

Specific Language Impairment Revisited: Parallelism vs. Deviance

A Learning-Theoretical Approach¹

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In this paper we discuss data from German speaking, specific language impaired children in three domains: prosody, wh-question formation, and early verb lexicon. The findings reveal that, in contrast with recent claims, the grammar of specific language impaired children constitutes a genuine deviation from normal language development. We argue that this deviation can be best captured in learning-theoretical terms. More precisely, due to reduced bootstrapping capacity, language impaired children lack the knowledge that is necessary in order not to violate constraints on interim grammars such as the Subset Principle. As a consequence, language impaired children unlike normally developing children, resort from early on to representations that are not included within the target grammar. These findings have far-reaching consequences for the intervention in language impaired children.

1. Preliminaries: Delay or Deviance?

There is a long-standing discussion in the tradition of language disorder research concerning the question of whether the grammar of language impaired children is “deviant” or simply “delayed”. A detailed overview of this issue is found in Clahsen (1988), Leonard (1997), Grimm (1999), and the literature cited therein. The following cover terms serve to distinguish three possible accounts for the differences between impaired and normal language development:

- (1) Possible differences between impaired and normal language development
 - a. **Delay:** The typical phenotype of children with specific language impairment follows from a late start. Although the language development is severely slowed down, the child should be capable of catching up with normal development.
 - b. **Stagnation:** The typical phenotype of children with specific language impairment follows from a plateau formation at a specific intermediate stage with persistence traits. The developmental path of the language impaired child constitutes a well-formed subset of normal development.
 - c. **Deviance:** The typical phenotype of children with specific language impairment follows from a qualitative difference between speech development in language impaired and normally developing children.

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Each of these accounts makes different predictions with regard to the deficits the language impaired child may have in the various domains of grammar. The common denominator of the Delay and the Stagnation Account is that the learning mechanism itself and the representations of the child's grammatical knowledge should not differ essentially between language impaired and normally developing children. By contrast, the Deviance Account can be maintained only if there is evidence that, in some basic sense, language impaired children resort to compensatory learning strategies the output of which is not found in normal language acquisition.

In what follows we provide evidence in support of the Deviance Thesis from longitudinal and experimental studies in three central domains of language acquisition, namely prosody, wh-question formation, and the early verb lexicon. The criterion we employ to evaluate the language impaired children's representations in these domains is adherence to Weissenborn's (1994) "Local Wellformedness Condition". The latter is a variant of the Subset Principle which we take to be a necessary learning constraint on underspecification in normal language acquisition.

It has been repeatedly proposed in recent literature on language acquisition that, given the inaccessibility of negative evidence, children must obey some continuity restrictions in order to avoid irreversible wrong decisions (cf. i.a. Wexler and Manizini (1987), Roeper and de Villiers (1992), Weissenborn (1994), Penner (1996), and Penner et al. (1998)). It has been further suggested that, in order to avoid irreversible wrong turns in the course of language acquisition, the child adheres to some variant of the Subset Principle. Given that the term "Subset Principle" in its strict set-theoretical interpretation might be misleading in our discussion, we will use the more accurate notion of "Local Wellformedness Condition" as a cover term for general constraints on the child's interim representations.

The "Local Wellformedness Condition" as developed in Weissenborn (1994) is claimed to account for constraints on the child's intermediate representations of the clause structure in German. It is a variant of the Subset Principle which says that each representation of the child's utterances is locally well-formed, i.e. it is included within a higher projection in the sense of Grimshaw's (1991) theory of extended projections.

Generalizing this constraint, we will assume that, at each point of acquisition and in any grammatical component, the child's grammar must be a licit structure of the target grammar at the same level of representation.²

This means that any kind of underspecification should be ruled out if it is inconsistent with the target grammar. This is easy to see in a binary system. So, for instance, no iambic interim representation should be allowed in a trochaic language.³ This holds in a similar way for head-directionality and object placement. Basic decisions at the level of lexical semantics behave in the same way. Taking the notion of event type to be a primitive of the verb lexicon, we expect that, if a given verb designates an unequivocally resultative (or telic) event in the ambient language, the child should avoid assigning a non-resultative meaning to this verb at any point of language acquisition. We will further assume that the child should avoid any violation of the

2. More specifically, the expression „at each point of acquisition" is to be understood as „from the onset of canonical babbling" (Oller (1986)). This is the stage at which the first rhythmic parameters are set (s. also Jusczyk's (1997)).

3. At the level of the "minimal word", as we will see below.

basic c-selectional mechanisms of extended projections. So, for instance, no infinitives embedded within a DP are ever expected to emerge in the course of language acquisition. In addition, the notion of “level of representation” plays a crucial role in constraining the child’s grammar. In this regard, it is assumed that the “Local Wellformedness Condition” rules out any overextension of discourse-dependent phenomena, which are restricted to root clauses or to embedded clauses. This restriction holds for “topic drop” and other discourse-based omission phenomena in German which may be applied only under intermediate discourse accessibility in root clauses.

The fact that the child’s intermediate representations are consistent with the target language in the above sense should prevent the emergence of parameter missetting or overextensions which the child cannot reverse. Once the child has projected an underspecified, but target-consistent representation, she can extend her knowledge to include more complex feature specification.

The crucial question of what enables the child to start out with a target-consistent representation unexpectedly has not been addressed in the literature. Following Jusczyk’s (1997) work on early sensitivity to prosodic regularities and Weissenborn et al. (1998) and Höhle and Weissenborn’s (1999) work on early sensitivity to syntactic triggers, we will assume that normally developing children gain access to prosodic and syntactic parameters during the first year of life, that is prior to the emergence of lexical production. It is this kind of grammatical information which the child employs very early in order to bootstrap target-consistent representations to start with.

Given these considerations, we will assume that if the language impaired grammar constitutes a genuine deviation from normal language development, then the difference between the two populations should be expressible in terms of violation vs. adherence to the Local Wellformedness Condition. If this turns out to be the correct generalization of language impaired grammar, we expect the reason for this phenomenon to be rooted in the language impaired children’s reduced capacity to process the information necessary for the early bootstrapping procedure.

2. Early Prosody

In acquiring the prosodic units along the prosodic hierarchy (Demuth (1996)) the normally developing child proceeds from minimal to supraminimal words. The minimal word, which is typical of the initial stage of phonological development, is defined as follows:

- (2) Minimal Words
(Content) Words are minimally bi-moraic. That is, content words are minimally binary feet under either a syllabic (CVCV) or a moraic (CVC) analysis.

As discussed in Demuth and Fee (1995), Demuth (1996), Salidis and Johnson (1997), and Penner and Wymann (1999), evidence for the Minimal Word Stage comes from a range of phonological processes whose function is to map the target word onto a minimal word template. Examples for these processes are given in (3):

(3) Processes involved in Word Formation during the Minimal Word Stage

Term	Process	Example
Omission	A syllabic or a subsyllabic unit is omitted	Ba'nane > ['nanə] „banana“, Ballon > ['pɒm]
Epenthesis	A segment is inserted in order to add a syllabic unit to the template	Melk > ['mɛlək] „milk“
Reduplication	Syllable copying	Paula > ['papa] (name) Bauch > ['baba] „belly“
Level Stress	Instead of having one single prominent stress, <u>polysyllabic, supraminimal words</u> are stressed as if it would consist of two independent minimal words	Ele'fant > ['ɛfa'fan] „elephant“

As can be seen from the examples in (3) and in line with Pye (1983), Connely (1984), Echols and Newport (1992), Gerken (1993), Gerken and McIntosh (1993), Wijnen, Kirkhaar, and den Os (1994), Demuth (1996), Salidis and Johnson (1997), and Lléo and Demuth (1999), it seems that early minimal words formation adheres to what Demuth (1996) refers to as “*stress-sensitivity*”. Normally developing children are claimed to be “stress-sensitive” in the sense that the lexical items they produce during the minimal word stage are guided and constrained by the rhythmic pattern of the target language. In technical terms, the child is capable of correctly representing the “head” and the “non-head” of the word. This representation has a threefold manifestation:

- (4) Stress-Sensitivity in Early Word Production
- All disyllabic minimal words in trochaic languages such as English, Dutch, or German are supposed to be trochaic templates (feet) produced from an early stage on.
 - If minimal word formation results from reduplication, we not only expect a trochaic pattern, but also a preference for the reduplicated material to stem from the stressed syllable of the target word (i.e. from the head of the target word).
 - If a target supraminimal word undergoes omission, the stressed foot (or syllable) is supposed to be retained.

The early stress-sensitivity of normally developing children implies that they have explicit prosodic representations in which the position of the head of the word is correctly fixed from the onset. More precisely, the child has correctly set the head directionality parameters, but can apply them only at the level of the minimal word. We thus conclude that normally developing children adhere to the Local Wellformedness Condition in the prosody.

The fact that the normally developing child starts out with a wellformed substructure of word rhythm is by no means trivial, given that the input data are highly contradictory. This holds, for instance, for disyllabic words in German. On the one hand, the child is exposed to a high rate of trochaic monomorphemic words such as '*Jacke* (jacket) or '*Blume* (flower). On the other hand, the child frequently hears final-stressed disyllabic words such as '*Pi'lot* (pilot) or '*Sa'lat* (salad). The child has to find out in the course of prosodic development that the trochaic words represent the underlying, productive rhythmic pattern of the target language, whereas the final-stress in disyllabic words results independently from the Main Stress Rule which assigns prominence to the superheavy syllable in the right most side. That is, disyllabic words are assigned final-stress if they are supraminimal due to the fact that the second syllable is super-heavy.

Fikkert and Penner (1998) and Penner and Wymann (1999) propose that the child succeeds in identifying the trochaic pattern as the default option by referring to the rhythmic pattern of nickname formation and other clipping mechanisms.⁴

Given this assumption, the question now arises of whether and to what extent language impaired children adhere to the principle of stress-sensitivity. Thus a detailed longitudinal study was conducted of the language impaired child N. from 1;1 to 5;6. In our presentation we will focus on N.'s prosodic development between 3;03,19 and 5;04,25.⁵

4. Typical examples for clipping (and reduplication) phenomena in German are given in (i):

Universität	>	Uni	Coca Cola	>	Coci	Dinosaurier	>	Dino
Kriminalpolizei	>	Kripo	Mutter	>	Mutti		>	Lari-fari
Michael	>	Michi	Liselotte	>	Lilo			

5. N.'s care was provided at home by the mother while the father worked during the day. Both parents are native speakers of the German variety of Berne (Switzerland). According to both speech therapeutic and psychological tests N. fulfills the standard criteria of Specific Language Impairment with respect to IQ, social environment, and psycho-emotional behaviour. The documentation of N.'s data begins with the babbling stage at the age of 1;1 in a video recording done by the parents. We began with systematic speech elicitation shortly after the third birthday. At that age N. displayed the main characteristics of severely delayed language development, namely a lexicon smaller than 50 items, no word combinations, and severe prosodic constraints on word production as well as on rhythmic deviations (cf. Fikkert and Penner (1998)). In our analysis we focus on N.'s prosodic development between 3;03,19 and 5;04,25. The data corpus consists of 16 1-hour sessions, which were recorded in the child's natural environment at home with a Sony DAT Walkman. Each of the utterances was phonemically transcribed, with special attention to prosodic features such as stress placement, syllable structure, and vowel length. In addition to monosyllabic words, for the purpose of rhythmic evaluation we extracted 7-40 di- and multisyllabic words from each recording which were appropriate for computer aided analysis. That is, the data base of our analysis consists of unfocussed lexical items which are noise- and overlapping-free. These items were entered into the computer speech application "Praat" and checked against the parameters [Intensity], [Pitch], and [Duration]. Note that the former is the main phonetic correlate of word stress in the dialect under investigation (for details see Penner and Wymann (1999)).

The development of N.'s stress patterns in disyllabic minimal words is summarized in Figures (1)-(3). The overall distribution of the various stress patterns indicates that stress assignment is close to chance level (at least as far as the distinction trochaic vs. non-trochaic is considered), namely 52% trochees, 29% iambs, and 19% level stress. Note also that the violations of the trochaic principle at the level of minimal words displays a persistent character (% of monomorphemic, non monosyllabic words N=205):

Figure (1): The distribution of trochees in disyllabic minimal words⁶

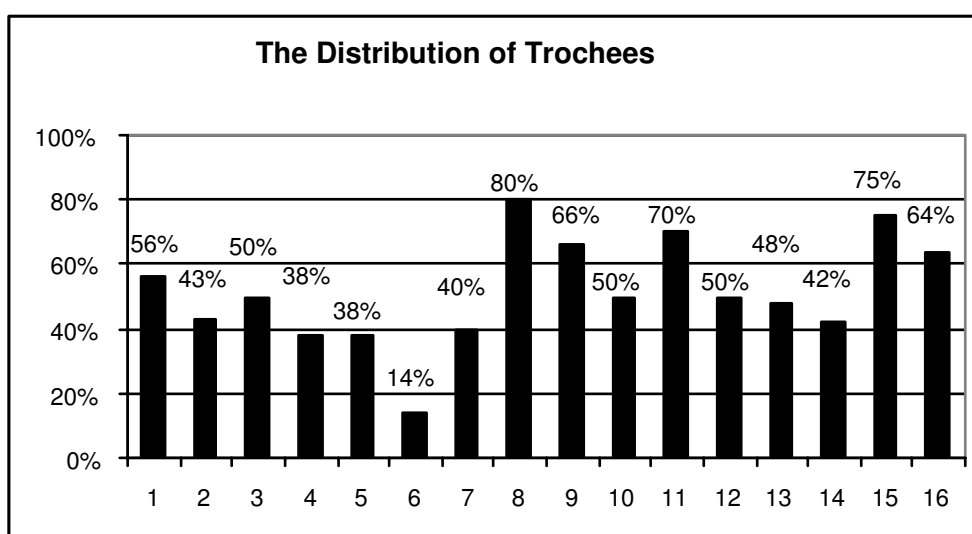


Figure (2): The distribution of iambs in disyllabic minimal words

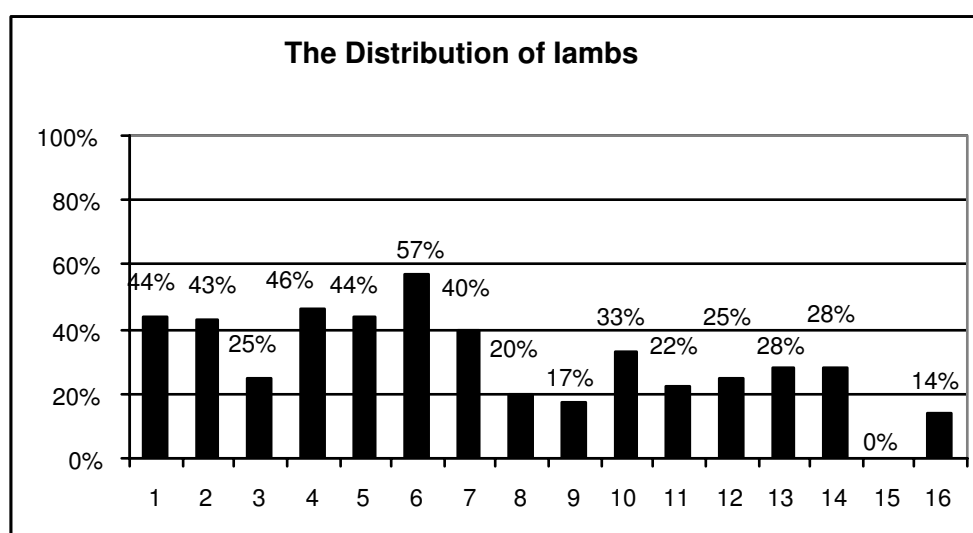
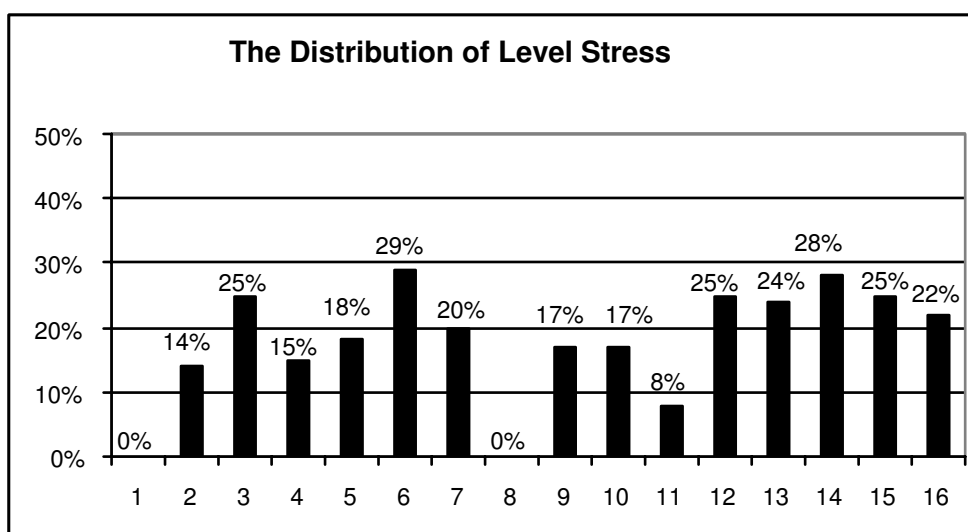


Figure (3): The Distribution of Level Stress in disyllabic minimal words

⁶ The age of N. at the number of session was the following: session 1 - 3;03;19, 2 - 3;04;06, 3 - 3;05;13, 4 - 3;07;09, 5 - 3;09;29, 6 - 3;10;29, 7 - 3;11;03, 8 - 4;01;00, 9 - 4;02;02, 10 - 4;03;28, 11 - 4;04;16, 12 - 4;06;16, 13 - 4;08;30, 14 - 4;11;11, 15 - 5;02;01, 16 - 5;04;26)



Furthermore the distribution of reduplication patterns needs to be examined. In general, reduplication is the most prominent strategy that N. employs in minimal word formation (mean value: 60% of all lexical items analyzed in the corpus). The crucial question is: Does N. reduplicate the head or the non-head constituent of the target word? Unexpectedly, as can be seen from (5), N.'s reduplication patterns do not display any preference for the head of the target word. In fact, the reduplicated syllable is preferredly the final, unstressed syllable:

(5) The Distribution of (Complete) Reduplication Items

Monomorphemic Words	
Stressed syllable (head) is reduplicated	36%
Unstressed syllable (non-head) is reduplicated	64%
Bimorphemic Words	
Stressed syllable (head) is reduplicated	12%
Unstressed syllable (non-head) is reduplicated	88%

We now turn to omission patterns which are rather marginal in N.'s word formation. The question is: Does N. retain the stressed foot in omitting material from the target word? A close examination of the data reveals that N.'s distribution of omission patterns shows no clear preference for the stress-sensitive pattern. The distribution is: 56% stress-sensitive omission vs. 44% stress-insensitive omission. Examples are given in (6):

(6) The Distribution of Syllable Omission in Monomorphemic Words

Age	Stress-dependent omission	Stress-independent omission
3;03,19		'Telefon > ['bawe]
4;01,00		Trom'pete > ['toto]
4;03,27	Ba'llon > [boom]	
4;04,15		Ba'nane > ['bawe]
4;06,14	Spi'tal > [tal] Me'lina > ['nina]	
4;08,29	Verstecken > ['te'ke]	Ba'nane > ['baa'ne]
5;02,01	Ele'fant > [fant] Pa'pier > [pier] Ba'llon > [poon]	Ba'nane > ['bwane] 'Telefon > ['tefon]
5;04,25		Ba'nane > ['bane] 'Telefon > ['le'fon] 'Ananas2 > ['a'naf]

In sum, the data of normally developing children indicate that they are stress-sensitive from early on. Expressed in learning-theoretical terms, normally developing children obey the Local Wellformedness Condition. By contrast, having examined the stress patterns in disyllabic words, the reduplication patterns, and the omission patterns in minimal word formation in N.'s corpus, it seems that the language impaired child performs at chance level with regard to the basic stress assignment parameters at any point of her developmental path. This gives rise to radically underspecified representations in which the head position is not fixed. The child's minimal word formation thus displays patterns which are excluded in the target language and which are clear violations of the Local Wellformedness Condition, which requires target-consistency at each stage of language acquisition. Moreover the language impaired child's representations include level stress patterns in minimal word formation. In contrast with iambic patterns which represent the underlying rhythmic rule in many languages, level stress is not a licit UG option. In this sense, it seems that the child not only missets the target parameter, but in fact also permits choices incompatible with UG.

3. Formation of Wh-questions

It has repeatedly been noted in recent literature that, as long as the CP shell and the V2 rule in German are not acquired, the child resorts to interim representations of wh-questions (cf. Müller (1993), Penner (1994), Tracy (1994), Kursawe (1994), Weissenborn (1999)). The most frequent patterns attested in early wh-questions in normally developing children are wh-drop, particle questions, and verb final structures (the finite verb is in the subordinate clause position). The following examples illustrate these patterns:

(7) Early Wh-Question Formation in Normally Developing Children

- a. Zero questions (i.e. the Wh-pronoun is dropped):
(Tracy (1994) V. (1;11))
der Flöte is?
the flute is?
"(where) is the flute?"
- b. VE questions (the finite verb is in the clause final position)
(Wode (1971) I. (2;08))
wo Björn wohnt?
where Björn lives
"where does Björn live?"
- c. Particle Questions (the Wh-pronoun is reduced to a prelexical place-holder)
(Penner (1994) M. (2;01))
k'hett's Hammer?
particle has-it hammer
"where is the hammer?"

The same patterns also occur in children with language impairment (cf. Penner & Hamann (1998), Hamann, Penner, and Lindner (1999), and Wymann (in preparation)). Two examples from Hamann, Penner, and Lindner (1999) are provided below:

- (8)
 - a. das is?
that is
"what is that?"
 - b. wo das brennt?
where that burns
"where does it burn?"

At first glance then, it seems that language impaired children differ from normally developing children merely in terms of delay and persistence of the interim solution in the sense of the Stagnation Thesis.

There is, however, one domain in which we observe a crucial difference between the two populations with regard to question formation in German. This difference concerns the occurrence of wh-infinitive questions. As can be seen from the data in (9), the mean value of wh-infinitive questions in normally developing children is 0.5% which is extremely marginal:⁷

(9) wh-infinitive questions in normally developing children

7. A detailed comparison of the German data with Dutch, Swedish, Italian, French, and English is found in Phillips (1995).

Corpus Penner (longitudinal study of 3 children) Penner (1994)	Corpus Müller (longitudinal study - Simone) Kursawe (1994)	Corpus von Stutterheim/Scharnhorst (longitudinal study (Henriette) Schweizer (1999)
N wh-questions =251	N wh-questions =306	N wh-questions = 214
0% Infinitive Questions	0.3% Infinitive Questions	2.4% Infinitive Questions

In this regard, language impaired children crucially differ from normally developing children. As can be seen from the data in (10), the mean value of wh infinitive questions in language impaired children is considerably higher. The data in Hamann, Penner, and Lindner (1999) are based on a profile study (single recordings) of 50 language impaired children. The data in Wymann (i.p.) are based on an analysis of N'.s and Ni.'s data:

(10) wh infinitive questions in language impaired children

Hamann, Penner Lindner (1999) (spontaneous data from 50 SLI children)	Wymann (i.p.) (longitudinal study – 6 late talkers)
N wh-questions = 151	N wh-questions = 99
24.98% Infinitive Questions	31.5% Infinitive Questions ⁸
	Wymann (i.p.) (longitudinal study – 6 late talkers)
	N wh-questions = 282
	19.1% Infinitive Questions ⁹

Typical examples are given in (11):

- wh infinitive questions in language impaired children: examples
- (11) a. wo das denn wohl hingehen? (Sebastian, Corpus Hansen)
where that then go to
"where is that then going to?"
- b. wo Anna gaa mama? (N., 4;01;00)
wo gehen Anna (hin), Mama?
where Anna go, mummy?
- c. wo das dinnsii? (N. 4;11;03)
wo das drinsein?
where this inside be

8. All 99 analysed questions are taken from the corpus of the child N. Many of N.'s questions are formulaic (*woda* questions without any overt verb or noun). If we put aside the *woda* questions (as in Hamann's et al. study) the percentage of infinitive questions increases to 81%.

9. All 268 analysed questions are taken from the corpus of the child Ni. Many of Ni.'s constituent questions are questions of the type analysed in (11)fe., a sort of wh-in-situ construction.

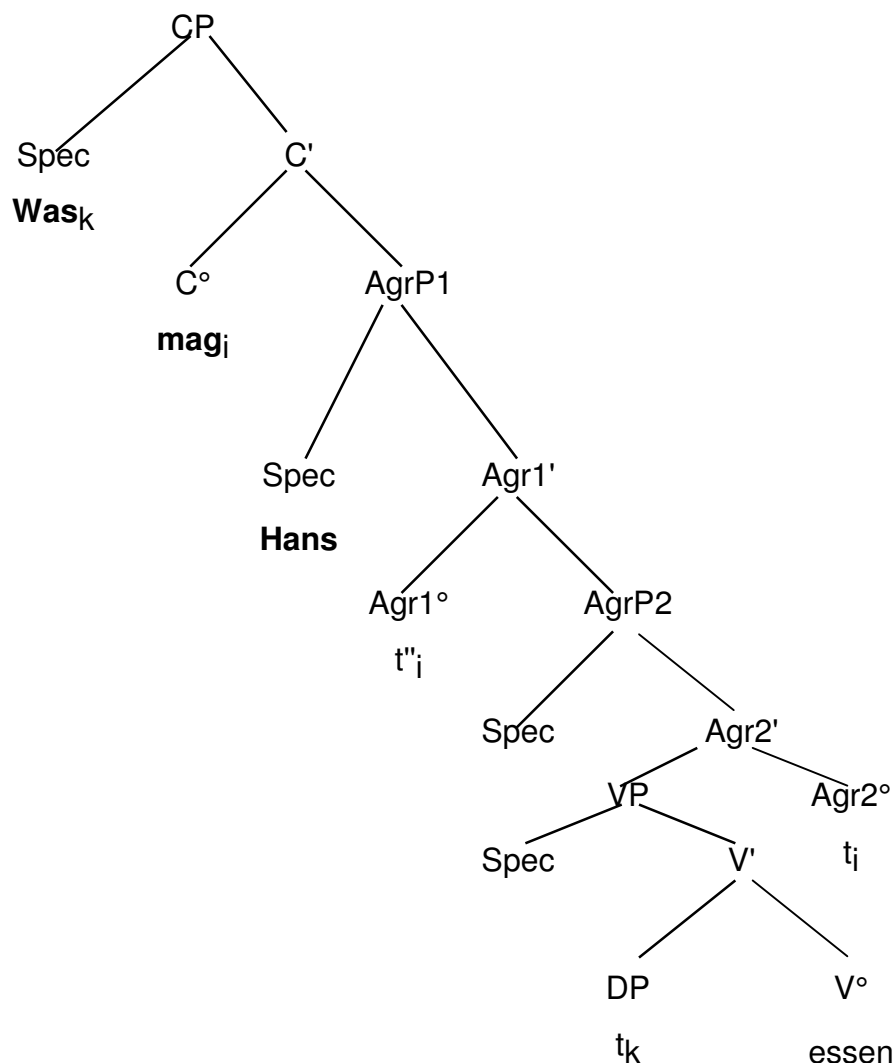
- | | | |
|----|--|---------------|
| d. | was bebe dinke?
was Baby trinken?
what baby drink | (N. 5;04;26) |
| e. | dä was mache?
der was machen?
this (one) what do? | (Ni. 3;06;06) |
| f. | was (d)as ufetlaage?
was das hochtragen?
what this carry up? | (Ni. 3;11;00) |

As shown in Hamann, Penner, and Lindner (1999), the *wh*-infinitive question is the most preferred error type found in the *wh*-question formation data of the language impaired children. This trend is confirmed by N.'s and Ni.'s data both with only 6.7% of *wh*-drop.¹⁰

How can we account for the difference concerning the distribution of *wh*-infinitive questions in the two populations (normally speaking and SLI children)? It is important to note that root *wh*-question formation in its unmarked form in German involves the application of the V2 rule. As shown in (12), *wh* formation involves *wh* movement to SPEC,CP and verb movement from AGR1° to AGR2° to C°:

10. Parallel to *wh*-infinitive questions, language impaired children also display illicit infinitives in (conjunctive) subordinate clauses. That this structure may become persistent is shown in Penner and Schönenberger's (1997) analysis of MF.'s corpus. Penner and Schönenberger found that of 733 subordinate clauses 100 involve uninflected verbs (14%). This goes hand in hand with the fact that 13% of MF.'s subordinate clauses involve illicit subject pro-drop.

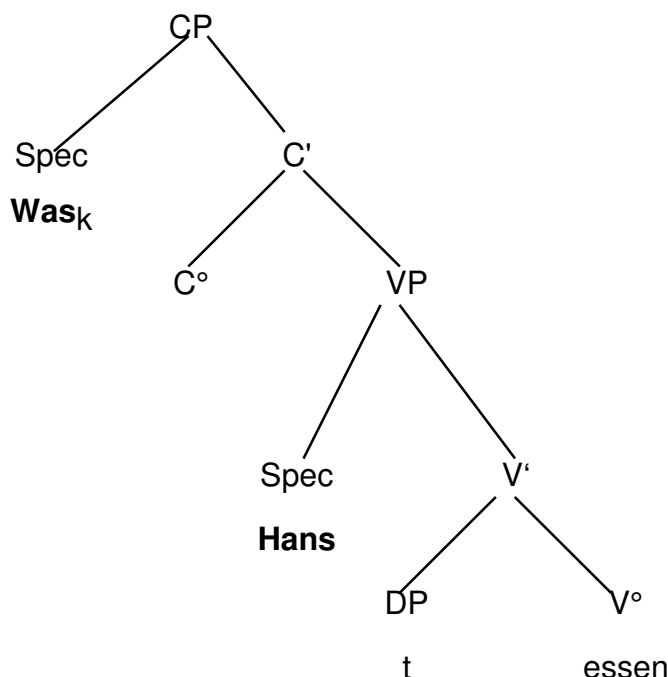
(12) The V2 Rule (main clause): was mag Hans essen
 what likes Hans eat
 "what does Hans like to eat"



In terms of subcategorization features, COMP selects an inflectional projection, i.e. the presence of an overt wh-phrase implies the presence of an AGRP.

The data indicate that the intermediate representations of wh-questions in normally developing children are systematically constrained by the "Local Wellformedness Condition" which rules out any violation of the target structure in terms of formal features. Given (12), the „Local Wellformedness Condition“ implies that the child may „truncate“ the CP shell in wh-question formation altogether, giving rise to wh drop or verb final configurations as in (7a-b) (since V2 does not apply). What seems to be excluded under the "Local Wellformedness Condition" in normal language development is the chain [**overt wh + Infinitive**] in (13), given that this configuration directly violates the basic selectional requirements of the COMP projection which in German root clauses entails an inflectional projection:

- (13) *was Hans essen?
 what Hans eat (infinitive)



As can be seen from the data in (9), (13) is exactly the kind of violation normally developing children generally avoid. As already alluded to in the previous section with regard to the rhythmic rule, the fact that normally developing children systematically avoid wh infinitives is by no means trivial. This is due, among other things, due to the fact that wh infinitive questions introduced by *warum* (why) are frequent in the adult language (cf. Schweizer (1999) for a detailed discussion of this phenomenon in German). Wh infinitive questions introduced by *warum* (why) frequently occur in discourse frames of the type (14) in which the missing modal is probably reconstructed by means of discourse anchoring (or linking to both the preceding and the following clauses):

- (14) Speaker A Kauf dir doch ein Fahrrad!
 "do buy yourself a bike"
 Speaker B Warum kaufen wenn ich eines klauen kann?
 "why buy-INF, if I can steal one?"

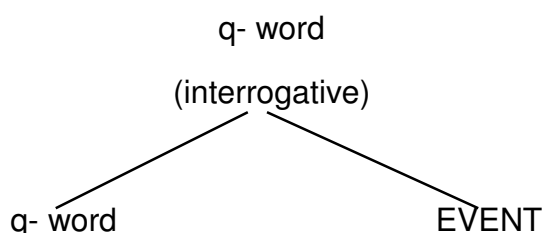
It is noteworthy that this kind of discourse-dependent root wh infinitives is a particularity of *warum* "why". With all other wh pronouns this option is ruled out. This idiosyncratic property of *warum* "why" is closely connected to the special pragmatic status of why questions (cf. de Villiers (1990)).

The fact that no essential overgeneralizations of wh infinitive questions occur in normal language acquisition indicates that normally developing children are sensitive to the fact that (14) is a residual, word-specific, and discourse-dependent option of

the target language rather than a productive rule of the target grammar. In other words, normally developing children seem to be aware of the fact that root wh infinitives may occur only at a specific level of representation so that any overextension of this option would violate the “Local Wellformedness Condition”.

In light of the fact that wh-infinitives are the most preferred error pattern with regard to wh-question formation in language impaired children, it seems that these learners are less sensitive to the “Local Wellformedness Condition”. As proposed in Penner and Hamann (1998) and Hamann, Penner, and Lindner (1999), language impaired children resort to a (radical) “Minimal Default Grammar” (Roeper (1996), Penner and Roeper (1998)). The “Minimal Default Grammar” format spells out the initial underspecification of syntactic structures within the minimalist framework of Chomsky (1995). The basic mechanism of structure building in the „Minimal Default Grammar“ format is the operation “Merge” which takes a pair of syntactic objects (SO_i, SO_j) and replaces them by a new combined syntactic object (SO_{ij}), without being specified for Formal Features such as categorial identity and subcategorization restrictions. In the radical form of the „Minimal Default Grammar“ only the word features are projected. This implies that in question formation the feature [Q-Word] is projected from the head position onto the mother node, whereas the complement position can be occupied by any constituent instantiating an event (VP or IP). The basic structure of the radical „Minimal Default Grammar“ is given in (15):

(15)



(15) is exactly the configuration type which may generate wh infinitive questions in language impaired children. Once the child permits (15), a violation of the Local Wellformedness Condition is given rise to, since the child does not adhere to the selectional feature of the interrogative pronoun.

We thus conclude that, on a par with the acquisition of the rhythmic rules, language impaired children do not adhere to the Local Wellformedness Condition in the domain of wh-question formation.

4. The Early Verb Lexicon

We now turn to the verb lexicon. In this section we report on new findings from our study of the acquisition of the verb's event-structure in German speaking normally developing and language impaired children. The data are based on series of longitudinal studies from the onset of word production (cf. Penner, Wymann, Dietz (1998)) and on an experimental comprehension study (cf. Schulz, Wymann, Penner (1999, to appear)). The subjects are 5 normally developing children and 4 language impaired children who were identified as late talkers in accordance with Rescola's

(1989) definition of delayed language acquisition and later classified as specifically language impaired children.¹¹

The acquisition of verb meanings poses a special challenge to the language learning child. On the one hand, events are more difficult to perceive in terms of joint visual attention due to their fleeting character and temporal structure. In addition, given the notorious ambiguity of scenes with regard to linguistic expressions, the child cannot *a priori* know which part of the event is transferred into a given verb. On the other hand, the child has to solve the problem of parametric variation and its interaction with verb semantics. In contrast to names for objects, verbs are subject to a considerable parametric variation. Languages may differ not only with regard to the choice of argument incorporation (cf. Talmy (1982), Hale and Keyser (1993) and related literature), but also with regard to how event structure is marked in the syntax. In German, compositional telicity is assumed to be marked by quantified objects. So, for instance, the verb *essen* “eat” is interpreted as an atelic process with a bare mass noun object (15a). If the object is marked by a determiner as in (15b), the predicate is interpreted as a telic event of the type ‘transition’ (cf. van Hout (1996), Verkuyke (1972, 1993)):

- (15) a. Er hat Käse gegessen “he has cheese eaten > he ate cheese”
(process, atelic)
- b. Er hat **den** Käse gegessen “he has **the** cheese eaten > he ate **the** cheese”
(transition, telic)

While this generalization holds for incremental verbs of consumption, no such unambiguous correlation between the presence of an overt determiner and telic reading exists with weak-endstate, incremental verbs such as verbs of removal with a locative object (e.g. *fegen* „sweep“) or verbs of creation of the type *bauen* „build, construe“. Such verbs are merely pragmatically-favored-endstate-verbs which can be associated both with a completive (telic) and a process (atelic) interpretation. Nevertheless, in both cases a determiner must occur with the direct object. This is shown in detail in Penner, Wymann, and Dietz (1998) and Wittek (1999), who content that the extent to which determiners may contribute to event type marking is dependent on the temporal, spatial, and material properties of the verb’s object.

Another way of marking event type in German is by verb prefixation. So, for instance, the prefixes *auf* or *aus* in (16) mark the incremental events as telic:

- (16) a. *Essen* „eat“ (process, atelic) vs. *auf-essen* “AUF-eat” > eat up (transition, telic)
- b. *Waschen* “wash” (process, atelic) vs. *aus- waschen* “AUS-wash” > wash out (transition, telic)

Note, that this kind of prefixation correlates with telicity only under specific circumstances. So, for instance, the prefix *an* in *an-machen* “AN-make” (“turn on”) contributes to telicity, while *an* in *anspritzen* “AN-spray” (“spray at”) does not. The latter is unequivocally atelic. The same holds for the prefix *auf*. As shown in (15a), this prefix is the telicity marker in *auf-essen* “AUF-eat” (“eat up”). This is not the case

11. The criterion is: „less than 50 lexical items at the age of 2;0”.

with the verb of creation *bauen*, since *aufbauen* “AUF-build” can be interpreted as atelic. Again, the extent to which verbal prefixes may contribute to event type marking seems to depend on the semantic type of the verb and its object.

Using Pustejovsky’s (1995) terminology, whether or not prefixes of the type *an* or *auf* contribute to telicity correlates with the distinction between the prominent and the less prominent subevents in complex events (“head subevent” vs. “non-head subevent”). This distinction seems to be tightly linked to the choice of the verb stem. So, for instance, in *an-machen* “AN-make” (“turn on”) the process subevent is unequivocally less prominent. That is, the manner of undergoing change from one state to another is irrelevant. This correlates with the fact that the process subevent is spelled out by the semantically empty verb *machen* “make, do”. The head of event, namely the endstate subevent, is expressed by the prefix *an*. By virtue of being the head of event, the endstate is entailed and the atelic reading is ruled out. This is not the case in change of location verbs such as *anspritzen* “AN-spray” (spray at) or incremental verbs of creation of the type *auf-bauen* „AUF-build, construe“. Although, on a par with *an-machen*, these verbs denote complex events of change of state, it seems that the process and not the endstate subevent figure as the head of event. That is, the manner of undergoing change is semantically more prominent. The implied endstate can be merely pragmatically-favored. In contrast with *an-machen* “AN-make” (turn on) these verbs can be associated with both telic and an atelic interpretation. More generally, prefixes of the type *an* or *auf* are “resultative” in the sense that they always refer to an endstate in some change of state event. Unequivocal telic interpretation is assigned to these prefixes only if they figure as the head of event.

In sum, there is an intricate relationship with regard to event type marking between parametrization and the semantic type of the predicate. This implies that, in acquiring the language-specific rules of event type marking, the child cannot benefit from parametric information as long as she has not assessed the semantic type of the predicate.¹²

Although verbs should be extremely difficult to learn, normally developing children acquire words to describe events already in very early stages of language acquisition.¹³ This raises the question of how and to what extent the normally developing child succeeds in overcoming the input ambiguities in acquiring verb meaning. As far as we are aware of, no learning algorithm has been proposed to account for how the child can acquire verb meaning during the second year of life.¹⁴

12. Evidence for this hypothesis comes from experimental studies of van Hout (1997, 1998) and Kortschak (1999). They found that Dutch and German speaking children fail to use determiners as telicity markers until late in the fifth year of life.

13. For an actualized overview see Woodward and Markman (1998) and Behrens (1998).

14. Three main proposals are found in the literature all of which have been tested with older children:

- a. **Biases of event perception:** In analogy to Markman’s (1994) „assumptions“ and Landau’s (1994) „shape bias“ as guiding principles of early object naming, it has been proposed that children may have certain preferences in event perception. So, for instance, Behrend (1990a) argues for preference for the outcome reading of complex events. By contrast, Gentner (1982), Gropen et al. (1991), Behrend (1990b) claim that children are guided by a „manner/instrument bias“. Note, however, that the evidence on which these accounts rely comes from experimental studies with children older than 2;0. That is, they do not reflect the initial knowledge of the verb lexicon.
- b. **Syntactic bootstrapping:** As argued in Gleitman and Landau (1985), Gleitman (1990) and related literature, the child makes use of the syntactic frame of the verb in order to derive the meaning. Although this account has been repeatedly confirmed in a number of studies (s., inter alia, Naigles, Fowler, and Helm (1992) and Naiglers, Gleitman, and Gleitman (1992)), there is no direct evidence

Recently, Penner, Wymann, and Dietz (1998) and Penner, Schulz, Wymann (1999) have proposed a model of „event-structure-bootstrapping“ (ESB). The ESB model, which is originally based on longitudinal studies of 5 German speaking, normally developing and 6 language impaired children from the onset of word production, is an attempt to account for how German speaking children succeed in logging into the verb lexicon without risking violations of the Local Wellformedness Condition.

Within the ESB framework, The initial state can be characterized as follows. At the first stage, the child focuses on the event structure component of verb meaning. More specifically she confines herself to the head-of-event, i.e. to the semantically most prominent subevent of a transition. In other words, the child first assesses whether the verb denotes a telic or an atelic type event. During this stage, the two other components of the verb’s lexical representation, namely core meaning and argument selection, remain unspecified.

In order for this selective procedure to be successfully applied, the child must log into the system with a specific verb whose event structure is optimally unambiguous. As for German, the best candidates for this purpose are prefix verbs of the type *auf-machen* „AUF-make“ (roughly „open“) and *zu-machen* „ZU-make“ (roughly „close“). This is mainly due to two factors:

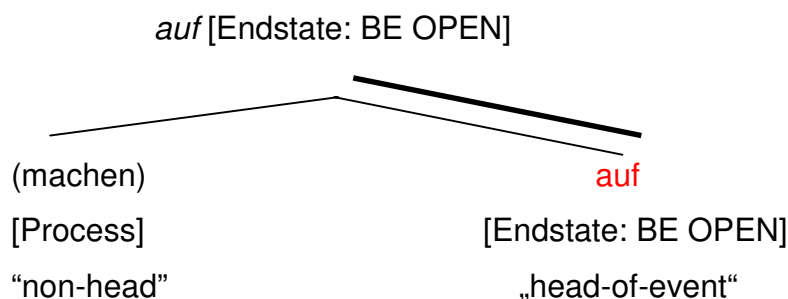
- a. Unlike incremental verbs of removal or creation, verbs of the type *aufmachen* the change of state (e.g. from BE CLOSED to BE OPEN) is punctual. For this reason, the transition denoted by *aufmachen* has a very simple temporal structure.
- b. The internal hierarchy of the transition-type event is optimally transparent, given that the less prominent process subevent is unequivocally marked as non-head by the dummy verb *machen* (make, do).

Once the child has picked an *aufmachen*-type verb out of the input, she first establishes an „economical“ representation of the event type. This initial representation of the child is best captured as a simple merger in the sense of the Minimal Default Grammar, depicted in the previous section with the prefix *auf* as the marker of the endstate in the head position and a position to host the non-head process subevent. The latter is initially empty, so that the verb is spelled out as a bare prefix. The light verb *machen* occurs a few weeks after the emergence of the bare prefix expressions. This initial merger is illustrated in (17):

that 1- and 2-year-olds indeed benefit from syntactic frames in learning verb meanings (s. Woodward and Markman (1998) and Behrens (1998) and the literature they cite). That is, it might be the case that linking verb meanings to the number of arguments is a late learning strategy which is first applied during the third year of life.

- c. **The Adverbial Modification Cue Hypothesis:** As shown in Wittek (1998, 1999), children aged 4;0-7;0 may refer to scope properties of event modifiers of the type *wieder* „again“ in learning event types.

(17) The initial event structure of *auf-machen* (AUF-make)



The table in (18) gives a brief overview of the emergence of bare prefixes among the normally developing children in our longitudinal studies:

(18) First verbal prefixes in 5 normally developing children

Child (Age)	H. (1;03,22)	K. (1;06,01)	E. (1;04;16)	L. (1;03,11)	J. (1;02,18)
Prefix	auf(-machen)	auf(-machen)	auf(-machen)	zu/auf(-machen)	zu(-machen)
Gloss	AUF-make	AUF-make	AUF-make	AUF/ZU-make	ZU-make

As can be seen from (17), during the initial stage only the event structure is specified in the child's representation of the verb meaning. The other semantic components of the verb, namely the core meaning and the argument selection seem to remain unspecified. For instance, taking the core meaning of the verb *aufmachen* to be something like (19) (Pause and Heitz (1999): x: Subject; v: CL_SYSTEM (closing system); z: B_SPACE (constrained space); y: CLOSING_R, (relational locking/closing entity = the moved entity)):

(19) $(\lambda z) (\lambda y) \lambda x \exists v$ [CAUSE (MANIPULATE (x,y), BECOME (ACCESSIBLE (z,v)))]

None of the predicates or the argument nodes in this representation are explicitly specified in the child's early lexicon. While the one- to two-year-old children in our studies seem to consistently interpret *auf* as the outcome of an action, they fail to distinguish between events of making an object accessible (OPEN) or inaccessible (CLOSE). There is also evidence in our data, that these children's usage of *auf* refers both to events of moving part of a relational closing system (OPEN) and to events of removing an object from a surface („cut“, „peel“, or „clear“). In addition, there is no evidence, that the initial representation of the child is specified for any selectional restrictions, i.e. with regard to whether the moving entity, the space (container), or the content of the space is linked to the direct object.

As shown in Penner, Wymann, and Dietz (1998), once normally developing children successfully project the initial bare-endstate-based representations around the head-of-event, a successive extension of the event structure tree takes place to include the

process subevent and the selected arguments. Complex predicates with quantified DP objects are productive at around the age of 2;6.

From a learning-theoretical point of view, this model reflects a developmental path compatible with the „Local Wellformedness Condition“. What the normally developing child initially projects is a target-consistent representation which is correctly specified with regard to the choice of the head of the event and telicity. In confining herself to this information, while ignoring the other meaning components, the child successfully avoids target-inconsistent specification. This is reminiscent of what we have seen in the domain of rhythm in which the child opts for the correct choice of head position from the onset.

This is not what we find in the data of language impaired children in our study. Interestingly enough, in addition to being delayed with regard to the emergence of the verbal items (after 2;02), language impaired children seem to log into the verb lexicon by means of qualitatively different strategies. Instead of using resultative verb prefixes such as *auf* and *zu*, the language impaired children in our longitudinal studies start out with the so-called “deictic prefixes“ of the type *runter*, *rauf*, or *(he)raus*. These prefixes generally specify the direction of a movement relative to the speaker’s perspective and independent of the telic/atelic distinction. Some examples from our corpus are given in (20)

(20) First verbal prefixes in 4 language impaired children

Child (Age)	D. (2;00,17)	V. (2;00,26)	N. (2;04;16)	R. (2;00,07)
Prefix	runter/rauf	runter/rauf	runter/rauf	rauf
Gloss	(r-down/r-up)	(r-down/r-up)	(r-down/r-up)	(r-up)

Beyond pure description, there seems to be an essential semantic and syntactic difference between the resultative prefixes *auf* and *zu* in *auf-* and *zumachen* and the deictic prefixes in German. Recall that resultative prefixes of this kind always refer to the endstate subevent. Whether or not a given verb with a resultative prefix is unequivocally interpreted as a telic event depends on the verb class. This is basically the distinction between entailed endstate verbs such as *aufmachen* and pragmatically-favored endstate verbs such as *aufbauen*. By contrast, deictic prefixes do not refer to a specific subevent, but express the speaker’s spatial perspective on the event. As such, they take wide scope over the entire event. In this sense, deictic prefixes *per se* are not linked to the notion of event headedness in complex events.

As shown in Stegmann (1996) from which the examples in (21) are taken, the aspectual interpretation of a VP involving a deictic particle does not depend on the verb but on whether the prepositional component of the deictic prefix is doubled or not. That is, the telic interpretation is obtained by adding a preposition which „copies“ the base of the deictic prefix:

(21) Telic/atelic reading of the deictic prefix “hinauf” (HIN-up)

a. Ich ging den Berg <u>hinauf</u> I walked the mountain up/onto I walked up/onto the mountain	Object type: +determiner/non-prepositional > ambiguous telic/atelic
b. Ich ging <u>AUF</u> den Berg hin <u>AUF</u> I walked on the mountain up/onto I walked up/ onto the mountain	Object type: +determiner/ +prepositional > unambiguous telic

The following brief overview illustrates the difference between normally developing and language impaired children at the initial stage during which children merely produce bare prefixes. After having started out with resultative prefixes, normally developing children add deictic prefixes to their repertoire. A close look at the data reveals that in all cases both types of prefixes are used correctly with regard to the event type they refer to. Crucially, the resultative prefixes are predominant. From 109 bare prefixes (in 4 children) during the first stage 73% are resultative prefixes, compared to only 27% deictic prefixes. This distribution confirms the “head-of-event-bias” which is typical of the initial stage of normally developing children.

The data of the language impaired children reveal a different picture. During the initial stage 34 bare deictic prefixes are attested all of which refer to process (atelic) events. In two additional cases the target resultative prefix *ab, weg* “off” is erroneously replaced by the deictic prefix *runter* “r-down”. These data suggest that, as opposed to normally developing children, language impaired children lack the “head-of-event-bias”. Note, however, that this conclusion does not imply that language impaired children completely ignore the endstate. In fact, in elicited production tasks of verbs such as *aufmachen* this children either resort to a prelexical item such as “*ojo*” (for which no identifiable counterpart in the input) or simply remain tacit. This implies that language impaired children do distinguish at some level between telic and atelic events, but systematically fail to encode this distinction verbally.

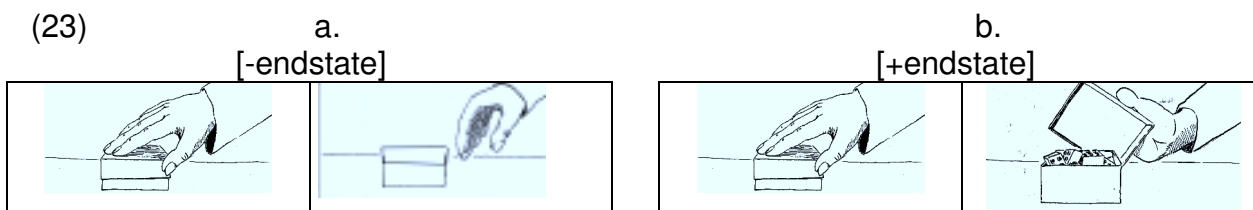
We will assume that the preference of deictic over resultative prefixes is by no means accidental. The distinction between normally developing and language impaired children during the initial stage can be captured as follows. Normally developing children initially project a target-consistent binary-branching representation with two event variables. This initial event structure is correctly specified for event headedness. By contrast, language impaired children initially project a non-branching representation with a single event variable. There is, of course, no specification of event headedness in a mono-nodal representation.

As shown in Penner, Wymann, and Dietz (1998), systematic violations of the “Local Wellformedness Condition” become visible at the second stage of language impaired children at which they begin to combine prefixes with verb stems. Our elicited production data indicate that language impaired children frequently mix up deictic prefixes (such as *hin-/rauf*) and resultative prefixes (such as *auf*) in elicitation tasks. This is shown in the examples of child V. in (22):

- (22) a. 2;05;22 abnehmen (target: runternehmen) (take/pull down)
 b. 2;09;19 aufgegangen (target: raufgegangen) (went up)
 c. 3;01;21 hinauflädt (target: aufladen) (load (on))
 d. 3;03;19 runterladen (target: abladen) (unload)
 e. 3;04;25 rauskippen (target: auskippen) (dump)
 f. 3;07;24 auf und runterziehen (target: rauf- und runterziehen) (pull up and down)

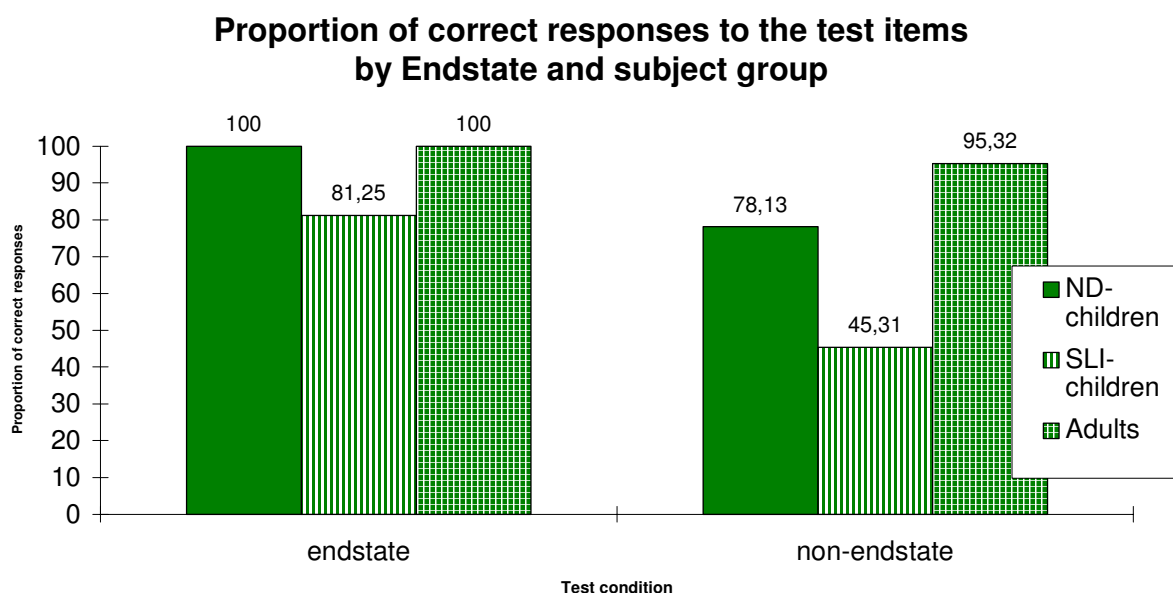
These findings can be accounted for by assuming that in situations in which the language impaired children are forced to project a binary-branching event with two event variables (“transition”), they systematically fail to assign the feature [head]. This results in a close to chance choice of the prefix.

Beyond production disabilities, our account of the initial stage of language impaired children’s verb acquisition predicts analogous deficits at the level of comprehension. That is, if language impaired children initially lack an explicit representation of complex events, and if this radical underspecification indeed becomes persistent, we expect them to perform at chance level in truth value judgement tasks in which they have to accept or reject a verb of the type *aufmachen* depending on whether the endstate is indeed part of the event. This prediction has been confirmed by the results from our experimental study (Schulz, Wymann, and Penner (1999, to appear). By means of a truth-value-judgement task, normally developing and language impaired children (and adults as a control group) had to decide whether a given event can be labeled as *aufmachen*. One example is given in (23):



The results are summarized in Figure (4) which shows a crucial difference between normally developing children (mean age 2;10, range 2;00-3;01) and language impaired children (mean age 3;09, range 2;11-4;10) (for a detailed statistical analysis of the data cf. Schulz, Wymann, and Penner (1999, to appear)). As can be seen from the results, language impaired children perform poorly especially when they are supposed to reject *aufmachen* in situations in which the process is not telic (i.e. [-endstate]):

Figure (4)



Our results are consistent with the findings of Ingham et al. (1999) whose recent study of elicited production of complex resultative expressions (e.g. “the man knocked the box off the table”) with older English speaking language impaired children (age range 5;1-8;0) shows that the difficulties these children experience with regard to the projection of event structures become persistent during pre- and school time.

The data from both longitudinal and experimental studies confirms our hypothesis that language impaired children generate a lexical representation of verbs which is qualitatively different from the one initially projected by normally developing children. Whereas the latter obey the “Local Wellformedness Condition” by correctly instantiating the head of event, the former lack any specification of the head of event. This omission leads to representations in which the head of event may be associated with *any* subevent in complex events, a state of affairs which is a clear violation of the “Local Wellformedness Condition”.

5. Conclusions and Consequences

We have provided evidence for qualitative differences between normally developing and language impaired children in three central domains of language acquisition, namely prosody, wh-question formation, and the verb lexicon. In all three domains, normally developing children show a similar kind of learning behavior in that the initial specification adhere to the Local Wellformedness Condition. This is summarized in (24):

(24)

Stress-sensitivity in minimal word formation	Wh-question formation	Event structure
Normally developing children correctly represent the (rhythmic) head of the word	Normally developing children respect the selectional requirements of the CP-Shell	Normally developing children correctly represent the head-of-event

By contrast, language impaired children display some sort of radical underspecification in all three domains resulting in target-inconsistent representations in the sense of the “Local Wellformedness Condition”, as summarized in (25):

(25)

Stress-sensitivity in minimal word formation	Wh-question formation	Event structure
Language impaired children lack a fixed position for the (rhythmic) head of the word.	Language impaired children violate the selectional requirements of the CP-Shell	Language impaired children lack a fixed position for the head of event

It is important to note that this radical underspecification characterizes not only the initial stage, i.e. the delayed speech onset at ca. 2;02-3;0, but also persists into later stages in the course of the pre-school period. We take these violations to be the source of the irreversible mistakes which are typical of the language impaired children’s phenotype.

If our argumentation is basically correct, then there is a deep discrepancy between the learning behavior of normally developing and language impaired children. This discrepancy becomes evident, once we analyze a wide corpus of longitudinal data in various domains of language acquisition, supplementing them by experimental studies. Our findings indicate that it is not simply the case that language impaired children stagnate in some intermediate developmental stage in the sense of “delay” and “stagnation”. In fact, language impaired children seem to lack the initial knowledge which is necessary to log into the system without violating the “Local Wellformedness Condition”. This deficit leads to a qualitatively different learning process, which can be said to deviate from normal development.

It is worth noting that this kind of deviation is not global in the language-impaired children’s language development. It is, for instance, well-known that violations of the Local Wellformedness Condition at the level of phrase structure do not occur in language impaired children. This holds, for instance, for head directionality in the syntax (object placement) or local scrambling with focus particles in German. As shown in detail in Penner, Tracy & Wymann (1998) and Penner, Wymann & Weissenborn (to appear), German speaking, language impaired children do not qualitatively differ from normally developing children with regard to the acquisition of the directionality of object placement (the “OV rule”), negation, and *auch* “too, also” constructions. In this domain there seems to be a delayed, but nevertheless parallel development in the two population and no violation of the Local Wellformedness Condition. This implies that the Deviance Thesis must be relativized in some way.

Penner (1998), Penner and Kölliker (1998), and Penner and Wymann (1999) propose that violations of the “Local Wellformedness Condition” are amenable to the language impaired child’s reduced bootstrapping capacity. It is argued that language impaired children have access only to a small set of triggering domains. The question, however, why this failure to discover the relevant triggering domains affects only certain areas of grammar can be adequately answered only on the basis of a

comprehensive study of the language learning capacity of language impaired children.

To conclude this paper, let us briefly comment on the consequences of our results for intervention in language impaired children. The findings in the domains of word formation and the verb lexicon indicate that violations of the Local Wellformedness Condition occur in the earliest stage of language acquisition. This implies that language impaired children deviate from normal acquisition from the onset. As we have seen, these deviations give rise to persistent disabilities. These findings are compatible with the results of Fee (1994) and Ingham (1999) and confirm the learning-theoretical assumption that unconstrained language acquisition yield irreversible mistakes. In fact, it seems that the disorders found in language impaired children are more than just persistent disabilities. So, for instance, Schulz, Wymann, Penner (1999, to appear) find out in their experimental study of the verb lexicon a “scissors effect”. That is, the language impaired children’s scores of correct answers decrease with age. Interestingly enough, a similar kind of deterioration with increasing age was found in Schöler (1992) and Schakib-Ekbatan and Schöler (1994) with regard to the children’s performance on intelligence tasks.

On the assumption that initial violations lead to persistent disabilities and even to a decrease of the child’s linguistic competence in the course of time, we have to ask ourselves at what point of the child’s development speech therapy would be optimal. Penner, Wermke, Weissenborn, Wymann (1999) argue that effective intervention should begin prior to the stage at which the child has already resorted to representations which involve “irreversible mistakes”. Given our results, we have to conclude that effective intervention must take place prior to the emergence of lexical production. Diagnostic tools by means of which language impaired children can be identified in very early phases are proposed in Grimm (1999), and Penner, Wermke, Weissenborn, Wymann (1999).

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