Variability in the agreement attraction effect

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Agreement attraction is an effect that has been extensively reported across different structures and languages [1-3]. This effect predicts that, for sentences like (1a), the ungrammatical verb (*were*) will be read faster and be judged more acceptable if there is an intervening plural noun (*sharpshooters*) between the singular subject and the verb, compared to when the intervening noun is singular. Some recent findings, however, found cases of null attraction effects and questioned the robustness of the effect [4]. Through a series of four experiments, the current study also found a null result for the standard number agreement attraction effect. The null results call for more work in understanding the variability and reliability of the agreement attraction effect.

Design and procedure. All four experiments are self-paced reading experiments conducted on Ibex Farm [5], with native English speakers recruited from Prolific.co. After reading each sentence, participants gave an acceptability judgment on a 1-7 scale (with 7 being the most acceptable). **Experiments 1-3** have a subject relative clause (SRC) structure, in the form of *NP1 who VERB NP2 (adverb) was/were …,* with the subject NP1 always in the singular form. In a 2x2 design, we varied Grammaticality (was vs. were) and Distractor Noun (singular vs. plural NP2) The stimuli for **Experiment 1** (subj n=58; item n=48) are adapted from [3], and an example is given in (1a). **Experiment 2** (subj n=59; item n=48) removed the adverb before the critical verb to reduce the distance between the verb and the distractor NP2 (1b). **Experiment 3** (subj n=61; item n=48) further removed the adjective modifiers on both NP1 and NP2, so that there are fewer encoding features to distinguish the two nouns (1c). The modifications on Experiment 2 and 3 are designed to maximize the chances of the agreement attraction effect. **Experiment 4** (subj n=81; item n=48) has the same 2x2 design as Experiment 3, but we looked at the object relative clause structure (ORC), in the form of *NP1 who NP2 VERB,* which placed the distractor noun NP2 in the embedded subject position within the relative clause (1d).

Results. For the **acceptability judgment tasks**, we performed a linear mixed-effects model on the ratings, with Grammaticality, Distractor Noun, and their interaction as fixed effects, and maximum by-participant and by-item random intercepts and random slopes that led to model convergence. Both Grammaticality and Distractor NP factors are sum coded. We found a standard number agreement attraction effect in all four experiments (Fig. 1), which appeared as an interaction between Grammaticality and Distractor Noun, such that ungrammatical conditions were rated higher when the distractor was a plural noun ($|t|>2$ for all experiments). However, we found no evidence of attraction in **the online reading measures**. For the reading time (RT) analysis, we performed linear mixed-effects models on the log-transformed RTs in the critical region (*was/were*) and the spill-over region. The models included the same fixed effects and random effects as the ones used in the judgment tasks. As shown in Fig. 2, across all four experiments, the only consistent effect is the grammaticality effect on the critical verb region, with ungrammatical conditions read slower than the grammatical conditions ($|t|>2$ for all experiments). There were no other consistent effects, and there was no evidence in any experiment for the standard number agreement attraction effect, which would have been demonstrated by faster RTs on the ungrammatical condition with a plural distractor noun than the ungrammatical condition with a singular distractor noun.

In summary, we did not find the standard number agreement attraction effect in online RTs in SRC and ORC constructions. This is in line with the recent results in [4] but is inconsistent with many previous studies that showed the effect (e.g., see a review in [6]). This difference in results across studies on agreement attraction might be due to differences in the constructions tested or the tasks used in these tasks (e.g., [4, 6]). The variability of the number agreement attraction effect across different studies calls for more nuanced investigations of the processing mechanisms involved in this phenomenon. We are currently running a follow-up study to better understand the process involved.

References. [1] Pearlmutter et al. 1999. JML. [2] Wagers et al. 2009. JML. [3] Dillon et al. 2013. JML. [4] Parker & An. 2018. Fpsyg. [5] Drummond. 2013. *http://spellout.net/ibexfarm* [6] Hammerly et al. 2019. Cog Psy.

(1) A sample of experimental sentences. *Slash (/) indicates the SPR regions
   a. **Experiment 1**: The cruel hunter / who accompanied / the accurate sharpshooter(s) / surely / {was/were} / capable / of finding / deer / in / the forest.
   b. **Experiment 2**: The cruel hunter / who accompanied / the accurate sharpshooter(s) / {was/were} / capable / of finding / deer / in / the forest.
   c. **Experiment 3**: The hunter / who accompanied / the sharpshooter(s) / {was/were} / capable / of finding / deer / in / the forest.
   d. **Experiment 4**: The sharpshooter / who / the hunter(s) / accompanied / {was/were} / capable / of finding / deer / in / the forest.
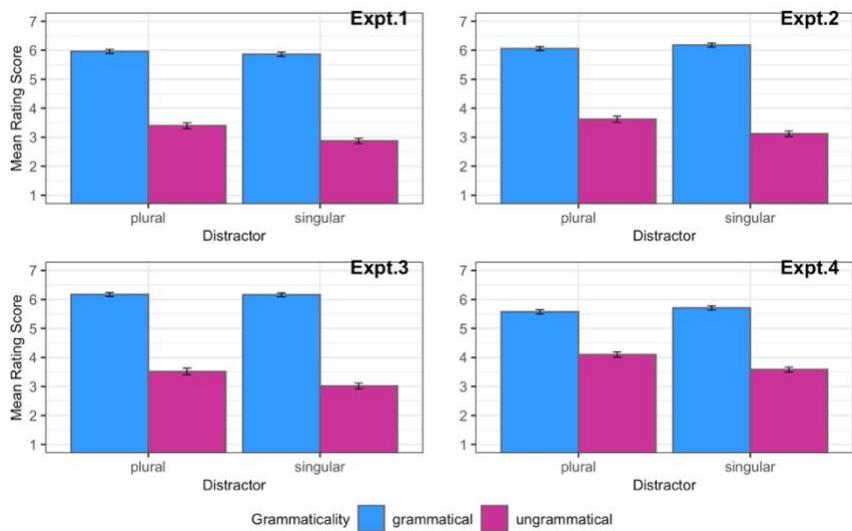

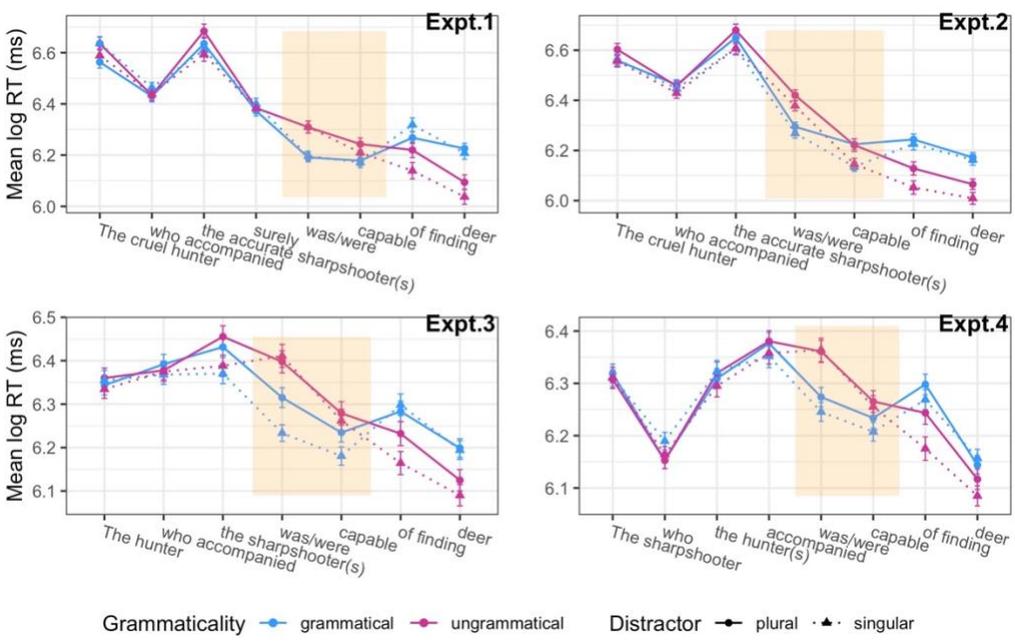**Figure 1**. Mean acceptability rating scores (Experiment 1-4).

Figure 2. Mean log reading times (Experiment 1-4).