Who Gets to Race? The Effect of Initial Bias on Pronominal Ambiguity Advantage

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1. Background: Processing ambiguous pronouns

❖ A pronoun can have more than one syntactically available antecedent.

(1) Brian mentioned to Andy that he would be a great leader of the team.

❖ Grant et al. (2020) showed an **ambiguity advantage effect** for processing ambiguous pronouns.
  ➢ (1) is less costly than its unambiguous counterparts in (2).

(2) a. Brian mentioned to Mary that he would be a great leader of the team.
  b. Grace mentioned to Andy that he would be a great leader of the team.

❖ They argue that this effect can be explained by the **Unrestricted Race Model** (URM) (van Gompel 2001, 2005).
  ➢ The parse that happens to be constructed faster will be adopted.
    ■ The outcome is stochastic.
  ➢ If this parse is later found to be problematic, reanalysis is triggered.
          → additional cost for unambiguous sentences
  ➢ But there is no reanalysis with ambiguity.

❖ URM, however, predicts the ambiguity advantage effect to be conditioned by **initial bias** between the two possible antecedents.
  ➢ Unambiguous sentences are more costly to the extent the parser will choose the incompatible antecedent about **half of the time**.
  ➢ But, if the two antecedents are NOT 'equal' to begin with,
    ■ The biased antecedent will be more selected in both ambiguous and unambiguous conditions.
    ■ Ambiguity advantage is thus predicted to reduce where the biased antecedent is available.
      ● Available = match the features of the pronoun

Prediction
If there is a referent bias for an ambiguous pronoun created by the construction, ambiguity advantage will reduce.

2. Design & Methods

❖ **Three possible antecedents**
❖ **The construction aims to create a matrix-subject bias**
  ➢ Subordinate clause subject + matrix subject + matrix object
  ➢ Subordinate clause: conjunction(when/after/before/as/because) + subject + intransitive verb
  ➢ Main clause: subject + *transfer-of-information* verb + object + embedded clause
❖ **Self-paced reading + comprehension question**
  ➢ 54 target items + 54 filler items
  ➢ 49 college-age participants from UC Santa Cruz
  ➢ 7 conditions (2x2x2 - 1[Mismatch, Mismatch, Mismatch])
  ➢ Pronoun gender and name-to-position assignment were counterbalanced across all itemsets.
  ➢ Names were selected from California Open Data Portal.

3. Results
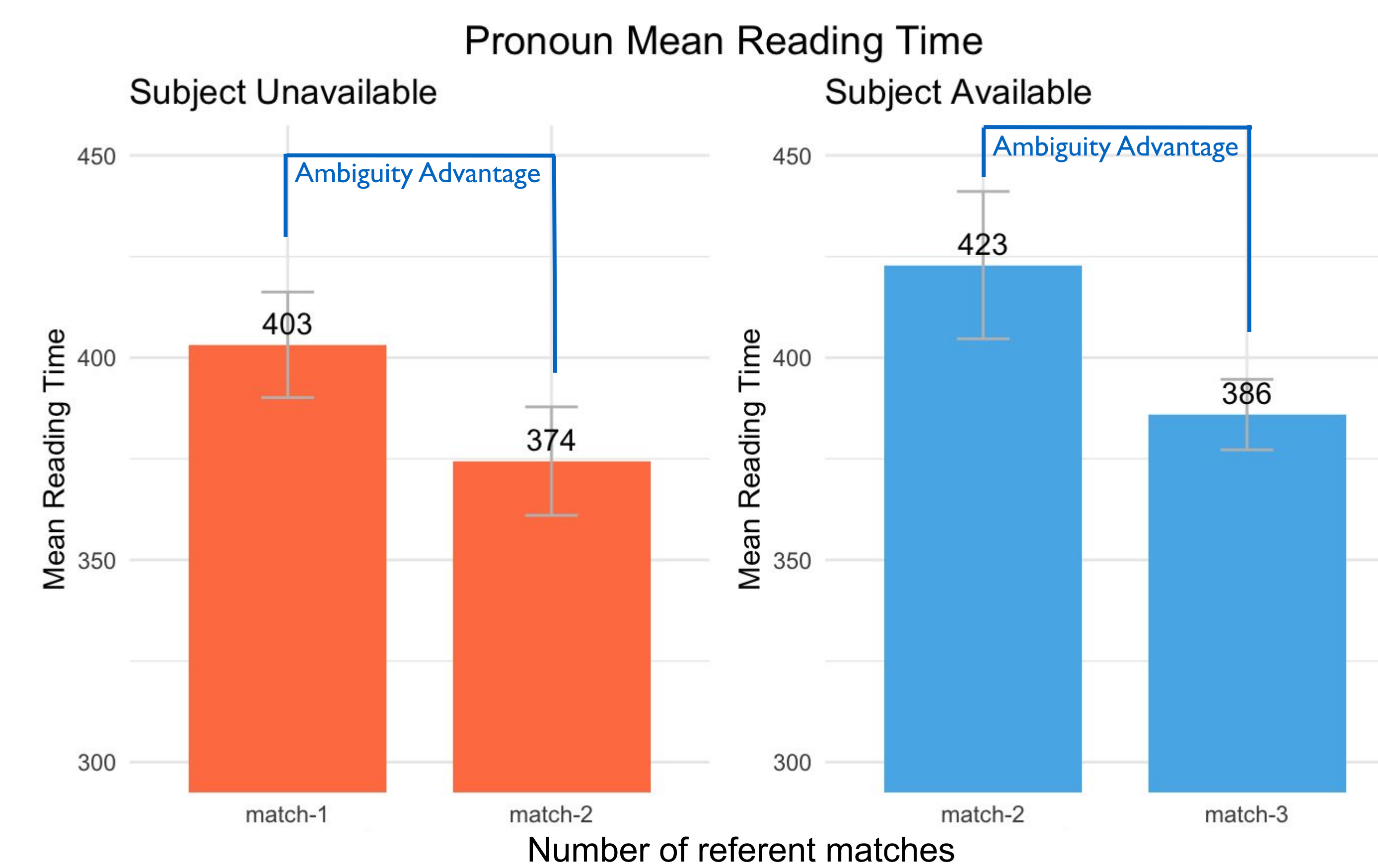### Ambiguity advantage conditioned by subject response

| | X | Y | | X | Y |
| Sentence: When **Michael**/**Lisa** arrived, **William**/**Crystal** mentioned to **Gregory**/**Amy** that the government would hire **him** in two weeks. |
| | X | Y | | | X |

Question: Who would be hired by the government in two weeks?
a. **Michael**/**Lisa** b. **William**/**Crystal** c. **Gregory**/**Amy** d. **I'm not sure**

✅ **Subject unavailable + not selected → Ambiguity Advantage**

✅ **Subject available + not selected → Ambiguity Advantage**

Pronoun Mean Reading Time

Subject Unavailable — 403 (match-1), 374 (match-2)
Subject Available — 423 (match-2), 386 (match-3)

[p=0.06, .95CI=(-76.7ms, 2.8ms)]   [p=0.03, .95CI=(-53.2ms, -2.6ms)]

Effect of Ambiguity: RT at pronoun is faster when there is one more match antecedent.

❌ **Subject available + selected → NO Ambiguity Advantage**

Pronoun mean Reading Time when the subject is chosen
NO Ambiguity Advantage — 364 (match-1), 389 (match-2), 372 (match-3)
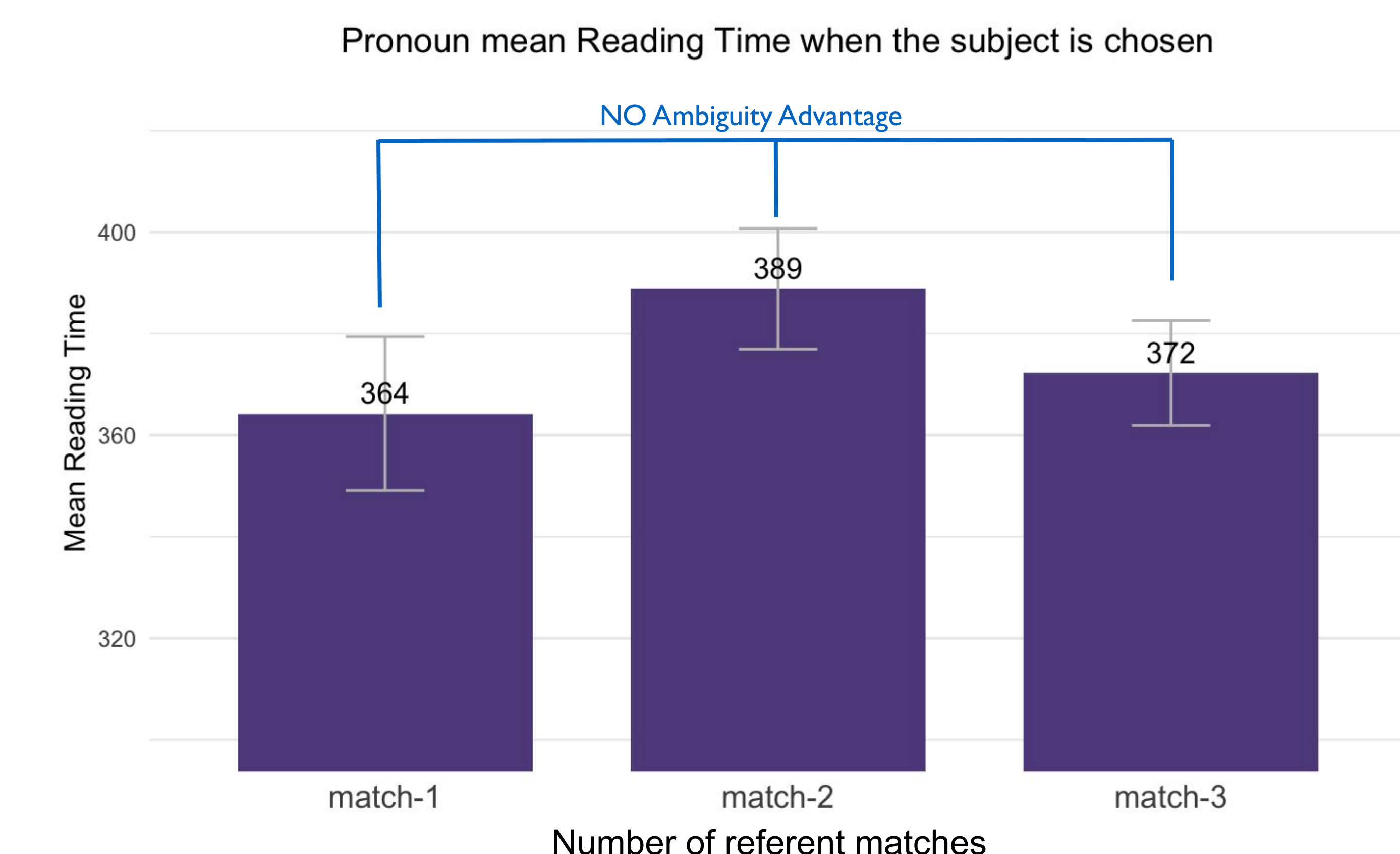
Effect of Ambiguity: Number of matches is not a significant factor of RT (p>0.1)

❖ **Pronouns are numerically read faster when the subject is selected than when not selected for the comprehension response.**

Interpretation responses Subject bias ✅

X = match Y = mismatch	Subject available			Subject unavailable	
	Match-3	Match-2	Match-1	Match-2	Match-1
Selection %	XXX	XXY	YXX	YXY	XYX	YYX	XYY
Sub. subject	21	29	2	4	26.5	2.4	**82.7**
Matrix subject	**39**	**56**	**49**	**86**	10.2	5.4	8.8
Matrix object	24	3	38	4	**49.7**	**86.7**	3.1
I'm not sure	16	12	11	5	13.6	5.4	5.4

4. Discussion

State of the biased referent		
Available?	Chosen?	Processing Effect
—	—	Advantage
+	—	Advantage
+	+	No advantage

❖ We found that pronominal ambiguity resolution doesn't always show the ambiguity advantage effect.
  ➢ It depends on whether the comprehenders select a preferred referent.
❖ If the comprehender doesn't select the biased referent, even when it is available, an ambiguity advantage effect occurs with multiple other match referents.

❖ **What could the underlying mechanism be?**
  ➢ **One possibility:** The subject is represented in a **special state** in memory.
  ➢ **Another possibility:** The subject has **stronger strength in activation** than other antecedents.

Main findings
❖ Ambiguity advantage is conditioned by the selection of the biased referent.
❖ Comprehenders either represent the biased referent in a special cognitive state or as having stronger activation.