

Fearing and loving: verb category matters in processing implicit causality

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The sentence “Will frightened Diane because...” is more likely to be completed with the pronoun “he”, referring to the subject (Will), than the pronoun “she”, referring to the object (Diane). In contrast, the sentence “Will loved Diane because...” is more likely to be completed with the pronoun “she”, referring to the object, than the pronoun “he” referring to the subject. This implicit causality bias has been linked to the semantic class of verbs: object- experiencer verbs, like frighten, are associated with a subject causality bias, while subject-experiencer verbs, like love, are associated with an object causality bias (e.g., Hartshorne & Snedeker, 2013). The implicit causality bias can impact online word-by-word comprehension, with prolonged costs evoked by pronouns that are inconsistent (versus consistent) with the bias in both behavioral (e.g., Koornneef & van Berkum, 2006) and event-related potential (ERP) studies (e.g., van Berkum et al., 2007). In the current study, we explicitly examined whether the semantic verb class influences the neurocognitive costs incurred when the implicit causality bias is disconfirmed by the input. Unlike previous ERP studies that have not classified verb classes in this fashion, we only used subject- and object-experiencer verbs. The verbs were defined according to taxonomy from VerbNet (which is an extension of a systematic function of verb class by Levin (1993)). Furthermore, these verbs had been tested for pronoun resolution bias in a large-scale behavioral study (Hartshorne & Snedeker, 2013). We measured ERPs as seventeen right-handed participants read two- clause sentences, presented word-by-word (400ms, ISI: 200ms). In 50% of sentences, the first clause contained an object-experiencer verb and in 50%, it contained a subject-experiencer verb. Verb class was fully crossed with bias consistency (pronouns were either consistent or inconsistent with the bias). ERPs were time-locked to the pronoun in the second sentence. After object-experiencer, but not subject-experiencer verbs, we observed a prolonged negativity effect between 300-800ms on pronouns that were inconsistent (versus consistent) with the implicit causality bias. These findings suggest that semantic verb class, influence the set-up of an implicit causality bias during word-by-word processing. Specifically, we suggest that comprehenders used object- experiencer verbs to generate relatively higher probability expectations for encountering a bias-consistent pronoun than a bias-inconsistent pronoun. Encountering the bias- inconsistent pronoun led to increased costs of selecting the less probable actual event structure over the more probable (predicted) event structure as the incoming pronoun was integrated. We further suggest that these ‘selection costs’, reflected by a prolonged negativity effect, can be distinguished from ‘revision or reanalysis costs’ observed on bias-inconsistent pronouns, reflected by a late positivity/P600 effect, previously observed by Van Berkum et al. (2007). Finally, we suggest that comprehenders were more likely to set up online causal expectations with object-experiencer than with subject experiencer verbs because the causal structure of object experiencer verbs is encoded within the lexical structure itself (Pesetsky, 1995), whereas, for subject experiencer verbs, it needs to be inferred.