

Imageability Shapes Retention of Morphosyntactic Information: Eye Tracking Evidence for Number and Gender Features in L1 and L2 Reading

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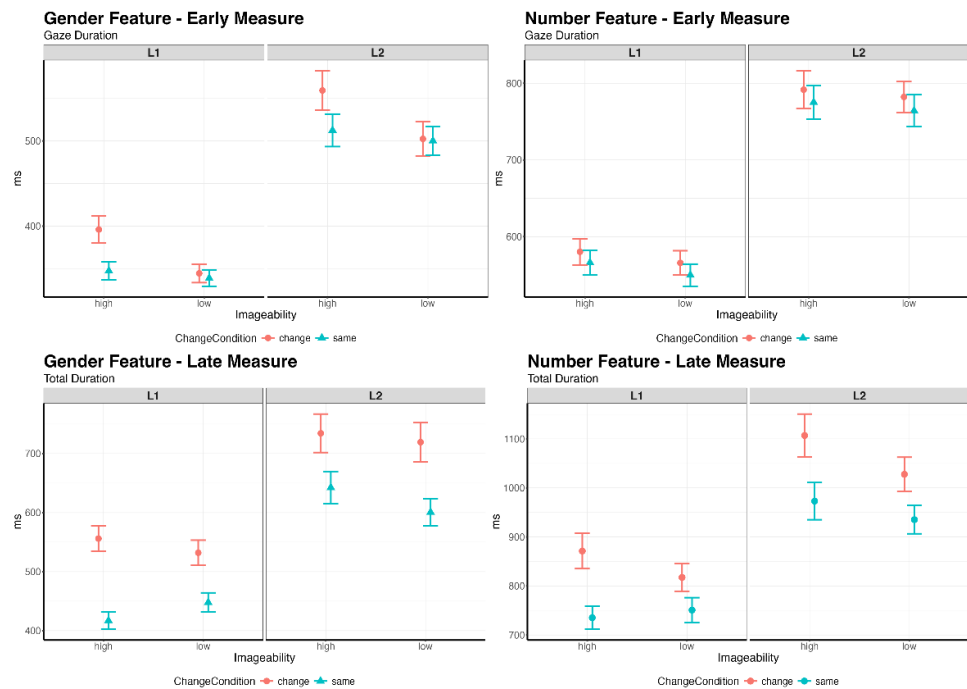
Language comprehension requires maintaining linguistic information over time so that earlier input can be integrated with later material. Although semantically rich, highly imageable concepts yield more stable representations [1], it remains unclear whether this benefit extends to the retention of grammatical features. We tested how referent imageability modulates the retention of gender and number in German, and whether this modulation differs between L1 and L2 readers, given claims that L2 processing favours surface form over conceptual content [2]. Gender–number contrasts allow us to test whether imageability has general or feature-specific effects on cross-sentence grammatical persistence.

Methods: Eye movements were recorded from 69 L1 and 70 L2 German readers, the latter mainly native speakers of Czech and other Slavic languages with similar gender/number systems. Participants read 32 sentences twice; on the second presentation, after 14–16 intervening sentences, the subject noun’s gender or number either matched or changed. Retention was indexed by increased reading times and regressions at feature-changed regions. Feature change was crossed with imageability (high vs. low, based on pretests). Materials were controlled for several factors, including length, frequency, and familiarity. Early (gaze duration) and late (e.g., total reading time) measures were analyzed using (generalized) mixed-effects models. **Results and Discussion:** Changed relative to unchanged repetitions increased reading times, indicating retention across sentences. This effect was modulated by imageability, feature, and L1/L2 group (see Figure 1). Direction of change (e.g., masc→fem vs. fem→masc) did not modulate the results. For gender, retention effects emerged early but only for highly imageable nouns; later measures showed effects for all nouns, with the strongest effects for highly imageable items in L1 readers. This pattern is consistent with the encoding of gender as a fixed part of the lexical representation, accessed during initial word recognition, and with lexical–conceptual mappings strengthened by imageability in the case of role nouns. For number, retention effects emerged only in later measures, were comparable in L1 and L2 readers, and were consistently enhanced by imageability. The later emergence of number effects aligns with accounts in which agreement is computed during structural integration, although some neuroimaging studies report earlier responses. Overall, the findings show that sensory–perceptual grounding contributes to the retention of grammatical information with a conceptual component, with tentatively stronger effects in L1 readers and in a feature-specific manner. Theoretical implications and directions for future research are discussed.

Examples of the gender (masc. vs. fem.) and number (sg. vs. pl.) manipulations in the high- and low-imageability conditions (ROIs highlighted in gray). Manipulated features, imageability, and order of presentation (e.g., change: masc → fem, fem → masc; identical: fem → fem, masc → masc) were fully counterbalanced across the experiment.

Gender (1)		
high imageability	masc	Der Violinist geht mit der Geige auf die Konzertbühne. 'The violinist.MALE goes on the concert stage with the violin.'
	fem	Die Violinistin geht mit der Geige auf die Konzertbühne. 'The violinist.FEMALE goes on the concert stage with the violin.'
low imageability	masc	Der Kollege präsentiert unsere Ergebnisse beim Meeting. 'The colleague.MALE presents our results at the meeting.'
	fem	Die Kollegin präsentiert unsere Ergebnisse beim Meeting. 'The colleague.FEMALE presents our results at the meeting.'
Number (2)		
high imageability	sg	Der Violinist geht mit der Geige auf die Konzertbühne. 'The violinist.SG goes on the concert stage with the violin.'
	pl	Die Violinisten gehen mit der Geige auf die Konzertbühne. 'The violinist.PL go on the concert stage with the violin.'
low imageability	sg	Der Kollege präsentiert unsere Ergebnisse beim Meeting. 'The colleague presents our results at the meeting.'
	pl	Die Kollegen präsentierten unsere Ergebnisse beim Meeting. 'The colleagues present our results at the meeting.'

Figure 1: Summary of results, showing differences between same-feature values (green) and changed-feature values (red) for gender (left) and number (right). s: late measures.



References

[1] Khanna, M. M., & Cortese, M. J. (2021). How well imageability, concreteness, perceptual strength, and action strength predict recognition memory, lexical decision, and reading aloud performance. *Memory*, 29(5), 622-636.

[2] Bordag, D., Opitz, A., & Berulava, H. G. (2025). Asymmetry in the retention of content and surface linguistic information during reading in L1 and L2. *Frontiers in Psychology*, 16, 1610120.