When do we plan agreement: Evidence from unaccusatives and agreement attraction

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Recent research in language production suggests that speakers' planning scope is shaped by syntactic dependencies.[1-3] For example, Momma and Ferreira[2] used an extended picture-word interference task (Fig1A) to measure sentence initiation times, finding that participants planned the verb in advance when producing sentences with an unaccusative verb, whose subject is patient-like (e.g., *The octopus below the spoon is boiling*), compared to an unergative verb (agent-like subject). These findings raise a key question about the timing of inflectional planning: do participants plan only the verb, or also its inflectional morphology, specifically number agreement? In principle, agreement could be planned as soon as the verb is accessed (eager agreement) or immediately before production (just-in-time agreement). In two experiments, we tested these hypotheses by combining advance verb planning with a long-standing and robust phenomenon known as agreement attraction. Speakers often make systematic errors in establishing number agreement between a verb and its agreement controller when another noun phrase (the attractor) with a different number intervenes.[4,5] Importantly, MF also showed that initiation times were unaffected by semantically related nouns for the second noun, such as *spoo*, suggesting participants did not plan the second noun while planning the unaccusative verb. We ask whether the probability of agreement attraction errors is greater in sentences with unergative verbs than unaccusative verbs, given that they may be planned later. **Exp1** directly replicated MF's extended picture-word interference task in which participants described scenes while distractors verbs were superimposed (see Fig1A). To further increase attraction errors, we also conducted a simpler picture description task without semantic interference (**Exp2**, Fig1B). Since unaccusative verbs are planned prior to the attractor (e.g., *spoon*), we predicted that if agreement is planned along with the verb, attraction rates would differ by verb type, with fewer errors for unaccusative verbs. However, the results did not confirm this prediction and instead showed that planning of the verb and its agreement morphology proceeds independently. **Exp1 (N=74).** The stimuli followed a 2x2x2 design (see Table1), manipulating VERBTYPE (unaccusative vs. unergative), DISTRACTOR NUMBER (sg vs. pl), and SEMANTIC RELATEDNESS of the distractor to the target verb (related vs. unrelated). Exp1 results (Fig2A) showed that participants made comparable numbers of agreement errors in both unaccusative ($\Delta_{PL\text{-}SG}$M=0.02 [0.01, 0.03]) and unergative conditions ($\Delta_{PL\text{-}SG}$M=0.01[0.00,0.02]). Our Bayesian GLM analysis confirmed this pattern by revealing no interaction between DISTNUM and VERBTYPE (β=−0.06;CI=[−2.61;2.58];P(β>0)=.47). However, the overall attraction rate was significantly lower than in previous picture description experiments,[6] raising concerns about the strength of the effect. To boost attraction effects, we modified the visual cue to highlight the entire scene rather than just the head noun, and we ensured that attractors could plausibly serve as target controllers. **Exp2 (N=66)**. The stimuli again followed a 2x2x2 design (see Table2), manipulating VERBTYPE, DISTNUM, and HEADNUMBER (sg vs. pl). Results from Exp2 (Fig2B) again showed that participants produced a similar number of errors across unaccusative ($\Delta_{PL\text{-}SG}$M = 0.10 [0.06, 0.14]) and unergative conditions ($\Delta_{PL\text{-}SG}$M = 0.09 [0.05, 0.13]), a finding confirmed by our Bayesian model as a lack of interaction (β = 0.06; CI = [−3.30; 3.49]; P (β > 0) =.51). Finally, our timing results from Exp2 showed an interesting pattern. While unergatives were unaffected from the number of the distractor ($\Delta_{PL\text{-}SG}$M = -19.27 [-91.29, 52.76]), participants took more time to start uttering the sentence with mismatching numbers only in unaccusatives (M=1300.67,SE=23.17), compared to matching condition (M=1247.07,SE=25.65). Our exGaussian Bayesian GLMs (Fig4A&B) verified this effect with a moderate interaction in singular (β=26.02;CI=[−22.02;73.83];P(β>0)=.86)) and plurals (β=−28.26;CI=[−73.51; 17.33]; P(β<0)=.89). Our preliminary results suggest that although speakers may plan unaccusative verbs earlier than unergative verbs, agreement morphophonology, that is prone to attraction errors, is planned separately and late. However, participants seem to be engaging in an early morphosyntactic planning that does not reflect attraction errors.

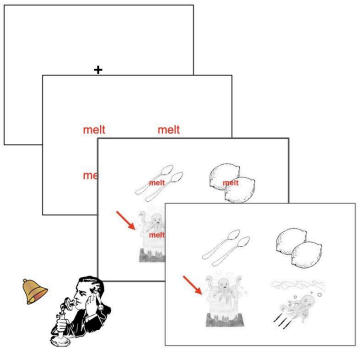

Fig1A: Extended Picture Work Paradigm. Participants initially saw either related or unrelated verbs written. Later, pictures are presented and participants are asked to describe the relevant scene.

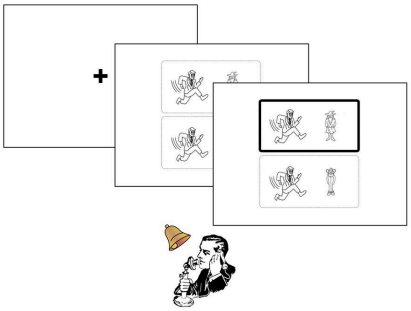

Fig1B: Participants are shown two scenes where the main action is the same, but differentiated by the 'attractors.' After a brief period, they were randomly asked to describe one of the scenes.

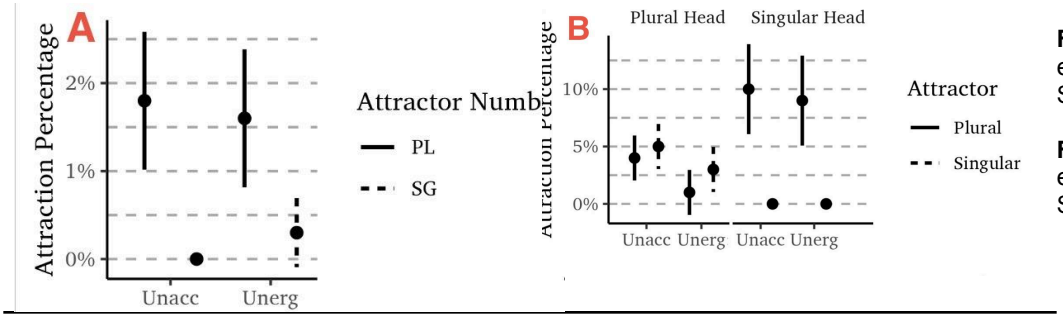

Fig2A: Mean percentage of erroneous agreement in Exp1 and 2 SE bars.

Fig2B: Mean percentage of erroneous agreement in Exp2 and 2 SE bars.

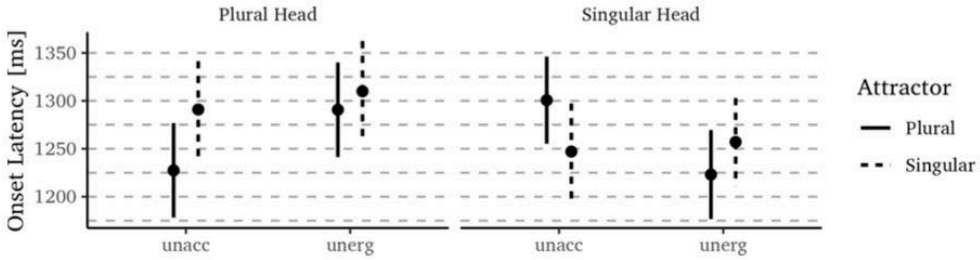

Fig3: The average onset times according to the experimental conditions in our Exp2.

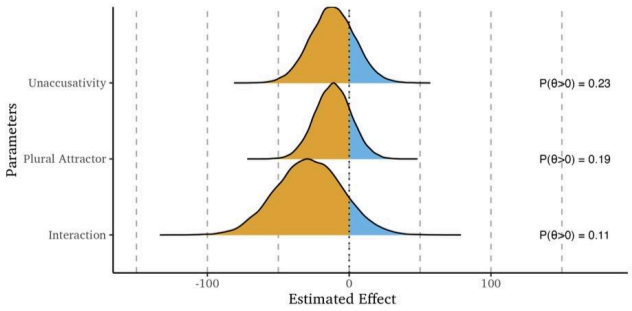

Fig4A: Posterior distribution and the degree of belief for the exGaussian regression coefficients for the model of onset latencies in Exp2 with **plural heads** only.

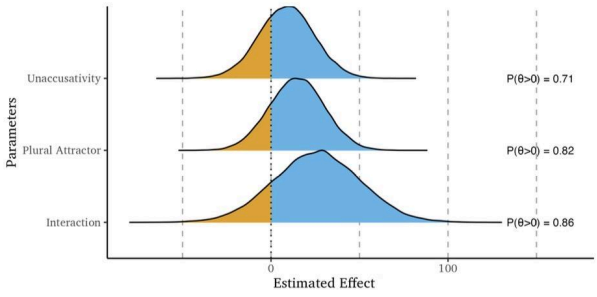

Fig4B: Posterior distribution and the degree of belief for the exGaussian regression coefficients for the model of onset latencies in Exp2 with **singular heads** only.

Verb Type	Target Sentence	Related	Unrelated
Unaccusative	The octopus under the spoon/spoons is boiling	melt	fall
Unergative	The octopus under the lemon/lemons is swimming	run	smile

Table 1: Target sentences for experiment trials for Exp1

Verb Type	Target Sentence
Unaccusative	The wizard/wizards by the doctor/doctors is/are boiling
Unergative	The wizard/wizards by the doctor/doctors is/are swimming

Table 2: Target sentences for experiment trials for Exp2

References: **[1]** Bock 1986] **[2]** Momma & Ferreira 2019 **[3]** Momma & Yoshida 2023 **[4]** Bock & Miller 1991 **[5]** Eberhard et al. 2005 **[6]** Kandel Phillips 2022