

Explaining the Gender Effect in Spoken-Word Recognition: Evidence of L1 Interference during L2 Lexical Competition

Garance Paris & Andrea Weber, Saarland University, Germany

gparis@coli.uni-sb.de

- Eyetracking studies have confirmed that during spoken-word recognition, words with similar onsets are simultaneously activated and compete against each other until they no longer match incoming acoustic input (e.g., Tanenhaus et al., Science, 1995)
- Moreover, when listening to a foreign language, competitors from the mother-tongue are also activated: In Weber & Cutler (JML, 2004), upon hearing "de...[sk]", Dutch participants in an English experiment also looked at a lid (*dekse*) because of its overlap with the *target* in their mother tongue

In native listening, gender-marked articles before the noun can prevent activation of gender-inconsistent competitor nouns: Dahan et al. (JML, 2000) found that French listeners who heard "le_[masc] bou..." ('the b...') fixated the picture of a button (*bouton*_[masc]) but not of a bottle (*bouteille*_[fem]), because the bottle's gender did not agree with the article in French. By comparison, when the plural *boutons*_[masc-pl] ('buttons') was preceded by the gender-neutral article *les*_[pl-neutral], *bouteilles*_[fem-pl] ('bottles') was activated.



Figure 1: Activation of the competitor from 300 to 700 ms in Dahan (2000) (fixations to the competitor minus fixations to the averaged distractors).

The authors propose 2 potential explanations, which can be formalized as follows:

- **Form-based:** The gender-effect is due to the frequency of co-occurrence of the phoneme sequences corresponding to the article and the noun (surface effect)

$$P(\text{le} / \text{lo} /) \gg P(\text{la} / \text{lo} /)$$

because

$$f(\text{but} \delta /, / \text{lo} /) \gg f(\text{but} \epsilon j /, / \text{lo} /)$$

- **Grammar-based:** The gender-effect is due to the likelihood of co-occurrence of an article of a particular gender with the noun

$$P(\text{le} | \text{Art}_{[masc]}) \gg P(\text{la} | \text{Art}_{[masc]})$$

because

$$P(N_{[masc]}, \text{Art}_{[masc]}) \gg P(N_{[fem]}, \text{Art}_{[masc]})$$

But what role does L1 morphosyntactic knowledge play in L2 listening?

Experiment 1 (Paris & Weber, AMLaP 2004)

- After hearing French *target* "la_[fem] ca...[ssette]" ('the ca...[ssette]'), German-speaking participants fixated a canon as *competitor* (German *Kanone*_[fem]), although its gender did not agree with the article in French (*canon*_[masc]), in which the experiment was conducted (Figure 2, (a))
- Native French speakers did not fixate the canon due to the gender mismatch, thus replicating Dahan et al. (2000; Figure 2, (b))
- Whenever the gender of *competitor* was the same in French and German, both natives and non-natives fixated the *competitor* (Figure 2, (c))

Experiment 2 (Weber & Paris, CogSci 2004; see also Paris & Weber, AMLaP 2004)

- Conversely, French natives who heard German "die_[fem] Ka...[ssette]" did not fixate the picture of the canon, because it is masculine in their mother-tongue (French *canon*_[masc]), although it agreed with the article in the presentation language (German *Kanone*_[fem]; Figure 2, (d))
- German native listeners did fixate the canon, since it was a potential continuation in their mother-tongue, in which the experiment was presented (Figure 2, (e))
- Again, when gender was the same, both groups fixated the *competitor* (Figure 2, (f))

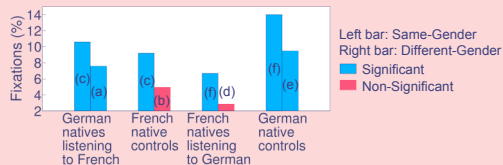
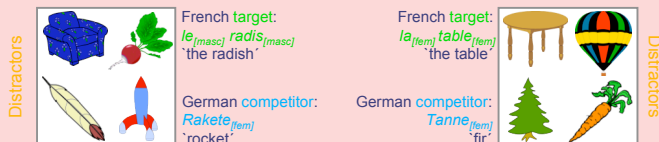


Figure 2: Activation of the competitor from 200 to 600 ms in Experiments 1 and 2 (fixations to the competitor minus fixations to the averaged distractors).

Experiment 3: Are these results due to the use of cognate nouns?

- Will German natives listening to French exclude a non-cognate such as 'rocket' (German *Rakete*_[fem]) from consideration when hearing French "le_[masc] ra...[dis]" ('the r...[adish]'), because the *competitor* does not match the gender of the target and its article?
- But activate the non-cognate 'fir' (German *Tanne*_[fem]) when hearing "la_[fem] ta...[ble]" ('the ta...[ble]')?



Method

- Displays: **Target** (to be clicked on), **competitor** (overlapping in onset with the target in German), and 2 unrelated **distractors**
- Two conditions:
 - **Different-gender:** German *competitor* of a different gender than the French *target*
 - **Same-gender:** German *competitor* of the same gender as the French *target*

Method (cont'ed)

- Head-mounted eyetracking
- Participants: 18 proficient German-speaking late learners of French and 12 native French speakers (control group)
- French names of competitors not overlapping with either *target* or German *competitor*; gender always different from the *target*
- 2 x 20 experimental trials alternating with 40 fillers
- French instructions: **Target** preceded by the gender-marked, definite article, e.g. "Cliquez sur la_[fem] table" ('Click on the...')
- Post-hoc proficiency test: Indicate the gender of all *targets* and *competitors*

Results

- Launching an eye-movement takes about 150-200 ms, so that fixations triggered by the onset of the *target* noun are expected from 200 ms on
- In the different-gender condition, when asked in French to click on the 'radish' ("le_[masc] ra...[dis]"), German native listeners did not fixate the rocket any more often than unrelated *distractors*, because of the mismatch between French article *le*_[masc] and German *Rakete*_[fem]
- In the same-gender condition however, having heard "la_[fem] ta...[ble]", the non-natives looked significantly more at the fir (German *Tanne*_[fem]), whose German gender matched with the French article (both feminine)
- French native listeners who did not know any German did not fixate the German *competitor* in any of the conditions, since it did not overlap with the *target* in their mother-tongue

Figure 3: Fixations to *target*, *competitor* and *distractors* from target onset in Experiment 3.

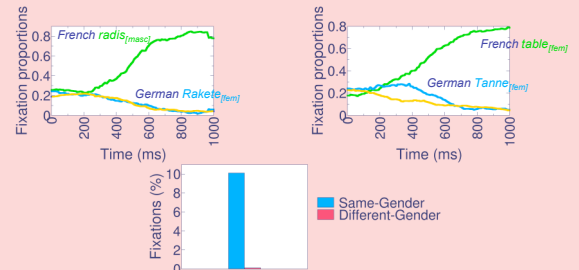


Figure 4: Activation of the competitor from 200 to 600 ms in Experiment 3 (fixations to the competitor minus fixations to the averaged distractors).

- Non-native participants appear unable to use the gender of their second language to reduce competitor activation (Experiment 1)
- Instead, native gender information seems to inappropriately interfere with non-native listening, by restricting the competitor set to gender-matching nouns in the mother-tongue
- Non-natives use the gender of their mother-tongue, although it is most likely to be irrelevant to noun recognition in a foreign-language (Experiments 2 & 3)

Given the results obtained with German-French participants, we must thus explain why *fir* (German *Tanne*_[fem]) is likely after French *la*_[fem] but *rocket* (*Rakete*_[fem]) unlikely after *le*_[masc]. Why is:

$$P(\text{fir} | \text{la}) \gg P(\text{rocket} | \text{le}) \quad ?$$

Let us consider the above explanations:

- **Form-based:** Since German nouns and French articles do not normally co-occur, direct co-occurrence frequencies cannot be estimated

$$f(\text{tan} \delta /_{[German]}, / \text{la} /_{[French]}) = ???$$

$$f(\text{rak} \epsilon t \delta /_{[German]}, / \text{le} /_{[French]}) = ???$$
- **Grammar-based:** In the case of the cross-linguistic effect observed with non-natives, this means the gender-effect would be mediated by categorical gender knowledge retrieved during lexical access. This is a potential explanation why the *fir* is fixated but not the *rocket*.

$$P(N_{[fem]}, \text{Art}_{[fem]}) = P(N_{[fem]} | \text{Art}_{[fem]}) * P(\text{Art}_{[fem]} | \text{LA})$$

$$P(N_{[fem]}, \text{Art}_{[masc]}) = P(N_{[fem]} | \text{Art}_{[masc]}) * P(\text{Art}_{[masc]} | \text{LE})$$

In addition, there is a 3rd possible explanation: The gender-effect could also be due to the co-occurrence of the article and noun lexemes.

$$P(\text{fir} | \text{LA}_{[French]}) \gg P(\text{rocket} | \text{LE}_{[French]})$$

because

$$P(\text{TANNE}_{[German]} | \text{LA}_{[French]}) \gg P(\text{RAKETE}_{[German]} | \text{LE}_{[French]})$$

In this case, the cross-linguistic effect would stem from **lexical transfer**, i.e. mediation by the article's translation. However, gender being arbitrary, both LE and LA are sometimes translated as DIE, so that both the *fir* and the *rocket* should be taken into consideration.

$$P(\text{TANNE}_{[German]}, \text{LA}_{[French]}) = P(\text{TANNE} | \text{DIE}) * P(\text{DIE} | \text{LA})$$

$$P(\text{RAKETE}_{[German]}, \text{LE}_{[French]}) = P(\text{RAKETE} | \text{DIE}) * P(\text{DIE} | \text{LE})$$

- Given our data, a grammar-based explanation of the gender-effect seems most likely
- This is reinforced by the results in Jakubowicz and Faussart (JPR, 1998), who found gender-effects in French after various types of determiners (article, demonstrative or possessive)
- Question: Can cross-linguistic evidence (our data) be used in this way to clarify observations made in native processing (Dahan et al., 2000)? Are the same processes at play?