Agreement attraction in Hebrew comprehension: Does verb-initial order affect attraction?

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Background. Grammatical illusions arise when comprehenders accept a sentence as grammatical despite it violating their grammatical knowledge. One case in which the processor is particularly susceptible to grammatical illusions is agreement attraction, where the predicate matches the features of an element other than the subject (e.g., "The key to the cabinets were rusty") [1-6]. According to Cue-Based Retrieval (CBR) [7-8], attraction arises since at the verb, the distractor may be erroneously retrieved from memory in place of the subject. Marking & Morphing (M&M) [9], in contrast, proposes that the distractor distorts the features of the subject, leading to acceptance of the ungrammatical verb. Notably, these theories share the assumption that the parser encounters the verb after processing both the subject head and the attractor. However, some languages allow also for a verb-subject order. Interestingly, both CBR and M&M do not predict attraction when the verb precedes the subject. Since processing is incremental, the dependency between the verb and the subject should be formed when the (mismatching) head of the subject phrase is encountered, at which point the sentence should be recognized as ungrammatical. The distractor appears only later, and cannot be retrieved or distort the features of the subject at the point where the subject head is encountered. However, whether and how verb-subject order modulates attraction in comprehension has not been examined to date (for related discussions see [10-11]).

The current study investigates agreement attraction in Hebrew, a language with relatively free word order, which received little attention in the attraction literature. Most research on agreement attraction in Hebrew focused on production [12-13]; one study looked at reading times [14], and only one study investigated the grammaticality illusion as it is reflected in grammaticality judgments and manipulated the gender feature [15]. The current study aims, first, to test for number attraction effects in Hebrew comprehension, and second, to test for the effect of word order on agreement attraction.

Methods. Materials consisted of 24 sets with four conditions, obtained by crossing two factors: (1) WORD ORDER (subject phrase appears before or after the verb); (2) ATTRACTOR MATCH (attractor matches or mismatches the verb in number). All experimental items were ungrammatical (balanced with 24 grammatical fillers), with a singular masculine subject and plural masculine verb (see example in Table 1). Forty-eight participants performed a speeded grammaticality judgment task. Sentences were presented as a whole, with presentation time of 400ms x number of words, and participants gave a speeded binary grammaticality judgment.

Results. Results are displayed in Figure 1. We found a main effect of ATTRACTOR MATCH ($p<.001$), such that participants were more likely to erroneously judge the sentences as grammatical when the number of the attractor and the predicate matched. There was no main effect of WORD ORDER, and no interaction between the two factors.

Discussion. The results suggest the existence of number agreement attraction in Hebrew comprehension, similar to findings in other languages. More interestingly, attraction occurs in similar rates when the subject and the distractor precede the verb, and when they follow it. As explained above, this is unpredicted under current theories of attraction. In CBR, even if we assume that the subject head is the retrieval site while the verb's features are those being stored and retrieved, the distractor cannot have an effect on retrieval as it only appears after the subject head. Similarly in M&M, the dependency between the verb and the subject head can be resolved before the attractor is encountered. One explanation for the results is that the parser is not eager to resolve the dependency when the verb precedes the subject and waits for the entire subject (which may turn out to be a plural coordinate structure) to appear. Alternatively, it is possible that at the moment the subject head is encountered, the sentence is ruled out by the parser. However, since grammaticality judgment is only made at the end of the sentence, it may involve the attractor subsequently tainting the decision.

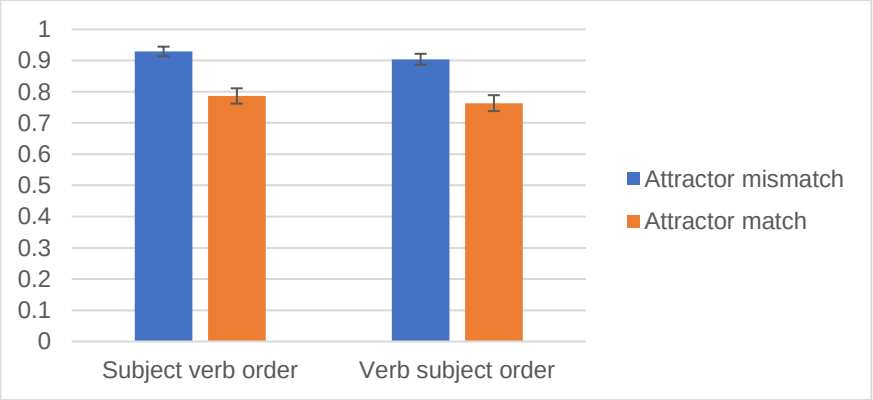
Table 1: Example of the experimental items in each condition.

ba-dox ha-psixiatri niršam še-kol boker…
in report the-psychiatric was+noted that-every morning…

Subject - Verb	Attractor Mismatch	**ha-minun** šel **ha-kadur** ke-xol ha-nir'e **mištanim**. the-dosage of the-pill.SG probably change.PL
	Attractor Match	**ha-minun** šel **ha-kadurim** ke-xol ha-nir'e **mištanim**. the-dosage of the-pills.PL probably change.PL
Verb-Subject	Attractor Mismatch	**mištanim** ke-xol ha-nir'e **ha-minun** šel **ha-kadur**. change.PL probably the-dosage of the-pill.SG
	Attractor Match	**mištanim** ke-xol ha-nir'e **ha-minun** šel **ha-kadurim**. change.PL probably the-dosage of the-pills.PL

"The psychiatric report showed that the dosage of the pill(s) probably change every morning".

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



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