Genus-sexus congruence in machine translation: DeepL's pronominal resumption of 'das Mädchen'

In German, the noun *das Mädchen* ('the girl') is grammatically neuter although its semantics refers to a female person – often, but not exclusively, a child (cf. Lind and Nübling, 2022). This genus-sexus clash frequently leads to conflicts in pronominal reference, as the grammatical gender implies the use of a neuter pronoun (*es*), whereas semantic factors tend to favour a feminine pronoun (*sie*), although the latter is now considered the default take-up form (Thurmair, 2006). Of strong interest in German linguistics and beyond, the phenomenon of hybrid nouns has been explored from various approaches, including morpho-syntactic (cf. Thurmair, 2006; Jaeger, 2010) and cross-linguistic perspectives (cf. Corbett, 1991; 2015). Following a sociopragmatic approach, studies have also examined the relevance of the referent's age and maturity (cf. Lind and Nübling, 2022; Hübner, 2021; Braun and Haig, 2010).

This study explores how the online machine-translation tool DeepL pronominalizes the German hybrid noun *das Mädchen* using personal pronouns (feminine *sie* 'she' or neuter *es* 'it') and possessive pronouns (feminine *ihr(e/r/s)* 'her' or neuter *sein(e/r/s)* 'its'). In addition to grammatical factors such as pronoun type and semantic factors such as definiteness, our analysis also considers the extent to which pragmatic and processing factors such as the age of the referent, the inclusion of stereotypical (male/female/positive/negative) adjectives, as well as the referential distance between *das Mädchen* and the pronominal take-up influence the pronominalization. We used an open-source Large Language Model (LLM), OLMo-2-7B (Team OLMo, 2025), to systematically generate English stimuli featuring all combinations of these factors. The stimuli were then translated into German via DeepL's API. Finally, we used a mixed-effects logistic regression model to analyse the combinations of factors that are associated with a greater likelihood of feminine versus neuter pronominal resumption.

Corroborating prior research, our results show that the use of neuter pronoun decreases significantly with increasing age. As the referent becomes increasingly feminised, the use of the neuter pronoun, which is typically associated with children (cf. Hübner, 2013; McConnell-Ginet, 2014), becomes less likely. Our results further suggest that, in the presence of negatively connotated, stereotypically feminine referents, DeepL favours neuter pronominalization. This is consistent with previous research on gender bias in language (cf. Lind and Nübling, 2022). We hypothesize that negative valence may lead to linguistic distancing and a reduction of the referent's perceived femininity, or even humanness, thereby favouring grammatical over semantic agreement (cf. Lind and Nübling, 2022; McKay, 1999). Aligning with preceding research, our study also demonstrates that semantic agreement tends to be stronger the greater the linear distance between the referent *das Mädchen* and its pronominal take-up (cf. Thurmair, 2006). We hypothesise that, as the linear distance increases, the referents grammatical features remain less activated mentally, whereas its conceptual properties become more prominent. (cf. Köpcke and Zubin, 2009; Hübner, 2021).

In sum, our study provides evidence that, like the humans whose data they are trained on, deep-learning machine-translation algorithms rely on more than just syntactic factors to make pronominalization choices for hybrid nouns. In fact, combinations of semantic and pragmatic aspects are the most important contributing factors that, in turn, reflect social and psychological factors (cf. Zhao, 2024; Kotek et al., 2023). Our findings provide further insights into gender bias in machine-translated and LLM-generated language.

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