Going the distance
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Chapter 2

2

Everything must go: language development

And if you need an explanation, Everything must go

Everything must go by The Manic Street Preachers from the CD Everything must go

2.0 Introduction

The study of language development\(^1\) has created a massive body of literature, most of which is strongly influenced by linguistic theories. The words language and development, however, have several interpretations, that come with a discussion on origin and novelty in development. In the nature-nurture debate, which is dedicated to the origin of behaviour, the question is: is the behaviour of humans determined by nature or by nurture? The extreme positions are that human behaviour is either the result of genes or neurons (i.e. nothing is added from the outside and man is an output device), or the sole product of nurture (i.e. humans are nothing more than input machines). The question thus is how new behaviour can arise. This question has its roots in biology, especially in developmental biology. If all humans are but one cell at the start of conception, how do we become differentiated and how do we end up being a human with many cells, functions and all kinds of behaviour? In short, the question is whether or not humans are confined to a predetermined path of development.

Another debate, i.e. the debate on discontinuity and continuity, deals with the question whether development proceeds little by little in an Aristotelian, continuous way, without any structural reorganisations or qualitative changes, or whether development is not continuous. This issue is related to change and it is also the central theme of this thesis. In the first section of this chapter, literature is reviewed with respect to development and (dis)continuity.

The second part of this chapter (section 2.2) is dedicated to language. The study of language and its structure received a push forward in a new direction in the second half of this century. Theories on the structure (i.e. syntax) of language and of language

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\(^1\) The term language development is used for the discussion on language (structures) in general. The more specific term grammatical development is used for the development of sentence structures.
development are reviewed, with special attention to transitional phenomena that are predicted by these theories.

Section 2.3 contains a summary of the chapter. It states the core problems of the study discontinuous behaviour, and a first conceptualisation of the central research questions of this study.

2.1 Discontinuity in development

Introduction

The debate on the origin of development has been called the debate on nativism (from the Latin *natal*, meaning inborn) and empirism (from the Latin (for Greek) *en* (in) *peirao* (try)), and it constitutes an important part of developmental research. Apart from origin issues, the issue of novelty in behaviour (e.g. language) is theoretically very important. It addresses the question: where does (new) behaviour come from? Origin and novelty will be discussed shortly and they introduce the main subsection on discontinuity.

Development is not an unambiguous concept: there are several meanings (or definitions) of development. Development means growth, and growth is defined as an increase in size or value. This means that something has been present all the time, nothing new is added. Development also means evolution, which derives from the Latin *evolve* meaning to unfold or to open out. Stage of advancement is listed as a definition of development, advancement being derived from the word advance, which means (among others) to rise or to move forward. If change (e.g. to increase, to open out, to move forward) is the core aspect of development, the next step is to determine the treatment of change (development) in theories on development.

Theories on development

“The primary goal of a developmental analysis is the study of change, not statis.” Riegel (1975)

Riegel’s statement on the meaning of the concept of development is by no means an incorrect view, it is, however, inspired by just one of the many meanings of development. The important issue is that all meanings of development assume change. Change is regarded as the main characteristic of development.

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2 The dictionary used here was the Concise Oxford Dictionary.
The dictionary descriptions, like other levels of analyses of development and its meaning (cf. van Geert, 1986b, 1986c), do not tell us much about the process, which development is after all. According to Hoppe-Graf (1989, 2), there is not even consensus on definitions of development. Despite this perhaps awkward situation, a number of developmental theories have been put forward, and they all have to account for change in behaviour, change just meaning “going from nothing to something” (e.g. from being a baby without a language or grammar to an adult with full communicative capacities and linguistic competence). These theories also have to account for the development of a subclass of behaviour, namely language.

Theories on development can be divided into two general types. First, non-stage theories are theories that predict gradual or linear change. Skinner’s theory, for example, is a learning theory, and most learning theories by definition predict gradual or linear, or continuous change (Wanner & Gleitman, 1982). Unless the environment changes suddenly, there is a chance of sudden change in development. Take, for example, the big prehistoric dinosaurs. They became extinct when the earth was struck by a meteor and the conditions on earth were no longer viable. Second, stage theories predict sudden changes in development (e.g. Piaget’s equilibrium model). They incorporate by definition qualitative reorganisation, which is also known as discontinuity. The discussion on the exact meaning or definition of (dis)continuity, captured in a large body of research, is used for the reinterpretation of the research question. It is not my intention to force all developmental theories in this stage vs. non-stage dichotomy, but it is a useful way of categorising theories within the context of this thesis. It also helps to limit the range of explanations of the form and the mechanisms of change. Why and how does a child go from “nothing” (i.e. the newborn state) to “everything” (i.e. the adult state)? And if there are stages, why are they ordered the way they are? The answers to the questions will show us the paths of development, and they are the main subject of this book.

The origin of behaviour: innate or not?

Since general developmental theories are not theories about language development, one of the main objections against them is that they leave aside the fact, for example, that all languages have a structure (usually referred to as the grammar of a language), and that languages share common features (e.g. most languages use verbs to denote actions). This emergence of structures (e.g. a grammar) in language is not explained by these theories. Furthermore, most theories on psychological development assume that learning is a very

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3 See, for example, Mussen (1983) or Miller (1993) for an overview of developmental theories.
important aspect of language development. However, this learning cannot explain how children acquire the application of rules and exceptions of, for example, the use of determiners (e.g. articles) or prepositions, the mistakes a child makes, and the deduction of rules in language development.

The origin of behaviour, i.e. the important question of how any behaviour can arise, and the structure of change is determined by the starting values of the brain. These starting values have two ‘extreme’ options. Humans are completely “empty-headed” at birth, which has been called a *tabula rasa*, or everything is available to a child at birth. The second option means that humans are born with full capacities to acquire any behaviour, including language. This so-called *innateness* could explain the speed of development. If it is assumed that all language faculties are innate, then language possibly develops much faster since the ability of using language does not need time to mature (see below for maturational accounts of language development). Plato was probably one of the first to notice that the origin of thought (including language) either needs a blueprint, or is completely caused by imitation. In *Meno*, he tries to prove that man cannot be without inborn capacities. Knowledge and behaviour are too complex and too broad to be learned in a lifetime. In the same way that Plato argued, modern *nativist* theories assume a blueprint that governs development. Chomsky wondered how humans come to rich and specific knowledge, or to intricate systems of belief and understanding, when the available evidence is so poor (although it is questioned whether the evidence is indeed so meagre; cf. Bowerman (1983) for a discussion on negative evidence, i.e. the fact that children have little evidence of incorrect, ungrammatical sentences). If all behaviour is determined by birth, change depends on the blueprint (e.g. everything develops at once on an underlying level, although factors like memory might hamper the immediate execution of the blueprint).

The specific innateness approach to (language) development called *modularity* is best known from the work of Fodor (1983). The modularity discussion has been one of the inspiring discussions on how humans acquire a language. Proponent of modularity believe in independent autonomous subsystems in psychological processes. These subsystems called modules explain the process of acquisition. According to Fodor (1983) a modular theory consists of input systems and of central systems. Input systems are autonomous from birth. There is some criticism (cf. Karmiloff-Smith, 1992) against such an approach. It holds that development is a process that goes beyond modularity. It is assumed that this process is not strongly restricted by clearly defined modules, since this would imply the absence of a creative process, which (language) development seems to be, according to developmental facts (see for an overview O’Grady, 1997). Neither
strong nor weak modularity is favoured because it is unlikely to be correct: it lacks a developmental component (Karmiloff-Smith, 1992).

In this study modules are used in a linguistic way. Such modules (e.g. syntax) help understand and limit the number of possible structures that exist in a language (see also section 2.2). Furthermore, it is highly unlikely that there are no interactions between modules from birth on. This has been shown by, for example, Donahue (1986) who found phonological constraints on the development of utterances. Nevertheless, it is useful to assume modularity on a descriptive level. That is, the assumption of modules like syntax and phonology help understand the relatively independent acquisition of, for instance, phonological features or syntactic rules. On a developmental (process) level, the interaction between several modules is probably the essential motor of creative use of language. Therefore, I assume that development is modular, but that there is a strong interaction between subsystems. In development, these subsystems can be separated to study one aspect, but there is a strong interaction between the modules (see also chapter 6 for an interpretation of the results). Atkinson (1986) summarizes the modularity and innateness discussion, and he argues that this discussion has two possible outcomes. Language acquisition is either a matter of learning, in which case there is hypothesis formulating and testing, or it is a matter of language structures being triggered by the environment. If it is assumed that there are modules (highly organised, fairly independent subsystems), like the syntax or semantics of a language, it is conceivable that these modules rest on innate structures that may be highly specialised in terms of a blueprint, and that are triggered by the environment. It is even plausible that the language system itself, in conjunction with the input from the environment, triggers new modules in development. In chapter 6, I argue for a ‘triggering’ approach to language development.

In learning theories it is proposed that every kind of behaviour is caused by learning processes. In adapting to the environment, a child copies or imitates behaviour and internalizes it. In Skinner’s behaviourist theory, for instance, new behaviour is added to the existing set of behaviour by of stimulus-response chains. Criticism by Chomsky and others holds that certain regularities in mistakes in behaviour cannot be learned, since these are not present in the environment. Furthermore, the “poverty of the stimulus”-argument holds that a child receives little information about ill-formed sentences. The child does not know a priori which strings are correct in a language. Since parents make false starts, or even ungrammatical sentences, children should make the same mistakes in their language (which they do not make). Another weak point is that although no innate principles are assumed in learning theories, a child must have a capacity to learn, and since these learning principles are not explicitly taught, they must be innate. So, instead
of going around the problem of innateness, the innateness assumption also plays an important part in learning theories.

*Maturational* theories assume that behaviour unwraps. There is a blueprint at birth, in which physical as well as psychological development is embedded. The child’s abilities are subject to the laws of slow and gradual growth. The direction of development is controlled by an intrinsic mechanism. Changes in an organism or system depend on the blueprint, and new behaviour is bootstrapped by the preceding behaviour. An important concept is the critical period: biological structures determine ontogenetically developing cognitive structures. This critical period also holds that there is a limit on the age that certain types of knowledge, e.g. language, are learnable. However, maturation and critical periods cannot explain the universals that exist in the ontogenetic development of language (De Graaf & Breeuwsma, 1996). Furthermore, the ‘function follows structure’-argument of maturational theories does not hold. Thelen and Ulrich (1991), for example, have shown that walking patterns are present from birth, but due to physiological constraints (e.g. muscle strength and fat proportions) these patterns remain unused until the first birthday. The ‘maturational’ predictions of change are that there is slow and gradual growth, since this is the sort of change we might aspect according to maturational theories (see Gibson & Petersen, 1991 for an overview of maturation and cognition).

In sum, the theories above support either inborn capacities (i.e. innateness), or capacities, learned from environment. This dichotomy is called the nativism-empirism debate, that in its pure form no longer exists in the literature on development. Usually, the best bits of both worlds are chosen to explain the nature of development. These interactionist theories of development are a combination of considerations of both nature and nurture, of both inborn capacities and environmental input. It is assumed that development is the result of inherent elements of a (developing) system.

**Discontinuity and continuity in development**

*Introduction*

It is often questioned whether or not development, more specifically cognitive development, is a continuous process, or that discontinuity is its central characteristic. Closely related to (dis)continuity are predictions about the form of changes over time. The form of change can be specified by the scores of a variable on, for instance, a test,

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4 A study of novelty can be found in De Graaf (1997).
repeated over time. In many traditional statistical tests (e.g. linear regression) it is assumed that this change is linear over time. Another assumption is that changes are unimodally distributed over groups. The assumption is that there is one mean, and all scores are distributed around this mean. Directly related to discontinuity are also all sorts of stage-concepts. Stage-wise development (e.g. in Piagetian theory) is in fact another conceptualization of discontinuous development.

**Discontinuous change: definitions**

The meanings of (dis)continuity differ across the disciplines that are relevant to this thesis (i.e. they are different in psychology, linguistics, and mathematics). Furthermore, (dis)continuity has several meanings within the field of psychology. According to Ford and Lerner (1992, 19), discontinuity refers to different ways and causes of development. Sternberg and Okagaki (1989) give two definitions of (dis)continuity. First, discontinuity is the lack of smoothness in growth curves. Second, discontinuity is the lack of constancy of the rank orders of individual differences across ages. According to Ende and Harmon (1984b), continuities refer to connectedness in development, to a linkage of early behaviour to later behaviour. Discontinuous changes are what Connell and Furman (1984) call structural or qualitative changes. In sum, there is a wide range of meanings of discontinuities. These meanings are listed below, and they summarize other meanings:

1. A phenomenon has different causes;
2. A lack of smoothness in growth curves;
3. A lack of constancy in rank orders of individual differences across ages;
4. No linkage of early behaviour with later behaviour;
5. Qualitative or structural changes.

These meanings of discontinuity lack a clear and functional application to development. For example, what does lack of smoothness mean? Or how is the absence of linkage with earlier behaviour measured? I postpone this problem for the moment, and return to the matter at the end of this section.

The second issue to be discussed is the relationship between learning theories and stage theories on the one hand and (dis)continuity on the other hand. If development is based on learning, then this process is at bottom continuous (Gleitman & Wanner, 1988). However, the opposite does not necessary hold since the outcome of an innate assumption interacts with (output) constraints. That is, if development is not learning, then it does not need to be discontinuous. If a child acquires a rule of some cognitive
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structure, then the execution of the rule could be hampered or limited by, for instance, memory constraints, or by other cognitive domains (e.g. learning to read the time depends on knowledge of numbers). These constraints slow down the execution of a rule. The crucial point here is that a theory that is adopted to explain a phenomenon has serious implications for the prediction of the change (of that phenomenon).

The third question is whether development is an either-or situation, or an and-and situation. Sternberg and Okagaki (1989), for example, argue that development is a process of both continuity and discontinuity. In most developmental theories it is assumed that development is either continuous or discontinuous. This is not likely to be so since development has its discontinuous processes (e.g. conservation; Van der Maas, 1993) and continuous processes that are an addition of (combining types of) knowledge (e.g. the knowledge to count). The only way to make plausible that development is both discontinuous and continuous is the proof of empirical data. Thatcher (1991) holds that it is an unresolved issue whether human cognitive development occurs as a continuous or a discontinuous function of age. Both processes coexist and operate throughout the life-span and those processes are a common feature of postnatal human cerebral development.

However, the discussion has not been settled yet. Discontinuity refers to qualitative change, but, as Fischer pointed out, this is not sufficient (Fischer, 1983a). One of the problems is the determination of discontinuities. Fischer, Pipp and Bullock (1984) developed two tools (the scalogram and the method of multiple tasks) for measuring discontinuities in cognitive development. According to Fischer et al. (1984) the (non-)existence of discontinuities and transitions depend on scale and method of measurement. The dependence on scale is expressed in a scalogram analysis. This analysis provides the scale that is required to find developmental spurts (i.e. a feature of discontinuities). With respect to the method, they put forward that “all that is required to test discontinuity is that the distance between steps not to be confounded with the points of discontinuity” (p. 102/103). This method produces evidence for a discontinuity in terms of going from zero performance to full or nearly performance. In addition to the method of measurement of Fischer et al., Bower (1983) supposes that discontinuity can be demonstrated if there is a gap between test scores. In sum, the measurement of discontinuity in development is strongly based on the speed and the distance between changes in growth curves. This, however, is not enough to prove discontinuities.
Discontinuous change: growth curves

The discussion of (dis)continuity can be related to the first definition of Sternberg and Okagaki (1989) using growth curves. Growth curves are scores of a variable (e.g. a score on a test or the frequency of a variable in a natural situation), measured over time. The sort of change in such growth curves is either continuous or discontinuous, or asymptotic or exponential. The examples in Figure 2.1 are continuous asymptotic or continuous exponential, the examples in Figure 2.2 are discontinuous (see chapter 3 for more details on the cusp).

![Figure 2.1. From left to right: linear, exponential, asymptotic and s-shaped growth.](image)

In psychological research a linear increase over time is more often than not the underlying continuous model of development, but there are other elementary types of change over time. Exponential change is characterised by a slow start and a gradual infinite increase. Logistic (also called gradual or s-shaped) change consists of a slow start, after which the graph shows an increasing steepness (the tangent increases in value), after which the growth levels off to a horizontal line. Asymptotic change is when change starts of very rapidly, but decreases when it reaches a maximum (a ceiling effect).

The two graphs in figure 2.2 depict sudden change. This change starts off like gradual change (zero score, thus a horizontal line), but instead of a smooth increase the graph
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shows a sudden change. This lack of smoothness of the curve relates to the Sternberg and Ogasaki definition of discontinuous change.

A gradual change may look like a sudden change. That is, when the steepness of the s-shaped graph (between the horizontal start and end) increases, figure 2.1 starts to look like the discrete step in figure 2.2. It is difficult, if possible at all, to decide where the border between both sorts of change is (i.e. in a data-driven approach).

In sum, I distinguished six forms of change in time series. There is change which has no end point, i.e. linear and exponential change, and there is change with an end point, i.e. logistic, asymptotic, discrete and cusp (See chapter 3 for an extensive discussion on change in the form of a cusp). This end point is constant with respect to the score on the y-axis. The difference between logistic/asymptotic and discrete/cusp (all four have an end state) is the suddenness of change. The difference between logistic and asymptotic growth is the starting point. The difference between the discrete step and the cusp is that the cusp has an overlap of states and more than one possible jump from one state to the other. Despite the intuitively appealing descriptions, all forms of growth lack a formal criterion (e.g. how can one distinguish between a rapid gradual change and a discrete step?). Apart from a conclusive definition, the descriptions are also problematic in the sense of testing. Therefore, I present a mathematical approach to quantitative development. Non-linear models and theories are introduced in the next chapter. These models and theories allow for an estimation of parameters and state the relationship between x (a time index) and y (the variable) values in terms of a growth indication (e.g. in terms of continuity and discontinuity).

Preliminary conclusions on the concept of discontinuity

Three elements have been discussed with respect to the subject of discontinuity. First, there are many definitions of (dis)continuity. Of these definitions, I derive the following definition:

There is a qualitative (structural) change in development in such a manner that there is no structural linkage (i.e. after the change there is a structure that was not there before) with earlier behaviour, and this change is reflected by the lack of smoothness of a growth curve.

This definition is not very distinguishing and precise. This is exactly the problem of the definitions of discontinuity that have been proposed (the problem is discussed in more detail in chapter 3). Change can come in several shapes, namely linear and non-linear. Linear change is continuous. Non-linear change may be gradual or sudden change. Non-linear continuous change (gradual) may come as exponential or s-shaped growth.
Exponential, gradual change has no end state. S-shaped growth means that there is an end state. Discontinuous change is either a discrete step or a cusp. A discrete step is an instant change from one equilibrium (horizontal line) to the next. The cusp equals the discrete step, but it has two extras. The equilibria (i.e. temporarily stable periods) overlap, and there is not one, but a collection of possible instant changes from one equilibrium to the next. Sudden change (which is quite often associated with discontinuity) is not a satisfactory aspect of discontinuity.

Stages and sequences: definitions

Instead of stage, words like period, phase, level, point in time, interval and stretch denote a duration of time. These words slightly differ in meaning, but the importance of the concept stage in developmental psychology is enormous. Over time, the ages of man have been a popular concept: man follows a path with or without stages, for instance, from birth to death trough puberty and adolescence. Cicero put it like this: Cursus est certus aetatis et una via naturae eaque simplex, suaque cuique partis aetatis temestivitas est data (Life’s racecourse is fixed and nature has only a single path and that path is run but once, and to each stage of existence has been allotted its own appropriate quality) (cited in Boom, 1993). In this section, the concept stage is discussed twice: once with regard to the use and meaning of the word in developmental psychology, and then with regard to its theoretical considerations.

The term stage is used (Brainerd, 1978) as:

a. a metaphor
b. a description (i.e. behaviours that undergo age change)
c. an explanation of age-related changes in behaviour.

Brainerd disputes that Piaget’s criteria of a stage are adequate, and although Fischer (1983b) and Fischer and Silvern (1985) mentioned other criteria (synchronicity (i.e. the timing of structure in development), qualitative change, discontinuous change and the presence of limits), there is additional criticism by Glaserfield and Kelly (1982). They hold that period, phase, stage and level have been used to name a stretch of time in which, apparently, there are no structural changes. Glaserfield and Kelly (1982) use an orthogonal framework where the x-axis represents a temporal dimension, and the y-axis a quantitative dimension. Period is any segment between two values of x. It has a time length, there is a starting and/or end point, and there is an event (state, process) that is characteristic for that period. Phase designates a stretch of time, the content of which is in some way related to the content of one or more contiguous segments along the time
(x-)axis. Thus, a phase exists when there is more than one stretch of time (as in stage), and some predictable change occurs. Stage implies a progression to an end state. Stages are a sequence of segments along the temporal axis, each one of which can be individually characterized by a change relative to the adjacent ones. In this stretch of time something (on the y-axis) is constant, and earlier stages differ from the present one in a dimension other than time. The final concept is level which is not a stretch of time, but a specific degree or height of some measurable feature or performance (i.e. measured on the y-axis). In contrast with stage, a level has no time index, only a score (i.e. level is a stage without a time index).

In the theoretical stage debate, Boom (1993) offers a systematic reconstruction of the concept developmental stage. This includes a historical review of the concept. Boom comes up with a characterisation that in a stage both unity and diversity, and stability play a role, and that a stage cannot be a single occurrence. There is a sequence of stages, i.e. there is not one, but there are several stages. Boom relates stages to the learning paradox (i.e. the Meno-paradox by Plato), and he advocates a close relationship between novelty in development, stages and transitions.

Although the large body of literature and theories on the concept stage has been discussed, the empirical application of these ideas across several developmental disciplines (including language development) remains problematic. Especially stage transition need more attention. In the debate on stages, Boom (1993) has displayed a philosophical exercise to unravel the problematic concept ‘developmental stage.’ His thesis on the concept developmental stage summarizes the extensive discussion on stage and related topics. However, Boom cannot offer working definitions or even an empirical and mathematical model to describe and explain stages, and the transitions between stages. Furthermore, the concept stage lacks a formal model (e.g. a linguistic model), which leads to the risk of a circular reasoning (e.g. using age related criteria to find stage related criteria).

Preliminary conclusions on the concept of stage

I have adopted the nomenclature by Glaserfield and Kelly (1982). Stages, in the meaning of both an end state as well as an intermediary state, is defined as a sequence of segments along the temporal axis, each one of which can be individually characterized by a change relative to the adjacent stages. In this stretch of time something is constant, and earlier stages are different to the present one in a dimension other than time. Furthermore, stages are not age or time related, but they are related to some feature on the y-axis. A philosophical discussion (e.g. Boom, 1993) does not help us out of the muddy pool of
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the exact theoretical meaning and of the empirical application of the stage concept, it does, however, offer a historical outline to the problem of the concept, that shows the complex matter of the concept over time, and therefore a solution is not easy to give.

2.2 Language: structure and development

Introduction

Theories on general development lack a thorough discussion of the acquisition of language structures (i.e. the acquisition of a grammar). For example, learning theories cannot explain why a child is capable of producing sentences in creative way (i.e. producing sentences he has never heard before). Therefore, we need a model of language to describe and analyse the nature of language structures itself. Linguistic theories offer such a description and analysis. These theories offer a structural analysis, which describes and explains how languages are ordered (on a sentential level), how language are related to each other (i.e. all languages share the same properties at some levels) and why language acquisition is possible at all. Especially generative grammars brought insight into the problems of language development. Grammar descriptions, linguistic theories with respect to surface and underlying structures, and theories on the acquisition of a grammar provide an answer to the question’s of why and how language development proceeds in the first three years of life.

The focus in this study is on a subset of development, namely grammatical development. Therefore, findings from linguistic research are emphasised with respect to the structure of language. All speakers of a language have an understanding of ill-formed or ungrammatical sentences and words. Since not all combinations of words (i.e. the order of words in sentences) are possible, it needs to be explained why some combinations are not possible whilst others are.

Since children make sentences they have never heard before, a theory has been proposed that is now known as generative grammar. This theory is discussed with an emphasis on the structural elements. I surely do not want to go into the details of linguistic theories, since these detailed analyses would lead us away from the main subject (i.e. change).
In the next section, I will summarize findings of linguistic theories. These findings of linguistic (here: generative) theories offer an explanation for the order in language development, i.e. a reason why children do not immediately utter adult-like sentences, but go through a series of stages or states. This series of states are highly ordered, but children do not acquire a language by first learning all the words that start with an ‘a’, and then work their way through all other words (from ‘b’ to ‘z’). Additionally, linguistic theories in general and generative theories in particular may explain and/or predict possible shapes of development (in terms of quantitative behaviour). Furthermore, generative grammar is probably the best worked out theory of language, and it relates several languages with each other, by indicating that the structures of various languages are not a random range of structures, but that they are various instantiations of one general underlying level.

**Structure in language**

Grammars are not new to the 20th century. The Greeks, for example, were fully aware of the fact that language has a structure, which is usually called grammar (from the Greek, *grammatike >* *gramma* for alphabet or letter). A grammar prescribes language specific rules for a language, that is, it specifies the fixed relations between words within a sentence. For example, the acting person is the subject of a sentence, and the subject agrees in number and person with a verb (in Germanic languages). The grammar of a language can, so to speak, do without any semantic analyses.

Linguistic theories have been inspired by the notion that language is highly organised. Language has a *structure* that has two connotations in linguistics. First, there is the surface structure of a spoken or written language which is the structure given in the language that we hear or read. It is the canonical form of a sentence. This surface structure is ordered according to the rules of a grammar of a specific language. Second, there is a deep structure (i.e. in GB and related theories) which is considered to be the underlying structure. One of the advantages of assuming this deep structure is that ambiguous sentences that have one and the same string (hence, the ambiguity), have an underlying structure that is completely different. A frequently used example might help here.

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5 Generative theories are not the only theories on the structure of language. Levelt (1989) built a model of language processing (not language development), in which he explains how sentences are processed from the initial concept till articulation. Wijnen (1990) showed that errors in language production of children are highly systematic, and they can be explained from other models than generative ones.
Take a look at example 2.1.

2.1. Time flies like an arrow.

```
CP
  SpecCP
    Time
  IP
    I
    VP
      V
      AP
        A
        NP
          An arrow

Figure 2.3. Syntactic tree with *flies* as a verb.
```

**Box 2.1 List of the abbreviations in the trees**

- **CP** = Complementizer phrase. CP refers to the complete sentence structure, as a complement of the verb and the objects. SpecCP is the head of a sentence.

- **IP** = Inflectional Phrase. I contains all the features of the verb (like agreement with the subject, both in number and in person).

- **VP** = Verb Phrase. VP is the part of the sentence that contains the objects and the infinite (not inflected) verb. V contains the uninflected verb (e.g. in English, the verb ‘be’ is infinite in ‘to be’).

- **AP** = Adverbial Phrase. AP is the phrase that contains adverbs.

- **NP** = Noun Phrase, i.e. a noun and its satellites (e.g. determiners and adjectives).

In recent papers, new phrases like DP (Determiner Phrase) have been proposed, but in the context of this study on change these new phrases would lead us off the track. Therefore, these new phrases are not discussed.

This sentence can be interpreted in more than one way. *Time* can either be a verb, a noun, or an adjective (to *flies*), and *flies* can either be a verb, or a noun. So, although the surface structure is the same, depending on the grammatical interpretation of the words, the sentence has different semantic interpretations (although some meanings are arguably bad: how, for instance, do you ‘like’ an arrow; poetry often uses this meaning of a
sentence). With the help of so called syntax trees, it can be understood how the structure of a sentence is organised. In Figure 2.3, the interpretation of the sentence leads to a tree, in which flies is the verb. However, in figure 2.4, the verb is like. Using the same basic underlying structure (i.e. the tree), we can explain the two or more different interpretations of a sentence. Note that the syntactic trees are used to elicit these different interpretations. The trees are not explicit and correct with respect to every detail of the syntax of a language, and the present state of theories on syntax.

One of the assumptions of the trees is that the underlying structures in language consists basically of a combination of a Subject, a Verb and one or more Objects. Typologically, languages are defined by their canonical word order (e.g. SVO, VSO, etc.). English, for example, is an SVO language. The underlying structure is a basic order of a subject, a verb, and one or more objects. This is reflected in English sentences, both in main clauses and subordinate clauses. However, in Dutch the underlying structure is SOV, which is reflected in subordinate clauses. Main clauses apparently have an SVO, but this order is derived from an SOV order (Koster, 1976).

Let me start with ordering the sentence in example 2.2.

2.2.a The woman saw the man with the binoculars.

There are two underlying structures. A reordering of this sentence with the SVO-idea (the assumed basic order in the English language) reveals that the subject is The woman and the verb is saw. So S and V are now known. But what is the object? In one case, the man has a binocular (2.2.b), but in the other the woman is seeing the man through a binocular, and we get example (2.2.c):

2.2.b The woman / see (+ past) / the man with the binoculars.
2.2.c The woman / see (+ past) with the binoculars / the man.
The idea of an underlying structure is a crucial element of generative grammars. This idea makes it plausible that language is more than just a string of sounds and sentences. Furthermore, complementary evidence for underlying structures can be found in a discussion on competence and performance. When adults are asked to, they can perfectly well say which utterances are and which utterances are not grammatical. Apparently, we humans have inbuilt knowledge of language, usually referred to as competence. Even children (at the age of 4) seem to have a knowledge of language when they are offered incorrect sentences that they have to repeat (Ruhland, 1991). In daily life, we do not use all language knowledge we can, for practical reasons. Performance is what we use every day in communication: it is our competence hampered by factors like memory and abilities of the hearer or the reader to understand language.

One of the essential assumptions of linguistic analyses within the generative framework is that apart from words (lexical items) there are functional categories, a special feature of Dutch (and many, but not all, other languages). In a later stage of this study, the relationship between the variables (function words) and the development of syntax is discussed with respect to quantitative changes. Since these functional categories are both important in the structure of a language and in this study, I discuss these categories in the next subsection.

**Functional categories**

The term “functional projections” is the counterpart of the term “lexical categories” (i.e. Nouns, Verbs, Adjectives and Prepositions). Lexical means that they are a part of our (mental) lexicon. Functional categories are projections of these lexical categories. These ‘projections’ are theoretical assumptions of non-concrete linguistic properties (i.e. entities not referring to reality) to explain verb inflections, diminutive and plural forms of nouns and other structural elements of the grammar or syntax of a language. Both categories are phrases in a syntactical tree. For example, it is assumed that the functional category associated with the verb is responsible for a number of features of the Dutch syntax (i.e. Inflectional Phrase). Important is that if functional categories are acquired by a child he has mastered an important step of his language, and his communicative ability will increase subsequently.

Functional categories are associated with syntactic features such as tense, agreement and case. These categories form a ‘shell’ over the lexical categories, which is an interface between the representation that specifies the thematic relations between the verb and its argument noun phrases on the one side, and phonological form on the other. This means that syntactic trees are assumed to invoke functional categories, that most of these
categories are invisible, and that they are abstract entities. It means that if these abstract categories are used, expressing thoughts with references to non-concrete entities proves a high command of syntactic relationships. The command (e.g. possible movements of words within a sentence), over these categories is shown in the syntactic trees by, for example, traces (see, for example, V₁ in figure 2.4.).

Functional categories are related with function words, and they are discussed in chapter 4. Most important aspect is their syntactic property in a sentence. There are a couple of functional categories (e.g. DP (Determiner) and AuxP (Auxiliary) which are important in this study). The main objective here is to elucidate that these projections are different from lexical projections by their abstract position they hold in a sentence, and their distributional quality in a language.

**Provisional conclusions**

The previous (sub)sections have been limited to a workable size by first defining the key words of a developmental study. Development, for example, has been defined as a change over time. Very useful to the concept of the stage is the nomenclature of Glaserfield and Kelly (1982), which is adopted in this study. Stages form a sequence of segments along the temporal axis, each one of which can be individually characterized by a change relative to the adjacent ones. Within this stretch of time the quantity of something measured (e.g. a variable) is constant, and earlier stages are different to the present one in a dimension other than time.

Discontinuity refers to a lack of smoothness in growth curves and of a linkage with earlier behaviour. Although some psychological theories on development assume discontinuity, like for example Piaget’s equilibrium model, there are no formal theories or models that are able to demonstrate discontinuity on an empirical level.

Languages have a structure which is commonly referred to as grammar. This implies that language is a rule governed system. It also means that words in sentences have a relationship. Furthermore, in most languages words have a fixed order in a sentence. The assumption of an underlying structure makes it plausible that all natural languages share common features. The surface structure of languages is derived from the underlying basic order through movement procedures. The lexical categories (i.e. words) in a sentence undergo changes (e.g. verbs are inflected). The changes that form to say a shell around the lexical entities are called functional categories. Functional categories are syntactic operations, that do not refer to entities in the real world. It is assumed that these categories are more difficult to acquire.
The importance of the concept of a language structure is that in any language, but also during development this structure follows rules. In other words, language and language development is not without a goal. There is an end state in development, which is described and explained with the aid of linguistic theory. Language development, i.e. the change from no language to that end state, is not a proliferation of change that is adrift, but a series of learning events in time that is rule guided, although these rules do not need to be innate or explicitly learned.

**Child language: theories, models and data**

Thumbing through the CHILDES/BIB (Higginson & MacWhinney, 1991; supplement 1994), an annotated bibliography of child language (and language disorders), one thing that stands out is the size of the book. It records over 13000 references to research on language development and disorders. Most references show that child language is frequently studied from either a linguistic or a psychological theory. This ‘either-or’ situation is undesirable, because it makes it more difficult to answer the four core questions of language development research (Weissenborn, Goodluck & Roeper, 1992). These four questions are:

1. What is the adult grammar (i.e. the end state of development)?
2. What does the child bring to the task of language acquisition?
3. What developmental stages are exhibited?
4. What are the conditions for successful learning?

Question 1 relates to linguistic theories (see the **Structure in language** section). Question 2 relates to the problem of innateness (and the learnability problem), question 3 has to do with the developmental problem, and question 4 relates to the continuity and discontinuity discussion. If these four questions represent the core of language development research, which I believe they do, both linguistic and psychological theories and methods have to be applied to the study of language development.

The study of language development, and the four questions above, are inspired by the fact that anyone can observe that child language of is different from that of adults (at least from the surface). In fact, children do not speak (i.e. use sounds, words and sentences that are the same as adult speech) at all at birth, and their first recognisable word is usually spoken around or after the first birthday. From the surface, child language remains different from adult language for a long time. But if there is a surface

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6 Children babble the same sounds in all languages in their first six months (Van der Stelt 1994).
structure and a deep structure (see previous section), in what respect is child language different from the surface or/and deep structure of adult language, and how do children arrive at an adult level of language production? The assumption of an underlying structure makes it plausible that grammatical development is rule governed, and not an accidental sequence, and that children acquire these rules.

There are two extremes on a continuum of theories, that explain the relationship between possible inborn capacities and the resulting patterns. I start with the continuity and discontinuity assumption that is strongly related to what is called Universal Grammar. The discussion of these approaches to structural components of language serves two goals. First, it is meant to be a clarification of concepts, and second, both assumptions yield possible different lights on development (in terms of change).

**Language development: origin and change**

*Universal Grammar*

The debate on the acquisition of language has been strongly influenced by structural theories. There is also a strong interaction of empirical data with descriptive theories, and with underlying mechanisms of both language and language development. Three questions are important. First, what are the linguistic characteristics of language development? Linguistic knowledge must be present in or become available to a child at some moment in time. Second, how does a child learn its language? Third, why is the order of language development the way it is? These questions are reflected in three kinds of theories:

1. Linguistic theories.
2. Learnability theories.
3. Developmental theories.

Linguistic theories aim at describing what kind of linguistic competence, such as syntax or semantics, a child has. Generative grammar (e.g. Government-and-binding-theory) is an example of a linguistic theory. Learnability theories explain how a child is able to learn a language and how a child is capable of learning the grammar and the metalinguistic properties of a language like Dutch or English. Developmental theories explain change in language development, that is, the fact that children go through various states towards the adult linguistic state.

A critique on outside-in theories, that explain language development on the basis of cues that a child derives from his language environment, is that the general rules of
association, induction and learning cannot explain, for example, the occurrence of structural mistakes in (language) development. The following example is taken from Atkinson (1986). Suppose, parents provide a child with the following sentences (examples 2.3 and 2.4):

2.3.a. The man is here.
2.3.b. The man has left.
2.3.c. The tall man has left.
2.3.d. The man who is outside is impatient.

2.4.a. Is the man here?
2.4.b. Has the man left?
2.4.c. Has the tall man left?
2.4.d. Is the man who is outside impatient?

In general the form of the yes-no interrogative is generated by placing the first verb in front of all words (examples 2.4). These examples can be learned from the input without any complex linguistic knowledge. However, in 2.3.d, this would lead to the wrong question (in 2.5.).

2.5. *Is the man who outside is impatient?

Induction from the input cannot explain why mistakes like in 2.5 are not found in the language of children. In the words of Martin Atkinson: “Accordingly, the hypothesis space through which the learner must search in acquiring the syntax of English is restricted so as not to permit hypotheses which embrace rules which are perfectly easy to formulate and completely explicit but which have the wrong sort of formal properties.” (Atkinson, 1986, 116).

With respect to inside-out theories, criticism came from Braine (1992, 1994). In his 1994-paper “Is nativism sufficient?”, Braine takes up the discussion whether “language acquisition is mostly a realization of innate principles, or mostly a consequence of learning” (p. 10). The problem is that learning needs mental contents or learning principles, which result in new problems. The solution to the problems that both nativist and empiricist approaches of language development are confronted with is interactionism, according to which development is the consequence of an interaction between genetic and environmental causes. Braine states that the empirism-nativism argument is a distinction between structure (or mechanism) on the one hand, and idea (or content) on the other. This distinction, however, has been absent from theoretical thinking. Nativism is still the central theory to explain language development, but the
problem is that nativism is insufficient because it does not account for developmental change. In the end, Braine proposes that a learning theory based on Piaget’s assimilation-accommodation, is needed to explain the ontogenesis of innate cognitive and linguistic primitives. The developmental primitives are:

1. A learning mechanism: old rules analyse new material.
2. Semantic categories.
3. A tendency to classify words and phrases.

Although there is no syntactical innateness assumed, there is an assumption of an innateness of learning principles and semantic categories, and classifying words. MacWhinney, Leinbach, Tabaran and MacDonald (1989) argue that language acquisition is not guided by rules (as in nativist approaches), but that children learn by cues. However, a child first needs to detect a cue (which might be the form or sound, the place of a sound/word in the input), then he must get hold of the frequency of language variables as an index of the importance of the input, the variation of availability, and lastly, he must be aware of the reliability and the consistency of these cues. In sum, the assumption of acquiring language by cues offers identical problems as rules. Since rules offer better descriptions of language development, I would suggest to choose rules, and to use cues in addition when rules fail to explain language acquisition.

Since other theories like Case grammar and Pivot grammar (cf. Ingram, 1989) could not explain the acquisition of syntax either, neither learning theories nor the assumption of full innate knowledge suffice to describe and explain language development (both are too strict to be applied to development). Furthermore, theories on the origin of language development do not explain or even describe the form of change.

Then, the question is: what do we need for a description of language development with respect to universal and inborn capacities? One of the main assumptions is that all languages of the world share so called universals. These shared basic elements of all languages constitute Universal Grammar. What is this Universal Grammar, or UG? How do we get from UG to a specific language? The central issues are the relationship between UG and innateness, and the relationship of UG with respect to development (i.e. in quantitative terms).

Chomsky and his followers have argued that the acquisition of language is impossible without innate linguistic knowledge. This body of knowledge, known as Universal Grammar (UG), is a set of principles (i.e. constraints on the architecture of grammars), that sets borders to the range of possible human languages. Since children may acquire any language depending on their language environment, this leads to a logical problem: how do they do that? Why are all languages learnable for all children? The answer is that
it is assumed that languages do not differ in their core grammatical architecture. In this core architecture, the universal principles are parameterised in such a fashion that the designs of specific languages vary over a limited range, each of which implements the underlying principles slightly differently. The child’s task is to determine which of the core grammar variants allowed by UG generates the sentences he is exposed to, and to set the values of the parameters accordingly (Chomsky, 1986, Gibson & Wexler, 1994, Goodluck, 1991).

The way UG is embedded in language specific grammars is shown in figure 2.5. All languages are, so to speak, ‘surrounded’ by UG. Languages differ in their surface grammar, but there is one underlying general knowledge base. In other words, any language is supposed to be a subset of UG. This body of knowledge is abstract and it provides constraints on possible languages. The subset-principle applies: children will always opt for the least permissive grammatical system to handle data in their linguistic environment.

![Diagram](image)

**Figure 2.5. Grammar of any language as a special case of UG.**

The following quote from Goodluck (1991) expresses the power of the assumption of UG:

“The use of principles of grammar potentially allows the child to form rules and hypotheses that affect and determine the form of sentence types for which he may have no direct evidence in the input itself.” (p. 144/145)

The benefits of the assumption of a universal grammar are that UG enables to predict, first, possible variation in any language (i.e. what sentences children will and will not produce). Second, it leads us out of the problem of learnability. That is, since UG is supposed to be guarding the underlying (however, not specified) structure of language, and it is therefore setting the cognitive and linguistic constraints, the problems of
acquiring a language are limited. Third, the presence of UG explains why any child might learn any language. There is one little drawback: UG does not predict the shape of change. That is, although UG sets the boundaries of language development, it does not predict how a score (e.g. on a test, or a frequency count in spontaneous language) changes over age. Is that change linear, or non-linear? Is change continuous or is it discontinuous (in quantitative terms)? Despite UG’s explanatory power, these questions cannot be answered by assuming UG.

Change: discontinuity in grammatical development

An important question is whether or not discontinuity (in the linguistic meaning, i.e. a qualitative meaning) predicts non-linear or discontinuous change (in the psychological meaning, i.e. a quantitative meaning). Linguistic discontinuity refers to all theories that assume that some or possibly all principles of UG are not present from the beginning. However, precise predictions of quantitative change, in terms of the change in figures 2.1 and 2.2, are not possible. In other words, linguistic theories are very difficult to link with quantitative analyses, since these theories concern about relationships between words on a non-chronological scale. They do not care about time-dependent issues. The main goal is here to prevent confusion in the rest of this thesis, since the meanings of (dis)continuity differ across disciplines.

A discussion on discontinuity in language development is problematic, since definitions of discontinuity and stage that originate from linguistics are not clear at all. Hyams (1986) notes that an analysis of early language supports the hypothesis of continuous development if it is constrained by principles and parameters of UG. Child grammar differs from adult language with respect to the setting of a particular parameter. In other words, syntactic development is a matter of fixing parameters of UG. Thus, discontinuous syntactic development means that each (or some) of the intermediate grammars does not fall within the limits imposed by UG. Discontinuity means that grammars are radically restructured from one stage to the next. These grammars are called semantically based grammars: they lack a syntactic component. The drawback of these grammars is that no simple inductive procedure can explain the transition from semantical grammars to abstract and adult syntax. However, this is in strong contrast with the majority of research, where it is assumed that language development takes place in parallel on all fronts and it does not involve a significant discontinuity or qualitative leap from semantics to syntax. This is also the assumption in this study.

Most of the time discontinuity refers to syntactic properties of language. It means that if grammars are discontinuous they are radically restructured from one stage to the next
(Hyams, 1986). The idea is that each language and every development has (as mentioned in the previous subsection) an underlying structure called Universal Grammar. Discontinuous development means that each of the intermediate grammars do not fall within the limits imposed by UG. Continuous syntactic development is a matter of fixing parameters of UG. A look at figure 2.5 reveals what (dis)continuity is. The grammar of a language is part of UG and if there is no restructuring, there is continuity. The opposite also holds: if a restructuring takes place, then there is discontinuity.

In summary, the difference between several definitions of discontinuity in psychology and those in linguistics is that psychological discontinuity refers to both qualitative and quantitative properties of development, whereas discontinuity in linguistics only refers to a qualitative property. The predictions of linguistic discontinuity are that there must be states that are clearly separated from earlier or later states. This discontinuity hypothesis also predicts all sorts of change. There are no clear arguments why linguistic discontinuity should predict quantitative discontinuity. Only general remarks can be made (e.g. ‘there is an increase over time’).

Change: stage issues in grammatical development

Of the four questions as proposed by Weissenborn, Goodluck and Roeper (1992), question 3 relates to the existence of stages. Let us suppose for a moment that there are no stages (whatever the definition). What is the form of change we might expect in development? In other words, this question deals with the kind of change that may be expected in grammatical development, under the assumption that child grammars are either different from or similar to adult grammar (continuity or discontinuity hypothesis). Theories on language development that may carry a solution for the developmental issue of language acquisition can be found in Verrips (1991) and in Weissenborn et al. (1992). They make a distinction between continuous and discontinuous development (discontinuity is dealt with on the next page). Weissenborn et al. (1992) make a distinction between strong continuity and weak continuity. Weak continuity is when the first child grammars are a subset of adult grammars: there are no changes on the structural level. Fodor (1983) comes close to the strong variant (strong means that all language structures are fully specified from the first grammar onwards), however, the weak version is probably the most popular version. The only claim weak continuity puts forward is that UG principles are obeyed in the grammars during the language development.

Working from the assumption that development is continuous (with respect to UG), the question is what this continuity assumption predicts with respect to quantitative
change. Given weak continuity, are we to expect that the quantitative change in the mastery of certain language variables takes the form of a continuous curve? The continuity hypothesis (i.e. in linguistic terms) does not a priori reject discontinuous change (i.e. in quantitative terms). If we suppose that continuity is the right hypothesis for language development, then this approach allows for discontinuous change, since continuity does not rule out the presence of stages. The only claim continuous models make is that the assumptions of UG are not violated. The prediction on discontinuous quantitative change is not narrowed by the continuity hypothesis.

It is important to discuss linguistic hypotheses to elicit the expected quantitative predictions on development. These hypotheses and their prediction on change demand a careful treatment to prevent problematic interpretations of the literature in the rest of this thesis. Two extremes have been discussed (continuity and discontinuity), but there is a third issue, namely the existence of linguistic defined stages, and the transitions from one stage to the other.

*From stage to stage: transitions*

Since language development has its own characteristics, there are with respect to the meaning of the concept stage differences between a general psychological and a linguistic approach to stages.

Ingram (1989) dedicates chapter 3 of his book to stages in language development. He points out that has stage rarely received a thorough definition. He makes a distinction between single and multiple behaviours. Single behaviours refer to the situation in which one behavioural variable is measured over time. In this case there are four kinds of stages. According to Ingram, a continuous stage is a stage ‘where a single dimension of

![Figure 2.6. a b c d. From left to right: continuous (2 dots), plateau, transition and acceleration stage](image)
behavior is being observed’ (p. 33). Graphically this looks like figure 2.6.a: it is a point on a continuum. Since I applied the definitions of Glaserfield and Kelly, this is not a definition of a stage, but a definition of a level. The second stage Ingram distinguishes is a plateau stage, and it is the end stage of any language behaviour. In other words, the continuum is halted. The plateau stage is depicted in figure 2.6.b. The third stage is called a transition stage: behaviour is expected to change again at some later time. However, I think this is a strange definition. It is a stage in terms of Kelly and Glaserfield, but whereas most transition definitions refer to sudden change, Ingram refers to stretch of time where there is no change at all (see figure 2.6.c). It is an intermediate plateau stage. The acceleration stage in figure 2.6.d is a rapid change between a ‘transition’ stage and a ‘plateau’ stage. There is a problem: if an acceleration stage looks as steep as a transition stage the difference between these stages is impossible to tell.7

At the end of the chapter, Ingram bears to mind the distinction made by Brainerd (1978). Like Brainerd, Ingram distinguishes two kinds of stages (apart from the four specific stage definitions on the previous page). Descriptive stages are stages with behaviours that undergo change and there are antecedent variables that are responsible for the change. In explanatory stages the variables must be subject to independent measurement.

In sum, the stage concepts that have been proposed by Ingram are confusing: there is a contradiction with the use of transition stage as being a stage of no change. There is also the problem of applying these stage definitions to an empirical study of language development, since these definitions of stages are qualitative, and a developmental perspective is missing. Furthermore, the definitions remain non-mathematical (and therefore non-testable in the sense of non-linear theories). Linguistic stage definitions have been discussed so that the study of language development may benefit from it. Furthermore, since this thesis is on the verge of linguistics and psychology, the concept stage (especially the differences between the definitions in both disciplines) was discussed to prevent confusion.

Since it is assumed that there are some stages (e.g. the prelinguistic and the linguistic stage), the question is how a change from one stage to the next takes place. Transitions (i.e. a change from one stage to the next) have been given different meanings and explanations. For example, transition in language development has been used for the language of a child that changes from the non-linguistic to the linguistic stage. Dore, Franklin, Miller and Ramer (1975) distinguished two transitional phases. The first is in

---7 Ingram also discusses the issue of two or more principles that cause behaviour (multiple stages; Ingram, 1989, 37). However, this issue is not relevant to this study.
agreement with Camaioni (1989), Golinkoff (1983) and Sugarman (1983) who state that there is a transition between prelinguistic vocalization and one word speech. None of the authors clearly defines this use of the word transition. The second transition would be between one word speech and patterned speech.

Dore et al. (1975) postulate a claim regarding transitions in language development. Each major linguistic stage, they say, is preceded by a transitional phase which serves as a bridging device for the next major acquisition. Furthermore, transitions are extremely important, because their delineation is essential to a complete description of language development and they relate directly to basic theoretical issues concerning developmental progression. According to White (1982), a transition is a matter of changing perception. That is, a change in the language (called a transition) is caused by a change in the way a child is perceiving the parents. If the parents change either slowly or radically, the effect on the child should be immediately evident. Whether this is the case should be evidenced by empirical data.

The problem is that transitions, for example from non-linguistic to linguistic behaviour, are loosely defined. In fact, transitions in language development are changes between two stages. This change is described in terms of a qualitative change. Although it is assumed that this linguistic transition is abrupt, there is no quantitative fundament of this abrupt change, and the discussion on this concept of transition is build on disputable arguments, since it lacks empirical data to decide for or against abruptness. In this study on grammatical development, I will come up with a definition.

The relationship to linguistic knowledge is that the development of linguistic structures (e.g. functional categories) in terms of branches of the linguistic tree depends on the assumption of the underlying ‘knowledge’ or syntactic structures. If all knowledge is present (the overall syntactic structure is available to the child), development is presumably a gradual or even linear process. The other extreme is that no syntactic structure is available, and the prediction of quantitative change is a sudden development, since syntactic branches do not ‘grow’ in a gradual way. In other words, branches are there or they are not. In chapter 4, this discussion of this underlying syntactic competence is taken up, and related to the variables in this study.

**Provisional conclusions**

In sum, there is a difference between the psychological and the linguistic meaning of stage and transition. Stages in child language, as discussed by Ingram, show a resemblance with the definitions of Glaserfield and Kelley (1982), but Ingram reserves the transition stage for what I call an intermediary stage or end stage, whereas an
acceleration stage is used for what I call a transition stage. In linguistics, *transitional* change is reserved for the change from prelinguistic vocalization to one word speech. A second transition would be between one word speech and patterned speech. As I pointed out, none of the authors clearly define the use of the word *transition*. One of my aims is to come up with a definition of transition in (language) development (see also chapter 3 and 6). The second goal is to define transitions and stages so that they are empirically testable. Although the definitions in the literature are clear, they cannot be applied to language development to find evidence for (dis)continuous change.

The assumptions of linguistic continuity and discontinuity, the idea of underlying knowledge called Universal Grammar, and questions on the absence or presence of stages do not yield any a priori prediction of the psychological, i.e. quantitative, (dis)continuity. The choice for some sort of underlying grammatical knowledge of a child are therefore not determinative for the sort of quantitative change one might expect in development. Therefore, linguistic analyses of development and of the question of innate structures must be chosen on grounds of structural analyses, not on grounds of expected quantitative change. The reverse reasoning also applies: the choice for the assumed underlying knowledge of a child does not depend on the quantitative patterns that are to be found.

### 2.3 Summary and conclusions of the chapter

When I gave this chapter the title *Everything must go*, I had in mind that a child develops his language simply because he has to. A child acquires a language, maybe because there is some ‘software program’ in the brains, probably because language is easily acquired (i.e. without explicit teaching) and it plays a crucial role in the communication of humans. In either case, development will go, and it has to go. Both linguistic and psychological theories aspire to explain why language is easily learned, but that is not enough to fully comprehend language development. What is needed is a model of the *change of language structures* in the course of *development*. That is, we need an account for the change of every aspect of a language and why these aspects ‘must go’, i.e why nothing remains the same in language development.

I discussed (language) development from very general observations and theories all the way down to a review of linguistic theories and findings. In section 2.1, it turned out that theories about psychological development have been focussing on two aspects. First, when describing (psychological) development, there is an assumption of *change*. Developmental theories either seem to support *stage wise change* (development), or *development without stages*. This dichotomy has serious implications. Non-stage theories
account for change simply as a linear dependency of time and input, i.e. an additive feature since there is no reorganisation of (underlying) structures, stage theories sometimes implicitly assume a reorganisation. If there are stages, the mechanisms for a stage shift are crucial. Second, the origin of development has been one of the central topics of development research, and it is a dichotomy, too, called the nativism-empiricism debate. In short, this debate has to do with how much we humans are endowed with when we are born. Nativist theories assume that somewhere in the brain humans have inborn capacities. Empiricist theories reject the presence of any inborn capacities. Finally, the discussion on (dis)continuity has not had clear-cut proposals for the field of developmental psychology. The general overlap between various definitions is that discontinuity refers to a qualitative change, i.e. there is no connection with previous moments in time with respect to behaviour. If development is discontinuous, there must be stages in development. However, the discussion on stages is complicated by a lack of clarity in nomenclature. The nomenclature by Glaserfield and Kelly (1982) is adopted in this study. A stage is a segment along the temporal axis. Each stage can be individually characterized by a change relative to the adjacent ones. In this stretch of time something (on the y-axis) is constant, and earlier stages are different to the present one in a dimension other than time. Third, the question on (the mechanisms of) transitions is directed to an explanation of how and why a system is forced to a next stage.

General psychological theories are not suited for a specific treatment of language development. The study of language behaviour, for example in the behaviouristic tradition, is not the study of language structure. Learning theories cannot explain the complexity of language. The idea of underlying structures of language, relations among languages and others has become known as generative grammar. Syntax (i.e. the structure in a language) is a highly organised system, and relations between words in sentences can be described terms of binding and governing relations. In fact, language is a system ruled by parameters and principles. Syntactical analyses within a generative framework offer justifications for the order in language development. However, the shape of change is hardly predicted by these theories.

Subsequently, I discussed theories on language development. Especially the continuity-discontinuity debate in linguistic theories constitutes an enormous quantity of literature. Continuity means that there are no grammars of a child that fall outside the limits that are set by Universal Grammar (UG). UG is the starting point for all children. It is a body of general, non-language-specific principles, from which all languages are derived. This view is adopted in this study. Discontinuity in linguistic theories is used for those grammars that do not build upon the principles of UG (therefore, the meaning differs from the one in psychology).
The linguistic stage definitions, given by Ingram (1989), are not unequivocal. They are in contrast to the psychological definitions. Linguistic stage definitions are qualitative, a developmental perspective is missing, and most important, the definitions remain non-mathematical and therefore hard to apply to development. Transitions have been allocated to two moments in language development: the transition from prelinguistic to linguistic speech, and the transition from one to multi word speech. Both stages and transitions are not well defined, and mechanisms of transitions are even less well defined. However, both stages and transitions are assumed to be an important aspect of a theory of language development.

The reformulation of the research questions of the first chapter means that core problems are reanalysed. Concluding the present review of the literature, the question becomes:

If some theories on human development propose discontinuity and others assume continuity as the quantitative pattern in development, and under the assumption that underlying properties of UG and principles are either available to a child from birth on or they become available during development, what are the sorts of change in language development in terms of a relationship between a change on the time-axis and a change on the score-axis?

In the next chapter, I discuss ‘Non-linear theories and models’. A specific class of these models is called Catastrophe theory, that can be used to demonstrate discontinuities (i.e. in the psychological meaning) in (language) development.