**The Interplay of Locality and Surprisal**
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Dependency Locality Theory (DLT) (Gibson 2000) predicts increasing processing difficulty at the verb as argument-verb distance is increased. However, recently Levy (2007), using surprisal (Hale 2001), has argued that increasing argument-head distance can sharpen the expectation for the verb, resulting in a facilitation at the verb -- an antilocality effect. We show that, although in general DLT and surprisal make conflicting predictions, they can be reconciled in a principled manner.

Consider Grodner and Gibson's (2005) experiment (see 1.a-c). They varied argument-head distance in object-extracted RCs with an unmodified subject (1-a), a PP-modified subject (1-b), and an RC-modified subject (1-c). The DLT predicts monotonically increasing processing difficulty at the first verb (supervised) in (1-a) to (1-c) due to the increase in predicted integration cost. By contrast, surprisal predicts that the increase in the number of preverbal constituents facilitates the expectation of the upcoming verb. Using a self-paced reading study Grodner and Gibson provide evidence that supports DLT's predictions.

We demonstrate that surprisal's antilocality prediction can be seen in these materials after DLT's effect on reading times is partialled out. Bartek et al (2006) replicated Grodner and Gibson's experiment using eyetracking, and also carried out a second experiment with the same design but using short (4-6 words), high-frequency words (>50-per-million occurrences).

For these two experiments, we fitted a linear mixed-effects model with fixation durations at the verb 'supervised' as dependent measure and DLT's predictions as a fixed effect (sentences and participants were the random effects), and examined the residuals, which constitute the variance unexplained by DLT. Interestingly, we found that, in the Grodner and Gibson replication the mean residual values showed a pattern consistent with surprisal's predictions (monotonically decreasing reading times in 1-a to 1-c at the verb); this was principally seen in first-pass measures such as single fixation duration, first fixation duration, and first pass reading time. In the second experiment, which had the same design but short, high-frequency words, the antilocality effect was evident in the residuals only for single fixation duration.

In sum, we show that surprisal's predictions can be seen even in data that apparently show locality effects as predicted by DLT. Moreover, surprisal's predictions are seen largely in early eyetracking measures; this is consistent with the fact that surprisal value depends on the satisfaction of the expectation for the upcoming verb, which occurs immediately after lexical access.

(1)
a. The administrator who the nurse supervised scolded the medic while...
b. The administrator who the nurse from the clinic supervised scolded the medic while...
c. The administrator who the nurse who was from the clinic supervised scolded the medic while...

**References:**
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