Overview of differences computational science (model, simulations, visualizations)

I'll focus on overview of sociolinguistics and how it relates to computational neuroscience.

Linguistics is the scientific study of language and how people use language. Linguistics is not the study of how to "speak good" or "talk well," as 'good' and 'well' are not scientifically valid concepts. Linguists look at how language is spoken by humans, track variation and changes throughout history with relation to language, and do analyses based on the data - the language output. The field of linguistics is broad. The field of sociolinguistics is the study of language in relation to social factors, including differences of regional, class, and occupational dialect, and gender differences.

So how does this relate to neurocomputation?

Well, there is bountiful evidence from neurolinguistics (people who study how the brain processes language) showing that people invoke prediction during sentence processing (Van Berkum et al. 2008, Hanulikova et al. 2012, Kutas et al. 2014). This means when we are listening to someone talk, our brain is one step ahead of us, trying to predict what will come out of that person's mouth next, based on the context of the conversation. Electroencephalography (EEG) is one method used by neurolinguists to look at this predictive processing. EEG measures electric potentials that are generated by tens of thousands of cortical neurons using electrodes placed on the scalp. Averaging the EEG signal that is recorded to multiple instances of a specific perceptual speech event reveals systematic voltage changes associated with the cognitive processes elicited by that event, called the Event-Related Potential (ERP). This neurocomputational tool is useful to linguists because it allows researchers to passively monitor neural activity which reflects implicit and on-line linguistic judgements, including the so- cial expectations of listeners. It also illuminates for researchers when, in real time, expectations on the part of the listener may be violated during processing, indicating that prediction is taking place. A great deal of prior work has revealed ERP signatures for semantic and syntactic violations (Luck 2005). For example, if something is semantically unexpected in a sentence string, a listener will exhibit an increase of negative voltages over the central scalp that peaks around 400 milliseconds after word onset (the "N400"). Let me give you an example. The sentence "I like my coffee with cream and sugar" is a pretty normal sentence. You know what it means, I talked about coffee, and as the sentence unfolded, you probably could have predicted that i was going to say sugar from what you know about coffee drinking. However, if I were to say, "I like my coffee with cream and shutters," that might shock you. Both sugar and shutters have the same initial consonant sound, and they're both nouns, but shutters doesn't belong in

the coffee context. When we hear shutters instead of coffee, our brain shows a semantic neurological response of surprisal, because our predictions during processing were violated. Thus, EEG is a great tool for people interested in the social information that listeners hold when they're listening to others speak, as we can learn more about what the brain is capable of recognizing and processing.

Potential Student Research Plan for students working with Weissler *

*All Student tasks should be completed prior to that week's meeting:

Week	**Rachel**	**Students**
Week 9	- other studies to be a part of - paid opportunities - closing remarks	- come to meeting prepared to discuss what you've learned over the course of the active research time, and what skills you believe you'll take with you

Research Commitment:

Skill & Knowledge Development

· experiment building tools (Gorilla SC, PsychoPy, E-Prime, all depending on funding

available for students to access these respectively)

· Tools for Analysis (MatLab fieldtrip toolbox, R)

· Data Management (excel)

· Linguistic Analysis Tools (Praat, free to download)

· Knowledge in Neurolinguistics (ERPs, surprisal effects, etc)

· Writing

Expectations for "active research" period:

1. Research Activities

2. Reading and writing assignments

3. Weekly meetings with PI

4. Maintain a physical or electronic lab notebook in which you make at least some notes every day that you work, e.g., http://colinpurrington.com/tips/lab-notebooks

    a. Summaries of meetings

    b. To-do lists

    c. Personal goals

    d. Hours worked, what you worked on

    e. Methodological details

    f. Insights and questions as they arise

What you need to be successful:

· Able to work independently

· Enthusiasm about learning a new field

· Confidence to be clear about what you do and don't know

· Dedicated flash drive (?)

· Access to files (via Google Drive)