

Anaphor Resolution at the Right Frontier - Is the RFC effective?

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Agenda

1. Research question
2. Theoretical Background
3. Method
4. Results
5. Discussion

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Research question

- Does discourse-relational information affect intersentential anaphor resolution?
- Empirical assessment of Right Frontier Constraint (RFC)
Polanyi (1988); Asher (1993); Asher & Lascarides (2003)
- Hypothesis:
Readers are more likely to resolve anaphora to antecedents that are perceived as discourse-structurally salient.
- Questionnaire-based experiment

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Previous Results

- Various linguistic factors influence accessibility of information
- Substantial empirical research has shown that phonologic and morpho-syntactic as well as semantic and pragmatic information guides the way an anaphor may find its antecedent:
 1. Aspects of the complexity of the anaphor (cf. Ariel, 2001)
 2. Properties of an anaphor's potential antecedents that affect their salience

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Linguistic factors for salience

- Morpho-syntactic information
 - gender
 - number congruency
- Certain semantic inferences
- Recency effect:
= Syntagmatic distance between anaphor and antecedent
- Grammatical function (or obliqueness)
 - preference for subjects
 - parallel function assignment strategy
- Further semantic aspects
 - animateness
 - topicality
- Information structure: new vs. familiar information

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Previous psycholinguistic research

- Resolution of anaphora depends on what entities are currently in the focus of attention, cf. Gordon, Grosz & Gilliom (1993), Hudson-d'Zmura & Tanenhaus (1998)
- The influence of discourse relations on the salience of potential antecedents of anaphora has not been in focus.

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SDRT – Fundamental assumption

- Discourse consists of a set of discourse units, which are connected by two sorts of discourse relations.
 - Subordinating relations:
 - one constituent discourse unit dominates another
 - e.g. Elaboration, Explanation (Asher & Vieu, 2005)
 - Coordinating relations:
 - no constituent discourse unit dominates another
 - e.g. Narration, Contrast (Asher & Vieu, 2005)

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SDRT – Formal setting

- A discourse structure or SDRS is a triple $\langle A, \mathcal{F}, \text{LAST} \rangle$, where:
 - A is a set of labels;
 - LAST is a label in A ; and
 - \mathcal{F} is a function which assigns each member of A a member of Φ , which is the set of well-formed SDRS-formulae.
- An SDRS can be converted into a graph.
 - Each subordinating relation creates a downward edge.
 - Each coordinating relation creates a horizontal edge.

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Right-frontier rule for attachment

- New information must either attach to the last entered constituent β in a discourse structure or to some constituent γ such that (β, γ) is in the transitive closure of the subordination relation. (Asher, 1993)
- The antecedent for an anaphoric expression is accessible only at the right hand side of any level of a linearly ordered discourse parse tree.

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Example

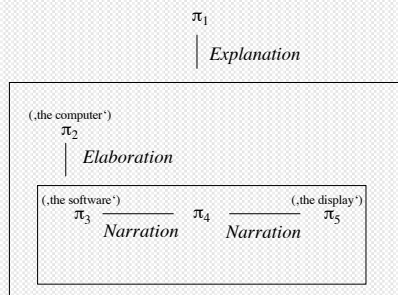
- π_1 : Hans hatte eine schlaflose Nacht,
Hans had a sleepless night.
- π_2 : denn **sein Computer**_i hatte ernsthafte Probleme.
because his computer had severe problems.
- π_3 : **Die Software**_k stürzte dauernd ab.
The software permanently crashed.
- π_4 : **Die Taste** für den Buchstaben A war kaputt.
The key of letter A was defect.
- π_5 : **Das Display**_i flackerte.
The display jittered.
- π_6 : **Es**_i muss dringend repariert werden.
It must be repaired urgently.
- π_6 ^{*}: **Er**_j muss dringend repariert werden.
It must be repaired urgently.
- π_6 ^{**}: **# Sie**_k muss neu installiert werden.
It must be newly installed.

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Example – Graph



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Method – Materials

- Experimental passages – General structure
 - Six lines
 - Pronominal anaphor in the last line
 - Two potential antecedents in the preceding text, one in the first, one in the fourth line
- Relative position of antecedents to Right Frontier (RF)
 - Discourse relation between first and second antecedent
 - Filler information interposed between the second antecedent and the anaphor

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Method – Materials

- Three types of items
 - Type A: only 1st antecedent at RF
 - Type B: only 2nd antecedent at RF
 - Type C: both antecedents at RF
- Each structural type in two versions
 - Both antecedents and pronoun of the same grammatical gender
 - Antecedents of different gender + pronoun only congruent to first antecedent

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- Am Morgen ging **die Studentin** in die Universität (π_1), denn es war mal wieder an der Zeit, die Vorlesung über die Vor- und Nachteile von Kants Kategorischem Imperativ zu besuchen. (π_2) Im Hörsaal war es sehr voll. (π_3)
*In the morning **the student** went to the university because it was time to attend the lecture on advantages and disadvantages of Kant's categorical imperative. The lecture hall was busy.*
- A **Die Kommilitonin** war wie immer schlecht gelaunt (π_4), und es hörte niemand zu. (π_5) *The fellow student was as always in a bad mood and nobody listened.*
- B **Die Kommilitonin** war stattdessen in der Bibliothek (π_4), denn dort war es sehr ruhig. (π_5) *The fellow student however was in the library because it was quiet there.*
- C **Die Kommilitonin** war wie immer schlecht gelaunt (π_4), denn es hörte niemand zu. (π_5) *The fellow student was as always in a bad mood because nobody listened.*

Nachmittags musste **sie** noch viel erledigen.
*In the afternoon **she** still had many things to do.*

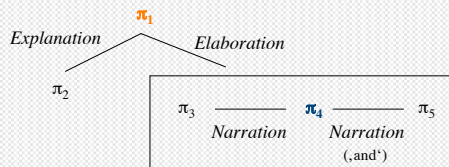
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Method – Materials

- **Type A:** First antecedent at RF



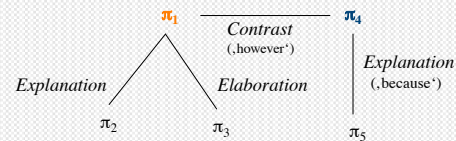
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Method – Materials

- **Type B:** Second antecedent at RF



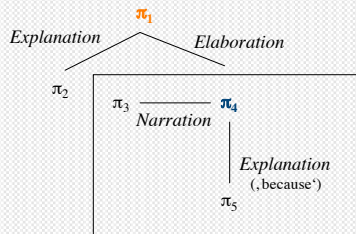
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Method – Materials

- **Type C:** Both antecedents at RF



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Method – Procedure

- Questionnaire containing 18 experimental passages
 - six of each type
 - three items with equal gender antecedents
 - three with unequal gender antecedents (only the first antecedent was gender congruent)

- Participants' task to name the antecedent of the pronominal anaphor

- *In the afternoon she still had many things to do*

Rephrasing question:
Who was the one who had to do many things?

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Predictions

- If RF constrains anaphor resolution in the outlined way participants should
 - tend to choose the 1st antecedent in Type A
 - tend to choose the 2nd antecedent in Type B
- No such difference is expected if other factors are more influential.
 - Recency favors the 2nd antecedent in all types of passages.
 - Gender congruency favors the 1st antecedent in case of unequal gender antecedents.

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Results – RFC

Table 1. Participants' choices in case of antecedents with unequal gender, separated by type of item

Choices	1. Antecedent	2. Antecedent	Total
Type A (1. antecedent at RF)	110	2	112
Type B (2. antecedent at RF)	111	2	113
Type C (both antecedents at RF)	110	3	113
Total	331	7	338

($\chi^2_{(2)} < 1$)

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Results – RFC

Table 2. Participants' choices in case of equal gender antecedents, separated by type of item.

Choices	1. Antecedent	2. Antecedent	Total
Type A (1. antecedent at RF)	72	38	110
Type B (2. antecedent at RF)	51	56	107
Type C (both antecedents at RF)	70	41	111
Total	193	135	328

($\chi^2_{(2)} = 8.323, p = .016$)

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Results – Alternative Accounts

- **Structural Parallelism** as primary influence on ambiguous pronoun resolution (Chambers & Smyth, 1998)
- Subject role for both antecedents and pronoun in 16 out of 18 items
- Experimental materials largely parallel in syntactic structure

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Results – Alternative Accounts

- **Situation models** as moderators of antecedent accessibility (Anderson, Garrod & Sanford, 1983; Morrow, Greenspan & Bower, 1987)
- Local character's accessibility as antecedents declines after substantial contextual changes (e.g. in space or time)

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Results – Alternative Accounts

- Changes only in Versions B
→ discourse units of antecedent 1 and 2 in coordinate discourse relation
- 7 items constant, 7 changing (Antecedent 1 is in the lecture hall, antecedent 2 is in the library...), 4 items in between (e.g. antecedent 2 just leaving)
- Analyses with items with unambiguous change or constancy

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Results – Alternative Accounts

Table 3. Participants' choices in cases of constant or changing situations in Type B.

Discourse Model	Type of Item	1. Antecedent	2. Antecedent
	Type A	57	26
Constant	Type B	18	23
Changing	Type B	22	23
	Type C	54	34
Total	Total	151	106

Conclusion

- Indication of primary influence of morpho-syntactic factors
- Indication of RFC affecting pronoun resolution
- Modeling of exact interplay of competing influences on antecedents' accessibility essential