

The role of marker prominence in the acquisition and processing of German noun plurals in school-aged children with and without Hearing Loss

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The acquisition of a first language involves the simultaneous processing of information at several linguistics levels. This is especially the case for the production and processing of inflectional morphology in general and of plural on nouns in particular. Plural markers can take different forms, that may not be equally prominent, because of their segmental characteristics. For example, markers including vowels (umlaut and syllabic suffixes) and certain suffixes (e.g., -s over -n) might be more prominent and thus easier to process. Past studies have shown that noun plural is not acquired at the same rate in all languages (e.g., English [1]; German [2]; Hebrew [3]; Palestinian Arabic [4]), possibly due to different types of markers involved. The complexity of the noun plural marking system in German (e.g., [5]) provides an excellent way to investigate the role of markers' prominences as it relies on different types of segments (i.e., both consonants and vowels) and type of processes (i.e., phonetic, phonological and morphological) that vary in their prominence. The possible effect of the differences in markers' prominence is especially relevant in the case of children who receive less or qualitatively different input, as is the case for children with Hearing Loss (HL). Previous studies have shown that perceptual abilities indeed play a role in the acquisition of plural marking, both in production (e.g., [6]) and comprehension (e.g., [7]), resulting in high levels of inter-speaker variability.

The present experimental research aims at understanding how children – both with typical hearing (TH) and HL – benefit from the available information in the speech input when they process nominal inflection. In particular, we explore how processing plural markers under the effects of the children's hearing abilities may reflect a difference in their intrinsic prominence. We use an experimental design combining behavioral and eye-tracking paradigms to explore the processing of phonetic, phonological and morphological markers in children with Cochlear implants (CIs) and children with TH (i.e., voicing contrast, word-stem vocalic contrast, and suffixation – Study 1) and we then focus on how processing morphological information is influenced by the linguistic material and the hearing profiles of children with HL (i.e., suffixation – Study 2).

Study 1 [8]: 30 children with TH and 16 children with CIs were recruited. They were all L1 speakers of standard German, aged between 5;1-11;10. We defined nine plural categories (see Table 1), based on combinations of morphological (3 suffixes), phonological (stem vowel alternation) and phonetic processes (final consonant voicing contrast) used to form plurals: we presented simultaneously pictures of the singular and the plural (i.e., the same picture twice) version of each word, and an audio recording of the target word. We measured the accuracy of the response, the reaction time (RT, log-transformed), and the direction of gaze fixation. Collected data was analyzed by means of mixed-effects models. Results indicated a higher Accuracy in children with TH and no evidence of significant between-group differences on RT and gaze fixation patterns. A preference was found for plural over singular forms, as evidenced by a shorter RT and earlier fixation to plural targets. Gaze patterns indicated a later fixation for plurals involving a vowel change and an earlier fixation for plurals including a suffix (see Figure 1).

Study 2: 31 children with TH and 22 children with HL (heterogeneous in terms of HL types and devices use) participated in this second study, all with standard German as their L1 and were aged between 6;2 and 14;0. The experimental setup and data analyses for study 2 were similar to study 1, but only plural formed by suffixation (i.e., -e, -s and -n suffixes) were included in the design (see Table 1). Results indicated quicker processing for children with TH, with slight differences in gaze patterns across suffixes for both groups (see Figure 2). No evidence of a benefit of the type of device (i.e., acoustic vs. electric/hybrid) was found, but better processing abilities with unilateral (over bilateral) HL.

The results of both studies indicated that all types of markers are processed differently, with a preference for suffixation, and under the influence of certain (but not all) individual characteristics of the children's hearing abilities. This suggests that markers are not equally prominent (i.e., preference for suffixes over other markers) and that the role of prominence to process plural depends on the children's hearing abilities. By exploring simultaneously linguistic and individual factors in plural processing, our work adds to the existing literature on the comprehension of inflection in language acquisition.

Plural type	Vowel change (umlaut)	Suffix	Voicing contrast	Example (singular-plural pairs)	Study 1	Study 2
No change	-	-	-	Kissen-Kissen [kɪsn̩] - [kɪsn̩], <i>pillow</i>	not analysed	not incl.
Vowel change: umlaut	+	-	-	Vogel-Vögel [fo:g] – [fø:g], <i>bird</i>	+	not incl.
-/s/ suffix	-	+	-	Auto-Autos [aʊto:] - [aʊto:s], <i>car</i>	+	+
-/ə/ suffix	-	+	-	Tisch-Tische [tɪʃ] – [tɪʃə], <i>table</i>	+	+
-/n/ suffix	-	+	-	Katze-Katzen [katsə] – [katsən], <i>cat</i>	+	+
Umlaut + -/ə/ suffix	+	+	-	Ball-Bälle [bal] – [bɛlə], <i>ball</i>	+	not incl.
Umlaut + -/ɐ/ suffix	+	+	-	Schloss-Schlösser [ʃlɔs] – [ʃlœsɐ], <i>castle</i>	+	not incl.
Voiced stem-final C + /ə/ suffix	-	+	+	Pferd-Pferde [pfe:ʁt] – [pfe:ʁdə], <i>horse</i>	+	not incl.
Voiced stem-final C + /ɐ/ suffix	-	+	+	Kleid-Kleider [klaɪt] – [klaɪdɐ], <i>dress</i>	+	not incl.
Umlaut + Voiced stem-final C + /ə/ or /ɐ/	+	+	+	Wald-Wälder [valt] – [vɛldɐ], <i>forest</i>	+	not incl.

Table 1: Details of plural types and types of contrasting cue available to mark plural for both studies (“not analysed”: included in the experimental design but not analysed; “not included”: not included in the experimental design)

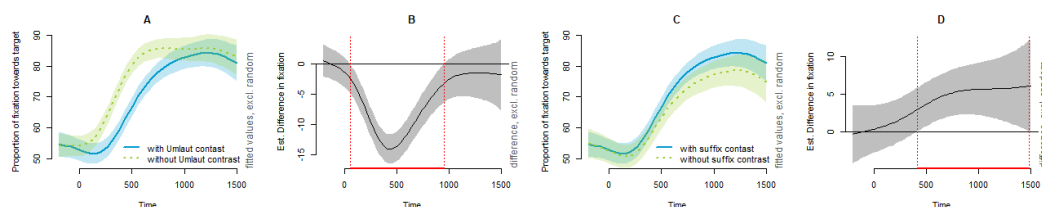


Figure 1: Study 1 – Gaze fixation for both groups together towards targets (A) and difference in fixation with or without umlaut contrast (B) and gaze fixation towards targets (C) and difference in fixation with or without suffix contrast (D)

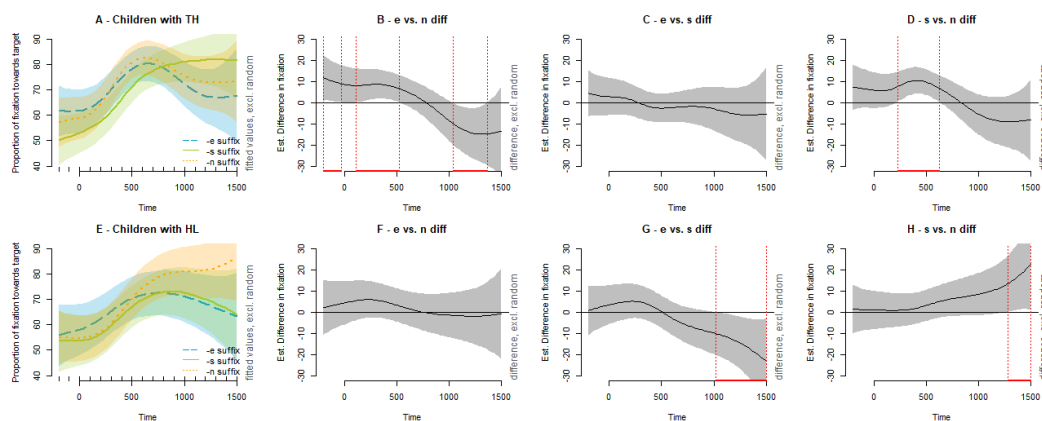


Figure 2: Study 2 – Gaze fixation pattern towards each suffix type for the children with TH (A) and between-suffix differences (B-D), and gaze fixation pattern towards each suffix type for the children with HL (E) and between-suffix differences (F-H)

References:

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