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Influence of intra- and extralinguistic factors on the distribution of plural allomorphs in German

The distribution of plural allomorphs in German was examined on the basis of three noun frequency lists and a sample of German children (N = 2,021), with 582 adults as a control group. For frequency lists, 75-96% of variance of the distribution was explained in categorical regressions by means of the following intralinguistic factors: number of syllables, (dichotomized) gender, application of the schwa deletion rule, and sound chains in the word final position (sounds and frequent suffixes). For children and adults, the same factors accounted for only 63-68% of the variance in the tasks with nonce words taken from the language test SETK 3-5. Consideration of sociolinguistic factors increased the explained variance to 77% for children. Statistically significant factors were length of contact to the German language in years and immigration background, with a marginally significant value for a membership in an association or a study group.

Keywords: language acquisition, morphology, plural, bilingualism, sociolinguistics

1. Introduction

In spite of a considerable number of publications on plural acquisition in German (Köpcke 1988, Korecky-Kröll and Dressler 2009, Mugdan 1977, Park 1977, Veit 1986), very little up-to-date statistically reliable information is available on both the distribution of plural allomorphs in Modern High German and the factors influencing this distribution

in (large) samples of children and adults. Up to now, much effort has been spent on finding evidence for single- and double-route models of pluralization, various abstract schemata behind plural acquisition, and psycholinguistic principles governing overgeneralization patterns. However, quantitative aspects of plural acquisition remain neglected and were subject to a profound statistical analysis for the last time in the year 1977 (Mugdan 1977). In the later research, authors usually refrained from calculations on vocabulary-related factors influencing the choice of German plural allomorphs and restricted their attention to inherent characteristics of plural markers (frequency, iconicity, cue validity etc.) (Zaretsky et al. 2011) including their status as regular or irregular (Marcus et al. 1995), sometimes also to the influence of one sociolinguistic variable like mother tongue of immigrant children (Marouani 2006) or a hearing impairment (Szagun 2002). However, evidence on single- and dual-route models remained contradicting, probably due to, among other things, very small sample sizes and often subjective classifications of plural allomorphs as valid, irregular etc. Different classifications resulted in different assumptions regarding expected plural allomorphs and abundant counterevidence for almost any finding in plural acquisition.

Although highly valuable and still cited in the research on the plural acquisition, the findings by Mugdan (1977) are not quite up-to-date and can be completed by other statistical methods with new frequency lists (Mugdan used a frequency list published in the year 1966). Also, instead of focusing on contradictory classifications of plural allomorphs as valid etc., more reliable classifications of noun characteristics might shed light on the distribution of plural allomorphs in German. This research gap will be dealt with in the present study. Also, to our knowledge, in spite of more than half a century of

active research, no study focused on a systematic examination of extralinguistic factors influencing the choice of plural allomorphs. Again, the last author to have addressed this topic was Mugdan (1977). The range of examined variables was, however, very limited, see Discussion, and needs to be extended.

Also, the importance of pluralization for the language assessment seems to be underestimated. As will be demonstrated in the Results, plural tasks are more representative of the level of language development than any other grammar task or tasks from other language domains. Research on extralinguistic regularities influencing the choice of plural allomorphs might provide clues for effective methods of language training or favorable extralinguistic conditions for the language learning and acquisition.

In this study, the distribution of plural allomorphs both in the target language and in the language of preschool children acquiring German is analyzed by means of categorical regressions. Categories to be predicted are in this case either grammatical or both grammatical and ungrammatical plural allomorphs used by a sample of children and adults. Factors instrumentalized to explain the variance in the distribution of plural markers are either intralinguistic, that is, related to the language material, or extralinguistic, that is, related to sociolinguistic and demographic characteristics of test subjects.

Distribution of plural markers in the answers of children is to be compared to the distribution in the target language which can be defined as a spoken and written form of Modern High German. In this study, it was accessed by corpora-based noun frequency lists and by the adults' answers to several language test items. No dialectal influences were identified in the documented plural forms. Therefore, the use of the term "standard

language" seems to be justified both for noun frequency lists and answers in the adults' group. The answers given by children to the same test items can be considered as belonging to a learners' variety with its own schemata following other regularities than the target language. Because children are still in the process of learning/acquiring the German language, their progress in the plural acquisition might depend on various sociolinguistic factors like age and length of contact to the target language. Hence, it is to be expected that the intralinguistic variables explain more variance in the answers of adults and in the frequency lists than in the answers of children, although the reactions of German adults to nonce words are also subject to a considerable variation (Zapf 2004).

All intralinguistic variables chosen for the explanation of the distribution of plural allomorphs—number of syllables, application of the schwa deletion rule, sound chains in the word final position, and gender—have already been described as relevant for pluralization (Fakhry 2005, Kauschke et al. 2011, Köpcke 1994, 1995, Korecky-Kröll 2011, Mugdan 1977, Werner 1969). However, statistics on this issue are scarce. Therefore, the relevance of these factors was controlled on the basis of one noun frequency list.

Relevance of the extralinguistic factors for the distribution of plural allomorphs (not for the plural test score) was also controlled for in the study sample because there is hardly any information on it in the literature. For instance, Clahsen (1995) reported shortly on some possible influences of mother tongues on the acquisition of German plural system in adults learning German as their second language, but the influence itself remained questionable due to a small sample size ($N = 11$). Extralinguistic factors in the presented study were, among others, a classification of children as those needing or not

needing medical help (related to speech and language deficits), membership in an association or a study group (irrespective of its profile: chess, football, choir, home handicrafts, drawing etc.), length of contact to the German language in years, immigration background (children acquiring German as their only mother tongue were classified as German, children with other mother tongues were classified as immigrants irrespective of their nationality), intelligence and language scores, sex and age of the child, length of the attendance of a daycare center in months. Also, the relevance of the plural tasks for the prediction of the current language level in the children's sample was checked for. The language level was assessed by means of a total score of a modified, validated version of the language test Marburger Sprachscreening (MSS) (Euler et al. 2010, Neumann et al. 2011). Extralinguistic variables were assessed by means of questionnaires from the same language test, which means that their relevance for the language acquisition had been proved in a validation study.

The structure of the study design reflected in the Results section can be summarized as follows. At first, relevance of noun-related characteristics for the distribution of plural allomorphs was examined and then these characteristics were analyzed in three noun frequency lists by means of categorical regressions. These lists were built on the basis of two word frequency lists (types and tokens, all parts of speech): DeReWo (Institut für Deutsche Sprache 2009) and Corpus of the Leipzig University (Leipzig University, Department for Natural Language Processing 2010). Due to different structures, see Methods section, one cannot expect identical results for the distribution of plural allomorphs. The first list delivers the equal proportions of plural allomorphs for noun types, the second the same for noun tokens, and the third equal proportions of

grammatical genders in tokens. In case of noun types, there is a certain probability of an inclusion of nouns which are rarely used in plural. Also, in case of both types and tokens, there is no guarantee that all genders are presented in the equal proportions. In case of the gender-balanced corpus, the plural marker umlaut occurs only in 18 nouns. Hence, all three corpora cannot be considered completely representative and only concordant tendencies are of interest. Next, relevance of sociolinguistic factors was assessed and those with significant results were added to noun-related factors in categorical regressions. Finally, the relevance of the plural items for the level of language development was examined.

We expected that the plural allomorphs produced by children depend on extralinguistic variables to a greater extent than plural allomorphs in the answers of adults because the latter (native speakers of German, predominantly students) had already acquired the standard language with all its schemata and regularities. Thus, the only factor which might influence their results is their creativity, playfulness in the language use, and not their grammar skills. Among intralinguistic factors, both children and adults were predicted to attribute more "weight" to the word final sound chains and the schwa deletion rule than to a number of syllables and gender. Number of syllables is only very loosely associated with the plural markers and the gender is a far too complicated category to be acquired by preschool children in its full extent. The schwa deletion rule, on the contrary, has no exceptions and might be easy to internalize. Several variants of the classification of word final sound chains are possible, three of them will be tried out in the Results section.

2. Methods

Intralinguistic factors were examined on the basis of three word frequency lists: (1) 1,000 most frequent tokens for each of the grammatical genders (masculine, feminine, and neuter) according to the Corpus of the Leipzig University (L1000); (2) 500 most frequent word forms (tokens) for each of six plural allomorphs according to the same corpus (L500); (3) 176 most frequent lexemes for each of six plural allomorphs according to the word list DeReWo (D176). For D176, only 176 nouns were available in DeReWo for the umlaut as plural marker, which constituted the upper limit for other plural allomorphs as well.

The frequency list L1000 was introduced not only because gender is one of the most important factors influencing the distribution of plural allomorphs, but also because in the other two frequency lists masculine gender was clearly over-represented: 50-51% nouns of masculine, 17-21% nouns of feminine, and 29-32% nouns of neuter gender. In L1000, each gender makes out 33.3% of the frequency list.

Test subjects were both children (N = 2,021) and adults (N = 582) speaking German. Because the adults' group was used as a control group representing the regularities of the target language, only native speakers were tested. In the children's sample, the influence of the immigration background was one of the variables of interest. Therefore, both German (N = 873) and immigrant children (N = 497) were tested. For 651 children, there was no reliable information on their immigration background. More children than adults were recruited because children tend to repeat singular forms instead

of pluralization so that much more children are usually needed to collect comparable numbers of plural allomorphs.

In the adults' group, 206 men, 367 women, and 9 test subjects of unknown gender were examined, the median of age was 24.0 years, age range was 18-96. There were no exclusion criteria except another mother tongue than German. In the sample of children, 1,095 boys and 926 girls were tested, the median of age was 51.0 months (4;3 years), age range was 39-92 months. According to experts' judgments based on questionnaires and results of the language test MSS, 493 children, mostly immigrants, needed pedagogical support in learning German and 180 children had various disabilities and illnesses effecting language acquisition (e.g., hearing disorders, Down syndrome). There were no exclusion criteria for children. The sample of children can be considered almost unselected, but the sample of adults consisted mostly of students, which makes the results less representative than in the case of the pre-school group.

Test items for children were taken from the language test SETK 3-5 (plural items) (Grimm 2001), the language test MSS (grammar, articulation, vocabulary, speech comprehension, phonological short-term memory), and a language-free intelligence test Colored Progressive Matrices (Raven 2009). Plural items consisted of ten real words and eight nonce words: (1) real words: *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'; (2) nonce words for a wug test: *eine Ribane*(*–n*), *ein Tulo*(*–s*), *eine Plarte*(*–n*), *ein Biwo*(*–s*), *eine Tapsel*(*–n*), *ein Ropf*(*Röpfe*), *ein Dolling*(*–e*), *eine Kland*(*Klände*). Children were shown pictures representing real or imaginary objects and had to answer questions like 'Look, here is one book, and there we

can see three…?'. In the adults' group, lists with the same nonce words in singular had to be filled out with plural forms, but no real words were offered.

Basic sociolinguistic information about children was collected in questionnaires filled out by parents and daycare center teachers. For adults, only age and sex were documented because it was expected that adults had already acquired German and extralinguistic variables were of no relevance anymore.

Adults were recruited in the years 2011-2013 in the German state of Hesse, mostly among students. Children were recruited in the years 2009-2012 in the states of Hesse and North-Rhine Westphalia in the local daycare centers. The anonymized data were examined in SPSS 20.

For the analysis of the influence of various factors on the distribution of plural allomorphs, categorical regressions were calculated. For visualizations of the associations between most important factors identified in the categorical regressions and the distribution of plural allomorphs, Principal components analysis for categorical data (CATPCA) was used.

Because the numerical data were not normally distributed according to Kolmogorov-Smirnov tests (ps < .001), non-parametrical Kruskal-Wallis H-Tests for more than two independent groups were calculated to examine parameters like number of syllables. For nominal categorized variables like gender, Chi-square values were calculated. To examine the degree of association between nominally scaled variables, Cramér's *V* coefficient was used (φ_c). For the examination of the link between various language skills and the classification of children as needing or not needing additional language support or medical help, point biserial correlations were utilized (r_{pb}).

Two sets of plural allomorphs were examined: (1) plural allomorphs of the target language: *–e, –e* with umlaut, *–s, –er, –(e)n*, umlaut; (2) all grammatical and ungrammatical plural allomorphs occurring in the answers of our samples: *–e, –er, –s, –(e)n*, all with or without umlaut, and umlaut only. The first set consists of six allomorphs, the second one of nine allomorphs, including three ungrammatical ones. The zero plural allomorph was not considered because there were no appropriate items in SETK 3-5 and because it was not possible to differentiate between zero plural markers and repetitions of a singular form in a test situation. Therefore, nouns demanding zero plural were not included into frequency lists, either.

3.   Results

The relevance of the chosen noun characteristics—number of syllables, application of the schwa deletion rule, sound chains in the word final position, and gender—was controlled in L500, which contains 3,000 nouns.

According to a Kruskal-Wallis test, there was a significant difference in the length of singular forms of nouns, measured by syllables, depending on the plural allomorphs they demand: $H_{(5)} = 561.69$, $p < .001$. For instance, nouns demanding umlaut as a plural marker are longer than all other nouns, and nouns demanding *–er* are longer than all other nouns except those demanding umlaut.

The application or non-application of the schwa deletion rule was codified as a special dichotomized variable. The differences in the application of this rule were highly

significant dependent on plural allomorphs the nouns demand: $\chi^2_{(5)} = 2{,}229.05$, $p < .001$.

For instance, nouns demanding umlaut as a plural marker always have a schwa in the last syllable and thus always require the application of the schwa deletion rule. On the contrary, nouns demanding *–er*, *–e* plus umlaut, *–e*, and *–s* never or almost never require the application of this rule.

Grammatical gender influenced the distribution of plural allomorphs significantly: $\chi^2_{(10)} = 2{,}913.55$, $p < .001$. For instance, 90% of nouns demanding *–e* plus umlaut are of masculine gender and none of them is of neuter gender. There are almost no nouns of feminine gender demanding *–e* and *–er*. More than 90% of nouns of neuter gender demand the plural marker *–er*.

If gender is reduced to a feminine vs. non-feminine dichotomy, the differences in the distribution of plural allomorphs remain significant because most nouns of feminine gender demand *–(e)n*, whereas nouns of non-feminine gender are rather associated with *–e*: $\chi^2_{(5)} = 1{,}482.66$, $p < .001$. In all three frequency lists, the dichotomized gender is more associated with the sounds and suffixes in the word final position than the non-dichotomized gender (masculine, feminine, neuter): In L500, it is $\varphi_c = .662$ vs. $.751$; in L1000, $\varphi_c = .655$ vs. $.799$; in D176, $\varphi_c = .618$ vs. $.729$.

A simple classification of all sounds in the word final position as a consonant, a full vowel or a schwa also yielded highly significant differences in the distribution of plural allomorphs: $\chi^2_{(10)} = 1{,}872.38$, $p < .001$. For instance, all or almost all nouns demanding *–e*, *–er*, umlaut, and *–e* plus umlaut end in a consonant. Full vowels demand *–s* in almost all cases. There is a certain not very strong association between this variable and the gender: $\varphi_c = .459$, $p < .001$.

However, it is rather to be assumed that preschool children are capable of distinguishing not only between these three categories—consonants, full vowels, and schwas—but also between all members of these categories and also some most frequent suffixes like *–ung*, *–heit,* and *–är*. Therefore, all vowels, consonants, and frequent suffixes were codified as such in the next variable and cross-tabled with the distribution of plural allomorphs, with a highly significant result: $\chi^2_{(230)} = 7{,}441.01$, $p < .001$. For instance, all vowels ending in *–a* and *–o* always require the plural marker *–s*. All items ending in *–ier*, *–ling,* and *–eur* require *–e*, suffixes *–heit* and *–tät* require *–(e)n*, pseudo-suffixes *–en* and *–el* require umlaut in the most cases. Other examined suffixes were *–ar*, *–ent, –er, –is, –keit, –ion, –schaft, –or, –ist, –in, –ism, –tum, –anz, –enz, –ur, –ant*, and *–ing*.

Intralinguistic factors described above—number of syllables, application of the schwa deletion rule, sound chains in the word final position, and gender (masculine, feminine, neuter)—accounted for most of the variance of the six plural allomorphs in all three frequency lists, see Tab. 1.

An attempt was made to reduce the number of sounds and suffixes considered in the variable with the word final sound chains. Only those word final sound chains were chosen which occurred in L500 with only one plural marker in more than 95% of the cases. This resulted in a classification of all word final sound chains as (one group of) consonants, suffixes *–ist*, *–ung*, *–ling*, *–er*, pseudosuffix *–en*, a schwa, (one group of) full vowels, and a separate group of full vowels used only in foreign words. For L500, such classification explained 92% of the variance ($F_{(13,\ 2{,}986)} = 2{,}547.49$, $p < .001$), which was

less than 95% in Tab. 1. Accordingly, in the following calculations the detailed classification of the word final sounds and suffixes was retained.

Noteworthy is also the fact that with a simple classification of all word final sounds as a full vowel, a schwa or a consonant (that is, with only three categories), gender, number of syllables, and application of the schwa deletion rule, 91% of the variance in the distribution of plural allomorphs in L500 can be explained ($F_{(6, 2,993)} = 4,800.61$, $p <$ .001). This means that a maximally detailed classification used in the Tab. 1 adds only 4% of the explained variance to this value.

In the next step, the influence of intralinguistic factors on the distribution of plural allomorphs was analyzed by means of categorical regressions for the three frequency lists, the correct forms of SETK 3-5 test items, and for the test subjects, see Tab. 2. Because the nonce words were presented in SETK 3-5 with indefinite articles, only dichotomized gender was considered in order to make the results comparable over all samples and noun lists.

	Adjusted r^2	number of syllables		schwa deletion rule		sound chains		gender not dichotomized		F/df
		β	Impor-tance	β	Impor-tance	β	Impor-tance	β	Impor-tance	
L500	.950	.020***	.008	.252**	.217	.755***	.759	.049***	.045	1,142.61***/50, 2,949
L1000	.801	.043***	.005	.311***	.200	.325***	.220	.573***	.577	247.34***/49, 2,950
D176	.962	.022*	.020	.705***	.599	.548***	.388	.021	.004	585.87***/43, 1,012

Table 1: Categorical regressions with three noun frequency lists: intralinguistic factors. Gender not dichotomized.

* $p < .05$, ** $p < .01$, *** $p < .001$

	Adjusted r^2	number of syllables		schwa deletion rule		sound chains		gender dichotomized		F/df
		β	Importance	β	Importance	β	Importance	β	Importance	
L500	.949	.019***	.008	.259**	.221	.766***	.772	.011	−.001	1,148.65***/49, 2,950
L1000	.749	−.007	.001	.430***	.299	.426***	.386	.428***	.375	187.66***/48, 2,951
D176	.960	.022*	.011	.767***	.651	.543***	.340	.010	−.001	585.87***/43, 1,012
SETK 3-5 correct answers	1,000	−.025***	.020	.732***	.499	.737***	.460	.075***	.021	149,529,143***/12, 83,633
SETK 3-5 correct answers, only nonce words	1,000	−.008***	.007	.492***	.223	.764***	.773	.246***	−.043	453,300,018***/8, 37167
SETK 3-5 children, all items	.802	.003	−.003	.469***	.466	.545***	.571	.104	−.033	6,823.633***/12, 20,169
SETK 3-5 children, nonce words	.678	.005	.003	.274***	.323	.312***	−.065	.690***	.739	1,512.68***/8, 5,732

SETK 3-5 adults, nonce words	.630	.018	−.015	.428***	.297	.723***	.609	.181**	.060	888.65***/8, 4,138

Table 2: Categorical regressions with three noun frequency lists and SETK 3-5 results: intralinguistic factors. Gender dichotomized.

* *p* < .05, ** *p* < .01, *** *p* < .001

It should be noted that the calculations in the Tab. 2 were carried out to predict the distribution of six plural allomorphs from the target language. However, both children and adults used nine plural allomorphs including three ungrammatical combinations of umlaut and plural suffixes. Intralinguistic factors considered in Tab. 2 explained the variance in the distribution of these nine plural markers mostly to a higher degree: (1) for all SETK 3-5 items in the pre-school sample: not 80%, but 85% of the variance explained ($F_{(12, 20,169)} = 9,492.59$, $p < .001$); (2) for nonce words in the preschoolers' sample: 68% in both cases ($F_{(8, 5,732)} = 1,537.65$, $p < .001$); (3) for nonce words in the adults' sample: not 63%, but 64% explained ($F_{(8, 4,138)} = 906.04$, $p < .001$).

Again, dichotomized gender was more associated with the word final sound chains than the "real" gender: $\varphi_c = .764$ vs. .750, $p < .001$, for all SETK 3-5 items in the preschoolers' sample; $\varphi_c = .764$ vs. .750, $p < .001$, for all SETK 3-5 nonce words in the adults' sample.

Fig. 1 visualizes associations between the noun-related characteristics and the plural allomorphs as they were documented for the sample of preschoolers in SETK 3-5. An angle of 90° between two lines means that there is no association between the two variables.
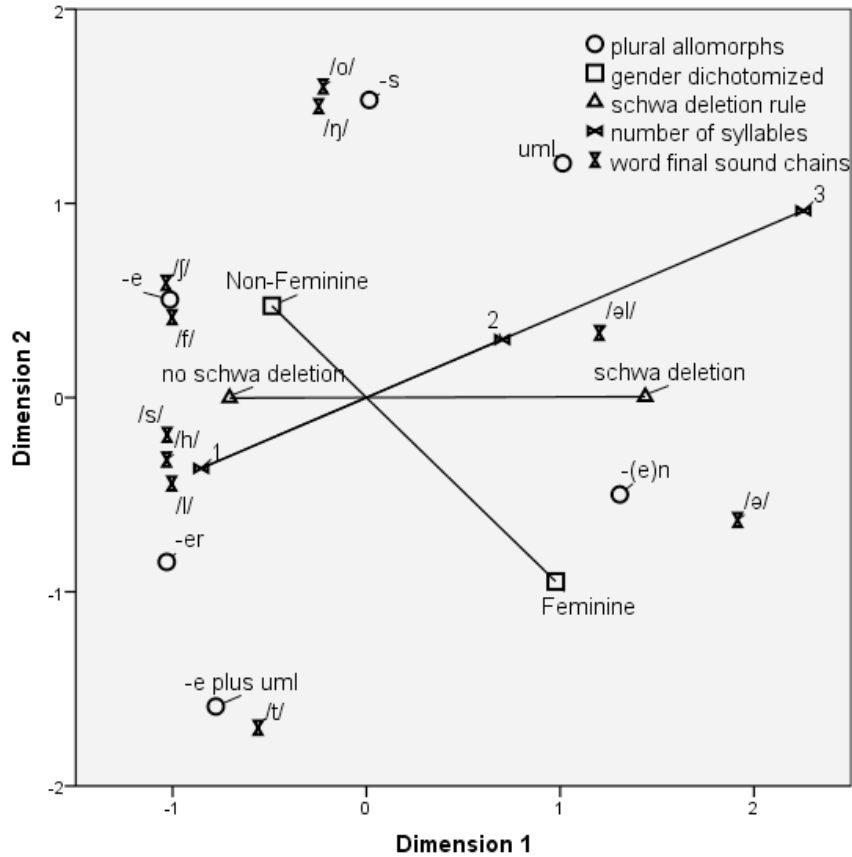
Figure 1: Visualization of associations between the dichotomized gender, number of syllables, application of the schwa deletion rule, word final sound chains, and the distribution of plural allomorphs. Principal components analysis of categorical data (CATPCA) in the sample of preschoolers in SETK 3-5 (all items).

Fig. 2 demonstrates the same regularities for the correct forms of SETK 3-5 items for a comparison.
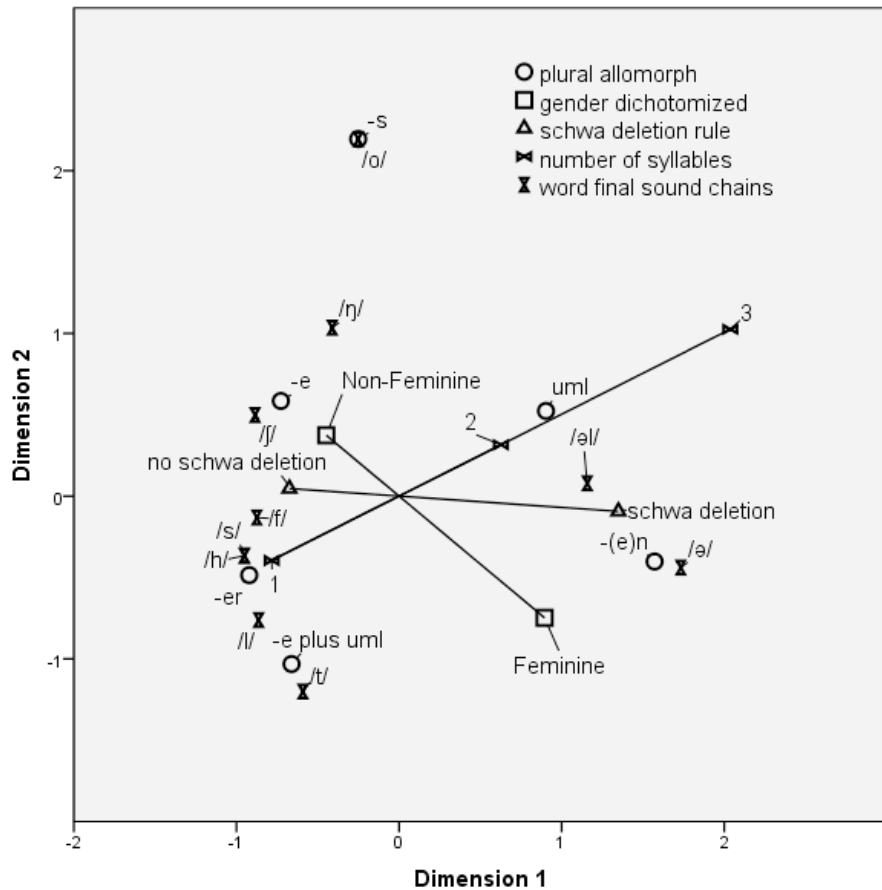
Figure 2: Visualization of associations between the dichotomized gender, number of syllables, application of the schwa deletion rule, word final sound chains, and the distribution of plural allomorphs. Principal components analysis of categorical data (CATPCA) with correct SETK 3-5 plural forms (all items).

In all categorical regressions, about 10-20% less variance was explained for the SETK 3-5 test subjects than for the word frequency lists. Hence, the explanation of variance values in the answers of the samples cannot be traced back to the intralinguistic variables only. In the next step, numerous items from the MSS questionnaires were analyzed by Cramér's *V* and Kruskal-Wallis tests regarding their relevance for the distribution of plural allomorphs. Results were significant for the following variables: immigration background (φ_c = .066, *p* < .001),

disabilities/illnesses/diseases influencing language acquisition (φ_c = .070, p < .001), length of

contact to the German language in years (φ_c = .079, p < .001), membership in an association or a

study group (φ_c = .038, p = .014), and all MSS subtest scores: vocabulary ($\chi^2_{(5)}$ = 123.45, p <

.001), speech comprehension ($\chi^2_{(5)}$ = 50.74, p < .001), articulation ($\chi^2_{(5)}$ = 50.51, p < .001),

grammar ($\chi^2_{(5)}$ = 193.01, p < .001), and phonological short-term memory ($\chi^2_{(5)}$ = 36.21, p <

.001). For instance, children without any disabilities/diseases influencing language acquisition

used sophisticated plural allomorphs –*er*, –*s*, umlaut, and –*e* with umlaut more often than

children who needed medical help. Children needing medical help preferred simple plural

markers –*e* and –*(e)n*.

Some other factors did not yield significant results (*p*s > .05) and were hence excluded: sex

of the child, attendance of a day nursery in the first two years of life, "the child likes to play with

other children", hearing disorders, language skills in the mother tongue (if not German), "the

child plays with German children beyond the daycare center time", and intelligence score.

In the next regression model, chosen extralinguistic factors were added to intralinguistic

ones for the analysis of the pre-school sample. In order to include all SETK 3-5 items,

dichotomized gender was used. All in all, 77% of the variance was explained for children ($F_{(21,}$

$_{1,535)}$ = 242.65, p < .001), with significant results for the grammatical gender (β = .268, p = .024,

importance .140), number of syllables (β = –.030, p = .034, importance .029), schwa deletion

rule (β = .377, p < .001, importance .341), word final sound chains (β = .550, p < .001,

importance .476), immigration background (β = .029, p = .017, importance .002), and length of

contact to German (β = –.090, p < .001, importance .009). Membership in an association or a

study group was marginally significant: β =.023, p = .061, importance .001. If not six, but all

nine plural allomorphs are considered, including three ungrammatical, the explained variance

amounts to 80% ($F_{(21,\,1,535)} = 289.68$, $p < .001$), with three significant factors: sound chains in the word final position ($\beta = .709$, $p < .001$, importance .719), schwa deletion rule ($\beta = .322$, $p < .001$, importance .218), and length of contact to German ($\beta = -.062$, $p = .001$, importance .005). Grammar score was marginally significant: $\beta = .032$, $p = .059$, importance .002.

If the same extralinguistic variables are examined without items-related characteristics, very little variance can be explained in categorical regressions: for six plural allomorphs, adjusted $r^2 = .190$, $F_{(10,\,2,770)}$, $p < .001$. Significant variables were grammar score ($\beta = .188$, $p < .001$, importance .386), vocabulary score ($\beta = .140$, $p < .001$, importance .278), speech comprehension score ($\beta = .069$, $p = .004$, importance .122), length of contact to German ($\beta = -.089$, $p < .001$, importance .161), and membership in an association or a study group ($\beta = .043$, $p = .020$, importance .040).

For adults, only sex and age (in years) were available as sociolinguistic variables. For the explanation of the distribution of six plural allomorphs in SETK 3-5 nonce words by means of noun-related and extralinguistic characteristics, these two variables did not add any explained variance in comparison with the models described in Tab. 2 (63%; $F_{(10,\,4,019)} = 698.82$, $p < .001$) and did not reach significance (ps > .05). If all nine plural allomorphs are taken, explained variance increases by one percent only (64%; $F_{(10,\,4,019)} = 258.21$, $p < .001$), but the influence of extralinguistic variables remains not statistically significant.

Three unexpected phenomena were encountered. Adults used more than one plural marker in one word significantly more often than children (e.g., *–ens, –ers, –ern*): $\chi^2_{(1)} = 67.40$, $p < .001$. Children used significantly more often correct combinations of plural markers with the umlaut than adults: $\chi^2_{(1)} = 99.34$, $p < .001$. In the SETK 3-5 nonce words, the schwa deletion rule was violated 18 times by adults (*Tapsel > Tapsele, Täpsele, Tapseler*) and not a single time by

children. However, children violated this rule twice with real words: *Apfelne, Vogele*. In spite of that, plural forms of adults corresponded more often to those marked as correct according to the SETK 3-5 test manual than plural forms of children: $\chi^2_{(1)} = 558.94$, $p < .001$.

Finally, the importance of the plural score for the assessment of the current language level is demonstrated by means of correlations between scores of MSS subtests and the classification of all children as those needing or not needing additional educational support or medical help in learning German. In MSS, grammar ($r_{pb} = -.705$, $p < .001$) delivered the highest correlation with this classification than other subtests ($r_{bp} > -.601$, ps $< .001$). Among all task sets within the grammar subtest, plural items ($r_{pb} = -.631$, $p < .001$) delivered the highest correlation with the same classification than other sets ($r_{pb} > -.622$, ps $< .001$). The sample sizes were between 961 and 1,071. According to a Kruskal-Wallis test, the influence of the preferred plural allomorphs was highly significant for the total MSS score: $H_{(5)} = 170.34$, $p < .001$. Use of more sophisticated allomorphs *–e* plus umlaut, umlaut, *–s*, and *–er* was associated with higher scores, use of simple allomorphs *–(e)n* and *–e* was associated with lower scores.

4.   Discussion

There is a gap in the research concerning the influence of extralinguistic (sociolinguistic, demographic, test subject-related) factors on the distribution of German plural allomorphs and hardly any up-to-date statistically reliable information on the influence of intralinguistic factors. The aim of the presented article was to close this research gap for pre-school children, mostly aged four, compared to German adults.

Although some analyses of the distribution of plural allomorphs in the frequency lists do exist, they are either not up-to-date or follow principles which are not compatible with the study design used in the presented article. For instance, a list of 14,985 nouns used in the dissertation by Fakhry (2005) lacks all compounds and also nouns with five frequent suffixes associated with the nouns of feminine gender. Words with other suffixes were not excluded. In the study design presented here, no noun groups were excluded except nouns with exotic non-productive plural markers (*Schema > Schemata* 'patterns') and proper nouns (*Frankreichs* 'Frances').

Most of the articles on the plural system in German still rely on statistics collected by Mugdan (1977) based on even older corpora and frequency lists. For the present study, three new frequency lists were built comprising both types and tokens of the standard Modern High German. Direct comparisons of these lists with other frequency lists are hardly possible. Clahsen et al. (1995) used word frequency lists (tokens) based on two corpora which might have been utlized for this study as well. One of the noteworthy discrepancies is a higher percentage of *s*-uses in L1000 (9%) compared to 2% and 6% in the corpora used by Clahsen et al. (1995). However, Clahsen et al. utilized much older data and the *s*-plurals are spreading rapidly in German (Fakhry 2005). Also, one of Clahsen's corpora included not only written but also spoken speech and the second one was a corpus of child-directed speech. Thus, both corpora are not directly comparable with L1000.

In order to examine the influence of several extra- and intralinguistic factors on the choice of plural allomorphs by means of categorical regressions, first of all, the relevance of the chosen factors was assessed. All intralinguistic factors—number of syllables, application of the schwa deletion rule, sound chains in the word final position, and gender —turned out to be of statistically significant importance for the distribution of plural allomorphs in one noun

frequency list (L500) and entered categorical regressions with the distribution of plural allomorphs as dependent variable. The criterion of animacy (Köpcke 1995) was excluded because any classification of nouns as animate or inanimate remains highly subjective due to a considerable grey zone of metaphorical uses ('the sun smiled at me friendly'), categories of moving objects (often perceived as animate), body parts, and collective nouns ('Republican party', 'nation').

For the frequency lists and correct plural forms in the language test SETK 3-5, chosen intralinguistic factors demonstrated significant results in almost all cases. Very high percentages of correctly predicted plural allomorphs (75-96% for frequency lists and 100% for correct plural forms of SETK 3-5 items) suggest that these intralinguistic factors account for the great majority of plural forms of the German nouns. The number of syllables in the singular forms is obviously rather loosely associated with the distribution of plural allomorphs, which resulted in comparatively low significance levels. In this case, regression values called "importance" are of interest. These values demonstrate in categorical regressions some tendencies which sometimes cannot be extracted from the significance values and would otherwise remain hidden. Thus, a highly significant result of the variable "number of syllables" in the frequency list L500 (Tab. 2) seems to imply that the number of syllables plays one of the major roles in the distribution of plural allomorphs. However, the importance value .008 is almost non-existent in comparison with the schwa deletion rule (.221), although the significance level of the schwa deletion rule is lower. The importance value of sound chains in the word final position is still higher (.766), although the result of this variable has the same significance level as the number of syllables has (ps < .001). This suggests that the schwa deletion rule must be more important for the

distribution of plural allomorphs in spite of its lower significance level in comparison with the number of syllables.

The classification of the sound chains in the word final position can be carried out in various ways, e.g., (1) a consonant, a full vowel or a schwa (3 categories, cf. Marouani 2006), (2) every single possible word final sound, as well as frequent suffixes and pseudosuffixes (43 categories), (3) word final sounds and (pseudo)suffixes which occur with a certain plural marker in more than 95% of cases (9 categories). For L500, the best results were achieved with the most detailed (second) variant. Hence, this variant was chosen for all categorical regressions. However, for the regressions with the items from the language test SETK 3-5, the difference between these three variants is minimal because only 18 items were included into the test battery for children and only eight into the test battery for adults. Hence, the variance of the word final sounds in SETK 3-5 was very limited and there were no suffixes in the test items. In spite of this radical reduction of the variance in comparison with noun frequency lists, the variable "sound chains in the word final position" remained among the most important ones in all categorical regressions. At least one more classification of word final sound chains is possible, but was not tried out in this paper, namely, full vowels vs. schwas vs. obstruents vs. sonorants, because the only difference between obstruents and sonorants regards the use of the zero plural marker (Ravid et al. 2008), which was not examined in the present article.

Under consideration of significance and importance values, the following observations can be made:

- If grammatical gender is not dichotomized, sound chains (sounds, suffixes, and pseudosuffixes) in the word final position and the application of the schwa deletion rule (forbidding two schwas in adjacent syllables) dominate over the number of syllables and

gender in the frequency lists. However, in the only frequency list where all three genders are represented equally (L1000), both importance and significance values of gender are high.

- If gender is dichotomized (feminine vs. non-feminine), gender and number of syllables can hardly predict the distribution of plural allomorphs in the frequency lists, whereas the application of the schwa deletion rule and word final sound chains are almost equally important.

- If gender is dichotomized, 100% of correct plural forms in 18 SETK 3-5 items can be predicted correctly by means of chosen intralinguistic factors, and all of them contributed significantly, although, again, the number of syllables and gender were very low as far as importance values are concerned.

- If gender is dichotomized, the application of the schwa deletion rule and the word final sound chains dominate over the number of syllables and gender in the plural forms of both children and adults. However, in the nonce words produced by children, gender delivered the highest importance value. Test subject-related factors influencing the choice of plural allomorphs significantly were immigration background, length of contact to the German language, and membership in an association or a study group (marginally significant), all with extremely low importance values in comparison with item-related factors.

Obviously, the application of the schwa deletion rule and sounds in the word final position predetermine the choice of plural allomorphs in most cases. Next, each of the intralinguistic factors will be commented on.

The schwa deletion rule is clearly associated with the plural markers devoid of a schwa (*–s*, *–n*, umlaut) and excludes the use of *–en, –e* with or without umlaut, and *–er* (Korecky-Kröll 2011). It remains the only German pluralization-related rule without exceptions and, hence, one can hardly find violations of this rule in our data. In Modern High German, in the seldom cases when plural markers containing a schwa are added to the nouns with schwas in the last syllable, the problem is solved by an accent shift to this syllable: *Charákter > Charaktére*. The schwa is thus substituted with a full vowel. Both children and adults recognized this pattern and used sometimes forms like *Ribáne > Ribanésen*. Another pluralization-related rule which used to have no exceptions until recently (e.g., described as a rule without exceptions by Werner 1969), is the combination of the plural marker *–n* with nouns ending in a schwa (*Rabe* 'raven' > *Raben*). In the last decades this rule has been violated by some foreign words demanding *–s* in plural (*Vize* 'deputy, runner-up' > *Vizes*), which is probably reflected in plural forms *Ribane > Ribanes* in our sample. An almost universal compatibility of the plural marker *–s* should also be considered in this case.

Sound chains in the word final position are either sounds, or suffixes, or pseudosuffixes. There are not many single sounds clearly associated with certain plural markers in L500. Full vowels demand *–s* in most cases, schwas are mostly followed by *–n*, but links between consonants and plural allomorphs are less clear: /k/ is associated with *–e* plus umlaut (48% of all plural allomorphs with this word final sound), /l/ with *–e* (48%), /p/ with *–s* (77%), /s/ with *–e* plus umlaut (52%), /ŋ/ with *–e* plus umlaut (94%). Nevertheless, even with less clear associations frequency-based schemata might keep on working. For instance, information that among the most frequent nouns /ʃ/ is associated in 40% with *–e* and in further 40% with *–e* plus umlaut is more valuable than no information at all. The associations between plural markers and

suffixes are, on the contrary, often unambiguous: If the child has internalized that *–ung* demands *–en* in 99% of cases and *–is* demands *–e* in 100% of cases, no complicated pluralization schemata are needed. In L500, most suffixes (23 out of 24) demanded a certain plural allomorph in at least 50% of the cases, the only exception being *–är*, and 17 demanded a certain plural allomorph in more than 95%.

Additionally, two pseudosuffixes (*–en* and *–el*) were examined because it can hardly be assumed that children are aware of the existence of categories like suffix. For them, probably only word final sound chains exist, and pseudosuffixes are memorized as associations between sound chains /ən, əl/ and umlaut (in case of *–en*, in 99%, and in case of *–el*, in 88%). Therefore, we also did not differentiate between real suffixes and word final sound chains looking like suffixes (cf. *Hoffnung* 'hope' with the suffix *–ung* vs. *Sprung* 'jump' without such suffix). Relevance of *–en* and *–el* for the pluralization has already been described by other authors (Bittner, Köpcke 1999, Köpcke 1995, Korecky-Kröll 2011).

In the German plural system, noteworthy differences between plural markers with nouns of masculine and neuter gender can be found only with schwas and full vowels in the word final position (Ravid et al. 2008). It has been often stated that children acquiring German classify nouns not as belonging to the masculine, feminine, or neuter gender, but rather as belonging to a feminine or non-feminine group (Wegener 1995, cf. Marouani 2006). Indeed, this link is more obvious because, as was shown above, feminine nouns are very clearly associated with the plural marker *–(e)n*, whereas there is no clear association with non-feminine nouns, but markers *–e* and *–er* are frequent.

A certain link can be recognized between variables gender and sound chains in the word final position. According to Tab. 1, importance values are high for the sound chains and low for

the (not dichotomized) gender in L500 and D176. In L1000, on the contrary, importance value of the gender is high, whereas importance value of sound chains is low, at least in comparison with the other two frequency lists. According to Tab. 2, importance values of sound chains are high in all but two calculations, whereas importance values of the (dichotomized) gender are low. In these two calculations—L1000 and nonce words from SETK 3-5 with children—importance values of the gender are high, and those of the sound chains are comparatively low. Obviously, high values on the one scale predetermine lower values on the other. This might be linked to the fact that both variables are associated with each other, which was shown by means of a Cramér's *V* coefficient. Hence, the significance values in the regressions are high, but the importance values attribute more "weight" either to the gender or to the word final sound chains because gender and word final sounds are closely interrelated. Only in L1000, where all three genders are equally distributed, both variables play important roles, probably because this interrelation is broken by nouns whose gender does not depend on word final sound chains and must be learnt by heart.

Interestingly, dichotomized gender was more associated with the word final sound chains than the "real" grammatical gender according to Cramér's *V* results, both in the frequency lists and in SETK 3-5. Obviously, dichotomization of gender reduces the "weight" of the gender category in this variable and strengthens the links with word final sounds. This might indicate indirectly why children acquire first the simple classification "feminine vs. non-feminine": It is rather a phonotactical than a grammatical category (cf. Marouani 2006). Dichotomized gender is obviously acquired as a schema of frequency rules or, in other words, of frequency-based associations between word final sounds or sound combinations and certain plural allomorphs

(that is, also sounds and sound combinations). A "real" grammatical gender is less phonology-bound and demands memorizing of numerous exceptions.

A search for extralinguistic categories influencing distribution of plural allomorphs was conducted in two steps. First, several sociolinguistic variables from questionnaires were identified which influence the distribution of plural allomorphs. Some other factors with not significant results were excluded and did not enter the regressions. Nevertheless, even among the factors which do have a statistically significant association with the distribution of plural allomorphs, none had an importance value comparable to those reached by item-related factors. This means that if intra- and extralinguistic factors are examined together, extralinguistic factors are totally suppressed by the noun characteristics. Exclusion of intralinguistic factors resulted in a model with only 19% of explained variance. Variables with significant results were language scores, length of contact to the German language, and a membership in an association or a study group. Only the MSS grammar score had a considerable importance value which is not surprising because the nonce words were also taken from a grammar test (subtest of SETK 3-5).

Results of the Principal components analysis for categorical data were used as visualizations of relations between the most important factors identified by categorical regressions and the distribution of plural allomorphs. A perfect correspondence to the results of regressions was not to be expected because regressions and CATPCA are two different methods using different formulae. Therefore, CATPCA can also be seen as a re-analysis of regressions results. However, results in the Fig. 1 do correspond in most cases to those of the regressions. For instance, according to the Fig. 1, nouns of feminine gender are associated with a schwa in the word final position and the plural marker *–(e)n*. The latter is also associated with the schwa deletion rule. Nouns from the non-feminine group are closely associated with the plural marker –

e. According to the regression results, one would expect that the number of syllables is more loosely associated with the plural allomorphs. Nouns with one syllable are clearly associated with *–er* and longer nouns (2-3 syllables) have a certain not very strong association with the umlaut. Fig. 2 demonstrates similar results for the correct plural forms in SETK 3-5. Umlaut is even closer associated with words containing two or three syllables, a schwa in the word final position is closer associated with the plural marker *–(e)n*. All in all, Fig. 2 shows the same tendencies, but in a more clear-cut form.

Importance of plural scores for the assessment of the current level of language development was examined by correlations of various MSS subtests with the classification of all children as those needing or not needing additional educational support or medical help in learning German. From all subtests, grammar yielded the highest correlation coefficient, and among grammar tasks, plural tasks yielded the highest correlation coefficient with this classification. Hence, there is no other task that predicts the current language status of the child better than plural items. Furthermore, preferred plural markers predict the level of the language development measured by the MSS score: more sophisticated markers are associated with higher scores. Two sociolinguistic factors were identified which can be influenced to facilitate the plural acquisition: membership in an association or a study group and length of contact to German in years (some children were brought up at home up to the age of three or even four without any contact to the German language).

Obviously, both children with advanced and restricted command of German utilize the same noun characteristics in order to predict the distribution of plural allomorphs: schwa deletion rule and word final sound chains, followed by gender and number of syllables. The schwa deletion rule is easily accessible for language learners because it is never violated in the language

input. The link between word final sound chains and plural allomorphs is less straightforward, but, as was shown above, a combination of very few factors—classification of all word final sounds as a full vowel, a schwa or a consonant (that is, with only three categories), gender, number of syllables, and application of the schwa deletion rule—accounts for 91% of the variance in the distribution of the six plural allomorphs in L500.

Regression results for the frequency lists are not directly comparable to the results for SETK 3-5 items because in the language test only 18 (with children) or 8 (with adults) items were examined. However, the only alternative would have been to examine longitudinally hundreds or thousands of test subjects till the number of plural forms in the frequency lists is achieved in each sample of the spontaneous speech. This alternative was not feasible, and, therefore, both children and adults were tested in a cross-sectional design. It would not have made much sense to test adults with real words from SETK 3-5, because the adults' sample consisted of German native speakers who were surely capable of pluralizing nouns like 'ship' and 'bird' correctly. Therefore, only nonce words were examined. Another potential limitation of the study was a misbalance in the sample sizes of children and adults. However, children often produced zero forms or used well-known avoidance strategies like numerals with nouns in singular (Koehn 1994), whereas adults produced plural allomorphs in almost all cases. Because zero forms and avoidance strategies were not the subject of this study, it was not necessary to test as many adults as children.

According to the original study design, adults were supposed to deliver evidence on the normative usage of Modern High German. Therefore, almost no extralinguistic variables were documented and a very high percentage of explained variance in categorical regressions was expected. Indeed, adults produced correct forms significantly more often than children.

However, only 63-64% of the variance was explained by noun-related factors, which is even less than for the preschoolers, although there were hundreds of immigrant children in the preschoolers' group and no immigrants in the adults' group. Explanation for this unexpected phenomenon might be traced back to the deliberate, accented violation of pluralization rules in the sample of adults. Adults used more often than children ungrammatical combinations of two and even three plural allomorphs (*–ens, –nse*) and used less often correct combinations of umlaut and plural markers. Whereas children used mostly only two combinations of plural allomorphs (*–ers, –ern*) which have already been described as typical for the plural acquisition in German (Clahsen 1995, Koehn 1994), the variance of such combinations in the answers of adults was immense and included dozens of forms including imaginary ones. In the nonce words, adults violated the schwa deletion rule 18 times and children not a single time. Several adults filled out their questionnaires with new nonce words or added not existing sound chains instead of plural markers. Neither sex nor age of adults contributed to the explanation of the distribution of plural markers in the adults' sample, so that further not documented variables should play more important roles. One of such variables might have been time pressure: Children were tested in an oral form and had to deliver an answer quickly. Adults, on the contrary, filled out questionnaires without any time pressure, although they had been asked beforehand to write down their very first reactions instead of demonstrating their creativity.

The rationale of the task with nonce words (wug test) is to activate pluralization schemata instead of the reproduction of memorized plural forms (Mugdan 1977). Hence, nonce words are widely used for the examination of pluralization strategies. In samples of children, this normally results in large proportions of zero forms, avoidance strategies, and overgeneralizations of the *–e*

and –*(e)n* (Schoeler et al. 1989), that is, of the most productive plural markers (Bittner and Köpcke 1999), as it was the case in the presented study as well.

No comparable studies with an analysis of both extra- and intralinguistic factors influencing the distribution of plural allomorphs were found. Very few studies on the use of plural allomorphs in the samples of adults are available (Mudgan 1977, Phillips and Lowell 1980, Spreng 2004), numerous studies investigate plural acquisition in German or immigrant children (Koehn 1994, Marouani 2006, Schaner-Wolles 1989, Wegener 1994), but we are not aware of any study with a comparable design. Surprisingly, if contrasted to the pre-school children from other studies, our sample handled nonce words with more success. For instance, according to Phillips and Lowell (1980), 90% of the answers of four-year-olds and 80% of the answers of five-year-olds were mere repetitions of singular forms. In the recent study by van de Vijver, Yildirim and Baer-Henney (2013), 20 five-year-old German children repeated singular forms of 39 phonotactically legal nonce words in 69% of the cases. In our pre-school sample, singular forms were repeated without pluralization only in 51% of cases. This discrepancy in percentages might be explained by retests of children with low compliance in our sample. No effort was spared to test every child completely, even if several appointments were necessary.

Although one can find numerous discrepancies between our results on the distribution of plural allomorphs and those in other studies, these are inevitable due to incomparable sample sizes and tasks. For instance, according to a spontaneous speech analysis of eight German children by Bittner and Köpcke (1999), –*e* is established as a plural pattern only in combination with umlaut. In our sample, however, –*e* without umlaut makes out 11% of all plural markers with nonce words and –*e* with umlaut only 5%. Because such plural forms of nonce words must have been actively produced and not merely reproduced, any plural marker surely belongs to

some internalized plural pattern. This does not mean, however, that the results of Bittner and Köpcke (1999) necessarily contradict ours because the distribution of plural markers might also depend on the chosen items, on age (in our study, children were older than in the study of Bittner and Köpcke (1999)), and other factors.

Also, some studies on regularities of plural markers in Modern High German, as it is reflected in the dictionaries and frequency lists, do report statistics but in a very limited form and mostly only descriptive data. For instance, Köpcke (1994) reports on semantic and phonological aspects of the distribution of *–e* with and without umlaut in all nouns extracted from the Duden Spelling Dictionary, but only descriptive statistics (percentage values) are given. It remains unknown whether the reported differences were statistically significant. However, even without statistical tests clear correspondences between our results and the regularities depicted in earlier works can be identified. For instance, according to L1000, 96% of nouns of feminine gender demand the plural marker *–(e)n*, and according to Bittner and Köpcke (1999), these are over 95% (cf. Mugdan 1977: 94). According to L1000, 55% of nouns from a non-feminine group demand *–e* with or without umlaut, and according to Bittner and Köpcke (1999), these are more than 60% (cf. Mugdan 1977: 98). In all three frequency lists used in the present study and also according to Bittner and Köpcke (1999) *–s*, umlaut, and *–er* have a low frequency. Clahsen et al. (1995) did not consider umlaut as a part of the plural system, but *–s* and *–er* reached low percentage values in all three frequency lists they analyzed (types and tokens).

Of special interest are calculations of contingency coefficients and percentage values by Mugdan (1977) for some of the noun characteristics and plural markers. Reported links between word final sound chains and plural markers correspond to those described in the Results section here, e.g., links between schwa and *–n*, full vowels and *–s*, nouns of feminine gender and *–(e)n*.

Discrepancies can be traced back to the choice of examined nouns. For instance, in L500, as was stated in the Results section, nouns of neuter gender demand the plural marker *–er* in more than 90% of the cases, which is supported by the findings of Clahsen et al. (1995). According to Mugdan (1977: 94), an analysis of the 2,180 most frequent nouns of German revealed a clear link between nouns of neuter gender and *–e*, followed by *–er*. This contradicts the results from L500, but corresponds to the results from L1000, where nouns of neuter gender demand *–e* in 62% of cases, followed by *–er* (18%).

Mugdan (1977) was also one of the very few authors who studied the influence of extralinguistic variables on the distribution of plural allomorphs. He found no significant differences in the distribution of plural allomorphs depending on the age groups (pre-school vs. school children), prestige of parents' profession, and parents' professional branch. Several associations between sex of the child and favored plural allomorphs were identified but the author attributed them to the fact that boys and girls were not of the same age and thus were not directly comparable. Also, one should add that the sample size of $N = 25$ is hardly appropriate for further subdivisions in the groups of boys and girls, age groups and alike. Contrary to our results, children in the study by Mugdan (1977) used *–(e)n* less often than the sample of adults (cf. 24% of all plural markers for adults and 49% for children in our sample), but such discrepancies are inevitable when two different sets of items are used. Indeed, in the test items chosen by Mugdan (1977) *–(e)n* was the correct plural form for 42% of the test items, whereas in our study 22% of test items demanded this plural marker. Hence, a higher frequency of *–(e)n* in the answers of adults in the study by Mugdan (1977) indicates more correct answers, and not more "simple" overgeneralizations, in comparison with children.

Laaha (2011) presented results of a binary logistic regression with correct plural forms as a dependent variable and age of her sample (140 Viennese children aged three to nine) and predictability of plural allomorphs as independent variables. Predictability was defined as a grammatical combination of gender and word final sound chains (classified as obstruents, sonorants, schwas, and full vowels) based on regularities of the target language. Only real words were used as test items. Both age and predictability yielded significant results. In our study, the age range was comparatively narrow, which might have contributed to the insignificant association with plural allomorphs. However, a direct comparison with the study by Laaha (2011) is hardly possible because of different dependent variables in regressions: plural allomorphs in this study vs. classification as correct or wrong answers (that is, varying plural allomorphs depending on test items) in the study by Laaha (2011). Hence, to our knowledge, the presented study is currently the first one to utilize categorical regressions to predict distribution of plural allomorphs by means of both intra- and extralinguistic factors. Also, no studies utilizing Principal components analysis of categorical data were found.

To sum up, both intralinguistic and extralinguistic factors influence the distribution of plural allomorphs in German, but intralingustic factors (mostly the schwa deletion rule and sound chains in the word final position) dominate. Among sociolinguistic variables, immigration background, length of contact to German, and probably a membership in an association or a study group play a certain role.

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