interpretation is used here, because it leads to clear predictions.
child uses the all word classes distinguished in her first language in the appropriate functions. A child learning a language with a single word class has an easier job than a child learning a language with four different word classes for the different syntactic functions. In all cases, the child language data will not show errors, since the input drives the expansion of the number of word classes. However, quantitative differences are expected between the proportions of words used by adults and children across syntactic functions. Some patterns are clearly not predicted based on Hengeveld’s typological hierarchy. Since all languages in the world that express the MP with a separate word class also express the three other syntactic functions with a separate word class, children should not start using all their early content words as MPs only. To put it even more strongly, children should not use single lexical items to express any of the syntactic functions HR, MR, and MP before they use them to express HP.

The crucial part in the acquisition of verbs and nouns according to Hengeveld is not the acquisition of the syntactic functions represented in the grammar, but the expression of these syntactic functions with lexical items. The prediction is that children will obey the implicational hierarchy of syntactic functions and consequently start using words predicatively, gradually expanding the use of certain word classes to the other three functions in the predicted order. The prediction for child production data is that children do not make errors, but their production patterns in initial developmental stages is quantitatively different from that of adults.

2.5. **Verbs and nouns emerging from constructions**

Both Croft (1991, 2000, 2001) and Goldberg (1995, 2006) present constructionist approaches to language, defining grammatical constructions as “conventionalized pairings of form and function” (Goldberg, 2006: 3). These authors define a grammar as a collection of constructions that differ in size and in abstractness. This collection emerges in the mind as a result of general human cognitive abilities such as memory, learning, and attention. The resulting representations are therefore always the result of surface generalizations, i.e., generalizations over the language actually used by speakers. These proposals focus more on learnability than on covering all linguistic facts connected to verbs and nouns, although of course an attempt is made to also do the latter. The representations assumed by constructionists can differ across language users and can have a prototype-like structure.

Croft’s (1991) proposal does not define verbs and nouns in terms of structural properties, although this was the criterion for the selection of theories in this chapter. Following a cognitive approach to grammar (Langacker, 1987), he starts his theory of verbs and nouns with the conceptualizations people have about the world. This approach is thus actually not a syntactic or distributional approach in the strict sense, but it ultimately does refer to distributional characteristics for the grammatical representations of verb and noun. The relevant conceptualizations for these categories are predication (i.e., making an “entity into a transitory state of affairs” (Croft, 1991: 108)) and reference (i.e., creating “an autonomous entity and making it into a kind or individual of the kind” (Croft, 1991: 108)). According to Croft, these conceptualizations are the basic pragmatic functions that determine language use. These pragmatic functions can be expressed by different words belonging to different word classes across different languages. However, certain words in language are prototypically used for predication, whereas other words are prototypically used for reference. These prototypical uses seem to be universal across languages and are called verbs and nouns by linguists. Croft (2000: 88) proposes typological prototypes for the categories of verbs and nouns as shown in (15).

\[
\begin{align*}
\text{Verb} & = \text{predication of an action} \\
\text{Noun} & = \text{reference to an object}
\end{align*}
\]

These prototypes are the most unmarked combinations of the meanings, the pragmatic functions and the word classes available in a language. The combinations presented in (15) are prototypes in the sense that they reflect the least marked functions of verbs and nouns; they are not the only functions possible. These prototypical conceptual categories are mentally represented. In Croft’s proposal, the prototypical categories are universals, but the boundaries of these categories differ across languages. Boundaries can be sharp or fuzzier to different degrees, depending on the language. It is crucial that the determining factor for categorization in a language is the mapping of words to a concepts that are also used for other purposes than language, for example for the perception of events. There are no categories that are specific to language. The categorization of a language-specific group of words depends upon generalization over the distribution of words in the constructions of the language under consideration. So although Croft’s central idea of word classes is not syntactic or distributional per se, the emergence of categories is based upon the language-specific distribution of certain constructions.
Goldberg (1995, 2006) proposes an architecture of speakers’ knowledge of language similar to that of Croft. According to Construction Grammar, linguistic representation in the mental grammar consists of systematic collections of constructions that are stored based on perceived speech. Constructions are pairings of form and function in different possible sizes: words, morphemes, idioms, and argument structures are all considered to be constructions. As a consequence, words do not have a special status compared to morphemes, phrases, or sentences. In this respect Goldberg’s idea is in agreement with the proposals by Marantz and Borer discussed in §2.2: a principled distinction between morphological and syntactic processes is not made. The major difference from the proposals discussed earlier is, however, that Goldberg places all constructions (from morphemes to sentences) in the lexicon, whereas Marantz and Borer eliminate the lexicon by proposing that linguistic units of all sizes are computed in the syntax. An important consequence of the lexical nature of constructions in Goldberg’s view is that constructions cannot be separated from their meaning or function.

In her proposal about how argument structure is represented in grammar, Goldberg (1995) emphasizes the important role of the inherent semantics of argument structure constructions. The meaning of a given sentence is not determined by the meaning of all individual lexical items that form that sentence, but by the meaning of the ‘argument structure construction’ used in the sentence. In the argument structure constructions, variables are defined for the arguments of the sentence. For example, the argument structure construction of the ditransitive is defined as in (16).

(16) X CAUSES Y to RECEIVE Z

In English, X and Y are often expressed with animate referring object words (‘animate nouns’), Z is often expressed with an inanimate referring object word (‘inanimate noun’) whereas CAUSES to RECEIVE is often expressed with a ditransitive predicing action word (‘ditransitive verb’). A prototypical example of a construction based on this argument structure construction is presented in (17).

(17) John gives Bill a book

However, since the argument structure construction itself has a meaning, speakers can interpret sentences like (18a) and (18b), eventhough bake is generally not considered to be ditransitive, book is not an animate noun, and a lot to think about is not an inanimate noun.
(18) a. John baked Bill a cake
   b. The book gave John a lot to think about

Conversely, the linguistic possibilities of the different elements of the constructions in (17) and (18) such as John, Bill, book, cake, gives, baked, and gave are determined not only by the properties of the elements themselves, but for a large part by the properties of the constructions in which they are used.

Categories, according to Goldberg, emerge in the lexicon (Construction Grammar does not distinguish lexicon from grammar) when constructions share the same distribution. This means that constructions of all possible sizes can be categorized together if they often share the same distribution. The linguistic forms that most frequently express variable X in (16) result in a prototype category that is the kernel of a wide network of associations, including other kernels. For example, the prototypical category consists of strong associations between the ‘animate noun’ constructions John, Bill, Mary, he, she, the waitress, etc. Another prototypical category consists of strong associations between the ‘inanimate count noun’ constructions the book, apples, the cup, etc. This second kernel, in turn, can be in the associative network of the first, so that the networks overlap. These combinations of kernels that are at play across more than one network gradually form larger categories. Goldberg focuses on the smaller networks by describing different categories of verbs based on the different constructions they can appear in (e.g., transitive verbs, intransitive verbs, and ditransitive verbs) and not so much on a larger, generalized class of verbs. Similarly for nouns, words are categorized differently as mass or count nouns based on the different constructions they can appear in. The larger categories VERB and NOUN are represented in the adult mental lexicon by an associative network of different kernels of strongly associated exemplars that frequently occur in similar constructions.

The central idea put forward by Croft and Goldberg emphasizes the emergent and language-specific character of categories such as verbs and nouns. Only those words that frequently share the same distributions in constructions of a language are actually categorized together by language users based on surface-level generalizations. In the adult grammar, verbal and nominal categories are represented as collections of items that very frequently occur in similar constructions. Items that share many distributional contexts are the most prototypical verbs and nouns, i.e., the predating action words and the referring object words. The representations of verbs and nouns consequently differ across languages and across speakers. After all, not every speaker encounters the same constructions in the same frequency. The
representation of verbs and nouns emerges as a result of learning. As a consequence, the proposed verbal and nominal representations are inherently learnable. The surface language determines the representations, which emerge in the mental grammar as a result of the input. If there were no input language, there would be no verbal and nominal representations. The innate knowledge is restricted to general cognitive knowledge such as the ability to recognize patterns and the ability to make analogies. No knowledge specific to language is available for the child before she encounters input.

2.5.2. Predictions

Since these constructionist theories interpret the classes of verbs and nouns as emerging from the distribution of constructions in a language, the predictions for child language development can be drawn directly from the development of categories in general. Since category emergence in general is described as a gradual process, the prediction is that category development also takes place gradually, reflected in different developmental stages of child language production. Categories are generalized patterns of the constructions in which certain types of words can occur. To acquire verbal and nominal categories, children attend to the input language they hear and use their general cognitive abilities to make surface-level generalizations from these input utterances. The results of this process are the end-state categories as assumed by constructionists, i.e., prototype-like representations in an associative network. Different developmental stages will be reflections of different cognitive stages combined with the language input received. The first sentences produced by children will be imitations of (parts of) earlier perceived sentences in the input. If the exposure to sentences with the same structure passes a certain threshold, children will break up the sentence level construction into smaller parts and produce more creative language utterances (Tomasello, 2003). The predicted pattern of child language based on these constructionist theories is different for different stages of development. The first stage of development should be marked by distributional patterns that can literally be traced back to adult input sentences. Such trace-back analyses have been performed for other aspects of grammar acquisition (Lieven, Behrens, Speares, & Tomasello, 2003). After a certain amount of exposure, child language patterns become more creative, in the sense that parts of previously heard constructions are interchanged. At still later stages, the associative networks have grown so strong that they can produce new constructions, so more creativity beyond the adult input is expected. However, children at the earliest, pre-generalization stage of language development are predicted not to use items, constructions, and sentences in ways that are unattested in adult language.
2.6. Summary and conclusions

The aim of this chapter was to provide an overview of fundamentally different linguistic theories, presenting their central ideas on how the categories verb and noun are represented in adult grammar and the predictions they make concerning acquisition. In this final section, I will first summarize the findings of the previous sections for a concise overview of all theories discussed in relation to child language data. From this summary it should become clear to what extent the theories make different predictions for acquisition and whether they are distinguishable from each other on the basis of these predictions.

For each of the six theories discussed in this chapter we have seen what their central idea of verbs and nouns is. The theories first discussed propose discrete universal grammatical representations of verbs and nouns, whereas the theories discussed last propose prototype-like and speaker-dependent grammatical representations of these categories. The theories that assume discrete representations in general provide a more precise definition of verbs and nouns than those that assume prototype-like representations. Marantz (1997), Borer (2003), and Baker (2003) define specific syntactic structures determining verbhood and nounhood. Hengeveld (1992b) also defines specific syntactic functions relevant for categories, but adds to this a proposal for the definitions of lexical classes of verbs and nouns that differ across languages. These lexical categories namely depend on the language-specific expression of these functions. The constructionist theories (Croft, 1991; Goldberg, 1995; Croft, 2000; Goldberg, 2006) propose a more prototype-like representation of verbs and nouns that differs across languages and speakers.

At the end of each subsection on these central ideas, I briefly discussed the extent to which the proposals include learnability considerations. That is, whether the proposed representations can be learned or can be assumed to be part of an innate grammar. Learnability is in fact the most important aim of the constructionist theories. Their proposals for how verbs and nouns are represented in the adult grammar are actually based on the representations that emerge during learning. These representations are inherently learnable. There seems to be a correlation between the way (presence or absence) a theory incorporates linguistic facts and learnability and the position the theory has on the ‘representation scale’. The primary aim of theories proposing detailed universal grammatical representations is to account for all linguistic facts concerning these categories. As was shown for Baker (2003), this is even his only concern, as learnability considerations are not included in his proposal. Generally speaking, if a theory focuses more on the
numerous linguistic facts about verbs and nouns, it proposes a more abstract grammatical representation of discrete verbal and nominal categories; if a theory focuses more on the learnability of verbs and nouns, it proposes a fuzzier representation of prototype-like verbal and nominal categories.

For us to be able to compare the compatibility of the theories with child language data, the theories have to make different predictions. Most of the theories do not in themselves make explicit predictions for child language acquisition, except for Borer’s (2004). However, on the basis of their tenets, I could derive some predictions for all theories. The theories of Marantz (1997) and Borer (2003) predict categorization errors during early development, because children have to find out which vocabulary items can be used in the pre-given verbal and nominal syntactic structures. It is predicted that children use items in category structures that are nonexistent from an adult point of view at an early stage of development. Although it is hard to translate Baker’s ideas into predictions, my own interpretation predicts a very conservative use of verbs and nouns as predicators and referrers in an early stage of development. The prediction from Hengeveld’s implicational hierarchy of language types is also conservative: in accordance with the hierarchy for language types, children probably start with the assumption that lexical items can be used predicatively. Based on evidence from the input, a subset of vocabulary items can be used for reference. The difference between the predictions based on Baker and Hengeveld’s proposals is that Hengeveld would expect that children at a very early stage of development do not yet have a class of words reserved for reference. The relative proportions of content words used across syntactic functions is expected to differ quantitatively from the proportions of adults. However, they should not make errors. Croft (1991) and Goldberg (1995; 2006) propose that categories emerge from surface level language use. Categories therefore should emerge in child grammars during development, based on the input language children attend to. They gradually make generalizations of the constructional patterns. As a consequence, at an early stage of development children are expected to use verbs and nouns correctly in those constructions that are attested in their input.

In sum, the six theories for child language production patterns can be reduced to only two qualitatively different predictions, as can be seen from Table 2.1. Most theories predict an initial stage of very conservative, adult-like use of verbs and nouns by children. Hengeveld allows for the possibility that children are even more conservative than adults, as should be evidenced by a stage in which they only use words predicatively. Only Borer strongly predicts an initial stage of categorization errors, a prediction that can also be applied to Marantz’s proposal. Adult-like production patterns (i.e., no errors) are compatible with four out of the six theories.
Table 2.1. Summary of the six syntactic theories of verbs and nouns and their predictions for the earliest child production data (ordered according to the presentation in this chapter).

<table>
<thead>
<tr>
<th>Theory</th>
<th>Central idea of verb and noun</th>
<th>Predictions for initial child language production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marantz (1997)</td>
<td>Insertion of atomic roots and phonological forms in syntactic structures with functional heads D or v</td>
<td>Categorization errors are predicted</td>
</tr>
<tr>
<td>Baker (2003)</td>
<td>Lexical heads with either a specifier (verb) or referential index (noun) in underlying syntactic structure.</td>
<td>Adult-like use of words in syntactic patterns predicted</td>
</tr>
<tr>
<td>Hengeveld (1992)</td>
<td>Lexical items that can either occupy the head of predicate phrase (verb) or the head of referential phrase (noun).</td>
<td>Adult-like (but possibly quantitatively different) use of words across syntactic patterns predicted</td>
</tr>
<tr>
<td>Croft (2000)</td>
<td>Language-specific distributional patterns make different categories emerge from constructions with predicating and referring elements.</td>
<td>Adult-like use of words in syntactic patterns predicted</td>
</tr>
<tr>
<td>Goldberg (2006)</td>
<td>Surface-level generalizations of overlapping construction parts, resulting in several smaller distributional categories.</td>
<td></td>
</tr>
</tbody>
</table>

Thus, although the ideas about verbs and nouns presented by Baker (2003) and Goldberg (2006) are fundamentally different in nature, they cannot be distinguished from each other by evidence from child language production data. Whereas Baker has a detailed view of how discrete verbal and nominal categories are anchored in the language competence, Goldberg sees categories as associative networks emergent from language use itself. Ideally, it would be possible to evaluate the extent to which these different ideas yield the most appropriate account of the representations of verbs and nouns in adult mental grammars. Since the appropriateness of an idea depends, among other things, on learnability, one possible evaluation procedure is to test the compatibility of the ideas with child language
data. However, with respect to the acquisition of the categories verb and noun, both theories predict adult-like production patterns in early child language.

The two proposals that define the categories verb and noun in the functional syntactic structure by Marantz and Borer do not predict adult-like production patterns from the start. As Borer (2004) spells out, it is strongly predicted that children pass through a stage in which they have acquired the syntactic categories, but have not yet acquired the correct mappings of lexical items to these syntactic positions. As a consequence, they will make categorization errors of the sort *Mummy trousers me*. Although this prediction is different from the other predictions, adult-like production patterns are even consistent with these theories. If the error stage takes place before children produce multi-word utterances, there is no way to distinguish these theories from all other theories of this chapter. This is, however, a methodological problem, which I will address in Chapter 3.

Concluding this chapter on the ideas and predictions about verbs and nouns made by different theories, four of the theories discussed can only be compared on their compatibility with child language data if it can be determined that the child language patterns deviate qualitatively from the adult-like patterns proposed by these theories. If categorization errors are found in very early child language patterns, there is some evidence for the other two theories by Marantz and Borer. However, in later production stages errors are also predicted by the constructionist theories. What needs to be established in Chapter 3 is which prediction is borne out by the data. The focus of Chapter 3 is on Dutch children’s production data, which will be studied by means of an analysis of a spontaneous speech corpus.