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The Study of Ambiguous Relative Clauses in Non-Native Sentence Processing

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(1) The girl envied [the maid]_{DP1} of [the princess]_{DP2} who was eating chocolate.

Who was eating chocolate?



Overview

1. Ambiguous relative clauses
2. Experiments
 - 2.1 German learners of English
 - 2.2 Greek learners of English
 - 2.3 Native speakers
 - 2.4 Spanish, Russian and German learners of Greek
3. Discussion
4. Remaining Issues
5. References



1. Ambiguous Relative Clauses

(2) Someone shot [the servant]_{DP1} of [the actress]_{DP2} who was on the balcony.

Crosslinguistically attested preferences:

- a) DP1 attachment (German, Greek, Russian, Spanish, French, Dutch)
- b) DP2 attachment (English, Swedish)



1. Theories on Preferences

- a) Parsing Principles
- b) Attachment-Binding Hypothesis
- c) Tuning Hypothesis
- d) Other factors



a) Parsing Principles

(multiple-constraint model, Gibson & Pearlmutter)

Recency: “Attach new incoming material to the most recently processed phrase if grammatically possible” → DP2

Predicate Proximity (DP1): “Attach as structurally close as possible to the head of the predicate phrase”; e.g. IP node → DP1

Interaction; (Non)configurationality (cf. adjacency of V and its complement)



b) Attachment-Binding Hypothesis (Hemforth et al.)

- Is the relative pronoun obligatory or optional?
- Sensitivity to pronoun constraints → attach pronoun to most salient discourse entity



c) Tuning Hypothesis (Mitchell et al.)

- The attachment preference of speakers in temporarily ambiguous sentences is influenced by the frequency distribution of adjunct attachments they were exposed to.
- Support: RC-attachment preferences and corpus data

d) Other factors (lexical)

(3) Someone shot the actress **with** the servant who was on the balcony.

→ DP2 preference (across languages)

- Construal Theory (Frazier and Clifton): nonobligatory constituents are associated with closest thematic-processing domain



1. Research Interest

- Inconclusive results in previous studies
- Different materials used to test native and non-native speakers
- Which processing strategies do advanced L2 learners use? L1 Transfer? Native-like?
- Do other factors, like lexical-semantic information, influence their choice?



1. Hypotheses

- I. L2 speakers transfer their L1 processing strategy.
- II. L2 speakers acquire a native-like processing strategy.
- III. Their choice depends on lexical-semantic information.



2.1 German Learners of English

2.1.1 Questionnaire

2.1.2 Self-Paced Reading

2.1.3 Summary



2.1 Participants

Felser et al. 2003

- 28 German learners of English from the University of Düsseldorf
- Proficient
- Knowledge in relevant area

Sepúlveda 2012

- 30 German learners of English from the University of Göttingen
- Passed (local) grammar test



2.1.1 Items used by Felser et al. 2003

- 20 experimental items and 20 filler sentences
- 2 versions
- Form: **DP-V-[DP1-P-DP2]-RC**
(2a) The girl envied the maid of the princess who was eating chocolate.
(2b) The girl envied the princess with the maid who was eating chocolate.

2.1.1 Results by Felser et al. 2003

	Mean (DP2)	Standard Deviation
DP1-<i>of</i>-DP2	52%	28.1
DP1-<i>with</i>-DP2	87%	14.4

- Significant DP2 preference in *with*-condition.
- No significant preference in *of*-condition

2.1.1 Results by Sepúlveda 2012

- 4 experimental sentences
- Question of the form: Who was eating chocolate?

	DP2
<i>of A</i>	55.71%
<i>of B</i>	60%
<i>of Total</i>	57.63%
<i>with A</i>	83.33%
<i>with B</i>	71.43%
<i>with Total</i>	77.59%

- Replication of Felser et al.'s results



2.1.2 Self-paced Reading (Felsler et al. 2003)

- Same participants as in questionnaire
- 10 practice and 96 filler sentences
- 48 experimental sentences
- 2 versions
- Disambiguated relative clauses (Number of DP and Aux)
- 4 conditions

2.1.2 Four Conditions

(3a) DP1 Attachment (of)

*The little girl envied the **maid** of the princesses who **was** eating chocolate.*

(3b) DP2 Attachment (of)

*The little girl envied the maid of the princesses who **were** eating chocolate.*

2.1.2 Four Conditions cont.

(3c) DP1 Attachment (with)

The little girl envied the princesses with the maid who were eating chocolate.

(3d) DP2 Attachment (with)

The little girl envied princesses with the maid who was eating chocolate.



2.1.2 Method

- (Noncumulative) moving window technique
- 2 versions, within-subject-design
- Processing should take longer on disambiguating element than on dispreferred one

2.1.2 Method: Segmentation

- Segment 1: *The little girl envied*
- Segment 2: *the maid of the princesses*
- Segment 3: *who*
- Segment 4: *was*
- Segment 5: *eating chocolate.*

2.1.2 Results

	Segment 4 was / were	Segment 5 eating chocolate.	Total
Of-DP1	435	918	4180
Of-DP2	439	938	4204
With-DP1	502	887	4203
With-DP2	428	876	4166

- Analyses of variance on preposition and attachment
- Significant statistical effects on disambiguating segment (4) and segment 5 (spill-over)
- Segment 4: shorter reaction time in *with-DP2* condition



2.1.3 Summary for German learners

1. Sensitivity for DP2 attachment in *with* constructions
2. Lack of on-line and off-line preference of complex-genitive-DPs with *of*
3. Longer reading times in *of* conditions
4. L1 Transfer seems to be excluded.



2.1.4 *Von*-construction in German

- *Von*-construction in (colloquial) German

(4) Jemand erschöß die Dienerin von der Schauspielerin, die auf dem Balkon war.

2.1.4 Items used by Sepúlveda 2012

- 3 items in 2 versions: *von*, *mit*, *Genitive*
 - ❖ *von*-Condition:
[die Schwester]_{ACC} von [der Schauspielerin]_{Dat}
 - ❖ *mit*-Condition:
[den Vater]_{ACC} mit [dem Jungen]_{Dat}
 - ❖ *Genitive*-Condition:
[die Schwester]_{ACC} [der Moderatorin]_{GEN}
- 1 disambiguated item (Plural)

2.1.4 Results by Sepúlveda 2012

	DP2
<i>von A</i>	53.33%
<i>von A</i>	60%
<i>von Total</i>	56.67%
<i>mit A</i>	40%
<i>mit B</i>	76.92%
<i>mit Total</i>	60.87%
<i>Genitive A</i>	20%
<i>Genitive B</i>	46.67%
<i>Genitive Total</i>	33.33%

- difference in versions of questionnaire
- as in Gross 2002 no significant preference in *von*-Condition
- no firm results in other conditions

2.1.4 *Von*-Construction

- First experimental results (Gross 2002, Sepúlveda 2012) indicate a lack of preference in *von*-construction
- Further testing is needed
- Case?
- Need to test a language without such an opportunity.



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2.2 Greek Learners of English

2.2.1 Questionnaire

2.2.2 Self-Paced Reading



2.2.1 Questionnaire

- Test with 39 Greek mother tongues
- Similar items as before
- Questionnaire results:

Like the German participants, the Greek ones preferred DP2 for *with* (82%) and had no preference for *of* (51%).

2.2.2 Self-Paced Reading

- 24 experimental sentences
- Within-subjects-design
- statistical effects only on segment 4
- no effect in *of*-condition.
- Longer reading times on dispreferred DP1-reading in *with*-condition.

	Segment 4 (<i>were</i>)
<i>Of</i>-NP1	508 (224)
<i>Of</i>-NP2	533 (256)
<i>With</i>-NP1	661 (333)
<i>With</i>-NP2	532 (190)



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2.3 English Speakers

2.3.1 Questionnaire

2.3.2 Self-Paced Reading

2.3.1 Questionnaire (Marinis et al. 2003)

- 45 native speakers tested with the same type of items

	Mean (DP2)	Standard Deviation
DP1- <i>of</i> -DP2	63%	48.3
DP1- <i>with</i> -DP2	91%	29.3

2.3.1 Questionnaire (Sepúlveda 2012)

	Mean (DP2)
DP1-<i>of</i>-DP2	75.47%
DP1-<i>with</i>-DP2	100%

- 6 items in *of*-condition, 3 in *with*-condition, fillers
- Reactions to structures
- Comments on content.

2.3.2 Self-Paced Reading (Marinis et al. 2003)

- 24 sentences in 8 conditions (*of*, *with*, *next to*)
- Disambiguated by auxiliary
- Segment 4: faster reaction time for DP2 attachment independent of preposition (statistically significant effect of attachment only for *with* condition)
- Statistically reliable DP2 preference, but no interaction with type of preposition
- Difference between DP1 and DP2 significant for *of* and *with*



L1-L2 Difference?

- Status: No preference in genitive antecedent constructions with different L1-L2 attachment preference.
- Preference if both languages have the same attachment preference?



3. Experiments with Learners of Greek (Papadopoulou & Clahsen 2003)

3.1 Acceptability Judgment

3.2 Self-Paced Reading

3.3 Summary



3. Greek

- Relatively free word order.
- RCs introduced by complementizers.
- Morphologically marked genitives (distinct from PP antecedents)

3. Participants

- 3 groups of residents in Greece (Athens)
- 18 Spanish, 2. 19 German, 3. 10 Russian

Table 1. Characteristics of the L2 groups

Characteristics	L2-S		L2-G		L2-R	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Years of residence in Greece	11.21	6.90	13.73	12.16	4.30	3.40
Years of formal instruction in Greek	2.06	1.59	1.42	0.58	2.35	2.54
Greek Language Proficiency scores	75.33	3.27	72.63	5.96	71.90	4.89
Age of first exposure to Greek	26.39	4.62	23.74	9.22	22.10	6.47

- Maximum score on proficiency test = 80

3. Items

Enas antras kitakse ton dhaskalo
 α -MASC-SG-NOM man-MASC-NOM looked the-MASC-SG-ACC teacher-MASC-ACC
tis mathitrias pu itan stin avli.
 the-FEM-SG-GEN pupil-FEM-SG-GEN that was in-the-FEM schoolyard
 “A man looked at the teacher of the pupil who was in the schoolyard.”

- Main Clause: Transitive verb with an overt subject; direct object and either a genitive DP or a PPs with *me* (with)
- Restrictive RC with complementizer *pu*
- Note: alternative syntactic analysis by Alexiadou (Genitives not base-generated postnominally)



3. Items

- 20 experimental sentences, 40 filler sentences
- 4 conditions: disambiguated by gender marking on participle
 - a. Condition Genitive-high
 - b. Condition Genitive-low
 - c. Condition PP-high
 - d. Condition PP-low

3. Grammaticality Judgment Scores

Table 2. Mean grammaticality judgment scores and standard deviations for subject RCs with complex antecedents

Subject RCs	L2-S		L2-G		L2-R	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Hits	4.33	0.84	4	1	3.70	1.16
Correct rejections	5	0	4.84	0.50	4.80	0.42

Note. The maximum score for hits and correct rejections is 5.

- 50 sentences, 25 grammatical
- grammatical properties needed for relative clauses with complex antecedents acquired

3.1 Acceptability Judgment Scores

Table 3. Mean acceptability judgment scores and standard deviations

Participants	Gen-high		Gen-low		PP-high		PP-low	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Native speakers	4.24	1.10	3.05	1.53	1.62	1.10	2.97	1.67
L2-S	3.26	1.72	3.17	1.71	2.06	1.44	3.02	1.76
L2-G	3.82	1.24	3.54	1.38	2.50	1.40	3.17	1.36
L2-R	3.50	1.50	2.70	1.53	2.42	1.39	3.04	1.51

Note. The scores ranged on a 5-point scale from 1 (*not at all acceptable*) to 5 (*completely acceptable*).

- 5 items on each condition
- 40 filler sentences (10 grammatical)
- Scale: 1 not at all to 5 completely acceptable

3.2 Self-Paced Reading

- 24 critical sentences, 6 for each condition
- 72 filler sentences
- Parallel structure as in previous tasks
- Exception: auxiliary *itan* (*was/were*) → finite form of *fenome* (*seem*): *fenotan* (SG)
- 5 segments (plus comprehension question)
- Critical Element = Segment 4: participle disambiguated by gender marking

3.2 Self-Paced Reading

- Significant effects on 4th
- Significant effects on 5th segment (spill-over)
- L2 learners pattern together
- Main effect of group between natives and L2 learners
- Same pattern for PP (*with*) → DP2 preference

3.2 Self-Paced Reading

- Different pattern for Genitive conditions on fourth segment
- Greek natives: significant difference between high and low Gen-condition
 - Gen-high significantly faster than Gen-low (disambiguation via gender)
- L2 learners: no difference for Gen-conditions, . As in other experiments no significant preference for either attachment



4. Discussion

1. Learners transfer their L1 processing strategy. → Not confirmed.
2. Learners acquire native-like processing strategy. → Not confirmed.
3. Learners' choice depends on lexical-semantic information. → Partially confirmed, e.g. DP2 preference for thematic preposition *with*. Preference also found in L1s.

4. Discussion

- Native speakers preferences were replicated.
- Experience-/Exposure-based accounts: not supported by the evidence (no preference even if same choice in L1 and L2)
- Language particular differences prevent transfer? (Spanish: el techo de la casa, de, PP, no genitive) → not confirmed (Russian, German)
- Incomplete acquisition? → unlikely, great proficiency attested in grammar tests and specifically designed measures.



4. Discussion

- Working-memory? → Same results in both on-line and off-line measures.
- Shallow parsing?
- Declarative vs. procedural?
- Greater role of lexical-semantic information in non-native parsing



5. Remaining Issues

1. Investigation of other prepositions (usability of *with*?)
2. Development in L2 learners? Teachability? Learnability?
3. Structure in corpora
4. Context: unsuccessful readings?
5. Areas of L1 transfer?
6. Replication (especially of studies that claim to have found L1 transfer [Franck-Mestre])



5. Main References

- Clahsen, H. & Felser, C. 2006. “Grammatical processing in language learners.” *Applied Psycholinguistics* 27: 3-42.
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Thank you for your attention!