

# Neural evidence for a new Bayesian model of adjective-noun modification Sarah Solomon & Sharon Thompson-Schill

Department of Psychology, University of Pennsylvania



#### How are concepts combined?

We tested whether the uncertainty of a feature (BRIGHTNESS) in a concept (e.g., DIAMOND) affects how that feature is flexibly modulated in combined concepts ("dark diamond"). We used the adjectives "dark" and "light" to modulate the conceptual brightness of 45 noun concepts.

Feature uncertainty was captured using entropy and a predictive Bayesian model.

#### **EXPLICIT RATINGS OF CONCEPTUAL BRIGHTNESS**



## **PREDICTIVE MODELS**



**Ground-truth effect:** The extent to which a noun concept's conceptual brightness can be modulated by "dark" and "light" adjectives.

Explicit modulation of conceptual brightness is predicted by:

FEATURE UNCERTAINTY

**BAYESIAN MODEL** 



### FEATURE MODULATION IN LIFG & LATL



- Univariate LIFG responses to combined concepts are correlated with ground-truth effects and feature uncertainty.
- Univariate LATL responses are predicted by a Bayesian combinatorial model and multivariate responses are correlated with ground-truth effects.



- Increased uncertainty in conceptual brightness results in increased modulation of conceptual brightness in "dark" and "light" combinations.
- A Bayesian model which incorporates feature uncertainty outperforms an additive combinatorial model.

ENTROP

## REMARS REMARS DAMPAND SUGAR FOAM BRRAD CLOUD BRRAD CLOUD BRRAD CLOUD BRRAD CONNEET BRRAD CONNEET FUR FUR ROCK BRREE LEANS EVESHADOW BREED FANORGEATE



- Univariate effect: The extent to which mean level of activity was influenced by the dark- and light- combinations relative to the noun
- Multivariate effect: The mean pattern dissimilarity between



#### Entropy







