Considerable evidence suggests that readers and listeners actively predict concepts, words, and structures during sentence comprehension \[1, 2, 3, 4, 5\]. However, the specific role that predictions serve remains unclear. Some have argued that these predictions serve to ease processing of upcoming material \[6, 7\]: when a representation is pre-activated, its subsequent processing will be facilitated. This study provides novel neuroimaging evidence consistent with this view by examining feature-level predictions. The findings suggest that comprehenders predict broad lexical-semantic classes (animate vs. inanimate nouns) based on a verb’s coarse-grained semantic constraints \[8, 9\], facilitating subsequent processing.

However, in contrast to previous violation-based reading or ERP studies, the current findings provide neural evidence consistent with featural pre-activation, in plausible easy sentences.

College-aged adults (n=14) read sentences in a rapid serial visual presentation (RSVP) format while their brain activity was recorded during a functional Magnetic Resonance Imaging (fMRI) scan (Siemens 3T). Participants read plausible SVO sentences up to presentation of the object noun. Sentences were either predictive for an animate or inanimate object, or were equally plausible for an animate/inanimate object (non-predictive; Table 1). Participants made a judgment via button press whether the next word would be animate, inanimate, or indeterminate. Post button-press and a variable jitter interval per trial, participants saw the noun. Norming with a separate set of college-aged adults established that the predictive conditions were strongly predictive/non-predictive of animate or inanimate themes.

BOLD-weighted images were normalized in AFNI and analyzed via univariate contrasts. Critical contrasts compared BOLD response for animate-predicting vs. matched non-predictive sentences ([1a]+[1b] vs. [1c]) and inanimate-predicting vs. matched non-predictive sentences ([2a]+[2b] vs. [2c]). Note that the predictive conditions involve predictions based on verb information only (semantically empty ‘someone’ followed by predictive verb), whereas the non-predictive conditions contain semantically specific agents followed by non-predictive verbs. We examined activation in regions of interest (ROIs) that are sensitive to animacy, identified using Freesurfer [http://surfer.nmr.mgh.harvard.edu/]: left/right lateral occipital cortex [LO], fusiform gyrus [FG], and superior temporal sulcus [STS] \[10\].

Results revealed that during the predictive window, between the verb and noun, participants had greater BOLD response for non-predictive compared to predictive sentences in the left STS, an animacy-sensitive ROI (t=-2.49, p=0.03). This held for the animate condition only. During the noun window, participants again had greater BOLD response for non-predictive compared to predictive sentences, this time in left STS (t=-2.60, p=0.02), left and marginal right LO (left: t=-2.86, p=0.01; right: t=-2.09, p=0.06), and left and right FG (left: t=-2.29, p=0.04; right: t=-2.83, p=0.01). Again, these held for animate conditions only.

Additional planned multivariate analyses of BOLD response during the predictive window found further evidence for word-category predictions. Sentences predicting animate nouns were discriminated from those predicting inanimate nouns ([1a+b] vs. [2a+b]) in left FG and LO and right STS. Sentences predicting animate nouns were also discriminated from non-predictive sentences ([1a] vs. [1c]) in right FG. However, no regions discriminated inanimate-predicting sentences from non-predictive sentences.
Assuming that decreased BOLD response indicates facilitated processing as in repetition-priming fMRI studies (e.g. [11]), these findings indicate that comprehenders generated predictions regarding the upcoming theme, which facilitated subsequent processing of animate themes. This pattern appeared in animacy-sensitive ROIs before the critical word, as comprehenders were making a judgment about upcoming material, and when they encountered bottom-up information (the noun), confirming their prediction. These findings provide novel evidence that comprehenders make coarse-grained predictions at the featural level for animacy (see [12] for predictions of word classes). It is unclear why effects appeared more clearly for animate themes. This may reflect a general processing cost associated with animate themes, based on the typical association of animacy and agency/subjecthood ([13]).

### Table 1

**Example Stimuli**

<table>
<thead>
<tr>
<th>ANIMATE</th>
<th>INANIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>Someone</td>
</tr>
<tr>
<td>1b.</td>
<td>Someone</td>
</tr>
<tr>
<td>1c.</td>
<td>The ballerina</td>
</tr>
</tbody>
</table>

a.+ b. vs. c., predictive vs. non-predictive conditions

Presentation segments for RSVP task are indicated with a pipe (|). Question mark (?) indicates the jitter interval per trial, which varied from 2-22 seconds. Participants made predictive judgment during jitter.

### References