

How known constructions influence the acquisition of other constructions:  
the German Passive and Future Constructions

Kirsten Abbot-Smith\*

Heike Behrens<sup>2</sup>

\*Psychology, Max Planck Institute for Evolutionary Anthropology

<sup>2</sup>Department of English and German Linguistics, University of Basel

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Postal Address:

Kirsten Abbot-Smith

Department of Comparative and Developmental Psychology

Max Planck Institute for Evolutionary Anthropology

Deutscher Platz 6

04103 Leipzig

Germany

Email: [smith@eva.mpg.de](mailto:smith@eva.mpg.de)

Tel: +49 341 3550 400

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## Abstract

This article suggests evidence for and reasons why prior acquisition may either facilitate or inhibit acquisition of a new construction. It investigates acquisition of the German passive and future constructions which contain a lexical verb with either the auxiliary *sein* 'to be' or *werden* 'to become', and are related through these to potential supporting constructions. We predicted that a supported construction should be acquired earlier, faster and unusually rapidly. An inhibited construction should show an extended depressed usage. We analyzed a dense corpus of a German boy between 2;0-5;0. He acquired the *sein*- before the *werden*-passive. The former was supported by his prior acquisition of the *sein* copula, whereas the *werden*-passive itself supported one *werden* copula construction. He acquired the *werden*-future extremely slowly due to the hindrance of a semantically identical construction. These results fit with an emergentist approach in which apparently 'sudden' acquisition is still due to gradual learning mechanisms.

One of the key issues in language acquisition research is why children appear to learn certain aspects of grammar very quickly while other aspects appear to develop only very gradually. Attempts to account for this can be divided into emergentist or usage-based theories on the one hand and, on the other, theories which assume innate representations of certain syntactic categories and principles (linguistic representational nativist theories). Emergentist and usage-based theories argue that grammar is learned through mechanisms which are not necessarily limited to language learning. Thus, input frequency crucially impacts the speed of acquisition as do other factors related to general cognitive constraints such as minimal utterance length, meaning complexity and complexity of form-function mapping (e.g. Tomasello, 2003; Elman, Bates, Johnson, Karmiloff-Smith, Parisi & Plunkett, 1996). Such approaches tend to focus on the acquisition of an individual aspect of grammar in isolation, and the lexical specificity of these phenomena (e.g. Dabrowska, 2000). Because of this, emergentist and usage-based researchers tend to emphasize gradual grammatical development. In contrast, linguistic nativist accounts tend to focus on purported innate constraints that limit the possible shape of grammars and assist their acquisition.

As an alternative to both extremes, we investigate if certain relationships to previously learned aspects of grammar may facilitate or inhibit acquisition of a particular target construction. The investigation of transfer from prior learning is often ignored in emergentist and usage-based approaches. If it were taken into account it might be possible to develop an emergentist theory which is able to deal both with instances of acquisition which are apparently not influenced by input frequency and with instances of apparently "sudden" acquisition of certain constructions. Linguistic nativist accounts, on the other hand, have often argued that superficially unrelated grammatical phenomenon are dependent on the acquisition of some underlying commonality and that sudden acquisition of a particular aspect of grammar - especially if certain unrelated grammatical features are acquired simultaneously - is

evidence in support of their proposals (e.g. Chomsky, 1981:4-6; Rice, Wexler & Hershberger, 1998). These latter approaches, however, have not yet reached agreement on what these essential underlying commonalities might be because of the diversity and constantly changing nature of the grammatical theories concerned (cf. Chomsky, 1995). Thus, in the current article we focus on an overlap in lexical material and semantic-pragmatic function between the constructions under investigation because these are theory-neutral in that nobody would deny that they are likely to play an important role.

## **1. Transfer in grammatical acquisition: the Construction Conspiracy Hypothesis**

### *1.1. Measuring inter-construction support and hindrance*

While the investigation of transfer from prior learning has been examined extensively in relation to the acquisition of non-linguistic skills - particularly in adults - (see e.g. Rehder, 2001), it has largely been ignored in relation to grammatical acquisition by children. Indeed it is not immediately obvious exactly how transfer might work in this domain. There are two notable exceptions to this, the first involving a connectionist model of WH-question acquisition by Morris, Cottrell and Elman (2000). This model could only generalize to an untrained target construction in a comprehension task if it had previously learned a group of syntactically and semantically related constructions. Morris et al. (2000) termed this a "construction conspiracy". On the basis of this simulation, we might predict that a target construction for which a child has previously learned simpler related constructions (a construction conspiracy) should be learned earlier and more quickly than a target construction for which this is not the case. However, it is extremely difficult to know if and how we can draw an analogy between learning in this model and language learning in children, since the

former was merely a computer simulation, and indeed one with a number of drawbacks (see Abbot-Smith, 2003: 206-207).

The second study, Ruhland, Wijnen and van Geert (1995), did investigate grammatical acquisition (by a Dutch-speaking boy between 1;6 and 3;0) and in doing so examined developmental curves for a number of different aspects of grammatical and general language learning. Again, the examination of learning curves has a long history in developmental psychology. More recently it has been applied to the acquisition of vocabulary (see Elman et al, 1996, for a summary) and of particular aspects of grammar in isolation (e.g. Ninio, 1999; Szagun, 2001). However, Ruhland et al.'s (1995) study is one of the few which attempted to define how positive versus negative transfer may differentially impact the shape and speed of grammatical development.

The authors first discuss potential learning patterns in the absence of transfer. Namely, they argue (1995: 113-4) that if the child's representation of, for example, verb finiteness undergoes a sudden change, this should be reflected in a sudden jump in the learning curve. If, however, the acquisition of verb finiteness entails a process of learning by generalization from the input, they predict that the development of finite verbs will display an s-shaped pattern<sup>1</sup>. Secondly, following van Geert (1994), Ruhland et al. (1995: 116) define the following three basic inter-construction relationships. In a precursor relation, the precursor construction has to have reached a certain level or threshold before the target construction can start to develop. In a supportive relationship the growth level of the target construction will increase faster when the level of the supporting construction is higher. In a competitive relationship, on the other hand, the increase of the target construction will slow down as the level of the competing construction becomes higher.

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<sup>1</sup> The authors actually call this a quadratic curve, but since a quadratic curve can mimic a number of functions from linear to exponential to s-shaped, we refer to the actual curve-form they found for reasons of clarity.

From their dataset, Ruhland et al (1995: 126-8) claimed that both utterance length and verb finiteness appeared to be precursors to and to support the acquisition of determiners + pronouns, because the former were both best fit by an s-shaped curve whereas the latter was best fit by a cubic curve (sudden jump). However, there are several reasons to question their conclusion that there was a supportive relationship between verb finiteness and pronoun/determiner usage. Firstly, the child was only recorded once every two weeks so it is impossible to tell whether his acquisition of pronouns/determiners was in fact sudden, or whether there was actually a gradual increase between weeks 112 and 114. Secondly, the minimal utterance length of a sentence containing a pronoun and/or determiner is necessarily longer than that of a sentence in which the verb is merely required to be finite. Therefore the crucial "supporter" for pronouns/determiners may in fact have been utterance length.

### *1.2 What might support and hinder the acquisition of grammatical constructions*

In the current study, the grammatical level we focus on is that of whole constructions, such as the passive. This enables us to have some compatibility in terms of minimal utterance length among the targets and potential "supporters" or "interferers". In regards to what might contribute to positive facilitation, we draw on the body of research in non-linguistic cognitive psychology dating back to Thorndike (1906). In an extended version of this work, Singley and Anderson (1989) argue that if common elements are shared between a previously learned and a target task, the target task will be learnt more quickly. If we apply this to the acquisition of grammatical constructions such as the English passive utterance such as *the fence is painted*, one potential support for its acquisition would be if the child had previously acquired the necessary lexical component *is* and the participle *painted*. Emergentist grammatical theories such as Construction Grammar (e.g. Goldberg, 1995) and Cognitive Grammar (e.g. Langacker, 1988) argue that such constructions form the "basic" level of grammar, in that they

cannot be predicted from the meaning of component lexical items. In addition, constructions form a kind of network hierarchy, i.e. they are not fully independent, (e.g. Goldberg, 1995: 109). Langacker (1991: 200-207), for example, regards the English passive construction as inherently interconnected to other BE-constructions (such as the copula constructions) and to other constructions with past participles.

Negative transfer has perhaps received less attention in the previous literature. One relevant finding, however, is that of Rehder (2001), who found that when subjects learnt certain problem-answer associations in one task, these hindered the learning of new such associations even after a one week interval. If we apply this to grammatical acquisition, we might postulate that if children have previously learned to use a particular form for a particular function, then even when they become aware that another form is sometimes used for apparently the same function, they may nonetheless fall back on using the original form. Of course, in regards to whole constructions there is a case to be made that two distinct constructions never mean exactly the same thing in adult language (e.g. Goldberg, 2002). This follows from the pragmatic principle of contrast (e.g. Clark & Clark, 1979). However if they occur in very similar semantic-pragmatic contexts, what might appear to have overlapping but nonetheless distinct functions for the adult may appear identical in meaning to the child. We would predict that only when children learn the functional distinction between the two competing forms will they start to use a target form with adult-like regularity.

In sum, our version of the construction conspiracy hypothesis predicts, firstly, that the acquisition of a target construction will be hindered by the prior acquisition of a construction which has an identical semantic-pragmatic function, or whose meaning is initially indistinguishable for a language-acquiring child. Secondly, the acquisition of a target construction should be facilitated by the prior acquisition of a construction with which it shares essential lexical or morphological sub-parts and has a distinct semantic-pragmatic

function (although since lexical items usually contribute meaning to a constructions, the constructions concerned might be considered to be related in a family resemblance type manner).

Our version of the construction conspiracy hypothesis acknowledges that many other factors play an important role in syntactic acquisition. Input frequency of a particular construction in isolation will of course affect the ease of acquisition, especially if that construction is far more frequent than many others, as will semantic/conceptual complexity, phonological salience and the minimum length of the target construction in the adult language. Thus, to see potential positive or negative transfer effects we need to compare the acquisition of two target constructions which are matched in regards to these factors, namely the German stative and eventive passive, and the eventive passive and future tense constructions.

## **2. The target matched constructions**

### *2.1 The German stative versus eventive passives and their related constructions*

The first set of target constructions is that of the German stative and eventive passives. As can be seen from examples 1 (stative passive) and 2 (eventive passive) below, the two passives are structured very similarly, consisting essentially of an auxiliary and the participle which is also found in the *Perfekt* constructions (which refer to past time). Further, the prototypical meaning of both constructions involves a focus on the argument of a transitive action which is normally defocused (e.g. the patient of action transitives or the experiencer of stimulus-experiencer transitives) and the demotion of the other argument (e.g. the agent of action transitives). The two constructions are nonetheless semantically and morphologically distinct from one another: the stative passive, which takes the auxiliary *sein* 'to be', denotes the

state of the subject which implicitly results from another entity having acted on it or affected it in some way (see example 1 below). The eventive passive, which takes the auxiliary *werden* 'to become', denotes a dynamic event in which the subject undergoes an action or experience caused by another entity (see example 2 below). We shall refer to the two passives as the *sein*-passive and *werden*-passive. Formally, both passives can occur with certain *von*-phrases (by-phrases), *mit*-phrases (instrument phrases) and agent-related adverbs (e.g. Rapp, 1996; Lenz, 1993; Eisenberg, 1994; Höhle, 1978). However, in spoken discourse both passive constructions hardly ever occur with a *von*-phrase or instrument phrases (e.g. Abbot-Smith, in prep; Helbig, 1987). Therefore, the distinction between *sein*-and *werden*-passives is largely one of tense-aspect semantics, rather than syntactic complexity.

*Sein*-passive (Stative)

1)     *Der    Reis    war                   (von    einem   Experten)    ge-koch-t*  
the    rice    be.3<sup>rd</sup>.sg.PAST (by    a       expert)        cook-PARTICIPLE  
'the rice was in a cooked state (having been cooked by an expert)'

*Werden*-passive (Eventive)

2)     *Der    Reis    wurde                   (von Ulf/ einem Experten) ge-koch-t*  
the    rice    become.3<sup>rd</sup>.sg.PAST (by Ulf/ a expert)        cook-PARTICIPLE  
'the rice went through a process of being cooked (by Ulf/ an expert)'

Following the construction conspiracy hypothesis it is possible that German children are assisted in the learning of the passive constructions through prior learning of lexically or morphologically related constructions. To investigate this, we need to examine the acquisition of other constructions in German which share the constituents of the two passives, namely the participle and the lexical items *sein* or *werden*. Table 1 below shows the *sein*-passive

(example 9) and the constructions morphologically related to it. As in English, *sein* also occurs in copula constructions, such as *sein*+ NP (e.g. that's a car), and *sein*+adjective (e.g. that's big). The *sein*-passive is also related via the participle to the periphrastic construction most commonly used to refer to past time in spoken German, namely the *Perfekt* (see examples 6, 7, and 8 in Table 1). Two auxiliaries are possible in this construction. Transitive verbs take *haben* (to have). Intransitive verbs can be divided into two groups, those which take *haben* and those which take *sein* (see Keller & Sorace, 2003, for details). Importantly, the *sein*-intransitive is morphologically identical with the *sein*-passive in this tense. We shall refer to *haben*+*Perfekt* participle as *haben*+participle and *sein*+intransitive participle as *sein*-intransitive.

-----INSERT Table 1 ABOUT HERE-----

Table 2 below shows the *werden*-passive (example 16) and the constructions morphologically related to it. Like the *sein*-passive, the *werden*-passive also shares the *Perfekt* participle with the *haben*+participle construction. The auxiliary *werden* also occurs in copulaic constructions, namely *werden*+NP and *werden*+adjective. The most crucial difference here between the two passive constructions is that the *werden*-passive does not have a morphologically identical construction. Rather *werden*+intransitive participle - which occurs with a subset of certain intransitive verbs (Keller & Sorace, 2003) - is an impersonal passive construction.

-----INSERT Table 2 ABOUT HERE-----

## 2.2 The German *werden*-passive versus *werden*-future and their related constructions

The second comparison will test the hypothesis about the types of factors

that lead to one construction hindering another. For this we again chose two constructions which are formally alike. They share the same auxiliary, *werden*, and take a main verb, namely a participle in the *werden*-passive and an infinitive in the *werden*-future (examples 12 vs. 16, Table 2 above). But unlike the two passives, these constructions are semantically more different: the *werden*-passive denotes an event or process which the subject undergoes and it is restricted to a subclass of transitive verbs (and to a very restricted subclass of intransitive verbs, see example 14, Table 2). The *werden*-future, on the other hand, refers to future time and can be used with almost any lexical verb.

Both constructions have a set of morphologically related constructions which may potentially support their acquisition. In regards to the *werden* constructions in Table 2, it has been argued that they all share a meaning which places them at the stage in an event between intention, which is expressed by modal constructions (example 17 below), and the actual carrying out of the construction, which is expressed by the present tense (Redder, 1996). The *werden*-passive is perhaps an exception to this because it can encode either simultaneous or future reference (see example 16).

The *werden*-future is also related via the infinitive to the modal constructions which take the infinitive. The core modal verbs in German are: *müssen* (must/have to), *können* (can/be able to), *mögen* (like), *dürfen* (may/be allowed to), *sollen* (should/be supposed to), and *wollen* (want to) (see example 17 below). Since these are more numerous and - as a group more frequent - than the *Perfekt* participle constructions (which may potentially support the acquisition of the *werden*-passive), one might expect that they would assist the *werden*-future construction to be learned earlier than the *werden*-passive.

- 17) *Sie* *will/muss* *heute abend* *weg-fahr-en*  
She want/have to-3<sup>rd</sup>.sg.PRES today evening away.drive-INFINITIVE  
(She wants/has to leave this evening)

### 2.3 Potential "hindering" constructions

It is possible, however, that the *werden*-passive and the *werden*-future constructions may be differentially hindered in their acquisition by the prior acquisition of constructions which have a virtually identical semantic-pragmatic function. Potential "hindering" constructions for the *werden*-passive might thus be the *sein*-passive and *werden*+adjective - at least in the early stages of acquisition before the child has differentiated the meanings of these constructions. However, since the meanings of these three constructions are fairly distinct (see 2.1 above), such a hindering effect should not last for long.

We might predict, however, a greater hindrance for the *werden*-future because there exists another construction which is more frequently used to refer to future time, namely the *Präsens*-future (see example 18 below). The *werden*-future and the *Präsens*-future do not have clearly distinguishable meanings; they are often used interchangeably in child directed speech for both distant future reference (see examples 18 and 19 below) and immediate future time reference without any obvious difference in meaning. Both constructions can encode the same functions, as can be seen from examples 18 and 19, in which they are used to encode intentions and promises. Therefore, although there exist potential supporting constructions which are likely to be acquired prior to the acquisition of the *werden*-future, we expect the *Präsens*-future to also be previously acquired (due to its high input frequency) which will hinder the acquisition of the *werden*-future, so that it develops more slowly than the *werden*-passive.

(from Leo 2;1.23 in which he and his mother are looking at photos)

MOT: *da ist die Schmal-spur-bahn durch's Erz-gebirge.*  
(there is the narrow-track-train through-the Erz mountains.)

18) [NEXT UTTERANCE]

MOT: *Das mach-en wir auch mal*  
that make. 1<sup>st</sup> /3<sup>rd</sup> pl.PRES we also one.time.  
(We'll do that some time.)

19) [NEXT UTTERANCE]

MOT: *da werd-en wir mit der Eisen-bahn fahr-en*  
there become.1<sup>st</sup> /3<sup>rd</sup>.pl.PRES we with the train drive-INFINITIVE  
(we'll go on the train there)

#### 2.4 The predictions from our construction conspiracy hypothesis

In sum, we predict that young German children initially learn the semantic meaning of *sein* from the copula constructions because - as in English - these have overwhelmingly high input frequency. From our construction conspiracy hypothesis we argue that this supports them in learning constructions which contain this item, i.e. the *sein*-intransitive and the *sein*-passive. Moreover, our construction conspiracy hypothesis makes the following concrete predictions:

- 1) If two target constructions such as the *sein*-passive and the *werden*-passive have equal input frequency, one will become productive before the other if its lexico-morphologically related constructions have been previously learned. If one target construction is supported in this fashion and the other is not, the supported construction (in this case the *sein*-passive) should be acquired a) earlier and b) at a faster rate than the non-supported constructions. Such constructional support may even lead to c) apparently "sudden"

acquisition (i.e. the child proceeds from zero usage to apparently adult-like regularity of usage within days) because the child knows the sub-parts of the construction.

However, this supporting effect will only occur if the target construction is not hindered by prior acquisition of a competing construction, that is one which has an identical semantic-pragmatic function.

2) If two constructions have equal input frequency but one is "hindered" in this fashion it should show a very slow rate of acquisition - not just initially - but up to the point at which the meaning of the "hinderer" and target construction are differentiated by the child.

Therefore, we predict that the *werden*-future will be acquired later than the *werden*-passive because children will previously acquire the highly frequent *Präsens*-future and they will not be able to differentiate its meaning, as this is almost identical to it in semantic-pragmatic function.

Our empirical investigation is divided into two parts. The first is an examination of which German passive is acquired earlier and faster and of possible facilitative effects from prior acquisition of related constructions. The second examines whether the *werden*-passive or *werden*-future is acquired earlier and faster and whether this is due to possible hindering effects by semantically equivalent constructions.

### **3 The Leo corpus: sampling and coding of our data**

To investigate these questions, we examined the *sein*- and *werden*-passives and *werden*-futures found in a high density longitudinal corpus of one German-speaking boy, Leo, between 2;0 and 5;0. This corpus is unusual in that Leo was recorded for one hour a day, five

days a week between 2;0 and 3;0 (20-22 recordings per month), during which time the mother was present in on average 15 recordings per month (range = 15-17). In addition, the parents recorded all utterances involving new and complex syntactic structures in diary format. Then, between 3;0 and 5;0, the diary was discontinued and Leo was recorded for one hour a day, five days a month (20 recordings per four months) during which time Leo's mother was present in average 4 recordings per month (range = 3-5). Due to the sampling density and the diary notes of this corpus, we can more reliably ascertain when Leo starts to use infrequent constructions like the passive and *werden*-future on a regular basis.

All child utterances which included an imitation of the verb phrase from the input or a self-repetition of the previous eight discourse turns were excluded from analysis. The target constructions were coded in CHAT format by two native German-speaking linguistics students according to formal criteria developed by the second author. *Werden*-passives were clauses which included a form of *werden* and a *Perfekt* participle (mostly transitive). *Werden*-futures were clauses which included a form of *werden* and an infinitive. For the current study, firstly, subjunctive forms were excluded from the *werden*-future category. Secondly, all forms of *werden* in the mother's data for Leo's months of 2;2 and 2;3 were hand-coded because they are not morphologically coded in the original corpus. 20% of the data was also coded by the first author, with 100% agreement for both types of coding.

*Sein* was coded in the original corpus as either an auxiliary or a copula. For the current study *sein* as auxiliary was recoded into either *sein*-passive or *sein*-intransitive or 'other' by a native German-speaking computer science / linguistics student, who wrote a computer program which recalled prior coding decisions for particular participles. All utterances with *sein* as an auxiliary were double-checked by the first author. We classified *sein*-passives as clauses which included a form of *sein* and a transitive *Perfekt* participle to distinguish them from the *sein*+intransitive *Perfekt* participle construction (see Abbot-Smith, in prep, for more

details). The methodology and rationale for each analysis are discussed together with the results.

#### 4. Study One: The Stative versus Eventive passives

##### 4.1 Do *sein*-passives become productive before *werden*-passives?

Leo produced a total of 428 non-imitative non-repetitive recorded tokens of the *werden*-passive and 399 of the *sein*-passive between 2;2 - 4;11.31. Both types of passive together thus represent 1.5% of the 54,000 main verb constructions attested in Leo's data.

Fig. 1 shows the cumulative type frequencies for the *sein*- and *werden*-passive from 2;0-3;0 (after which sampling dropped to five recordings per month). A new verb type for either the *sein*- or the *werden*-passive was a verb root which Leo had not used in that particular passive before. A root with several verbal prefixes was counted as one type (e.g. *an-bauen* 'build-on' (= attach further elements) and *ab-bauen* 'build-off' (= deconstruct, demolish)). Utterances with different word order, but the same verb type were also counted as one type only.

-----INSERT Fig 1 ABOUT HERE-----

When we look at Fig. 1, it becomes clear that the criterion of first occurrence is unsuitable for judging whether a child has acquired a particular construction, as Leo clearly makes faster progress in assimilating new verb types to the *sein*-passive than to the *werden*-passive, despite his first passive utterance being with *werden* rather than *sein* (see also Ruhland & van Geert, 1998). Therefore we need to be sure that the child is using the construction with a number of verb types and we took a productivity criterion of eight verb types. This is based on Braine (1976) who used six types if they all had the same word order and eight types if one had a different word order. Since we counted utterances with different

word order but the same verb type as one type only, we decided that the latter criterion was the more appropriate (see also Pine, Lieven & Rowland, 1998).<sup>2</sup> Using this criterion we can see that although Leo produces his first *werden*-passive utterance at 2;2;7, it takes him almost three months to reach a cumulative frequency of eight verb types at 2;5;14. With the *sein*-passives, on the other hand, he reaches the same number of types within just one month, at 2;4;15, and carries on accumulating more verb types at a much faster rate than he does with the *werden*-passives. In addition, when two alternative acquisition criteria (type-token ratios and active-passive alternation) were applied to this dataset we found that Leo becomes productive with the *sein*-passive before the *werden*-passive according to all three productivity criteria (Abbot-Smith, 2003).

Leo's earlier productivity with the *sein*-passives is in line with the findings from two children studied by Bryan (1995), Paul and Lisa. In addition, the same tendency was found when we examined the corpora of two other German-speaking children, Simone and Kerstin (Miller, 1976, available on CHILDES, MacWhinney, 2000). None of these four children were sampled anywhere near as frequently as Leo, so their overall passive usage is rare but nonetheless consistent with Leo's data (see Abbot-Smith, 2003, for details).

#### *4.2 Why do sein-passives become productive earlier than werden-passives?: investigating potential supportive relationships*

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<sup>2</sup> Of course the number of verb types needed in such a productivity criterion depends on the density of sampling in a corpus. Many researchers have used a criterion of only three or four types or even instances (e.g. Bloom, Tackell & Lahey, 1984). Such a criterion is clearly inappropriate for a high-density corpus like Leo's because even after Leo uses three distinct verb types in the *werden*-passive he still does not accelerate in assimilating other verb types into this construction. Thus, while setting the criterion at eight verb types is somewhat arbitrary, this criterion does seem to reflect something about productivity, because after Leo has used this number of verb types in a construction, he continues to use the same construction on a regular basis (e.g. for the *werden*-passive until he reached a cumulative type frequency of 8 verb types it took Leo an average of 14 days to assimilate a new verb type into this construction, whereas between a cumulative frequency of eight and 15 types it took him an average of only five days to do the same).

The next question investigated is the reason why Leo (and Simone and the two children in the longitudinal corpora studied by Bryan, 1995) started to regularly use the *sein*-passive before the *werden*-passive. The first possibility we need to exclude is that this might be due solely to the *sein*-passive having a higher input frequency than the *werden*-passive. In fact, Fig. 2 below shows that the *sein*-passive actually has almost exactly the same type frequency in the mother's input as the *werden*-passive. Likewise, the token frequency of the *sein*-passive in the mother's input is also almost exactly the same as that of the *werden*-passive (total of 90 versus 84 tokens respectively in 63 hours).

-----INSERT Fig 2 ABOUT HERE-----

An alternative is our construction conspiracy hypothesis which predicts that a construction which is supported by prior acquisition of lexically and/or morphologically related constructions will be acquired earlier and faster than a construction which does not have this support. That is, it is argued here that Leo becomes productive with the *sein*-passive construction first because he has previously learned its lexico-morphologically related constructions quite some time previously, and these then support its acquisition. To investigate this we compared the two passive constructions in terms of whether Leo had previously acquired their essential lexical or morphological sub-parts, namely their auxiliaries and the participle.

In fact - as we will see - Leo had acquired the participle quite some time prior to his first usage of both passives. Therefore, the relevant contrast is between the two auxiliaries *sein* 'to be' and *werden* 'to become' and their copulaic equivalents. We did not want to merely assume that the child at this early stage in acquisition was aware of the paradigmatic relationships between the various lexical realizations of the different person and tense forms of *sein* and *werden*, since there is evidence in the literature that this may be mastered quite late in languages with complex subject-verb agreement paradigms (e.g. Pizzuto & Caselli, 1992).

This is especially relevant for *sein*, since we would be attributing quite a big leap to the child if we assume that learning for example *bin* 'am' in the construction *X bin ADJECTIVE* assists him in his acquisition of *ist* in the construction *X ist PARTICIPLE*. Therefore, in order to ensure that there really was a possibility that Leo might have generalized lexical forms across constructions, all the following analyses only involve the third person singular present tense forms. We chose the third person singular present tense because it was by far the most frequent in Leo's usage of *sein* and *werden* in all constructions in the initial acquisition period examined below (61%-73%, depending on the construction, with similar rates for Leo's mother). However, for all constructions, when the same curve-fitting analyses were carried out including all person and tense forms of *werden* and *sein* the same basic pattern of results was found<sup>3</sup>.

#### 4.2.1 *Sein-passive and werden-passive related constructions*

Fig. 3 shows the cumulative verb type frequency for Leo's *sein (ist)*-passives and related constructions containing either *ist* = 'is' and/or the participle up to age 2;7. The *ist*+locative was not included because Leo did not reach the cumulative type frequency of 25 locative types during this time period. Using our acquisition criteria of cumulative frequency of eight verb types or predicate types (e.g. noun types or adjective types in the copula constructions), we can see that at least one month prior to acquiring the *sein*-passive, Leo had acquired all the constituent parts of the passive; *ist* as a copula by 2;2 and the *Perfekt* participle with *hat* 'has' by 2;3 at the latest. Moreover, Leo's acquisition of the *sein*-passive occurred in parallel with his acquisition of the morphologically identical construction of '*ist*+intransitive participle'.

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<sup>3</sup> With the exception of *werden*-adjective, for which both the linear and exponential functions were an equally good fit

-----INSERT Fig 3 ABOUT HERE-----

Fig. 4 shows the cumulative verb type frequency for Leo's *wird*-passives and related constructions containing either *wird* = 'becomes' and/or the participle up to age 2;7. The developmental sequence for the *werden*-passive and lexically related constructions looks quite different from the pattern we saw for the *sein*-passive. That is, Leo started to use the *sein*-passive only quite some time after he had acquired the lexical sub-parts. For the *werden*-passive, however, Leo had not previously acquired the copulaic use of *wird* or any other person/tense forms of *werden*.

-----INSERT Fig 4 ABOUT HERE-----

#### 4.2.2 A closer examination of the construction conspiracy predictions for Leo's *sein*- and *werden*-passives: order, rate and shape of acquisition

It is clear that the order of acquisition of the two passive constructions and their lexically related constructions follows the prediction of the construction conspiracy hypothesis regarding order of acquisition; namely that the *sein*-passive is acquired before the *werden*-passive because the former is preceded by prior acquisition of its auxiliary in related constructions whereas the acquisition of *werden*-passive is not. However, before we conclude that this prediction is confirmed we need to examine the other two predictions made by the construction conspiracy hypothesis, namely that for two constructions of equal input frequency:

- a) that a supported construction like the *sein*-passive may show apparently "sudden" acquisition;
- b) that a supported construction should initially be acquired at a faster rate than a non-supported construction like the *werden*-passive;

- c) that a non-supported construction like the *werden*-passive should initially be acquired gradually, with the ability to extend the construction to new verb types speeding up with each new assimilated verb type.

To examine rate and pattern of acquisition we measured the growth curves for cumulative type frequency shown in Figs. 3 and 4 above and 5 and 6 below. This dependent variable is appropriate if we want to examine the development of productivity, rather than mere repetition of rote-learned utterances and it has been previously used to examine growth curves in vocabulary acquisition (e.g. Elman et al, 1996), grammatical constructions (e.g. Ninio, 1999) and German noun plurals (e.g. Szagun, 2001).

Rate of acquisition can be examined by comparing curves in terms of the steepness of the slope of the curve but only if the curve concerned shows a good linear fit (Szagun, 2001). In addition, a number of previous researchers have argued that the shape of growth curve shown for cumulative type frequency reflects something about how that construction is learned (e.g. Ninio, 1999; Elman et al., 1996; Ruhland et al., 1995). In particular, many have claimed that cumulative type frequency curves which are best fit initially by an exponential function may reflect learning from the input (e.g. Ruhland & van Geert, 1998; Elman et al., 1996). (This would of course be an s-shaped curve if one continued to trace the course of development over a longer period of time.) Such curves are often found in studies of infant word learning, for example, and have been argued to reflect the fact that 'the more words you know, the easier it is to accumulate more' (Elman et al., 1996: 181-186). Applied to the current study this predicts that - when learning solely from the input - the more lexical items a child has used in a construction, the easier it is for the child to accumulate more in that construction. Of course, these learning curves only apply to the initial stage of acquisition. Later on, children start to use new vocabulary items at an adult-like rate, which Elman et al. (1996) described as typically showing a linear pattern for cumulative type

frequency. Thus, since the construction conspiracy hypothesis' prediction regarding the pattern of acquisition concerns only the initial stage of acquisition, our analyses are conducted only on the first 25 predicate types Leo used with each construction.

The construction conspiracy hypothesis predicts that not all constructions are learnt solely off the input. In the introduction we discussed Ruhland et al.'s (1995) claim that if a construction is aided by a supporting construction the growth curve should show a sudden jump. However, the predicted growth curve forms will change somewhat if the dependent variable is not proportional or absolute usage of a construction (as in Ruhland et al.'s, 1995, study) but cumulative type frequency as in our study. In the latter case, what Ruhland et al. (1995) describe as 'sudden' acquisition will appear as a pattern in which the child goes from a state in which s/he is not using the construction at all to a state in which s/he starts using the construction at an adult-like rate, without an apparent transitional 'learning-like' phase.

Thus, before we examine the child's pattern of acquisition of the target constructions we first need to know what usage of the target construction at an adult-like rate would be. This is especially important when using cumulative type frequency as the dependent variable because the curve will rise no matter whether the speaker is learning or not (see Ganger & Brent, 2004). That is, to examine the shape of learning we need to know what cumulative type frequency in these constructions would look like when the speaker is not learning. There are three possible patterns for adult usage (= non-learning). Firstly, following previous findings for vocabulary usage by adults (e.g. Elman et al., 1996), we might expect for cumulative type frequency that since an adult is not learning, his/her usage should basically fit a linear function. However, this only applies if the construction in question is used at a regular rate in all pragmatic contexts and if there are a large potential number of types which can be used in this construction. Secondly, if the construction is used at a regular rate but there are a limited number of potential verb types with which it is normally used, we might expect cumulative

verb type frequency to be best fit by a negative quadratic function, which is a curve with an initial steep ascent and later tail-off. The later tail-off indicates that with time most of the verb types which are usually used in the construction have already been said previously by the speaker. However, passive constructions may not exactly fit either of these two patterns because they are unusual in that even adult speakers may use them at an irregular rate since their usage is pragmatically conditioned (e.g. Prat-Sala & Branigan, 2000). Nonetheless, for an adult speaker the curves for these constructions should always show a better fit for either a linear or a negative quadratic function than for an exponential function.

Therefore, we examined the mother's cumulative type frequency of the same constructions. To enable a fair comparison between Leo's and the mother's usage, the following analyses of the latter also only involve utterances containing the third person singular present tense forms of the auxiliary and only of the first 25 verb types. Similarly to Leo's data, the same pattern of results was found when we included all lexical person and tense forms of *werden* and *sein*.

We used linear and nonlinear regression methods to determine whether linear or exponential functions provided the 'best fit' for Leo's mother's *ist+* and *wird+* passives for the first 25 verb types (e.g. Howell, 2002). Summary statistics for linear and exponential curve estimation models for both constructions are presented in Table 3 below. The criteria for 'best fit' were, firstly (and most importantly), the percentage of variance accounted for by the curve which is measured by R-squared. That is, if the difference between the  $R^2$  for two models (e.g. linear or exponential) is greater than 5%, the model which has the higher  $R^2$  indicates the better fit because a greater percentage of the data for that particular construction is accounted for by that particular curve. Secondly, we examined the error residuals for each curve-model. An error residuum is the difference between the observed and the fitted (predicted) value. The variance of all error residuals is the remaining unexplained variance (i.e. the part of the total

variance not accounted for by the model). It is necessary to inspect the distribution of error residuals for each curve-model, to determine whether the fit is without outliers and shows random variation around zero (that is, that the curve does not show consistent under- or overestimation). Residuals should also be normally distributed and randomly scattered around zero. It is difficult to check for normal distribution with such a small data set but if they are normally distributed there should be no outliers (at least with such a small data set) and they should be randomly scattered (which means they are not skewed),

-----Table 3 ABOUT HERE-----

We converted the error residuals into z-scores (normalized scores) to allow for comparison between constructions and to check for outliers, which are residuals  $>2$  or  $<-2$ . If a particular function is a good fit to the growth curve for a particular construction for a particular speaker the z-scores versions of the error residuals should be randomly distributed between  $+2$  and  $-2$  as cumulative type frequency increases. That is, the error residuals should be randomly scattered above and below the line (no bias) and the spread of variance should be similar throughout.

Table 3 above and Tables 4 & 5 below also list the F statistic, which is often used to see if a particular model (curve fit) can be explained by chance or not when carrying out a regression analysis. According to the F statistic, all of the curve fitting models reported here were significantly different from chance for all curves ( $p < 0.001$ ). However, we should note that with cumulative type frequency it does not make sense to say that a particular curve provides a significant fit or not, because the dependent variable cannot decrease and data are dependent. In this case, it is highly unlikely that linear and exponential curves would not provide a significant fit. Therefore  $R^2$  (the percentage of variance accounted for by the model) together with a visual inspection of the random error residual distribution is a better criterion for which curve provides the better fit.

#### 4.2.3 Curve fitting for the mother's sein- and werden-passives

-----INSERT Fig 5 HERE-----

-----INSERT Fig 6 HERE-----

The observed data and the two fitted functions (linear and exponential) are plotted for the mother's *ist*+passive (Fig 5) and *wird*+passive (Fig 6) above. The output statistics for these are shown in Table 3 above, where we see that according to the amount of variance accounted for by the function, the mother's *ist*+passive growth curve is better fitted by a linear function ( $R^2 = 0.96$ ) than by an exponential function ( $R^2 = 0.87$ ). One might think - since the percentage of variance in the mother's *ist*+passive accounted for by the exponential function is quite high -, that this is also a fairly good fit. We can see that this is in fact not the case if we examine the scatter plots for this construction showing the relationship between the fitted curve and the Z score transformations of the error residuals in Figs 7a and 7b below.

-----Fig 7a ABOUT HERE-----

In Fig 7a above we can see that the error residuals for the linear fit for the mother's *ist*+passive are fairly randomly distributed as cumulative type frequency increases (shown on the x-axis). This is not the case for the exponential fit for the same construction (Fig 7b below). Rather, between a cumulative type frequency of between 3 and 14 there is consistent underestimation and from then on there is consistent overestimation (see Fig 5 above).

-----Fig 7b ABOUT HERE-----

As for the mother's *ist*+passive, Table 3 above shows that the exponential function fits the mother's *wird*+passives poorly ( $R^2 = 0.64$ ), whereas the linear function is much better ( $R^2 = 0.87$ ). (An even better fit is provided by a negative quadratic function. As mentioned

above, the later tail-off of this function indicates that with time most of the verb types which can be used in the construction have already been said previously by the mother. This was supported by findings for the error residuals, which showed a reverse U-shaped pattern for both the linear and the exponential fit, but were randomly distributed between +2 and -2 for the negative quadratic fit.) Thus, as expected, both  $R^2$  and the distribution of the error residuals indicate that cumulative type frequency for both of the mother's constructions is better fit by a linear curve than by an exponential curve.

#### 4.2.4 Curve fitting for Leo's *sein-* and *werden-passives*

The mother's data clearly fit with the body of previous findings that developmental curves which are initially exponential reflect learning and are unlikely to be found as a pattern of usage when the particular dependent variable has already been acquired. Rather, the mother's data indicate that once acquisition has taken place we should expect the curve to be better fit by a linear or negative quadratic function than by an exponential function. From this, we can make the following predictions regarding curve shape for the child's acquisition of the target constructions:

##### a) Supported Constructions

We adapt Ruhland et al.'s (1995) claim regarding 'supported' constructions as follows: growth curves for cumulative type frequency which go from an extended period of zero usage to a curve which fits a linear function with a steep slope from the start are indistinguishable from the adult's cumulative type frequency curves. Such a pattern thus indicates that children have some kind of representation of the construction prior to their first use.

##### b) Non-supported Constructions

In contrast, if a construction is acquired by learning from the input with gradual schematization, then the cumulative type frequency should fit an exponential curve if we only look at the first 25 verb types (Ruhland et al., 1995, Ninio, 1999, and Elman et al., 1996).

We chose these linear and exponential functions rather than using, for example, a quadratic function because the quadratic model can in principle mimic a number of different curve forms, including linear and exponential, and is therefore not useful for distinguishing different observed curve forms from one another.

The following curve fitting analyses all relate to Leo's passive constructions shown in Figs. 3 and 4 in section 4.2.1, which both contain only the third person singular present tense forms for the reasons given there. From Fig. 4 it can be seen that the form of the growth curve for Leo's *wird*-passive is quite different to that of his mother, and to that for his acquisition of the *ist*-passive in Fig. 3. Table 4 below shows that the exponential function accounted for the most variance for Leo's *wird*-passive cumulative type frequency curve ( $R^2= 0.97$ ). The error residuals for the exponential fit were randomly distributed between Z scores of +1.5 and -1. The linear function accounted for less of the variance of Leo's *wird*-passive ( $R^2=0.89$ ). Moreover, its error residuals formed a U-shaped pattern, indicating that Leo's *wird*-passive growth curve is initially clearly not linear.

-----Table 4 ABOUT HERE-----

The opposite was the case for Leo's *ist*-passive cumulative type frequency curve. Here the linear function accounted for the most variance ( $R^2=0.95$ ), whereas the exponential function only accounted for 0.88 of the variance. Likewise the error residuals show the opposite pattern to that found for Leo's *wird*-passive. Those for a linear fit for Leo's *ist*-passive are randomly distributed between +1.5 and -2, indicating a good fit. Those for an exponential fit for the same construction are not. Rather, the exponential model consistently

underestimates his *ist*+passive for the first three data points, then consistently overestimates it for next 14 data points and finally consistently underestimates the last three data points. The best fit for the two passive constructions is plotted in Figs 3 and 4 above in section 4.2.1.

In addition, Table 4 - like Table 3 for Leo's mother - also lists the  $b_1$  coefficient, which indicates the steepness of the slope of the curve for a linear fit. It can be seen that the  $b_1$  coefficient for Leo's *ist*+passive is twice as high (.22) as that of his *wird*+passive (.10), but since a property of exponential curves is that the slope changes with time, this is not an entirely appropriate comparison. However, if we compare the two passives in terms of the amount of time it took Leo to reach a cumulative type frequency of 25 verb types, we find the same result. That is, whereas it took Leo around seven months to reach this criterion for *wird*+passive, it took him less than three months to do so for *ist*+passive.

Thus, we find three clear distinctions between the *sein*- and *werden*-passives in their development. Firstly, the *sein*-passive is acquired earlier than the *werden*-passive according to the productivity criteria. Secondly, it is acquired at a faster rate from the start. Thirdly, whereas the cumulative type frequency for the *werden*-passive is best described as the curve expected if Leo is learning and schematizing from the input (i.e. exponential), that of the *sein*-passive instead jumps from zero usage to usage similar to that of the adult non-learner.

#### *4.2.5 Discovering which constructions are supportive and which are supported among sein- and werden-constructions*

Therefore our analyses indicate that the *sein*-passive received support from previously acquired lexico-morphologically related constructions whereas the *werden*-passive did not. If this is the case, following the construction conspiracy hypothesis we should expect the supportive constructions to have a better fit to an exponential function than to a linear

function because they are learned through schematization from the input. Therefore we carried out the same curve estimation procedure for Leo's *sein* and *werden* related constructions.

The summary statistics are shown in Table 4 above and Table 5 below. It can be seen that according to our  $R^2$  criterion those *sein*-passive-related constructions which are acquired earlier ('*ist*+NP', '*ist*+adjective', and '*hat*+participle') are indeed better fit by the exponential function, whereas the *sein*-constructions which are acquired later ('*ist*+intransitive' and *ist*-passive) are better fitted by the linear function. This was also reflected in the distribution of the error residuals. For those *sein*-related constructions which are acquired earlier ('*ist*+NP', '*ist*+adjective', and '*hat*+participle') we found that the error residuals for the exponential function were always randomly distributed between +2 and -2 whereas those for the linear function showed a U-shaped pattern. For the two *sein* constructions which are acquired later ('*ist*+intransitive' and *ist*-passive) the error residuals for the exponential function were not randomly distributed, supporting the conclusion that this is not a good fit<sup>4</sup>.

Table 4 above and Table 5 below show that the same is true for the *werden*-constructions. The exponential function has a higher  $R^2$  for those *werden*-constructions which are acquired earlier ('*wird*+passive', '*wird*+adjective'), whereas the linear function accounts for most variance for the *werden*-construction which is acquired later ('*wird*+NP'). Furthermore, the *werden*-passive is the first construction in which Leo uses the third person singular form of *werden* (*wird*). This is also the case for most of the other inflected forms of *werden*, such as *werden* as (modal) infinitive, *werden* as first and third person plural, *wirst* (second person singular), *wurde* (first / third person singular past), the only clear exception being *werde* (first person singular present/future), which is never used in the passive by Leo in the whole corpus (2;0-5;0). Thus, the *werden*-passive itself (perhaps together with the *werden*+adjective

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<sup>4</sup> It should be noted that although the  $R^2$  measure indicates a very good linear fit for the *ist*+intransitive (0.95), the error residuals for the linear fit show a U-shaped pattern for this construction, indicating that perhaps neither a linear nor an exponential curve provides the best fit for this construction.

construction) appears to be a supportive construction for the acquisition of *werden*+NP. These correspondences provide additional evidence for our construction conspiracy hypothesis, namely they suggest that when a particular construction is learned earlier than its related constructions, it is initially more difficult to learn than a construction which is learned after its related constructions.

-----Table 5 ABOUT HERE-----

#### 4.2.6 *Why are the sein-copulas productive earlier than the werden-copulas?*

It seems clear that Leo's acquisition of the *sein*-passive was supported by his prior acquisition of the *sein*-copula constructions. One might ask, however, why the *sein*-copulas are learned so early when the *werden*-copulas are not. The answer probably lies in the fact that the *sein*-copulas are nearly 70 times more frequent in the input than the *werden*-copulas, as can be seen from Table 6 below. That is, Leo's mother uses *ist*+NP / *ist*+adjective / *ist*+locative 2591 times during 30 hours of recordings, whereas she only uses *wird*+NP and *wird*+adjective 39 times in the same period.

-----Table 6 ABOUT HERE-----

### **5.0 Study Two: The werden-passive versus the werden-future**

#### ***5.1 Do werden-passives become productive before werden-futures?***

The second two target constructions we compared were Leo's acquisition of the *werden*-passive versus the *werden*-future. As can be seen from Fig 8 below, Leo reached a cumulative type frequency of eight verb types for the *werden*-future two months later (at 2;7;19) than for the *werden*-passive (at 2;5;14) (see Figs. 1 and 10 for age information). More

striking is, however, how his acquisition of these two constructions progressed after this point. For the *werden*-passive this marked the beginning of an increase in the gradient of the slope and fairly consistent number of new types per week (see Fig. 8). For the *werden*-future, not only did the gradient of the slope remain depressed, he did not start using this construction regularly. Rather, it took him around 10 weeks to proceed from a cumulative frequency of 10 (at 2;8.5) to 11 verb types (at 2;10.18) (see Fig. 10). This fits with previous studies which have found that the *werden*-future appears to be acquired relatively late (Behrens, 1993; Szagun, 1978; Bassano, Laaha, Maillochon & Dressler, 2004). In addition, when we examined the Simone corpus, we found only one token of the *werden*-future in the entire corpus (compared with 21 non-imitative tokens of the *werden*-passive), which confirms that this construction is rarer than the *werden*-passive in early child German.

-----Fig 8 ABOUT HERE-----

### 5.2 Why does Leo acquire the *werden*-passive before the *werden*-future?

Before we investigate potential explanations as to why Leo acquired the *werden*-passive before the *werden*-future we need to address whether input frequency might have played a role. From Fig. 8 above we can see that this clearly not the case as the *werden*-future has a slightly higher type frequency than the *werden*-passive in the input and the token input frequency of the *werden*-future (196 tokens) is more than double that of the *werden*-passive (84 tokens) construction during 63 hours of recording.

A second potential explanation we need to explore is whether Leo had previously acquired lexico-morphologically related supporting constructions for the *werden*-passive but not for the *werden*-future. However, in regards to the lexical item *werden* we saw in Fig. 4

above that Leo had not previously acquired this before he started to use the *werden*-passive. Moreover, by the time Leo reached a cumulative type frequency of ten verb types for the *werden*-future he could presumably have transferred his knowledge of *werden* in the *werden*-passive, *werden*+adjective and *werden*+NP (which he had acquired by this time) to the *werden*-future. So this cannot account for his depressed usage of the *werden*-future.

In regards to the other crucial sub-part of these two constructions, Fig. 9 below shows us that Leo had acquired the infinitive in the modal constructions *wollen* (want)+infinitive, *können* (can)+infinitive, and *müssen* (must)+infinitive by 2;2;15 at the latest - which is quite some time earlier than when he acquired the *Perfekt* participle in the *haben*+participle, *sein*+intransitive and *sein*-passive constructions. Therefore, the role of previously acquired lexico-morphologically related constructions cannot account for the difference between the *werden*-passive and *werden*-future in Leo's data.

-----Fig 9 ABOUT HERE-----

### 5.2.1 Potential competition with paraphrase constructions as an explanation of the delay in the *werden*-future acquisition

A third possible explanation for the sequence and speed of acquisition involves hindrance. Our construction conspiracy hypothesis predicts that a target construction will be hindered by the prior acquisition of a construction with which it shares a paraphrase relationship; that is, a construction which for the child has identical semantics or pragmatics. The *werden*-future has a paraphrase construction which is almost semantically identical even for German adults, namely the *Präsens*-future. To investigate whether Leo acquired the *Präsens*-future prior to when he started to use the *werden*-future construction we examined his use of the *Präsens* (excluding auxiliaries and copulas). Leo reached a cumulative frequency of eight verb types with the *Präsens* by 2;0.19 at the latest. However, it was extremely difficult

to tell from audio-recordings - even using context - whether Leo's usage had current reference or future reference. We therefore decided to restrict our investigation to non-imitative multiword utterances involving the present tense form of a lexical verb together with the adverb "*gleich*" (in a minute / straight away). All such uses were coded by a native German-speaking linguistics student into either future reference (e.g. *Papa kommt gleich* 'daddy comes soon' "Daddy'll come in a minute" Leo 2;3.26) or non-future reference (e.g. *gleich bist du unten herausgekommen* "you came out (from) underneath straight away" Leo 2;7.9). 15% of the *gleich* utterances were also coded by the first author, with 97% agreement between the two.

It can be seen from Fig. 10 below that Leo starts to use *Präsens-future+gleich* non-imitatively at 2;1;13 and reaches a cumulative type frequency of eight verb types at 2;4;11, before he has even reached a cumulative type frequency of two verb types with the *werden-future*. Since this is quite a conservative estimate of when Leo actually acquired the *Präsens-future* we can conclude that this construction is a very good candidate for a construction which competes with the *werden-future*.

In addition, the *werden-future* may also have had competition from one of its potential supporting constructions, namely *wollen(want)+infinitive* because this construction pragmatically serves a very similar function. The *wollen+infinitive* of course expresses desire rather than intention, so the addressee is less certain that the event will actually occur. However, people often do what they want to do and predicted future events sometimes do not happen. Thus, for young two-year-olds there may be little difference between the *werden-infinitive* and *wollen-infinitive*, since both involve the outward activities of moving in relation to a goal (e.g. Montgomery, 2002). Leo certainly acquires *wollen+ infinitive* extremely early: his first non-imitative use is at 2;0;7 and he reaches a cumulative type frequency of eight verb types at 2;2;23.

We also do not have to look very far to see why these two potential hindering constructions were acquired earlier than the *werden*-future. The *Präsens-future* is morphologically identical to the present tense used for current reference which has an incredibly high input frequency, as one might expect. *Wollen*+infinitive also has a reasonably high input frequency (170 tokens in 30 hours of Leo's mother's data, compared to 124 tokens of the *werden*-future in the same period) but it also has support from the construction in which *wollen* is used as a main verb together with an object (e.g. *will mehr* "(I) want.1<sup>st</sup>/3<sup>rd</sup>.sg.PRES more" Leo 2;0.20).

-----Fig 10 ABOUT HERE-----

## 6.0. Discussion

The current study investigated the proposal that previously learned constructions can either support or hinder the acquisition of a target construction (Ruhland et al., 1995). Our version of the construction conspiracy hypothesis proposes firstly, that a previously acquired construction may support the acquisition of a target construction if the two share lexical or morphological sub-parts. Secondly, a previously acquired construction may hinder the acquisition of a target construction if the two share an identical semantic-pragmatic function.

To test this we used a longitudinal corpus of high-density acquisition data from a German-speaking boy, Leo, between 2;0-5;0, to make two sets of comparisons between matched constructions. The first matched pair were the *sein*-passive and the *werden*-passive. We found that Leo had acquired the participle sub-part in the *haben*-participle construction prior to his acquisition of both the *sein*-passive and the *werden*-passive. The two passive constructions showed an asymmetry, however, regarding the acquisition of the auxiliary. Leo acquired *sein* in the copula constructions several months before he started to use the *sein*-

passive, whereas this was not the case for the *werden*-passive. Because of this asymmetry, the construction conspiracy hypothesis would predict that the supported construction, i.e. the *sein*-passive, should be acquired earlier and faster than the non-supported construction, i.e. the *werden*-passive. As predicted, Leo acquired the *sein*-passive earlier than and twice as fast as the *werden*-passives. (When the alternative acquisition criteria of type-token ratios and active-passive alternation were used for the same dataset, the same order of acquisition was found, see Abbot-Smith, 2003).

We also investigated the proposal that a supported construction and a non-supported construction should show different patterns of development. Firstly, the form of a non-supported construction such as the *werden*-passive should be initially exponential, where the child demonstrates a cumulatively increasing ability to use the construction the more s/he has previously used it (e.g. Elman et al, 1996; Ruhland & van Geert, 1998). Secondly, a construction which receives adequate support (and no hindrance) may demonstrate apparently sudden (or unusually rapid) acquisition in production where the child proceeds from zero usage to an approximation of adult-like regularity of usage without a transitional period (Ruhland et al., 1995). To determine what usage of the target construction at an adult-like rate would be when cumulative type frequency is the dependent variable, we examined the mother's usage of the same constructions. The mother's data indicate that once acquisition has taken place we should expect the curve to be better fit by a linear or negative quadratic function than by an exponential function. From this, we predicted that for the child a supported construction such as a *sein*-passive would be better fit by a linear than by an exponential function. Both predictions were confirmed.

Since our construction conspiracy hypothesis predicts that non-supported constructions in general should initially fit an exponential curve whereas supported constructions should precede from zero to adult-like regularity of usage unusually rapidly, we carried out the same

analyses for the *sein* and *werden* related construction. If we treat the *sein*-constructions and the *werden*-constructions as two syntactic networks, we can see that those constructions which are acquired earlier- the 'supporters' - fit an exponential curve, whereas those constructions which are acquired later - 'the supported' - fit a linear curve. In the approach of Ruhland et al. (1995; also Elman et al., 1996) these findings suggest that the forerunner constructions (i.e. *sein*-copula, *haben*-participle, *werden*-adjective and *werden*-passive) are acquired largely by learning and generalizing from the input; whereas the constructions acquired later (i.e. *sein*-passive, *sein*-intransitive and *werden*+NP) receive support from these forerunner constructions. Because the exponential shape of the non-supported constructions looks so much like that previously found for vocabulary learning (e.g. Elman et al, 1996), it might be tempting to conclude that vocabulary learning is all that these curves reflect. This is not the case because at the time point at which Leo apparently had difficulty using new verb types in the *werden*-passive (at age 2;4) he was simultaneously using 75% of the verb types which he was hearing used in this very construction in his mother's input in the present tense, *haben*-participle and/or *sein*-passive constructions. It is also unlikely that the linear pattern shown by the supported constructions merely reflects a general acceleration in the ability to combine morphemes, because the supported constructions for the *sein*-constructions are acquired earlier than the forerunner constructions for the *werden*-constructions.

The second set of matched constructions we investigated were the *werden*-passive and the *werden*-future. Despite the fact that the input frequency of the *werden*-future was slightly greater than that of the former, Leo's acquisition of the *werden*-future lagged at least two months behind (eight verb types reached only by 2;7.19) and was several times slower than that of *werden*-passive. In contrast to the passive study, however, we were unable to find an asymmetry between the two constructions in regards to the prior acquisition of lexically-morphologically related constructions. Rather, it appeared that his delayed acquisition of the

*werden*-future was most likely due to his prior acquisition (by 2;4 at the latest) of the *Präsens*-future construction, the usage of which in the adult language is so similar to that of the *werden*-future that it is highly likely to appear to the child to have an identical semantic-pragmatic function. This ties in with our construction conspiracy hypothesis which predicts that supporting constructions will be unable to aid the acquisition of a target construction if the latter is competing with another construction which has an extremely similar semantic-pragmatic function.

The current study thus appears to provide some support for our version of the construction conspiracy hypothesis which takes as its starting point the predictions of Ruhland et al. (1995). Our approach differs, however, in a number of important ways from that of Ruhland et al. In regards to the data themselves, Ruhland and van Geert (1998) point out that densely sampled data are essential in order to determine growth curves and relationships between constructions. The current study indicates, however, that even their rate of sampling - and Ruhland et al.'s - (one hour every two weeks) is probably not dense enough to determine whether acquisition of a particular construction is truly sudden (see Tomasello & Stahl, 2004). We - like they - are clearly limited in our interpretive power by the fact that our study is based on one child only, but this was unavoidable as Leo is to date the only German child whose longitudinal acquisition has been sampled densely enough.

In regards to data analysis, we believe it is extremely important to use the same dependent measure for all constructions when comparing the acquisition of one with another. It is also important to use the same measure with a sample of adult data in order to see what the pattern of usage is like when no learning is involved. Furthermore, it is much easier to interpret findings for one construction if we are able to compare it with the acquisition of another "control" construction on which it is matched in terms of phonological saliency, length, input frequency, and semantic/syntactic complexity.

Of course our interpretation of our findings rests on the assumption that the constructions in a particular comparison set are truly matched in terms of input frequency, semantic and syntactic complexity. We argued that Leo's order of acquisition of the two passive constructions did not merely reflect their frequency in his mother's input, since these are equal. However, it is of course possible that when Leo initially started to acquire the *sein*-passive he did not distinguish between this construction and the morphologically identical *sein*-intransitive construction. If this is the case, it would be true that the *sein*-participle constructions together do have a higher input frequency than the *werden*-passive. However, input frequency of a particular construction in isolation clearly does not have a deterministic influence. This can be seen from the fact that Leo did not start to acquire *werden*+infinitive to denote future tense until after he had acquired the *werden*-passive, although the *werden*-future is more frequent than the *werden*-passive in the input. Consequently, we argue that input frequency should be examined in relation to a network of related constructions, rather than in relation to a construction in isolation.

A second potential criticism might be that the *werden*-passive - as an eventive passive - is syntactically (e.g. Borer & Wexler, 1987; Wexler, 2002) or conceptually (e.g. Wegener, 2003) more complex than the *sein*-passive, a stative passive. These claims are challenged by the syntactic properties of the *sein*-passive in adult German, such as the ability to take *von*-phrases (by-phrases) and instrument phrases (see Rapp, 1996; Eisenberg, 1994, for details). They are also challenged by the fact that from 2;6 Leo began to regularly alternate between the *sein*-passive and the active transitive (Abbot-Smith, 2003), which implies that he was aware of the conceptually implicit agent in the former. Furthermore, Leo acquired the *werden*-future far later than the *werden*-passive which goes against arguments that the *werden*-passive is particularly syntactically or conceptually complex, since this would lead to the prediction that it should be acquired later than a construction for future time reference. Such theories also

predict late acquisition of eventive passives cross-linguistically whereas they are actually acquired very early in languages like Inuktitut and Sesotho in which they are more frequent in the input (e.g. Allen & Crago, 1993; Demuth, 1989). Moreover, we would predict that when a particular passive construction - such as a reflexive passive, for example, - is clearly acquired prior to another passive construction in a particular language, this may well be related to prior acquisition of related constructions, for example other reflexive constructions.

Thirdly, there have been claims that early *sein*-passives are represented by the child as eventive passives (Eisenbeiss, 1993) or even that a large part of *sein*-passives produced by adults are in fact the *Perfekt* tense form of the *werden*-passive with *worden* ellipped (e.g. Wegener, 2003; Lenz, 1993). If, however, Leo's *sein*-passives and *werden*-passives were in fact one construction we would not expect them to show two distinct curve forms when measured by cumulative type frequency (see Abbot-Smith, in prep, for more evidence; see Rapp, 1996; Eisenberg, 1994, for further arguments against the *worden* ellipses analysis in adult German).

Since none of these plausible alternative explanations seem to hold, we believe that our account of the various supporting and hindering relationships between these constructions provides the best explanation as to their order, rate and pattern of acquisition. Of course, we are not the first to claim that children build up their grammatical knowledge from prior acquisition. Bryan (1995) developed a generative account which has notable similarities; she argues that German children build up to the passive from participle constructions and use copula constructions to "check" their case analysis. However, Bryan's (1995) account contains no explanation as to why the *sein*-copulas are acquired earlier than the *werden*-copulas. In all emergentist frameworks, however, this would be accounted for in terms of their much greater input frequency. In addition, because her account assumes that the underlying structure of the *werden*-passive is more complex, it would neither predict that the *werden*-passive is acquired

before the *werden*-future and *werden*+NP nor that children learn the lexical item *werden* from the *werden*-passive.

Bryan's (1995) account is also encumbered by her reliance on the generative mechanism of syntactic triggering from either the presence of the *by*-phrase and/or by "noticing" that the same verb types are used in the active and passive constructions. But since both types of information are presumably in the input from the start (although the former rather infrequently), it remains a mere stipulation that children "notice" these input characteristics at the time point at which they supposedly do. Bryan (1995) also provides no account of the essential issue investigated in the current study; that is, why certain constructions are acquired initially very gradually with increasing speed over time, whereas other constructions appear to be acquired suddenly. Instead, Bryan has a "building block" analysis whereby once the child has acquired all the parts of the construction, s/he should immediately be prepared to begin using a construction. This is not the case in the current study where the acquisition of the crucial lexical and morphological sub-parts (*ist* and the *Perfekt* participle) did not immediately lead to acquisition of the *sein*-passive. This is consistent with emergentist-type theories of grammar such as Construction Grammar and Cognitive Grammar which claim that the meaning of a construction cannot be predicted entirely from the meaning of its constituent parts (e.g. Goldberg, 1995).

That said, there are clearly some unresolved issues in our construction conspiracy account. Firstly, in the current study we have only contrasted potential supporting relationships with potential competing relationships. In the original predictions of Ruhland et al. (1995), however, they distinguished between supporting relationships, which assist the development of a target construction, and precursor relationships, which are necessary for the development of a target construction. We believe that the assisting relationships in the current study are more likely to be that of support than prerequisite for the following reasons. Firstly,

there does not appear to be a particular threshold of types used with a particular supporting construction which is then necessary and sufficient for the target construction to begin to be used. Leo had used a large number of predicate types with the *sein*-copulas before he started to use the *sein*-passive, whereas he had only used the *werden*-passive and *werden*+adjective constructions with about eight verb types each before his unusually rapid acquisition of the *werden*+NP construction. Thus, we suspect that there is certainly not one single prerequisite, and if there are multiple ones, distinguishing this from support may prove difficult. Another reason to prefer the notion of support rather than of prerequisite is that children appear to be able to learn at least certain constructions merely by generalizing from the input, as is apparently the case with the *sein*-copula constructions. A second issue is that the current study does not resolve exactly how many and what kind of supporting constructions are necessary for a construction to be supported in its acquisition, for example, how many and which other *sein*-constructions were essential for Leo's rapid acquisition of the *sein*-passive. Both of these issues await experimental research before they can be dealt with satisfactorily.

With time the supported constructions themselves will become supporting constructions for other constructions. An example of this can be seen in the *haben*+participle construction which we argue is a supporting construction for the *sein*-passive, but it itself is presumably at least partially supported by the prior acquisition of *haben*+NP (e.g. '*Mama hat Kaffee*' 'Mummy has coffee', Leo 2;2.10) and the participle in isolation. Thus, during ontogeny we expect to see a child increase in his or her ability to acquire a new grammatical construction the more grammatical constructions that child has previously acquired.

A third important issue is what exactly constitutes a supporting construction. Findings from non-linguistic cognition indicate that if common elements are shared between a previously learned and a target task, the target task will be learnt more quickly. On the basis of this we proposed that the central relationship to the target construction is one of shared lexical

or morphological material. This fits with the emergentist claim that children's initial representations of constructions like the passive may be lexically-specific with slots allowing more variability, such as *it is VERBed* (e.g. Tomasello, 2003; Pine et al., 1998). The more abstract versions of these constructions, such as *NP BE PARTICIPLE* are proposed to gradually emerge as generalizations over categories consisting of more lexically-specific representations (e.g. Goldberg, 1995; Langacker, 2000). However, mere lexical overlap may not be sufficient for support if the meaning of the two lexical items in the two constructions is completely different. Rather, some kind of family-resemblance-like semantic similarity such as a relationship of metaphorical extension may also be necessary (see Goldberg, 1995). Further research will need to be carried out to determine the degree to which this is the case, and to clearly distinguish family-resemblance-like semantic similarity from a paraphrase relationship, which we argue is likely to hinder a target construction.

The final unexplored issue relates to the differential roles of comprehension versus production. We argue that the prior acquisition of lexico-morphologically related constructions assists the child in interpreting the target structure-meaning mapping with relatively little input frequency of the target in isolation. It is true that Morris et al.'s (2000) connectionist simple recurrent network did generalize to constructions it had never been trained on, but their comprehension task was essentially forced choice. That is, it was trained to assign a limited set of semantic categories, such as agent or experiencer, to words in a series of different constructions involving action (e.g. 'kiss') and experience verbs (e.g. 'see'). Thus, even if it were possible to assume that this computer simulation in any way reflected how children generalize, it would only suggest that prior acquisition of related constructions makes it easier to interpret the target construction in the input, if given a very limited set of possible interpretations (which is unlikely to be the case).

In our view, prior acquisition of the lexico-morphological sub-parts makes it easier to interpret the target construction in the input and thus may lead to a more rapid generalization process. By contrast, non-supported constructions proceed through an initial phase in which the construction is based around a small number of particular lexical items. Nonetheless, even a supported construction needs to be heard with at least some input frequency for children to be able to interpret it correctly since its meaning cannot be predicted entirely from the meaning of its supporting constructions. Rather, our interpretation of the current findings is that the prior acquisition of lexically related constructions made it easier for Leo to interpret *sein*-passives in the input and his previous usage of *ist* in *sein* copulas facilitated his production of this lexical item in *sein*-passives.

In sum, the aim of the current study was to make clear predictions using a sufficiently dense dataset about the role of potential supporting versus hindering constructions in grammatical acquisition. In doing so, we considered input frequency in terms of the frequency of certain aspects of grammar in the grammar network as a whole rather than merely of the particular item or construction under consideration. We believe that the current findings are highly compatible with emergentist frameworks because they suggest that even apparently sudden acquisition may be due to underlying learning mechanisms which are essentially gradual in nature. Moreover, the notion of 'cumulative support' of lexically or metaphorically related constructions ties in with emergentist grammatical theories that grammatical constructions form a network hierarchy (e.g. Goldberg, 1995; Langacker, 1988).

Table 1: The constructions lexico-morphologically related to the *sein*-passive

Plus	<i>Haben</i> 'to have'	<i>Sein</i> 'to be'
Noun Phrase (NP)		3) <i>Das ist ein Zug</i> (that is a train)
Adjective		4) <i>Der Reis ist schwarz</i> (the rice is black)
Locative		5) <i>Der Reis ist oben</i> (the rice is on top)
intransitive participle	6) <i>Der Mann hat gearbeitet</i> ,the man have.3 <sup>rd</sup> .PRES worked' (the man worked / has worked)	7) <i>Der Ball ist gefallen</i> ,the Ball be.3 <sup>rd</sup> .PRES fallen' (the ball fell / has fallen)
transitive participle	8) <i>Der Mann hat den Reis gekocht</i> 'the man have.3 <sup>rd</sup> .PRES the rice cooked' (the man (has) cooked the rice)	9) <i>Der Reis ist gekocht</i> 'the rice be.3 <sup>rd</sup> .PRES cooked' (the rice is cooked)

Table 2: The constructions lexico-morphologically related to the *werden*-passive

Plus	<i>haben</i> 'to have'	<i>werden</i> 'to become'
Noun Phrase (NP)		10) <i>Das wird ein Zug</i> ,that become.3 <sup>rd</sup> .PRES a train' (that's going to be a train)
Adjective		11) <i>Der Reis wird schwarz</i> ,the rice become.3 <sup>rd</sup> .PRES black' (the rice is turning black)
Infinitive		12) <i>Der Mann wird arbeiten</i> ,the man become.3 <sup>rd</sup> .PRES work.INF' (the man will/ is going to work)
intransitive participle	13) <i>Der Mann hat gearbeitet</i> ,the man have.3 <sup>rd</sup> .PRES worked' (the man worked / has worked)	14) <i>Hier wird gearbeitet</i> ,here become.3 <sup>rd</sup> .PRES worked' (work is being done here)
transitive participle	15) <i>Der Mann hat den Reis gekocht</i> ,the man have.3 <sup>rd</sup> .PRES the rice cooked' (the man (has) cooked the rice)	16) <i>Der Reis wird gekocht</i> 'the rice become.3 <sup>rd</sup> .PRES cooked' (the rice is being/going to be cooked)

Table 3: Curve fitting for Mother's *ist-* and *wird-* passives (first 25 types only)

		$r^2$	Degrees of freedom	F	b1
<i>ist</i> -passive	Linear fit	.96	16	367.19	.66
	Exponential fit	.87	16	110.64	.08
<i>wird</i> -passive	Linear fit	.87	13	85.85	.46
	Exponential fit	.64	13	23.31	.04

Table 4: Curve fitting for Leo's *ist*- and *wird*-passives (first 25 types)

		r <sup>2</sup>	Degrees of freedom	F	b1
<i>ist</i> -passive	Linear fit	.95	18	328.71	.22
	Exponential fit	.88	18	132.05	.02
<i>wird</i> -passive	Linear fit	.89	17	137.04	.10
	Exponential fit	.97	17	584.88	.01

Table 5: Curve fitting for Leo's constructions related to the passives (first 25 predicate types)

		r <sup>2</sup>	Degrees of freedom	F	b1
<i>ist</i> +noun phrase	Linear fit	.84	19	99.21	.38
	Exponential fit	.97	19	713.40	.05
<i>ist</i> +adjective	Linear fit	.81	17	70.98	.24
	Exponential fit	.98	17	742.18	.03
<i>ist</i> +intransitive participle	Linear fit	.95	20	393.42	.19
	Exponential fit	.89	20	156.49	.02
<i>hat</i> + participle	Linear fit	.89	17	143.35	.29
	Exponential fit	.99	17	1117.59	.03
<i>wird</i> + noun phrase	Linear fit	.97	17	583.01	.25
	Exponential fit	.77	17	57.48	.03
<i>wird</i> +adjective	Linear fit	.93	19	254.82	.14
	Exponential fit	.96	19	451.73	.02

Table 6: Input frequency for the 3<sup>rd</sup> person singular present tense of *sein-* and *werden-* related constructions, depicted against Leo's order of acquisition of these constructions

	Mother's token frequency in the first 30 hours of recording	Leo's order of acquisition
<i>ist</i> + noun phrase / adjective / locative	2591	1
<i>hat</i> + participle (past)	190	2
<i>ist</i> + intransitive participle (past)	146	3
<i>wird</i> + infinitive (future)	66	<b>8</b>
<i>ist</i> + passive	27	4
<i>wird</i> + adjective	27	5
<i>wird</i> + passive	22	6
<i>wird</i> + noun phrase (NP)	12	7

Fig. 1:

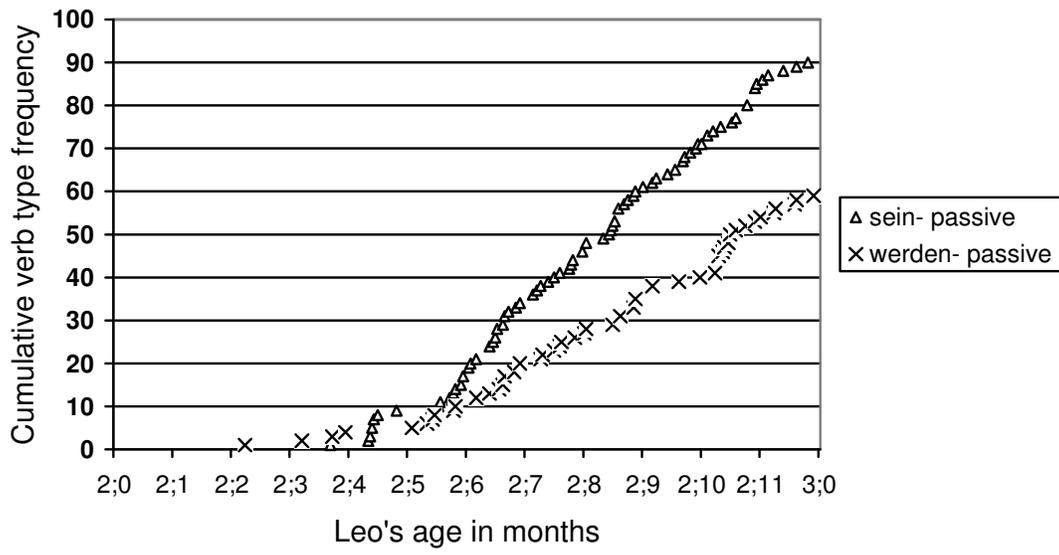


Fig. 2:

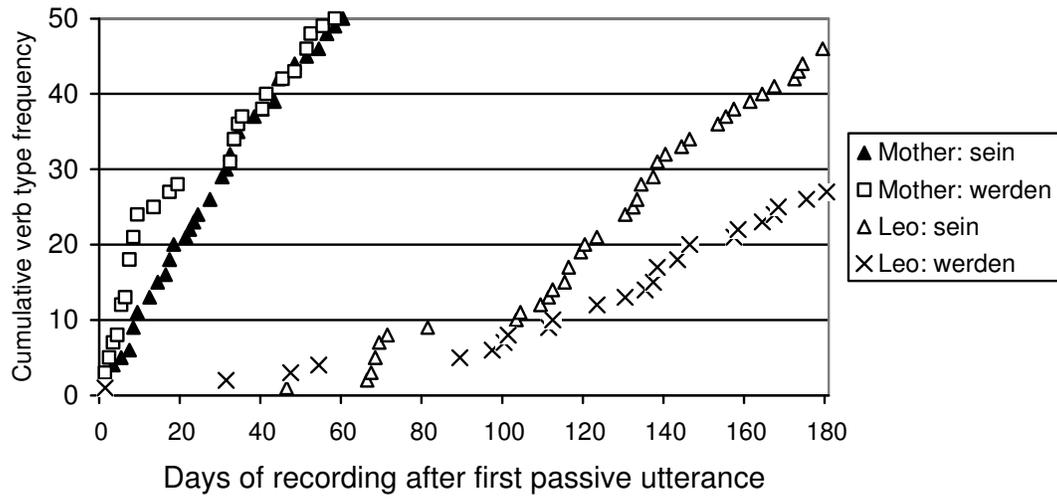


Fig. 3:

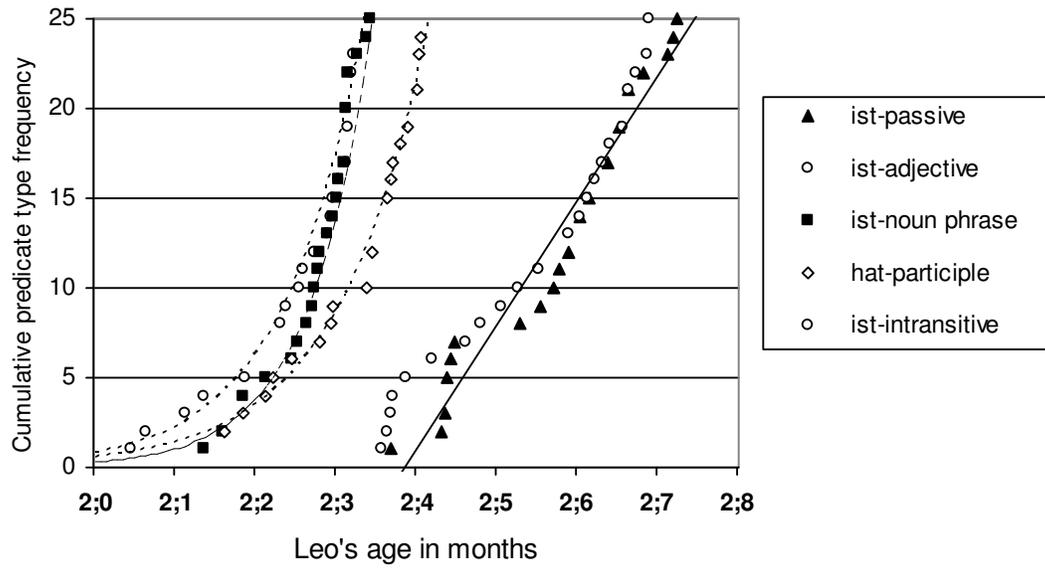


Fig. 4:

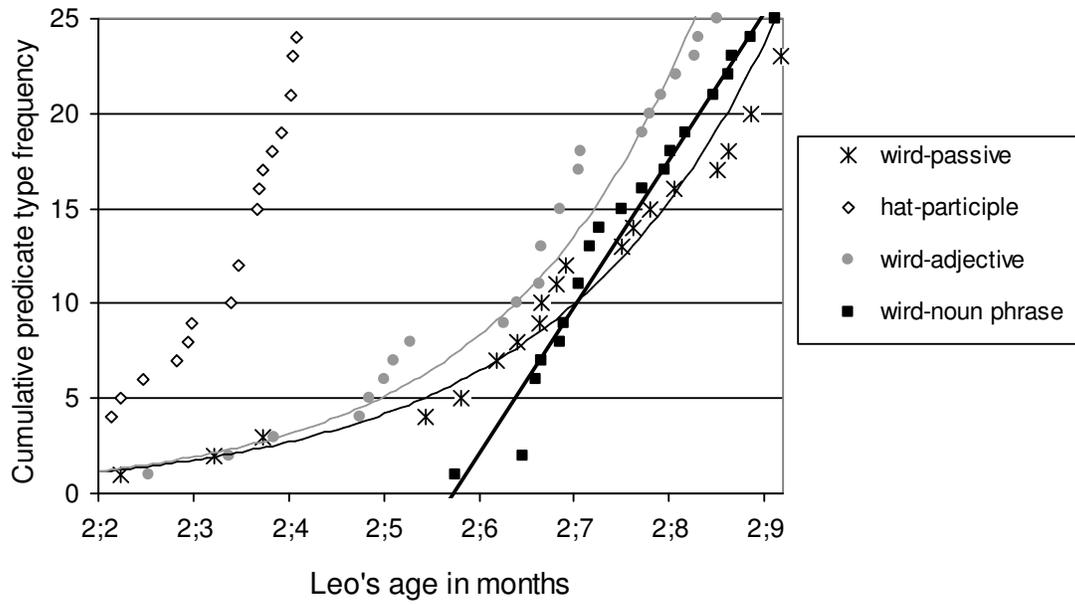


Fig. 5:

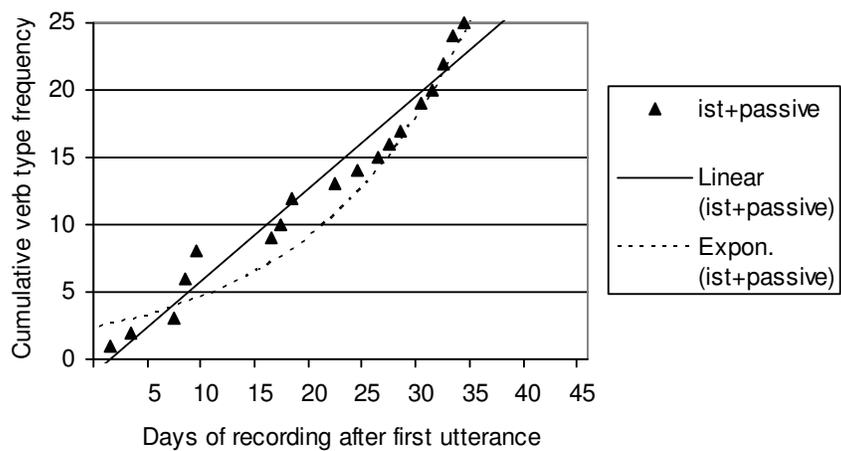


Fig. 6:

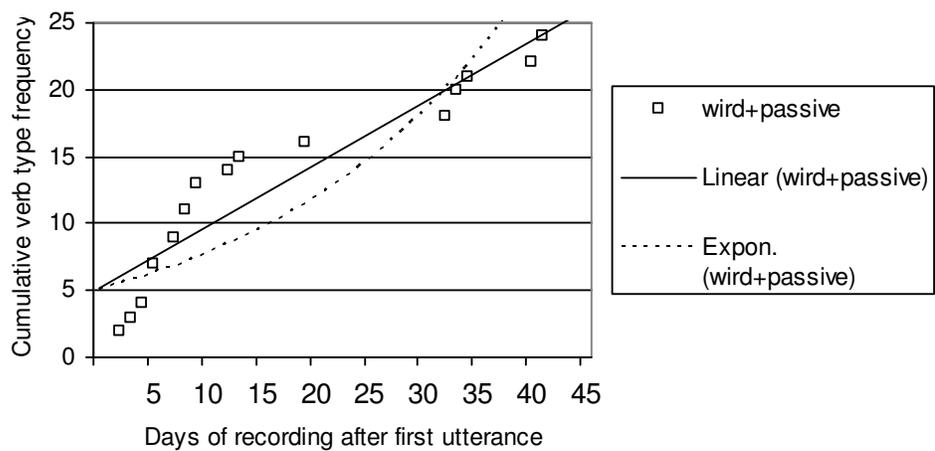


Fig. 7a.

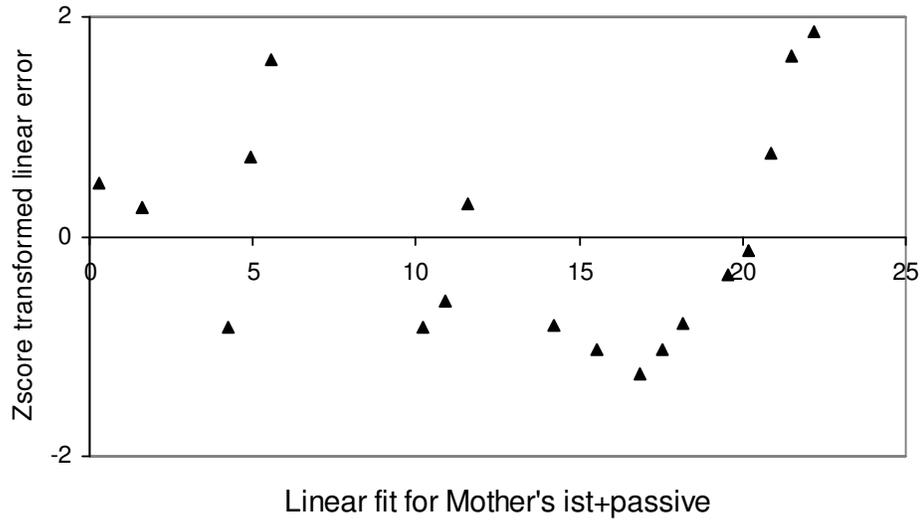


Fig. 7b.

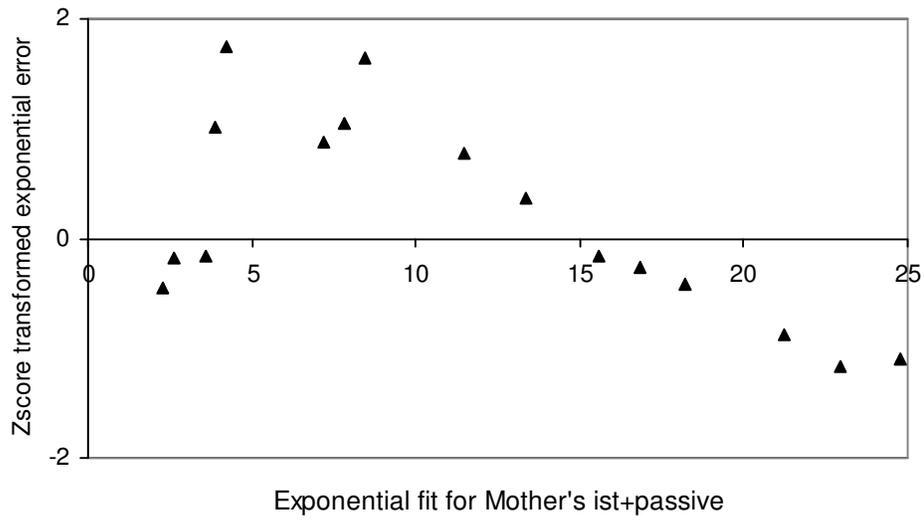


Fig. 8:

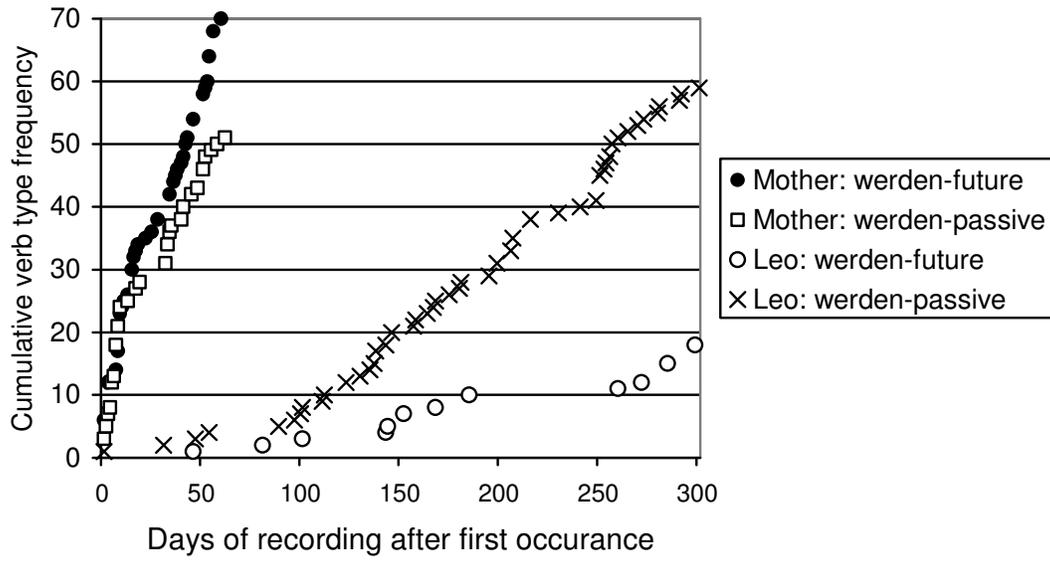


Fig. 9:

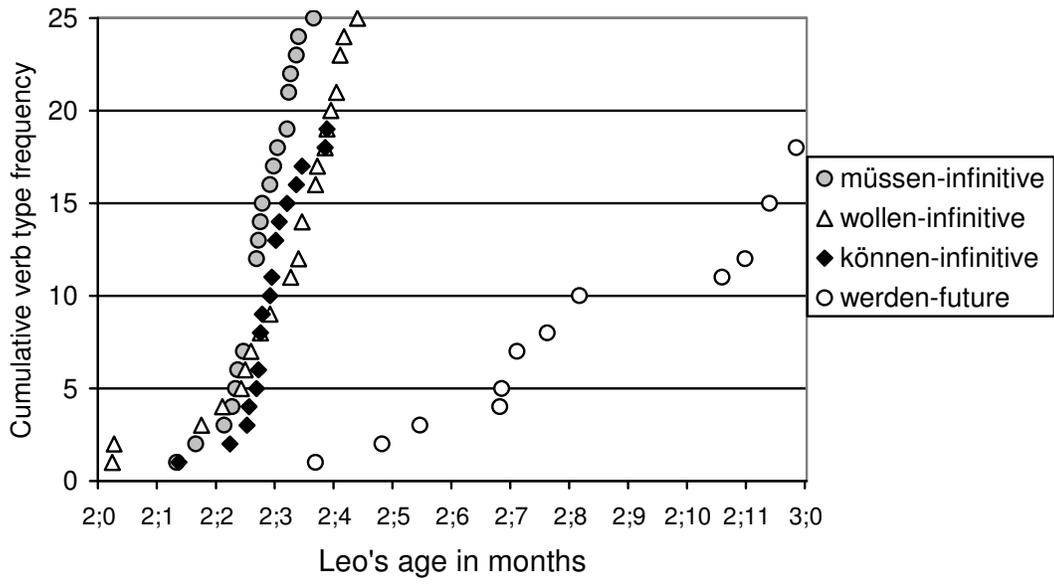
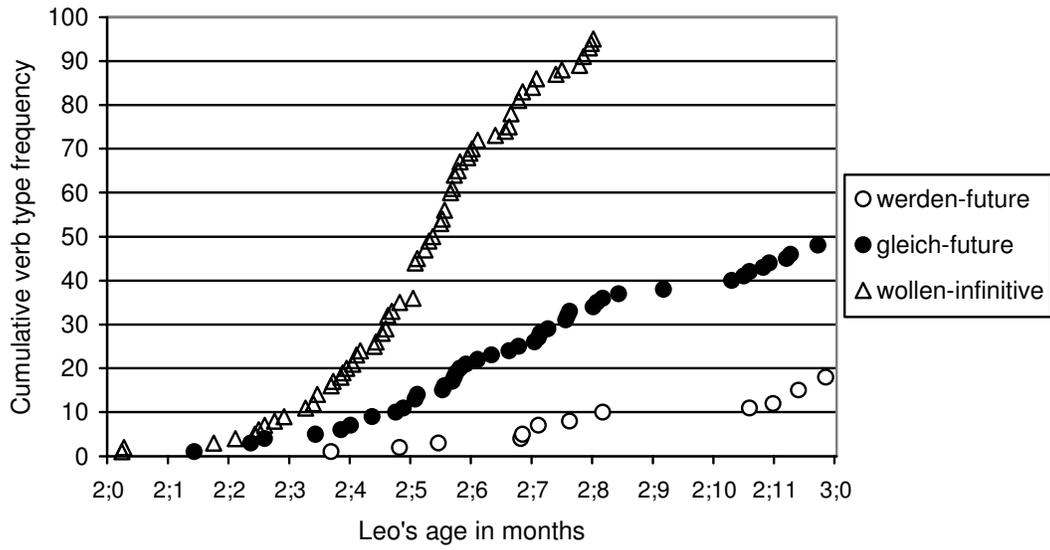


Fig. 10:



## Figure Captions

Fig. 1: Cumulative type frequencies for Leo's *sein*- and *werden*-passives

Fig. 2: Cumulative type frequency for *sein*- and *werden*-passives for Leo and his mother (in days of recordings after first passive utterance)

Fig. 3: Cumulative type-frequencies of Leo's constructions related to the *sein*-passive (3<sup>rd</sup> person singular only)

Fig. 4: Cumulative type-frequencies for Leo's constructions related to the *werden*-passive (3<sup>rd</sup> person singular only)

Fig. 5: Curve fitting for Mother's *ist*+passive (first 25 verb types)

Fig. 6: Curve fitting for Mother's *wird*+passive (first 25 verb types)

Fig. 7a: Linear fit: the distribution of error residuals between a fit and cumulative type frequency for the mother's *ist*+passive

Fig. 7b: Exponential fit: the distribution of error residuals between a fit and cumulative type frequency for the mother's *ist*+passive.

Fig. 8: Cumulative type frequency for *werden*-future and *werden*-passive for Leo and his mother (in days of recordings after first passive or future utterance by a particular speaker)

Fig. 9: Cumulative type-frequencies for Leo's *werden*-future, *wollen*+infinitive *müssen*+infinitive and *können*+infinitive.

Fig. 10: Cumulative type-frequencies for Leo's *werden*-future, *gleich*-future and *wollen*+infinitive.

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