

## Feature distortion is not limited to upward percolation

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Agreement attraction occurs when a verb erroneously agrees with a structurally irrelevant distractor noun (e.g., *The key to the cabinets were rusty*), in production [1] and comprehension [2–3]. In *retrieval-based accounts*, attraction is modeled as mis-retrieval of a morphologically matching distractor noun by the verb [4]. In *representational accounts*, e.g., Marking & Morphing (M&M) [5], attraction arises when the features of an embedded noun percolate upward within the phrase, affecting the node that controls agreement. However, M&M is challenged by findings that attraction also occurs in relative clauses (RCs), where the distractor is the RC head, i.e., lies outside the subject phrase [2] (e.g., *The drivers who the runner wave to...*) (see also [6]).

We compare gender agreement errors in Hebrew comprehension across possessive and RC constructions. In addition to standard gender attraction, we test for *composite* attraction, where an ungrammatical verb matches a conjunction of marked features across nouns [7] (Table 1), i.e., the agreement target is M.PL, the distractor is F.SG, and the verb is F.PL. Retrieval-based accounts do not predict composite attraction errors, namely, they do not predict a contrast between *Composite* and *No match* (Table 1), as in both cases the target and distractor mismatch only one of the verb's features. On the other hand, representational accounts uniquely predict *Composite* agreement errors: Even if a distractor doesn't fully match the verb, its marked feature is predicted to affect the target's representation, erroneously licensing the verb.

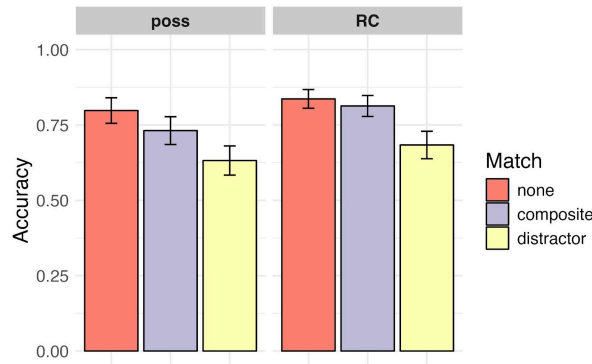
**Methods.** 163 Hebrew speakers (31 excluded) participated in a binary speeded grammaticality judgment task. In 36 item sets with plural feminine verbs, we crossed: *Structure* (*RC* or *poss*) and *Match*, such that the ungrammatical verb either matches the *Distractor*, a *Composite* across the target and the distractor, or *None* (Table 1).

**Results.** Accuracy (Figure 1, Table 2) was lower in *Composite* compared to *None*, providing evidence for composite attraction. Accuracy in *Composite* was higher than in *Distractor*, suggesting that fully matching distractors are more illusory. Crucially, interactions with *Structure* were weak and non-reliable. An estimated Bayes factor of  $BF=414.46$  provides extreme evidence against an interaction of composite attraction with *Structure* (although it is weak in RCs). Moreover, RT data (Figure 2, Table 3) indicate a slowdown in *Composite* compared to *None*, which was larger for *poss* than *RC*; and similar RTs across *Distractor* and *Composite*.

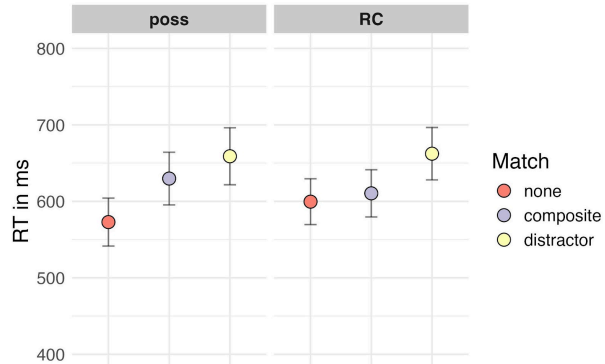
**Discussion.** Our results replicate the composite attraction effect [7], as accuracy was lower in *Composite* conditions— when the target and distractor each partially match the verb, but a conjunction of their marked features licences the verb— compared to *None*, where both nouns partially match the verb in the same features. Most crucially, composite attraction is also observed in RCs, suggesting that feature distortion is not limited to upward percolation within the noun phrase. Composite attraction in RCs is not predicted by either retrieval-based accounts— which predict similar error rates across *Composite* and *None*, as the distractor in both conditions is equally attractive— or by M&M, which restricts feature distortion to complex noun phrases. Instead, our results motivate alternative formulations of representational interference which do not implicate upward percolation, such as [8]. Under [8], agreement and composite attraction across constructions receive a unified account: Both result from erroneously binding a distractor's marked feature (in this case, +F) to the subject position targeted by the verb for agreement. The fact that accuracy was lower in *Distractor* compared to *Composite* conditions potentially implicates both encoding and retrieval [9], or may be due to the presence of overtly matching morphology, which may have a privileged role in the representation of agreement.

**Table 1.** Example set (final phrase shortened from original).

| <i>Possessive</i>           |                        |                                |                                |                   |   |
|-----------------------------|------------------------|--------------------------------|--------------------------------|-------------------|---|
| Composite match             | hevanti<br>I.undersood | še-ha-ovdim<br>that-the-worker | šel ha-orexet<br>of the-editor | me'akvot<br>delay | et ha-pirsum ...<br>ACC the-publication |
| Distractor match            | hevanti<br>I.undersood | še-ha-ovdim<br>that-the-worker | šel ha-orexot<br>of the-editor | me'akvot<br>delay | et ha-pirsum ...<br>ACC the-publication |
| No match                    | hevanti<br>I.undersood | še-ha-ovdim<br>that-the-worker | šel ha-orexim<br>of the-editor | me'akvot<br>delay | et ha-pirsum ...<br>ACC the-publication |
| <i>Relative clause (RC)</i> |                        |                                |                                |                   |   |
| Composite match             | hevanti<br>I.undersood | et ha-orexet<br>ACC the-editor | še-ha-ovdim<br>that-the-worker | me'akvot<br>delay | me-pirsum ...<br>from-publishing        |
| Distractor match            | hevanti<br>I.undersood | et ha-orexot<br>ACC the-editor | še-ha-ovdim<br>that-the-worker | me'akvot<br>delay | me-pirsum ...<br>from-publishing        |
| No match                    | hevanti<br>I.undersood | et ha-orexim<br>ACC the-editor | še-ha-ovdim<br>that-the-worker | me'akvot<br>delay | me-pirsum ...<br>from-publishing        |



**Figure 1.** Mean accuracy in speeded grammaticality (SEM bars).



**Figure 2.** Mean RTs in accurate trials (SEM bars).

|                            | Est.         | Est. Err    | I-95% CI     | u-95% CI     |
|----------------------------|--------------|-------------|--------------|--------------|
| Match1:<br>Comp vs<br>None | <b>-0.38</b> | <b>0.12</b> | <b>-0.63</b> | <b>-0.14</b> |
| Match2:<br>Dist vs<br>Comp | <b>-0.73</b> | <b>0.12</b> | <b>-0.98</b> | <b>-0.50</b> |
| Structure                  | <b>-0.15</b> | <b>0.05</b> | <b>-0.26</b> | <b>-0.04</b> |
| Match1 ×<br>Structure      | -0.15        | 0.11        | -0.36        | 0.05         |
| Match2 ×<br>Structure      | 0.11         | 0.10        | -0.08        | 0.31         |

**Table 2.** brms output for accuracy in grammaticality.

|                            | Est.        | Est. Err    | I-95% CI    | u-95% CI    |
|----------------------------|-------------|-------------|-------------|-------------|
| Match1:<br>Comp vs<br>None | <b>0.04</b> | <b>0.02</b> | <b>0.01</b> | <b>0.08</b> |
| Match2:<br>Dist vs<br>Comp | 0.07        | 0.02        | -0.01       | 0.01        |
| Structure                  | 0.00        | 0.00        | -0.01       | 0.01        |
| Match1 ×<br>Structure      | <b>0.04</b> | <b>0.01</b> | <b>0.00</b> | <b>0.07</b> |
| Match2 ×<br>Structure      | -0.01       | 0.01        | -0.05       | 0.02        |

**Table 3.** brms output for RTs in accurate trials.

[1] Bock & Miller (1991) *Cogn. Psychol.* [2] Wagers, Lau, & Phillips (2009) *JML*. [3] Pearlmutter, Garnsey, & Bock (1999) *JML*. [4] Lewis, Vasishth, & Van Dyke (2006) *TICS*. [5] Bock, Eberhard, Cutting, Meyer, & Schriefers. (2001) *Cogn. Psychol.* [6] Hartsuiker, Antón-Méndez, & van Zee (2001) *JML*. [7] Cartner, Keshev, Lipitz, Dillon, & Meltzer-Asscher (2024) *AMLAP*. [8] Keshev, Cartner, Meltzer-Asscher, & Dillon (2024) *TopiCS*. [9] Yadav, Smith, Reich, & Vasishth (2023) *JML*.