The informational content of individual words is flexible across contexts, requiring the cognitive system to generate context-specific representations during language comprehension. For example: “DARK” has a large effect in “DARK PAINT”, but not in “DARK CHARCOAL.” Our goal is to predict the context-specific representations in a simple model, using the test case of adjective-noun combinations. We use the adjectives “LIGHT” and “DARK” to modulate brightness levels of 45 concepts (e.g., SNOW, FUR, CHARCOAL), and try to predict the amount of brightness modulation in each case.

We calculated brightness probability for each concept, and transformed these probability values to brightness entropy, which is used in information theory to capture the informativity of a signal.

We predicted that the entropy (i.e., informativity) of an adjective in a given adjective-noun pair should predict the amount of brightness modulation that occurs during comprehension.

**BEHAVIORAL RESULTS**

1. **Probability**
   Participants on AMT (N=68) reported the extent to which each unmodified concept is “typically dark” on a scale from 1-5. These values were then scaled between 0 and 1 to create $P_{DARK}, P_{LIGHT} = 1 - P_{DARK}$.

2. **Entropy**
   $P_{DARK}$ and $P_{LIGHT}$ were transformed into Entropy using the standard equation from information theory:
   $$Entropy = -P_{DARK} \log(P_{DARK}) - P_{LIGHT} \log(P_{LIGHT})$$

3. **Darkness Values**
   One group of participants on AMT (N=118) made explicit darkness judgments on the 45 unmodified concepts, and another group (N=235) made explicit darkness judgments on the 90 combinations.

**NEUROIMAGING RESULTS**

During comprehension of adjective-noun phrases, the brain must represent the individual constituents (e.g., “dark”, “paint”) and also must generate a context-specific representation.

What neural regions contain brightness representations that are modulated by the informativity of an adjective-noun phrase? We collected fMRI data while participants (N=11) were presented with the same concepts and combinations and performed an orthogonal color judgment task. We isolated regions that were sensitive to the brightness of the unmodified concepts.

**CONCLUSIONS**

1. Using explicit judgments of darkness, we find that the amount of brightness modulation in “light” and “dark” combinations is predicted by entropy, a measure from information theory that captures informativity.
2. Using fMRI, we find that not all regions that represent brightness do so in a context-specific way: effects of adjective-informativity are found in frontal cortex, but not visual cortex.
3. These results begin to reveal the pathways by which conceptual information is transformed into context-specific representations.

**ACKNOWLEDGEMENTS**

This research was supported by Grant R01 DC015359 awarded to STH and an NSF Graduate Research Fellowship awarded to STH.