

Introduction

► Much theorizing about agreement dependencies comes from AGREEMENT ATTRACTION ERRORS:

(1) [NP The key [PP to the cabinets]] are on the table. (Bock & Miller, 1991)

- However, the majority of these studies assume number and gender behave identically
- Notable exceptions: Badecker & Kuminiak (2007) and Lago, *et al.* (2015)
- For reasons specific to the grammars of Slovak & Spanish, no one has isolated gender from case in verbal agreement morphology.

Experiment 1 — Design

Subjects:

- 104 native speakers of Arabic (104 females; mean age 20.4 years)
- Subjects < 70% accurate on comprehension Q's excluded

Stimuli:

► 48 item sets in Modern Standard Arabic (MSA) of the form:
NP Subj – Complementizer – RC Verb – NP Attr – Adv/PP – Verb – Continuation

► Adverb inserted to avoid Attr spillover effects (Wagers, *et al.*, 2009)

► Systematically manipulated for:

- ATTRACTOR MATCH: Yes, No (Attr) (MATCH)
- VERB GRAMMATICALITY: Grammatical, Ungrammatical (Verb) (GRAM)

► Critical verbs balanced for tense/aspect (perfect/imperfect)

► Diacritics only used for lexical disambiguation; short-vowel case markers not written

► All feminines created from masculines by suffixation (ʔ-/a)

► All subjects masculine, so NoMATCH = NP_[FEM] & UNGRAM = V_[FEM]:

(2) a. المترجم الذي ساعد المدير احيانا يتكلم خمس لغات بفضاحة.
b. *ʔal-mutarjīm-u* ʔallaḏii saaʔad-a ʔal-muḏiir-a ʔahjaanan
the-translator-NOM COMP.MASC.SG helped-3.SG.MASC the-president-ACC often
ja-takallamu xamsata luyaat-in bi-fasʔaahatin.
3.SG.MASC-speaks five languages-ACC with-fluency
“The translator who helped the manager (MASC/FEM) often speaks (MASC/FEM) five languages fluently.”

► Four conditions:

Grammatical Conditions

- MATCH/GRAM masc. attractor, masc. verb
- NoMATCH/GRAM fem. attractor, masc. verb

Ungrammatical Conditions

- MATCH/UNGRAM masc. attractor, fem. verb
- NoMATCH/UNGRAM fem. attractor, fem. verb

Procedure & Analysis:

► Self-paced word-by-word moving window procedure using Linger software (Doug Rohde, MIT)

► Every item followed by a comprehension question (with feedback)

► 1% Winsorization of outliers by region and condition (not by subject)

► Mixed-effects model fitted with experimental variables, orthographic length, and previous region

Predictions:

- Main effect of GRAM in verb region and spillover regions (ungrammatical > grammatical)
- Interaction of GRAM × MATCH in verb and spillover regions (MATCH/UNGRAM > NoMATCH/UNGRAM)
- Perhaps a main effect of MATCH in Attr region (NoMatch > Match; Wagers, *et al.*, 2009)

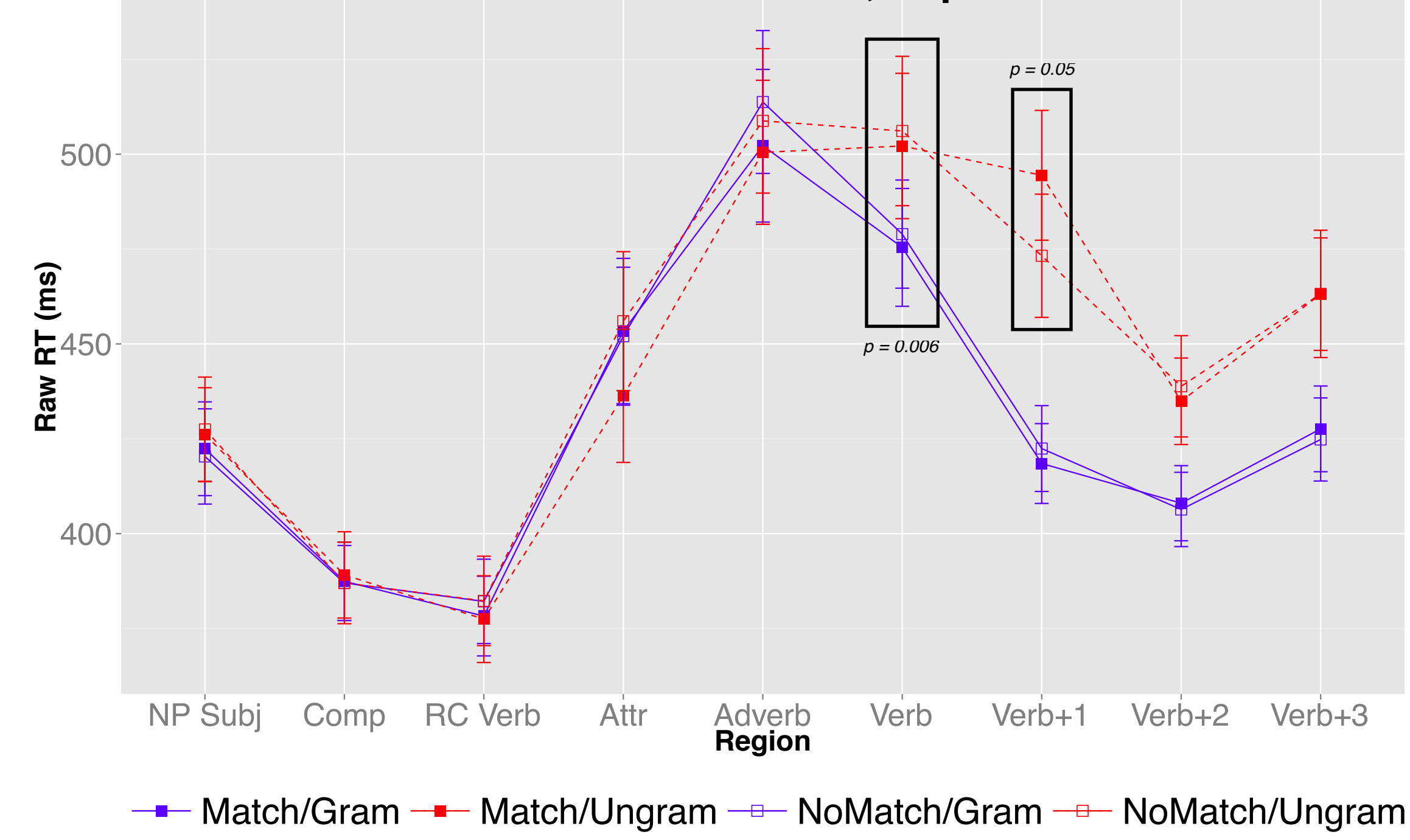
Thanks & Selected References

Acknowledgments — Thanks to Souad Al Helou, Salam Khalifa, and Anas Shahrour for assistance with stimuli creation. Thanks also to Stephen Politzer-Ahles, Kevin Schluter, and Matt Wagers for comments on this project.

Selected References — BADECKER, W. & KUMINIAK, F. 2007. Morphology, agreement and working memory retrieval in sentence production: Evidence from gender and case in Slovak. *JML* 56:65–85. BOCK, K., & MILLER, C.A. 1991. Broken agreement. *Cognitive Psychology* 23:45–93. LAGO, S., SHALOM, D.E., SIGMAN, M., LAU, E.F., & PHILLIPS, C. 2015. Agreement in Spanish comprehension. *JML* 82:133â$#3949. RYDING, K.C. 2005. *A Reference Grammar of Modern Standard Arabic*. Cambridge UP. TUCKER, M.A., IDRISSE, A. & ALMEIDA, D. Representing number in the real-time processing of agreement: Self-paced reading evidence from Arabic. *Frontiers in Psych.* 6:347. WAGERS, M.W., LAU, E.F., & PHILLIPS, C. 2009. Agreement attraction in comprehension: Representations and processes. *JML* 61:206–237.

Experiment 1 — Results

Raw RT in All Conditions, Experiment 1



Attraction errors for verbal gender occur in MSA

Experiment 2 — Design

But: a key component of attraction is *asymmetry with respect to markedness*

► In MSA, feminine is more marked than masculine (Ryding, 2005)

► One expects fewer attraction errors/smaller effects with feminine subjects

► **Experiment 2:** Add a third manipulation (SUBJGEND) of the subject's gender (masc./fem.)

- Result is a 2 × 2 × 2 (still only 48 items)
- SUBJGENDER (masc., fem.) × MATCH × GRAMMATICALITY (gram., ungram.)
- Similarly counterbalanced for tense/aspect
- 24 perfect, 24 imperfect

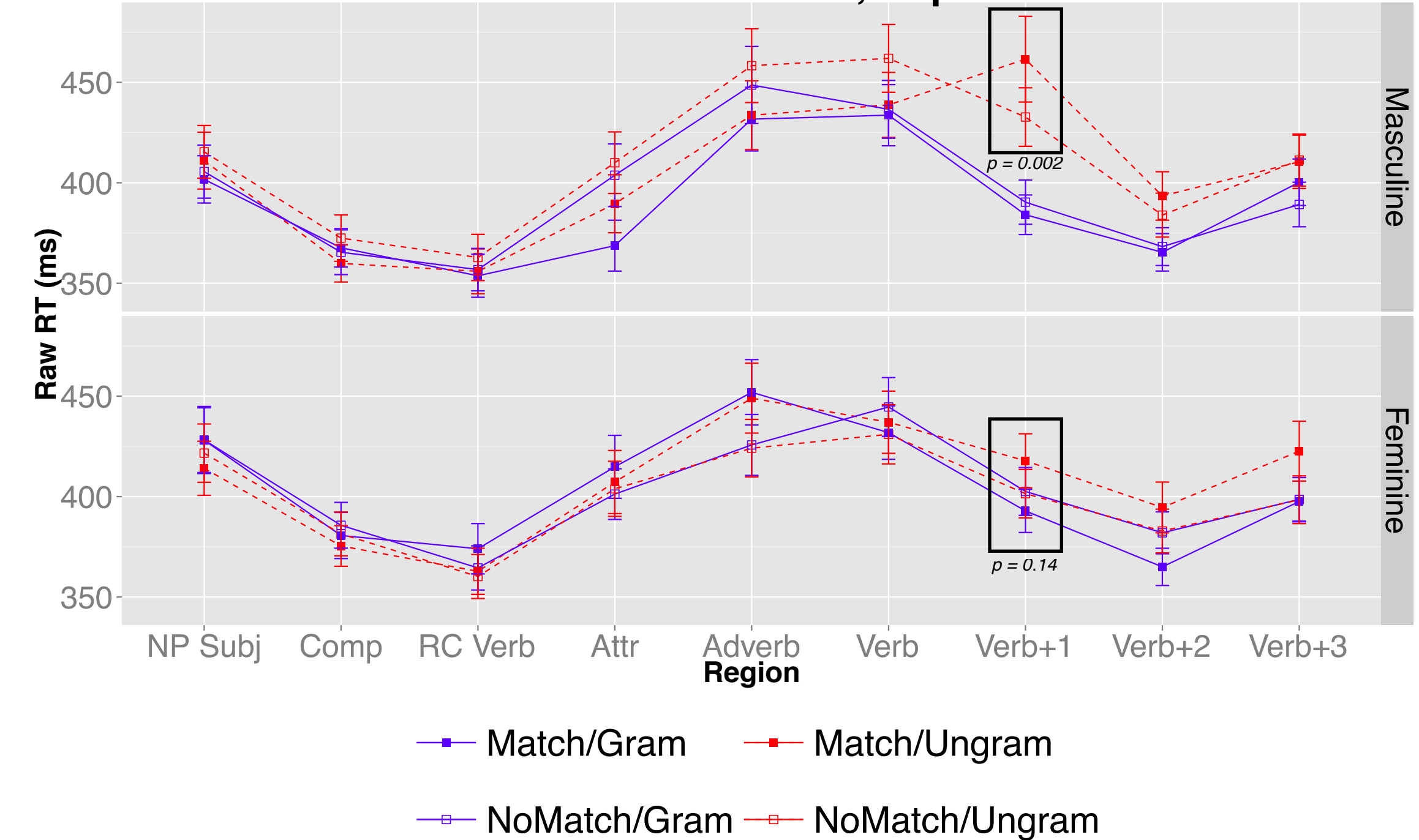
► 128 subjects from UAEU (128 females; mean age 20.4 years) in identical methodology

Predictions:

- Continued main effect of GRAMMATICALITY at the critical verb.
- Continued interaction of GRAMMATICALITY × MATCH
- Added 3-way interaction of GRAM × MATCH × SUBJGEND (Fem/NoMatch/Ungram > Masc/NoMatch/Ungram)

Experiment 2 — Results

Raw RT in All Conditions, Experiment 2



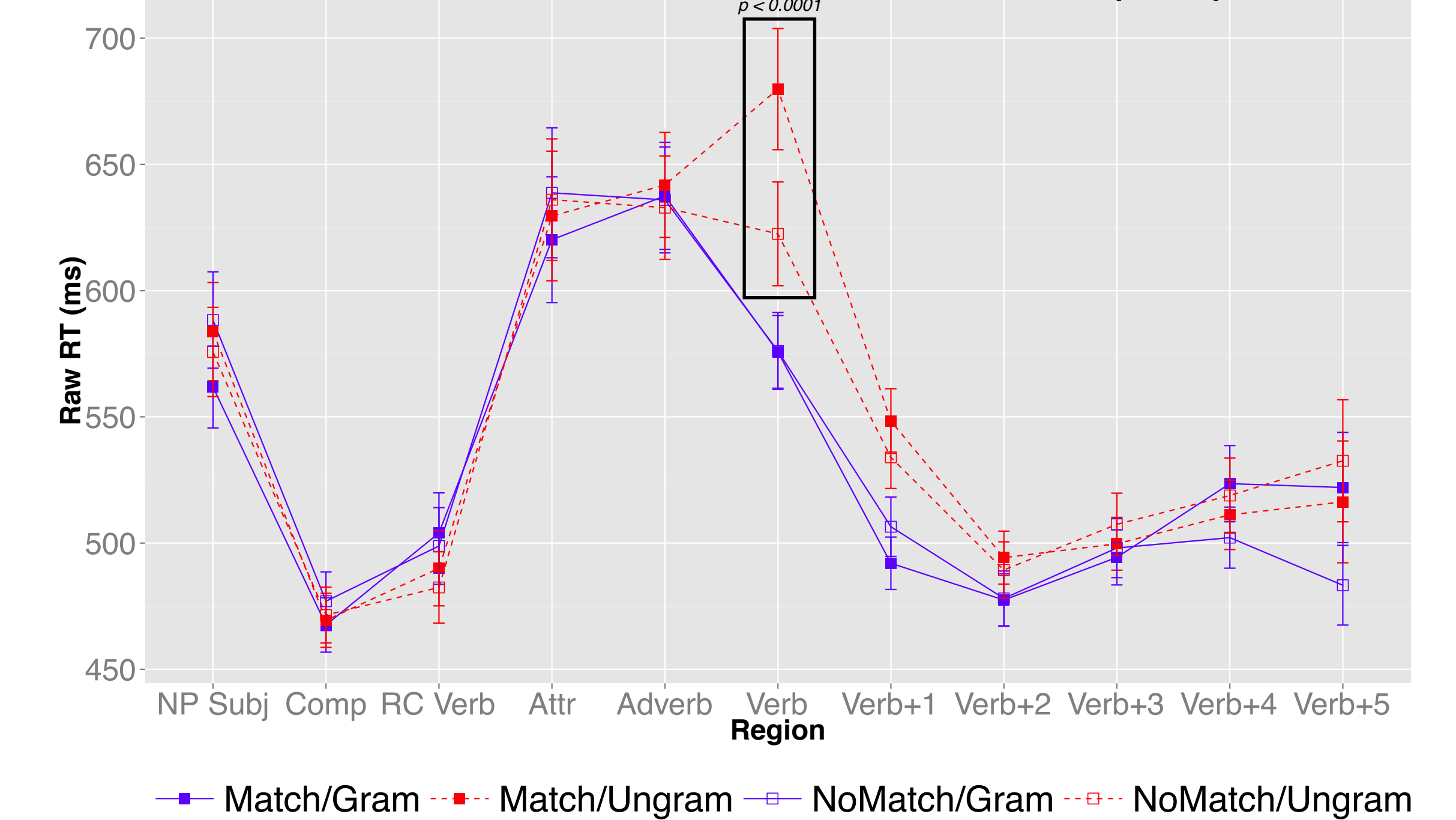
Gender attraction errors are mediated by morphological markedness

Additional Considerations

Issue 1: The timing of the gender effect is consistently delayed

- Not uncommon for SPR effects to spill-over...
- But the effect replicates. 3 number studies in our lab give timing as in Tucker *et al.*, 2015:

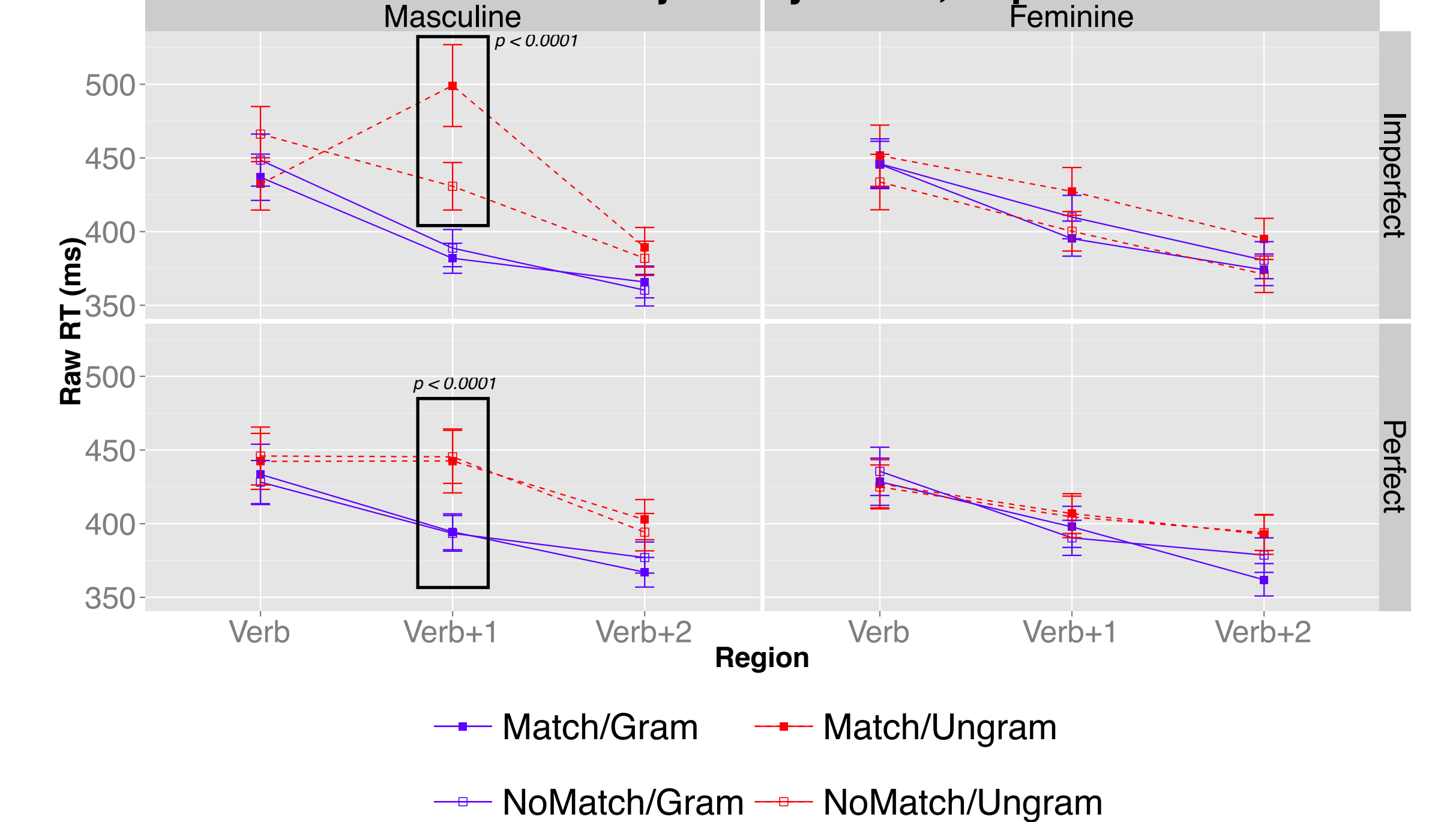
Raw RT in All Conditions – Tucker, et al. (2015)



Issue 2: Recall the counterbalancing for gender = {perfect, imperfect}

- Consistently counterbalanced in all our studies (incl. those for number); never a determinant of reading time
- Until this study, and only for masculine subjects:

Raw RT w/ All Subjects by Tense, Experiment 2



- Hard to attribute to orthography: gender appears *before* number in affix order (in the imperfect; Ryding, 2005)
- E.g. *ja-takallam-u/3.MASC-√SPEAK-SG* vs. *ta-takallam-u/3.FEM-√SPEAK-SG*, “he/she speaks”

Discussion & Conclusions

Conclusions:

- Gender error profiles track number profile errors in isolation of {case, category, ...}
- Grammaticality effects appear earlier than attraction effects (Lago, *et al.*, 2015)
- Gender errors are possibly recognized *later* than number errors
- No evidence for a “gender complexity effect” ≈ plural effect in Wagers, 2009
- ⇒ verbal gender agreement is susceptible to the same kinds of errors seen in verbal number

Future Directions:

- What about nouns with inherent/ablaut-driven gender morphology (*i.e.*, not suffixation)?
- Is the tense-driven effect in Exp. 2 real? If so, is it about tense or agreement morphology?
- Combined number & gender errors should stack additively
- What about tripartite markedness systems (Badecker, 2007)? Arabic has a [DUAL] number
- What about the effect of short vowels not represented by orthography? *Int Malti?*