

# 2017

## Kavli Summer Institute in Cognitive Neuroscience

**Week 1: Computational perspectives on language prediction in the brain**

### Course Directors

Gina Kuperberg  
Tufts University &  
Massachusetts General Hospital

T. Florian Jaeger  
University of Rochester

Language presents our brains with considerable challenges. On the one hand, language processing benefits from linguistic and real-world knowledge stored in memory to predict new inputs. On the other hand, the neural systems underlying language processing must still be flexible enough to make sense of novel events and situations, and learn from these experiences to adapt to our ever-changing communicative environments. This course considers some of the computational principles and mechanisms by which our brains meet this challenge. Selected speakers from multiple areas of Cognitive and Brain sciences will discuss how computational models can yield insights into neurocognitive mechanisms engaged in probabilistic, graded prediction at multiple levels of language, ranging from speech perception to discourse comprehension. In addition, we will discuss how these principles can inform our understanding of the links between language processing and language learning in the brain.

### **Monday (6/26): Overview: Computational principles and neural instantiation of prediction**

8:00-8:30	Breakfast
8:30-8:35	Welcome – Mangun, Giesbrecht, Miller and Gazzaniga
8:35-8:45	Introductory Remarks – Gina Kuperberg/Florian Jaeger
8:45-10:15	Lecture 1: <b>Gina Kuperberg &amp; Florian Jaeger:</b> Probabilistic prediction during language processing: Overview of computational and neural challenges
10:15-10:30	Break
10:30-11:45	Lecture 2: <b>Dave Kleinschmidt</b> (Princeton University): The link between prediction and adaptation: linking the ideal observer perspective to brain function
11:45-1:45	Lunch
1:45-5:00	Lab Session: – Neuroanatomy – Skirmantas Janusonis (UCSB) LOCATION: Physical Sciences Building North (PSBN), Rms. 2664 and 2666 <a href="http://www.aw.id.ucsb.edu/maps/ucsbmap.html">http://www.aw.id.ucsb.edu/maps/ucsbmap.html</a> (in D5, next to Chemistry).

**Tuesday (6/27): Prediction and learning in speech perception (comp; intracranial recordings)**

- 8:00-8:45 Breakfast  
8:45-10:15 Lecture 3:  
**Edward Chang** (UC San Francisco): The neural basis of prediction in speech perception: Evidence from intracranial electrode recordings  
10:15-10:30 Break  
10:30-11:45 Lecture 4:  
**Naomi Feldman** (University of Maryland): Probabilistic prediction in speech perception & acquisition: an ideal observer computational perspective  
11:45-1:45 Lunch  
1:45-5:00 Lab Session: – Neuropsychology Videos

**Wednesday (6/28): Prediction in semantic, lexical and syntactic processing (ERP; MEG; fMRI)**

- 8:00-8:45 Breakfast  
8:45-10:15 Lecture 5:  
**Kara Federmeier** (University of Illinois): The whether, how, and when of semantic, lexical and orthographic prediction in the brain  
10:15-10:30 Break  
10:30-11:45 Lecture 6:  
**Ellen Lau** (University of Maryland): Semantic and syntactic prediction in the brain: Perspectives from multimodal imaging studies  
11:45-1:45 Lunch  
1:45-5:00 Lab Session: **Ralf Haefner, Dave Kleinschmidt, and Florian Jaeger:** Computational basics on prediction in the brain

**Thursday (6/29): Prediction and adaptation in discourse comprehension (comp; ERP, MEG, fMRI)**

- 8:00-8:45 Breakfast  
8:45-10:15 Lecture 7:  
**Vera Demberg** (Saarland University): Linking computational and neural perspectives on prediction in discourse comprehension  
10:15-10:30 Break  
10:30-11:45 Lecture 8:  
**Gina Kuperberg** (Tufts University & Mass. General Hospital) & **Tamara Swaab** (University of California, Davis): Neural signatures of prediction and prediction error in discourse comprehension  
11:45-1:45 Lunch  
1:45-5:00 Debate Preparation (no lab)  
6:30-8:00 **DEBATES: Teams 1 and 2** (fellows will be organized into teams during week 1)

## **Friday (6/30): Language prediction: From algorithms to neural implementation**

- 8:00-8:45 Breakfast
- 8:45-10:15 Lecture 9:  
**Jay McClelland** (Stanford University): A neural network that learns an implicit probabilistic model of sentence meaning: Implications for neural signatures of prediction in language processing
- 10:15-10:30 Break
- 10:30-11:45 Lecture 10:  
**Ralf Haefner** (University of Rochester): Prediction in computational neuroscience
- 11:45-1:45 Lunch
- 1:45-3:00 Lecture 11:  
**Tobias Egner** (Duke University): Neural instantiation of non-linguistic prediction and adaptation: Insights from visual cognition
- 3:00-3:30 Final discussion and sum-up.
- 3:30-5:30 Chill
- 5:30 **BBQ at Goleta Beach (walking distance from campus – see map)**

**Saturday and Sunday:** Free, to enjoy the Santa Barbara area and each other's company

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