Supplementary information: posttest on context-irrelevant associates

To explore whether our fMRI ambiguity effect in sentences could be due to the inhibition of context-irrelevant information, we did the following post-hoc test. First, we determined which were the semantic associates of the sentence onsets of our experimental items (e.g. *Beide vluchten*), and which of these associates were context-irrelevant (inhibited in the remainder of the sentence). Then we compared the amount of context-irrelevant semantic associates for ambiguous and unambiguous conditions. To investigate whether this difference in context-irrelevance could explain our fMRI results, we included the context-irrelevance score for each sentence item as a covariate in the fMRI analysis. This procedure is described in detail below.

Part A. Determination of strong associates.

Part A of the posttest determined which semantic associates were activated by the onset of the sentence up to and including the critical word (see Table 1 of main paper for example sentences). The sentence onsets (3x68 items) from the ambiguous noun/verb (SAn/SAv, e.g. *Zodra jullie bewijzen*), unambiguous verb (SUv; e.g. *Zodra jullie beweren*), and unambiguous noun (SUn; e.g. *Zodra jullie kopij*) conditions were distributed over three versions. Thirty native Dutch speaking volunteers (22 females, aged 18-31) participated in an online test for course credit or a small fee. None of the participants had participated in the pretest or the fMRI experiment. Participants were presented with the sentence onsets, and were asked to write down five words that come to mind. "Strong associates" were defined as the words that were written down by at least 40% of the participants.

Results. Sentence onsets had between 0 and 5 strong associates. The mean number of strong associates per sentence onset was 1.7 for SAn/SAv, 1.8 for SUn and 1.6 for SUv. The number of strong associates per item did not differ over the three conditions ($F<1$). For the SAn/SAv condition 57 out of the 68 sentence items had at least one strong associate, for both the SUn and SUv condition this was 56 out of 68 sentences.

Part B. Identification of context-irrelevant associates.

Part B of the posttest identified which of the strong associates determined in Part A were context-irrelevant (i.e. were inhibited in the remainder of the sentence). All experimental sentences of which the sentence onset had at least one strong associate (see part A) were included in part B. The SAv, SUv, SAn and SUn sentences (see Table 1 of main paper for examples) were distributed over four versions. Forty-four native-Dutch speaking volunteers (28 females, aged 18-30) participated in an online test for course credit or a small fee. None of the participants had participated in the pretest, the fMRI experiment, or Part A. Participants were presented with the full sentence and the list of associates produced in Part A for the corresponding sentence onset. Random words were added to the list of associates as fillers (one per associate). Participants were asked to select context-irrelevant associates (words that were unrelated to the sentence).

Results. To test for differences in context-irrelevance over conditions, we calculated the number of rejected associates per condition per subject. There were more rejected (context-irrelevant) associates for ambiguous than for unambiguous items ($F_{ambiguity}(1,43)=47.59$, $p<0.001$; mean number of rejected associates 28.7 for ambiguous and 21.5 for unambiguous items).

Conclusion from parts A and B: Thus, in the ambiguous condition the sentence onset activated more semantic associates that appeared to be context-irrelevant (inhibited in the remainder of the sentence) than in the unambiguous conditions.

Part C. Context-irrelevance as a covariate in the fMRI analysis

Can our fMRI results be explained by a different amount of selection/inhibition of semantic information between ambiguous and unambiguous words? To test this directly, we included the context-irrelevance score for each sentence item as a covariate in the fMRI analysis.

For every sentence item we calculated a 'summed context-irrelevance score' (Sum_CI). This score was obtained as follows. Every sentence had between zero and five strong associates (see part A). For every associate the weighted context-irrelevance was calculated: the context-irrelevance (the percentage of subjects that rejected this associate,

as defined in part B), weighted by the strength of the associate (defined by part A, score between 4 and 10). Thus, the weighted context-irrelevance could be a number between 0 and 10. Then, for every sentence item the 'summed context-irrelevance score' (Sum_CI) was calculated by summing the weighted context-irrelevance over all associates of that particular sentence item. In formula:

$$Sum\_CI = \Sigma_{associates}(\text{strength associate} * \text{percentage rejected})$$

In this way we obtained a summed context-irrelevance score for every sentence item. At the first level of the fMRI analysis (see Data Analysis section main paper) the Sum_CI score was added as a covariate to the GLM (temporally convolved with the canonical haemodynamic response function), thus regressing out the effect of context-irrelevance. We performed two second-level analyses. The first second-level analysis (both ROI and whole-brain) was performed in the same way as in the analysis without the covariate (see main paper). Here we looked at the SA>SU contrast to explore the effect of ambiguity within sentences when Sum_CI was regressed out. The second second-level analysis looked at the effect of the covariate Sum_CI itself. Here we generated single-subject contrast images for Sum_CI relative to the baseline FIX (see main paper), and used these in a one-sample T-test at the second level.

Results. The ROI analysis for LIFG with Sum_CI included as a covariate showed the same pattern of results as in the analysis without context-irrelevance. LIFG was activated more for sentences than for words ($F(1,27)=26.2$, $P<0.001$), while only within sentences there was an effect of ambiguity (Ambiguity*Grammaticality: $F(1,27)=5.1$, $P=0.033$; SA>SU: $T(27)=2.6$, $P=0.008$). The whole-brain analysis showed the same regions to be involved in the SA>SU contrast whether or not Sum_CI was added as a covariate. The clusters of activation were smaller when the covariate was added, which is to be expected when adding a regressor with similar timings as the experimental items.

When looking at the effect of the covariate Sum_CI itself, we find absolutely no activation in LIFG or LpMTG (nor in the other regions identified by the ambiguity contrast), even at the very low threshold of $p<0.05$ (voxel P uncorrected).

Conclusion part C: The results indicate that the difference in context-irrelevance between ambiguous and unambiguous items cannot explain our ambiguity effect in sentences in LIFG and LpMTG.