

Gender agreement attraction in Hebrew comprehension

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Background: Agreement attraction is a well-known phenomenon where the predicate in a sentence agrees with a noun other than its subject (a so-called 'attractor'). Although such sentences are ungrammatical, they are often found in production (e.g. [1-2]), and their ungrammaticality often goes unnoticed in comprehension (e.g. [3-4]). While most research on agreement attraction examined number agreement, the gender feature has also been examined, mostly in production (e.g. [2]). Gender attraction effects in comprehension and production were found in many studies [2, 5-11]. However, the results are inconsistent with regard to the attractor markedness asymmetry, namely the question of whether only morphologically marked (i.e. feminine) attractors produce attraction (as was argued for number agreement, [3]), or whether both marked and unmarked attractors produce attraction (e.g. [5-9]).

The current experiment. We examined gender agreement attraction in comprehension in Hebrew (for relevant properties of Hebrew, see p. 3). There has been one previous experiment targeting this topic [12]. However, it included feminine attractors only, thus not comparing the effectiveness of marked and unmarked attractors. In addition, the study provided only online measurements (reading times). In order to get a fuller picture of gender attraction in Hebrew, we performed a speeded grammaticality judgment experiment with conditions covering all permutations of the gender feature of the subject, the attractor and the verb.

Methods. Materials included 32 sentence sets, each consisting of eight configurations, obtained by crossing three factors: (a) GRAMMATICALITY (grammatical or ungrammatical sentence) (b) GENDER MATCH (attractor matches or mismatches the predicate); (c) ATTRACTOR GENDER (masculine or feminine). The experimental sentences contained a subject relative clause with the attractor as the object (see sample set in Table 1). Only animate nouns were used for subjects and attractors. We included 64 fillers containing subject/object relatives and complement clauses, half of which were ungrammatical with diverse syntactic errors. 64 Hebrew speakers participated in the experiment. Sentences were presented word-by-word in a moving window, with each word displayed for 350ms with a 100ms interstimulus interval. At the end of each sentence, participants were asked to judge whether the sentence sounded good, and had up to two seconds to do so.

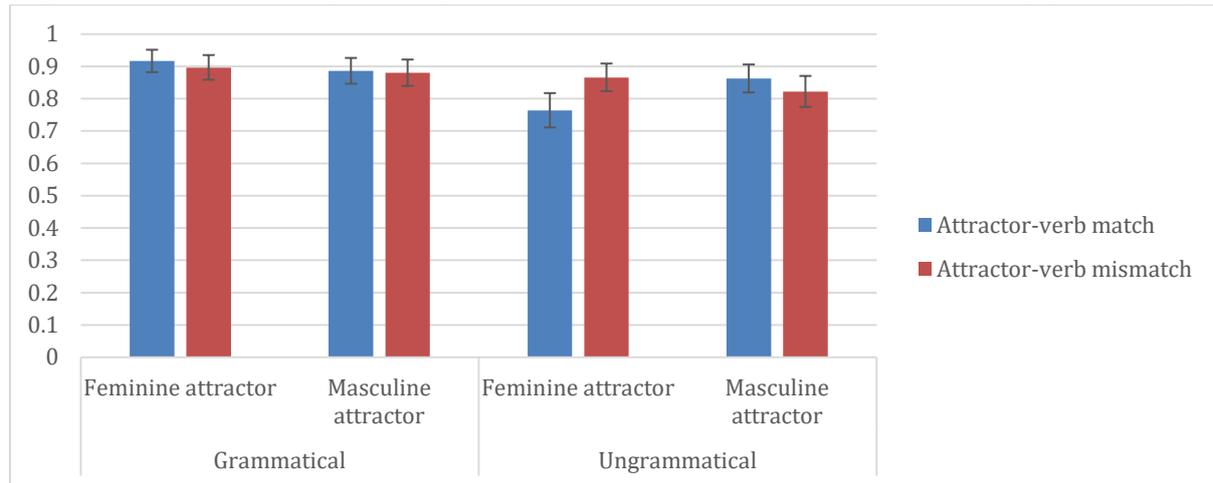
Results. Results are displayed in Figure 1. A mixed-model regression with random intercepts for participant and set revealed a main effect of GRAMMATICALITY ($p < .001$) indicating that judgment of ungrammatical sentences was more error prone. In addition, we found a significant three-way interaction ($p = .022$), indicating that only in ungrammatical sentences with a gender match between the attractor and the predicate, sentences with a feminine attractor were judged less accurately than the same sentences with a masculine attractor.

Discussion. The three-way interaction we observed between GRAMMATICALITY, GENDER MATCH and ATTRACTOR GENDER suggests that agreement attraction in Hebrew comprehension arises mostly in ungrammatical sentences, when the attractor is feminine. These results affirm both the so-called grammaticality symmetry, namely that attraction is limited to ungrammatical, rather than grammatical sentences, and the markedness asymmetry, namely that attraction arises only in the presence of a morphologically marked attractor. It can be concluded that Hebrew exhibits gender agreement attraction effects in speeded grammaticality judgments, in ungrammatical sentences with feminine attractors. These findings should allow examining attraction in more intriguing configurations, e.g. sentences with irregular plural forms, where masculine nouns are marked with a feminine suffix and vice versa.

Table 1. Translation of an example set

The pupil (Masc/Fem)	who	met	the principal (Masc/Fem)	today in the morning	the	will begin (Masc/Fem)	the school year
subject	RC verb	comp	+ attractor	adverbs		main Verb	object

Figure 1: Mean accuracy rates by condition (error bars represent +/- 1 SEM by participant)



References: [1] Eberhart et al. (2005). Making syntax of sense. *Psychol Rev* [2] Vigliocco & Franck (1999). When sex and syntax go hand in hand. *JML*. [3] Wagers et al. (2009). Agreement attraction in comprehension. *JML* [4] Jäger et al. (2020). Interference patterns in subject-verb agreement and reflexives revisited. *JML* [5] Antón-Méndez et al. (2002). The relation between gender and number agreement processing. *Syntax* [6] Acuña-Fariña et al. (2014). Gender and number agreement in comprehension in Spanish. *Lingua*. [7] Slioussar & Malko (2016). Gender agreement attraction in Russian. *Front. Psychol*. [8] Paspali & Marinis (2020). Gender agreement attraction in Greek comprehension. *Front. Psychol*. [9] Deutsch & Dank (2011). Symmetric and asymmetric patterns of attraction errors in producing subject-predicate agreement in Hebrew. *LCP* [10] Deutsch & Dank (2009). Conflicting cues and competition between conceptual and grammatical factors in producing number and gender agreement. *JML* [11] Dank & Deutsch (2010). The role of morpho-phonological factors in subject-predicate gender agreement in Hebrew. *LCP*. [12] Dank et al. (2014). Resolving Conflicts in Natural and Grammatical Gender Agreement. *JPR*.

Hebrew gender properties. Gender is a prominent feature in Hebrew subject-predicate agreement. It consists of two values: masculine and feminine. The masculine is considered the unmarked form – it is morphologically simpler, more frequent, and used also as the default value. In contrast, the feminine value is marked by distinctive morphemes, most often suffixes, except for verbs in the future tense where the feminine marking appears as a prefix. Nouns, adjectives and verbs are inflected for gender. While this inflection is consistent for adjectives, verbs and animate nouns, inanimate nouns do not always contain the predicted gender morpheme.