The bare necessities: the method of the study

And go along not thinkin’ about it
I’ll tell you something true
The bare necessities of life will come to you

The song **The bare necessities** from the Disney movie **The jungle book**

4.0 Introduction

Problems with respect to discontinuous development have been discussed in chapter 2. The problem is that traditional approaches do not have clear criteria to decide for or against non-linearities or discontinuities. I therefore introduced dynamic systems theory and catastrophe theory. The latter theory can explain discontinuous change (chapter 3).

In this chapter I zoom in on the variable of this study. The goal is to find empirical evidence for discontinuities or continuous nonlinear change and to answer the main research question in chapter 5. The choice of the variable(s) should satisfy two criteria. First, the empirical variables have to make up an important aspect of language. Second, the variable(s) should have the possibility of sudden change. That is, a variable should develop in a potentially rapid or even discontinuous fashion.

In the vast body of literature on language development most papers and books deal with structural (e.g. syntactic) analyses. In my experience, quantitative change plays a minor part in the study of language development, but some of these quantitative findings of Brown and others (e.g. Wells, 1986) is reviewed, with an emphasis on the presence of possible discontinuities and stage wise development. The variable of the study, *function words*, is introduced in section 4.1. I discuss the general characteristics and the linguistic properties of function words (i.e. the structure of function words) on the basis of three examples (i.e. pronouns, modals and articles).

In section 4.2 I introduce the conditions for the study of catastrophes in language development, i.e. the quality of the data, the use of frequency (e.g. of the recordings) and the length of the recordings.
Six children have been recorded for the analysis of their speech. Their age, the length of the period of the recordings and the transcripts of the children’s utterances, and the programs from the CHILDES project are presented in section 4.3.

The summary (section 4.4) describes the tools that are needed for analyses of language data of children on the basis of catastrophe theory criteria, and a reformulation of the research question.

4.1 Function words in language and development

Introduction

The first part of this chapter deals with the structural properties of function words. The relationship between function words and linguistic theories is stressed (cf. Ruhland, Wijnen & van Geert, 1995). The second part of this section discusses the development of functional categories. Linguistic theories and their prediction on the development of function words are discussed, and I introduce three specific cases of function words, namely articles, pronouns and modals. The syntactic properties of these words are discussed, and I emphasise research on the development of these three function words.

Function words in general

For syntactic reasons linguists make a distinction between lexical items and functional phrases. Lexical phrases consist of lexical items such as nouns, verbs, and adverbs. In the early stages of development, prepositions are also assumed to be lexical, whereas in later stages of development, this class of words is used in a syntactical way. Lexical items are the first acquired words, and in most cases they refer to the surrounding physical world. That is, content words refer to a non-linguistic reality. The concepts can be regarded as references to what we see, hear, do, smell, etc., in short, to all entities and actions in our world. Functional phrases are more or less abstract words that have a grammatical rather than a referential use. These phrases, directly related to function words, are built up from, for example, articles (the and a), modal verbs (e.g. must, may and will) and pronouns (e.g. personal pronouns like I, you and we). Function words are called closed class words because they form a class that is limited and that is hardly ever expands, unlike lexical items which are expanded each time a new word is coined for a new cultural phenomenon. For example, the noun computer has been added to the vocabulary of many languages in the world since the 1970's, but articles are a class of words that have not been expanded for a long time: in Dutch there are two definite articles (de and
het, ‘the’) and one indefinite article (een, ‘a’). Furthermore, function words have some intriguing characteristics. Apart from the aspect of constituting a closed class and the relationship with syntactic structures, function words have systematic distributional properties in sentences, i.e. they appear in fixed positions, they often are monosyllabic and compose a small set of phonemes, they receive weak stress and may undergo cliticization, i.e. be attached to other words, and they are extremely frequent in speech (see also Gerken, Landau & Remez, 1990, Ruhland 1997). Note that function words are not the same as functional categories: functional categories refer to a syntactic analysis, whereas function words refer to the surface form of these categories.

Given their primarily grammatical function, the productive use of function words requires a relatively high level of syntactic differentiation, and vice versa. The frequency with which function words occur in the child’s language constitutes an important indicator of syntactic development. Function words also appear relatively late (despite their frequency and systemacy in the input and their monosyllabic character) in development, i.e. when sentences have a MLU (i.e. Mean Length of Utterance) of over 1.75 (Brown, 1973). The appearance of function words constitutes a new stage in language development, namely the differential stage which follows the telegraphic stage. The structural difference between these stages lies in the use of function words, inflection etc. during the differential stage.

With respect to syntactic trees (chapter 2), functional categories are associated with syntactic features such as tense, agreement and case. These categories form a ‘shell’ over the lexical categories. This shell is an interface between the representation that specifies the thematic relations between the verb and its argument noun phrases, and phonological form. Function words form one subclass (apart from, for example, verbs inflection) within this class of functional categories.

Function words are typical in a linguistic way. They are grammatical markers in a sentence, and they have a function in relation with other words (i.e. lexical items). They refer to other words, phrases or sentences. For example, he in example 4.1 refers to the man, and her refers to his wife (this is indicated by the use of the index i and j).

4.1 The man, is unfaithful to his wife, because he, is married to her.

These words are syntactic elements in a sentence, they do not refer to definite entities in reality. In other words, they are related to functional categories in a language, i.e. associated with syntactic structures. Their distributional properties in sentences are systematic: they appear in fixed positions. Articles appear in front of nouns, not behind them. Furthermore, they often are monosyllabic and constitute a small set of phonemes.
They receive weak stress and may undergo cliticization (i.e. be attached to other words). Examples in Dutch are ‘kep’ (ik heb, I have) and ‘daggie’ (dacht hij, thought he). They are extremely frequent in speech, and additionally, there is no dependence on the subject of a conversation. Function words limit the meaning of contents words. My guitar refers to a much more limited class than a guitar or guitar(s). Function words in Dutch have been summed up in van Wijk and Kempen (1980). There are 418 function words in Dutch, classified in 8 categories: prepositions, conjunctives, determiners (adjuncts before a noun), relatives (linking relative clauses with their antecedents), pronouns, auxiliary verbs, adverbs, and adverbs of degree (qualifiers). There are only few data on function words (in development or in the speech of adults) with respect to frequency.

In sum, the reasons for choosing function words, and not, for instance, all words that end with an e or an x, are that this class of words is syntactically important, that they are not dependent on the subject of the conversation (and therefore, quantitative aspects important in the analyses are not hampered by the problem that there might be too few occurrences in the language of a child) and that they constitute a closed class group of words. The combination of these three aspects makes them a very interesting and linguistically and communicatively important group of words.

The question is what one may expect with respect to developmental sequences of functional categories as compared to lexical categories. There are three general hypotheses about the development of syntax. All three make a claim about the origin and the structure of the initial competence of early child language.

**Hypotheses of development: full, reduced and no competence**

Three approaches make a claim about the possible nature of underlying syntactic structures in development. These approaches to structures in language (development) are based on linguistic theories (cf. Ferdinand, 1996, Ruhland, 1997). First, there is the hypothesis of full competence (FC). According to FC, children have full knowledge of grammar structures with birth. FC is based on the continuity assumption: all UG options are available to the child from birth on. Change is only a behavioural (i.e. superficial) change, underlying structures are fixed. However, children leave out functional elements in their actual language production. Solutions to this problem are reduction rules, production limitations, and phonological development (Ferdinand, 1996).

Second, the reduced competence (RC) hypothesis leaves a few blanks in the initial syntactic knowledge of a child. Clahsen, Penke and Parodi (1994), for example, assume that the functional structure of a sentence is extended gradually.
Third, the *lexical thematic* (LT) hypothesis states that all relationships between words and phrases are non-syntactical at early acquisition stages. LT is problematic on a theoretical level since it is unclear how “lexical thematic children” reach syntactic knowledge since this knowledge is not provided by the parents. FC is problematic on a behavioural level when children do not show any overt command of syntactic knowledge, which they should have according to FC.

Since there are three assumptions of the origin of functional categories there is not one position with respect to the change that may come about, and independent from the point taken in the discussion on the nature of a child’s knowledge of syntactic structures, a theory on development needs to express, apart from the acquisition of structural properties of function words, the expected change in the development of function words as functional categories.

**Theories on the development of functional categories**

In the initial phase of language development, children first use proper names (most notably, their own name, instead of ‘I’), or common nouns that can be interpreted as such, instead of pronouns. After a period in which determiners, such as the definite articles *de* and *het* (‘the’), and the indefinite *een* (‘a’), are not realized at all, children start using *schwas* in the appropriate positions (schwa’s are fillers, an ‘uh’-sound). Modals are used, but only in the present singular. The common denominator in these aspects of syntax and syntactic development is the concept of ‘functional projections’ (see chapter 2). Determiners (e.g. articles) and determinative pronouns, for example, are considered to be the head of the DP (Determinator Phrase). If pronouns and determiners are systematically absent, this may mean that the grammar lacks the category DP. Note that the absence (or unsystematic use) of particular elements that are associated with functional categories does not necessarily lead to the conclusion that these categories are absent (see Hoekstra & Jordens, 1994, for a critique of these assumptions).

Three theories on language development predict distinct quantitative increases in language development. Radford (1988b, 1990b) has repeatedly argued that during the initial phase of combinatorial speech, grammars lack functional categories and that the associated modules of grammar (the Case module) are inoperative. At this time, only the ‘categorial’ modules (e.g. the lexicon) are active. The X-bar module (i.e. the set of principles governing the construction of hierarchically structured phrases from lexical entries) is also available, but the set of categories it can operate upon is limited to the four lexical classes Noun, Verb, Adjective and Preposition. The transition from this limited grammar (subgrammar) to the target grammar has yet to be determined by the
child. This target grammar comprises functional categories and the associated principles of grammar. *Maturation* could induce the transition. It is conceivable that the modules of grammar that are associated with functional categories need more time to mature than the principles that govern lexical categories and their projections. All functional categories are interrelated, they address the same modules of syntax (notably the Case module)). Therefore, they are expected to emerge at the same time.

An alternative hypothesis is that all functional categories and the associated grammatical modules are available from the start, but that a certain amount of input (i.e. specific lexical and morphological items) is needed for them to be ‘triggered’ (i.e. become operative). Clahsen, Eisenbeiss and Penke (1994), for instance, suggest that acquisition of the regular subject-verb agreement paradigm results in the incorporation of the corresponding grammatical features into the child’s phrase-structure representation. “This may lead to new phrase structure layers or to the specification of previously existing functional positions” (Clahsen, Eisenbeiss & Penke, 1994: 18). This is argued to be evidenced by, among other things, unrestricted movement of finite verbs. They furthermore contend that the emergence of DP is a consequence of the acquisition of inflection, since both relate to the same syntactic (case) features (see also Chapter 2).

The main difference between the maturational account and the *Lexical Learning* (LL) approach of Clahsen and his collaborators is that the latter does not imply a qualitative shift in syntactic development. In LL, there is no change in the carrying capacity (see chapter 3), the body of syntactic knowledge, associated with either the growth of finite verbs or pronouns and determiners. Clahsen, Eisenbeiss and Penke’s (1994) suggestion entails a process of learning by generalization. Their proposal seems to imply that the acquisition of the agreement paradigm is a necessary condition for the acquisition of pronouns and determiners, which may be called a precursor relation (between finite verbs and pronouns and determiners). The quantitative prediction is a gradual increase, and maybe even a linear change. Sudden changes are not expected from this theoretical assumption.

With respect to the relation between function words and *Parameter Setting*, language development is a question of pushing the right buttons. Parameter setting, in its simplest form, is a theory that assumes that all linguistic knowledge is present from the beginning (a continuity approach to language development), but it takes time to switch all buttons to their correct state. This delay in time is the result of other linguistic factors, as well as psychological factors. The child’s task is to determine which of the core grammar variants allowed by Universal Grammar generates the sentences it is exposed to, and to set the values of the parameters accordingly (Chomsky, 1986, Gibson & Wexler, 1994). Parameter setting was conceived as a solution to the logical problem of language
acquisition: it explains the possibility of acquiring a complex grammatical system in the absence of sufficient data. It pertains to an idealized model of acquisition, which assumes simultaneous presentation of all relevant linguistic stimuli (triggers) and an instantaneous, non-graded transition from the initial state - UG in its pure form - to the final state - the target grammar. It does not need much contemplation to see that language acquisition in reality can never be instantaneous, even if it is assumed that the child is a perfect parameter setter, simply because the full array of necessary triggers can not be presented simultaneously. Still, acquisition of grammar might take place within a very short time. Given a sufficiently large passive vocabulary, a relatively small number of input utterances would be sufficient to set all parameters. However, on the assumption that the order of presentation of triggers is non-deterministic, the order in which parameters are set, or, in other words, the sequence of intermediate grammars would be unpredictable. Finally, it is conceivable that all principles are available, and that all of the necessary triggers are accessible, but that particular parameters cannot be set until certain other parameters have been set first (ordered parameters, Weissenborn, Goodluck & Roeper, 1992; see Verrips, 1991, for a critique of this perspective).

However, as pointed out in Ruhland, Wijnen and van Geert (1995), sudden changes of an underlying covert variable do not necessarily have to lead to abrupt changes in the overt variable. A structural change in some underlying mental capacity may fail to produce an abrupt change (discontinuity) in behavior because the behavioral reflexes of the new state may be in competition with the old. The net result of this competition would be a gradual adaptation of the performance system to changes in competence. Anyone coming from the Continent must have felt the sensation of walking through a Scottish city (or in any other left driving country) and planning to cross a road. In most countries one has to drive on the right lane, and cars come from the left first. In a Scottish town the cars come from the right first. The absence of control over this situation is dangerous, but the dangerous situation will die out if one stays long enough in one of the left-driving countries. This "old habit lingers on"-principle may explain why a structural change may not instantaneously lead to a new equilibrium (i.e. an direct adaptation to the new situation). Possible quantitative predictions include a sudden change and a gradual but rapid change to the new equilibrium. However, a precise prediction is not possible.

With respect to functional categories and function words, predictions of the quantitative development of function words on the basis of linguistic theories are diverse. Learning theories (like Lexical Learning) would predict a non-stagewise change. Change can impossibly be discontinuous. Parameter setting may explain and predict sudden
changes, as all “switch” theories predict. Maturational accounts of development (in the true sense of the word maturation) are growth theories, which predict gradual change.

The conclusion must be that theories on syntactic development contain a limited explanation for the way syntax develops in sense of psychological (dis)continuity. Existing structural (linguistic) theories allow for both continuous and discontinuous predictions (in psychological meaning). Nevertheless, these theories do not predict language development in terms of exact change. Here it is assumed, in accordance with a number of authors, that functional categories develop, i.e. not all functional categories are present from the beginning (De Viliers, 1992, Ferdinand, 1996). However, this structural assumption does not predict the quantitative paths of development. The way these paths develop in a quantitative way has been studied by Roger Brown (amongst others). His work and related work is reviewed in the following section.

**Function words development: general and specific observations**

In a series of articles Brown (1973, 1976; Cazden & Brown, 1975) has shown that the development of function words and functional morphemes has a characteristic pattern. They are suddenly introduced in the language of a child. Take a look at the following graph.

![Figure 4.1 The development of the plural morpheme (Brown, 1973); Age range from approximately 116 to 208 weeks.](image)

Within months, the child (here Sarah) in Brown (1973, 256) shows a rapid development in the acquisition of the use of pluralization. For this reason two stages have been
distinguished. Before the introduction of function words the stage is called telegraphic speech. In this stage sentences have limited length and there are no function words. After the introduction the stage is called the differentiation stage. Sentences become longer and they contain function words. There is a normal word order in both stages (i.e. no violations of the grammar prescriptions of a language). Quantifications or growth curves of grammatical morphemes like personal pronouns and articles lack in Brown’s work (apart from two graphs in Brown, 1973), but Brown’s main contribution to language development is that he developed a coherent framework of child language from the early stages to the acquisition of the grammatical morphemes, showing that the development of these morphemes is rapid. Cazden and Brown (1975) explicitly say that their findings only apply to English. According to Schlesinger (1971), however, telegraphic speech (or telegraphese) is observed in all children in all languages. Cazden and Brown (1975) claim that determinants of development are not frequency of the input nor the salience of function words. The development of function words is determined by their cumulative complexity (i.e. the various complexity of function words explains their development). Finally, the acquisition of syntax is impervious to deliberate assistance. In terms of catastrophe theory: the system has a structural stability.

In the mid eighties, a comprehensive, quantitative study of function words was published by Wells (1985). Over 100 children participated in the study. They have been measured once a month. The variables Wells studied overlap with those in this study, namely function words.

In figure 4.2, I present the data of Wells study. One can see the beautiful s-shaped form which is rather characteristic of large groups of subjects, measured and averaged over age. The analysis of Wells’ graphs shows that the shape of figure 4.1 is indeed an s-shaped curve (Ruhland, 1996).

![Figure 4.2. The development of pronouns.](image-url)
What is clear from the quantitative study of Wells is that monthly cross-sectional recordings yield near perfect s-shaped graphs. However, this is not in line with Brown’s findings, i.e. the sudden change of function words. These group studies with large recording intervals are not suitable for the study of development since they average out individual trajectories, and they leave out the intermediary changes within the development of function words.

**Pronominal vs. Nominal style**

Qualitative differences between children in early language development (i.e. the development of function words like pronouns) are based on the notion that children have different styles. These styles have been called *nominal* and *pronominal* (Bates, Bretherton & Snyder, 1988, Bloom, Lightbown & Hood, 1975, Shore, 1995), or *expressive* and *referential* (Nelson 1975). Bloom et al. (1975) found that if MLU equals or exceeds 2.5 (i.e. an average of 2.5 morphemes per utterance), the variation in children decreases. With shorter sentences (i.e. an MLU smaller than 2.5), they conclude, a child’s first sentences are either pronominal (using mainly pronouns) or nominal (using nouns), and these two styles are not mutually substitutable in the beginning. Children use either a pronominal or a categorizational strategy. Pronominal and nominal variation explains the telegraphic and pivot contradiction since different children can travel different paths, but they reach the same end. In addition, Nelson (1975) found that in the language of referential children (R), nouns decline as MLU increases, whereas in expressive children (E) nouns increases as MLU increases. R-children start with a high proportion nouns to pronouns, and their developmental course amounts to an increasing use of pronouns. E-children start with a balance of noun-pronouns, and they become increasingly lexical. E- and R-children developmental patterns are not discrete types but different points along a continuum of greater or lesser lexical-syntactic emphasis.

The question is whether the distinction between pronominal and nominal (Bloom, Lightbown & Hood, 1975) or referential and expressive styles (Nelson 1975) enables us to make predictions on the quantitative change we might expect in language development. We think that there is no compelling reason to believe that a linear, a slow gradual or a very rapid change follows logically from either of the styles that according to Nelson (1975) and Bloom et al. (1975) exist in language development. Pronominal children may acquire pronouns early in their language development, but this development may be either very rapid, slow, or linear. In a similar reasoning, nominal children are late, but when they catch up they may show any quantitative behaviour (from linear to sudden change). The style of development, so to speak, does not rule out any of the kinds of
change proposed. My analysis will shed a light on the issue of two (or more) paths in terms of quantitative patterns.

**Provisional conclusions and summary**

Function words relate to several linguistic and developmental theories in the sense that these words call for a high level of syntactic knowledge. I discussed three hypotheses on the linguistic patterns of change. First, it is conceivable that the modules of grammar that are associated with functional categories need more time to *mature* than the principles that govern lexical categories and their projections. An alternative hypothesis is that all functional categories and the associated grammatical modules are available from the start, but that a certain amount of input information, specific lexical and morphological items, is needed for them to become operative. At the surface level, this suggestion entails a process of *learning* by generalization. *Parameter setting* assumes that all linguistic knowledge is present from the beginning (a linguistic continuity approach to language development), but it takes time to switch all buttons to their correct state. Predictions on the quantitative development of function words on the basis of linguistic theories are very general. Maturational accounts of development (in the true sense of the word maturation) are growth theories, which predict gradual change. Parameter setting may explain and predict sudden changes, as all “switch” theories predict. Learning theories (like *Lexical Learning*) would predict a non-stage wise change.

It is assumed that since all functional categories are interrelated (i.e. they address the same modules of syntax) they are expected to emerge at the same time. I might paraphrase The Beatles’ song *Come together* here: *All together, right there*. “All” are function words and “there” is the third year of a child’s life. The development (i.e. the introduction) of function words is a process in which several function words develop in the same time span. The interrelationship between function words is supposed to be very high. This interrelationship consists of the syntactical and distributional properties. Finally, the quantitative behaviour of syntactic elements like function words is predicted as a very general one, namely that they are suddenly introduced in the language of a child. This study aims, among other goals, at filling the gap of a method that uses the data of frequently recorded children.

From this summary, four developmental hypotheses about function words are drawn. The four hypotheses are in fact specifications of the main research question in chapter 1.
1. Function words address identical syntactic slots, i.e. functional categories.
2. Therefore, function words are qualitatively highly related language variables.
3. As a result, function words are assumed to be related in quantitative shape and in timing (i.e. the timing in the developing language, not as an age related phenomenon) between the children.
4. Function words appear suddenly as the result of their closed class characteristics (they come together because they are not separate, but related words).

This study aims, among others goals, at filling the gap of conclusive empirical evidence. Suppose that function words appear suddenly in child language. What is needed to perform quantitative analyses, in order to find evidence for a sudden (i.e. catastrophic) change?

4.2 Methods of analysis: frequency analyses

Introduction

Traditionally, linguistic approaches to development emphasize syntactic acquisition. Pronouns, for example, have not been counted, but these words were subjected to structural analyses (using a small number of examples) (cf. Koster, 1993). Quantitative analyses of linguistic structures are not commonly used as a method of empirical research. However, for the analyses of data and in search of catastrophes, a quantification of data is needed. This quantification calls for a method that reliably allows for conclusions on the nature of change in development. This method (i.e. conditions) differs from traditional research, especially with respect to the density of the time series (see also Ruhland, 1996).

Conditions for frequency analyses

Frequency analyses of time series in language development research must satisfy a number of conditions. In a number of recent papers (Behrens, 1993, Wijnen, 1996, Ruhland & van Geert, 1998a), this kind of analysis has been used to study language development. Part of the research with frequency analyses is exploratory since there is no fixed idea about, for example, how to determine the density of measurement. There is a need for more specification, and it is essential to formulate a number of guidelines or conditions, based on general principles and empirical analyses. So, the question is: what is needed to perform frequency analyses in language development? The obvious answer is, of course, language development data. However, it is not as simple as that. In the literature some general principles can be found with respect to the repeated recording of
child language (I discuss longitudinal research of spontaneous language data only). Ingram (1989), for example, states that ‘the child is visited at predetermined intervals for a reasonable length of time with the purpose of collecting a representative sample.’ Three concepts are important, namely intervals, reasonable length of time, and representative (I will use the word standardized, since representative refers to a sample from a population).

The length of the interval between two recordings must be short enough to cover the developmental path (i.e. the shape of change). In many cases, an interval of two weeks has been considered to cover language development sufficiently. Some researchers employ a ‘one day sampling’ schedule (Brandenburg, 1915). Every word, every sentence, spoken by a child should be recorded. The ideal situation with respect to interval and the length of recording would be something like the Seven Eleven stores, which are open 24 hours a day, 365 days a year. One would be able to see the variance of a child during a day or any other time index. However, one can see that this is nearly a mission impossible. The amount of time spend on collecting, transcribing, and analysing would be nearly infinite. Furthermore, the question is whether day to day sampling yields more information than recording every week or every two weeks. The density of the intervals of recording depends on another factor: what language variable is one interested in? Some language characteristics appear rather slowly in the language of a child, while others come rushing in. Thus, the frequency of recording also depends on the sort of variable. With respect to syntactic variables (as in this study), two-weekly observations was my starting point in order to cover the developmental path. Follow up studies must be carried out to yield a better understanding of the recording density needed.

A second aspect of recording child language is the length of the recording session. This length of recording has usually been one hour (cf. the Childes Database for examples; see also Nelson, 1973, Wijnen, 1996). It might, however, very well be that a representative sample is obtained only after two or even three hours of recording language development (see also the study of emotion; de Weerth & van Geert, in press). The question is again: representative of what? The recordings should cover so many utterances that an increase of recording time no longer changes the (average) score of a certain variable. Thus, if the average amount of, for example, two word sentences in one hour of recording is the same as the average amount in two hours of recording, we have a representative sample using one hour of recording. Of course, taping half an hour could be sufficient as well. So, no clear-cut proposals have been made with respect to this ‘length of recording’. In this study I used one hour as a probably sensible index of syntactic development (see also Nelson, 1973, Wijnen, 1996).
Lastly, the quest for a standardized sample means that if children are to be compared with each other, the situation in which the children have been recorded must be exactly the same. The same toys, the same house and even the same mother. This is, of course, impossible. What is possible is a general setting: the mother is present, the child is playing with toys, no guided questions, and the child is left in her daily routine. In my study, this general setting is kept as much the same as possible. Every recording of a child has been made on the same moment of the day, the child is playing with toys, and the mother is present. Differences between sessions (in terms of, for instance, the amount of words spoken) are individual variation and/or error measurement.

From a practical point of view, I use an interval time of two weeks for recording longitudinal spontaneous data. In recent papers, this time series and frequency scores have been used to study the development of verbs in German and Dutch (Behrens, 1993 and Wijnen, 1995), and to study the development of function words (Ruhland & van Geert, 1998a). Observations with a two week interval of one hour recording in a constant setting are used in this study.

The three concepts, i.e. the time interval, the length of recording and a standardized setting, are important because frequency scores are a measure of the use of a variable in the language of a child. This use is the overt form of a covert syntactic rule. Frequency scores of a variable measured over time only are not a process. However, through theories like dynamic systems theory or catastrophe theory we can interpret these time series of frequency scores as the overt form of a process. Additionally, a linguistic theory is needed to explain the process in terms of relationships between sessions (the process) and between variables (structure). These qualitative analyses are used to show that frequency scores are more than just a number: the amount of, for example, articles are indicative for the amount of DP’s (Determinator phrases), and therefore, frequency scores refer to both the acquisition of grammar, and the process of acquiring that grammar.

Proportional or absolute, that’s a question

One objection to the use of frequency scores could be that frequency scores based on absolute scores do not highlight a process, but that they are a collection of random numbers (i.e. measurement errors). That is, it is argued that absolute scores reflect only partially the true nature of development, but that variance and measurement errors obscure the ‘real’ scores, and therefore these absolute scores are rather random numbers. Due to measurement errors and variance these frequency scores of absolute numbers would not be representative for the development of, for instance, language structures. Of
course, the question is if proportional numbers should be used. An example will show that this is equally problematic. Suppose that a child is not using any variable (e.g. the number of inflected verbs) until a specific age. The frequency score of that variable is 0. Then, suddenly, the absolute level of inflected verbs jumps from 1 to 20 cases (a graph of this increase would look like figure 3.3.1 in the previous chapter). Suppose furthermore that an independent variable is changing suddenly, for example, the number of words (i.e. all words spoken during a session) increases from, let us say, 10 to 1000 in the same age period. As a result, the proportional number of inflected verbs increases from 0.1 (verbs divided by words = 1/10) to 0.02 (verbs divided by words = 20/1000). Proportional and absolute numbers differ by their true nature. In the example given, there is a decrease in the proportion, but an increase in the production.

Behrens (1993) used corpora of child language to study the temporal reference in German child language (i.e. the development of verbs). One of her findings was that sentences with a verb, as a proportion of the total amount of sentences, increase quite suddenly. This is a remarkable finding for two reasons. First, not only function words (according to Brown and others) develop suddenly, but so do sentences with a verb (i.e. all sorts of verbs, finite and non-finite). Second, proportional scores do not rule out the possibility of sudden change. Wijnen (1995) showed on the basis of time series of recordings of the same children as in this study that the development of finiteness in Dutch is a gradual process. Children acquire finite verbs first slowly, then the speed of acquisition increases, and finally, the process slows down until all verbs are finite (in all cases where finiteness is obligatory). Both Behrens and Wijnen show that proportional frequency scores are optimally suited for bringing about the form of change. This form of change has not so much to do with grammar, but it concerns the mechanisms that have to be associated with the development of verbs. The most important finding, however, is that these proportional frequency scores show changes, sudden changes being one of them. Proportional scores show the importance of the dependent variable as a subset of the overall structure or system (e.g. words, sentences, or language in general). The use of proportional numbers, however, is not free from problems. The disadvantage of proportional numbers is that small absolute differences can lead to big proportional differences. To circumvent this problem, absolute numbers are used in the analyses. In chapter 5, these absolute numbers were checked for possible influences of other, independent variables.
The method of the study

Provisional conclusions

Most important criterion to use frequency scores was the need for quantitative data. These data are used for analyses on the basis of catastrophe theory and dynamic systems theory. The conditions or guidelines for frequency analyses of time series in language development must satisfy three elements:

a. intervals that cover the developmental path;
b. a reasonable length of recording time;
c. a standardized session.

Two-weekly observations of one hour in a general setting (the mother is present, the child is playing with toys, no guided questions, and the child is left in his daily routine) were used as the starting point in order to cover the developmental path. Frequency scores are a measure of the use of a variable in the language of a child, i.e. the overt form of a covert syntactic rule.

With respect to the objection of using absolute scores, I argued that absolute and proportional represent different scores. It is possible to have a decrease in the proportion of scores, but an increase in the absolute production. With proportional numbers, small absolute differences can lead to big proportional differences. To circumvent this problem, absolute numbers are used in the analyses. In chapter 5, these absolute numbers were checked for possible influences of other, independent variables.

4.3 The children, the recordings and the transcripts

Introduction

Frequency scores of function words in Dutch child language reflect the use of function words. The goal is to test with these scores Brown’s findings in Dutch. Before I can present analyses of child language I introduce both the children, the language, and the method behind the transcription.

The children

The data of the children in this study were collected in the ‘First Language Acquisition’-project. The aim of this project was to obtain a detailed description of language development. Originally, there were 7 children in the project, but one child, a girl, acquired otitis media. She was left out from the analyses, and this reflects an important
aspect of this study: only healthy children, without neurological, motor or other impairments (e.g. deafness), were included.

The period of observation captures a considerable portion of the early phase of language acquisition, starting at the ‘single word stage’ and ending at the point where the children showed an essential command of Dutch syntax. In all, this period amounts to approximately 16 to 20 months. All children were recorded in their homes. This home and normal activities situation makes it possible to obtain an optimal comparison of all children and all sessions. It is assumed that this daily routine rules out possible unnatural variation: the variation that is still in the language data is error variation. The children were engaged in their daily routine. Apart from the mothers, one other adult was present during the sessions, namely an investigator, who took part in the conversation as a normal speaker (i.e. the investigator plays with and talks to the child in the same way the mother does). The data of the children in table 4.1 have been added to the Childes Database (august 1997) as The Groningen Dutch Corpus. This corpus was collected and transcribed by Gerard Bol, Evelien Krikhaar, and Frank Wijnen (Bol, 1996, Wijnen, 1996, 1997a, 1997b).

<table>
<thead>
<tr>
<th>Name</th>
<th>Recording age (y;m.d)</th>
<th>Sex</th>
<th>No. of recordings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abel</td>
<td>1;10.30 - 2;08.13</td>
<td>Boy</td>
<td>17</td>
</tr>
<tr>
<td>Daan</td>
<td>1;08.21 - 3;03.30</td>
<td>Boy</td>
<td>34</td>
</tr>
<tr>
<td>Josse</td>
<td>2;00.07 - 2;09.16</td>
<td>Boy</td>
<td>26</td>
</tr>
<tr>
<td>Matthijs</td>
<td>2;00.24 - 3;07.02</td>
<td>Boy</td>
<td>42</td>
</tr>
<tr>
<td>Peter</td>
<td>1;05.09 - 2;08.22</td>
<td>Boy</td>
<td>27</td>
</tr>
<tr>
<td>Tomas</td>
<td>1;07.05 - 3;01.02</td>
<td>Boy</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 4.1. The children in this study.

In total there are 6 children and 172 recordings. The average of age of recording at the start is 1;9 (92 weeks, Sd = 10.8), and at the end is 3;1 (159 weeks, Sd = 14), the average number of recordings per child is 28.7 recordings (Sd = 7.74). Curiously, all children are boys. This is not a deliberate choice, but purely coincidental. Whether this is or is not problematic for the interpretation of the data is discussed in chapter 6.
The recordings and the transcripts

The frequency of the recording sessions was mostly two-weekly, except for the period that the child was sick or on holidays with his parents. This exception due to sickness and holiday immediately leads to a problem. Children do not share the same weeks of recording (see table 4.1). The first recording of the children has been on a different age. Whereas, for instance, Peter’s first recording was made around the 17th month of age, Matthijs was first recorded around his 25th month of age. The differences in the ages of the first recording were not deliberately chosen, but the result of a random selection. The only guarantee had to be that the child was still in his early stages of language development, i.e. the one word stage. The last recordings of each child also differ. Furthermore, the weeks between the recordings are, logically, not included: there are no data collected in these weeks. For example, one child is taped in week 100 and another child is taped in week 101. Therefore, it is not possible to compare children with respect to age differences and/or to average over age, which is one of the goals of this study. A solution to this problem is given in chapter 5 (using a technique called Splines).

The recordings of the children were transcribed according to CHILDES conventions (MacWhinney & Snow, 1990). The frequency of function words, length of utterance, mean length of utterance (MLU), and the number of words were calculated with CLAN software (MacWhinney, 1991). These frequency counts were absolute counts of tokens, i.e. the total of absolute numbers of a variable, as well as types, i.e. the sort variable.

4.4 Summary and conclusions of the chapter

A method that can reliably distinguish discontinuous change from random fluctuation or continuous change was presented in this chapter. This method consists of the bare necessities that are used to apply frequency analyses to language development in order to find evidence for quantitative change. Function words were introduced, and these words constitute a set of closed class words which are grammatical markers in a sentence, are syntactic in nature and do not refer to definite entities in reality.

There are three hypotheses with respect to the syntax of language development. The lexical thematic hypothesis states that all relationships between words and phrases are non-syntactical at early acquisition stages, the reduced competence hypothesis leaves a few blanks in the initial syntactic knowledge of a child, and the full competence hypothesis states that children have full knowledge of grammar structures with birth. The reduced competence hypothesis is adopted in this study.
Linguistic theories reason about the development of functional categories. If in the initial phase of combinatorial speech, grammars lack functional categories, they develop through maturation. An alternative hypothesis is that all functional categories and the associated grammatical modules are available from the start, but that a certain amount of input information is needed for them to become operative (lexical learning, learning by generalization). Parameter setting assumes that all linguistic knowledge is present from the beginning (a continuity approach to language development), but that it takes time to switch all linguistic buttons to their correct state. All principles may be available, and all of the necessary triggers are accessible, but that particular parameters cannot be set until certain other parameters have been set first.

Predictions of the quantitative development of function words on the basis of linguistic theories are very general. The same predictions as in chapter 2 come back again: learning theories (like Lexical Learning) would predict a gradual non-stagewise change. Change can impossibly be discontinuous. Parameter setting may explain and predict sudden changes, as all “switch” theories predict. Maturational accounts of development (in the true sense of the word maturation) are growth theories, which predict gradual change.

General observations of the development of function words can be found in the work of Roger Brown. Brown and coworkers showed that function words develop rapidly. For this reason (the sudden introduction), two stages can been distinguished: telegraphic speech, i.e. sentences have limited length, no function words, and normal, i.e. no violation of the grammar of a language, word order, and a differentiation stage.

It is assumed that all functional categories are interrelated, because they address the same syntactic slots. This interrelationship leads to the expectation that they emerge at the same time. That is, the development (i.e. the introduction) of function words is a process in which several function words develop at the same moment, and the quantitative behaviour of function words is predicted as a sudden introduction in the language of a child, possibly referring to a psychological discontinuity.

This study aims at a detailed analysis of function words. The ideal method using frequency analyses could be called ‘The 7-11 shops in America’ method. These shops are open all day, all year. With respect to development, this implies that every word on every day of every child would be recorded and analysed during a human’s life. The 7-11 method is far too labourious. With respect to syntax, a two-weekly interval should suffice in order to cover the developmental path. The length of the recording session should cover so many utterances that an increase of recording time would not change the (average) score of a certain variable any more. In this study one hour was used. A standardized sample means that if children are to be compared with each other, the
situation in which the children have been recorded must be the same. Frequency scores are a measure of the *use* of a variable in the language of a child. These scores are indicative for functional phrases, and therefore, frequency scores refer to the acquisition of grammar, they are needed for the detection of catastrophe flags.

The subjects of study are six healthy Dutch boys with no apparent language or developmental problems. The recordings started at the ‘single word stage’ and ended at the point where the children showed an essential command of Dutch syntax. This period lasted roughly 16 to 20 months. All children were recorded in their homes, while the children and their mothers were engaged in their usual activities and routines. Each session lasted for approximately one hour. The frequency of sampling should be sufficient to capture the relevant fluctuations in the growth process. The data were gathered at intervals of roughly two weeks. The recordings of the children were transcribed according to CHILDES conventions (MacWhinney & Snow, 1990). Frequency counts (e.g. function words, the (mean) length of utterance, and the length of words) were performed with CLAN software (MacWhinney, 1991).

Function words are linked with important syntactic features, and they are assumed to develop rapidly. The question to be answered is:

Under the assumption that, according to the literature, function words are introduced very rapidly (at least) and that there are two stages (a telegraphic stage and a differentiation stage), the question is if there is any evidence of a catastrophic change (as defined by the flags) in the development of function words in the six children between 1;6 and 3;0 years of age, measured on the basis of frequency analyses in a longitudinal design using two weekly observations.

In Chapter 5, I present the analyses of function words. Both continuous and discontinuous models are tested against the data.