The Online Interpretation of Sentence Internal *Same* and Distributivity

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May 19, 2012
Adjectives of Comparison

• Languages have lexical means to compare two elements and express identity / difference / similarity between them.
• English uses adjectives of comparison (AOCs) like same, different and similar.
Sentence-external readings

• Comparing an element in the current sentence and an element mentioned previously

(1)   a. Arnold saw ‘Waltz with Bashir’.
     b. Heloise saw the same movie.
Sentence-internal readings

- A sentence-internal comparison, without referring to any previously introduced element, e.g.

\[
\begin{align*}
\text{Each student} & \\
\text{The students} & \\
\text{All the students}
\end{align*}
\]

\[
\{ \text{Each student} \quad \text{The students} \quad \text{All the students} \} \quad \text{saw the same movie.}
\]

- Sentence-internal readings must be licensed by a semantic plural (Carlson, 1987)

\[
\frac{\text{Sue saw the same movie.}}{(3) \quad \#Sue \quad \text{saw the same movie.}}
\]
Our goal

Investigate how sentence-internal *same* is processed with:

- 3 of its licensors
  - EACH
  - ALL
  - THE

- 2 orders
  - Q+AOC: surface scope
    
    (4) \[
    \begin{align*}
    \text{Each student} & \quad \text{The students} \\
    \text{The students} & \quad \text{All the students}
    \end{align*}
    \]
    saw the *same* movie.

  - AOC+Q: inverse scope

    (5) The *same* student saw
    \[
    \begin{align*}
    \text{each movie} & \quad \text{the movies} \\
    \text{the movies} & \quad \text{all the movies}
    \end{align*}
    \]
Previous theories and their predictions

Inverse scope interpretation harder to process than surface scope:

(6) A boy climbed every tree.

Previous theories and their predictions

Explanation in terms of covert scope operations:

- Inverse scope requires an extra operation
  (Anderson, 2004)

(7) A boy climbed every tree.

- [every tree] [a boy climbed _ ]
Previous theories and their predictions

Explanation in terms of discourse model:

- Inverse scope requires revising discourse model structure
  (Fodor, 1982; Crain and Steedman, 1985)

(8) A boy climbed...

(9) A boy climbed every tree.
Previous theories and their predictions

The sentence-internal reading of *same* has to be scopally licensed:

(10) The same student saw every movie.

- *every movie* scopes and distributes over *same*
  (Carlson 1987, among many others)

But no revision necessary of the discourse model structure because of the meaning of *same*.

- Thus, *same* can help us distinguish between the two theories of inverse scope
Previous theories and their predictions

In addition, previous theories:

• postulated different meanings of *same*

• postulated different meanings for quantificational NPs

On-line interpretation of AOCs brings new data which can help decide between theories.

• Anderson 2004, Dwivedi et al. 2009
Plan

- Experimental study
- Results of the study
- Analysis of the results
Method

• A self-paced reading task testing how easy it is to process sentence-internal *same*
  • with 3 licensors: EACH, ALL and THE
  • in 2 orders: Q+SAME (quantifier precedes AOC) and SAME+Q (AOC precedes quantifier)
  • i.e., $3 \times 2 = 6$ conditions in total
• Each condition was tested 8 times
  • four times in sentences most likely judged as true relative to the background scenarios
  • four times in sentences most likely judged as false
  • for a total of 48 stimuli
Sarah and Madeleine are two young women who live in a village that has only three shops, a fabric store, a bakery and a DVD store. Last Monday, Sarah went to the fabric store, then to the bakery and finally to the DVD store, while Madeleine was at home all day.
Example
Example

- think —— — ——— — — — ——— — — — ———
Example

- —— that — —— — ——— — ——— — — — ———
Example
Example

- —— —— same —— —— —— —— —— —— ——
Example

- —— —— young —— —— —— —— ——
Example

- — — — — — — — woman — — — — — —
Example

- — — — — — — — each — — — — — —
Example

- —- — — — — — — shop — — — —
Example
Example
Example

Example

Am I right to think that?
In general, scenarios consist of:

- 2 sets of entities (e.g., women and stores)
- a relation between them (e.g., ‘visit’)
Method

- 115 participants
- 2 groups
- each group: 12 items in surface scope, 12 items in inverse scope
- i.e., 24 test items plus 35 fillers = 59 stimuli per participant
- the participants completed the experiment online
- order pseudo-randomized for each participant
Method

• the two data sets (75 and 40 participants) were initially analyzed separately
• no differences, hence final analysis based on merged data sets
• 22 participants excluded because 15% or more questions answered incorrectly
• Length of words and position in sentence factored out
Regions of interest

- Quantifier + 2 following words
- *Same* + 2 following words
- Reading times of full sentences
Quantifier and 2 following words

Surface scope:
  • I think that each young woman visited the same shop in the village.

Inverse scope:
  • I think that the same young woman visited each shop in the village.
Quantifier and 2 following words

Surface scope

![Graph showing surface scope](image)
Quantifier and 2 following words

Surface scope

![Graph showing the relationship between quantifiers and words](image)
Quantifier and 2 following words

Surface scope

-4.5
-4.0
-3.5

All
Each
The
Quantifier and 2 following words

Surface scope

Inverse scope

![Graph showing quantifiers and their effects on surface and inverse scope.](Image)
Quantifier and 2 following words

Surface scope

Inverse scope
Generalizations: Quant and 2 following words

- Surface scope $\succ$ Inverse scope
  $(a \succ b$ means ‘a takes more time than b’)
  - But the two scopes are not directly comparable due to different positions of quantifiers (subject vs. object)

- In case of Inverse scope: Each, The $\succ$ All
Surface scope:
  • I think that each young woman visited the same shop in the village.

Inverse scope:
  • I think that the same young woman visited each shop in the village.
Same and 2 following words

Inverse scope

-4.4
-4.0
-3.3
Same and 2 following words

Inverse scope
**Same and 2 following words**

**Inverse scope**

**Surface scope**

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---
**Same and 2 following words**

**Inverse scope**

**Surface scope**

---

![Graph showing data for inverse and surface scope with markers for all, each, and the words.](image-url)
Generalizations: *Same* and 2 following words

- **Inverse scope > Surface scope**
  - But the two scopes are not directly comparable due to different positions of *same* (subject vs. object)
- In case of **Surface scope**: *Each, The > All*
Total times

- Surface
- Inverse

All
- Each
- The
Generalizations: Total times

- **All:**
  - Surface scope $\approx$ Inverse scope
- **Each, The $>$ All**
- **Each, The:**
  - Inverse scope $>$ Surface scope
Analysis

Three assumptions about the meanings of:

- *same* – ambiguous
- *each* – requires differentiation
- *the* – ordered interpretations
**Assumption 1: Same is ambiguous**

... like different in many languages (Beck, 2000; Dotlačil, 2010)

(11) \[
\begin{align*}
\text{(11)} & \quad \left\{ \begin{array}{c}
\text{Iedere} \\
?\text{Alle de} \\
*\text{De} \\
\text{Every} \\
?\text{All the} \\
*\text{The}
\end{array} \right. \\
\text{jongen lezen een ander boek.}
\end{align*}
\]

(12) \[
\begin{align*}
\text{(12)} & \quad \left\{ \begin{array}{c}
\#\text{Iedere} \\
\text{Alle de} \\
\text{De} \\
\#\text{Every} \\
\text{All the} \\
\text{The}
\end{array} \right. \\
\text{jongen lezen verschillende boeken.}
\end{align*}
\]

(11) Every boy reads a different book.

(12) All the boys read different books.
Assumption 1: *Same* is ambiguous

**Same[1]**: identity between two entities

- **Sentence-external:**

  (13)  
  a. Arnold saw ‘Waltz with Bashir’.

  The movie seen by Heloise = ‘Waltz with Bashir’

- **Sentence-internal:**

  (14)  
  \[
  \text{Each boy} \quad \text{All the boys} \quad \text{saw the same[1] movie.}
  \]

  For any two boys \(b_1\) and \(b_2\), \(b_1\)’s movie = \(b_2\)’s movie
Assumption 1: *Same* is ambiguous

- **Sentence-internal:**
  
  \[
  \begin{align*}
  \{ & \text{Each boy} \\
  \{ & \text{All the boys} \}
  \end{align*}
  \]
  
  saw the same[1] movie.

- **The distributive quantifier temporarily creates in its scope interpretation contexts of sentence-external form**

  \[
  \begin{align*}
  \begin{cases}
  \text{boy}_1 \text{ movie}_1 & \text{boy}_2 \text{ movie}_2 \\
  \text{boy}_1 \text{ movie}_1 & \text{boy}_3 \text{ movie}_3
  \end{cases}
  & \& \ \text{movie}_1 = \text{movie}_2 \\
  \begin{cases}
  \text{boy}_2 \text{ movie}_2 & \text{boy}_1 \text{ movie}_1 \\
  \text{boy}_2 \text{ movie}_2 & \text{boy}_1 \text{ movie}_1
  \end{cases}
  & \& \ \text{movie}_2 = \text{movie}_1
  \end{align*}
  \]

  etc.
**Assumption 1: Same is ambiguous**

**Same[2]:** relates parts of a plural individual to one entity by a binary relation $R$

Dowty, 1985, Barker, 2007

(16) \[
\{ \text{The boys} \}
\{ \text{All the boys} \}
\text{saw the same[2] movie.}
\]

- plural individual = the boys
- $R =$ saw movie
- same[2]:
  - ‘saw movie’ relates any two boy atoms to the same entity
Assumption 1: *Same* is ambiguous

Sentence-internal reading with *same*[1]:

• all the work is done by the distributive quantifier (the licensor)

Sentence-internal reading with *same*[2]:

• all the work is done by *same*
Assumption 2: *Each requires differentiation*

Tunstall, 1998: *Each* needs “differentiated” events in its scope

(17) Jake photographed \{#each student, every student, all the students\} in the class, but not separately.
Assumption 3: Ordered readings for *The*

COLLECTIVE >>> CUMULATIVE >>> DISTRIBUTIVE

(18) 

a. The boys elected the representative.
b. The boys hugged the girls.
c. The boys had a sip of juice.

Accounting for generalizations

The is interpreted collectively by default, so incompatible with same:

(19) # The boys elected the same president.

Reanalyzing towards non-collective takes extra time, hence:

• The > All for reading times on same in surface scope

(20) The/all the young women visited the same shop in...

• and for full-sentence readings times in surface scope

(21) The/all the young women visited the same shop in...
Accounting for generalizations

Each requires differentiation:

(22) Each young woman visited a shop.

a very strong preference for distinct shops (Anderson 2004, Roeper et al. 2011)

... which makes it a dispreferred licensor of same:

(23) Each young woman visited the same shop.

Hence:

- Each > All for reading times on same in surface scope

(24) Each/all the young women visited the same shop in...

- and for full-sentence readings times in surface scope

(25) Each/all the young women visited the same shop in...
Accounting for generalizations

No difference in full-sentence reading times between Inverse scope and Surface scope for All, hence:

• no evidence for processing costs of covert scoping operations
Accounting for generalizations

- **Inverse scope** > **Surface scope** for **Each** and **The** for full-sentence reading times

(26) The same young woman visited each shop / the shops...

- **Each, The** > **All** for reading times on QUANT in inverse scope

(27) The same young woman visited each shop / the shops...

**Each** and **The** (unlike **All**) force disambiguation of **same**:
  - **same[1]** for **Each**
  - **same[2]** for **The**

(28) The same young woman visited each shop / the shops.

Late disambiguation takes extra time
(Clifton and Staub, 2008)
Conclusion

• Inverse scope of quantifiers is costly because of model structure reanalysis, not because of covert scope operations
  - no inverse-scope slowdown when **All** licenses **same**
  - inverse-scope slowdown with **Each** and **The** due to **same** disambiguation

• Surface-scope slowdown on **Each** and **The**, as compared to **All**, because of lexical incompatibility with **same**
Acknowledgments

Jakub Dotlačil was supported by a Rubicon grant from the Netherlands Organization for Scientific Research. Adrian Brasoveanu was supported by an SRG grant from the UCSC Committee on Research.
References I


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References II


