Quantifier processing: Focus accounts

Kevin Paterson
University of Leicester
Lecture 2 topics:

1. Interpreting quantifiers
2. Quantifier focus effects
3. Accounts of quantifier focus effects
What do I mean by focus?

Discourse/psychological focus vs. Semantic focus.
Psychological focus refers to focus of attention.

It was the boy who threw the stones.

Focus information often fixated for longer & recalled more accurately.

Review paper: Filik, Paterson, & Sauermann (in press)
“Many students went to the lecture.”

Reference Set of students who went to lecture.

Maxset of all students.

Complement Set of students who did not go to lecture.

Sanford, Moxey, & Paterson (1996)
Interpreting Quantifiers

• Meaning of a sentence containing a quantifier can be represented in terms of different discourse referents.
  • Maxset - i.e., set of all students (or at least a contextual relevant set of students, e.g., Westerståhl, 1985).
  • Reference set - i.e., those students who were actually at the lecture.
  • Complement set - i.e., those students who were not at the lecture.

Nouwen (2008); Moxey & Sanford (1997)
Interpreting Quantifiers

- Widespread assumption that not all of sets are included by default as part of discourse representation.
- According to Discourse Representation Theory (DRT; Kamp & Reyle, 1993) only maxset and other explicitly introduced subsets are included, as only these are required for a truth-functional semantic account of quantification (see also Corblin, 1996; Kibble, 1997, Percus, Gibson, & Tunstall, 1997).
- Assumption that no default operation corresponding to set-subtraction, in which maxset minus refset is represented.
Interpreting Quantifiers

- Marble example (e.g., Roberts, 1989)
  Nine of the ten marbles are in the bag.
  # It’s under the couch.

It is not possible to refer to the tenth marble using an anaphor (“it”), because the compset is not included in the discourse representation.

- It is, however, possible to refer to the tenth marble with a fuller noun-phrase (e.g., “the other marble”), presumably because accommodation of this fuller expression triggers a set-subtraction procedure.
Interpreting Quantifiers

Nine of the ten marbles are in the bag.

<pause>

It’s under the couch.

- Roberts also notes that the continuation is more felicitous if there is a delay before the speaker utters the continuation, especially if the speaker seems aware the listener is seeking something (the other marble).

- The suggested explanation is that this triggers the operation of a non-linguistic mathematical procedure of set-subtraction.

Roberts (1989, pp. 705-706)
Quantifier Focus Effects

- Is it always the case that compset is not represented?
- Moxey & Sanford (1987): “Negative” quantifiers such as “few” and “not many” license pronominal reference to compset.
- This form of reference often called complement anaphora.
- Accounted for in terms of “quantifier focus effects”
**Quantifier Focus Effects**

- Moxey and Sanford (1987) argued that positive quantifiers such as *some*, *a few*, and *many*, and negative quantifiers such as *not all*, *few* and *not many*, as well as communicating quantity information, have the important discourse function of providing different perspectives on this.

- At its simplest, positive quantifiers focus on the refset, whereas negative quantifiers focus on the compset.

- This is assumed to have consequences for language processing and comprehension.
Quantifier Focus Effects

- Positive Quantifiers

  All / Some / A few / Many of the students went to the lecture.
  A. They listened carefully to the speaker.
  B. # They sat in the coffee bar instead.

- Refset reference is acceptable but compset reference is unacceptable.
Quantifier Focus Effects

- Negative Quantifiers

None / Not all / Few / Not many of the students went to the lecture.
A. ? They listened carefully to the speaker.
B. They sat in the coffee bar instead.

- Refset reference is certainly possible but compset reference seems more acceptable.
Quantifier Focus Effects

- Klima (1964) - linguistic tests of negativity.

- The acceptability of “tag” questions such “didn’t they” and “did they” provides a diagnostic of negation.

Some people went to the party, didn’t they?
No people went to the party, did they?
Many people went to the party, didn’t they?
Not many people went to the party, did they?
A few people went to the party, didn’t they?
Few people went to the party, did they?
Quantifier Focus Effects

- Another linguistic test of negativity involves assessing the acceptability of negative polarity items (e.g., “anymore”) in positive and negative quantifier contexts.

  # Some students go to parties anymore.
  No students go to parties anymore.
  # Many students go to parties anymore.
  Not many students go to parties anymore.
  # A few students go to parties anymore.
  Few students go to parties anymore.

Fauconnier (1975)
Quantifier Focus Effects

- A potentially important function of positive and negative quantifiers involves licensing different scalar inferences.

- Positive items appear to license inferences that generalise from a subset to an entire set.

  Some people like ice-cream. In fact, everyone does.
  # Few people like ice-cream. In fact, everyone does.

Fauconnier (1975)
Quantifier Focus Effects

- Conversely, negative items license inferences that generalise from a subset to the empty set.

# Some people like jazz. In fact, no-one does.
Few people like jazz. In fact, no-one does.
Quantifier Focus Effects

- The scalar inference function of various quantifiers may have an important role in discourse comprehension.
  - Positive quantifiers license upwards inferences and so focus the reader’s attention on the refset / maxset.
  - Negative quantifiers license downwards inferences and so focus attention onto the compset.

- May serve important rhetorical function in communication. Compare following messages:
  A few of these cars break down within the first year.
  Few of these cars break down within the first year.
Quantifier Focus Effects

- A further (or alternative) function of negation may be to deny a supposition (see Clark, 1976).
- Thus, when a speaker says “Not many people went to the party”, this may carry supposition that the speaker (and potentially the hearer) expected more to go.
- Thus, an important function of quantifiers may be to provide an interpretation of quantity relative to some expectation (held by the speaker or assumed to be held by the listener).

Moxey & Sanford (1993)
Quantifier Focus Effects

- Research has assessed the processing consequences of quantifier focus using various techniques:
  - Production studies
  - Comprehension studies - self-paced reading, eye movements while reading.
  - Electrophysiology - EEG/ERP measures.
- Results of these studies provide broad support for the claims for quantifier focus effects.
Quantifier Focus Effects

- Moxey & Sanford (1987) used production tasks to assess referent of plural pronoun continuations in positive and negative quantifier contexts.

- Production task reveals what interpretation are available to participant and preferred - but not time limited task, so could involve conscious deliberation.

Some of the students went to the lecture. They....
Few of the students went to the lecture. They...
Quantifier Focus Effects

Some of the students went to the lecture. They....

Few of the students went to the lecture. They...

- Continuations in positive quantifier contexts (e.g., “some”, “many”, “a few”) generally concerned refset.

- Continuations in negative quantifier contexts (e.g., “not many”, “few”, “very few”) generally concerned compset.
Quantifier Focus Effects

- Negative quantifiers in this experiment denoted small amounts, and so the reference set was small or empty, e.g., few, very few.

- Could be that when refset is small, people provide generalisations about the maxset, and this could appear to be reference to compset (Percus et al.).

Very few students went to the party.

They (generally) had to revise for an exam.
Quantifier Focus Effects

- Sanford et al. (1996) used negatives (e.g., “Not quite all”) where refset is large.

<table>
<thead>
<tr>
<th>Quantifier</th>
<th>Reference</th>
<th>Complement</th>
<th>General</th>
<th>All</th>
<th>Other</th>
<th>Unclassified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not quite all</td>
<td>4</td>
<td>19</td>
<td>4</td>
<td>2 (6)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Not all</td>
<td>2</td>
<td>24</td>
<td>0</td>
<td>2 (2)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Less than half</td>
<td>7</td>
<td>18</td>
<td>0</td>
<td>2 (2)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Not many</td>
<td>2</td>
<td>25</td>
<td>1</td>
<td>1 (2)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Few</td>
<td>8</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Overall negative</td>
<td>15%</td>
<td>71%</td>
<td>3%</td>
<td>5% (8%)</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Nearly all</td>
<td>29</td>
<td>0</td>
<td>1</td>
<td>0 (1)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Almost all</td>
<td>27</td>
<td>0</td>
<td>2</td>
<td>1 (3)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>More than half</td>
<td>25</td>
<td>0</td>
<td>2</td>
<td>2 (4)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Many</td>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A few</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Overall positive</td>
<td>93%</td>
<td>0%</td>
<td>3%</td>
<td>2% (5%)</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Note—The Unclassified column shows materials that resulted from a judge finding the subject’s continuation categorization unintelligible, or where the subject failed to check a continuation option. Other classes as defined in the text. The numbers and percentages in parentheses represent the combined value for all and in general, and correspond to the generalization class.
Quantifier Focus Effects

Self-paced reading

Participants read text one chunk at a time and press response key to indicate they have read and understood each chunk.

Response time for each chunk provides indication of comprehension difficulty.

Can compare response times for identical / similar chunks in different experimental conditions.
Quantifier Focus Effects

Sanford et al. (1996; see also Paterson et al., 1998)

- A Public Meeting
  Local MPs were invited to take part in a public enquiry about proposals to build a new nuclear power station. A few / few of the MPs attended the meeting. Their presence / absence helped the meeting run smoothly.

Was the public enquiry about sewage disposal?
Quantifier Focus Effects
Sanford et al. (1996)

Longer reading times for continuations that refer to the refset in positive quantifier contexts.

Conversely, longer reading times for compset continuation in negative quantifier contexts.

See also Jarvella & Lundquist (1994)
Quantifier Focus Effects

- Filik, Moxey, Sanford & Leuthold (2009)

- EEG research using event-related brain potentials (ERPs) has shown that complement anaphora evoke a larger N400 effect in positive quantifier contexts only.

- Thus, ERP data suggest that complement anaphora are perceived as anomalous only in positive quantifier contexts.

- Explanation of EEG recording....
Quantifier Focus Effects

- EEG methodology
- Electrodes placed at various locations on scalp record underlying electrical activity in the brain.
- Text displayed to participants a chunk (word or phrase) at a time at the centre of the screen (to eliminate effects of eye movements).
- Combine recordings from many trials (100s) to produce ERP waveform.
- Assess magnitude of characteristic peaks and troughs in ERP waveform across experimental conditions.
- Information about timecourse and (approx) location of effect.
Quantifier Focus Effects

- EEG methodology
- Some components
- P1, - letter / word shape processing?
- N1 - sub-lexical processing?
- P235 - lexical processing.
- N400 - contextual incongruity / semantic incongruity
- P600 - syntactic reanalysis
EEG & the N400 effect
Summary of findings

- Evidence for quantifier focus effects in production and comprehension tasks, including tasks sensitive to brain activity.

- Effects broadly consistent with S&M focus account.

- Can effects be accounted for in other ways?
Alternative accounts

- Apparent reference to the compset are actually generalisations about maxset (Corblin, 1997; Geurts, 1997; Kibble 1997; Nouwen, 2003; Percus et al., 1997).

- Such an approach has advantage of uniform treatment of standard refset reference and complement anaphora in formal approaches to quantification, such as DRT.

- However, does not explain performance with negative quantifiers when compset represents minority, e.g., Not quite all of the students attended the lecture. They...
Alternative accounts

- Are differences between positive and negative quantifiers related to monotonicity?
- Upwards entailing quantifiers, like “a few”, license inference that property of subset is also property of maxset.
  
  A few students went to the lecture, in fact they all did.
  # Few students went to the lecture, in fact they all did.

- Downwards entailing quantifiers permit statements of form:
  Few students went to the lecture, in fact none did.
  # A few students went to the lecture, in fact they all did.

- In this case, the quantifier allows the possibility that the refset is in fact an empty set (i.e., that no students went to the lecture).
Alternative accounts

- Does monotone-decreasing property of negative quantifiers license complement anaphora? (e.g., Hendriks & de Hoop, 2001; Kibble, 1997; Nouwen, 2003).

- Nouwen (2003): complement anaphora is a special type of inference that requires the reader to infer the existence of a complement set, and that such an inference is only possible in the context of a downwards entailing quantifier.

- This is based on the observation that only downwards entailing contexts license the possibility of an empty refset and, by extension, imply the existence of a complement set.
The Supposition-Denial Account

- Negative quantifiers give rise to both an assertion of an amount, and an implied expectation that more might have been the case.
- Thus “not many of the students attended the lecture” asserts that some small number of students came to the lecture, and implies that more were expected to do so.
- This difference between expectation and observation is referred to as a shortfall and it is this shortfall that is the focus of attention for the reader.

Moxey (2006); Moxey, Filik, & Paterson (2009)
Conclusions

- Quantifier focus effects appear real - negative quantifiers license focus on complement set.
- Evidence in support of this account from studies of production, comprehension, and brain activity.
- Current explanations of the effect based on either semantic notion of directional monotone inferences or psychological notion of “shortfall”.
References


References


References