

## RESEARCH

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### ***PIZZAS, PIZZEN, PIZZE: FREQUENCY, ICONICITY, CUE VALIDITY, AND PRODUCTIVITY IN THE PLURAL ACQUISITION OF GERMAN PRESCHOOLERS***<sup>1</sup>

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*Summary:* Some factors which influence the choice of plural markers in German are discussed: frequency of nouns and plural allomorphs, iconicity, cue validity, productivity, and gender specific distribution of plural allomorphs. The evidence comes from studies on a language screening conducted in the state of Hesse in Germany in 2007-2010 with three-, four-, and five-year-old monolingual and multilingual children.

#### **1. Introduction**

A total of 7,394 three-, four-, and five-year-old monolingual and multilingual children was tested in 2007-2010 in several studies conducted in the state of Hesse (Germany) in order to develop and validate a new language screening, the *Kindersprachscreening (KiSS)* [Euler et al. 2010; Neumann et al., in preparation; Neumann et al. 2011]. Furthermore, 476 four-year-old children were tested with the language test *SETK 3-5* [Grimm 2001], which examines among others the morpho-syntactic abilities and was used as a reference test for *KiSS*. Extensive test protocols enabled us to carry out additional research on other topics such as plural acquisition patterns. This paper analyzes some of the factors which can influence the choice of plural markers in German: frequency of nouns and plural markers in the input, cue validity, productivity, iconicity, and gender specific distribution of plural markers. This analysis was used in the construction of eight models explaining pluralization strategies in preschoolers acquiring German in [Zaretsky et al., submitted a].

As was demonstrated in [Zaretsky et al., submitted b], no plural marker was used as the universal one in the above named studies by German children and by immigrant children acquiring German. Hence, it can be assumed that not a default plural marker compatible with any phonetic-phonological environment and any gender, but a more sophisticated system of other factors is used when constructing plural forms. The constellations of such factors and their respective

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importance in the system have been a subject of an extensive discussion in the last forty years [Bittner & Köpcke 2001; Köpcke 1988; Korecky-Kröll & Dressler 2009]. Because most of the authors provided only case studies or studies with less than 30 children, it remains unclear which of their – often contradicting – results can be generalized for all or at least most German monolingual and multilingual children. The named *KiSS* validation studies provide sufficient material for a generalization because they were carried out in a larger geographical region, did not imply language-specific, medical, or any other exclusion criteria, and were performed with a population-based, unselected sample of more than 7,000 children with a clinical-based or otherwise selected sample.

Previous research has identified several factors associated with the choice of plural markers and hence with the plural forms of German nouns. Correct plural formation at the early stages of language acquisition depends, among other factors, on the child's familiarity with test items, as measured by input **frequency** [Kauschke et al. 2011; Korecky-Kröll & Dressler 2009]. In a study by [Kauschke et al. 2011] with a sample of 60 normally developed German children aged between three and five, highly frequent plural forms (from the database CELEX [Centre for Lexical Information 1995]) were produced significantly more often correctly than seldom used plural forms (tokens). However, in this case it cannot be excluded that correct plural forms are not actively constructed by language learners but reproduced from the memory.

Korecky-Kröll and Dressler [2009] demonstrated that there was no significant difference between the frequency of plural allomorphs (types) in the spontaneous speech of an Austrian preschool child and his mother, with the most frequent plural markers being *-(e)n* and *-e*. These were also the first plural markers to be acquired and extended to the nouns requiring other markers, later giving way to new overgeneralization patterns based on the principles of Natural Morphology (transparency, iconicity, productivity). Szagun [2001] demonstrated in a study with 22 German preschoolers tested longitudinally a preference for the same plural allomorphs which dominated in the language of their parents: *-(e)n* and *-e*. The frequency of all plural markers (types) in the speech of three-year-old children corresponded to the frequency in the input.

The next factor which could influence the choice of plural allomorphs is the **iconicity** of plural suffixes. Iconicity refers to the ability of the plural marker to encode the new meaning (plurality) by a clear-cut new form added to the body of the singular form, ideally as a new syllable without opaque markings like umlaut or accent shift [Bittner & Köpcke 2001]. The suffixes *-e*, *-er* without umlaut, *-s*, and *-(e)n* are generally considered to be iconic, the suffixes *-e* with umlaut and *-er* with umlaut to be less iconic, and umlaut minimally iconic. Zero plural (*-Ø*) is not iconic at all because it does not change nouns in any respect and thus cannot signal a new meaning by a new form. Köpcke [1998] relates iconicity to the concept of cue strength, comprising also salience, type frequency, and cue validity of the plural allomorphs. Iconicity is very closely linked to the concept of acoustic salience as it is defined, for instance, by [Wegener 1995]. Acoustically most salient plural markers, *-(e)n*, *-e*, and *-er*, are believed to be easily perceptible as such and thus acquired earlier than the least salient markers umlaut and *-Ø*. According to [Korecky-Kröll & Dressler 2009],

the first plural markers to be acquired and overgeneralized are those with the highest iconicity and morphological transparency.

Even though four-year-old children are probably not aware of all specific facets of gender in German, there might be some algorithms in form of unconscious probabilistic analyses of the interrelation between gender and the most prominent noun characteristics like plural formation. Such algorithms could allow them to make frequency based assumptions on the compatibility of plural allomorphs not only with certain final sounds, but also with certain genders. In order to determine allomorph frequencies, a list of the 1,000 most common nouns based on the lexem list DeReWo was used in [Zaretsky et al., submitted b]. The most frequent suffixes were *-e* and *-Ø* for masculine nouns, *-(e)n* and *-e* + umlaut for feminine nouns, and *-e* and *-er* for neuters.

This **gender-based allomorph distribution** is not representative enough with respect to the frequency of the tokens, because many factors could have influenced the respective word forms. Some nouns are used predominantly in singular so that their plural forms do not have any influence on the plural acquisition in spite of the high ranking in the DeReWo list [Institut für Deutsche Sprache 2009]. For this reason, the same plural allomorphs were additionally examined in the use of 1,000 most common noun forms (tokens).

Another possible factor in the plural acquisition, namely **cue validity** of plural allomorphs, refers to the unambiguousness of an allomorph to signal the plural meaning or, in other words, to the relative complexity of being perceived as the plural marker [Bittner & Köpcke 2001; Wegener 1995]. Thus, the more ambiguous an allomorph is, the higher is the «noise» of this signal. The plural suffix *-(e)n* corresponds, for instance, to the infinitive ending in the substantivized verbs (*das Leben* ‘life, living’) and to the final sounds of some nouns in singular (*Kissen* ‘pillow’, *Wagen* ‘car’). The suffix *-er* corresponds to the marker of the comparative degree in adjectives (*schöner* ‘more beautiful’), to the suffix denoting an agent in substantives (*Macher* ‘maker’), it occurs often as a pseudosuffix (*Fenster* ‘window’), and has a number of other functions. Thus, [Wegener 1994] explains the scarcity of *er*-overgeneralizations in her sample of eight immigrant children by low cue validity of *-er*, whereas the abundance of *(e)n*-overgeneralizations is explained by the high ranking of this suffix on the cue validity scale. According to [Wegener 1995], plural markers with the highest cue validity are *-s* and *-(e)n*, with *-s* clearly dominating because of the almost total lack of nouns ending in *-s* in singular (e.g., *Atlas* ‘atlas’).

Finally, the **productivity** of plural allomorphs was examined, a very widely and inconsistently defined concept which refers to the (theoretical) applicability of a plural allomorph to as many nouns as possible, among others also to nouns which practically require other plural allomorphs. This concept relates to the frequency of certain plural allomorphs with certain word final sounds, sound combinations, or with certain grammar categories (e.g., high frequency of *-e* with masculine and neuter nouns, low frequency of *-e* plus umlaut with feminine and neuter nouns), which prompts language learners to project internalized regularities on new nouns with the same features. For instance, one would expect German native speakers to produce following plural forms of the nonce word *die Kland*: *Klanden* (because *-(e)n* is productive, that is, can be often

found with, feminine nouns) and *Klands* (because *-s* is productive with almost any phonetic-phonological environment). In case of *die Pizza* 'pizza', plural forms *Pizzas* (due to the high compatibility of *-s* with full vowels) and *Pizzen* (due to the high compatibility of *-(e)n* with feminine nouns) are most probable. The form *Pizze* can rarely be encountered but it is not motivated by the productivity of the plural allomorph *-e*. The productivity is linked to the concept of predictability of the morphological patterns, because the plural output of the singular form can easily be predicted when it corresponds to some patterns which require a certain productive plural marker. Furthermore, the higher the productivity is, the higher is the frequency of the nouns (types and tokens) following corresponding pluralization patterns, *-s* being the only exception, because *-s* is both very productive and rare in the input. There also seems to be a certain interaction between the productivity and morphological transparency of the plural markers, which is reflected in the low transparency of non-productive plural markers and vice versa.

In the analysis of our studies, the model of productivity proposed by [Laaha et al. 2006] was chosen because it allows quite clear statements concerning the direction of expected overgeneralizations and considers the same plural allomorphs that we do: *-e*, *-e* with umlaut, umlaut, *-er*, *-s*, *-(e)n*, and  $-\emptyset$ . According to this model, the following German plural suffixes are productive: *-s* for any gender and almost any phonetic-phonological environment, *-(e)n* for feminine nouns, *-(e)n* for masculine nouns with schwa as final sound, *-e* (with and without umlaut) for masculine and neuter nouns, and  $-\emptyset$  for nouns with schwa plus sonorants as final sounds. Non-productive are the same plural markers in other conditions than described above, for instance, *-(e)n* with neuter nouns, as well as *-er* and umlaut in any environment. Non-productive plural allomorphs are neither overgeneralized on other plural markers, nor are they added to the neologisms and new borrowings from foreign languages.

Noun frequency in the input, plural allomorph frequency, gender-based distribution, cue validity, iconicity, and productivity will be examined in the following as possible factors in the plural acquisition. It is assumed that preschool children acquiring German do not stick to any default plural forms, but work out pluralization strategies based on the input characteristics. Plural forms are not subdivided into regular or irregular ones, but are all considered to be «regular» because of being based on the regularities extracted from the input. More frequent and unambiguous regularities are reflected in earlier acquisition and frequent overgeneralizations. Seldom markers, or those which can be hardly perceived as such, are acquired later and probably tend to be substituted by others. Thus we remain within the single-route model of plural acquisition [Dressler et al. 1987; Köpcke 1988; Korecky-Kröll & Dressler 2009] which stresses equality of all plural markers in terms of their liability to the unconscious probabilistic analysis constantly carried out by the language learners by means of morphological decomposition of the input.

## 2. Methods

We used different databases collected in the above named *KiSS* validation studies [Euler et al. 2010; Neumann et al., in preparation; Neumann et al. 2011] or in the state-wide administration of the *KiSS* test (external *KiSS* tests):

- 162 three-year-old children tested with *KiSS* in the *KiSS* validation studies (further called internal tests). These children produced 129 overgeneralizations and zero forms.
- 893 four-year-old children tested with *KiSS* in the *KiSS* validation studies (852 overgeneralizations and zero forms).
- 6,144 four-year-old children tested with *KiSS* by preschool teachers beyond the *KiSS* validation studies (further called external tests). Wrong answers were not documented.
- 195 five-year-old children tested with *KiSS* in the *KiSS* validation studies (71 overgeneralizations and zero forms).
- 476 children tested with *SETK 3-5* in the *KiSS* validation studies (3,282 overgeneralizations and zero forms).

The samples can be considered representative for the state of Hesse, because they were population-based and non-selective.

Depending on the subsample, 30% to 50% of the children were immigrants. Males slightly outnumbered females in all databases. Because *KiSS* was constructed for children aged 4;0-4;5, age median in the databases with the four-year-olds varied between 4;2 and 4;3. Age medians in other two databases (three- and five-year-old children) were 3;8 and 5;5.

The items in *KiSS* and *SETK 3-5* which were examined for plural forms were *Apfel-Äpfel* ‘apple’, *Ball-Bälle* ‘ball’, *Auto-Autos* ‘car’, *Fisch(-e)* ‘fish’, *Bild(-er)* ‘picture’, *Stuhl(Stühle)* ‘chair’, *Buch(Bücher)* ‘book’, *Hand(Hände)* ‘hand’, *Schiff(-e)* ‘ship’, *Glas(Gläser)* ‘glass’, *Gabel(-n)* ‘fork’, *Vogel(Vögel)* ‘bird’; nonce words: *eine Ribane(-n)*, *ein Tulo(-s)*, *eine Plarte(-n)*, *ein Biwo(-s)*, *eine Tapsel(-n)*, *ein Ropf(Röpfe)*, *ein Dolling(-e)*, *eine Kland(Klände)*. Nonce words were included to provide insight into pluralization strategies without any influence of memorized plural forms.

All calculations were carried out in the statistic program SPSS with non-parametric tests because according to the Kolmogorov-Smirnov test the available data were not normally distributed in most cases. An alpha level of .05 was used for all statistical tests. All results are reported as two-tailed if not stated otherwise. The data available for our study include dichotomized values («correct»-«wrong») and more detailed incorrect results: overgeneralizations (i.e., substitution of correct plural markers by wrong ones), answers in other languages, no answer at all, inappropriate answers like ‘book’ instead of ‘cars’, and numerals without plural forms. Zero forms were not considered to belong to overgeneralizations due to the fact that they dominate in the answers of the linguistically weakest children who tend to avoid overgeneralizations [Zaretsky et al., submitted b].

All children were subdivided by language experts into three groups according to their performance in *KiSS*: children with normal language development,

children in need of educational support, and children with medical issues such as stuttering, voice disorders, and specific or comorbid language impairment.

Apart from the results of the *KiSS* validation studies (external and internal tests), additional corpus data were analyzed in order to estimate the possible weight of the plural markers and test items in the input. Both types and tokens were checked: in the first case (types), the Corpus of the German Language by the University of Leipzig [Leipzig University, Department for Natural Language Processing 2010] was used; in the second case, the frequency list DeReWo [Institut für Deutsche Sprache 2009].

### **3. Results**

#### **3.1. Noun frequency**

In contrast to [Kauschke et al. 2011; Korecky-Kröll & Dressler 2009], we have checked not tokens, but types of the nouns. The same results were obtained. In our *SETK 3-5* data, means of correct answers to the more frequently used nouns, namely *Bild*, *Hand*, *Buch*, *Schiff*, and *Vogel*, were significantly higher than those to comparatively rarely used ones: *Glas*, *Fisch*, *Stuhl*, *Apfel*, and *Gabel*: 3.3 ( $SD=1.80$ ) vs. 3.1 ( $SD=1.66$ ,  $N=458$ ,  $Z=-4.85$ ,  $p<.001$ , Wilcoxon test). Frequency values were extracted from the DeReWo lexem list [Institut für Deutsche Sprache 2009].

Other corpora than DeReWo might demonstrate other frequency rankings of the *SETK 3-5* items. For instance, according to the Google Books Ngram Viewer (<http://ngrams.googlelabs.com>), in the German written sources from the year 2000 to 2008 the noun *Vogel* was used somewhat less frequently than *Glas*, all other tendencies being the same as in DeReWo. For the period up to 1994, the ranking in the Google Books Ngram Viewer fully corresponded to that in DeReWo.

#### **3.2. Frequency of plural allomorphs**

The frequency of plural allomorphs in the input might influence the order of acquisition of plural allomorphs and, herewith, the directions of overgeneralizations.

In the *SETK 3-5* data from the *KiSS* validation studies, *(e)n-* and *e-* overgeneralizations accounted for 65% of all 937 overgeneralized forms, followed by 32% of *s-* overgeneralizations and an inconsiderable number of other forms (13%). Yet only *-(e)n* and *-e* ranked high in the controlled lists of German types and tokens based on the mass media texts. Taken as one group, without gender differentiation, the frequency values of the plural allomorphs according to our DeReWo list amounted to 50% of 1,000 most frequent noun lexems (types) for *-(e)n*, followed by *-e* (20%), *-e* plus umlaut (8%), *-s* (7%), *-er* (5%), and umlaut (0%). Zero forms were excluded from these calculations because they could not be taken into account in the analysis of the *KiSS* and *SETK 3-5* data. The values in the Corpus of the German Language by the University of Leipzig [Leipzig University, Department for Natural Language Processing, 2010], based on a list of 1,000 most commonly used plural forms (tokens), correspond both to those found in DeReWo (*-(e)n* > *-e* > *-e* plus umlaut > *-s* > *-er* > umlaut) and to those (types and tokens) found in the corpus of child directed

speech by [Clahsen et al. 1992], with one exception: *-er* > *-s* in the corpus of child directed speech instead of *-s* > *-er* in our data. The rarity of *s*-forms in the input demonstrates that the mere frequency in the input does not explain the high frequency of *-s* in the overgeneralizations (*-s* is very infrequent in the input), but it can at least account for the dominance of (*e*)*n*- and *e*-forms.

Four-year-old immigrant children ( $N=52$ ) preferred (*e*)*n*-overgeneralizations to *s*-overgeneralizations in *KiSS*, whereas German children ( $N=46$ ) preferred *s*-forms to (*e*)*n*-forms ( $\chi^2_{(1)}=4.03$ ,  $p<.05$ ). Because immigrant children yielded significantly lower results in all *KiSS* subtests ( $ps<.001$ ) and were classified significantly more often as needing educational support ( $\chi^2_{(1)}=528.07$ ,  $p<.001$ ,  $N=6,144$ ), it is to be assumed that the preference for the (*e*)*n*-forms is a feature of the simplest and most rudimentary pluralization strategies, whereas *s*-forms are rather a product of advanced pluralization rules.

Not only the occurrence of plural allomorphs in the overgeneralizations but also their characteristics like umlauting could be based on frequency. For instance, because in German the plural marker *-er* always requires the umlaut and the marker *-e* sometimes does, children do not doubt that the umlaut in case of *-er* must be added and thus produce almost no umlauting errors. Hence, 0.0 umlauting errors were found with the *SETK 3-5* items *Bücher*, *Gläser* ( $SD=0.18$ ) and 0.2 with the items *Hände*, *Stühle* ( $SD=0.42$ ,  $N=457$ ,  $p<.001$ ,  $Z=-6.47$ ) [cf. Szagun 2001; Schaner-Wolles 2001].

### 3.3. Gender specific distribution of plural allomorphs

Next, it was examined which grammar performances correlate with performances in the subtest «Plural» and thus can be related to the plural acquisition in a specific way. The following scores in the *KiSS* subtest «Grammar» substantially correlated with the total score of correctly answered plural items: participle forming ( $r=.52$ ); subordinate clauses ( $r=.52$ ); verb forms (2nd person, singular) ( $r=.32$ ); case forms (accusative and dative cases plus gender marked on articles) ( $r=.61$ ; all  $ps<.001$ ,  $N=6,144$ ). The relatively high correlation for case forms indicates that case or gender aspects figure importantly in plural acquisition.

As the selection of the plural allomorph and the article form partially depends on gender, which is inseparable from the case marking, the total score of correct plural items highly correlated with the additionally calculated scores for gender only (e.g., *auf der Brett* instead of *auf dem Brett* ‘on the board’ – feminine gender instead of masculine;  $r=.69$ ) and case only (e.g., *auf das Brett* instead of *auf dem Brett* – accusative instead of dative;  $r=.70$ ,  $ps<.001$ ,  $Ns=878$ ) marked on the articles. Hence, for putting plural acquisition theories to test, knowledge of gender aspects is also to be examined, although according to some accounts, at the early stages of plural acquisition learners of German tend to ignore gender based regularities [Wegener 1994].

Preschool children acquiring German are still in the process of mastering the gender differentiation marked on articles, at least in the accusative and dative forms. Three-year-old Germans ( $N=107$ ) produced in *KiSS* on average 2.5

out of four possible correct gender forms ( $SD=1.36$ ), whereas five-year-old Germans ( $N=137$ ) produced 3.6 correct forms ( $SD=0.78$ ,  $p<.001$ ,  $Z=-6.80$ ).

Gender based distribution of plural allomorphs was examined using 1,000 most common noun forms (tokens) from the Corpus of the German Language by the University of Leipzig. The result was that frequency of usage of the tokens corresponded with the frequency of usage of the types (see «Introduction»): (1) masculine nouns:  $-e > -e + \text{umlaut} > -(e)n$ , (2) feminine nouns:  $-(e)n > -e + \text{umlaut} > -s$ , (3) neuter nouns:  $-e > -er > -s$  (see Tab. 1).

*Tab. 1.* Usage frequency of plural allomorphs in the list of 1,000 most frequent noun tokens according to the Corpus of the German Language by the Leipzig University.

	Masculine nouns		Feminine nouns		Neuter nouns	
	#	%	#	%	#	%
1) -e	119	28.2	1	0.2	78	46.2
2) -e + umlaut	99	23.5	15	3.7	0	0.0
3) -s	20	4.7	5	1.2	19	11.2
4) umlaut	11	2.6	2	0.5	2	1.2
5) -er	4	0.9	0	0.0	27	16.0
6) -(e)n	67	15.9	386	94.4	11	6.5
7) -∅	102	24.2	0	0.0	32	18.9

As was demonstrated in [Zaretsky et al., submitted a], the gender-based frequency distribution does not explain the pluralization strategies of the preschool children acquiring German if other factors, like the schwa deletion rule, are ignored. However, taken together as one group, masculine and neuter nouns represent a greater contrast with feminine nouns due to the preference of  $-e$ ,  $-s$ , and zero forms in the first group and  $-(e)n$  in the second one. This contrast is also reflected in the statistics: 1)  $-e$  is preferred with non-feminine nouns: 0.06  $e$ -overgeneralizations with feminine *SETK 3-5* items ( $SD=0.11$ ), 0.12 with non-feminine ones ( $SD=0.14$ ,  $N=455$ ,  $Z=-10.60$ ,  $p<.001$ ); 2)  $-s$  is preferred with non-feminine nouns: 0.05  $s$ -overgeneralizations with feminine items ( $SD=0.10$ ), 0.07 with non-feminine ones ( $SD=0.10$ ,  $N=458$ ,  $Z=-6.92$ ,  $p<.001$ ). Yet there is no significant difference in the use of  $(e)n$ -forms.

### 3.4. Iconicity

The analysis of the *SETK 3-5* concrete nouns showed that items with iconic plural suffixes *Fische*, *Bilder*, *Schiffe*, and *Gabeln* were significantly more often produced correctly than those with less iconic suffixes *Stühle*, *Bücher*, *Hände*, and *Gläser* (0.70,  $SD=0.34$ , vs. 0.65,  $SD=0.38$ ,  $p<.001$ ,  $Z=-4.06$ ,  $N=458$ ), and those with less iconic suffixes more often than those with minimally iconic ones: *Äpfel*, *Vögel* (0.65,  $SD=0.38$ , vs. 0.49,  $SD=0.42$ ,  $N=458$ ,  $p<.001$ ,  $Z=-9.08$ ). Iconic plural suffixes mentioned above are overgeneralized on average on three other plural allomorphs, whereas less iconic and minimally iconic ones on only one plural allomorph.



Among the *KiSS* items, the plural suffix *-s* and thus the item *Auto* are more iconic than the suffix *-e* plus umlaut (*Bälle*). Both are more iconic than the umlaut alone (*Äpfel*). The levels of difficulty of the plural allomorphs support the assumption that in the German morphology acquisition, different degrees of iconicity are accounted for, because the plural form *Autos* is more often produced correctly than *Bälle*, which is more often produced correctly than *Äpfel*. All differences were statistically significant in the database of children tested beyond the *KiSS* validation studies: 1) *Autos* vs. *Bälle*:  $p < .001$ ,  $Z = -25.69$ , in a cross-table; 2) *Bälle* vs. *Äpfel*:  $p < .001$ ,  $Z = -22.71$ ,  $N_s = 6,144$ .

### 3.5. Cue validity

For examining the cue validity of plural allomorphs, the DeReWo list was used again. We chose the same 1,000 most frequent nouns capable of pluralization and not demanding exotic plural patterns like *Stadium-Stadien*. We assumed that the higher the proportion of each plural form among the total number of the nouns with the same final sounds or sound combination is, the more valid the signal and, thus, the lower the «noise» is. Only nouns were taken into consideration, because even the linguistically less proficient children are probably capable of differentiation between nouns and other parts of speech. Out of 57 substantives ending in *-s*, all 57 were *s*-plurals. All 219 occurrences of nouns ending in *-e* (without umlaut) also turned out to be plural forms, hence the highest possible cue validity for these plural markers. Other plural markers can be ranked as follows: *-(e)n* (430 occurrences, 95% of them plural markers) > *-e* + umlaut (124, 93%) > *-er* (136, 27%) > umlaut (94, 13%). In case of the plural marker *-er*, the concept of cue validity predicts very low rates of overgeneralizations, whereas the concept of iconicity would rather predict high rates due to the syllabicity of this plural marker. For *-s*, the cue validity value predicts high overgeneralization rates in spite of its low frequency. Which of these factors is internalized earlier and hence matters more for the choice of plural markers, has been shown by [Zaretsky et al., submitted a].

As both Germans and immigrants almost exclusively overgeneralized the plural markers with the highest cue validity (*-s*, *-(e)n*, and *-e*) and the overgeneralizations of *-er*, *-e* plus umlaut, and umlaut alone were virtually non-existent in the *KiSS* and *SETK 3-5* data (for details see [Zaretsky et al., submitted b]), it can be assumed that the cue validity is a further possible factor in the acquisition and selection of plural allomorphs.

### 3.6. Productivity

Productivity in case of inflections is the compatibility of a certain marker, e. g., a plural allomorph, with different morphological or phonetic-phonological features: suffixes, word final sounds or sound combinations, syllable structure. The *SETK 3-5* items were classified as requiring more or less productive plural markers. For instance, *Biwo* belongs to the group of nouns requiring the most productive plural markers because the suffix *-s* is highly compatible with full vowels. The item *Kland* was classified as the one requiring a non-productive plural marker because *-e* plus umlaut can rarely be found in feminine nouns. *Biwo*, *Tulo*, *Ribane*, and *Plarte* were all considered as most productive, *Gabel*,

*Tapsel* as medium productive, *Fisch*, *Schiff*, *Stuhl*, *Ropf*, and *Dolling* as less productive, and *Bild*, *Buch*, *Glas*, *Apfel*, *Vogel*, *Kland*, and *Hand* as not productive. We found that most productive and medium productive nonce words (*Biwo*, *Ribane*, *Tulo*, *Plarte*, *Tapsel*) were more easily produced than less productive and non-productive ones (*Ropf*, *Dolling*, *Kland*). The mean numbers of correct answers were: 0.4 ( $SD=0.32$ ) vs. 0.1 ( $SD=0.18$ ,  $N=455$ ,  $p<.001$ ,  $Z=-14.69$ ). The same tendency was evident for *SETK* 3-5 concrete nouns. After creating a dichotomized variable by categorizing all plural items either as more or less productive, a group comparison yielded again that more productive items were more easily produced than less productive ones. The numbers of correct answers were: 0.7 ( $SD=0.35$ ) vs. 0.6 ( $SD=0.35$ ,  $N=458$ ,  $p<.001$ ,  $Z=-9.27$ ).

One of the most obvious examples of the productivity concept in our *SETK* 3-5 data is the overgeneralization of the plural marker *-s* with the item *Glas*. Because in German *-s* is not productive with nouns ending in a sibilant [Korrecky-Kröll & Dressler 2009], overgeneralization *Glases* has not occurred a single time among 71 overgeneralized forms. On the other hand, the plural marker *-(e)n*, in spite of its low productivity with neuter nouns, dominated with the *SETK* 3-5 items *Schiff*, *Buch*, and *Bild*, thus violating the concept of productivity in favor of frequency.

#### **4. Discussion**

Several factors for choosing plural allomorphs have been examined: plural allomorph and noun frequency in the input, iconicity, productivity, and cue validity of plural markers. All of these factors influenced the choice of plural markers to a certain extent, although some contradictions inevitably emerged between them. Test items with high frequency in the input were pluralized correctly more often than those which are found rarely in the input. Very frequent plural markers (*-(e)n* and *-e*) clearly dominated among overgeneralized plural forms. However, the rare plural suffix *-s* also belonged to the most prevalent overgeneralizations, which demonstrates that the frequency alone does not account fully for the choice of plural markers to be overgeneralized. As far as gender aspects are concerned, preschool children acquiring German did not recognize the division of all substantives into masculine, feminine, and neuter ones, but rather a more obvious and easily perceptible division into feminine and non-feminine ones, because masculine and neuter nouns possess very similar pluralization characteristics. Hence, children preferred *-s* and *-e* with non-feminine nouns because both of these markers are characteristic for most frequent masculine and neuter nouns, as was demonstrated by means of the token frequency list generated with the Corpus of the German Language by the Leipzig University. Iconic plural markers were produced more often correctly than non-iconic ones. Plural markers with high cue validity (*-s*, *-(e)n*, and *-e*) clearly dominated in the overgeneralizations. Yet, all of them are also iconic and two of them very frequent in the input. Nouns with productive plural markers were significantly more often produced correctly than those with less or non-productive markers. Thus, all the chosen factors did influence the pluralization strategies.

The weight of each factor in the pluralization strategies of preschoolers acquiring German was evaluated by eight different models in [Zaretsky et al., submitted a]. It was concluded that the general frequency of plural allomorphs in the input had a significantly higher priority for multilingual children, whereas monolingual German children chose the plural markers according to the gender (or, rather, feminine vs. non-feminine)-based distribution. The chosen factors presuppose a set of limitations for the pluralization models because all of them belong to the so called single-route model [Bittner & Köpcke 2001; Köpcke 1988; Korecky-Kröll & Dressler 2009] and thus exclude the existence of any universally applicable plural marker which can be used as a default form irrespective of phonetic-phonological environment, gender, and other factors.

Only the frequency of plural allomorphs in the input unambiguously predicts the pattern of overgeneralization. Thus, one can expect the most frequent suffix to be followed by the second most frequent suffix, and so forth. On the other hand, iconicity, productivity, and cue validity are comparatively vague indicators for overgeneralization patterns. In case of iconicity, for instance, one would expect that the plural markers *-(e)n*, *-s*, *-er* or *-e* will supersede umlaut alone, but it remains unclear which of them will dominate with which item. However, one would expect that any model which is supposed to explain overgeneralization patterns should account for these factors as well, or at least for their common denominator which can be formulated as follows: 1) plural markers high in general frequency, cue validity, and iconicity, namely *-e* and *-(e)n*, will be dominant among overgeneralizations; 2) because the concept of gender has been internalized only to a limited extent by the four-year-olds, the productivity with certain genders plays a secondary role, but the unique compatibility of *-s* (not only with all genders but also with almost any phonetic-phonological environment) in combination with high cue validity and iconicity assures this plural marker also a dominant position in the overgeneralizations. Indeed, the analysis of different pluralization models in [Zaretsky et al., submitted a] demonstrated that the most appropriate models fulfilled these criteria.

The results can be generalized to all monolingual and multilingual children acquiring German, whether Germans or immigrants, because the sample size, selection of study participants and geographical parameters of the study encompass all large and small subgroups of the target population. All test participants belonged to the unselected sample which was tested either within or beyond *KiSS* validation studies.

Most of the findings have already been described in the literature, although the sample sizes were comparatively low. For instance, the tendency to overgeneralize *-s* and *-e* in the linguistically proficient groups and to overgeneralize *-(e)n* and to repeat zero forms in weaker groups applies not only to the Germans and immigrants but to other groups as well. Thus, according to [Bartke 1998; Schöler & Kany 1989; Kauschke et al. 2011], children with the specific language impairment tended to overgeneralize *-(e)n* and to repeat zero forms, whereas normally developed children overgeneralized rather *-s* and *-e*. Adult learners of German with the language contact of 18+ months tended to use plural allomorph *-s*, those with the shorter language contact, up to 18 months, preferred *-(e)n* [Mugdan 1977]. While the reason to overgeneralize *-(e)n* and *-s* is

obvious (frequency in the input in the first case and almost universal applicability in the second), the tendency to overgeneralize *-e* is sometimes traced back to, apart from its frequency, the subconsciously internalized phonological requirement to produce a prototypical plural form, namely a bisyllabic trochee [Kauschke et al. 2011].

The role of gender in the plural acquisition is controversially discussed in various studies. Spreng [2004], for instance, comprised children ranging between three and seven years of age into one group arguing that even three-year-old Germans have already acquired the category of gender and that therefore it makes no sense to subdivide older children into different age groups when studying the gender based regularities in the plural acquisition. The assumption itself that the three-year-old Germans are capable of proper handling the gender category finds counter-evidence in our data. Thus, the inclusion of younger or older children into our sample of the four-year-olds would not be justified. According to our data, the groups of linguistically proficient children take into account, among other factors, also the gender of the nouns or at least the categorization feminine versus non-feminine nouns. But the notion of gender is rather probabilistic and frequency-based at the early stages, and the plural suffixes are probably added according to the frequency of certain plural allomorph with certain gender or even with a certain word final sound as shown in [Zaretsky et al., submitted b]. Hence, the majority of the «correct» gender forms can probably be explained by two internalized phonetic-phonological rules: schwa plus *-(e)n* (feminine forms) and consonant plus *-e* (masculine and neuter forms) [Dieser 2008; Wegener 1994].

In order to construct theoretical models which could explain the overgeneralization patterns in a large sample of monolingual and bilingual children acquiring German, several cues from the language input were checked: frequency of nouns and plural allomorphs in the input, cue validity, productivity, iconicity, and gender specific distribution of plural markers. All of them were relevant for the description of the German plural system, yet to different degrees.

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