Attraction and Similarity-Based Interference in Object Gender Agreement

VILLATA, Sandra, FRANCK, Julie

Abstract

Two key processes in sentence processing are syntactic movement and the computation of agreement. We report two studies exploring the consequences of gender mismatch in the comprehension and production of French object relatives, requiring both the computation of movement and agreement. We show that gender mismatch enhances comprehension while penalizing production. We argue that comprehension and production are sensitive to different kinds of intervention: while comprehension is sensitive to similarity-based interferences, which are reduced by feature mismatch, production is sensitive to attraction effects, which arise in configurations of feature mismatch.

Reference

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ATTRACTION AND SIMILARITY-BASED INTERFERENCE IN OBJECT GENDER AGREEMENT

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ATTRACTION IN PRODUCTION

Speakers occasionally agree the verb with an intervening element which is not the agreement controller and mismatches its feature (e.g., Bock & Miller 1991, Vigliocco & Nicol 1998, Hartsuiker et al. 2001, Badeker & Kumiak 2007, Franck et al. 2008)

The key-SG to the cabinets-PL .... *were-PL rusty

Recept-M na maz-F ... *byla-F prosročennoy-F
Prescription-M for ointment-F .... *was-F expired-F

What does it happen in comprehension?
Also the comprehension process is sometimes perturbed by the presence of a mismatching intervener:

- Slower reading times at the verb in grammatical sentences with a number mismatching intervener
  

  E.g., The key-SG to the cabinets-PL was-SG rusty ....

- Failure to detect an agreement error (= illusion of grammaticality) in ungrammatical sentences with a number mismatching intervener
  

  E.g., *The musicians-P who the reviewer-SG praise-PL ...
ATTRACTION IN COMPREHENSION

However...
The comprehension process is also sometimes perturbed by the presence of a matching intervener.

- Increased reading times at the verb in grammatical sentences with a number matching intervener (Franck et al. 2015)
  
  E.g., John talks to the prisoner-SG that the guard-SG takes out-SG.

- Children also show lower comprehension accuracy for object relatives in the presence of a number match (Adani et al. 2010)
  
  E.g., Show me the elephant-SG that the lion-SG is-SG washing.

  Or of a gender match (Adani et al. 2010, Belletti et al. 2012)
  
  E.g., Show me the girl-FEM that the woman-FEM draws-FEM.
**TO SUM UP**

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<tr>
<th>PRODUCTION</th>
<th>COMPREHENSION</th>
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<td>Detrimental effect of mismatch</td>
<td>Detrimental effect of <strong>mismatch</strong> in ungrammatical conditions</td>
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<td>Detrimental effect of <strong>match</strong> in grammatical conditions</td>
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The two opposite effects of feature match reflect two different mechanisms
HYPOTHESIS

① Interference effects due to mismatch: agreement computation

In production and in the comprehension of structures with canonical word order (e.g. The key to the cabinets was rusty)

The system occasionally generates/predicts a plural verb if there is a mismatching intervenor (e.g., Gennari & MacDonald 2009, Pickering & Garrod 2013)

This leads to a production error or a slow down at the singular verb in comprehension

= attraction
HYPOTHESIS

② Interference effect due to match: *structure building*

In the comprehension of structures with movement

The parser struggles with structure building and tends to analyse the first NP as the subject

The agreement features on the verb provide a cue to retrieve the subject iff the subject and the object mismatch in number
(e.g., McElree et al. 2003, Lewis et al. 2006, Van Dyke & McElree 2006)

= *similarity-based interference*
### TO SUM UP

<table>
<thead>
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<th>MECHANISM AT PLAY</th>
<th>EFFECT</th>
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<td>Agreement computation</td>
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<td>Structure building</td>
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**Production**

**Comprehension of Simple Sentences**

**Comprehension of Complex Sentences**
PRESENT STUDY

**Aims:** Explore these two mechanisms through the study of object gender agreement in French object relatives

La serveuse-FEM que le danseur-MASC a surprise-FEM buvait un cocktail alcoolisé
The waiter-FEM that the dancer-MASC has surprised-FEM drank a cocktail with alcohol
PRESENT STUDY

Two experiments:

① Effect of gender mismatch in **production**
   Prediction: **attraction** from the gender mismatching subject in the computation of object-verb agreement

② Effect of gender mismatch in **comprehension**
   Prediction: **similarity-based interference** from the gender-matching subject in the cue-based retrieval of the object
EXPERIMENT 1 (PRODUCTION): MATERIAL

OBJECT RELATIVES (ORs)

FEMININE OBJECT, MATCH
i. La serveuse / que / la danseuse / a / surprise / buvait / un cocktail / alcoolisé
The waiter-FEM / that / the dancer-FEM / has / surprised-FEM / drank / a cocktail / with alcohol

FEMININE OBJECT, MISMATCH
ii. La serveuse / que / le danseur / a / surprise / buvait / un cocktail / alcoolisé
The waiter-FEM / that / the dancer-MASC / has / surprised-FEM / drank / a cocktail / with alcohol

MASCULINE OBJECT, MATCH
iii. Le serveur / que / le danseur / a / surpris / buvait / un cocktail / alcoolisé
The waiter-MASC / that / the dancer-MASC / has / surprised-MASC / drank / a cocktail / with alcohol

MASCULINE OBJECT, MISMATCH
iv. Le serveur / que / la danseuse / a / surpris / buvait / un cocktail / alcoolisé
The waiter-MASC / that / the dancer-FEM / has / surprised-MASC / drank / a cocktail / with alcohol
EXPERIMENT 1 (PRODUCTION): METHODS

RAPID SERIAL VISUAL PRESENTATION TASK

La serveuse que le danseur a surpris

400 ms

(Staub 2009, 2010)
EXPERIMENT 1 (PRODUCTION): RESULTS

DISTRIBUTION OF PRODUCTION ACCURACY

- Effect of Match ($p<.001$)
- Effect of Gender ($p<.001$)
- No Interaction
EXPERIMENT 1 (PRODUCTION): RESULTS

DISTRIBUTION OF RESPONSE TIMES FOR CORRECT ANSWERS

- Effect of Match (p<.001)
- Effect of Gender (p=.003)
- Interaction (p=0.04)
EXPERIMENT 1 (PRODUCTION): DISCUSSION

- Detrimental effect of gender mismatch both in accuracy and response times
  - Attraction effect in object gender agreement (Santesteban et al. 2013)

- General advantage for masculine objects
  - Masculine past participle is the default

- Stronger mismatch effect for masculine objects in response times
  - Feminine interveners are stronger attractors (=marked?)
    (Badecker & Kuminiak 2007, Malko & Slioussar 2013)
EXPERIMENT 2
(COMPREHENSIN): MATERIAL

OBJECT RELATIVES (ORs)

FEMININE OBJECT, MATCH
i. La serveuse / que / la danseuse / a / surprise / buvait / un cocktail / alcoolisé
   The waiter-FEM / that / the dancer-FEM / has / surprised-FEM / drank / a cocktail / with alcohol

FEMININE OBJECT, MISMATCH
ii. La serveuse / que / le danseur / a / surprise / buvait / un cocktail / alcoolisé
    The waiter-FEM / that / the dancer-MASC / has / surprised-FEM / drank / a cocktail / with alcohol

MASCULINE OBJECT, MATCH
iii. Le serveur / que / le danseur / a / surpris / buvait / un cocktail / alcoolisé
    The waiter-MASC / that / the dancer-MASC / has / surprised-MASC / drank / a cocktail / with alcohol

MASCULINE OBJECT, MISMATCH
iv. Le serveur / que / la danseuse / a / surpris / buvait / un cocktail / alcoolisé
    The waiter-MASC / that / the dancer-FEM / has / surprised-MASC / drank / a cocktail / with alcohol
EXPERIMENT 2
(COMPREHENSION): MATERIAL

SUBJECT RELATIVES (SRs)

Feminine Object, Match
i. La danseuse / qui / a / surpris / la serveuse / buvait / un cocktail / alcoolisé
   The dancer-FEM / who / has / surprised-MASC / the waiter-FEM / drank / a cocktail / with alcohol

Feminine Object, Mismatch
ii. La danseuse / qui / a / surpris / le serveur / buvait / un cocktail / alcoolisé
    The dancer-FEM / who / has / surprised-MASC / the waiter-MASC / drank / a cocktail / with alcohol

Masculine Object, Match
iii. Le danseur / qui / a / surpris / le serveur / buvait / un cocktail / alcoolisé
    The dancer-MASC / who / has / surprised-MASC / the waiter-MASC / drank / a cocktail / with alcohol

Masculine Object, Mismatch
iv. Le danseur / qui / a / surpris / la serveuse / buvait / un cocktail / alcoolisé
    The dancer-MASC / who / has / surprised-MASC / the waiter-FEM / drank / a cocktail / with alcohol
EXPERIMENT 2
(COMPREHENSION): METHODS

SELF-PACED READING + COMPREHENSION QUESTION

La serveuse que le danseur a surprise...

Did the dancer surprise the waiter?
EXPERIMENT 2
(COMPREHENSION): RESULTS

DISTRIBUTION OF READING TIMES AT THE PAST PARTICIPLE

- Effect of Relative Type (p<.001)
- Effect of Gender (p<.001)

OBJECT RELATIVES
- No effect of Match
- Effect of Gender (p=.005)
- Interaction (p=.031)

SUBJECT RELATIVES
- No significant effect
EXPERIMENT 2 (COMPREHENSION): RESULTS

DISTRIBUTION OF COMPREHENSION QUESTION ACCURACY

Effect of Relative Type (p<.001)

**OBJECT RELATIVES**
- Effect of match (p<.001)
- Marginal effect of gender (p=.065)
- Interaction (p<.001)

**SUBJECT RELATIVES**
- Effect of match (p<.001)
- Effect of gender (p<.001)
EXPERIMENT 2
(COMPREHENSION): DISCUSSION

- Detrimental effect of gender match both in reading times and in comprehension accuracy of object relatives with feminine objects
  - Similarity-based interference in object retrieval

- No effect of gender match with masculine objects
  - Only the feminine feature is a cue to object retrieval (= marked?)

- Unexpected detrimental effect of gender match in comprehension accuracy in subject relatives
  - Similarity-based interference at encoding?
CONCLUDING REMARKS

Two mechanisms at play in the production and in the comprehension of sentences with long-distance dependencies:

- **PRODUCTION**: detrimental effect of gender mismatch affecting agreement computation (Badecker & Kuminiak 2007, Malko & Slioussar 2013)
  - Incorrect production of the verb due to the presence of a mismatching intervener

- **COMPREHENSION**: detrimental effect of gender match affecting structure building (Franck et al 2015, Adani et al 2010, Belletti et al. 2012)
  - Incorrect retrieval of the object due to its similarity with the subject (same gender feature)

Further research needed to better understand when and why in comprehension the parser relies on a predictive mechanism rather than on a cue based retrieval mechanism in comprehension.
AND THANKS TO THE STUDENTS THAT HELPED IN THE REALIZATION OF THE EXPERIMENTS (SAMUEL SCHMID, CLARISSE CAO AND SOLANGE VILPERT), AND TO SILVIA ALBERTINI (IUSS, PAVIA) FOR HER SUPPORT IN STATISTICAL ANALYSES