

## Can L1 Syntactic Transfer in L2 Reading Be Explained by an Expectation-Based Account?

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Cross-linguistic syntactic transfer from the first language (L1) can facilitate or inhibit comprehension of a second language (L2), depending on whether syntactic structures overlap across languages [1, 2]. In this work, we use eye-tracking data and computational modeling to explore whether syntactic transfer can be understood within the framework of an expectation-based account [3, 4], where predictions generated during L2 reading are in part shaped by L1 expectations. These expectations are confirmed when there is structural overlap between the two languages, leading to facilitated processing, whereas divergence results in violated expectations and processing difficulty.

We use neural language models (LMs) (two-layer LSTM; 650 units/layer; 650-dim embeddings) to test this hypothesis, and we ask whether they can capture reading times of English sentences designed to elicit syntactic transfer effects from the L1 in Dutch–English bilinguals relative to English monolinguals. If syntactic transfer is driven by L1 expectations, surprisal from a bilingual LM (trained on L1 Dutch; L2 English) should better account for L1 transfer effects in L2 reading than surprisal from a monolingual LM (trained only on English).

Two conditions in the eye-tracking data manipulated the direction of syntactic transfer and whether processing difficulty of dispreferred English structures was expected to be increased or decreased relative to their preferred counterparts (see Table 1 for examples). In the Decrease condition, the dispreferred late-particle structure in English was expected to be facilitated for bilinguals, as Dutch allows only late particles. In the Increase condition, complementiser-*that* drop is ungrammatical in Dutch and thus processing difficulty of the dispreferred structure without the complementiser was expected to be increased. Relative to English monolinguals, the difference in bilingual gaze durations of the critical regions between preferred and dispreferred sentences was smaller in the Decrease condition and larger in the Increase condition (left panel; Figure 1), confirming the predicted L1 transfer effects.

Mixed-effects regression analysis<sup>1</sup> revealed a significant three-way interaction between group (monolingual vs. bilingual), transfer (decrease vs. increase) and difficulty (preferred vs. dispreferred), suggesting that the effect of difficulty on surprisal differs between monolingual and bilingual LMs and whether L1 transfer is expected to facilitate or inhibit processing of the dispreferred structure. As can be seen from Figure 1, LMs displayed similar patterns to humans for the Decrease condition, with a smaller difference between preferred and dispreferred structures for bilinguals than monolinguals. However, LMs showed the same pattern in the Increase condition as in the Decrease condition, whereas humans showed the opposite, predicted pattern, with a larger difference between preferred and dispreferred structures for bilinguals relative to monolinguals.

These results partly support an expectation-based account of syntactic transfer. LMs show syntactic transfer when L1 expectations facilitate processing of the dispreferred structure, as in the Decrease condition. However, the results for the Increase condition, where violated L1 expectations induce a garden-path effect in bilinguals, suggest that surprisal alone may not be sufficient to account for processing difficulty arising from L1 transfer.

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<sup>1</sup>surprisal  $\sim$  sentence position + word length + group\*transfer\*difficulty + (1 | sentence pair)

## References

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## Figures and Tables

Table 1: Example stimuli. Critical regions in bold.

| Transfer | Difficulty                                                                            |                                                                                       |
|----------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|          | Preferred                                                                             | Dispreferred                                                                          |
| Decrease | Mom told Kevin to clean <b>out</b> his smelly little room in the attic before dinner. | Mom told Kevin to clean his smelly little room in the attic <b>out</b> before dinner. |
| Increase | The employees understood that the contract <b>would</b> be changed significantly.     | The employees understood the contract <b>would</b> be changed significantly.          |

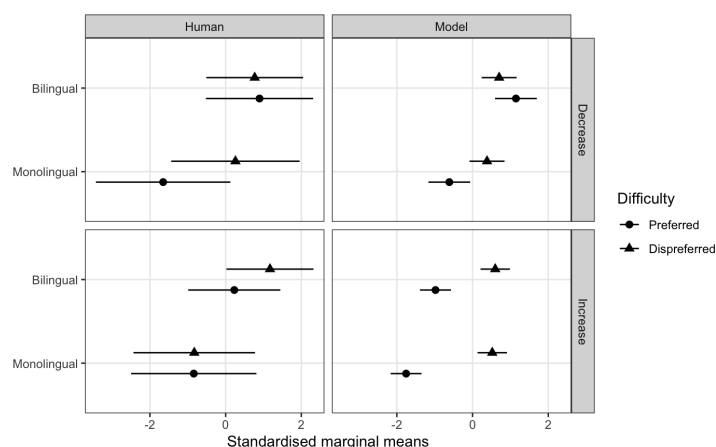


Figure 1: Standardised marginal means for log gaze durations (humans; left panel) and surprisal (LMs; right panel) predicted by the three-way interaction between group (monolingual vs. bilingual), transfer (decrease vs. increase) and difficulty (preferred vs. dispreferred). Error bars represent 95% CIs. Means are standardised within humans and LMs separately.