Some preliminary terms – semiology

Animals have mental states & communication, but propositions & language? To talk about this, we need to agree on terms:

▶ **mental/cognitive states**: thoughts, ideas
  ▶ feelings, percepts, memories, eventualities, plans, . . .
  ▶ **propositions**: thoughts that can be true or false

▶ **communication/signals**: transmit information, w. form and meaning
  ▶ indices: pointers (firefly lights, bee dances, . . .)
  ▶ icons: resemblances (photos, diagrams, art, . . .)
  ▶ symbols: signals w. known, shared meanings (monkey alarms, names)
  ▶ **languages**: signal (‘sign’) systems with indices, icons, symbols, and . . .
    ▶ semanticity: signs have meanings
    ▶ arbitrariness: signs just have to be different from each other
    ▶ discreteness: form consists of clusters/classes (excludes bee, firefly)
    ▶ displacement: meanings may refer to place/time other than here/now
    ▶ duality of patterning: signs perceived as phonemes and words
    ▶ generativity: signs, meanings can be composed to make new thoughts
Generative linguistic knowledge (knowledge of a language) consists of:
- a **lexicon**: a set of elementary signs with associated meanings
- a **grammar**: a set of rules for composing signs and meanings

This use of ‘grammar’ differs from what you learned in primary school:

- **prescriptive** grammar describes how people *should* talk:
  - don’t end a sentence with a preposition: *for what are you looking?*
  - don’t split an infinitive: *boldly to go …*
  - don’t use *who* in accusative case: *whom did you meet?*
  - don’t use *less* for count nouns: *ten or fewer items*

  This knowledge can help you get a high-paying job!

- **descriptive** grammar describes how people *do* talk:
  - *what are you looking for?*
  - *to boldly go …*
  - *who did you meet?*
  - *ten or less items*

  This knowledge can help you get a job…as a linguist!
Some preliminary terms – linguistics

Grammatical/compositional knowledge may be further broken down into:

- **phonetics**: physical production of acoustic phenomena in sequence
  - **acoustic signal**: variations of speech sounds, e.g. [dʰ]
- **phonology**: what percepts can acoustics be classified into
  - **phonemes**: learned classes of speech sounds, e.g. /d/ + /o/ + /g/
  - **prosody**: contours of pitch (signify focus in English)
- **morphology**: how meaning-bearing signs can form words
  - **morphemes**: minimal meaning-bearing signs, e.g. `dog + -s`
- **syntax**: how smaller signs can combine into larger signs
  - **phrases/clauses**: sequences of signs w. same referent, e.g. `dogs + bark`
  - **agreement**: signs that signify redundant information (gender of subject)
  - **case**: (like word order) signs signify roles (participants of propositions)
  - **recursion**: embedding one phrase/clause inside another `[dogs [we] own]`
- **semantics**: how smaller meanings can combine into large meanings
  - **propositions**: meanings, e.g. `λx . Dog(x) ∧ Own(We, x)`
  - **arguments**: participants in propositions
  - **roles**: class of labels to distinguish participants
- **pragmatics**: what meanings of signs can be inferred from context
  - **discourse referents**: e.g. your concept of Woofy and Barky
Some preliminary terms – psycholinguistics

Study of language may also be divided into knowledge and processing:

- **Linguistic competence** models describe rules that *can* apply:
  - phonotactic rules (e.g. when to flap /t/)
  - morphological rules
  - syntactic rules
  - rules of acquisition (e.g. when to allow dropped subjects)

  This is what linguists typically talk about.

- **Linguistic performance** models describe which rules *do* apply, and how:
  - processing order
  - how to choose between competing meanings
  - weights / strengths of different rules
  - constraints of observed evidence
  - resource constraints (working memory)

  This is what psycholinguists typically talk about (this course).
Some preliminary terms – psycholinguistics

Processing issues:

- **encoding** meaning into signal
- **decoding** signal into meaning
  must be robust to **ambiguity**, when signal has multiple meanings:
  - need to **segment** sounds into phonemes, words
  - sometimes multiple words will match:
    - [rekənai̯spiç] → *recognize speech*
    - [rekənai̯spiç] → *wreck a nice beach*
  - need to **parse** words into phrase structure trees
  - sometimes multiple phrase structures will match:
    - *saw the boy with the telescope* → *saw [NP the boy with the telescope]*
    - *saw the boy with the telescope* → *[VP saw the boy] with the telescope*
Some preliminary terms – psychology

Psycholinguistic models have a history...

- An old dialectic in psychology:
  1. **Freudian** psych – unconscious forces
  2. **behaviorist** psych – observable effects, operant conditioning
  3. **cognitive** psych – memory, mental states (now also observable)

- A new dialectic, within cognitive psych:
  1. **discontinuous / modular / nativist** models –
     Mind manipulates *symbols* in task-specific *modules*.
     Language systems come from special evolved hardware, instinct
  2. **continuous / connectionist / empiricist** models –
     Mind manipulates *activation* in *neurons*: connections with weights
     Language systems come from general learning, evidence
  3. **Bayesian** models –
     Mind manipulates *probabilities*: symbols with weights (or create new ones)
     Language systems come from genetics (‘prior’) + evidence (‘likelihood’)
Many animals have natural communicative abilities:
- fireflies, bees – communicate location of self/nectar
- birds, whales – communicate fitness to potential mates
- cats, dolphins – communicate a search for a specific animal by name
- diana monkey – communicate alarm calls

Some can be trained to have human-like communicative abilities:
- Clever Hans (horse) – pretend to add (recognize expectation to end count)
- Dog that knows 1000 words – knows 1000 words (symbolic)
- Alex the parrot – identify items by shape and color (classify)
- Anonymous finches – recognize recursion in birdsong
- Vicki the chimp – recognize, produce (a few) spoken utterances
- Washoe, Nim Chimpsky, Koko (gorilla) – produce sign language
- Panpanzee, Panbanisha (bonobo) – from infancy
- Akeakamai the dolphin – word order, argument structure

Tomasello – most animals don’t collaborate; no need for complex structure
Maybe language is a human instinct...

Lenneberg (1967) – a cognitive function (e.g. language) is biological if:

- it is species specific
- it is replicated in every member of the species
- it is differentiated spontaneously with maturation
- certain aspects emerge only during infancy
- comes about by spontaneous adaptation to other individuals
For next time... 

Read:
- Traxler ch 1, pp. 14–28