Print exposure and memory effects on pronominal resolution

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Aims

• to examine the vulnerability of anaphora resolution in adult monolingual native speakers as a function of individual differences in:
  • Memory abilities  
    (working memory and episodic memory)  
  • Language experience  
    (print exposure and education)  
  • Age
Anaphora Resolution

- Anaphora resolution (AR) is a linguistic phenomenon which describes the process of identifying the referent of anaphoric expressions into the context.

- AR is computed in syntax and at the interface with discourse (Tsimpili, et al. 2004; White 2008 a.o.).

- Recent research identified both linguistic and cognitive factors conditioning AR (Hendriks et al., 2014; van Rij et al., 2013).
Overt vs. Null pronoun resolution

• Greek is a Null Subject Language (NSL)

• Ambiguity in antecedent preference:

(1) O Kostas, xheretise ton Gianni, otan pro/aftos to plisiase.
the Kostas waved at the John when pro / he him approached

(Papadopoulou et al. in press; but Tsimpili et al. 2004)
Previous studies: Age effects on AR

- Older adults are less strategic in encoding / retrieving the most important information from *discourse*
- and *overuse* ambiguous pronouns

**BUT**

- have no problems disambiguating a pronoun on the basis of information presented in an immediately preceding sentence

(Hendriks et al., 2014; Light & Capps, 1986; Titone, Prentice, & Wingfield, 2000 a.o.)
Internal Factors

- Cognitive Abilities
- Language Experience

Linguistic Factors

- Linguistic Form (overt /∅)
- Syntactic Complexity (Word Order)

Discourse Effects

Anaphora Resolution

Age
Language experience

- **may lead to** variability in sentence comprehension performance.

- **print exposure** (Stanovich & West 1989)

- education level (Dabrowska 1997; Dabrowska & Street 2006)

- Familiarity with print is positively correlated with better word recognition abilities (Chateau & Jared, 2000; Fotiadou et al. 2014)
Research Questions and Predictions

• Age, Print exposure and Cognitive measures of memory will affect pronominal resolution

• Linguistic properties: Word-order and Context will affect pronominal resolution in all participants
METHODOLOGY

Participants
Materials & Procedure
Independent variables:  
Age & Education

Male and female monolingual Greek speaking adults  
(N= 40, M= 40.7; Age range: 18-75)

Distribution of Participants' Age

Participants' Educational Level (%)
Cognitive Tasks: 
WM and episodic memory

- **Backwards digit recall task** *(Alloway, 2007)*
  - To assess verbal working memory: Oral presentation of series of numbers with gradient difficulty

- **Immediate and delayed recall story task** *(Rivermead: adapted for Greek by Efklides et al., 2002)*
  - To assess episodic memory: Oral presentation of a story with 21 ideas. Participant’s performance is scored according to the number of ideas repeated.
Language Experience

- **Author and Magazine Recognition Tests** (Fotiadou et al., 2014; modelled after Stanovich and West, 1989)

- **Education levels** (questionnaire)
Results: Cognitive Tasks

WM (%)

ART-MRT scores (Mean)

Rivermead

Experimental Psycholinguistics, Madrid, 1-3 October 2014
Word-order (topicality) & context effects

**Topicality & word order**

- the first out of two or more entities in a sentence – often the grammatical subject and the continuing discourse topic – is the most salient one in the preceding discourse
  
  (Ariel’s accessibility theory 1998; 1990; Arnold et al. 2000; Reinhart 1981)

**Context**

- contextual information prior to the target sentence helps resolution in comparison with isolated sentences
  
  (eg. van Berkum, Brown & Hagoort, 1999: ERP findings)
Linguistic tasks

- self-paced listening antecedent identification
- sentence-picture matching task
  (E-prime: Schneider et al., 2002)

- The effect of **Word Order**: SVO (unmarked) vs. OVS (marked) sentences in null (*Condition 1*) **OR** overt (*Condition 2*) pronouns

- The effect of a **preceding context with** or **without explicit reference** to the actors: SVO sentences in null (*Condition 1*) **OR** overt (*Condition 2*) pronouns

The SPL experiments described include:

- 10 experimental items per condition
  Duration: 10-20 min approx.
- 20 filler sentences
- 5 practice sentences
CONDITION 1
a. The old lady -NOM / waved at/ the pupil -ACC / when / she / was crossing/ the street.
b. The pupil -ACC/ her _Cl waved at / the old lady -NOM/ when / she / was crossing/ the street.

CONDITION 2
a. The old lady -NOM / waved at/ the pupil -ACC / when / Ø already/ was crossing/ the street.
b. The pupil -ACC/ her _Cl waved at / the old lady -NOM/ when /Ø already/ was crossing/ the street.

Who was crossing the street?
Because the show was not going well, during the break a ballerina\textsubscript{FEM} got angry and splashed the singer\textsubscript{FEM}.

Because the show was not going well, during the break the members of the group got very angry.

**CONDITION 1:** The ballerina\textsubscript{FEM} approached the singer\textsubscript{FEM} when she was entering the stage.

**CONDITION 2:** The ballerina\textsubscript{FEM} approached the singer\textsubscript{FEM} when \(\emptyset\) slowly was entering the stage.

Who was entering the stage?
Fillers

- Various combinations of pictorial stimuli
- Various syntactic structures in the sentences used
The Analyses

- 3 measures in the self-paced listening referent-matching task
  - online listening times (in \textit{msecs}) per segment
  - offline RTs (in \textit{msecs}) on matching decisions
  - Preferred referent (%)
**Word Order**

### Aftos Pronoun

- The old lady NOM waved at the pupil ACC when she was crossing the street.

### Null Pronoun

- The old lady NOM waved at the pupil ACC when she was already crossing the street.
(a) Because the show was not going well, during the break a ballerina$_{FEM}$ got angry and splashed the singer$_{FEM}$.

(b) Because the show was not going well, during the break the members of the group got very angry.

- **Aftos Pronoun**

- **Null Pronoun**

Integration of known information $\rightarrow$ slow down
RESPONSE LATENCIES
PREFERRED REFERENTS
Word Order

Who was crossing the street?

Word Order - Overt Pronoun
Reference

Word Order - Null Pronoun
Reference

RTs on the Response

Word order markedness → Overt P
Word Order

Who was crossing the street?

Word Order - Overt Pronoun Reference

- Subject
- Object
- other

svo_aftos
oclvs_aftos

Word Order - Null Pronoun Reference

- Subject
- Object
- other

svo_null
oclvs_null

WM
\[ r = -0.443; \quad p = 0.004 \]

Lang.exp.
\[ r = -0.406; \quad p = 0.011 \]

WM
\[ r = 0.560; \quad p = 0.002 \]

Episodic (immediate & delayed)
\[ r = 0.389; \quad p = 0.041 \]
\[ r = 0.458; \quad p = 0.014 \]
(a) Because the show was not going well, during the break a ballerina got angry and splashed the singer.
(b) Because the show was not going well, during the break the members of the group got very angry.

Who was entering the stage?

Context - Overt Pronoun
Reference

Context - Null Pronoun
Reference

RTs on the Response

No reference → slower Response
Context

(a) Because the show was not going well, during the break a ballerina got angry and splashed the singer.
(b) Because the show was not going well, during the break the members of the group got very angry.

Who was entering the stage?

Correlation with AGE:

$r = -0.322; p = 0.046$

$r = 0.402; p = 0.011$
(a) Because the show was not going well, during the break a ballerina got angry and splashed the singer.  
(b) Because the show was not going well, during the break the members of the group got very angry.

Who was entering the stage?
(a) Because the show was not going well, during the break a ballerina got angry and splashed the singer.
(b) Because the show was not going well, during the break the members of the group got very angry.

Who was entering the stage?

Context - Overt Pronoun Reference

Subject Object Other

Context - Null Pronoun Reference

Subject Object Other

Episodic $M_r = -.436; \ p = .033$

Educ. Level: $r = -.441; \ p = .031$

Experimental Psycholinguistics, Madrid, 1-3 October 2014
Summary and Conclusions

- **Linguistic properties**:
  
  a. *Word-order* affected antecedent preference and RTs in the *overt* pronoun conditions only

  b. *Context* affects pronominal resolution in the *overt* condition (more subject antecedent in the +repeated NP condition)

- **Age** effects in the neutral context: older participants selected ‘other’ referent more than object in the *overt pronoun* condition

- **Language experience** affects antecedent preference in the *overt* pronoun condition (more language experience increases ambiguity in the subject/object antecedent preference)

- **Memory ability**: Lower scores in episodic memory task → more selection of ‘other’ referent in neutral context
Overall,

- **Context**: Pronominal resolution shows effects of ‘internal factors’ (age, language experience and episodic memory) in selected conditions only and primarily with *overt* pronouns.

- This is consistent with work on attrition and second language learners showing that *overt* pronouns in NSL are affected.

- **Word-order**: Memory and language experience affects the degree of overriding the *default* subject antecedent preference in the null pronoun condition.
Selected References


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