Good-enough processing versus rational inference in linguistic illusions: Modeling judgments of formal correctness and meaning recoverability with a race model

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A linguistic illusion is said to have occurred when an ungrammatical sentence is perceived as being grammatical (e.g., *The key to the cabinets are on the table*), or when a nonsensical sentence is perceived as making sense (e.g., *The woman gave the candle the daughter*). Two theoretical proposals exist that may be able to capture the entire range of linguistic illusions. One is the "good enough" approach to language processing, which assumes that in order to save time and effort, speakers sometimes compute heuristic, "quick and dirty" representations of the input [1,2]. The other proposal is that speakers make rational inferences to recover the intended meaning of malformed utterances, using prior knowledge about plausible meanings and "repairing" likely production or transmission errors [3,4]. Under the "good enough" approach, linguistic illusions are *failures* of the language processor, because errors or inconsistencies are missed, but under the rational inference approach they can be considered *successes*, because the communicative intention is correctly identified. Another difference between the two approaches is that rational inference can involve conscious "repairs" [5], while good-enough processing is usually taken to preclude error awareness.

It is possible that good-enough processing and rational inference both contribute to linguistic illusions to different degrees, depending on the type of illusion [6]. As a step towards a typology of illusions, I asked 100 English native speakers to give combined judgments of whether sentences were formally correct and of whether they could recover the intended meaning. The same participants were tested on a battery of different illusion sentences, as shown in (1). Good-enough processing predicts that readers should completely miss the errors, which should result in "formally correct, and I get it" judgments. By contrast, the rational inference account predicts that readers should give "formally incorrect, but I get it" judgments, assuming that "repairs" rise to consciousness.

I model judgment and reaction time data with a Bayesian lognormal race model (LRM; [7]). The LRM assumes that each response option accumulates evidence over time, with the fastest option winning the race. The assumption is thus that good-enough processing and rational inference take place in parallel and compete to produce a response. Outright rejections ("Don't get it") are produced by a noisy timer. "Inversion" sentences like (1a) are used as the baseline against which the other illusions are compared, as they have been convincingly argued to trigger rational inferences [8,9]. Sentence length is included as a continuous predictor to control for base error probability.

Table 1 shows response percentages and median RTs by illusion type. The modeling results are shown in Figure 1. For **"inversion"** sentences, rational inference is faster than good-enough processing, supporting the claim that they are mainly processed via "repairs" based on their intended meaning and likely speech errors. The processing profiles of **comparative illusion** sentences and **missing VP** sentences are similar to that of "inversion" sentences. **Agreement attraction** sentences show a different pattern, with relatively fast speeds for both rational inference and good-enough processing, resulting in few outright rejections. Even more strikingly, **depth charge** sentences show a large advantage for good-enough processing over rational inference, as well as few rejections. The dominance of good-enough processing for this sentence type suggests that the depth charge illusion may not be mainly driven by rational inference, contra [10]. Finally, **NPI illusion** sentences are distinguished mainly by their high rejection rates, in addition to slow good-enough processing.

The results show that good-enough processing and rational inference can be modeled as parallel, competing processes that generate variable outcomes – error awareness or non-awareness – for different linguistic illusions. Conscious rational inference dominates processing for some but not all illusions, the depth charge illusion being an outlier for which error awareness is mostly absent.

(1) (a) **"Inversion"** (arguments have been swapped)
The mother gave the candle the daughter before bedtime.

(b) **Agreement attraction** (verb number agreement with wrong NP)
The waitress who sat the girls unsurprisingly were unhappy about all the noise.

(c) **Comparative illusion** (set cardinality compared with event frequency)
More relatives went to my 21st birthday party than my friend did, because my parents invited everyone that they knew.

(d) **Depth charge illusion** (*too* used instead of *enough*)
When Jack inspects the uniforms, no stain is too subtle to miss.

(e) **Missing VP** (three subjects but only two verbs)
The crime that the gangster who the story had profiled was quickly solved.

(f) **NPI illusion** (NPI *ever* licensed by embedded *no*)
The soldiers that no diplomats supported have ever shown bravery in the controversial war.

	Don't get it	Get it, incorrect	Get it, correct	median RT
"Inversion"	18%	72%	10%	7.7 s
Attraction	9%	65%	26%	8.2 s
Comparative	22%	51%	26%	8 s
Depth charge	5%	14%	82%	7.3 s
Missing VP	22%	63%	15%	8.5 s
NPI	38%	52%	11%	9.1 s

Table 1: Response percentages and median reaction times by illusion type. Reaction times have been residualized against sentence length in characters.

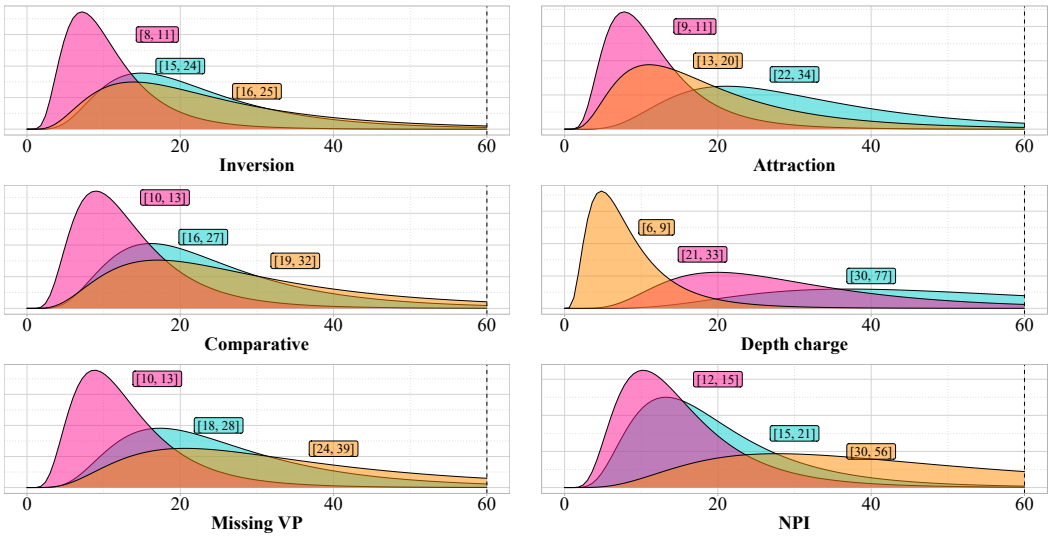

Figure 1: Finishing time distributions based on posterior mean finishing times (in seconds) for the three evidence accumulators by illusion type, with 95% highest density intervals for mean finishing times. pink = Rational inference, orange = Good-enough processing, cyan = Rejection.

References [1] Ferreira et al. (2002). *Current Directions in Psychological Science*. [2] Karimi & Ferreira (2016). *Quarterly Journal of Experimental Psychology*. [3] Levy (2008). *Proceedings of EMNLP*. [4] Ryskin et al. (2021). *Neuropsychologia*. [5] Ryskin et al. (2018). *Cognition*. [6] Brehm et al. (2021). *Language, Cognition and Neuroscience*. [7] Rouder et al. (2015). *Psychometrika*. [8] Gibson et al. (2013). *PNAS*. [9]. Gibson et al. (2017). *Psychological Science*. [10] Zhang et al. (2023). *Cognition*.