When Sex and Syntax Go Hand in Hand: Gender Agreement in Language Production

The Research Question
Theoretical Backdrop and Preview of Findings
Overview of Experiments
Big-Picture Implications

Our Roadmap
Does the language production system use conceptual information regarding biological gender to encode gender agreement between a subject and a predicate adjective?

The Question
TWO TYPES OF GENDER
(for the purposes of this experiment)

(13) a. La ragazza e’ rossa
The-FS girl-FS is red-FS (meaning: has red hair)
b. La pietra e’ rossa
The-FS rock-FS is red-FS

(14) a. Il ragazzo e’ rosso
The-MS boy-MS is red-MS
b. Il sasso e’ rosso
The-MS stone-MS is red-MS

- CONCEPTUAL GENDER (a)
  - Related to characteristics of the noun

- GRAMMATICAL GENDER (b)
  - Not related to characteristics of the noun
BACKGROUND
(2) *Sono scese quattro persone, dei quali tre sono andati
Are got-F down four persons-F, of which-M three are gone-M
(Four persons got off; of the four, three went)

- “persone” is feminine (regardless of the sex of the referent), but the relative pronoun and participle are masculine

(3) *Stanze che sono anni e anni che sono chiusi
Rooms-F that are years-M and years-M that are closed-M
(Rooms that have been closed for years and years)

- “stanze” is feminine, but the participle is masculine
- There are masculine nouns between the head noun and the participle. Are they interfering??

AGREEMENT ERRORS HAVE BEEN PREVIOUSLY REPORTED in ITALIAN
The relative pronoun agrees with the following noun, not the head noun.

The adjective in the embedded clause agrees with the subject of the main clause.
- **Conceptualizer** (lexicon plus semantics)
  - Takes information about a speaker’s intended meaning and selects abstract lexical representations, called *lemmas*
  - Lemmas include semantic and syntactic information – syntactic category, grammatical function, theta grid, etc…
  - …AND grammatical gender, which may or may not have a conceptual correlate

- **Grammatical Encoder** (syntax)
  - Syntactic info in lemmas guides structure-building
  - Agreement happens here and is based on grammatical gender…exclusively???

- **Phonological Encoding** (phonology)

- **Articulation** (phonetics)
...but, do agreement processes make reference only to grammatical information or to both grammatical and conceptual information?

<table>
<thead>
<tr>
<th>Minimal Input Hypothesis</th>
<th>Maximal Input Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>- NO</td>
<td>- YES</td>
</tr>
<tr>
<td>- Agreement is purely syntactic.</td>
<td>- Agreement is not purely syntactic.</td>
</tr>
<tr>
<td>- After syntactic features are established, no conceptual information is accessed.</td>
<td>- Agreement processes access syntactic and conceptual information.</td>
</tr>
</tbody>
</table>

Big Picture Significance: What kind of input does the encoder receive from the conceptualizer?
CONCEPTUAL VS SYNTACTIC AGREEMENT

- Syntactic agreement is required for some kinds of agreement
- (6) is OK in British English, but (7) is bad
  - Conceptual agreement OK with a verb
  - Syntactic agreement required with demonstrative

(6) The committee are voting themselves a raise
(7) *These committee voted for a raise

- Conceptual agreement is required for other kinds of agreement
- *Vous*, French 2nd person plural pronoun, can be used as a polite 2nd person singular pronoun
  - Syntactic agreement with the verb
  - Conceptual agreement with the participle/adjective
How Italian and French Encode Gender

**Italian**

- Masculine words end in -o
- Feminine words end in –a
- For humans, the marking depends on the sex
- Ending reflects conceptual and grammatical gender

**French**

- Morphologically more complicated
- Some endings generally associated with masculine/feminine nouns (in writing, most feminine nouns end in -e.)
- To form the feminine in writing, -e is added to the masculine form (but this doesn’t necessarily translate to speech)

*This will become important later*
- Errors in verbal number agreement more common when the subject noun is conceptually plural (12) than when conceptually singular (11). –Dutch, French, Italian, Spanish
  - One baby
  - Multiple labels

- Number agreement errors more common when a noun of a different number intervenes between the subject and the verb
  - The king of the colonies... vs The king of the colony...
- And, errors are more common when the subject noun is singular than plural
  - A (marked) plural noun interferes more than an (unmarked) singular noun

– Support Maximal Input Hypothesis
– Show an effect of linear order on agreement
OVERVIEW OF EXPERIMENTS
– Four experiments: two for Italian and two for French
– Completion task
  – Participants shown two forms of an adjective, then shown a sentence fragment, then asked to repeat the fragment and complete it using the adjective
  – Italian experiments: self-paced reading
  – French experiments: prompts shown on screen, but not self-paced

THE QUESTION: Do agreement processes refer to conceptual information?

More technically: Does the encoder treat agreement features with conceptual connotations differently from agreement features with no conceptual connotations?

PREDICTION: Fewer agreement errors between a subject and predicate adjective when the syntactic gender has a conceptual connotation.

➢ Conceptual gender should “help” agreement.
Experiments 1 (Italian) and 2 (French) investigated whether subject nouns with conceptual or grammatical gender have differing numbers of agreement errors.

“If conceptual information is taken into account by the encoder, agreement errors should be less common for head nouns with conceptual gender than for head nouns with grammatical gender.” [p.461]

Experiment 2 also investigated whether the gender of a local noun interferes with agreement.

Findings suggest:
- Conceptual gender influences agreement
- The gender of a local “interfering” noun influences agreement
Experiment 1: Italian

Does agreement access conceptual information? YES
**Four Conditions:**

1. Feminine subject noun – grammatical
2. Feminine subject noun – conceptual
3. Masculine subject noun – grammatical
4. Masculine subject noun – conceptual

Local noun always mismatched in gender

**Participants:** 40 students at the University of Trieste
### RESULTS

#### TABLE 2

<table>
<thead>
<tr>
<th>Head noun gender:</th>
<th>Gender type:</th>
<th>Feminine</th>
<th></th>
<th>Masculine</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conceptual</td>
<td>Grammatical</td>
<td></td>
<td>Conceptual</td>
<td>Grammatical</td>
</tr>
<tr>
<td>Type of response</td>
<td>Correct responses</td>
<td>569</td>
<td>556</td>
<td>558</td>
<td>570</td>
</tr>
<tr>
<td></td>
<td>Agreement errors</td>
<td>8</td>
<td>22</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous</td>
<td>63</td>
<td>62</td>
<td>78</td>
<td>53</td>
</tr>
</tbody>
</table>

- Errors more common with grammatical gender
- Supports Maximal Input Hypothesis
- Can’t tell if the local noun had an effect because gender always mismatched

- Correct agreement: 88%
- Wrong agreement: 2%
- Misc Responses: 10%
Experiment 2: French

Does agreement access conceptual information? YES
Does an intervening noun interfere with agreement? YES
Same as Experiment 1 except gender of local noun varied

**Prediction:** More agreement errors when then subject noun and the local noun mismatch in gender

**Eight Conditions:**

1. Feminine subject noun – grammatical
   a. feminine local noun
   b. masculine local noun
2. Feminine subject noun – conceptual
   a. feminine local noun
   b. masculine local noun
3. Masculine subject noun – grammatical
   a. feminine local noun
   b. masculine local noun
4. Masculine subject noun – conceptual
   a. feminine local noun
   b. masculine local noun

**Participants:** 70 students at the Université Catholique de Louvain
<table>
<thead>
<tr>
<th>Head nouns with conceptual gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feminine head noun, feminine local noun</strong></td>
<td><strong>Feminine head noun, masculine local noun</strong></td>
</tr>
<tr>
<td>La soeur de la pharmacienne</td>
<td>La présidente du jury</td>
</tr>
<tr>
<td>The-F sister-F of the-F chemist-F</td>
<td>The-F president-F of the-M jury-M</td>
</tr>
<tr>
<td><strong>Masculine head noun, feminine local noun</strong></td>
<td><strong>Masculine head noun, masculine local noun</strong></td>
</tr>
<tr>
<td>Le gardien de la prisonnière</td>
<td>Le délégué groupe</td>
</tr>
<tr>
<td>The-M guardian-M of the-F prisoner-F</td>
<td>The-M delegate-M of the-M group-M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Head nouns with grammatical gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feminine head noun, feminine local noun</strong></td>
<td><strong>Feminine head noun, masculine local noun</strong></td>
</tr>
<tr>
<td>La couleur de la robe</td>
<td>La sortie du tunnel</td>
</tr>
<tr>
<td>The-F color-F of the-F dress-F</td>
<td>The-F exit-F of the-M tunnel-M</td>
</tr>
<tr>
<td><strong>Masculine head noun, feminine local noun</strong></td>
<td><strong>Masculine head noun, masculine local noun</strong></td>
</tr>
<tr>
<td>Le travail de la couturière</td>
<td>Le visage du voleur</td>
</tr>
<tr>
<td>The-M work-M of the-F dressmaker-F</td>
<td>The-M face-M of the-M robber-M</td>
</tr>
</tbody>
</table>
### RESULTS

- **Correct agreement:** 87%
- **Wrong agreement:** 2%
- **Misc Responses:** 11%

#### TABLE 4

Number of Responses for Each Scoring Category, Experiment 2

<table>
<thead>
<tr>
<th>Head noun gender</th>
<th>Feminine</th>
<th>Masculine</th>
<th>Feminine</th>
<th>Masculine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Local noun</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Correct responses</strong></td>
<td>245</td>
<td>224</td>
<td>233</td>
<td>253</td>
</tr>
<tr>
<td><strong>Agreement errors</strong></td>
<td>3</td>
<td>8</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td>32</td>
<td>48</td>
<td>32</td>
<td>25</td>
</tr>
<tr>
<td><strong>Type of response—Head nouns with conceptual gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Correct responses</strong></td>
<td>254</td>
<td>241</td>
<td>224</td>
<td>267</td>
</tr>
<tr>
<td><strong>Agreement errors</strong></td>
<td>9</td>
<td>20</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td>17</td>
<td>19</td>
<td>47</td>
<td>13</td>
</tr>
</tbody>
</table>

- Errors more common with grammatical gender. Same as Italian
- Supports Maximal Input Hypothesis
- Errors more common when subject noun and local noun mismatch
- And, more errors when subject noun is feminine
Experiment 3: Italian

Does animacy effect agreement? NO
Eight Conditions:

1. Masculine subject noun – masculine local noun  
   a. animate subject noun  
   b. inanimate subject noun

2. Masculine subject noun – feminine local noun  
   a. animate subject noun  
   b. inanimate subject noun

3. Feminine subject noun – feminine local noun  
   a. animate subject noun  
   b. inanimate subject noun

4. Feminine subject noun – masculine local noun  
   a. animate subject noun  
   b. inanimate subject noun

Participants: 64 students at the University of Trieste
Sample Items from Experiment 3
(taken from Table 5)

Key Point:
- Both “cheetah” and “eagle” are animate
- "Cheetah" is masculine
- "Eagle" is feminine
## RESULTS

**Analyze nouns do not have (significantly) more agreement errors.**

**Errors more common when subject noun and local noun mismatch.**

Same as Experiment 2.

**No difference w.r.t. feminine vs masculine subject noun.**

**Unlike Experiment 2, feminine subjects do not have more errors.**

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**Correct agreement:** 89%

**Wrong agreement:** 1%

**Misc Responses:** 10%

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**Table 6:**

<table>
<thead>
<tr>
<th>Head noun gender:</th>
<th>Feminine</th>
<th>Masculine</th>
<th>Feminine</th>
<th>Masculine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of response</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Animate nouns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct responses</td>
<td>468</td>
<td>450</td>
<td>433</td>
<td>458</td>
</tr>
<tr>
<td>Agreement errors</td>
<td>1</td>
<td>15</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>43</td>
<td>47</td>
<td>64</td>
<td>52</td>
</tr>
<tr>
<td>Type of response</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Inanimate nouns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct responses</td>
<td>461</td>
<td>447</td>
<td>454</td>
<td>459</td>
</tr>
<tr>
<td>Agreement errors</td>
<td>1</td>
<td>15</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>50</td>
<td>50</td>
<td>48</td>
<td>52</td>
</tr>
</tbody>
</table>
Experiment 4: French

Is the conceptual gender effect an animacy effect? NO
If the effect of conceptual gender is actually an effect of animacy, there shouldn’t be any difference between animate nouns that have conceptual vs grammatical gender.

Four Conditions:
– All subject nouns were animate
– All local nouns inanimate

1. Feminine subject noun – grammatical
2. Feminine subject noun – conceptual
3. Masculine subject noun – grammatical
4. Masculine subject noun – conceptual

Participants: 30 students at the Université Catholique de Louvain
Local noun always mismatched in gender (like Experiment 1)
Interference by the local noun has already been established
Correct agreement: 78%
Wrong agreement: 5%
Misc Responses: 17%

More agreement errors for subject nouns with grammatical gender.
When animacy is kept constant, conceptual gender still aids agreement.
Animacy is not the issue.
1. More errors when the head noun doesn’t have conceptual gender
   - Supports the Maximalist View (the key point)
     - Conceptual gender helps agreement, but animacy doesn’t

2. More errors when the local noun is mismatched in gender with the subject noun
   - Consistent with previous findings that a local noun can interfere with number agreement
3. Difference between Italian and French with respect to the gender of the subject noun

- Italian: Same amount of errors for masculine and feminine subject nouns (Experiments 1/3)
- French: More errors for feminine subjects (Experiment 2)

- Italian and French differ w.r.t. adjective inflection
- In Italian, the difference is between –o and –a.
  - There’s no default
- In French, the feminine form is derived from the masculine form.
  - The masculine is the default, so possibly easier to not alter the form