When unpredictable does not mean difficult to process

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Abstract

During language comprehension, words that are less expected tend to take more effort. This phenomenon has been described by the hypothesis that cognitive cost scales in surprisal (negative log probability; Hale, 2001; Levy, 2008), with a core justification being that surprisal quantifies the amount by which a rational comprehender's beliefs about meaning change upon encountering a word. However, this focus on next-word prediction may be too narrow. In this work we advocate measuring processing cost directly with the size of the change in beliefs about meaning, a reframing which implies a novel class of potential situations where surprisal may systematically overestimate cost. We identify typographical errors as a test case, and implement estimators of surprisal and belief-update in a noisy-channel model of comprehension as inference about intended strings. In a self-paced reading time study, we present evidence that human reading time behaves as predicted by belief-update size, rather than surprisal.

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