Introduction

What can semantic ambiguity reveal about underlying sentence processing mechanisms?

Quantifier Scope Ambiguity (QSA)

Surface scope interpretation: Inverse scope interpretation:

Every kid climbed a tree.

Every N1 Verbed S N2

Two possible meanings:

Determined by the order of interpretation of quantifiers (i.e. quantifier scope interpretation)

Disambiguation of QSA sentences

- Relies on number configuration (i.e., number agreement)
- Dwivedi (2013; see also Dwivedi et al., 2010) showed no preference, concluding that people process sentences using a “heuristic first, algorithmic second processing strategy”

Heuristic vs. Algorithmic processing (Simon, 1956; Feinman, 1992)

Previous findings

- Using both behavioral and ERP methods, Dwivedi (2013) and Dwivedi et al. (2010) argued for shallow heuristic processing of QSA sentences, resulting in no interpretation preference. As such, algorithmic computation of quantifier scope sentences is not a primary mechanism.

Dwivedi et al. (2010)

In the self-paced reading reading study, the stimuli from the previous work were re-analyzed, such that:

- A by items analysis revealed that some sentences were heavily biased for surface scope interpretation
- E.g., Every kid climbed a tree was interpreted as plural 100% of the time
- And some sentences were not biased for either interpretation
- E.g., Every jeweler appraised a diamond was interpreted as plural 50% of the time.

Stimuli were separated by lexical-pragmatic bias and by task.

- Experiment 1: Heavily biased stimuli were presented without questions querying their interpretation.
- Experiment 2: Same partially biased stimuli were presented, now with questions regarding interpretation
- I.e., How many trees were climbed? ONE SEVERAL
- RTs were faster for plural vs. singular continuation sentences. No effects of ambiguity (consistent with the lexical-pragmatic bias of QSA context sentences)
- Experiment 3: Non-biased (truly ambiguous) stimuli were presented with questions regarding their interpretation.
- RTs were faster for continuation sentences following unambiguous vs. ambiguous context sentences.
- No effects of number (e effects were consistent with lexical-pragmatic bias of QSA context sentences)
- For both Exps 2 & 3, when RTs were presented with lexical-pragmatic bias of context sentences, question response accuracy rates showed a strong dependency for inverse scope condition (AS)

The trees were in a playground.

In other words, reading times showed one pattern whereas question response accuracy showed another.

Concluded that readers interpret QSA sentences using a heuristic mechanism. Algorithmic computation only occurs if required.

The present study

Does addition of a pre-context sentence modulate attention to change sentence processing mechanism of QSA sentences?

Relevance:

Perhaps participants do not deeply process QSA sentences such as Every N1 Verbed an N2 because Every, which is a context-dependent quantifier, does not have a previously specified domain with which it can be interpreted (Heinevroom, 1986; Dwivedi, 1983)

Hypothesis:

(i) Addition of a pre-context sentence, which would provide Every a context set, could result in greater attention in processing Every, and then rest of sentence—resulting in algorithmic first processing.

(ii) Alternatively, it could be the case that heuristic first processing is a general processing strategy, independent of grammatical requirements of lexical items, such that the addition of pre-context would not have an effect.

Predictions:

(i) Expect that inverse scope condition RTs are longer than control, whereas surface scope (plural) RTs will not differ. Question-response accuracy pattern should mirror RT pattern.

(ii) Pattern of on-line RTs and question response accuracy should replicate those in Exp. 2 of Dwivedi (2013).

Methods and materials

Participants

30 (23 female; mean age 20.7 years) right-handed native English speakers from Brock University

Materials

- 24 target sentences with 165 filler sentences
- A pre-context sentence with plural subject N1 was added to provide a context over which Every N1 could quantify.
- N2: two types in pre-context:
  - Ambiguous condition - N2 was consistent with the scene depicted by QSA context sentence: this way did not bias for specific reading of N2 in Q2.
  - Control condition: synonym, or related word was used for N2, so (that/those/those) N2 would not be pragmatically anomalous. Avoided repeated names.

All trials were followed by a question regarding sentence interpretation.

E.g., How many trees were climbed? ONE SEVERAL

Procedure:

- Participants were instructed to read and answer corresponding questions.
- The pre-context sentence was displayed in full, while the QSA context and continuation sentences were displayed one by one in a self-paced reading paradigm (cf. Just, Carpenter, & Wooley, 1982)

Discussion

- Preliminary findings indicate that the addition of pre-context sentence did not result in a different processing strategy by participants.

Overall, we observed a mismatch between on-line RTs and question response pattern, as exhibited in previous Experiment 2 (Dwivedi, 2013).

- Furthermore, this RT pattern was replicated in a study with no questions at critical trials, indicating that our findings are due to addition of pre-context, and not due purely to task effects.

- Readers maintained a heuristic first, algorithmic second processing strategy in semantically ambiguous sentences.

- Although we have evidence that readers did try and interpret Every (Fig. 5), this effort did not result in a change in sentence processing strategy.

- However, increased power is required to discern trend at EOS for AS vs. CS RTs (Figs 2 & 5).

In addition, several interesting findings revealed regarding anaphoric resolution of singular vs plural anaphors (using model of Sanford & Garrod, 1994; Garrod & Tenenbaum, 2000).

Cost to integrating these anaphors, where this cost is greater for plural vs. singular definite NPs (either due to increased search space considerations and/or due to need to represent several vs. singular anaphoric mental models).

In addition, integration of definite plural NPs is delayed as compared to singular NPs (cf. Fraser, Sanford, & Ludvigh, 2008)

Finally, we have shown that Every is indeed context dependent, such that empirical effects observed for interpretation of this quantifier are similar to those found for interpretation of ambiguous pronouns.

Future studies

- Investigate individual differences with respect to accuracy and WM measures to further explicate RT patterns exhibited (cf. Gibson et al., 2011)

- Investigate eye movements associated with stimulus (e.g., what is search procedure for definite NPs anaphors/context dependent quantifiers)

- Compare non-context dependent (i.e., weak) quantifiers, such as “many”.

- Investigate sentence processing of non-biased QSA sentences using appropriate pre-context stimuli.

References

- Forwards.


