Do reflexives always find a good antecedent for themselves?

Joseph King, Caroline Andrews & Matthew Wagers
Department of Linguistics • University of California, Santa Cruz

LINGUISTICS
RESEARCH CENTER
UNIVERSITY OF CALIFORNIA SANTA CRUZ

ROUTES TO DEPENDENCY BUILDING IN MEMORY AND GRAMMAR

Phillips, Wagers & Lau (2011)'s Question:
Why are some dependencies formed in a way that's robustly **faithful** to grammatical constraints, while other dependency formation processes are **fallible**, and consider illegal linkages?

For Example:
Argument <u>REFLEXIVE ANAPHORS</u> seem to target the correct antecedents in an interference-robust manner.
Nicol & Swinney (1989), Sturt (2003), Badecker & Straub (2002; Exp. 5-7) Dillon et al. (CUNY2011); **but** *cf. Patil et al. (CUNY2011)*

<u>SUBJECT-VERB AGREEMENT</u> is highly interference-prone.
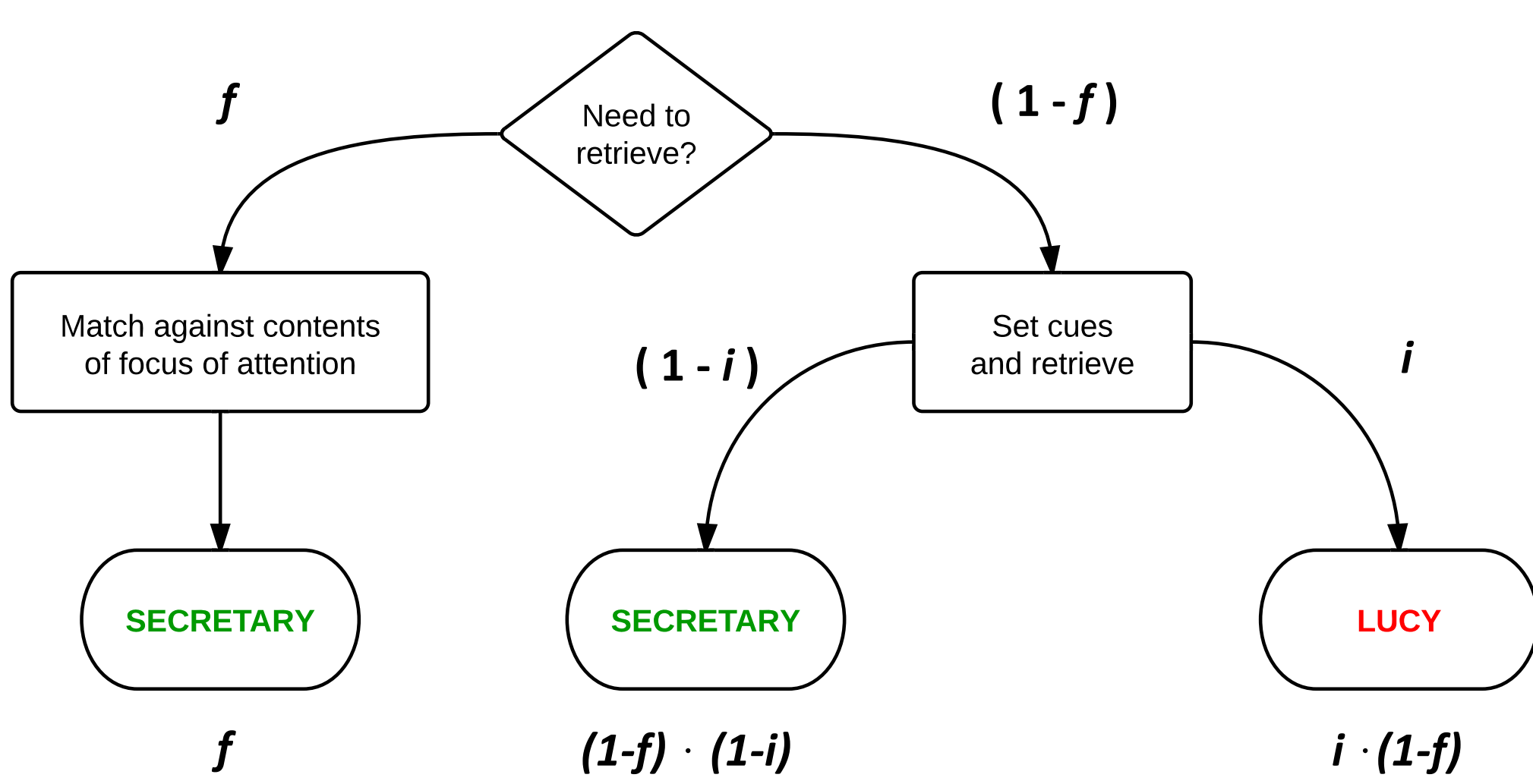*Pearlmutter, Garnsey & Bock (1999), Wagers, Lau & Phillips (2009)*

Candidate Influences:
- Directionality of dependency formation
- Mechanism of memory access
- Dependency type, level of representation
- Nature and number of constraints

CLAIM
Grammatical fidelity is strongly influenced by at least the following two factors:
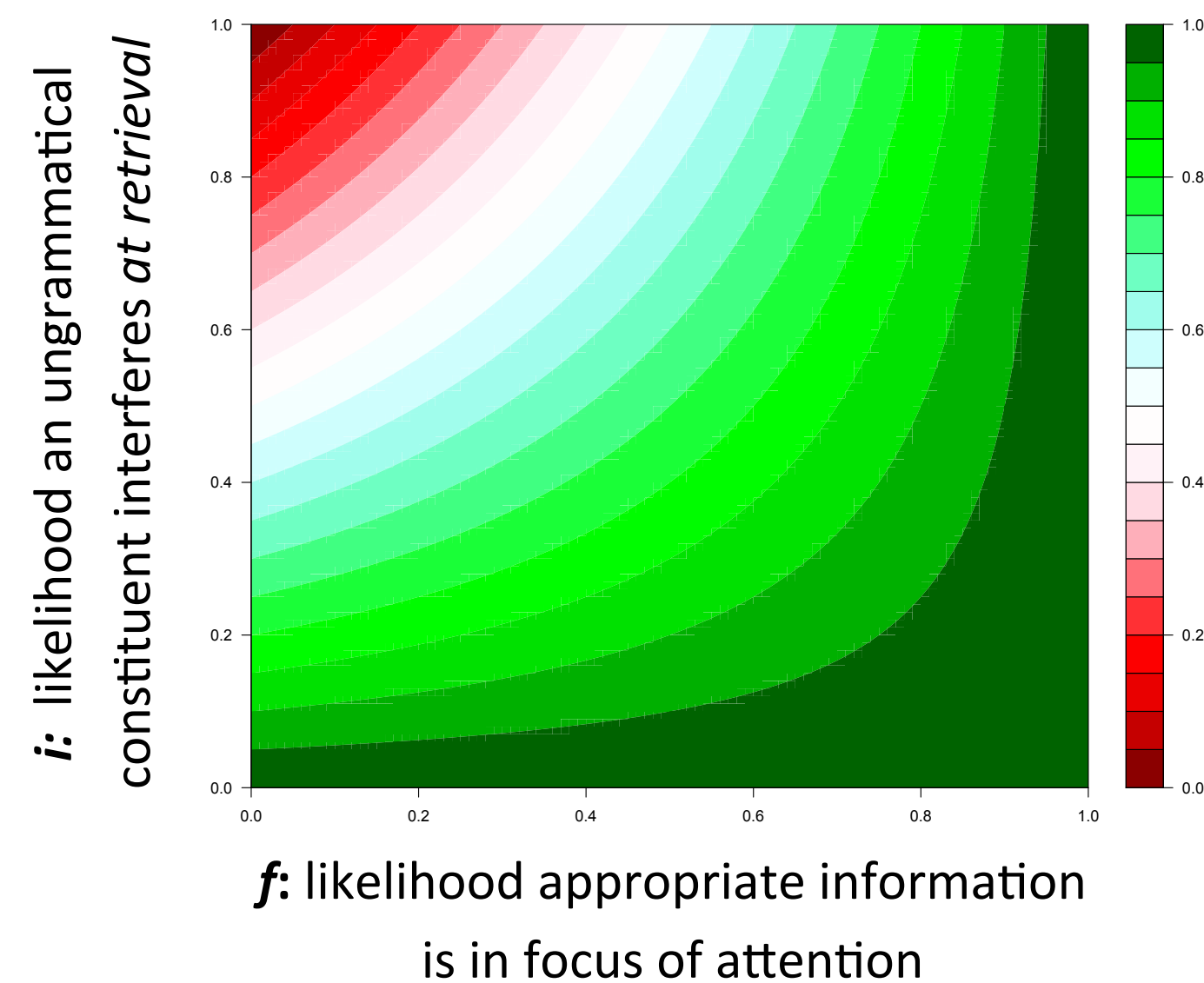- The contents of the **focus of attention** *(McElree, 2006; Wagers & McElree, 2009)*
- The similarity of **candidate dependent encodings** to the **grammatical dependent encoding(s)**
  (Gordon et al., 2002, Van Dyke & Lewis, 2003, Lewis & Vasishth, 2005, Van Dyke & McElree, 2006)

CONSIDER: The **secretary** who encouraged **Lucy** *bought* a cup of coffee for *herself*.

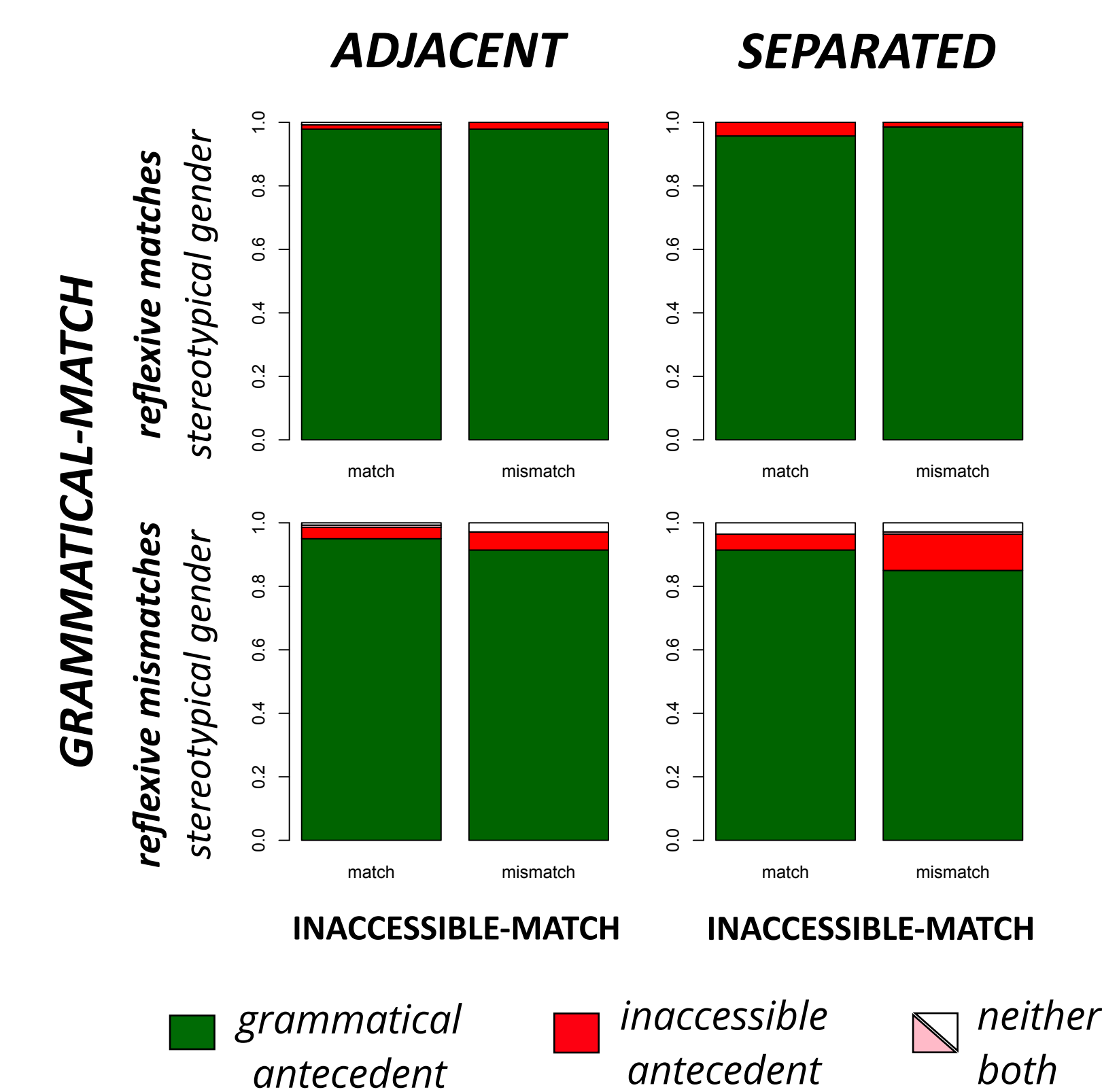*What antecedent will be identified for* <u>*herself*</u>?

Regimes of Fidelity/Fallibility

i: likelihood an ungrammatical constituent interferes *at retrieval*
f: likelihood appropriate information is in focus of attention

BOTH ARGUMENT ANAPHORS have the SAME BINDING POSSIBILITIES

**RESPONSE PROPORTIONS**

BINDING POSSIBILITIES QUESTIONNAIRE
- Mechanical Turk; n = **149**
  Stimuli in same design as real-time studies
- Participants selected the coreference possibilities of a highlighted pronoun or reflexive, from a list of names, descriptions, 'both' or 'neither'
- 8 benefactives, 8 verbs of transfer

- Grammatical antecedent selected **94%** of trials
- GRAMMATICAL MATCH effect: (~6%; p < .001); marginal interaction with INACCESSIBLE MATCH (p < .10)

- **Crucially:** <u>no effects</u> of POSITION or VERB TYPE on antecedent selection

Legend:
■ grammatical antecedent
■ inaccessible antecedent
▨ neither / both

SELF-PACED READING RESULTS
n = 48

Reading the reflexive <u>himself</u> / <u>herself</u> *w+1*
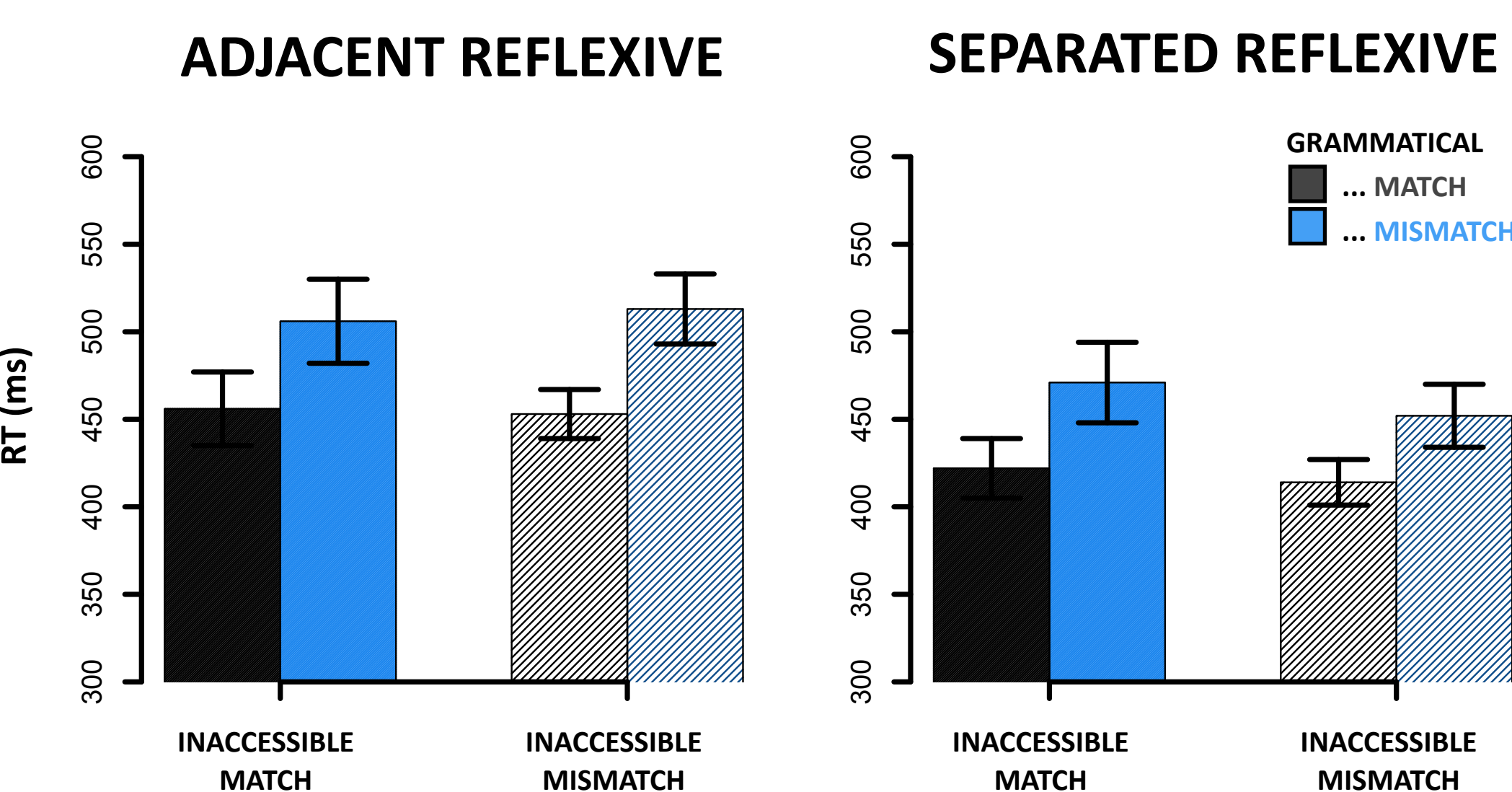
- Reliable effect of **POSITION** (p < .005)
- Reliable effect of **GRAMMATICAL MATCH** (p < .001)
- No effect of INACCESSIBLE MATCH, or interaction with POSITION
- This pattern does not conform to our prediction
- .... but it is also observed at some delay from the reflexive itself; it would be more convincing if we observed it on the reflexive (like Sturt, 2003)

REFERENCES
Badecker, W., & Straub, K. (2002). Journal of Experimental Psychology: Learning, Memory, and Cognition, 28, 748-769.
Lewis, R. L., & Vasishth, S. (2005). Cognitive Science, 29, 375–419.
McElree, B. (2006). In B. H. Ross (Ed.), The psychology of learning and motivation (Vol. 46, pp. 155-200). San Diego: Academic Press.
Nicol, J., & Swinney, D. (1989). Journal of Psycholinguistic Research, 18, 5-19.
Pearlmutter, N. J., Garnsey, S. M., & Bock, J. K. (1999). Journal of Memory and Language, 41, 427-456.
Phillips, C., Wagers, M. W., & Lau, E. F. (2011). In J. Runner (ed.), Experiments at the Interfaces, Syntax & Semantics, vol. 37, pp. 153-186.
Sturt, P. (2003). Journal of Memory and Language, 48, 542-562.
Wagers, M.W., Lau, E. F., & Phillips, C. (2009). Journal of Memory and Language, 61, 206-237
Wagers, M.W., & McElree, B. (2009). Focal attention and the timing of memory retrieval in language comprehension. AMLAP 15, Barcelona.
Van Dyke, J. A., & McElree, B. (2006). Journal of Memory and Language, 55, 157—166.

HYPOTHESIS AND DESIGN

HYPOTHESIS
f, the likelihood that appropriate information is in the focus of attention, is higher at **predicate-adjacent** reflexives than **predicate-separated** reflexives.

DESIGN
Stereotypical gender mismatch design (Sturt, 2003)

REFLEXIVE POSITION: position with respect to V [with same thematic role]
GRAMMATICAL MATCH: match of reflexive to stereotypical gender of subject
INACCESSIBLE MATCH: match of embedded name to subject gender

ADJACENT REFLEXIVE | GRAMMATICAL MATCH/MISMATCH
Inaccessible Match
The **bricklayer** who employed **Gregory** *shipped* **himself/herself** sacks of mortar …
Inaccessible Mismatch
The **bricklayer** who employed **Helen** *shipped* **himself/herself** sacks of mortar …

SEPARATED REFLEXIVE | GRAMMATICAL MATCH/MISMATCH
Inaccessible Match
The **bricklayer** who employed **Gregory** *shipped* sacks of mortar to **himself/herself** …
Inaccessible Mismatch
The **bricklayer** who employed **Helen** *shipped* sacks of mortar to **himself/herself** …

32 item sets, with two counterbalanced multi-argument VP types:
VPs containing <u>verbs of transfer</u> (e.g., *send, give*) and
VPs containing <u>benefactive</u> arguments (with verbs like *buy, draw*, etc.)
Local gender stereotype norms collected in Santa Cruz, CA.

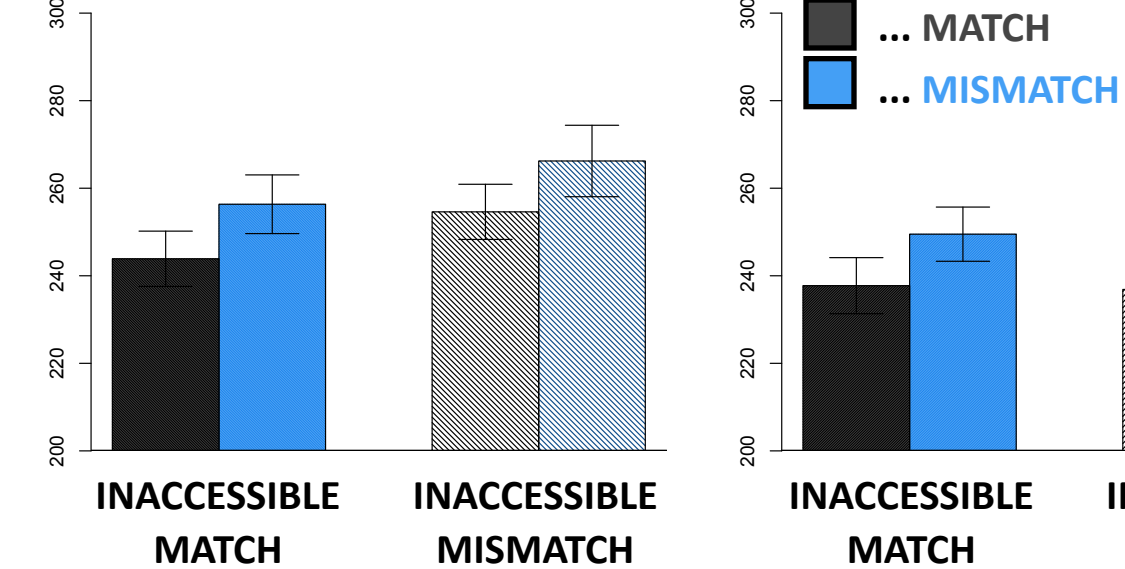**PREDICTION** *assuming* $f_{separated} < f_{adjacent}$ *and* $i_{separated} \gtrsim i_{adjacent}$
In **predicate-separated conditions,** the expected *grammatical-match* effect in reading times should interact more strongly with the levels of *inaccessible-match* than in the **predicate-adjacent conditions**.

EYE-TRACKING RESULTS
n = 48

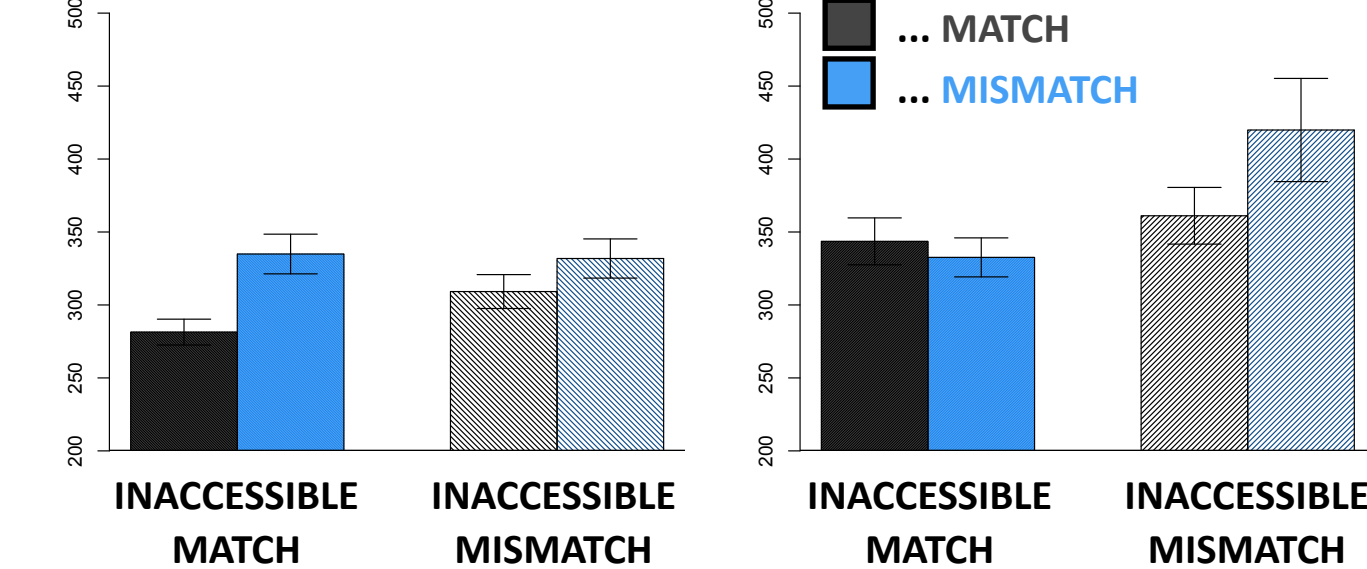**Reading the reflexive** <u>himself</u> / <u>herself</u>

FIRST-FIXATION (ADJACENT REFLEXIVE / SEPARATED REFLEXIVE)
REFLEXIVE POSITION: 13 ms (4 ms), p < .05
GRAMMATICAL MATCH: 10 ms (6ms), p < .10

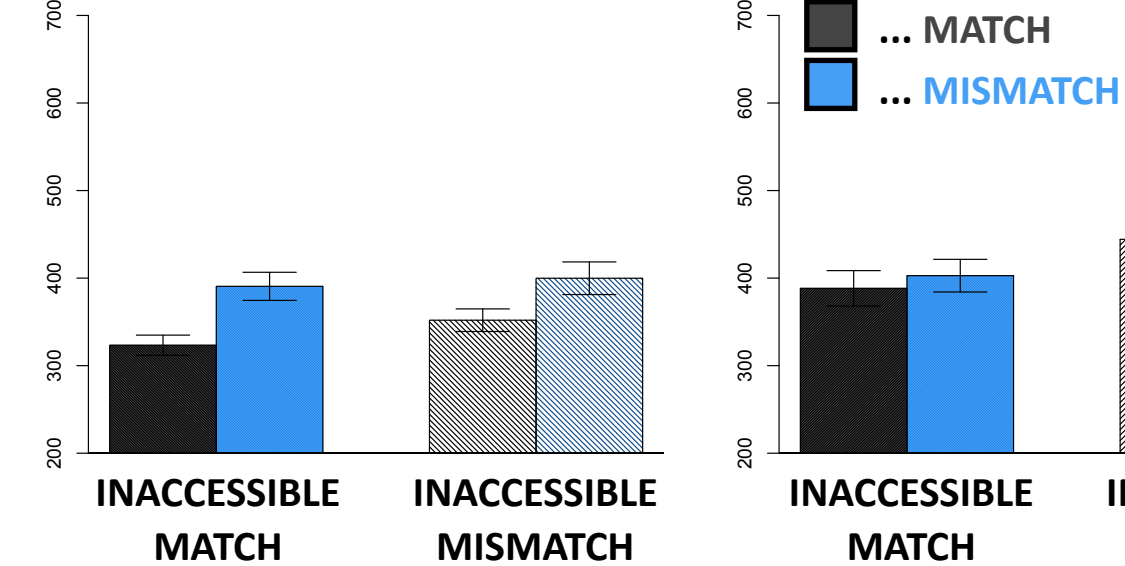**GAZE DURATION** (ADJACENT REFLEXIVE / SEPARATED REFLEXIVE)
REFLEXIVE POSITION: 51 ms (12 ms), p < .001
GRAMMATICAL MATCH: 33 ms (18 ms), p < .01
INACCESSIBLE MATCH: 29 ms (12 ms), p < .05
POSITION × INACCESSIBLE: 42 ms (25 ms), p < .10
POSITION × ACCESSIBLE × INACCESSIBLE: 103 ms (50 ms), p < .05

1. Early sensitivity to GRAMMATICAL MATCH.
2. INACCESSIBLE MATCH sensitivity *depends* on reflexive position.

Identical statistical patterns in go-past times.

GO-PAST (ADJACENT REFLEXIVE / SEPARATED REFLEXIVE)

REGRESSION PROPORTIONS

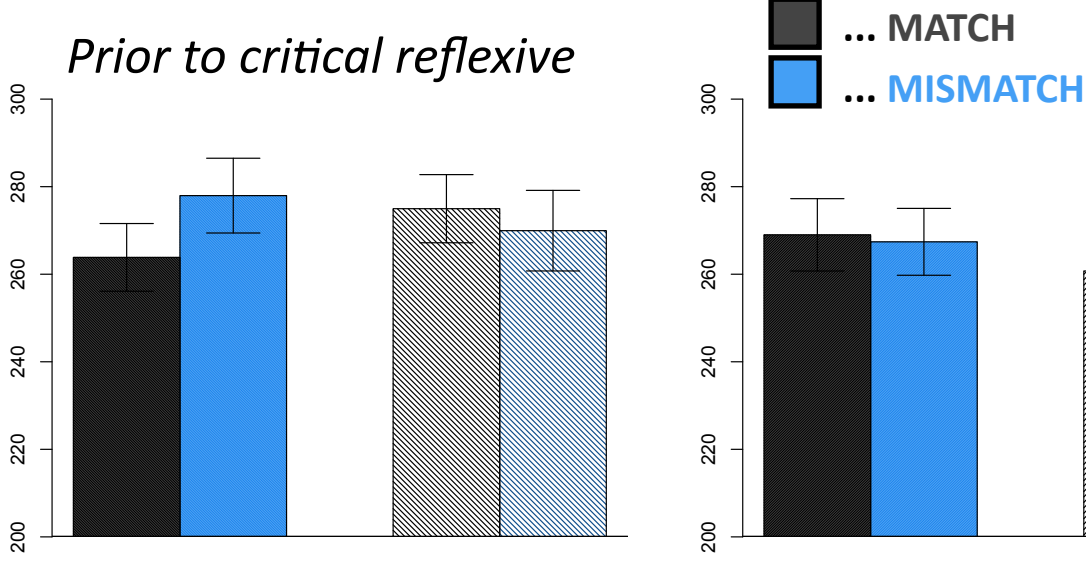| Reflexive position:		ADJACENT	SEPARATED
MATCH	inacc:match	0.20	0.24
	inacc:mismatch	0.19	0.29
MISMATCH	inacc:match	0.25	0.31
	inacc:mismatch	0.24	0.30

More regressions when reflexive mismatches stereotypical gender (5%, p < .05) **and** when separated from the predicate (7%, p < .01).

CONCLUSION: Predicate-separated reflexives showed **less grammatically faithful** early resolution of their antecedent than did predicate-adjacent reflexives, consistent with the claim that grammatical fidelity depends in part on whether two dependents are likely co-active in the focus of attention.
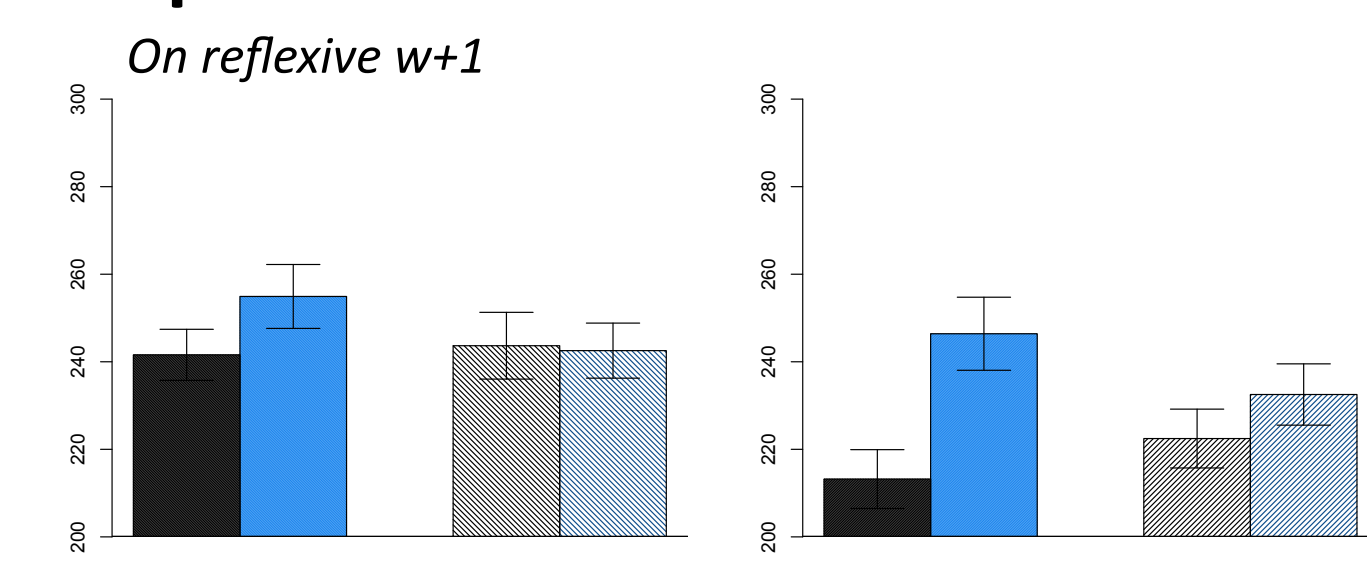
Effects before and after the reflexive

Last fixation *Prior to critical reflexive*

Spill-over first-fixation *On reflexive w+1*

Last fixation (ADJACENT REFLEXIVE / SEPARATED REFLEXIVE)
No reliable effects of experimental manipulations.

Spill-over first-fixation (ADJACENT REFLEXIVE / SEPARATED REFLEXIVE)
REFLEXIVE POSITION: 16 ms (5 ms), p < .001
GRAMMATICAL MATCH: 14 ms (5 ms), p < .005
GRAMMATICAL × INACCESSIBLE: 18 ms (9 ms), p < .10
POSITION × INACCESSIBLE: 16 ms (9 ms), p < .10