Gender features in German: Evidence for underspecification

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Abstract

A series of behavioural experiments is reported that investigate the processing of grammatical gender of nouns in German. Results consistently indicate processing differences between nouns of different genders. Masculine nouns show indications of increased processing cost compared to feminine nouns. We assume that the lexical representation of nouns is characterized by underspecified gender information. This assumption is in contrast to more traditional views stating that only inflected forms are underspecified with respect to grammatical features. However, the presented account supports the idea that underspecification as a general characteristic of the mental lexicon is mainly driven by economical reasons: a feature that is never used for grammatical operations (e.g., evaluation of agreement) is not needed in the language system at all.

Key words: grammatical gender, underspecification, German, mental lexicon

Background

In models of language processing, grammatical categories (e.g., gender or case) are traditionally split into distinct classes. For example, grammatical gender in German classifies into masculine, feminine or neuter. Current morphological theories however propose more differentiated analyses of these categories. Almost all frameworks rely on abstract feature decomposition and the concept of underspecification (see, e.g., Distributed Morphology (cf. Halle & Marantz, 1993), Paradigm Function Morphology (Stump, 2001), Minimalist Morphology (Wunderlich, 1996), and many others). The overall idea behind these two concepts is a decomposition of traditional labels into more abstract, binary features, thus allowing to refer to natural classes of such categories. Accordingly, the three instances of grammatical gender in German can be described by the following two abstract binary features [±f] and [±m]: 'feminine' [+f, −m], 'masculine' [−f, +m], 'neuter' [−f, −m]. In contrast, psycholinguistic models of inflection consistently lack such more differentiated morphological analyses. This holds, for such diverse models as schema-based models (Bybee, 1995), variants of connectionist models (cf. Rumelhart & McClelland, 1982), serial modular models (Levelt, Roelofs, & Meyer, 1999), the Augmented Addressed

Morphology Model (Caramazza, Laudanna, & Romani, 1988), and others. However, relevant reason to implement the notions of decomposed features and underspecification into a cognitive model of language would only be given if traditional and underspecification-based approaches make different, empirically testable predictions. Although there is first evidence in favour of such an account (e.g., Penke, 2006; Clahsen, Eisenbeiss, Hadler, & Sonnenstuhl, 2001), these findings have not yet been incorporated into existing models. The present study addresses the question whether there are inherent processing differences between nouns of different grammatical genders in German that are not due to a syntactic process of agreement checking (as suggested in Opitz et al. 2013).

Experiment 1 − Gender & Agreement / Grammaticality Judgment

Method & Procedure: 180 German nouns (60 of each gender), each of which was embedded in a syntactic structure of the type preposition + adjective + noun. For each phrase two illicit versions were created by marking incorrect gender agreement on the adjective. Stimuli were presented visually word-by-word centred on a computer screen with a fixed duration. 24 Participants performed a grammaticality task after each trial.

Results: Main effect of Gender for accuracy of responses: F_1 (2,46) = 7.7, $p < .01$; F_2 (2,177) = 6.87, $p < .01$. Feminine phrases were rated with higher accuracy (97.9%) than masculine (93.3%) and neuter phrases (93.1%). Main effect of Gender for reaction times: F_1 (2, 46) = 7.25, $p < .01$; F_2 (2, 177) = 3.24, $p < .05$. Responses to feminine phrases were faster (720ms) than to masculine phrases (758ms).

Experiment 2a − Morphological Marking / Gender Decision

Method & Procedure: A total of 252 nouns were chosen and distributed over 3 lists. Each list consisted of 84 nouns, 42 feminine and 42 masculine. In each of these two groups there were 21 nouns with derivational affixes clearly indicating their gender and 21 mono-morphemic nouns without gender cues. Items were presented visually and in a pseudo-randomized order. The task for 18 Participants was to decide whether the presented word was masculine or feminine by pressing a corresponding button.

Results: Main effect for Gender (F_1 (1, 17) = 22.01, $p < .001$, F_2 (1, 83) = 6.78, $p < .05$) but no effect for Morphological Marking (F_1 (1, 17) = 1.79, $p = .19$, F_2 (1, 83) = 1.23, $p = .27$). Again, there were significantly longer reaction times to masculine (769ms) than to feminine nouns (715ms).

Experiment 2b – Gender Verification

Method & Procedure: A total of 90 nouns was used, 30 of each gender. The task for 30 participants was to decide whether the presented word belonged to the gender category asked for in the particular block by pressing a corresponding Yes or No button.

Results: Main effect for Gender (F_1 (2, 58) = 3.55, $p < .05$; F_2 (2,83) = 3.90, $p < .05$). Decisions for feminine nouns were faster (686 ms) than for masculine nouns (720 ms). Neuter nouns scored numerically in between (703 ms) and did not differ statistically from either feminine or masculine nouns.

Experiment 3 - Word Class Decision

Method & Procedure: 60 nouns were used as experimental items, 20 of each of the three genders. 60 additional words (30 adjectives and 30 inflected verbs) were used as fillers. 30 Participants performed a word class decision.

Results: Main effect for Gender (F_1 (2, 58) = 17.7, $p < .001$; F_2 (2, 57) = 3.5, $p < .05$). Responses to feminine nouns (621ms) were shorter compared to responses to masculine (656ms) and neuter nouns (652ms). Latencies did not differ between neuter and masculine nouns.

Discussion

In all reported experiments we obtained evidence that gender features of nouns have an impact on language processing in German. Consistently, masculine nouns induced longer reaction times and partially lower accuracy rates, both indicating increased processing demands for masculine nouns, compared to members of the feminine category. We assume that the observed effects are grounded in an underspecified representation of grammatical features. In contrast to previous accounts, both in theoretical linguistics and psycholinguistics, we propose that the notion of underspecification extends to the representation of gender features of nouns in the mental lexicon. More precisely, we assume gender features of German nouns to be lexically specified as follows: masculine nouns:[−f, +m]; neuter nouns: [−f]; feminine nouns: [ ]. Moreover, the proposed specifications not only match the present data, but also agree with existing accounts of inflectional morphology (Blevins, 1995). These specifications can alternatively be modelled as generic gender nodes in an activation based model (cf. Levelt et al. 1999). Traditionally, generic gender nodes are viewed as categorical instances of grammatical gender. Each noun is associated with one of these nodes. In contrast, an underspecification-based account predicts that nouns in the mental lexicon differ in the number of associations to feature nodes (see Figure 1). Thus, the number of these associations corresponds to

processing costs as mirrored in reaction times and error rates in behavioural experiments. This assumptions straightforwardly leads to further predictions concerning , e.g., priming experiments by providing a possible explanation why the so called gender congruency effect occurs rather unsystematically across experiments and is notoriously hard to replicate (cf. Friederici & Jacobson, 1999).

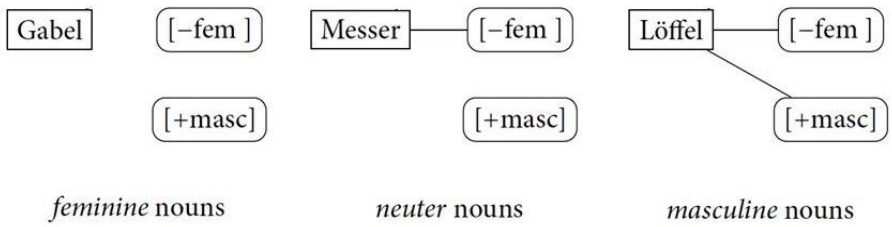

Figure 1. Lexical specification for the three genders of nouns in German.

References

Blevins, J. 1995. Syncretism and paradigmatic opposition. *Linguistics and Philosophy, 18*, 113–152.

Bybee, J. 1995. Regular morphology and the lexicon. *Language and Cognitive Processes, 10(5)*, 425–455.

Caramazza, A., Laudanna, A., & Romani, C. 1988. Lexical access and inflectional morphology. *Cognition, 28*, 297–332.

Clahsen, H., Eisenbeiss, S., Hadler, M., & Sonnenstuhl, I. 2001. The mental representation of inflected words: An experimental study of adjectives and verbs in German. *Language, 77*, 510–543.

Friederici, A. D., & Jacobson, Th. 1999. Processing grammatical gender during language comprehension. *Journal of Psycholinguistic Research, 28*, 467–484.

Halle, M., & Marantz, A. 1993. Distributed morphology and the pieces of inflection. In K. Hale & S. J. Keyser (Eds.), *The View from Building 20. Essays in Linguistics in Honor of Sylvain Bromberger. Vol. 24 of Current Studies in Linguistics* (pp. 111–176). Cambridge, Mass.: MIT Press.

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. 1999. A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22(1)*, 1–75.

Opitz, A., Regel, St., Müller, G., & Friederici, A. D. 2013. Neurophysiological evidence for morphological underspecification in German strong adjective inflection. *Language, 89(2)*, 231–264.

Penke, M. 2006. *Flexion im mentalen Lexikon*. Tübingen: Max Niemeyer.

Rumelhart, D. E., & McClelland, J. L. 1982. An interactive activation model of context effects in letter perception: Part 2. The contextual enhancement effect and some tests and extensions of the model. *Psychological Review, 89*, 60–94.

Stump, G. 2001. *Inflectional Morphology*. Cambridge: Cambridge University Press.

Wunderlich, D. 1996. Minimalist morphology: The role of paradigms. In: G. Booij & J. van Marle (Eds.), *Yearbook of Morphology 1995* (pp. 93–114). , Dordrecht: Kluwer.