

**Language development in physically and motor impaired
children without speech:
A case study of a child using a speech-generating device**

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Note from the translator

At times I found it useful or necessary to add notes to explain what might otherwise be lost in translation. You will find these marked [LJ]. The English translations of passages quoted from other sources in German are also mine. *Liane Jeschull*

Abbreviations used in glosses

1SG	1 st person singular
3SG	3 rd person singular
ACC	Accusative
BE-	prefix <i>be-</i>
DAT	Dative
FEM	feminine
GE-	prefix <i>ge-</i>
INF	infinitive
MASC	masculine
NEUT	neuter
NOM	nominative
PL	plural
PRS	present
PST	past
PSTPRT	past participle
SG	singular

Table of Contents

1. Introduction and overview	5
2. Theoretical background	7
2.1 Language acquisition in typically developing children.....	7
2.1.1 Language acquisition theories	7
2.1.2 General assumptions about language acquisition.....	8
2.1.3 Overview of the course of language acquisition	9
2.1.4 Morphological development.....	10
2.1.4.1 The acquisition of gender.....	11
2.1.4.2 The acquisition of case.....	12
2.1.4.3 The acquisition of verb inflection	12
2.1.5 Syntactic development.....	13
2.1.5.1 Syntactic characteristics of German.....	13
2.1.5.2 Milestones in the acquisition of syntax.....	14
2.2 Language development in physically handicapped children without speech	16
2.2.1 Children with Cerebral Palsy and severe Dysrthria / Anarthria	16
2.2.2 Theoretical considerations.....	17
2.2.3 Motor impairments and their impact on language development	17
2.2.4 Altered conditions in child-caregiver interaction and their impact on language development	19
2.2.5 Current state of knowledge regarding the grammatical development of children using AAC.....	20
2.2.5.1 Research on Augmentative and Alternative Communication.....	20
2.2.5.2 Distinctive features in morphosyntactic development.....	21
2.2.6 Suggested reasons for short and incomplete utterances	22
2.2.7 Influence of the AAC system on the language acquisition process	23
2.2.8 Factors that aid language acquisition	24
2.2.9 Consequences for successful intervention efforts	25
2.2.10 Complex electronic speech-generating devices.....	26
2.2.11 Specifications for complex speech-generating devices.....	26
3. The study.....	28
3.1 The subject: Lennart.....	28
3.2 Device and strategy	28

3.3 Data	29
3.3.1 Description of the data set	30
3.3.2 Data chosen for investigation	30
3.3.3 Preparation of the data for analysis	30
3.3.4 Method of analysis	31
3.4 Results	31
3.4.1 General aspects	32
3.4.2 Analysis of morphological marking of gender and case	32
3.4.2.1 February	33
3.4.2.1 September	34
3.4.2.3 Comparison of the analyses of the two periods and discussion.....	34
3.4.3 Analysis of syntactic structures	36
3.4.3.1 February	37
3.4.3.2 September	37
3.4.3.3 Comparison of the analyses of the two periods and discussion.....	38
3.4.4 Analysis of sentence complexity	38
3.4.4.1 More detailed analysis of complex structures in February	40
3.4.4.2 More detailed analysis of complex structures in September	40
3.4.4.3 Comparison of the analyses of the two periods and discussion.....	41
3.4.5 More detailed analysis of selected syntactic aspects	41
3.4.5.1 Material in the <i>Vorfeld</i>	41
3.4.5.2 Expansion of sentence structure.....	42
3.4.5.3 Participial constructions.....	45
3.4.6 Summary of the results	44
3.5 Discussion of the results.....	45
3.5.1 Ambiguities in the data and unresolved issues	45
3.5.2 Discussion of the results in relation to the speech-generating device	46
3.5.3 Discussion of the results within the context of current research	47
3.5.4 Final discussion	47
4. Conclusion	49
Bibliography	51

1. Introduction and Overview

Children are born into a speaking environment and acquire their native language within the first three or four years of their lives. What complex mechanisms enable this seemingly effortless process has been researched extensively in the past few decades. The research findings allow for generalizations to be made about language development and its course. Standardized tests have been developed in order to assess children's language development. Potential problems may thus be diagnosed at an early stage, and children may receive the appropriate kind of intervention on the basis of a wide array of evidence-based measures.

For children who are unable to develop their own speech because of a physical-motor impairment, the situation is different, however. There are only few empirical findings about their linguistic development, and it is impossible to make generalization about the course of acquisition. Therefore, a future goal should be to have a similar empirically founded knowledge base ready for children who are unable to develop speech and depend on Augmentative and Alternative Communication (AAC), so that their acquisition processes can be better understood and potential problems can be purposefully diagnosed.

The reason for why no such knowledge base about children using AAC that practitioners could rely on when planning intervention measures is available yet may be that the scientific study of AAC is a relatively new field. It was only within the past decade that AAC has received attention as an academic subject and scholarly work has been published for the first time. While first empirical findings about lexical development have already been published, for example about core and extended vocabulary (Boenisch, Musketa & Sachse 2007), no such empirical findings are available yet for grammatical development within a German-speaking context. Therefore, the current study will focus on the development of syntactic and morphological structures in order to expand the study of grammatical development within research on AAC.

The current case study is concerned with the following research question:

What progress in morphological and syntactic development will a five-year old boy with Cerebral Palsy and severe Dysarthria make in language production within a year, while using a complex speech-generating device?

The goal of this study is to report an empirical example of the possible development of morphology and syntax over a year and thereby to contribute to this young field of research.

First, we will present general findings about typical language development, including the development of morphology and syntax, in order to understand the basic mechanisms of the language acquisition process. Based on current international research findings, we will then outline potentially different or special starting conditions for language acquisition in children without speech and explore potential factors that might influence their linguistic development. In this context, we will also look at the current state of knowledge regarding the morphological and syntactic development of children and adults who depend on AAC.

In the title of this study, I am referring to 'language development.' However, I will use the terms 'language development' and 'language acquisition' interchangeably in the course of this study. One might assume that the term 'language development' implies a more passive role on the part of the child in the sense that something develops, while the term 'language acquisition' might imply a more active role. Eventually, there are parts for a more active role as well as a more passive role that the child plays in the acquisition process, as the sketch of language

acquisition theories in the next chapter will show. In addition, the current literature neither explicitly distinguishes between these two terms, nor assumes or discusses any meaning differences between them.

2. Theoretical background

2.1 Language acquisition in typically developing children

2.1.1 Language acquisition theories

Two major families of theories, which Hirsh-Pasek & Golinkoff (1996) (cited in Hennon, Hirsh-Pasek & Golinkoff 2005, Tracy 2005, Grimm & Weinert 2002, Dittmann 2006) summarize as “Inside-out” and “Outside-in” theories, may be delineated in the field of language acquisition. While “Inside-out” theories, with Chomsky and Pinker as most famous representatives, assume that the preconditions for language acquisition are innate, representatives of the “Outside-in” position consider the child’s social interactions, her input (the ambient language), and her general cognitive capacities the key to language acquisition. Although innate capacities and environmental are still at the core of current discussions of language acquisition and its theoretical foundation, the discussion has become less polarized. Instead, the question is **how** and **to what extent** the child’s innate capacities and environmental factors (linguistic input and social interaction) play out in the acquisition process.

In line with Hennon, Hirsh-Pasek & Golinkoff (2005: 46), we note that constructivist and emergentist perspectives largely prevail today, promoting an interactionist view of language development.

Thanks to recent findings from infant research and the cognitive neurosciences, it is now generally accepted that infants come into this world equipped to acquire language, but not in the Chomskyan sense of a Universal Grammar. Rather, specific cognitive abilities enable the infant to direct her attention to language, for example; thereby focus on linguistically relevant units; and step by step recognize and construct, or derive, regularities (cf. Grimm & Weinert 2002, Tracy 2008).

In this context, the epigenetic view of language acquisition, as advocated by Gisela Szagun (2006, 2007), is worthy of mention.

The epigenetic view assumes that human behavior develops as a result of the interaction between maturation, which is genetically determined, and experience with the environment. Language may thus be viewed as a result of the interaction of different, partially innate, capacities, neural mechanisms, and environmental factors. None of the individual components alone is responsible for language; only their interaction leads to the development of language.

It is through the interaction with other cognitive capacities like intentional communication, classification, and imitation of actions and sounds that children acquire language from the linguistic input of their environment in meaningful, communicative contexts. Thus they use learning mechanisms that generally operate in cognitive development, like classification, analogy formation, and structure building. (Szagun 2006: 267)

Consequently, learning plays a central role under the epigenetic view. Szagun defines it as the gradual construction of linguistic structures through the use of the available input, and the organism’s self-organization plays the key role. On the basis of the linguistic input, the child gradually constructs generalizations, spurred by her discovery of regularities. Such learning

entails learning “in the sense of constructivist theories, which assume that the organism creates new structures by interacting with its environment” (Szagun 2006: 268).

2.1.2 General assumptions about language acquisition

Generally, language acquisition is a very robust and highly systematic phenomenon, despite large individual differences (cf. Tracy 2008: 68). Moreover, it is independent of general intelligence and takes place regardless of whether the acquired language is a spoken or a signed language (ibid.). Further, receptive language development generally precedes language production.

Large differences may be observed in the course of acquisition with respect to the age and the pace at which children acquire certain competencies and skills or enter and pass through developmental phases. Some children may even skip a developmental stage altogether or pass through it silently or in a less pronounced manner (cf. Szagun 2006, Grimm & Weinert 2002: 526). Using the FRAKIS test (*Elternfragebogen zur frühkindlichen Sprachentwicklung* ‘Parental questionnaire about early child language development’), Szagun (2006: 207ff.) found large individual variation in lexical development, sentence complexity, and inflectional morphemes across age groups. For example, children’s vocabulary at the age of 2;0 varied in size between 46 and 571 (Szagun 2006: 210).

Moreover, children may use different strategies to approach the acquisition task. Tracy (2008: 87), for example, differentiates between an analytic and a holistic strategy. While analytic children focus on individual words and combine them only gradually, children using the holistic strategy tend to longer prosodic units of several adult words.

Likewise, two different acquisition paths have been observed in lexical development. According to Szagun (2006: 121), there are referential children and pronominal children:

... ‘referential’ children, whose early vocabulary predominantly consists of nouns (more than 50% of all words), and ‘pronominal’ children, whose early vocabulary consists less of nouns (fewer than 50%) but rather of function words, stereotypical expressions, and routines.

Despite all individual differences, I would nonetheless like to discuss the course of acquisition in terms of stages or so-called milestones, as is customary in the acquisition literature (cf. Tracy 2008, Szagun 2008, Grimm & Weinert 2002), in order to provide a brief introductory overview of the major steps of language development. Thus between approximately 1;0 and 1;8 children produce their first words, between 1;6 and 2;3 two-word utterances, and between 2;0 and 4;0 multi-word utterances. Complex structures with subordinate clauses emerge at about age 3;0. It is important to keep in mind though, that children do not suddenly jump from one-word utterances to two-word utterances, for example, but instead stages may overlap. Grimm & Weinert (2002: 532) point out that “[c]hildren talk about that which is in their immediate interest and what they are cognitively able to express.” Szagun (2006: 151) likewise remarks that children need to know something about the world in order to communicate it to others:

It appears to be reasonable to assume that cognitive development precedes and at least partially determines linguistic development. On the other hand, it is also possible that the linguistic encoding of knowledge about the world influences our thinking.

We will not further discuss the relationship between linguistic and cognitive development at this point, as it is a complex issue that goes beyond the scope of this thesis. As a final remark, we note that linguistic and cognitive development are closely connected and influence each other (see also Weinert 2002).

2.1.3 Overview of the course of language acquisition

Before children utter their first words and thus reach the first milestone, they have already undergone some major and to an extent complex receptive and productive development. The experiences that infants gather in this preverbal phase are an important prerequisite for the development of language comprehension and production. One of the most important experiences in this context is the infant's interaction with her parents or caregivers (cf. Papousek 1994, Zollinger 1996, Grimm & Weinert 2002).

According to Szagun (2006: 65), children's first words are usually nouns, particles, and demonstratives, and occasionally adjectives and verbs. Whether children are able to differentiate these syntactic categories is unclear, however (cf. Szagun *ibid.*). A closer look at these first words shows that they refer to social-affective regulators, and objects, animals and people in the child's surroundings, e.g. *winke-winke* ('bye-bye'), *danke* ('thank you'), *nein* ('no'), or *Mama* ('mommie') (Grimm & Weinert 2002: 526, Szagun 2006: 65). Nelson (1985, as cited in Grimm & Weinert *ibid.*) assumes that a word at this stage is an integral part of a holistic event representation, which does not yet refer to a distinct event or a distinct object. Only when they reach the first phase of Piaget's sensorimotor stage will children recognize the abstract-cognitive quality of words and understand that things can be named (Grimm & Weinert *ibid.*).

This developmental step coincides roughly with the child's reaching the 50-word benchmark, which is usually followed by a vocabulary spurt. But not all children equally go through a vocabulary spurt. Thus their vocabulary may also develop in several small spurts or increase gradually (cf. Szagun 2006: 117ff., Grimm & Weinert 2002: 525, Kauschke 1999: 132ff.).

At the time that children's vocabulary comprises about 50 words, their first two-word combinations may be observed as well, which marks the beginning of their productive grammar (Grimm & Weinert 2002: 531). In these two-word utterances, children encode their knowledge of object permanence. They are now able to separate the self, objects and actions involving the objects, and to express them in language (Szagun 2006: 69).

The two-word combinations also represent children's earliest examples of syntactic structure and can be classified according to the following meaning categories:

1. demonstrative/adverb and object/person:
 - a. denoting their presence: *auto da* ('car there'), *ein affe* ('a monkey'), *der igel* ('the hedgehog')
 - b. denoting their absence: *katze ab* ('cat off'), *hund weg* ('dog away'), *alle buch* ('gone book')
2. agent and action:
baby weint ('baby cries'), *hund bellt* ('dog barks'), *ich tanken* ('I fuel')
3. agent and object:
anna auto ('Anna car'), *mama schaukel* ('mommie swing')

4. object and action:
nana habe ('nana have'), *schaf setze* ('sheep set.down'), *das mach* ('that do'), *wasser habe* ('water have')
5. actions and localization:
pferd rein ('horse in'), *raus katze* ('out cat'), *mund rein tun* ('mouth in put'), *ab soll* ('off should')
6. person/object and localization:
baby stuhl ('baby chair' = 'the baby is on the chair'), *buggy uni* ('buggy university' = 'buggy is at the university')
7. modification:
arme katze ('poor cat'), *grosse (ele)fant* ('big elephant')
8. possessor and possessed:
titas wauwau ('Tita's dog'), *mama bein* ('mommie leg')

The majority of these are combinations of content words and of content words with function words. Combinations of function words are rare (cf. Szagun 2006: 70). Morphological marking, such as plurals, may occasionally be observed. Yet the bulk of inflectional paradigms is not acquired until the child produces multi-word utterances (cf. Szagun 2006: 72, Grimm & Weinert 2002: 533).

Children's lexical and grammatical development are interdependent, just as their morphological and syntactic development are (cf. Szagun 2006: 126ff.). Only when they have enough words can children start to combine words and step by step discover morphological regularities. In turn, the more inflectional paradigms they have mastered, the more complex their sentences can be (cf. *ibid.*).

By about 4 years of age, children have mastered the morphology and syntax of their language, even if they occasionally make morphological errors. The acquisition of grammar is basically completed, and children are able to use their L1 correctly (cf. Grimm & Weinert 2002: 533, Tracy 2008, Szagun 2006: 59). What follows is the fine-tuning of the acquired linguistic structures and the development of explicit linguistic knowledge. In addition, literacy comes into play. According to Grimm & Weinert (2002: 534), an automatic reorganization process takes place at approximately age 6 that transfers implicit linguistic information into explicit knowledge. During this phase, there may be another increase in performance errors while available representations are internally reorganized.

At the time they start 1st grade, children on average have an active vocabulary of 3,000 to 5,000 words and a passive vocabulary of 9,000 to 14,000 words (cf. Rothweiler & Meibauer 1999: 9, Kauschke 1999: 134). Vocabulary growth continues throughout life, and adults have an average active vocabulary of 20,000 to 50,000 words, while their passive vocabulary may even be twice that much (cf. Rothweiler & Meibauer 1999: 9).

2.1.4 Morphological development

Morphology studies the structure of words, word formation by inflection, and the creation of new lexemes by derivation and compounding. While compounding means combining two or more lexemes, e.g. *Haus-Tür* (lit. 'house-door'='front door') and *Haus-Tür-Schlüssel* (lit. 'house-door-key'='front door key'), derivation refers to the creation of new lexemes by prefixation and suffixation, e.g. *Faul-heit* ('lazy-ness'), *be-greifen* ('BE-grip'='comprehend, apprehend'), and

un-begreif-lich ('un-comprehend/apprehend-ly'='incomprehensible, inapprehensible'). The latter may change the syntactic category of a word of the same root. The change of *begreif-en* ('comprehend-INF') to *begreif-t* ('comprehend-3SG.PRS'), on the other hand, is a case of inflection. Inflection marks the relationship between the words of a sentence. Compared to a language like English, German is a morphologically rich language: articles, pronouns, adjectives, and nouns are marked for case, number, and gender; main verbs, auxiliaries, and modals for tense.

Consequently, the acquisition task includes learning an array of rules that may be very complex, the so-called inflectional paradigms. What's even more, most paradigms in German are only probabilistic, that is they apply only to a certain extent.

In what follows, we will take a closer look at the acquisition of gender and case as well as the acquisition of verb marking. Although the acquisition of plural marking in German has been studied extensively, we will exclude it from this summary, since it is not part of our study in chapter 3 of this thesis. For typically developing children, acquiring the German plural means learning how a word changes when the plural is formed, i.e. how the plural is marked (e.g. by means of the Umlaut in *Baum* ('tree.SG') vs. *Bäume* ('tree.PL'), by use of the morpheme *-e* in *Tier* ('animal.SG') vs. *Tiere* ('animal.PL'), and by the 0-morpheme in *Messer* ('knife.SG') vs. *Messer* ('knife.PL'). In order to do so, they need to operate with eight rules, which are based on gender as well as the sound structure of words (cf. Szagun 2006: 90ff.). In contrast, children like Lennart, the subject of our study, who use a speech-generating device, only have to push a button, and the device will generate the relevant plural form on its own. Therefore, these children do not have to operate with the eight possible rules of German plural formation.

In what follows, I will primarily refer to Gisela Szagun's data derived from the Oldenburg Corpus. The Oldenburg Corpus is a cross-sectional study of the acquisition of language by 22 children that was completed in 2004 and is, therefore, the most current and most extensive study of its kind in the German-speaking world.

2.1.4.1 The acquisition of gender

Analyzing the language data of 6 children between 1;4 and 3;8 from the Oldenburg corpus, Szagun found that articles inflected for gender emerge at 1;6. Starting at age 3;0, children correctly inflect both the definite article (*der* 'the.MASC', *die* 'the.FEM', *das* 'the.NEUT') and the indefinite article (*ein* 'a.MASC/NEUT', *eine* 'a.FEM') for gender in almost 90% of all cases. Szagun (2006: 76) attributes the swiftness and relative ease with which children acquire gender to their use of information from the sound structure of words because for the vast majority of German nouns, gender assignment is arbitrary and not semantically motivated, i.e. gender is not determined by the word's meaning. For nouns ending in the following suffixes, gender assignment is probabilistic:

- multisyllabic nouns that end in *-e* are predominantly feminine
- multisyllabic nouns that end in *-el*, *-en*, or *-er* tend to be masculine
- monosyllabic nouns that start and/or end with one or more consonants tend to be masculine

For the following suffixes, gender assignment is deterministic, i.e. the rule is always observed:

- nouns ending in the suffixes *-keit*, *-heit*, and *-ung* are always feminine
- nouns ending in the suffixes *-chen* and *-lein* are always neuter
- nouns ending in the suffixes *-ist* and *-ling* are always masculine

The claim that children use the sound structure of nouns to determine their gender is supported by the finding that children make fewer errors with nouns whose gender abides by the rules. On the other hand, children tend to regularize gender assignment for monosyllabic nouns. Thus errors like **der Pferd* ('the.MASC horse'), **der Holz* ('the.MASC wood'), **der Haus* ('the.MASC house') are more frequent than errors like **die Pferd* ('the.FEM horse'), **die Holz* ('the.FEM wood'), **die Haus* ('the.FEM house').

2.1.4.2 The acquisition of case

Szagun's analysis further shows that the majority of the six children of the Oldenburg corpus use the Nominative and the Accusative, as marked on articles, and occasionally even the Dative case, as early as at the age of 2;0. The Nominative is the most frequent case, followed by the Accusative and the Dative:

With regard to children's initial use of case marking, there is no use in saying that the Nominative is acquired before the Accusative and the Accusative before the Dative, since all three of them occur in child speech from early on and more or less correctly.

Regarding the degree to which case is also marked correctly, however, Szagun notices that the Nominative is used in a target-like manner earlier than the Accusative is, and the Accusative earlier than the Dative. Moreover, the (in)definiteness of the article is intricately related to the acquisition of gender, such that the definite and indefinite articles differ in the degree to which they are used correctly. First, the Nominative is mastered (90% correct) in the definite and indefinite paradigms, followed by the definite article in the Accusative, while the indefinite article is still used erroneously in the Accusative case. The Dative is marked correctly only 50% of the time and therefore shows a highest error rate.

The most frequent errors are the use of *ein* ('a.NOM') rather than *einen* ('a.ACC') for the indefinite article in the Accusative case and *den* ('the.ACC') instead of *dem* ('the.DAT') for the definite article in the Dative case.

Szagun (2006) suggests that children use the Accusative form *den* ('the.ACC') in Dative contexts because the forms *den* ('the.ACC') and *dem* ('the.DAT') are hard to distinguish. In contrast, there are by far fewer errors in the feminine paradigm (e.g. use of *die* 'the.FEM.ACC' for *der* 'the.FEM.DAT'). The error with the indefinite article in the Accusative (i.e. use of *ein* 'a.MASC.NOM' rather than *einen* 'a.MASC.ACC') may be similar to that with the definite article.

2.1.4.3 The acquisition of verb inflection

The acquisition of verb inflection, at least as far as person marking in the present tense is concerned, does not present any major difficulty for children (cf. Szagun 2006: 76).

Children start out by using the infinitive or an infinitive-like form ending in *-e*, like *setze* ('set, sit'), or merely the verb stem. (Szagun 2006: 76)

A few months later, erroneous forms occur only occasionally, and soon the correct forms are used 90% of the time (ibid.)

Tense marking in the form of (bare) perfective participles likewise occurs early on, occasionally as early as in the two-word phase. Subsequently, forms of *haben* ('have') and *sein* ('be') used as auxiliaries merge with those participles.

The earliest perfective participle forms are often used without the prefix *ge-*, as in *finden* '(have) found' [target form: *gefunden*, LJ] or *macht* '(have) done' [target form: *gemacht*, LJ]. (Szagun 2006: 76)

While the rate of omission of the prefix *ge-* soon declines considerably, other errors continue to persist, even if at low rates, such as erroneous or missing suffixes on the participial form, as in *gemach* 'done' [target form: *gemacht*], *aufgegesst* 'eaten up' [*aufgegessen*], and *rausgegangen* 'gone out' [*rausgegangen*], or combinations of errors involving suffixes, vowel changes, and prefixes, as in *getrinkt* 'drunk' [*getrunken*], *funde* 'found' [*gefunden*], *eingesteigt* 'stepped in, boarded' [*eingestiegen*]. By age 3, these errors decrease to a level of approximately 10% or below (cf. Szagun 2006: 77).

Imperfective forms of main verbs are rare; yet those of modal verbs and of *sein* and *haben*, including *war* 'was,' *wollte* 'wanted,' *sollte* 'should, was (expected) to,' and *hatte* 'had,' are frequent. This correlates with the use of the Perfect and the Imperfect tenses in spoken adult German, where the Imperfect of main verbs is extremely rare (cf. Szagun 2006: 77).

As a final remark, Szagun assumes that a morphological marker has been mastered, when it is used correctly in 90% of cases.

2.1.5 Syntactic development

2.1.5.1 Syntactic characteristics of German

The syntax of German may be represented as a so-called topological field (see table below). In German main clauses, the finite (inflected) verb occurs in second position (V2). Non-finite verb forms, on the other hand, such as separable prefixes (particles) like *auf* 'up,' *ab* 'off,' or *zu* 'to,' infinitives, and participles, occur in verb-final position (VE). Together, the finite verb and the non-finite verb forms make up the so-called *Satzklammer* ('verbal bracket'). All syntactic constituents (with the exception of the finite verb) may occur in the *Vorfeld* ('prefield'), including subjects, objects, adverbs, and question pronouns. The position may also remain empty.

Main and subordinate clauses have asymmetrical verb positions in German: in main clauses, the inflected verb is in V2, while uninflected verb forms and verb particles are in the VE (final) position; in subordinate clauses, on the other hand, all verb forms occur in the VE (final) position. With conjunctions and relative pronouns in the V2 position of sub-ordinate clauses, the finite verb will surface in the right-hand verbal bracket.

Further particles like *nicht* ('not') and *auch* ('also') follow the finite verb in main clauses, but precede it in subordinate clauses.

Table 1 Diagram of the topological field (following Tracy 2008: 40)

	----- ↓	----- Satzklammer ----- (‘verbal bracket’)	----- ↓
Vorfeld (‘prefield’)	V2 (Verbzweit ‘verb- second’)	Mittelfeld (‘middle field’)	VE (Verbend ‘verb-final’)
Der Frosch (‘the frog’)	sass (‘sit.3SG.PST’)	unter einem Seerosenblatt. (‘under a water lily leaf’)	
Seit Tagen (‘for days’)	hatte (‘have.3SG.PST’)	er keine einzige Fliege (‘he not a single fly’)	gefangen. (‘catch.PSTPRT’)
Was (‘what’)	sollte (‘shall.3SG.PST’)	er nur (‘he only’)	machen? (‘do.INF’)
Ich (‘I’)	gebe (‘give.1SG.PRS’)	die Hoffnung nicht (‘(the) hope not’)	auf, (‘up’)
	dachte (‘think.3SG.PST’)	er schliesslich. (‘he finally’)	
Eine Prinzessin (‘A princess’)	küsse (‘kiss.1SG.PRS’)	ich nur im Notfall, (‘I only in an emergency’)	
	conjunction or relative pronoun		
	Wenn (‘if’)	es keine Alternative mehr (‘it no alternative any more’)	gibt. (‘give.3SG.PRS’)

2.1.5.2 Milestones in the acquisition of syntax

Children’s syntactic development between the onset of language and the age of four can be observed to proceed in a certain order of developmental stages. Tracy (2008: 77ff.) distinguishes the following four major milestones in children’s developing syntax:

- I. **ca. 1;0 – 1;6 Single-word utterances** (especially nouns and particles):
da ‘there,’ *nein* ‘no,’ *weg* ‘away,’ *ab* ‘off’ etc.
- II. **ca. 1;6 – 2;0 Basic word combinations**
(initially two and subsequently more words, including verbs (infinitives) and verb particles; many syntactic categories (especially articles, preposition, question words etc.) still absent):
Tür auf ‘door open,’ *Mama Bus fahren* ‘Mommie bus go,’ *Mama auch Bus* ‘Mommie also bus’
- III. **ca. 2;0 – 3;0 Simple, complete sentences**
(target-like word order; but also continuing use of structures like those in stage II):
Jetzt geh ich hoch. ‘I am going up now.’ *Da kommt Ball rein.* ‘Ball goes in there.’ *Wo kann der hingehen?* ‘Where might he/it go?’
- IV. **ca. 3;0 4;0 Complex sentences**
(including subordinate clauses, with the inflected verb in the final (VE) position; most syntactic categories available):

Ich warte, bis der Hund wegegangen ist. ‘I’ll wait until the dog has disappeared.’

These milestones cannot always be clearly distinguished from each other, and some researchers assume that stages I and II may coincide. Moreover, the age specifications are only approximate (cf. Tracy 2008: 86f.).

In children’s early utterances, verbs occur in uninflected form in sentence-final position. With the acquisition of subject-verb agreement, main verbs move into the V2 position, and children enter stage III. According to Szagun (2006), Grimm & Weinert (2002), and Tracy (2008), this step—moving the verb into V2—is the major benchmark in children’s acquisition of German syntax. Children now use the word order Subject-Verb-Object in a target-like manner, and soon after they are able to produce sentences with derived word orders, such as questions and requests (cf. Szagun 2006: 77ff., Grimm & Weinert 2002: 533, Tracy 2008: 80f.). Further, auxiliaries (*haben* ‘have’ and *sein* ‘be’) and modals (*müssen* ‘must,’ *können* ‘can’ etc.) may likewise occur in the V2 position (cf. Tracy 2008: 84).

The major accomplishment in stage IV is the use of subordinate clauses (‘hypotaxis’). Conjunctions, and later relative pronouns, occur in the left verbal bracket, while the verb will appear in the right verbal bracket (Tracy 2008: 84). In fact, producing subordinate clauses [with the finite verb in clause-final position, LJ] does not require children to abandon the structural format of their early utterances (cf. Tracy 2008: 84). This may explain why children make hardly any word order errors in subordinate clauses, as Szagun (2006: 79) points out.

Experts generally agree that children’s utterances are rule-based from early on, even though children are not consciously aware of the rules they are using (see especially Grimm & Weinert 2002: 531). Hence, child utterances not only have a semantic basis but also follow formal syntactic principles, as our illustration of the semantic categories in two-word utterances that we provided in the previous chapter already suggested (cf. also Szagun 2006: 68f., Grimm & Weinert 2002: 532). Moreover, the final position prevails among the (yet uninflected) verbs in children’s two-word utterances (cf. Szagun 2006: 70). Further, children typically adhere to certain word order constraints. Thus they never say “*gross das*” ‘big the.NEUT’ or “*schön die*” ‘pretty the.FEM,’ even though they would say things like “*grosser Hund*” ‘big.MASC dog’ and “*schönes Mädi*” ‘pretty.NEUT girl’ (cf. Grimm & Weinert 2002: 523). This means that children are sensitive to the formal structural principles of language and must already have acquired a grasp of the formal-grammatical characteristics of their transient language (cf. *ibid.*).

On the other hand, certain constituents are missing from children’s early utterances:

Even after children have essentially mastered the structure of simple sentences in German, their utterances often continue to lack certain closed-class elements, e.g. relative pronouns [and] conjunctions. (Tracy 2008: 91)

But also articles, modal verbs, prepositions, and subjects as well as inflectional morphology are systematically missing (cf. *ibid.*, Grimm & Weinert 2002: 532).

Although children already have an understanding of the word order rules, they do not yet have the same abstract syntactic schemas that adults have. As Szagun (2006: 109ff.), following a study by Tomasello & Brooks (1998), shows, children almost exclusively use new verbs in the same construction in which they encountered them. For example, children use the transitive (subject-verb-object) and intransitive (subject-verb) constructions only in connection with

particular lexical items. Thus certain verbs form the core around which children extend the pattern in a piecemeal fashion.

Wittek & Tomasello (2005, cited in Szagun 2006: 112) made similar observations for active and passive constructions as well as for nouns:

Children below the age of three will use a new noun that they encountered as Accusative in one sentence—functioning either as a direct object or as a prepositional object—in a sentence of the same type, rather than in a sentence in which this noun would be Nominative. The same goes for the Dative case.” (Szagun 2006: 112)

With increasing age, children are able to use more and more verbs and nouns independently of the type of sentence construction that they originally encountered them in.

2.2 Language development in physically handicapped children without speech

The central question of this thesis is what progress in language production a five-year old boy with Cerebral Palsy and severe Dysarthria can make within a year regarding his morphological and syntactic development. In order to pursue this research question in chapter 3 of this thesis, we will now lay further theoretical groundwork and investigate what is already known about processes of language development in children lacking speech as well as whether and how preconditions for language acquisition differ in these children. Moreover, we will provide a review of the current state of knowledge of how morphosyntax develops in these cases.

2.2.1 Children with Cerebral Palsy and severe Dysarthria / Anarthria

Some physical handicaps and cognitive impairments such as cerebral ataxia, acquired brain damage, autism spectrum disorders, or degenerative diseases may result in compromised or absent speech. This thesis focuses on children with (severe) infantile cerebral ataxia—cerebral palsy (CP)—and severe dysarthria/anarthria. On the one hand, these make up a large proportion of the children who depend on AAC. On the other hand, the subject of our case study to be presented in the third part of this thesis represents precisely this group.

According to Hinum (1995: 14), CP is a sensorimotor impairment that results from pre-, peri-, or postnatal brain damage and may lead to loss of motor control with clinical symptoms in the areas of spasticity, athetosis, and ataxia. The term ‘sensorimotor impairment,’ in turn, refers to “an abnormal regulation of muscle tension (muscle tone) and of the coordination between muscle groups” (Köster & Schwager 1999: 12).

Dysarthria or anarthria may accompany CP “when, due to the motor impairment, the muscle tone and the coordination of motion sequences in the pectoral girdle, the arms, the neck, the face, and the mouth area is altered” (Köster & Schwager 1999: 15). According to Oskamp (2002: 36), dysarthria refers to a speech disorder caused in the central motor system that impedes speech, potentially up to the point that it becomes unrecognizable, while the language capacity itself is not affected.

Cases of the most severe form of dysarthria, when speech production is altogether impossible, are often called ‘anarthria’ in special education contexts (cf. Köster & Schwager 1999: 16). However, Oskamp (2002: 36) points out that the term ‘anarthria’ in its clinical use

refers to “the loss of language as the final stage of degenerative diseases of the brain.” In this thesis, we are using the term ‘anarthria’ the way it is used in the context of special education.

2.2.2 Theoretical considerations

Researchers in the German- as well as English-speaking context have repeatedly wondered whether children whose ability to articulate speech sounds is severely impaired and who depend on AAC follow typical or deviant language acquisition profiles (cf. Bedrosian 1997: 181f., Gerber & Kraat 1992). With the research findings available today, this is still an open question. Therefore, it is critical, as Gerber & Kraat (1992) demand, to be open to both possibilities. On the other hand, it should be assumed, until empirical evidence has proven the contrary, that the underlying developmental principles are the same (cf. Hinum 1994: 123, Boenisch & Engel 2002:52).

But because of physical handicap and the absence of speech resulting from it, on the one hand, and because of the use of alternative and/or augmentative forms of communication (like, for example, gestures, communication boards, and speech-generating devices), on the other hand (cf. e.g. Lund & Light 2003: 1110, Sutton, Soto & Blockberger 2002, Blockberger & Sutton 2003, Binger & Light 2008: 123) we should suspect that special conditions and circumstances apply to the acquisition of language in this case. Boenisch (2009: 48) remarks that language development in a child without speech may indeed be facilitated by the use of alternative or augmentative forms of communication, but nonetheless the interplay of the various conditions for language acquisition remain extremely complex.

There are intrinsic factors, like the child’s cognitive development, general development, motor skills, intelligibility of speech, impairments in the development of receptive and/or productive language, and environmental factors such as input and parent-child interaction that influence the process of language acquisition.

There are further specific factors that may have an impact on language acquisition in children lacking speech and using augmentative and alternative communication. These extrinsic factors may include (cf. Binger & Light 2008: 132): the nature of the communication system; efforts to accelerate the communication process; the communication partner’s co-construction processes (cf. Bedrosian 1997: 185, Binger & Light 2007: 30, Binger & Light 2008: 132, Blockberger & Johnston 2003, Lund & Light 2003, Sutton et al. 2003); the vocabulary range available to the child (cf. Boenisch, Musketa & Sachse 2007, Sutton et al. 2002: 198, Andres, Guelden & Stahl 2007); opportunities for (true) communication; the time span that a form of AAC is available to the child; and the type, duration and length of previous intervention efforts.

In the further course of this thesis, we will first present the distinct underlying conditions for language development and then move on to discuss additional, extrinsic factors that might influence the developmental process, based on current research findings.

2.2.3 Motor impairments and their impact on language development

A child’s linguistic development is closely connected to her achievements in physical-motor development and cognitive development as well as her accomplishments in sensory integration that are built on them. Thanks to her achievements in motor development and coordination, the infant is able to gradually conquer space by crawling and walking and to explore and manipulate

objects. This affords her a multitude of experiences in visual, auditory, kinesthetic, tactile, gustatory, vestibular, and olfactory perception.

The triadic eye gaze, which Zollinger (1996: ch. 2.1ff.) considers the basic prerequisite for language acquisition, is a particularly important achievement. It enables the child to tend to an object as well as another person and to interact with the other person about the object. In this context, the child learns what actions may be carried out with the object and how the other person labels it. This way, the child discovers “in the context of recurring actions ... that particular words or sentences are used in those situations and these have particular meanings” (Zollinger 1996: ch. 2.23).

These basic sensorimotor skills are an important prerequisite for developing lexical comprehension skills and hence for constructing a lexicon, which in turn advances grammatical development (see ch. 2.1.3). If children are not able to make these basic experiences, or only to a limited extent, because they are physically handicapped (cf. Boenisch 2009: 40), this will most likely impede language acquisition.

This hypothesis is supported by a study on lexical acquisition in physically handicapped and non-handicapped children that Boenisch, Musketa & Sachse conducted between 2003 and 2006 (cf. Boenisch et al. 2007, Boenisch & Sachse 2007). For this study, 46 physically handicapped and 25 non-handicapped children between the ages of 2;3 and 7;7 were videotaped while engaged in pre-structured play and similar play situations, and their language was transcribed (cf. Boenisch, Musketa & Sachse 2007: 361, Boenisch & Sachse 2007: 14).

The analysis of the data revealed largely identical results regarding word formation and use (cf. Boenisch, Musketa & Sachse 2007: 365). Yet at the same time, there were also some clear differences in language use between the physically handicapped and non-handicapped children:

To illustrate, the total of words produced in a timeframe of 30 minutes was on average 30% to 45% lower in the physically handicapped children (N=44, Ø 653 words) than in the non-handicapped children (N=22, Ø 910 words). (Boenisch 2009: 31)

Moreover, certain building blocks of language such as prepositions and adverbs were clearly underrepresented in the language of the handicapped children compared to that of the non-handicapped children (cf. Boenisch, Musketa & Sachse 2007: 365).

The data analysis further shows that the linguistic development of physically handicapped children and that of non-handicapped children diverges in the further course of development. While the MLU at 30 months is approximately four words per utterance in both groups alike, the MLU of the handicapped children then stagnates or even decreases, yet in non-handicapped children it rises to more than seven words per utterance at age 5 (cf. Boenisch 2002: 32f., following Musketa 2007: 55ff.). Similarly, physically handicapped children will on average use 30 % fewer prepositions in the course of language acquisition than their non-handicapped peers, despite almost identical findings at the outset (cf. Boenisch 2009: 32).

If the articulation of sounds is also compromised due to the cerebral motor impairment, additional challenges in language acquisition are likely to occur. For example, Boenisch (2009: 33, following 2007: 57) observes in the above mentioned study that children with cerebral motor impairment and speech disorders produce yet fewer words than children with Spina bifida not affected by impairments in the articulation of sounds.

Moreover, in children with Dysarthria/Anarthria, the range of available speech sounds is limited, and the production of strings of sounds is challenged. Thus it's not only basic motor and sensory experiences that are affected, but these children also have fewer or even hardly any opportunities for spatial and tactile-kinesthetic experiences with the articulators in their own mouths (Boenisch, Musketa & Sachse 2007: 360). In addition, involuntary sounds as well as pathologically conditioned distortions and delays in the articulation of speech sounds may occur and hence alter conditions in the child's interaction with her environment.

2.2.4 Altered conditions in child-caregiver interaction and their impact on language development

The communication between parents or caregivers and the child is a circular process that involves "consistent physical and verbal responses from the child towards the parents, the parents' affirmation of meaning towards the child, and corrective feedback, embedded in a linguistically meaningful interaction" (Boenisch 2009: 25). If this circular process is compromised, it will have an impact not only on the child's understanding "of the power and function of language" (Boenisch 2009: 25), but also on the caregivers' ability to find possible reference points in the child's utterances (cf. Konrad 2002: 49). Parents of children with cerebral motor impairment can hardly rely on their child's facial expression, gestures, and body tension for an indication in how far the child has processed some given information and has understood the course of action (cf. Konrad 2002: 50). Therefore, it is very difficult for parents and caregivers of affected children to provide fine-tuned and motivating learning situations. Papousek (1994: 172) assumes that parents intuitively adapt their linguistic input in such a way that it tends to be one step ahead of the child's productive capabilities and may thus serve as a scaffold, motivation, and model for learning new structures. Yet in order to do that, parents need a sufficient number of reference points from their child to guide them.

In many cases, corrective feedback is likewise limited (cf. Boenisch 2009: 47). In the typical course of language acquisition, child utterances are continuously and casually corrected with regard to lexicon and grammar. However, that is not possible in the case of the children we are focusing on here, or only to a very limited extent, because their ability to express themselves is limited. Moreover, it is very hard to assess the level of language development in these children, and therefore it is only marginally possible to diagnose and treat potential deficits. What's even worse in this connection are frequent misjudgments regarding the cognitive development of these children. The level of cognitive development in children lacking speech due to severe motor impairments is often underestimated. This is also evident in the study 'On the situation of children and adolescents lacking speech in German schools with a remedial focus on physical and motor development,' which Boenisch conducted between 2001 and 2002. Boenisch found that "82% of the teachers place students lacking speech in classes for the mentally handicapped, 10% in those for students with learning disabilities, and only 3% into mainstream education classes" (Boenisch 2009: 128, cf. also Boenisch 2003: 22). Thus what stands out is that the frequency with which students with Dysarthria/Anarthria are considered to be mentally handicapped is exceptionally high, while placement into mainstream education is remarkably rare (cf. *ibid.*).

To summarize, children lacking speech have fewer opportunities to gather experience with language, since maintaining not only interaction in general, but also an interest in engaging

with language is considerably more difficult in these children because of the conditions we just discussed (cf. Konrad 2002: 52).

In what follows, we will discuss the morphological and syntactic development of children lacking speech, based on current research findings, and identify factors that impact the developmental process in these children. As a further step, the results are meant to serve as a basis for recommendations for effective intervention for language and communication.

2.2.5 Current state of knowledge regarding the grammatical development of children using AAC

2.2.5.1 Research on Augmentative and Alternative Communication

Augmentative and Alternative Communication is a rather young scholarly field. According to Binger & Light (2008: 124), studies and empirical analyses dedicated to topics in AAC first emerged in the Anglo-American literature around 1985. In the German-speaking world, however, the earliest empirical studies did not appear until around 2000 because up until then “AAC was either disregarded entirely in academia ... or did not receive sufficient attention as a field of research ...,” as Boenisch (2009: 70) remarks. The reason for this delay might be that in Germany, in contrast to the Anglo-American world, AAC was primarily introduced and advanced by dedicated professionals such as remedial and special education teachers, and occupational therapists. For a long time, therefore, AAC had to rely on the experiences of individual practitioners (cf. Boenisch 2008: 452) and was primarily considered an intervention process (cf. von Tetzchner 2008: 26). The field is currently undergoing a paradigm shift toward professionalizing and establishing AAC as a scholarly discipline. As a consequence, more and more research findings from empirical studies are being documented in the German-speaking context as well, for example the above mentioned study by Boenisch, Musketa & Sachse (2007), or a study on the situation of children lacking speech in German schools (Boenisch 2008, 2009) as well as a study on literacy development in children with Cerebral Palsy using AAC (Thiele 2007).

A look at the current state of knowledge about individuals without speech regarding language acquisition in general and morphosyntactic development in particular reveals that there are relatively few empirical studies, compared to other fields of research. In their research review on the topic “Morphology and syntax of individuals who use AAC,” Binger & Light (2008: 132) had to resort to 31 studies, for example. Moreover, their research review is the first and only to date on this topic.

It is not only the limited number of available studies that makes it difficult to draw general conclusions from the research findings. As Binger & Light (2008: 132) remark, many studies have “relatively low values of evidence”:

Out of the 31 studies, 20 lacked any type of experimental control and reported only descriptive measures, and many of the studies that included individuals who used AAC had very few participants.” (Binger & Light 2008: 132)

Moreover, the participants were very heterogeneous, which makes the results of those studies incomparable. For example, there were large differences in age, developmental stage, cognitive,

linguistic and motor skills, and clinical presentation of the handicap as well as the status of AAC intervention, the communication system used, and the commitment of the environment.

It is this heterogeneity of the group of individuals using AAC that is characteristic for AAC as a discipline. This heterogeneity makes it difficult to draw conclusions of general validity and therefore poses a great challenge, if not the greatest challenge, for the design of further research projects. Thus it is very difficult to recruit a larger group of subjects with comparable conditions, since the specific underlying conditions and paths of life of non-speaking individuals vary greatly. In addition, there are no standardized tests for assessing the linguistic and cognitive development of individuals with physical-motor impairment who lack speech. These aspects make it very difficult to produce significant results that are valid and reliable and to compare results. Therefore, it is crucial to gather and analyze more empirical data in order to provide further points for comparison and to expand the field of research. With this thesis, we aim to contribute to this goal.

2.2.5.2 Distinctive features in morphosyntactic development

As we already saw in the findings of the Boenisch, Musketa & Sachse (2007) study in chapter 2.2.3, children with physical-motor impairment differ in their linguistic development from non-impaired children. They generally speak less, form shorter utterances, use fewer prepositions, and lag behind in lexical development (cf. Boenisch 2009: 47). Comparing 31 studies on the acquisition of morphology and syntax in children using AAC, Binger & Light (2008: 131) also found difficulties with grammar: “although some individuals who use aided AAC demonstrated grammatical proficiency, many individuals had difficulties with receptive and expressive grammar” (see also Lund & Light 2003: 1111, Blockberger & Johnston 2003).

The results of a study by Blockberger & Johnston (2003)¹ showed that children who depend on AAC had greater difficulty recognizing and producing grammatical morphemes than the children in two control groups with the same level of language comprehension. The authors studied the acquisition of the English past tense *-ed*, possessive *-s*, and third person *-s* morphemes by 20 children using AAC, 20 normally developing children, and 15 children with a developmental delay in language acquisition, using a variety of tasks. The group of children using AAC performed worse than the two other groups in all three parts of the study.

Kelford-Smith et al. (1989, cited in Binger & Light 2008 and Blockberger & Johnston 2003) analyzed writing samples produced by 6 AAC users between 13 and 22 years of age. Although all participants showed functional face-to-face communication skills, Kelford-Smith et al. found errors and omissions in the use of morphological endings and function words in written communication.

To summarize, individuals who depend on AAC tend to communicate in short and incomplete utterances (cf. Binger & Light 2008: 131) and to omit morphological markers such as plural and tense morphemes and function words such as articles, prepositions, pronouns, adverbs etc. (cf. Blockberger & Johnston *ibid.*, Lund & Light 2003: 1110). Binger & Light (2007: 30) also found problems in the production of multi-word utterances and report that AAC users exceedingly frequently communicate via single-symbol utterances (Binger & Light 2007: 30, Blockberger & Johnston 2003: 208, Binger & Light 2008).

¹ ‘Grammatical morphology acquisition by children with complex communication needs’

Because of these characteristics, such utterances are also called telegraphic (cf. Blockberger & Johnston 2003: 208, Binger & Light 2008).

2.2.6 Suggested reasons for short and incomplete utterances

There are a number of possible reasons for why the language of individuals using AAC has the characteristics discussed above. It has been repeatedly pointed out in the literature that the telegraphic nature of an utterance may be a strategy to communicate more efficiently (cf. Binger & Light 2007: 30, Binger & Light 2008: 131, Blockberger & Johnston 2003: 208, Sutton et al. 2002), since communicating by means of a communication aid and other modes of communication is usually an effortful and slow process. The use of short telegraphic utterances then may accelerate the communication process and save time and energy (cf. Binger & Light 2007: 30, Binger & Light 2008: 131, Blockberger & Johnston 2003: 208, Sutton et al. 2002). Striving for a more efficient communication, moreover, individuals using AAC usually rely on their communication partner's co-construction efforts and incorporate them into their communication. Binger & Light (2007: 30) write that "the communication partner may use contextual knowledge about a child to expand the child's single symbol messages and infer the child's meaning." Thus using contextual information, communication partners expand those utterances and fill in syntactic structures and morphological markers (cf. Lund & Light 2003:1111).

Lund & Light (2003: 1111) summarize the situation as follows:

Individuals who use AAC are often faced with the dilemma of choosing between grammatical completeness and speed. Many AAC users elect to increase the rate of their communication by using telegraphic utterances. Although this fosters the rate of information transfer, it sacrifices completeness.

If this was the main reason, AAC users should not show any deficits in receptive skills and should not have any difficulties in situations that prompt them to produce complete and morphologically correct utterances, e.g. in written text production or in a grammatical test such as that of Blockberger & Johnston (see above). Since this is often not the case, as for example the studies by Blockberger & Johnston and Kelford-Smith show, there must be further factors that impact the acquisition process.

A major factor is the AAC system itself, which we are going to discuss in more detail in the next chapter.

Blockberger & Johnston (2003: 208) further assume:

The slow rate of AAC output interacting with working memory constraints or the difficulty writing with a physical impairment may lead to the unconscious omission of vulnerable forms such as grammatical morphemes (Kelford-Smith et al. 1989, Light & Lindsay 1991).

Moreover, the way in which communication partners act and how communicative situations unfold have a significant impact on the general course of language development. Communication partners influence and form the communicative situation not only by means of co-construction processes but also by way of their general (linguistic) behavior. If

communication partners ask questions that may be answered in a single word or with a simple ‘yes’ or ‘no,’ the child is not encouraged to produce and continuously practice multi-word or multi-symbol utterances (cf. Binger & Light 2007: 30).

In sum, both efforts to communicate more efficiently and the nature of the communicative situation seem to impact the child’s linguistic experience (cf. Blockberger 1997: 2008). Thus attention to grammatical structures (syntax and morphology) and experiences in producing morphological and syntactic structures play only a minor role.

2.2.7 Influence of the AAC system on the language acquisition process

It has been suggested that the communication system itself with its specific regularities may influence the language acquisition process:

The fact that graphic symbols are used for production while language acquisition is in progress raises three issues regarding their role during development. First, AAC language production is multimodal rather than mainly spoken; second, linguistic concepts are represented graphically rather than as spoken words; and third, the mismatch between modalities used for language input (speech) and language output (graphic symbols) may alter the acquisition process. (Sutton et al. 2002: 197)

The second issue in particular—that linguistic concepts are coded in graphic symbols—may be a major factor in language development, but it has not yet been sufficiently studied, so we can only speculate about its role. In addition, it is not only communication by means of a communication aid per se that leads to an asymmetry between input and output (see below), but also the manner in which linguistic structures and vocabulary are coded by the communication aid.

In this context, Binger & Light (2007: 30) and further Sutton et al. (2002) point to research by Smith (1996) and Sutton & Morford (1998) on non-impaired preschool children using AAC systems. It showed that normally developing children likewise tend to produce single-symbol utterances. In addition, their language displays “... relatively high rates of one particular word order difference—specifically, the use of object-verb structures—when using aided AAC” (Sutton et al. 2002, following Sutton & Morford 1998).

Whether morphological markers are available on the communication aid and may be manipulated by the user also influences grammatical development (cf. Blockberger & Johnston 2003: 208), since morphological and syntactic regularities are generally acquired by way of language use, i.e. by practice and numerous repetitions.

Further, the vocabulary available to the child through the communication aid plays a central role for language development, which we will discuss in the next chapter.

Another factor entailed by the communication system that is assumed to have an influence on language development is the input-output asymmetry (cf. Binger & Light 2007:31, Binger & Light 2008: 132, Lund & Light 2003: 1110). Children who depend on AAC receive their linguistic input primarily via spoken language, but produce utterances via a multimodal communication system (gaze, facial expression, bodily gestures, communication boards, speech-generating devices, and signs). This creates an asymmetry between input and output. Even if parents or caregivers provide a model, i.e. use the child’s communication aid in everyday life and naturally occurring situations and thus serve as an example, the majority of the linguistic input nonetheless consists of spoken language (cf. Binger & Light 2007: 31).

In typical language development, children acquire grammatical regularities implicitly, which means that they are not consciously aware of the rules they are following. Sutton et al. (2002: 198) wonder whether this is also the case with children who depend on AAC or whether the processes are more overt:

However, it is not known whether the same unconscious, internalized processes would guide their use, even when grammatical morphemes are fully available on graphic symbol displays. Rather, it seems that selecting these elements from the available array would require overt, intentional processes, although a high level of automaticity may develop over time. If device programming adds grammatical elements to the vocabulary items selected, it is not clear how the user would develop the skills to control and manipulate them. (Sutton et al. 2002: 198)

2.2.8 Factors that aid language acquisition

We assume that, just like in normal language acquisition, internal factors like the child's general and cognitive development, intelligence, language comprehension, and motor and articulation skills influence language acquisition. The better or stronger they are, the more favorable the preconditions for language acquisition. Moreover, Blockberger & Johnston (2003: 209) just like Sutton et al. (2002: 196) assume that good language comprehension skills promote language development and that AAC users may acquire morphology on the basis of receptive language skills alone. In addition, there are external factors that influence and may benefit the process of language development.

Tracy (2008: 9) emphasizes that children acquire language incidentally: "They need interested, interesting, and sensitive communication partners, not a drill, no identical repetitions, corrections or requests to speak in full sentences." Hence what will promote language acquisition are communicative situations in which children using AAC will be able to gather manifold receptive and productive experiences with language, especially with its syntactic and morphological regularities. Further positive effects are achieved when, for example, the non-speaking individual is prompted to produce more complex utterances by open-ended questions, when language is offered in its full complexity, when a communication aid is continuously available, when the communication partner provides a model (see below), and when communication is part of natural and everyday situations or arises from such. In this connection, Bedrosian (1997: 183f.) mentions the positive effect of jointly reading picture books: "Through joint participation in storybook reading, adults provide children with opportunities to learn/use vocabulary ..., linguistic structures ..., and discourse skills ..." (Bedrosian 1997: 183).

Positive effects on language acquisition are also achieved when intervention efforts for language and communication start as early as possible. Ideally, children unable to produce speech should receive communication aids and intervention at the point when normally developing children start acquiring language. This will prevent that valuable time is lost and will ensure that children in need are able to gather successful and engaging experiences with/in communicative situations and to experience the power of communication and language from early on. Early intervention will also decrease the risk that, frustrated by unsuccessful communication attempts, children gradually withdraw.

Further, the early use of speech-generating devices, opportunities to experiment with grammatical morphemes, and access to core vocabulary have a positive influence on the language acquisition process.

2.2.9 Consequences for successful intervention efforts

As we already saw, intervention for language and communication plays a central role in the process of language acquisition in children lacking speech. Therefore, the goal of successful intervention should be not only the ability to communicate but also the promotion of language development and linguistic skills. After all, these are the key to education and social participation, as Sachse (2009: 111f.) emphasizes.

Based on the factors beneficial to the acquisition process that we discussed in the above chapter, we will now discuss selected aspects of successful intervention.

A central issue is the available vocabulary range. In the case of children using AAC it is not the child but the environment, in particular those who plan and conduct the intervention process, that decides which words are available to the child (cf. Anders, Gülden & Stahl 2007: 174). Therefore, the choice of words and the organization of the lexicon need to be considered very carefully. It is crucial for language development which words the available lexicon consists of, since the child will only be able to acquire more complex linguistic structures if “small words” are available as well (e.g. prepositions, function words, articles, pronouns, question words, adverbs, and adjectives). Children lacking speech should have access to the core vocabulary of their native language from the outset of language development. According to Sachse (2009: 109), the core vocabulary of a language consists of the 200-300 words that are used most frequently, independently of context, and make up ca. 80% of what is said. At this point, we can only refer the reader to further discussions of the significance of core and marginal vocabulary in Boenisch, Musketa & Sachse (2007), Boenisch & Sachse (2007), and Sachse (2007) and the work of Andres, Gülden & Stahl (2007) regarding the development of the target vocabulary. For reasons of space, we will not discuss these aspects any further here.

Moreover, the organization of the vocabulary on the communication aid likewise needs to be considered very carefully and designed in such a way that it will grow along over the years but will nonetheless remain clearly organized and allow motor-physical automation. Motor-physical automation means that the positions or the spatial organization of the words on the communication aid is retained as part of a motion sequence and words may be retrieved automatically, similar to typing on a computer keyboard or switching gears when driving a car with manual transmission. The Cologne Communication Materials, which Boenisch & Sachse designed on the basis of the vocabulary study already discussed and continuously refined over the past two years, offer an example for such vocabulary organization.

In order for intervention efforts to be successful, it is important to establish an intervention plan that includes long-term goals, e.g. the development of a target vocabulary, but also short-term goals, e.g. the use of certain words in everyday situations. The planning and implementation of the intervention should be accompanied by detailed documentation and evaluation in order to illustrate progress and revise less successful steps. Detailed documentation is particularly important in cases where the team providing therapy and care for an AAC user changes. This way, the long-term intervention goals may be continued effectively. Moreover, the closer the team around a child works together, the more successful the intervention will be. This is particularly important when a complex electronic communication device is used.

What has proven particularly effective for language development is modeling, which means that caregivers use the communication aid along with the child in everyday situations and thus serve as a model and guide for the child to gradually learn how to use the communication aid. Modeling also helps reduce the input-output-asymmetry, since the child receives input not only in the form of spoken language but also via the communication aid.

2.2.10 Complex electronic speech-generating devices

As we already indicated, complex electronic speech-generating devices play a significant role for language development in children lacking speech. It is only by use of such a device that language production becomes possible to begin with and is supported in an optimal manner.

These devices enable users to reduce their dependence on the co-construction processes and thus the efforts and skills of their communication partners (cf. Boenisch & Sachse 2008: 8.1). Moreover, they enable users to communicate with less familiar communication partners, conversations may take place across spatial distances, and users will learn to express their own thoughts without the help of others, which in turn supports a more active and independent role in communication. By using a speech-generating device, users may influence the course of a conversation more easily and have more opportunities to take the lead in a conversation and to enter a conversation spontaneously (cf. *ibid.*).

Another advantage of speech-generating devices is that users may receive auditory feedback upon manipulating the device. It is important for the development of language and for grammatical structures in particular that children have the opportunity to experiment with words and their (morphological) endings and tense forms (cf. Sachse 2009: 117) and to receive immediate feedback. As a result, AAC users may correct themselves, or their environment may provide corrective feedback.

Moreover, electronic aids offer a variety of access tools, so that even for individuals with severe motor impairments, as in the case of the subject of our study, an appropriate access method may be found, e.g. via scanning processes, eye gaze, or a head mouse².

Despite all these advantages, it is important to point out that the communication aid alone does not necessarily have a positive impact on language development. Only targeted and long-term intervention planning (see above) that comprises all areas of the child's life if possible, including school, home, and therapy, will ensure success. In addition, people in the child's environment need to study the aid system and to service and maintain the device, e.g. add new words to it.

2.2.11 Specifications for complex speech-generating devices

We can derive several recommendations from the previous chapters for specifications that complex electronic speech-generating devices should fulfill in order to support language development to the best possible extent.

To begin with, this concerns the choice and organization of the vocabulary, as discussed above. Especially in the context of a complex speech-generating device it is necessary to ensure that the vocabulary remains well-organized. Complex aids usually store between 2000 and 3000

² Access via a head mouse is similar to access via an eye-controlled mouse, except that the camera doesn't track the pupils but a reflector attached to the forehead.

words, which should therefore be accessible in a logical manner. Words should also be organized in such a way that, despite the size of the lexicon, it makes motor automation processes possible.

Next, it is also important that the device and the application software installed on it make all morphemes available to the child and enable her to experiment with them freely (cf. chapter 2.2.7). The device should also provide access to written language, so that the child may gather early experiences with literacy.

Another specification is quick access to the selected word or statement. When discussing possible reasons for AAC users' telegraphic utterances in chapters 2.2.5 and 2.2.6 above, we found that saving time and energy plays a significant role in the generating of statements. Therefore, we assume that the fewer buttons/fields need to be activated, the more attention children pay toward complete utterances. A faster generation of utterances may also increase (spontaneous) participation in communication in general and this way provide more exposure to and experience with language.

Language acquisition is the acquisition of linguistic structures. If we assume that a child gradually and independently discovers the regularities of her language while immersed in it, as we discussed in chapter 2.1, then it would be beneficial for the linguistic development of a child who lacks speech if the communication aid made such independent discovery possible. This does not mean that the child a priori 'explores' the device on her own. But instead there should be a self-generating application software that is designed in such a way that it would allow the child or user, once she gathered sufficient experience with the system and its parts, to discover further regularities in this area on her own.

At this point, we are not going to discuss the different types of communication systems and aids. Instead, the reader is referred to the work of Boenisch & Sachse (2008: 8.1ff.) and Bünk, Sesterhenn & Liesen (2003: 248ff.). We will only point out that communication aids based on the Minspeak strategy (see chapter 3.2 below) largely fulfill the specifications we just discussed.

3. The study

3.1 The subject: Lennart

At the beginning of data collection (October 5, 2008 through September 25, 2009), Lennart was 5 years and 6 months old and attended an inclusive preschool. In August 2009, he entered the first grade of a mainstream elementary school, where he has since been instructed in the mainstream curriculum.³ Due to infantile cerebral palsy, Lennart suffers from spastic quadriplegia and dysarthria/anarthria (cf. chapter 2.1). In an adequate sitting posture (when the torso is sufficiently supported), he can control his head movements in such a way that he is able to use a head mouse to directly access a speech-generating device. With the help of a control in the head rest, he is also able to independently operate his electric wheelchair. However, Lennart cannot form any words or meaningful strings of speech sounds that would be intelligible to anyone around him, not even the people closest to him.

According to his mother, Lennart has received AAC intervention, coordinated by the occupational therapist, since his fourth year of life. Lennart's family is very committed and aims to support him in his communication and to provide him with appropriate aids.

In addition to his speech-generating device, Lennart uses a range of forms of unaided AAC. He communicates multi-modally using unambiguous eye movements for 'yes' and 'no' as well as facial expressions. Moreover, he uses a communication board with 25 PCS symbols and has been learning the head alphabet since November/December 2008.⁴ By the summer of 2009, Lennart was able to reliably indicate word-initial sounds using the head alphabet, and he made increasingly use of it during communication.

Before Lennart started using an ECO device with the Minspeak application software Wortstrategie 84, he used a comparable device (SmallTalker) with the Minspeak application software Quasselkiste 45. This was a test phase, so to speak, meant to find an appropriate and practical access method for Lennart.

3.2 Device and strategy

The ECO device is a complex speech-generating device with a dynamic user interface and Minspeak coding. The strategy behind Minspeak is the following: Each word is generated by a combination of two to three icons (graphic symbols). These sequences of icons need to be memorized, aided by associations and mnemonic devices. Thanks to this coding strategy, words that are not easily represented visually, like articles, function words, prepositions, adverbs, or verbs, can be represented as well. The user can consistently operate from the same interface, which grants him/her a better spatial orientation and hence easier motor automation (cf. chapter 2.2.9.1). The taskbar provided by the dynamic display makes it possible to easily create and

³ In Germany, children enter elementary school at the 1st grade, rather than in kindergarten, as in the U.S. Thus they start their primary education at the age of 6 or 7, rather than 5 or 6. This explains why Lennart was still in preschool at the age of 5;6 and even 6. [LJ]

⁴ The head alphabet system represents all letters of the (German) alphabet using two head and eye gaze directions. All letters are assigned to one of 6x6 fields, starting with A in the upper right-hand corner (from the perspective of the non-speaking communication partner). The first head movement selects the field and the second head movement the position within the field in which the letter is located. The movements follow the order upper right, upper center, upper left, lower right, lower center, lower left.

retrieve new pages with vocabulary on such topics as food, school, leisure activities, and other interests.

The Minspeak application software Wortstrategie 84 allows Lennart to access a total of 2400 words, among them 300 “small” words, ca. 350 verbs, and 300 adjectives. It also enables him to express morphological markers. This is possible through grammar keys, which are arranged in two rows above the image icons and are divided into verb conjugation (left) and the declension of adjectives, nouns, articles, and pronouns (right). Lennart also has access to a written language function.

Lennart’s device is set in such a way that the auditory output immediately follows the generation of a word, and the generated word remains in the display until it is deleted. The display can hold several words at a time, and these can be retrieved all at once and as often as desired.

3.3 Data

3.3.1 Description of the data set

The present study is based on spontaneous data that were collected between October 5, 2008, and September 25, 2009, in natural and everyday situations. The data were recorded using the Language Activity Monitoring (LAM) function in Lennart’s speech-generating device. When the LAM function is activated, all language events are recorded and the use of the device is tracked. Via a USB stick, the data may be transferred onto a computer and viewed as text files. In Lennart’s device, the function was activated throughout the entire time of the study. Therefore, there is a wealth of data available about Lennart’s language production.

As can be seen in the example below, the data contain information about the precise time of the language event (first column), the mode that was used (middle column), and the generated word (third column). SEM represent a Minspeak icon combination, ACT the generation of a word from the taskbar, and PAG and SPE written language. Events noted after “CTL” provide information about which of the device control functions Lennart used. The most important are Delete Display (DL), Delete Icon (IL), Plural Marking (PL), Delete Word (WL), Delete Letter/Symbol (LZ), Delete Last Entry (LöleE), and the marking of sequences produced by Lennart’s mother (Britta Anfag/Ende ‘Begin/End Britta’).

13:29:47 CTL "DL"	13:32:57 CTL "DL"	13:35:43 SEM "voll "
13:31:46 SEM "ich werde "	13:33:08 SEM "Zug "	13:35:48 CTL "IL"
13:31:58 CTL "DL"	13:33:12 ACT "ICE "	13:35:49 CTL "IL"
13:32:03 SEM "sie "	13:33:57 ACT "Boot "	13:35:52 CTL "DL"
13:32:04 CTL "DL"	13:34:09 CTL "DL"	13:35:53 CTL "DL"
13:32:06 PAG "g"	13:34:10 CTL "DL"	13:41:17 SEM "ich will "
13:32:11 PAG "g"	13:34:26 SEM "Zug "	13:41:20 SEM "dir "
13:32:12 PAG "t"	13:34:30 CTL "DL"	13:41:24 SEM "zeigen "
13:32:12 PAG "g"	13:34:34 SEM "Zug "	13:43:09 CTL "DL"
13:32:48 SEM "führt es "	13:34:51 SEM "Zug "	
13:32:55 CTL "IL"	13:35:32 SEM "Automarke "	

3.3.2 Data chosen for investigation

In order to investigate the development of Lennart's morphological and syntactic performance over time, we chose two time periods, analyzed their data individually using the same set of criteria, and compared the results. The time periods were chosen such that there was sufficient time between them to clearly show developmental progress.

We chose 14 days in February 2009 (02/08 – 02/24) and 14 days in September 2009 (09/07 – 09/22). One LAM file corresponds to one day. Since no LAM recordings are available for February 11, 13, and 14 or September 17 and 21, we added the LAM files of February 22 through 24 and September 22 in order to have data available for analysis from 14 days each.

There are two reasons why we chose February as the first period of analysis. For one thing, data generated by the function CTL (see above) were not included in the files before February 8, 2009. These markers show which words Lennart deletes (WL), when he finishes an utterance (DL), and which linguistic material must be attributed to the mother, who keeps using the device for modeling purposes ("Britta Anfang/Ende" 'Begin/End Britta'). Only with the marking of these functions did we have sufficient information in order to analyze language events. What is more, Lennart had just received the device, when we started collecting data in October 2008, and so had to get used to the new application software Wortstrategie 84. Therefore, the first few weeks and months of data collection were a phase of familiarization and exploration for Lennart and therefore do not necessarily say anything about his linguistic development. We chose September as the second time period in order to have a large enough distance between the two periods of data analysis, and the data collected in September were the most recent at that time.

3.3.3 Preparation of the data for analysis

For better clarity and documentation, we inserted the LAM data from their original text files into Excel tables and inspected them manually.

During the inspection of the data, it became clear that there were morpho-syntactically analyzable and unanalyzable language events. Language events that do not have any meaningful connection to other events, e.g. concatenations of words, false starts, and stored messages consisting of multiple words such as "Ich habe Hunger!" ('I am hungry. '), were considered unanalyzable. Language events that form coherent two-, three-, and multi-word utterances and thus provide sufficient morphological and syntactic information for a meaningful analysis were considered analyzable. An utterance was defined as consisting of all language events that occur between two markers of 'Delete Display' (DL). Other criteria for a coherent utterance were time and meaning connection. If more than two minutes elapsed between two language events, this was considered the end of an utterance and the beginning of a new utterance, even if the display was not deleted. All analyzable utterances were further copied into a separate document and numbered, and source information (date and line in the relevant Excel table) was added. The language events, together with the markers Delete Display (DL), Delete Word (WL), Delete Last Entry (LöleE)⁵, Plural Marking (PL), Written Language (PAG)/(SPE), and Delete Character (LZ), were copied one-to-one and arranged as sentences in a linear format. All other markers are irrelevant for a morpho-syntactic analysis and were therefore not copied. We also separated

⁵ The Marker LöleE is marked LL in the working document.

Lennarts data from those of his mother. The beginning of an utterance by the mother is marked with a single “Britta Anfang/Ende” and its end by twice “Britta Anfang/Ende.” The mother’s utterances that provide information about the context of a communication situation were likewise transferred into the working document and marked as follows: (M: xy).

In a second step, we removed all those words from Lennart’s utterances that he himself had deleted (those marked WL or LL) and calculated the utterance length, as determined by the number of words. Repetitions of words or parts of sentences, e.g. in case of self-correction processes, were counted only once. For example, “*iss so vorne nicht eine meine Eier aus auf*” (08.09./80) (lit. ‘eat so ahead not one my eggs out up’) were counted as 5 words.⁶ Moreover, we established that the last word in such strings of words was the one that Lennart had meant to generate, even if it was a ‘reverse correction’ of a correct form into an incorrect one. For example, “*das Schule*” (‘the.NEUT school’) in an utterance like “*aber sie musste 19 Tage zur Schule das Schule gehen*” (12.09./206) (‘but she must.PST 19 days to.the.FEM school the.NEUT school go’) was treated like the intended form in the further course of the analysis.⁷ A stored message embedded in a sentence, as in “*du Mama ‘Ich habe dich lieb!’*” (10.02./785) (‘you mom “I love you.”’) was counted as an analyzable utterance, yet only as one word. Following the steps described in this section, we culled 201 of the February utterances and 229 of the September utterances from the data set as morphologically and syntactically analyzable utterances.

3.3.4 Method of analysis

In our analysis, we used exploratory and descriptive methods. We found that Lennart did use morphological markers of case and gender on articles, adjectives, and pronouns, which allowed us to analyze them more closely. In order to analyze the morphological markers, we inspected the data and counted the individual forms. As acquisition criterion we used Szagun’s criterion of 90% correct marking in language production (cf. chapter 2.1.4). The count is documented in the “comment” column of the working document. For our analysis of syntactic structures, the morpho-syntactic component of the ASAS (Aachener Screeningverfahren zur Analyse von Spontansprache ‘Aachen screening process for the analysis of spontaneous language’), developed by Dietlinde Schrey-Dern (2006), turned out a useful guide. Following her manual, we examined whether sentences were complete and further divided sentences into simple and complex structures. This method did not capture all syntactic structures, which is why as a third step we examined Lennart’s utterances in terms of the topological field (cf. chapter 2.1.5.1).

3.4 Results

For each part of the analysis, we will briefly describe our approach, then illustrate the results for the chosen time periods in February and September, and finally discuss the progress in development. We chose this approach in order to provide a well-structured overview of the respective analyses and their results. In the subsequent chapter, we will further discuss all results within a larger context.

First we will illustrate general aspects of the data. Then we will analyze the data with respect to the morphological marking of gender and case. Next follow our analysis of syntactic

⁶ The intended sentence most likely was *Iss nicht meine Eier auf* (‘Don’t eat up my eggs.’). [LJ]

⁷ The correct definite article form for *Schule* is feminine *die*, rather than neuter *das*. [LJ]

complexity and further examinations of selected syntactic structures. The chapter will close with a summary of the results of all parts of the analysis.

3.4.1 General aspects

Compared to the rate of speech in normally developing children, Lennart requires a lot of time to generate an utterance. In order to generate the utterance “ich möchte noch einen kleinen Joghurt” (10.02./197) (‘I would like another small yogurt’), for example, he needs 1:10 minutes. This is one of his faster times. In comparison, it takes him 5:54 minutes to produce the utterance “aber heute hat er Geburtstag” (17.02./59) (‘but today is his birthday’). Overall, Lennart tends to be faster in generating utterances in September than he was in February. We did not calculate any means of the lengths of time it takes him to produce an utterance, as on the one hand, these times vary widely and, on the other hand, they say little for our analysis of morphological and syntactic knowledge. What is clear, however, is that Lennart needs to keep an utterance plan in his head for up to several minutes, which requires a lot of concentration.

Moreover, the data are marked by numerous word deletions and self-corrections, as in “wir turnen DL wir brauchen zehn WL eine Schere DL und viel WL vieler WL viele Strohalm PL DL” (08.02./231) (‘we exercise DL we need ten WL a pair of scissors DL and much WL many.GEN WL many.ACC straw PL DL’). In addition, the data reflect false starts, exploratory behavior, and experimentation with the written language function. Exploratory behavior here refers to Lennart’s exploration of the device by clicking through numerous pages and creating strings of words and letters. This may be a sign of playful manipulation of language. On the whole, there is a whole range of language events that stand by themselves and cannot be meaningfully connected to others. In addition to false starts and exploratory behavior, these might also include single-word sentences. None of these language events contribute to our morphological and syntactic analysis in a meaningful way. Therefore, we did not include them into our working document (see appendix). In comparison to February, the amount of unanalyzable data decreased, and false starts and exploratory behavior declined, by the time of the second period of analysis in September. Even though the structure of his utterances is still marked by self-corrections, they contain fewer “detours,” and the boundaries of utterances emerge more clearly.

Finally, we note that Lennart speaks relatively little. Thus the number of words that Lennart produced in February was 2705, and in September it was 1969. These numbers include all language events, among them false starts and those events that Lennart himself deleted. Strings of letters and numbers were not included. Because of the lack of contextual information, it is impossible to determine the precise number of words that Lennart indeed uses in the targeted manner in any given communication situation.

3.4.2 Analysis of the morphological marking of gender and case

In German, case and gender are marked on articles, pronouns, and adjectives (cf. Szagun 2006: 97ff.). In order to obtain an overview of Lennart’s skills in this area, we examined the noun phrases in all utterances with respect to case and gender marking on articles, pronouns, and adjectives. A noun phrase consists of a head noun and its extended projection, which may include articles, pronouns, and adjectives, e.g. “einen kleinen Joghurt” (10.02./197) (‘a.ACC small.ACC yogurt’). Therefore, the development of gender and case marking on articles and

adjectives allows for a differentiated analysis. Sometimes articles occur without nouns, but they are not included in our analysis in the interest of a better overview and clarity. A noun phrase extended by a preposition is called a prepositional phrase, as in “ich möchte aber *in mein Kinderzimmer*” (08.02./678) (‘but I would like to go to my room’), “... *auf dem Pullover*” (09.02./139) (‘on the sweater’), or “*mit dem auto*” (10.02./70) (‘with the car/by car’). In our analysis of gender and case marking, we did not differentiate between prepositional phrases and noun phrases, as the focus is on morphological marking of adjectives and articles and these may occur in prepositional phrases just as well as in noun phrases.

3.4.2.1 February

For the period of analysis in February, a total of 86 noun phrases, among them 27 prepositional phrases, is available for the analysis of case and gender marking. The analysis yielded the following results:

Table 2 Distribution of case marking on articles, pronouns, and adjectives for the period of analysis in February

February		definite article		indefinite article		pronoun		adjective alone	
		correct	wrong	correct	wrong	correct	wrong	correct	wrong
Nominative	11	3		3	2	1		2	
Dative	18	12	3			1	1	1	
Accusative	42	14	2	18	4	1		3	

Table 2 provides information about the distribution of instances of case marking on articles, pronouns, and adjectives and about the distribution of erroneous markings.

The table does not include six cases of article omission and seven correct forms that could not unambiguously be assigned to either the accusative or the nominative case, due to the non-completion of the constructions or the lack of context. Likewise, the precise nature of the error in “aber nicht klein Saurier” (19.02./334) (‘but not small dinosaur’) could not be determined definitely.⁸ Neither is the erroneous “den pink” (08.02./308) (‘the.ACC.SG.MASC pink’) included in the table. Three of the four erroneous accusative markings on the indefinite article can be attributed to the use of *ein* (‘a/one.NOM.SG.MASC/NEUT’) for *einen* (‘a/one.ACC.SG.MASC’). There are no genitive markings.

Altogether, there were five errors in gender marking, including two combined case and gender errors.

In the interest of clarity, we will forego an exhaustive list of all case and gender errors here as well as in our illustration of the results for the time period in September. They are documented in the “comment” column of the tabulated results in the working document (see appendix) and may be inspected there.

⁸ The utterance contains two errors of omission: it lacks an article or pronoun as well as case, number, and gender marking on the adjective *klein*, cf. *aber nicht Ø klein-Ø Saurier* (‘but not Ø small-Ø dinosaur’). [LJ]

3.4.2.2 September

For the time period in September, 142 noun phrases, among them 41 prepositional phrases, are available for the analysis of case and gender marking. The analysis yielded the following distribution:

Table 3 Distribution of case marking on articles, pronouns, and adjectives for the period of analysis in September

February		definite article		indefinite article		pronoun		adjective alone	
		correct	wrong	correct	wrong	correct	wrong	correct	wrong
Nominative	26	11		12		3			
Dative	33	25	1	3	1		1	2	
Accusative	66	19	1	29	8	7	1	1	

Just like table 2 for February, Table 3 provides information about the distribution of instances of case marking on articles, pronouns, and adjectives and about the distribution of erroneous markings.

The table does not include seven cases of article omission and ten correct forms that could not unambiguously be assigned to either the accusative or the nominative case, due to the non-completion of a construction or the lack of contextual information. Four out of the eight erroneous accusative markings on the indefinite article again can be attributed to the use of *ein* ('a/one.NOM.SG.MASC/NEUT') instead of *einen* ('a/one.ACC.SG.MASC'). Again, there are no genitive markings.

Altogether, there were five errors in gender marking, including four combined case and gender errors.

3.4.2.3 Comparison of the analyses of the two periods and discussion

First of all, we found that for our analysis of case and gender marking more data were available from the period in September than there were from the period in February. Thus in February 43% of all utterances determined to be analyzable in chapter 3.3.3 contained a noun phrase, whereas in September their proportion was 60%. Moreover, the rate of omission of articles (six in February and seven in September), in relation to the total number of data points, seems to have decreased.

We will include in our discussion of the results only the data illustrated in tables 2 and 3 above and in particular the morphological marking on the definite and indefinite articles, since they occur most frequently and are therefore most telling. All other data are less telling in relation to the developmental process and will therefore not be considered in the further analysis. Nonetheless, it is useful to consider these data in order to get a general picture of Lennart's skills on the whole. Since the number of data points available for February and September differs greatly, yet we would nonetheless like to get a general overview, we will proceed to describe the data in terms of percentages for illustration.

In the definite paradigm, there is marked progress in development for dative-case marking. While in February Lennart used correct forms in 75% of all cases, in September that percentage is 92%. Similarly, our analysis of the data suggests progress in the accusative-case

marking of the definite article: Lennart improved from 85% to 95% correct forms. If we adopt 90% correct use as the mastery criterion for a morphological marker, as advanced by Szagun (2006; cf. chapter 2.1.4), our results indicate that by September Lennart must have mastered the marking of the definite article in the dative and accusative cases.

Further, Lennart uses the indefinite article in the accusative case correctly 77% of the time in February and 72% of the time in September. The finding that the percentage of correct marking was higher in February than in September might be the result of a kind of playful intervention situation (12.02. lines 111 through 379) that produced five out of the 18 correct markers, when Lennart produced sentences like “du sollst ein blaues Auto malen” (‘you should draw a.ACC.SG.NEUT blue.ACC.SG.NEUT car’) and “du sollst ein rosanes Schwein malen” (‘you should draw a.ACC.SG.NEUT pink.ACC.SG.NEUT pig’).

A peculiar finding is that Lennart used only nine correct nominative markers in February—only one to three each on the definite article, the indefinite article, a pronoun, and an adjective. Thus we do not have enough data to draw any major conclusions about the status of Lennart’s nominative marking in February. In September, however, Lennart produced 26 correct nominative markers (eleven on the definite article, twelve on the indefinite article, and three on a pronoun), which leads us to conclude that by September he mastered nominative case marking.

It is possible that there were further instances of correct nominative marking among the seven correct forms mentioned above that could not unambiguously be assigned to either the accusative or the nominative case, which would change the situation regarding correct nominative marking. It is also possible that our restriction on noun phrases lead to a skewed picture and that the data might yield further nominative articles (der ‘the.NOM.SG.MASC,’ die ‘the.NOM.SG.FEM,’ das ‘the.NOM.SG.NEUT,’ ein ‘a.NOM.SG.MASC/NEUT,’ eine ‘a.NOM.SG.FEM’). A subsequent analysis of the data with respect to this question revealed only two cases of nominative articles outside a noun phrase: “das ist lecker” (10.02./779) (‘the.NOM.SG.NEUT / it is delicious’) and “der Düsenjäger *der* gross ist und *der* klein nicht” (23.02./184) (‘the jet fighter the.NOM.SG.MASC / that big is and the.NOM.SG.MASC / that small not’). It is peculiar that the nominative occurs so infrequently, compared to other case markers. The question what the reason for this could be cannot be answered yet, but we will return to it after presenting our further analyses.

In sum, Lennart made progress in almost all areas of case marking. By September, he mastered the marking of dative and accusative case in the definite paradigm as well as the marking of nominative case. Yet he still has problems with the accusative case marker on the indefinite article, which is reflected in his use of *ein* (‘a.NOM.SG.MASC/NEUT’) in place of *einen* (‘a.ACC.SG.MASC’). As regards dative case marking on the indefinite article, there are no examples in February and as few as three in September, so that no conclusions can be drawn here. Forms of genitive marking, finally, are non-existent, in February just like in September.

In the marking of gender, Lennart showed firm mastery. Thus he marked gender correctly in 93% of all cases in February and in 96% of all cases in September. Therefore, we can safely conclude that Lennart mastered gender marking at both stages of analysis.

A further area of morphology is verbal inflection. Inflection establishes agreement between a subject and a verb. If a verb shows subject-verb agreement, it is also called a finite verb (cf. also chapter 2.1.5.1). In principle, the ability to establish subject-verb agreement belongs to the area of morphology, but it is also a phenomenon at the interface with syntax. Only when child is able to establish subject-verb agreement will he/she be able to produce the basic word order subject-verb-object and, based on it, variable word orders. Whether or not a child has

acquired subject-verb agreement, therefore, is automatically determined by including only utterances with subject-verb agreement into the analysis of sentence structures. This will be done in the next step of our analysis. We can already say that Lennart shows firm mastery of subject-verb agreement and produces merely two utterances in February with explicit errors: “ich sehen nicht hin” (08.02./85) (‘I look.INF not at it’) and “ich möchte habe bitte Puppe” (09.02./198) (‘I want have.1SG.PRS please doll’).

3.4.3 Analysis of syntactic structures

For our analysis of syntactic structures, the morpho-syntactic component of Dietlinde Schrey-Dern’s (2006) ASAS (Aachener Screeningverfahren zur Analyse von Spontansprache ‘Aachen screening process for the analysis of spontaneous language’) turned out to be a useful instrument. It offers a well-structured manual, on the basis of which syntactic structures can be examined in spontaneous speech.

As a first step, we determined the number of complete and incomplete utterances in the data classified as analyzable in chapter 3.2.3. Next, we analyzed the syntactic structures of the utterances we determined to be complete.

What needs to be kept in mind though is that the data we are discussing here represent spoken language in natural, everyday situation. Characteristic for spoken language is that it often consists of incomplete sentences, which in the context of a given communicative situation is nonetheless correct and appropriate. These cases are called ellipsis. Schrey-Dern defines ellipses as utterances “...that may be interpreted as partial sentences, based on the (verbal and non-verbal; situational) context in which they are uttered” (2006: 85). As a rule, they occur in answer to wh-questions, e.g. “nur den Joghurt” (22.09./156) (‘only the yogurt’), as modifiers, e.g. “wo man Gebet betet” (19.09./382) (‘where one prays prayer’) or “mit Opa Hartmut...” (10.02./679) (‘with grandpa Hartmut’), as affirming or negating expansion, e.g. “Ja nur für mich” (14.09./257) (‘Yes only for me’), or as accompanying action. In the latter case, the verbs “haben” (‘have’) and “sein” (‘be’) and/or the object are omitted, e.g. “darf ich noch das Brot” (18.09./20) (‘may I yet the bread’). In our study, we also included utterances like “doch Mama” (‘yes mama’) and “o nein” (‘oh no’) (15.02./243), “Hallo und Tschüss” (19.02./78) (‘hi and bye’), “Hallo Sozan” () (‘hi Sozan’), and “gut so” (09.09./275) (‘good job, that’s good’) cases of ellipsis.

In addition to elliptical utterances, there are sentences and sentence-like utterances: “An utterance is interpreted as sentence-like if it represents a complete sentence, an utterance conceived as a sentence but grammatically incorrect, or an imperative” (Schrey-Dern 2006). It is important to distinguish incomplete sentences from elliptical sentences because elliptical sentences occur in natural speech and are perceived as complete and appropriate. Incomplete sentences, however, indicate cases of syntactic difficulty. If elliptical sentences were analyzed as incomplete sentences, the resulting picture of grammatical competence could be skewed, as Schrey-Dern mentions (2006: 84).

In the process of our analysis, it turned out that not all utterances initially classified as (morpho-syntactically) analyzable (see chapter 3.3.3) were either elliptical or sentence-like utterances. These are marked in grey in the working document and will not be included in further analyses, e.g. “in ans Schwanz sitzen Boot” (09.09./111) (‘in on.the.ACC.SG.NEUT tail sit.INF boat’), “Erdbeere Oma” (19.02./75) (‘strawberry grandma’), “Lautstärke und rundem” (20.02./140) (‘volume and round.DAT.SG.MASC/NEUT’), and “dem findet den” (‘the.dat.SG.MASC/NEUT finds the.ACC.SG.MASC’) as well as stored utterances as in “Rückspiegel

‘Was ist das?’” (‘Rear-view mirror “What is that?”’) or “‘Ich habe Durst!’ Mama” (“I am thirsty!” mom’), even if they were combined with another word. Our analysis of the data yielded the following distribution for February and September:

Table 4 Overview of complete and incomplete utterances in February and September

	February		September	
Number of analyzed utterances	201		229	
Number of words	794		1064	
Number of elliptical sentences	51		56	
Number of sentence-like utterances	complete	incomplete	complete	incomplete
	101	26	145	16
Non-classifiable utterances	23		11	
Mean length of utterance	3.9		4.6	

The classification of the individual utterances into the categories in table 4 is documented in the working document and the tabulation in the appendix. There, all utterances assigned to the category ellipsis are marked with an E in column 3, all complete sentence-like utterances with Sv, and all incomplete ones with S-. The type of omission is documented in the “comment” column.

3.4.3.1 February

In February, there were 26 incomplete sentences, with the omitted sentence constituents distributed as follows:

- in two cases the object was omitted (10.02./57; 20.02./52)
- in six cases articles, pronouns, or conjunctions were omitted (08.02./277; 09.02./759; 10.02./24; 12.02./310; 21.02./168; 24.02./112)
- in five cases the verb phrase was incomplete (09.02./198; 09.02./572; 16.02./892; 19.02./69; 19.02./474)

We will nonetheless include these sentences into our analysis of syntactic structures, since they show subject-verb agreement.

In the following 13 utterances several sentence constituents were omitted, including the verb: (09.02./467; 09.02./816; 10.02./494; 16.02./241; 16.02./588; 18.02./22; 19.02./19; 19.02./59; 19.02./313; 24.02./443; 21.02./353; 22.02./222; 24.02./3). Therefore, we will not include them in further analyses.

3.4.3.2 September

There were 16 incomplete sentences in September, with the omitted sentence constituents distributed as follows:

- in four cases the object was omitted (10.09./144; 11.09./54; 13.09./123; 19.09./236)

- in four cases an article or pronoun was omitted (11.09./37; 13.09./631; 15.09./435; 19.09./387)
- in one case a conjunction was omitted (13.09./148)
- in the following utterance the verb “schreiben” (‘write’) was omitted: “darf ich nach dem Joghurt an dem Computer (M: schreiben)” (16.09./107) (lit. ‘may I after the yogurt on the computer (M: write)’)

These utterances nonetheless show subject-verb agreement and will therefore be included in the analysis of sentence complexity. In the following six utterances, subject-verb agreement is missing, e.g. “ausschneiden auch im in zwischen” (16.09./461) (‘cut out also in.the.DAT.SG.MASC/NEUT in between’) and “hie Sozan” (11.09./242) (‘was called Sozan’) as well as (22.09./162; 11.09./631; 11.09./304). These utterances will therefore not be included in the analysis of sentence complexity.

3.4.3.3 Comparison of the analyses of the two periods and discussion

The results of our analysis show that the mean length of utterance increases only slightly between February and September. Yet there is developmental progress toward more complete utterances. Thus the proportion of complete sentence-like structures increases from 50% in February to 64% in September. The proportion of incomplete sentence-like utterances, in turn, decreases from just under 13% in February to just under 7% in September. Similarly, the number of unanalyzable utterances decreased. Among the incomplete sentences, moreover, there were 13 utterances without subject-verb agreement in February. By September, that number decreased to six utterances. These utterances were not included in our analysis of sentence structures.

3.4.4 Analysis of sentence complexity

In this part of our study, we will analyze the data for simple and complex syntactic structures. Following Schrey-Dern (2006: 90), simple structures are declarative sentences, questions with question pronouns, inversions, and imperatives. Complex syntactic structures are characterized by coordination, i.e. by conjoining main clauses using coordinating conjunctions like *und* (‘and’), *oder* (‘or’), and *aber* (‘but’), and by subordination, i.e. by joining main clauses and subordinate clauses introduced by conjunctions like *weil* (‘because’), *wenn* (‘when’), *nachdem* (‘after’), *obwohl* (‘although’) etc. and relative clauses respectively. In subordinate clauses, the finite verb appears in the final position.

In order to draw conclusions about the complexity of the syntactic structures, we excluded elliptical sentences and included only those sentence-like utterances that show subject-verb agreement. In February, the number of those sentences was 106 and in September 154. As a first step, we assigned the utterances to the categories: two-word utterances, declarative sentences in multi-word utterances, questions, imperatives, coordination, and subordination, and we then determined their quantities. We also counted as coordination utterances that start with a coordinating conjunction and are hence directly connected to the utterances immediately preceding them. They are represented in the table below by the numbers in parentheses. Our analysis yielded the following distribution:

Table 5 Overview of simple and complex syntactic structures in February and September

		February	September
	Number of utterances analyzed	106	154
Simple structures	Two-word utterances	2	2
	Declarative sentences in multi-word utterances	72	112
	Questions	10	16
	Imperatives	3	4
Complex structures	Coordination	1 (8)	6 (1)
	Subordination	4	7
Non-classifiable structures (see below)		5	7

Both in February and in September, Lennart makes use of the full range of simple syntactic structures, with the majority of them declarative sentences in multi-word utterances. At both times, he also uses questions with inversion, imperatives, and finite verbs in V2 position.

The following utterances from February could not be classified as belonging to any of the categories in table 5 above:

- “Blanka schläft und macht Lärm” (10.02./277) (‘Blanka is asleep and making noise’)
- “hier wohne ich und du auch *aber* nur nicht beißen” (19.02./402) (‘here I live and you too but no biting’)
- “ich glaube an den Gott und die Vögel auch” (15.02./267) (‘I believe in God and the birds too’)
- “gib mir die Saurier grün und die gelbe Murmel” (19.02./270) (‘give me the dinosaurs green and the yellow marble’)
- “Düsenjäger der der groß ist und der klein nicht” (23.02./184) (‘jet fighter the/that the/that big is and the/that small not’)

The following utterances from September could not be classified either:

- four cases of direct speech, e.g. “Milan sagte zu Bela bau ein Haus für dich ja” (13.09./396; further 11.09./370; 14.09./290; ...) (‘Milan said to Bela build a house for you/yourself yes’)
- “danach hatte Sahra Ruhe und konnte Lehrerin werden” (12.09./353) (‘after that Sahra was left alone and could become a teacher’)
- “dann suchte er er wohnt einen starken Baum und nahm sich 2 Blätter.” (11.09./486) (‘then he searched he lives a strong tree and took himself 2 leaves’)
- “Maja war krank darum hatten wir Kunst” (16.09./29) (‘Maja was sick therefore we had art [class]’)

3.4.4.1 More detailed analysis of complex structures in February

In February, Lennart produced the following coordinating main clause construction: “aber der Saurier hat spitze Zähne und ich bin neidisch dem” (19.02./622) (‘but the dinosaur has sharp teeth and I am envious him’).

Further coordinating main clauses that seem connected to a preceding utterance are, for example, “und nachher wir brauchen Räder aus Plastik” (12.02./413) (‘and later we need wheels from plastic’) as well as 16.02./718; 10.02./47; 15.02./294; 16.02./794; 17.02./59; 18.02./64, and 18.02./151.

Lennart also used four subordinating sentence constructions in February:

- “ein Glück *dass* wir gehört zu die Engel *als* Feuer war” (19.02./474) (‘lucky that we belongs to the angels when fire was’)
- “du fährst zu mir *weil* ich soll baden jetzt” (21.02./47) (‘you drive to me because I should bath now’)
- “ich frage dich (Mutter: *ob*) ich schreiben kann mit Talker” (24.02./112) (‘I ask you (M: whether) I write can with speech-generating device’)
- “*weil* er hat nicht zwei Beine” (16.02./706) (‘because he has not two legs’)

It is striking that Lennart does not yet use the verb in final position in subordinate clauses. Even though the verb in the subordinate clause “als Feuer war” (‘when fire was’ = ‘when there was fire’) is in final position, non-target-like use prevails.

3.4.4.2 More detailed analysis of complex structures in September

In September, Lennart used six coordinated sentence constructions, four with *und* (‘and’) (12.09./233; 14.09./290; 18.09./42; 20.09./410) and two with *aber* (‘but’) (11.09./262), including the double coordination “ich war ein Kind aber jetzt bin ich ein Schuljunge aber ich denke auch sonst noch an den Kindergarten heute” (09.09./193) (‘I was a child but now I am student but I also still think about preschool today’). One utterance connects to someone else’s previous utterance (20.09./538).

The following seven utterances represent subordination:

- “wenn ich große groß bin möchte ich Bäcker warden” (10.09./350) (‘when I am big big I would like to become a baker’)
- “ich verspreche dass ich keins kaufe” (16.09./407) (‘I promise that I will buy none’)
- “es traf während er ging ein Maulwurf” (13.09./315) (‘it hit while he went a mole’)
- “ab Sonntag darf ich bald ein neuer Bus kaufen weil mein alter Bus kaputt ist” (15.09./295) (‘from Sunday I may soon buy a new bus because my old bus is broken’)
- “sie lernte Deutsch und Mathe sie weil sie mochte Schule.” (12.09./187) (‘she learned German and math she because she liked school’)
- “weil ich sage mein Bein ist eingeschlafen” (15.09./44) (‘because I say my leg fell asleep’)
- “du kannst heute nicht joggen weil du sollst dies” (22.09./188) (‘you can’t go jogging today because you should this’)

While the first four utterances have their verbs in the final position, the latter three still have errors.

3.4.4.3 Comparison of the analyses of the two periods and discussion

Altogether, Lennart uses only few complex structures, and the majority of his utterances are declarative sentences. The quantitative increase in complex structures between February and September is rather low, as is the increase in the mean length of his utterances. One might conclude that there was barely any developmental progress. Yet in sentential coordination in particular his sentences seem to have become more differentiated, as in September he used a fully correct coordinating construction in six out of seven cases, whereas in February it was only one out of eight. Among the sentences referred to as ‘non-classifiable structures’ several are cases of so-called coordination ellipsis, which show some of the characteristics of coordinating structures and are also common in spoken language, but are not yet cases of true coordination. Moreover, the clause-final placement of the finite verb in subordinate clauses seems to have undergone developmental progress as well, as Lennart placed the verb correctly in four out of seven subordinating sentence constructions in September, but only in one in February. Nonetheless, it is not clear whether Lennart already mastered the verb-final position of the finite verb in in subordinate clauses by September. Rather, he seems to be in the middle of a developmental process. Constructions involving the subordinating conjunction *weil* (‘because’) seem to be particularly problematic. Yet this might also indicate that he is about to master the construction, and the erroneous uses might be the result of him experimenting with the construction. At any rate, Lennart seems to have acquired the concept of *weil* (‘because’). The finding that Lennart’s performance on subordinate clauses with *weil* is not always grammatically correct may also reflect the artifact that in colloquial German clauses introduced by *weil* often display precisely the word order that Lennart’s erroneous constructions exhibit.

In what follows, we will take a more differentiated look at some further syntactic structures in order to get a more comprehensive picture of Lennart’s skills.

3.4.5 More detailed analysis of selected syntactic aspects

3.4.5.1 Material in the *Vorfeld*

If we look at Lennart’s declarative sentences in the context of the topological field (cf. chapter 2.1.5.1), we find that in February he uses a pronoun or a subject in the *Vorfeld* (‘prefield’) in almost all of the cases (24.02./582; 23.02./321; 23.02./146; 17.02./43; 16.02./892). Typical examples are “ich möchte noch einen Joghurt” (12.02./87) (‘I would like another yogurt’) and “Awe ist tot” (24.02./582) (‘Awe is dead’). Only in the following three cases does Lennart use a noun phrase in the *Vorfeld*: “eurem Zuschauer ist krank (M: langweilig)” (09.02./60) (‘your spectator is sick (M: bored)’), “in dem Magen ist ein nichts Junge” (22.02./609) (‘in the stomach is a nothing boy’), “aber auch kleinem Saurier mit Flügel gab es” (18.02./151) (‘but also small dinosaur with wing was there’). Other exceptions are: “frech ist Kutte” (10.02./288) (‘naughty is Kutte’) and “hier ist einen eine Sackgasse” (‘here is a.ACC.SG.MASC a.NOM.SG.FEM cul-de-sac’).

In cases when Lennart does use an adverb or a conjunction in the *Vorfeld*, he predominantly prefixes it to the subject-verb combination without inversion, i.e. without breaking up the subject-verb structure or moving the subject into the *Mittelfeld* (‘middle field’).

As a result, he produces constructions such as “‘Ich habe Durst!’ also ich soll trinken” (08.02./96) (“‘I have thirst!’ so I should drink’ = “‘I am thirsty!’ so I should drink”)⁹, “vorher ich esse Joghurt” (09.02./206) (‘before.that I eat yogurt’ = ‘before that I will eat a yogurt’)¹⁰, “vielleicht ich gehe zu Spanien” (09.02./314) (‘perhaps I go to Spain’ = ‘perhaps I will go to Spain’)¹¹, “also ich ziehe den Pullover mit dem Auto an ziehen” (10.02./70) (‘so I put the sweater with the car put on’ = ‘so I put on the sweater with the car on it’)¹², and “vorher aber ich muss mal” (‘before.that but I must once’ = ‘but before that I have to go to the bathroom’)¹³. In the second half of the relevant time period in February, Lennart starts to relax the subject-verb structure and in five cases places the subject behind the inflected verb, as in, for example, “vorher aber muss ich mal” (15.02./294) (‘before.that but must I once’ = ‘but before that I have to go to the bathroom’), “aber heute hat er Geburtstag” (17.02./403) (‘but today has he birthday’ = ‘but today is his birthday’), “aber jetzt sind sie tot” (18.02./64) (‘but now are they dead’ = ‘but now they are dead’), “hier wohne ich...” (19.02./403) (‘here live I ...’ = ‘Here I live ...’), and “ja aber vorher muss ich mal” (22.02./553) (‘yes but before.that must I once’ = ‘yes but before that I have to go to the bathroom’).

Among the data from the time period in September, more noun phrases can be found in the *Vorfeld* than in February, as in, for example, “das Ela and Alo Schreiben bringt mir Spass” (09.09./261) (‘the Ela and Alo writing brings me fun’ = ‘writing Ela and Alo gives me joy’), “das Flugzeug soll ab” (10.09./225) (‘the plane shall off’ = ‘I want the plane off’), or “ein Opa hat da mitgespielt” (18.09./250) (‘a grandpa has there played.along’ = ‘there was a grandpa who played along’). There are also multiple instances of constructions with “das” (‘that’), as in, for example, “das soll ab” (10.09./238) (‘that shall off’ = ‘I want that off’), “das gibt es nicht in dem Bäckergeschäft” (10.09./434) (‘that gives it not in the bakery’ = ‘they don’t have that in the bakery’), and “das ist mein Geheimnis” (14.09./21) (‘that is my secret’).

Overall, pronouns still prevail in the *Vorfeld* when Lennart uses the word order subject-verb. Yet he seems to be more flexible in using the subject-verb combination than he was in February. Thus there are no more errors in word order when an adverb, a conjunction, or an object occupies the *Vorfeld* and, therefore, requires the verb-subject order. There are 13 examples where this is the case (08.09./116; 08.09./219; 09.09./219; 09.09./193; 10.09./350; 10.09./434; 11.09./468; 12.09./206; 12.09./353; 13.09./543; 14.09./421; 15.09./259; 16.09./29).

3.4.5.2 Expansion of sentence structure

In his declarative sentences, Lennart uses *und* to combine sentence constituents and to enumerate. He also uses *aber* (‘but’) regularly, either as a conjunction or as a particle expressing protest, as in “ich möchte aber in mein Kinderzimmer” (08.02./678) (‘I would.like but in my room’ = ‘but I would like to go to my room’), or in cases of ellipsis as in “aber doch”

⁹ Target structure: “‘Ich habe Durst!’ also soll ich trinken (‘I have thirst!’ so should I drink.’ = “‘I am thirsty!’ so I should drink”) [LJ]

¹⁰ Target structure: *vorher esse ich einen Joghurt* (‘before.that eat I a yogurt’ = ‘before that I will eat a yogurt’) [LJ]

¹¹ Target structure: *vielleicht gehe ich nach Spanien* (‘perhaps go I to Spain’ = ‘perhaps I will go to Spain’) [LJ]

¹² Target structure: *also <ich> ziehe <ich> den Pullover mit dem Auto an* (‘so <I> put <I> the sweater with the car [on it] on’ = ‘so I put on the sweater with the car on it’) [LJ]

¹³ Target structure: *vorher muss ich aber mal* (‘before.that must I but once’ = ‘but before that I have to go to the bathroom’) [LJ]

(09.02./704) ('but nonetheless'). Moreover, he experiments with a variety of adverbs (see examples above).

Lennart gradually expands the subject-verb-object construction by using noun phrases and prepositional phrases, which is particularly apparent in the case of prepositional phrases. There are seven instances with two prepositional and/or noun phrases each, for example "ich habe Schmerzen unter die Zahn von dem Becher" (22.02./140) ('I have pain under the tooth from the cup')¹⁴. In the majority of cases, however, he uses constructions like "ich möchte noch einen kleinen Joghurt" (12.02./87) ('I would like yet a small yogurt' = 'I would like another small yogurt'). A peculiar structure, which remains characteristic through September, is the following: "Ich kann Rockmusik machen mit Gitarre and Schlagzeug" (10.02./461) ('I can rock.music make with guitar and drums' = 'I can make rock music playing the guitar and the drums')¹⁵. What stands out is that Lennart first forms a 'core sentence' and then gradually expands it. In the above example, Lennart may have answered a question in response to a previous statement of his in an elliptical manner, or he may have expanded one of his utterances himself without being prompted. The structure "Du sollst schneiden eine vier" (12.02./286) ('you should cut a four')¹⁶ is another case in point. This structure could be a subsequent elaboration on his own utterance, or it may indicate continuous difficulty in splitting up the verb complex. In the context of a description in terms of the topological field (cf. chapter 2.2.5.1), this means that Lennart has difficulties placing non-finite verb forms, in this case the infinitive, at the end of the sentence and placing other sentence constituents into the *Mittelfeld*. In this sense, three examples are target-like: "du sollst ein kleines blaues Auto links malen" (12.02./172) ('you shall a small blue car left draw' = 'I want you to draw a small, blue car on the left-hand side'), "du sollst ein rosanes Schwein malen" (12.02./212) ('you shall a pink pig draw' = 'I would like you to draw a pink pig'), and "du sollst sie holen" (22.02./123) ('you shall her/them get' = 'I would like you to go get her/them'). Considering that the first two of these three probably arose out of a language practice situation of sorts (cf. chapter 3.4.2.3) and that forms of this type are rather infrequent (whether correct or incorrect), we cannot draw any final conclusions about Lennart's development in regard to the sentence-final placement of non-finite verbs.

In September, we find the same structural formats we just discussed for February. Yet it is also evident that Lennart produces an increasing number of complex verb phrases, while observing the correct word order, as in "ich möchte mal den Kindergarten besuchen" (08.09./154 and 08.09./201; 09.09./313; 12.09./272; 15.09./386; 15.09./421; 15.09./531; 18.09./70) ('I would like once the preschool visit' = 'I would like to visit the preschool some time'). Further, his speech shows an increasing number of participial constructions, which we will discuss in the next section.

¹⁴ Although the word order in this sentence is grammatical, the following would be more neutral: *ich habe von dem Becher Schmerzen unter dem Zahn* ('I have from the cup pain under the tooth' = 'I have pain under the tooth from the cup') [LJ]

¹⁵ Even though this sentence is fully grammatical, the neutral word order would be *Ich kann mit Gitarre and Schlagzeug Rockmusik machen* ('I can with guitar and drums rock.music make' = 'I can make rock music playing the guitar and the drums') [LJ]

¹⁶ Target word order: *Du sollst eine vier schneiden* ('you should a four cut' = 'you should cut a four') [LJ]

3.4.5.3 Participial constructions

In February, Lennart produces a mere five participial constructions, for example “*ich möchte habe bitte Puppe*” (09.02./198) (‘I would.like have please doll’ = ‘I would like to have the doll, please’)¹⁷, “*gesehen im Fernseher*” (16.02./241) (‘see.PSTPRT in.the TV’ = ‘seen on TV’)¹⁸, or “*Awe gesagt*” (16.02./892; also 19.02./474; 24.02./592) (‘Awe say.PSTPRT’ = ‘Awe said’), of which only the latter is a complete utterance.

In September, however, he produces 17 participial constructions, of which 11 are complete and show the correct word order (15.09./44; 15.09./71; 18.09./250; 19.09./149; 19.09./163; 19.09./376; 19.09./410; 20.09./75; 20.09./376; 22.09./176) and one is incomplete (11.09./304). The following four constructions show non-target-like word orders: “*ich habe auf der Zurückfahrt gesehen ein eine Frau ohne Arme fast nur mit Schulter*” (10.09./3) (‘I have on the return.trip see.PSTPRT a.ACC.SG.MASC a.ACC.SG.FEM woman without arms almost only with shoulder’ = ‘on the return trip I saw a woman without arms, almost with a shoulder only’)¹⁹, “*ich habe gespielt mit Jason Jan*” (11.09./152) (‘I have play.PSTPRT with Jason Jan’ = ‘I played with Jason Jan’)²⁰, “*ich habe bekommen ein cooles Auto*” (13.09./619) (‘I have get.PSTPRT a cool car’ = ‘I got a cool car’)²¹, and “*er hat ein Kind geschlagen in den Hintern*” (18.09./76) (‘he has a child hit.PSTPRT in the butt’ = ‘he hit a child on the butt’ or ‘he kicked a child in the butt’)²².

Our analysis of participial constructions revealed that Lennart used the past tense in only three cases in February: once in an example with “... gab es” (18.02./151) (‘... gave it’ = ‘there was ...’, ‘there were ...’) and twice in examples with “*ich war ...*” (22.02./279; 22.02./299) (‘I was ...’). In September, in contrast, he used forms like “*ich war*” and “*es gab*” regularly.

3.4.6 Summary of the results

Lennart’s competence in verb agreement and gender marking in both February and September was right on target, so much so that we may assume mastery in these areas, according to Szagun’s criterion of 90% correct marking.

In the areas of Dative and Accusative case marking on the definite article, we found developmental progress toward mastery in September, while this cannot be said for February. The same is true for Nominative marking.

Accusative marking on the indefinite article continues to show a high error rate, as can be seen in the use of *ein* (‘a.NOM.SG.MASC/NEUT’) for *einen* (‘a.ACC.SG.MASC’).

With regard to his syntactic development, we found that Lennart correctly produced verbs in V2 as well as imperatives and questions with question pronouns and inversion in both the February and the September time periods. In the area of complex syntactic structures,

¹⁷ Target structure: *ich möchte bitte eine Puppe haben* (‘I would.like please a doll have’ = ‘I would like to have the doll, please’) [LJ]

¹⁸ Target structure: *im Fernseher gesehen* (‘in.the TV seen’ = ‘seen on TV’) [LJ]

¹⁹ Target structure: *ich habe auf der Rückfahrt eine Frau ohne Arme gesehen* (‘I have on the return.trip a woman without arms seen’ = ‘on the return trip I saw a woman without arms’) [LJ]

²⁰ Target structure: *ich habe mit Jason Jan gespielt* (‘I have with Jason Jan played’ = ‘I played with Jason Jan’) [LJ]

²¹ Target structure: *ich habe ein cooles Auto bekommen* (‘I have a cool car gotten’ = ‘I got a cool car’) [LJ]

²² Target structure: (i) *er hat ein Kind auf den Hintern geschlagen* (‘he has a child on the butt hit’ = ‘he hit a child on the butt’ or (ii) *er hat ein Kind in den Hintern getreten* (‘he has a child in the butt kicked’ = ‘he kicked a child in the butt’) [LJ]

Lennart still seems to be at the beginning of development, in February as well as in September. But we saw developmental progress in Lennart's use of coordinating constructions, and the development of subordination seemed to be on its way.

When we investigated Lennart's syntax in more detail, we found that his sentence constructions seem to be built around the subject-verb combination, with little word order variation, although he already produces questions with inversion and imperatives. More specifically, he seems to begin almost all of his sentences with pronoun-verb combinations, with few exceptions of anything else in the *Vorfeld* position. When Lennart does use an adverb, for example, he places it in front of the pronoun-verb combination, without the required inversion (verb-pronoun or verb-subject respectively). This pattern, i.e. the prevalence of utterances starting with a pronoun and a finite verb, may also be the reason for why there are only few noun phrases in the Nominative (cf. chapter 3.4.2.3). By September, Lennart's syntax seems to have become more variable with respect to word order and constituents in the *Vorfeld*, and he correctly inverts subjects and verbs when there is an object or an adverb in the *Vorfeld* position. Nonetheless, even in September, sentence constructions beginning with a pronoun-verb combination are characteristic of Lennart's syntax.

Further developmental progress can be observed in that by September Lennart has become more flexible in placing different constituents in the *Vorfeld*, produces participial constructions, and places nonfinite verb forms in the final position.

3.5 Discussion of the results

3.5.1 Ambiguities in the data and unresolved issues

When analyzing our data set, we realized that we lacked important contextual information in order to unambiguously classify language events and to clearly define the boundaries of utterances, since the data contain no information about the linguistic behavior of communication partners or the communicative situation, or the events in the context of which an utterance was made. Thus in several cases, we had to rely on our own interpretations to determine utterance boundaries. This problem can be illustrated on the basis of the example “rot Zähne auf dem Pullover” (09.02./139) (‘red teeth on the sweater’). 1:06 minutes elapse between *rot* and *Zähne* and further 1:57 minutes between *Zähne* and *Pullover*. The communicative situation may have been such that *rot* was a single-word utterance and that Lennart wanted to put on a/the red sweater. Then, in response to a clarification question or out of his own motivation, he may have referred to ‘teeth on the sweater’ as a modification of what he had meant by ‘red.’ It is also possible that “rot” and “Zähne auf dem Pullover” are unrelated, or that he meant *rote Zähne* (‘red.PL teeth’) but failed to mark agreement on the adjective. Because of the time span that elapsed between *rot* and *Zähne*, we decided not to include *rot* into our analysis of morphological and syntactic structures, even though the time span was shorter than two minutes, the criterion we had previously determined. This example illustrates how individual interpretations may influence the calculated values for utterance length (in this case 5 or 4 respectively) and the number of faulty constructions.

Another consequence of missing contextual information is that in many cases single-word utterances cannot be distinguished from exploratory behavior and false activations. Therefore, it is impossible to determine the true number of single-word utterances and their proportion in Lennart's overall language use. Determining whether an utterance was an elliptical

or an incomplete sentence turned out to be difficult in some cases as well and likewise depended on personal interpretations. Thus there could be utterances among those we determined to be elliptical that in the actual communication situation were not and vice versa.

As a third issue, there are indications that in some cases the beginning and/or end of an utterance that was not Lennart's was not marked accordingly. We suppose that this is what happened in those cases when sentences are fully correct, were generated without any corrective processes, and offer complex structures. In some cases, time may also be an indication that a given utterance was probably not Lennart's. All those utterances that we suspected were not Lennart's are shaded in gray in the working document and were not included into our analysis. If we included them, again our total numbers would change, and the values in the area of complex syntactic structures, for example, would be higher.

A fourth issue is that in some situations we may be dealing with cases of "language practice" of a sort in which Lennart practices specific forms and structures, rather than producing spontaneous language, as we already mentioned in the previous chapter. This may likewise skew the general profile of Lennart's linguistic competence. But we similarly lack the necessary contextual information to unambiguously differentiate such utterances from spontaneous language, which is why we included them in our analysis.

A fifth and final aspect that needs to be taken into account in this context are multimodal communication practices, which individuals who are unable to produce speech naturally make use of. These are not recorded in our material, however. Therefore, we can only speculate that, for example, in sentences lacking an object, the object was filled in by use of a different mode of communication, such as eye gaze or the head alphabet.

Despite these ambiguities and unresolved issues, it made sense to us to quantify our data. On the one hand, it allowed us to better represent and describe our data set. On the other hand, it enabled us to compare values within the dataset.

3.5.2 Discussion of the results in relation to the speech-generating device

A distinctive characteristic of the data set we analyzed in this thesis is that the language events were generated by use of a speech-generating device. Therefore, our findings need to be viewed in conjunction with the role of the speech-generating device and its application software. In this respect, the question arises in how far Lennart's skills in operating the communication aid may have influenced our findings regarding his linguistic knowledge. This question cannot be answered within the confines of our research design. In order to detect any discrepancies between linguistic competence and competence in operating the device, we would have to conduct a comprehension study.

Without drawing any conclusions about the influence that Lennart's skills in operating the device might have had on his linguistic competence or about his developmental progress, we can nonetheless conclude that his skills with the device improved between February and September. For example, the number of false activations and his exploratory behavior decreased by September. The material in September matches his intentions much more clearly, and utterances can be isolated more easily, than in February. The path that Lennart went when generating a given utterance can be retraced on the basis of the raw data in the working document. It is evident that he tends to form utterances faster and more directly in line with the target in September than he did in February, which can be seen in the declining number of 'searches' (as reflected in the elements he deleted using WL and LL, for example).

If a word Lennart wants to use is not available, either because he cannot find it or because it is not part of the stored vocabulary on the device, his skills in operating the device and the device itself can skew the linguistic outcomes because in such cases utterances would be classified as incomplete.

3.5.3 Discussion of the results within the context of current research

Our overview of current research findings in the theoretical part of this thesis suggested that AAC users tend to produce short and morphologically impoverished utterances and to omit function words such as prepositions, articles, and others, or to simply produce single-word utterances. The results of our analysis of Lennart's language seem to paint a different picture of language use. For example, he uses prepositional phrases with morphologically marked articles, adjectives or pronouns in addition to prepositions. He also uses many complete sentence structures. If we take into account the data excluded from our analysis alongside those that we analyzed, however, our analyzed data may turn out to be so-called "performance peaks." Considering that out of the total of 2705 words in February only 794 were included in the analysis, there is a grey zone that cannot be captured by our analysis's criteria or by the data set available to us. We can only speculate that there may be a range of utterances in the grey zone of the type that have been called "telegraphic utterances" in the literature. By September, this grey zone decreased considerably, as out of the total of 1969 words 1064 were included in our analysis. Consequently, there is developmental progress, which may be attributed to improved competence in operating the device or improvements in linguistic competence.

3.5.4 Final discussion

On the basis of the data set, we were able to draw conclusions about the developmental course in language production over a period of eight months (February 2009 through September 2009). Unlike initially intended, we were not able to observe the development over the course of a full year, since the data of the first four months could not be analyzed. It is also noteworthy that six weeks before the second period of analysis, Lennart entered elementary school (1st grade) and hence was technically not a preschooler anymore. Nonetheless, we can draw conclusions about language development in the preschool years, since that applies to the largest part of the year of observation, and the first six week after starting 1st grade may be considered a phase of adjustment to primary school.

The largest difficulty for our study was the fact that the data set does not contain any contextual information, which would help classify language events. In this sense, the data set of the LAM file offers limited possibilities for the investigation of the development of linguistic structures. For future studies, it would be helpful to choose a research design that includes video recordings in addition to the LAM files. This way, ambiguities in the data, such as those we discussed above, could be reduced or even prevented entirely. Moreover, there would be empirical evidence for which of the utterances the subject produced independently. If a study is based exclusively on LAM files, like our study, the latter is not the case, and one can only guess. On the other hand, it is also critical to protect the subject's privacy when using LAM files.

Our study is nonetheless informative and important because it is the first to use LAM files to study the development of syntactic and morphological structures over a time period of eight months. The files provide an insight into interesting developmental steps, especially in the

area of syntax—despite the ambiguities and unresolved issues discussed above. LAM data recordings are nothing new, but so far have only been used for evaluating intervention programs (cf. Drommeter & Andres 2007), not for documenting the course of language development.

To conclude, further studies of this kind are needed in the future, as are improvements in the research design that would avoid said ambiguities. A large enough database of comparable studies could gradually be compiled for future meta-analyses. This way and by using a variety of research designs, we could step by step approach the final goal of creating an empirically solid knowledge base about language development in children lacking speech who depend on AAC. This knowledge could be used as the basis for an informed diagnosis, targeted intervention planning, and evaluation. The aim of the present case study was to contribute a small piece toward that larger goal and to serve as an example and reference point for further research plans.

4. Conclusion

Within this thesis, we were not able to touch upon all aspects of the complex topic ‘language development,’ and many interesting areas must remain unaccounted for. Moreover, only selected areas of the material could be included into the analysis, and more could be said about the others. Overall, we note that Lennart made considerable progress, especially in the area of morphology, with Accusative case marking of the indefinite article the only remaining difficulty. In the area of sentence structure, the next step in development could be for Lennart to fully acquire structures that involve splitting up the verbal complex, i.e. placing nonfinite verb forms in the sentence-final position and filling the *Mittelfeld* (‘middle field’) between the finite and non-finite verb forms with other constituents. This impending developmental step could be the subject of the next intervention units, in which, for example, the sentence-final placement of non-finite verb forms is practiced. This could also have a positive effect on sentence-final verb placement in subordinate clauses, which could be integrated into the intervention. Although our analysis primarily investigated Lennart’s “performance peaks” in language, we can nonetheless generalize that he is in the process of taking the final step among the milestones that Tracy describes for the acquisition of syntax, which is characterized by the acquisition of complex sentences with subordinate clauses.

In retrospect, we notice that a range of the factors that we identified as advancing language development in chapter 2.2.8 were and are indeed helpful in Lennart’s case. We will briefly highlight them in the following, final discussion.

To begin with, Lennart was provided with a complex electronic communication aid and started using it in the final year of preschool, so that by the time he entered the 1st grade of elementary school (August 2009) he was already competent in using the device. In addition, his communication aid grants him access to core vocabulary, which he makes use of regularly and frequently. Furthermore, his communication aid offers him possibilities to experiment with spoken language, but also with written language. Thus in almost all LAM files, we find strings of letters, but also instances of Lennart purposely using written language, as in “ich höre vier aaaü und psssss” (08.02./106) (‘I hear four aaaü and psssss’) or “Planet f a z n PAG Feuerwerhrauto Feuer WL WL mit Feuer” (19.02./313) (‘planet f a z n PAG fire truck fire WL WL with fire’). He also makes use of the option to produce compound nouns, e.g. Saurier-Aufkleber (‘dinosaur sticker’), and complex verbs, e.g. “ab-schneiden” (14.09./191) (‘off-cut’ = ‘cut off, cut a slice, cut a piece’), and to form words that are not available on his device, e.g. “ich kann ich bin nicht be ö (M: rühmt)” (15.09./512) (‘I can I am not BE-ö (M: famous)’).

Moreover, Lennart uses the auditory feedback option. Especially with respect to morphological marking on verbs, articles, and adjectives, he frequently clicks his way through possible markers, listens to them, seemingly compares them to his inner perception, and subsequently chooses the correct form, with very few exceptions.

The data set clearly shows that the mother (and other caregivers) time and again uses Lennart’s device along with him for the purpose of “modeling,” shows him new structures, offers him language in its full complexity, serves as a model, and thus contributes to the gradual development of Lennart’s productive language. It is also clear that Lennart has daily access to the speech-generating device for prolonged periods of time and that the device is regularly used in certain routines, e.g. during meals in the family circle. At the same time, this illustrates that the use of the device is an important part of the family’s everyday life and that the family

considers its use important for Lennart's further development and support him in the best possible way.

The data further indicate that communication partners in Lennart's immediate environment time and again fill communicative situations with open-ended and exploratory questions (an illustrative example of this and the "modeling" mentioned above can be found in the LAM files 15.09./325-489), and Lennart is encouraged to expand his utterances.

There are also sequences of utterances that reflect engaging experiences with language, e.g. joint storytelling in interaction with the mother (e.g. 07.09./146).

To conclude, we find many of the conditions that positively influence the process of language development fulfilled in Lennart's case.

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