Human Language Processing

- We understand language **incrementally**, word-by-word
  - *How do people construct interpretations?*

- We must resolve **local** and **global ambiguity**
  - *How do people decide upon a particular interpretation?*

- Decisions are sometimes wrong!
  - *What information is used to identify we made a mistake?*
  - *How do we find an alternative interpretation?*

- Answers can reveal important details about the underlying mechanisms
Theories of Sentence Processing

• Explanatory and descriptive goals

• Theories of parsing typically determine …
  • what **architecture** is assumed: modular? symbolic? ...
  • what **mechanism** is used to construct interpretations?
  • which **information** sources are used by the mechanism?
  • which **representation** is preferred/constructed when ambiguity arises?

• **Linking Hypothesis:** Relate theory/model to observed measures
  • What cognitive processes does the measure reflect, how can this be related with aspects of the model’s processing or memory

Topics

• Human language processing: Reading times, eye-tracking, EEG/ERP

• General and Philosophical Issues
  • Modularity versus Interaction
  • Marr’s levels, Rational theories
  • Experience-based versus innate mechanisms

• Syntactic Processing
  • Psychologically plausible parsers: Incrementality, Memory Load and Ambiguity
  • Theories of Syntactic Ambiguity Resolution (Frazier, Pritchett)
  • Reanalysis & Monotonic Parsing (Pritchett; Sturt & Crocker)
Topics

• Probabilistic Models
  • Lexical category disambiguation (Corley & Crocker)
  • Syntactic parsing (Jurafsky)
  • Wide coverage sentence processing (Crocker & Brants)
  • Other rational approaches: Informativity (Chater, Crocker & Pickering)
• Interactive Models (McRae et al)
  • Multiple competing constraints, non-modular
  • Setting model parameters from corpora and off-line experiments

Topics

• Linking Hypotheses: There are two kinds of theories/models involved when we model human language behaviour:
  • The model of the cognitive system itself (at any of Marr’s levels)
  • A theory that links some aspect of that system to a particular empirical measure (reading time, ERPs, visual attention, etc.)
• Most common linking theories in computational psycholinguistics:
  • Reanalysis (in serial processing models)
  • Pruning of unlikely parses, parse re-ranking (in bounded parallel models)
  • Surprisal – a computational theory, but with a mechanistic interpretation
  • Cycles for analysis to exceed threshold, reflects time need to reconcile constraints.
Relating Models with Data

Course Assessment & Materials

• Course assessment:
  • Satisfactory completion of all tutorials
  • Exam at end of course = 100% of grade
    • Responsible for all material **discussed** in the lectures & tutorials
    • Reading: Lecture material, tutorials, key papers

• Materials
  • Lecture overheads and recommended readings
    • available from the course web page
  • All tutorial material
Key Readings …


Why spend time on old theories?

- Important to see different motivations, these are still relevant!
  - Emphasis on linguistic representations, comprehension, action
  - Focus on cognitive limitations or strengths
  - Rationality? If so, rational in what sense?
  - Surprisal and the causal bottleneck … can psycholinguistics ever really tell us up linguistics? Is that important?
  - So far, assumed symbolic representations, computation & algorithmic theories … will implementation level theories (neural) change things?
Structure of the exam

• **Exam structure:**
  
  • Part 1: Short questions (8 or 9), all obligatory (approx 50%)
  
  • Part 2: Do 2 out of 3 long questions (approx 50%)

• **Materials for the exam:** 1 side (not both) of A4 paper, hand-written, with anything you want on it. A simple calculator is allowed. No smartphones.

• **Duration:** 100 minutes

• **Place:** Meeting Room & Aquarium

• **Time:** Monday 04.02.2019 @ 14:00 *sharp*