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Early word formation in German language acquisition: A study on word formation growth during the second and third years

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Abstract

This study investigates the development of German word formation as an important step in mastering complex lexical items for the language learning child. Thirty mother–child dyads participated. Means of word formation and resulting word categories were analyzed in children's spontaneous speech at ages 1;9, 1;11, 2;6, and 3;0. In contrast to the acquisition of English, the results show simultaneous development of compounds and derivations. German toddlers produce more verbal than nominal derivations and more compounds based on verbs than on nouns. The findings suggest that (1) there are cross-linguistic differences in the development of word formation devices, and (2) children rely heavily on verbs in word formation.

Keywords

cross-linguistic differences, language acquisition, parts of speech, productivity, word formation

The acquisition of the lexicon is a central and complex component of child language development. Research has approached the subject from different perspectives: vocabulary growth and composition, fast mapping, constraints of word learning, and semantic characteristics have been investigated, among others (for an overview, see Golinkoff et al., 2000).

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Moreover, the lexicon is often viewed as the entrance point to syntax (Devescovi et al., 2005). However, in the language acquisition literature there is still little research on the processes involved in word formation.

In word formation, suffixes combine in a rule-based manner with lexical morphemes to create complex words. In acquiring the regularities of word formation, children have to learn a rich combinatorial and structured system. Word formation comprises compounding and derivation as two productive devices to form new lexemes. Children acquire and build compounds to name entities more precisely. Using compounding, children can establish simple taxonomies because subordinate terms are often compounds. They are able to classify objects more properly and increase their vocabulary systematically (Clark, Gelman, & Lane, 1985). Derivation has similar functions. It contributes to the expansion of the lexicon. Through changes of the lexical category of a word via suffixes, children have a very powerful and comfortable tool to extend their vocabulary (Panagl, 1976). Derivation and conversion also serve for opening up complete lexical fields of lexemes (Meibauer, 1999).

Thus, it is important to study word formation in language acquisition for several reasons. First of all, in the case of German, the language studied here, it is simply not yet well understood when and to what extent children start to use complex words as, for example, derivations, compounds, and conversions. The acquisition of word formations, however, constitutes an important step in mastering the complexity of lexical items.

In addition, since derivation often implies a change of the word category, the topic of word formation is strongly related to lexical composition. To our knowledge, studies on vocabulary composition have mainly been based on simple lexical items and have tended not to take morphological complexity into account. Studying word formation, however, allows observing the categories used as the basis of complex words, as well as the categories of the products of word formation processes.

In this article, we first provide a review of the literature on the development of early word formation. Then we present a study on the acquisition of word formation in 2- to 3-year-old German children. This study aims to investigate the acquisition of word formation devices in conventional words and lexical innovations. We examine also the composition of the developing lexicon. Hence, we analyze word categories (parts of speech) resulting from the word formation processes as well as the categories that are used as the basis of word formation. Besides the early study by Stern and Stern (1928), we present the first longitudinal documentation of the development of early word formation in German based on a larger sample.

Acquisition of word formation

Recent research shows a comparatively homogeneous picture that is mostly based on the work of Eve Clark on English language acquisition. In children learning English, compounding (e.g., *crow-bird*) is observed from the age of 1;6 using mostly nouns. Zero-derivation (e.g., *to scale* 'to weigh') appears at the same age (Clark, 1998). Affixation (e.g., *thrower*) sporadically occurs at the age of 2;6 and is mastered during the fourth year of life (Woodward & Markman, 1997). The production of affixes in parts of compounds (i.e., mixed forms of word formation including compounding and derivation) displays an even more difficult step for toddlers.

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Clark (1998) finds the same developmental sequence for several Germanic languages. In general, compounding appears before the age of 2;0. By 2;6, children have analyzed the *determinans* (part of the compound that modifies the head) and the *determinatum* (head of the compound which is to be determined) and have understood the semantic content of the compound. In some languages, such as Hebrew, children need much longer to establish taxonomies via compounding and thus to analyze the semantic relation between the two parts of the compound (Berman & Clark, 1989).

In German, word formation represents an important, often used, and prominent feature of the language. To date, there only exist a few longitudinal studies of word formation in German. There is the well-known diary study of Stern and Stern (1928), and more recently Meibauer (1995, 1999) used a diary study to gain more insights into the development of word formation. Stern and Stern report for their two children interindividual differences in the developmental sequence. Their daughter, 'Hilde,' produces first a derivation at 1;8 (e.g., *Leibchen* 'bodice') and then two months later (1;10) a compound (e.g., *Taschentuch* 'handkerchief'). Their son, 'Günther,' utters compounds and derivations simultaneously, but only starting at the age of 2;4. A heterogeneous picture also emerges when investigating other rather early diary studies (Lindner, 1898; Neugebauer-Kostenblut, 1914). The only common feature in the development of word formation is the appearance of derivation and compounding before the age of 3;0. Conversion and implicit derivation (i.e., conversion with a vowel change) are not taken into account in these studies. With particular reference to German, Clark (1995a) reports compounds from the age of 1;6, followed by derivations between 2;6 and 3;0. In subsequent development, the proportion of compounds and derivation reverses: derivation increases and compounding decreases. In her reports concerning German, Clark (1995a) draws mainly on the diary studies of Neugebauer-Kostenblut (1914) and Stern and Stern (1928). In more recent German diary studies, Meibauer (1999) reports -er-derivations and conversions already between the ages of 1;10 and 2;10 and thus contradicts Clark's (1998) conclusions. Starting at 3;0, complex bases rapidly increase in German (Meibauer, 2001; Meibauer, Guttropf, & Scherer, 2004) as well as in English (Clark, 1995a). In sum, the need for more empirical data on word formation in German becomes evident.

Parts of speech in early word formation

In the context of the general discussion about lexical categories during early language acquisition (see Gentner, 1982; Kauschke & Hofmeister, 2002 on lexical composition in German), it is also interesting which lexical categories children use as bases for their word formation and which parts of speech they produce via word formation. One word category can be formed into another word category by means of word formation processes, which are termed syntactic transposition (e.g., teach-er/*Lehr-er* as a deverbal noun, i.e., as a noun derived from a verb). Another form of word modification occurs in semantic modification, by which the meaning of a word is augmented while the word category remains the same.

Concerning transposition, Meibauer (1995, 1999) and Clark (1995a) claim that, at first, a large number of nominal roots appear in order to form verbs. Later, verbal roots increase. Following Clark (1995a), denominal verbs (i.e., verbs derived from nouns)

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appear from the age of 2;0 in English and in German, while verbal bases are not employed before the age of 3;0. Adjectives represent the smallest group in early word formation and are only observed starting at age 4;0 (Clark, 1995b). Even at 4;6, German children show considerable difficulties in forming an adjective from a noun (Grimm & Schöler, 1988).

Concerning semantic modification, Clark (1995a) reports that at age 2;0, children first combine general-all-purpose (GAP) verbs such as *machen* 'to make' or *tun* 'to do' with prefixes and then gradually enlarge their repertoire of prefixes by antonyms such as *aufmachen* 'to open' and *zumachen* 'to close.' In elicited data Clark found that children produced the verb *machen* 'to make' most frequently and combined it most often with the adverbs *los* and *weg* 'gone/away' and the prefix *ab* 'off.'

Productivity in early word formation

Alterations of words via syntactic transposition or semantic modification can indicate productive usage of means of word formation. However, the occurrence of complex words in spontaneous speech is not so informative as to whether these utterances are based on a productive process. It is equally possible that children adopt conventional complex words as unanalyzed units from the input. Lexical innovations (e.g., 'sworders' and 'nose-beards,' see Becker, 1994) indicate that children productively utilize their knowledge of word formation devices, because these invented forms cannot be found in the input.

To demonstrate productive use of word categories in word formation, experimental methods are more revealing. However, experimental studies concerning productivity in word formation are scarce. In light of experimental findings on the differential productivity in children's use of simple (monomorphemic) nouns and verbs, Tomasello and colleagues (Tomasello, Akhtar, Dodson, & Rekau, 1997; Tomasello & Olguin, 1993) postulate the lack of an abstract verb category until the age of 2;2 because children show limited morphological and syntactic productivity with verbs. Rather, young children mostly proceed on a lexical specific basis (Tomasello et al., 1997, p. 386). They produce fixed verb-island constructions that are highly dependent on the input. If, instead, children drew on verbs flexibly as the basis for or as components of word formation processes at early stages of language development, this would suggest that children use verbs in a productive way earlier than proposed in usage-based theory.

Principles of word formation acquisition

Why do children use certain word formation devices first? And why are there language specific differences in the developmental sequence of word formations? Clark (1991) proposed some general mechanisms that have been referred to as the principles of productivity, of transparency, simplicity of form, conventionality, and contrast. In addition to the pragmatic factors of conventionality and contrast, morphological principles especially guide the acquisition of word formation. These are the principles of transparency and simplicity of form. Transparency describes the way that children use already known and transparent word formation elements. According to Clark, this

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leads first to compounds and conversions and only later to the less transparent derivations. If exactly one form can be mapped to one meaning, a word formation is completely transparent. Thus, single parts of a compound are much more transparent than those of derivations. It is only later in the development that children realize the form–meaning pairing of suffixes because of much more complex morphotactical changes that are concomitant with derivational processes (Clark & Berman, 1984; Clark & Hecht, 1982; Schaner-Wolles & Dressler, 1985).

Closely connected to transparency is the principle of simplicity of form: 'Simpler forms are easier to acquire than more complex forms, where simplicity is measured by the degree of change in a form. The less a word form changes, the simpler it is' (Clark, 1991, p. 49). In Germanic languages, the simplest way is to combine two nominal roots to one compound without any changes to these bases (see Becker, 1994, for lexical innovations in English). In addition, conversions are often considered to be quite simple word formation devices. For German, Clark (1995a) mentions examples of conversions from nominal roots to verbs, such as *bildern* 'to picture.'

It follows from the principles of transparency and simplicity that compounding and conversion should generally emerge before derivation. However, in light of the reported findings on word formation acquisition in German, it seems questionable whether the developmental sequence 'compounding before derivation' is also valid for German. Moreover, it is debatable if conversion is a simple process in German, because in contrast to English conversion requires at least an added inflectional ending.

The main goal of the present study is the longitudinal analysis of children's use of word formation in spontaneous speech in German. We look at every occurring word formation (conventional forms or innovations) and deal mainly with the ability of children to master existing complex words in German.

We address specifically the following questions:

1. Is word formation evident as early as in the second year of life in German-speaking children? What is the proportion of complex words resulting from word formation relative to the overall lexicon?
2. Which means of word formation, namely compounding, derivation, conversion, or implicit derivation, do children use during their second and third years of life? In which developmental order do the word formation devices appear?
3. Which parts of speech are the basis of children's word formations and which parts of speech are the results of their word formation processes?

Method

Participants

The following data are part of a larger database acquired for a project on mother–child interaction and its impact on the development of communicative competence in the child (see Klann-Delius, Hédervári, & Hofmeister, 1996). In that study, 39 mother–child dyads (18 girls, 21 boys) were observed at 20 sampling points between 1;1 and 3;0. No complications had occurred during birth and delivery and most of the children were first-borns.

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All children were raised monolingually, with German as their native language. Information about the participants' socioeconomic status was gained through a questionnaire assessing the education and current profession of parents: 41% of the participants came from upper middle-class families, 36% from middle-class, 10% from lower middle-class, and 13% from working-class families.

The longitudinal study presented here comprises four recording samples, two of which were taken during the second year, at age 1;9 and 1;11, one during the third year at age 2;6, and the final recording, which was taken at age 3;0. Since important milestones for the acquisition of the lexicon are known to occur at the end of the second year of life, it seemed reasonable to work with closer sampling points at that time.

Not every participant could be present at every sampling point, resulting in a varied sample size for all four points: $n = 30$ at 1;9, $n = 27$ at 1;0;11, $n = 29$ at 2;6, and $n = 33$ at 3;0. To allow for comparability, we work with means in the results.

During each 30-minute recording session, the mother interacted in a normal manner with her child in a room furnished with appropriate toys. The last 10 minutes of these videotaped sessions were then transcribed and coded. All verbal utterances, as well as vocal expressions (vocalizations, babbling), other sounds (e.g., crying, sniffing), and gestures of the mother and child were chronologically transcribed (see Klann-Delius, 1990, for methodological details).

Procedure

Determination of word formations. Transcripts were converted to spreadsheet-format. All substantive, adjectival, and verbal word formations in the transcripts were identified and listed in an extra spreadsheet table. In order to count types and tokens, all repetitions were listed. During this process, every word formation was noted in citation form, not in its actual realization; inflections were not taken into account. In addition, a target-language phonetic or phonological realization was not used as a criterion whether a word formation existed or not. If the utterance had a clear reference and was phonetically constant, every approximation to the target word was recorded as a word formation. For instance, /daufdɪkən/ or /dausdɪkən/ would be charted as *draufdrücken* 'to push.' However, all obligatory lexical and/or grammatical morphemes for the particular word formation had to be recognizable.

The computation was subsequently carried out by a software program developed especially for this purpose. With this program, it is possible to count every word formation type and/or token for every child at every single sampling point and to calculate any sum of those. Furthermore, every coded category could be separately counted or summed up. The coding and its categories are described in detail in the following section.

Coding of word formations. The lexemes of word formations gained from the transcripts were coded according to morphological and syntactic categories. Numerous classification systems of word formations have been considered in the literature. They differ in the assumed number of categories of word formations as well as in the category types and definitions. For the present study, we chose the schema of the well-established German reference book of Fleischer and Barz (1992). Their classification proved to be highly

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adequate for organizing our data with the aim of providing comparable codings for each participant and for detecting developmental trends.

Every word formation identified was assigned to a range of categories, namely (1) word status within the German language, (2) means of word formation, (3) part of speech of word formation product, (4) part of speech of the bases of word formations, and, where applicable, (5) way of affixation. In addition, the concrete affix of the respective word formation was noted.

1. The status of the word formation could be either a conventional German lexeme or a neologism. If the coders (all native German speakers) did not know the lexeme in question and they did not find it in a German dictionary, the lexeme was identified as a neologism.
2. Five categories of means of word formation were established, namely compounding, explicit derivation, conversion, implicit derivation, and mixed forms of those. Compounding refers to every combination of two free, lexical morphemes (e.g., *Flugzeug* 'airplane'), including compounding adverbs with verbs (e.g., *zurückkommen* 'to come back') or even nouns with verbs (e.g., *Bescheid sagen* 'to call in').

   Explicit derivation occurs when joining one free, lexical morpheme and a bound, derivational morpheme (e.g., *Häschen* 'little rabbit'). 'Umlaute' (vowel changes) that occurred in this context were not taken into consideration. Derivational German verbs are, according to Fleischer and Barz (1992), all separable (e.g., *einschlafen* 'to fall asleep') and inseparable (e.g., *verkaufen* 'to sell') verbs, excluding those verbs which are combined with an adverb or a noun (see above).

   A word formation was classified as a conversion if a word was created from an existing word without any change in form in order to transfer a word from one lexical category to another (e.g., *das Kaufen* 'the buy').

   Implicit derivation also transfers words from one part of speech to another but a change of the stem vowel is used (e.g., *werfen-Wurf* 'to throw – the throw'). This root alteration is also employed to form causatives (e.g., *liegen-legen* 'to lie – to lay').

   All complex word formations that included more than one word formation process were assigned to the category of mixed forms (e.g., *Feuerwehrmannhelm* 'helmet of a firefighter').
3. Parts of speech of the word formation products divide into the categories of noun, adjective, and verb (classification according to Duden, 1998).
4. Parts of speech of the bases of word formations also divide into nouns, adjectives, and verbs. For every explicit derivation, conversion, and implicit derivation, the part of speech of the basis was identified (e.g., *einschlafen* 'to fall asleep': basis verb). It was not necessary to assign the bases of compounds because the head of the compound is simultaneously the basis of a compound and determines the lexical category of the compound. The procedure for the mixed forms turned out to be more complex. For every single mixed form, a binary analysis of the respective word formation process was conducted. The underlying form of the whole word formation was identified and its part of speech was noted down as the basis of that mixed form.

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5. Affixation appears only in explicit derivations. Suffixation and prefixation was noted. For verbal products, prefixation was again divided into separable prefixes and inseparable prefixes. For mixed forms, only the last branching, i.e., the last word formation process analyzed, was taken into account. If this process constituted a derivation, affixation was coded as stated above.

The need for consistent coding required the programming of special software for this specific purpose. It allowed us to assess whether every word formation at every point of occurrence was coded in the same way and to correct any errors, if necessary.

Approximately 25% of the transcripts (eight mother–child dyads randomly chosen at each of the four data sampling points) were coded by a second independent coder. Cohen's kappa was calculated as a measure of interrater reliability for all different variables (as indicated in 1–4 above), which resulted in an overall mean of $\kappa = .89$ (0.72–0.98) indicating high agreement between coders.

Statistical analysis. The frequencies of types and tokens for all coded categories were counted per child and per recording. Basic statistics were performed by contingency tables. Mean values were calculated for every category since sample size varied over different sampling points.

Because the criterion of a normal distribution was not met, data did not fit the assumptions of parametric methods. To measure changes in vocabulary size of word formation (number of types and tokens) over time in children, the non-parametric Friedman test was applied to the data.

Results

Growth of word formation – types and tokens

The number of word formations produced by the children during each 10-minute recording session increases with age. Table 1 shows an overview of the mean values and the distribution in the children's production of types and tokens.

The growth rate for the types ranges from an average of 1.57 to 13.58 and constitutes a significant increase as a factor of age ($\chi^2(3) = 54.36$; $p < .001$). Thus, despite individual differences, general developmental sequences are evident.

Table 1. Descriptive values for types and tokens of word formations

	Age	*N*	Mean	Range	*SD*	Median
Tokens	1;09	30	2.80	0–24	5.02	1.00
	1;11	27	5.33	0–19	5.73	3.00
	2;06	29	11.72	0–31	7.90	10.00
	3;00	33	17.76	3–37	9.69	16.00
Types	1;09	30	1.57	0–7	2.18	1.00
	1;11	27	2.70	0–12	2.96	2.00
	2;06	29	7.59	0–17	4.83	6.00
	3;00	33	13.58	2–27	6.92	12.00

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Table 2. Proportion of word formation relative to overall vocabulary

Age	*N*	Tokens (raw scores)	Types (raw scores)
1;9	28	4.66% (73 of 1567)	7.46% (42 of 563)
3;0	30	8.76% (543 of 6195)	17.00% (417 of 2454)

The frequency with which children use a given word formation increases similarly with age. Table 1 shows how the mean of tokens grows from 2.8 to 17.76 word formations. Again, this increase is highly significant: ($\chi^2(3) = 41.76$; $p < .001$).

These results show that the overall expression of word formations increased significantly over all four points in time.

The number of subjects producing word formations in their spontaneous speech increases: at 1;9 46.67% of all children, at 1;11 18.52% of the children, and at 2;6 only one child (0.03%) did not use word formations. Eventually, at 3;0 every child produced at least two different word formations.

In addition, the proportion of word formations relative to the overall vocabulary was determined. Kauschke (2000; see also Kauschke & Hofmeister, 2002) analyzed the same sample with regard to the production of word types and tokens regardless of morphological complexity. For the present study, we used the results from two sampling points (1;9 and 3;0). The proportion of word formations relative to all types and tokens almost doubled from the first to the last recording (Table 2). This means that word formation not only grows in absolute terms, but also relative to the overall vocabulary in the second and third years of life.

Lexical innovations

Furthermore, the proportion of innovations in children's production amounted to a small percentage: 94.80% of all tokens and 89.60% of all types of word formations were conventional German lexemes. Innovations already appeared at the first recording and were found throughout the period of observation. Approximately half of the innovations (46.67%) were based on nouns, for example compounds consisting of two nouns as in *Automensch* 'carman' or *Murmeltreppe* 'marblestair.' The other half of the innovations (53.34%) were based on verbs, for example conversions and/or compounds consisting of verbs and adverbs or prepositions as in *einklopfen* 'to knock sth. in sth.' or *anleitern* 'to ladder sth. at sth.'

Development of different means of word formation

As shown in Figure 1, compounding and derivation appear in children's use of word formation from 1;9 on. Looking at the types, compounding and derivation develop parallel to one another and increase strongly until the age of 3;0. Conversion, implicit derivation, and mixed forms are rarely used, and there is no evidence of developmental change during this period.

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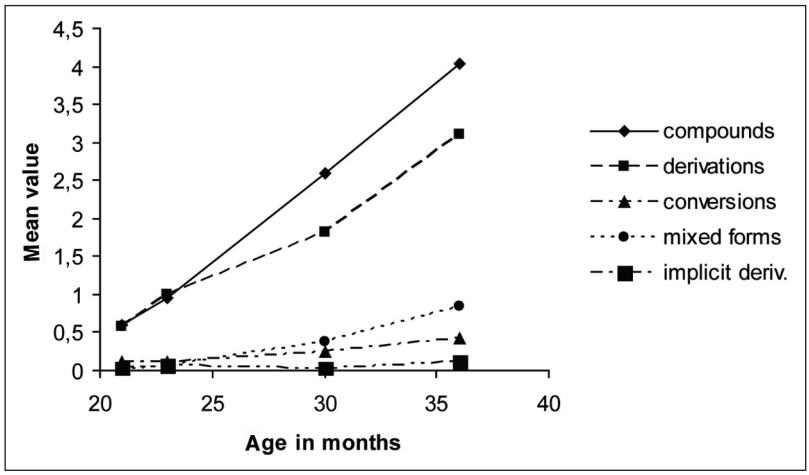

Figure 1. Means of word formations (types)

Parts of speech of word formation products

The number of different verbs produced by the children is surprisingly high from the age of 1;9 on, and verbs outnumber nouns as word formation products at the ages of 2;6 and 3;0 (Figure 2). Adjectives are rarely formed via word formation until the age of 3;0.

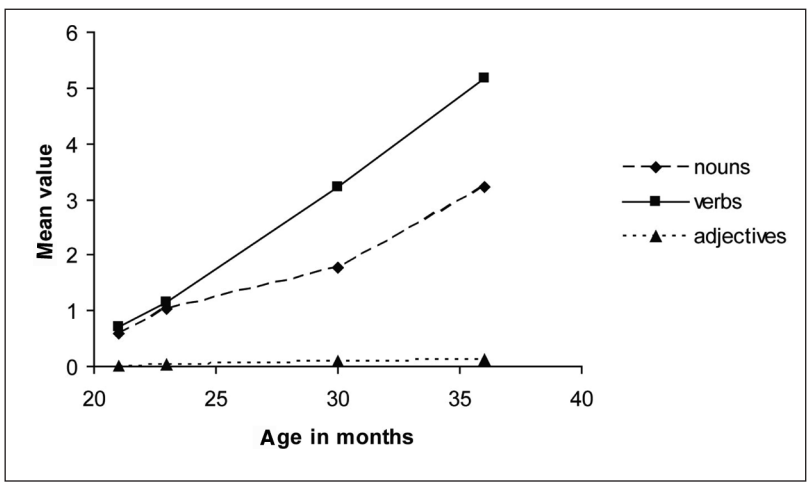

Figure 2. Parts of speech of word formation products (types)

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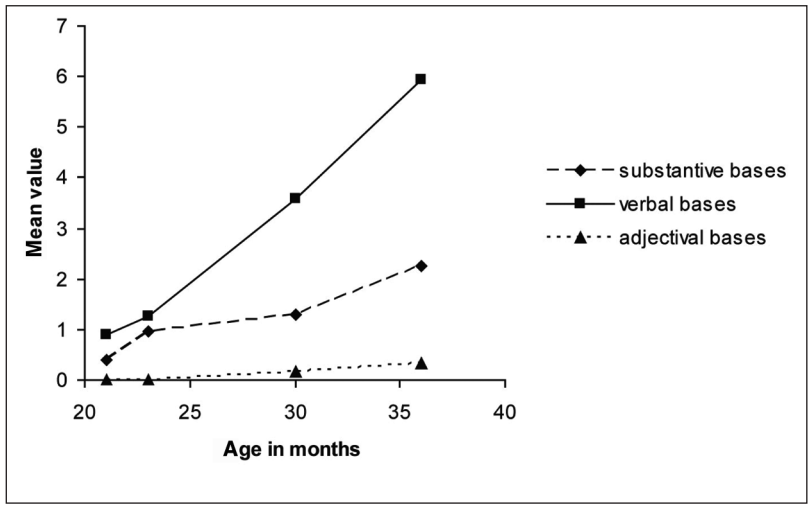

Figure 3. Parts of speech as the basis for word formations (types)

Parts of speech as the basis for word formations

Verbal bases are predominant throughout development from 1;9 to 3;0. Both verbal and nominal bases increase continuously over time and represent the majority of word formation bases at this age (Figure 3). Verbal word formations are almost exclusively formed on the basis of verbs via compounding and derivation. Compounding is utilized to connect adverbs (often locative adverbs) with verbs (e.g., *hochhalten* 'to keep up'). Thus, verbal word formation products comprise prefixated verbs and adverbial compounds. Often, the same verb functions as the basis for a number of different verbal products as it is combined with different prefixes and adverbs in different linguistic contexts (e.g., *aufmachen* 'to open', *raufmachen* 'to put sth. on sth.', etc.). These basal verbs consist to a large extent of general all-purpose (GAP) verbs: 40.69% of all verbs used are GAP verbs.

When creating nouns, children rely at first more on suffixation (50.00% derivation at age 1;9 vs only 38.89% compounds) and only later, at the age of 3;0, on compounding (28.30% derivation vs 40.57% compounds).

Discussion

Empirically supported claims regarding the development of children's word formation have been largely confined to the English language. The results presented here on the spontaneous use of words in a sample of German children both confirm and modify the existing picture. The period discussed here covers the appearance of first word formations (age 1;9–1;11) and the growth and development of word formations thereafter (age 2;6–3;00).

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The results suggest that word formations are already evident in children's vocabulary by our first observation (age 1;9). Importantly, the number of word formations increases progressively with age, but also expands in relation to overall vocabulary, representing a greater percentage of words used by age 3;0. Indeed, the proportion of word formations relative to all produced words doubled from the first to the last recording. It appears that children acquire and use word formation intensively in this period. This rapid development constitutes an important step in German lexical acquisition. Word formation enables the child to further diversify and enhance expressivity during the second and third years of life.

Among the different means of word formation, compounding and derivation predominate, while conversions, implicit derivations, and mixed forms hardly occur. The observations by Clark (1991) that children do not produce derivations before the age of 2;6, and that compounding appears more often in children's vocabulary than derivation, was not replicated for our German sample. In addition, the production of conversions also differs from findings on English language acquisition since it does not occur as early as stated by Clark (1991; at the age of 1;6). Thus, the results point to language-specific effects in the domain of word formation. Properties of the languages might account for these cross-linguistic differences (see Gathercole & Min, 1997, for cross-linguistic differences in the domain of semantic relations; Kauschke, Lee, & Pae, 2007, for the domain of noun and verb naming) since the distribution of word formation devices differs between the two languages. In German, compounding and derivation constitute the majority of word formations (compounding 59% and derivation 33% according to Kühnhold & Wellmann, 1973; Ortner & Müller-Bollhagen, 1991; Pümpel-Mader, Gassner-Koch, & Wellman, 1992), while conversion takes place less frequently (8%). Thus, the proportion of word formation devices in German is reflected in children's spontaneous speech. Possibly the principles of transparency and simplicity do not influence the acquisition of word formation in German as intensely as in English. Although compounding is more transparent than derivation and conversion fulfills the principle of simplicity, the frequency of word formation devices in the target language seems to have a strong impact on the developmental sequence.

Turning to the parts of speech involved in word formation, the results reveal that children produced considerably more verbs than nouns, both as the bases as well as in products of word formation. Within the subset of complex verbs, verbal bases represent the largest proportion. Since our German children drew on verbal bases beginning at age 1;09, verbal roots are used earlier and to a larger extent than expected by Clark (1995a). Therefore, the findings of this study do not converge with those of Meibauer (1995, 1999) and Clark (1995a), who found that children first employ their noun-based vocabulary in order to form verbs. Accordingly, it can be argued that children do not necessarily rely on nouns. At least in our German sample, they directly modified verbs previously acquired to form new verbs. Children in this study employed verbal roots already in a stage of vocabulary composition when the proportion of nouns outnumbered the proportion of verbs (Kauschke & Hofmeister, 2002).

GAP verbs, especially *machen* 'to make,' take a prominent position in early word formation. Given that children's inventory of specific simple verbs is quite restricted, GAP verbs are used in connection with derivation (with prefixes) and compounding (with locative adverbs) to attain a broader semantic diversity in their early lexicon.

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Hence, semantic modification arises as an important incentive for children in their second and third years of life. This is likely to constitute a strategy to compensate for the paucity of simple verbs in children's vocabulary. The frequent combination of GAP verbs with adverbs leads to many separable verbs. This observation is consistent with Clark (1995a), who assumes that locative particles appear first because of the principle of transparency, while separable verbs occur because of the simplicity of form.

Turning to the question of productivity, we have shown that children make productive use of verbs in word formation by combining prefixes and adverbs with existing verbs. Building a complex verb as a new lexical unit by using the same GAP verb with different prefixes or adverbs in different linguistic contexts implies linguistic creativity at this early age. An incorrect combination, e.g., a verbal prefix with a noun, did not occur in our data. The correct and creative treatment of verbs and nouns in forming complex words presumes that both nominal and verbal roots are accessible to word formation processes from the age of 1;9 and beyond. Tomasello and Olguin (1993), however, assume no morphologically productive usage of verbs until the age of 2;2 and postulate the lack of an abstract verbal category. Although the present study cannot directly demonstrate the existence of an abstract verbal category in children, the findings indicate productive manipulation of verbs in morphologically complex words before the age of 2;2. However, it cannot be ruled out that the use of variegated complex verb forms with the same basis may be closely tied to the input. In order to determine the degree of productivity of a given form, in-depth analyses of the context in which the words were used in the input are necessary. Yet another indication for productivity in the domain of word formation comes from lexical innovations. The innovations that children produced in our study demonstrate productive use of word formation devices throughout the period of observation. Interestingly, the children invented new words on the bases of verbs as well as of nouns. This observation, in turn, points to an early mastery of the verb category.

Further insights into word formation development can be gained by additional research. One example concerns the need to verify the patterns of word formation growth reported here by examining shorter time intervals during the third year of life. The investigation of productive word formation use should also be complemented by studies on children's receptive vocabulary of complex words. Furthermore, the development of word formation could represent a factor for the access to syntax. Especially the productive use of verbs in word formation could constitute the beginning of a verbal category in the mental lexicon. Thus, the correlation between these two factors – occurrence of verbal word formations and syntactic constructions – could reveal more insights into the role of the lexicon for syntax acquisition. Whether the mechanisms of word formation are already stored in a rule-based manner, or as whole words in toddlers' mental lexica, should be investigated by experimental study designs.

Conclusion

This longitudinal study on the acquisition of German word formation contributes to the description and analysis of quantitative and qualitative aspects of the development of word formation. The articulated increase of word formation compared to monomorphemic words emphasizes the important role of the acquisition of word formation for lexical

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development between 1;9 and 3;0. Word formation processes are mainly realized via semantic modifications, primarily of GAP verbs. Word formation is not completely built up at this age, but seems to provide an important mechanism in order to gain versatile expressivity.

Language-specific effects in comparison with English language acquisition include earlier and more frequent use of derivations, later and less frequent use of conversions, and increased production of verbs via verbal bases. These cross-linguistic differences may be due to the language-specific distribution of word formation devices in the target languages. For German, the impact of the principles of transparency and simplicity seems to be less relevant than for English. In addition, German children used a high number of verbal bases in order to form new verbs, suggesting a productive and flexible use of verbs in the second and third year of life.

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