

L2 Auditory Processing of German Plural Marking in Noise: An Eye-Tracking Study

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Background German nominals employ a variety of plural markers, including several suffixes and umlaut, e.g. <Hut-Hüte> (*hat-s*) (see p. 3). We tested L1 and L2 listeners' auditory processing timelines of German nominal plural marking in noise to assess online processing of speech comprehension under adverse listening conditions, thus increasing ecological validity. Background noise generally has a more detrimental effect on the language performance of bilingual and L2 listeners than that of L1 listeners [2, 5, 6]. **Research questions** Our previous work [1] suggests that L2 listeners struggle with processing plurals with schwa suffixes in noise, leading to the question of whether they can compensate by making use of other cues to plurality that can co-occur with the -e suffix, namely umlaut and a stem-final C voicing alternation. **Methods** We employed an eye-tracking experiment with a two-picture visual world paradigm. Participants (n: L1=39; L2=105, various L1s; <A1-B1>) heard one word, either the singular or plural noun form (ratio: 50%-50%) embedded in noise (+2dB SNR) of objects presented on the screen. Participants' eye movements and responses were recorded while they selected either the image of a single object or the image of two objects. We used four categories of plural marking (see p. 2), all combined with suffix -e: 1) umlaut, 2) stem-final voicing, 3) just suffix without umlaut but umlautable stem vowels, and 4) just suffix with non-umlautable stem vowels. **Predictions** We predicted that the suffix -e, which achieves the typical trochaic pattern for German plurals [e.g., 8, 9], would be the strongest, most reliable cue for L1 listeners, followed by umlaut (stressed vowels), then voicing alternations (unstressed syllables). For L2 listeners, we predicted that Umlaut and the voicing alternation might be stronger auditory cues to plurality than final weak, reduced schwa (-e) syllables. **Results** The Gaze data (correct answers, GAMMs: 0 aligned to timepoint where singular-plural diverge for critical feature, e.g., V onset for umlaut): L2 listeners' looks to target vs. competitor show a slower, more gradual rise, a lower peak, and more variability than L1 listeners (Fig. 1), modulated by L2 proficiency. Gaze to umlaut targets differs significantly from the other categories in that it rises more slowly (Fig. 2), an effect that is most pronounced in L2 listeners (cf. Fig. 1). We will discuss RTs (LMM), accuracy (GLMM) and L2 proficiency effects of all measures. **Discussion** Unlike predicted, umlaut is the weakest cue to plurality in both groups. Likely contributing factors are the lower frequency of umlaut compared to plural suffix -e, umlaut being the least productive cue to plurality in general [4], and the early position of Umlaut within the word. Suffixation seems to afford a processing advantage over stem-medial changes, as has been reported for children [2] and the acquisition of Arabic nominal plural forms [7].

Examples: 1) "Umlaut+Suffix": <Hut-Hüte> (*hat-s*); 2) "Voicing+Suffix": <Berg[k]-Berg[g]e> (*mountain-s*); 3) "SuffixOnly1": <Boot-Boote> (*boat-s*); 4) "SuffixOnly2": <Stift-Stifte> (*pencil-s*).

References

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Figures and Tables

Figure 1: Target fixation proportion by plural category and language

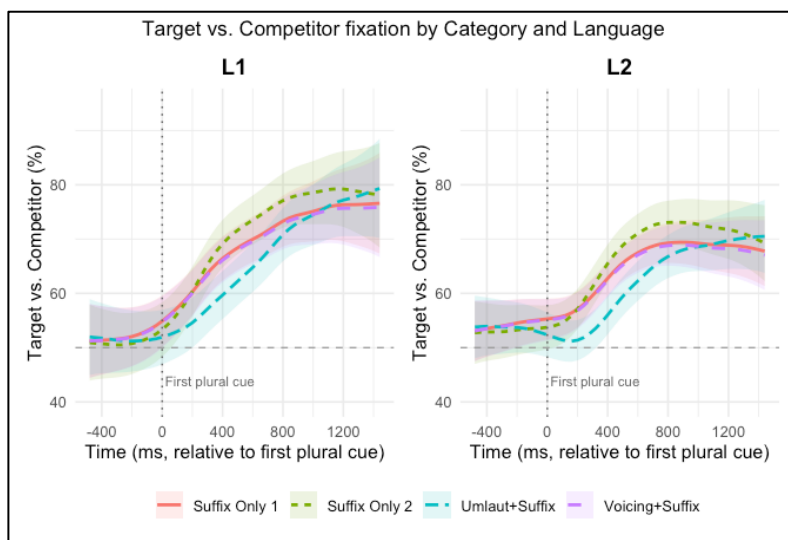
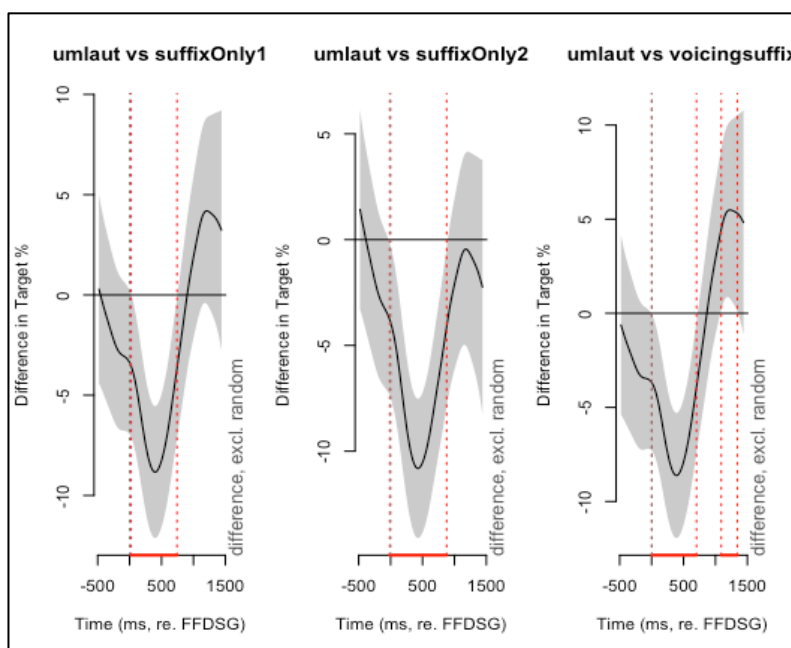


Figure 2: Difference plots for the four plural categories (L1 and L2)



Note: FFDSG refers to first difference between singular and plural.

Optional Supplemental Information:

Additional information about German nominal plurals:

German shows a range of plural allomorphs, including a number of suffixes, i.e.: <-n> /-n/, <-en> /-ən/, <-e> /-ə/, <-er> /-ɐ/, <-s> /-s/, and -Ø. Plurality in German can also be marked with umlaut, i.e. a vowel-fronting process on stem-vowels, e.g.: <o> /ɔ/ changing to <ö> /œ/, which can be combined with several suffixes (<-e> /-ə/, <-er> /-ɐ/, -Ø), including the null-suffix -Ø as in the example Flügel – Flügel-Ø (wing – wings) in (1). Examples of the various types of plural markings in German are provided in (1).

(1) Examples of German nominal plural marking

Plural marking	German singular – plural	English translation (sg. – pl.)
<-n> /-n/	Blume – Blume-n	(flower – flowers)
<-en> /-ən/	Frau – Frau-en	(women – women)
<-e> /-ə/	Hund – Hund-e	(dog – dogs)
<-er> /-ɐ/	Kind – Kind-er	(child – children)
<-s> /-s/	Auto – Auto-s	(car – cars)
-Ø	Flügel – Flügel-Ø	(wing – wings)
Umlaut /ɔ-œ/	T <u>o</u> chter – T <u>ö</u> chter	(daughter – daughters)

These plural suffixes differ in their phonetic-phonological make-up and also show different levels of productivity, frequency, morphological transparency, and arguably saliency (e.g. Köpcke 1998; Goebel & Indefrey 2000; Laaha et al. 2006). Each noun typically selects for one specific plural marker. However, the selection of the plural marker for any given noun is neither fully predictable nor arbitrary. Instead, plural marker selection is driven by tendencies related to the phonological and morphological features of the singular stem form.