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New paper thread! “An ERP index of real-time error correction within a noisy-channel framework of human communication”

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An ERP index of real-time error correction within a noisy-c...
Recent evidence suggests that language processing is well-adapted to noise in the input (e.g., spelling or speech error...

6:37 PM · May 31, 2021



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14



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joint work w/ Laura Stearns, Leon Bergen, Marianna Eddy, [@ev_fedorenko](#) & [@LanguageMIT](#) out now in *Neuropsychologia* 2/n



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Language input often contains errors (e.g., typos, speech errors, mishearing) yet comprehenders can typically infer the intended meaning based on prior plausibility and the likelihood of particular noise corruptions. 3/n



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...

The goal of this paper is to connect this “noisy-channel” account to the rich literature on ERP indices of language processing. Specifically, we propose that the amplitudes of the N400 and P600 are related to the probability of noisy-channel inference. 4/n

The storyteller could turn any incident into an amusing ...

Control

$$\frac{P(S_p = anecdote | S_i = anecdote) P(S_i = anecdote)}{P(S_p = anecdote | S_i = anecdote) P(S_i = anecdote)} = \frac{P(S_i = anecdote | S_p = anecdote)}{P(S_i = anecdote | S_p = anecdote)} = 1$$

Semantic

$$\frac{P(S_p = hearse | S_i = anecdote) P(S_i = anecdote)}{P(S_p = hearse | S_i = hearse) P(S_i = hearse)} = \frac{P(S_i = anecdote | S_p = hearse)}{P(S_i = hearse | S_p = hearse)} < 1$$

Syntactic

$$\frac{P(S_p = anecdotes | S_i = anecdote) P(S_i = anecdote)}{P(S_p = anecdotes | S_i = anecdotes) P(S_i = anecdotes)} = \frac{P(S_i = anecdote | S_p = anecdotes)}{P(S_i = anecdotes | S_p = anecdotes)} \gg 1$$

Recoverable

$$\frac{P(S_p = antidote | S_i = anecdote) P(S_i = anecdote)}{P(S_p = antidote | S_i = antidote) P(S_i = antidote)} = \frac{P(S_i = anecdote | S_p = antidote)}{P(S_i = antidote | S_p = antidote)} > 1$$

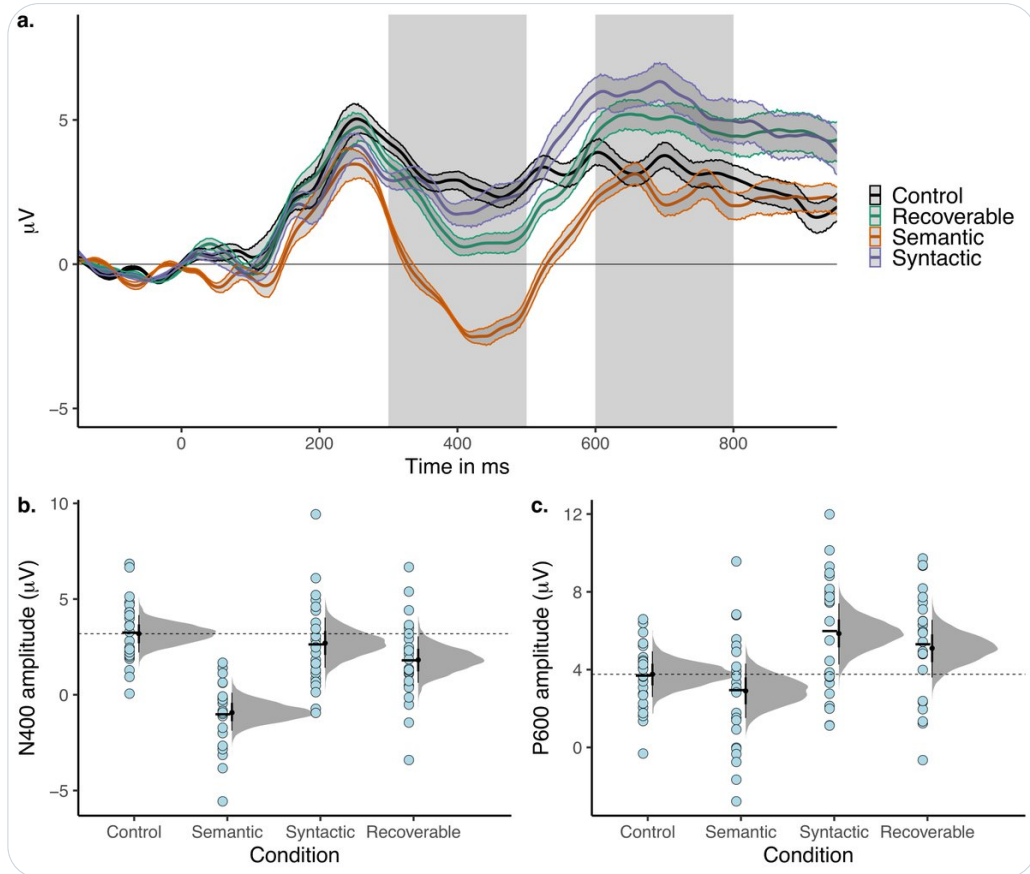
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...

We show that semantic violations which can be attributed to noise, e.g., “The storyteller could turn any incident into an amusing antidote” (close to “anecdote”) show reduced N400 and increased P600 effects, compared to “classic” violations, “...hearse”. 5/n



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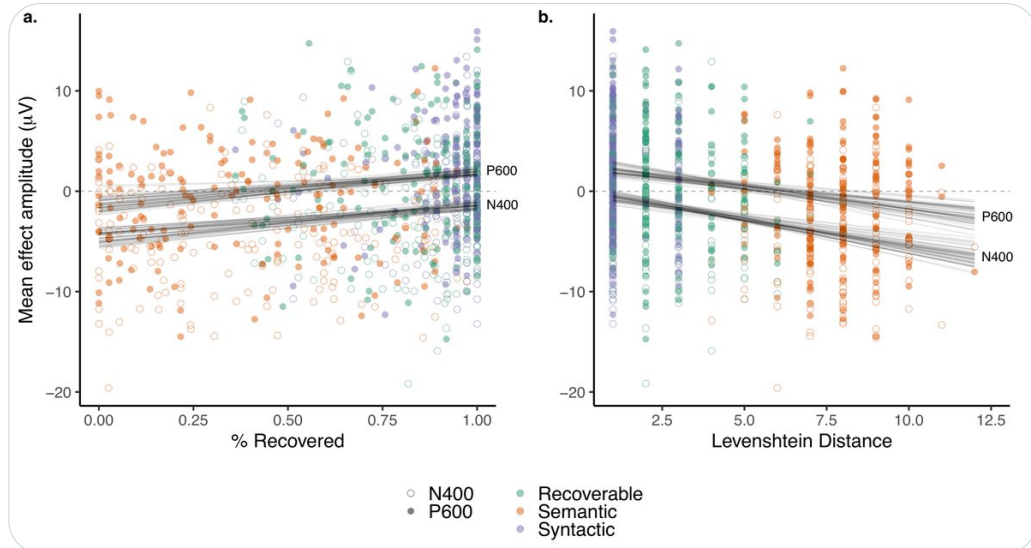




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The magnitudes of these ERP effects were correlated with the probability that the comprehender retrieved a plausible alternative and the Levenshtein distance between the word and its plausible alternative (antidote->anecdote). 6/n



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Lots still to be figured out regarding underlying mechanisms but we think this opens up exciting new directions and opportunities for investigating the reader's/listener's implicit model of noise in communication. 7/7



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