Human Cognitive Processes: psyc 345

Ch. 11 Language

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• (Q1) What makes human languages unique?
• (Q2) How is language structured?
• (Q3) How does the brain process language?
• (Q3) Do language affect our perception?

• Can chimps learn human-like language? (4:16)
  http://www.youtube.com/watch?v=utVXZAfEso
• Can chimps learn human-like language? (2:38)
  http://www.youtube.com/watch?v=wRM7vTrHj5
  &NR=1
• Can chimps understand sentences? (1:53)
  http://www.youtube.com/watch?v=2Dhc2zEPJE
  &feature=related
• Can chimps make tools? (1:27)
  http://www.youtube.com/watch?v=1zsSH9U0t
  Q&feature=channel
• Is this really language? (3:50)
  http://www.youtube.com/watch?v=KxmvRpnVXl
  Q&NR=1

What is language?

• A system of communication
  – That’s what the textbook says.

• What does he (Goldstein) mean by “a system”?

The creativity of human language

• Language is creative because it has a structure that is
  – (1) hierarchical
  – (2) governed by rules.

• Hierarchical:
  – Combining smaller units create larger units.
- Un + der + stand = Understand
- Un + avoid + able = unavoidable
- Philo + sophy = philosophy

• Word order counts
  - I understand what you said. → OK
  - Understand I what said you → not OK

• You can expand sentences infinitely.
  - I understand what you said yesterday, but I don’t understand what you said this morning. → OK

Guinness Book of World Records:

• The longest English sentence ever written: 1300 words in William Faulkner’s novel “Absalom, Absalom!”
  - “They both bore it as though deliberate flagellant exaltation…..”
  - Faulkner wrote, “They both bore it as though deliberate flagellant exaltation…..”
  - Takashi said that Faulkner wrote, “They both bore it as though deliberate flagellant exaltation…..”
  - Barb said, who cares Takashi said that Faulkner wrote, “They both bore it as though deliberate flagellant exaltation…..”

(Taken from S. Pinker’s “Language Instinct”)

Syntax and word order

• Syntax specifies the order of words in a sentence.
• Different orders give you different meanings.
  - A dog bites a man. A man bites a dog.
  - Bites a man dog a. dog a bites man a.

Syntax is (somewhat) independent from semantics (word meaning)

• You can produce a meaningless sentence by maintaining a word order.

  – Colorless green ideas sleep furiously.

I saw the best minds of my generation destroyed by madness, starving hysterical naked,
Angelheaded hipsters burning for the ancient heavenly connection to the starry dynamo in the machinery of night,
Who poverty and taters and hollow-eyed and high sat up smoking in the supernatural darkness of cold-water flats
floating across the tops of cities contemplating jazz.
who bared their brains to Heaven under the El and saw Mohammedan angels staggering on tenement roofs
illuminated, who passed through universities with radiant eyes hallucinating Arkansas and Blake-light tragedy among the scholars of war,
who were expelled from the academies for crazy & publishing obscene odes on the windows of the skull,
…..

(A. Ginsberg, “Howl” 1927-1997)

The curious flower wept every night to find a mountain to swallow.

The moment when she dive into the swelling lake,
she blossomed with sorrow,
and sit till tomorrow.

I roamed all over and
came in vain.

Takashi Yamauchi, 2008
Syntax is combinatorial

- Frank loves Mary.
- Mary loves mystery books.
- George loves ice cream.
- My dog loves ramen noodle.

The DNA code uses groups of three letters to make meaning. Most groups of three letters codes for an amino acid (some code for ‘punctuation’ - starts and stops). For instance, the DNA letters TGC code for an amino acid called cysteine, whereas the DNA letters TGG code for an amino acid called tryptophan. Each of these sequence of three DNA letters is called a DNA triplet, or codon. Since there are four different DNA letters (A, G, C and T), there are $4 \times 4 \times 4 = 64$ different combinations that can be used to make a codon.

(Q2) How is language structured?

- **Phoneme**: shortest segment of speech that, if changed, changes the meaning of the word.
- Acoustic elements of a language.
- English has 40 phonemes.
- Consonants and vowels are the major elements.
- Different languages have different phonemes.

Components of Words

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Morphemes

- Are the fundamental units of meaning in language.
- Morphemes are any meaningful unit of speech that cannot be broken down into smaller units of speech that still have meaning.
  - For example, “dogs and saddle” are morphemes that stand as words, and anti-, pre-, uni-, -ed, -s are also morphemes.
- So, morphemes are building blocks of words.
  - E.g., psychology, philosophy,

Examples:

- unify, unit, universal, universe, university, uniform, union, opinion, million, billion, trillion, neutron, neuron, neutral, central, century, cent, scent, crescent, descent, demand, declare, debate, decay, deduce, seduce, induce, reduce, produce, professional, program, procure, proceed, probe, problem, product, induct, deduct, conduct, connman, consider, contradict, converse, concrete, conform, confirm, conspiracy, conform, deform, reform, normal, neutral, neuron, neurotic, erotic, ecstatic, fantastic, impressionistic, idiotic, idealistic, idea, media, medium, mechanism, holism, relativism, relative, relate, relation, creation, association, revolution, evolution

Words and sentences:

- Words consist of morphemes.
- Sentences consist of words.
- How do we combine words to make a sentence?

Syntax

- Specify the structure of sentences
- Sentences are generative.

Palm-pilot, cell-phone, e-mail, e-commerce, Football, baseball, soccer-mom, bottom-line, shareholder, WMO (Weapons of Mass Destruction / Woman of Mass Destruction), automobile, automaker, lawmaker, homemaker, policymaker, tax return, tax incentive, taxpayer, tax-collector, mountain bike, rollerblade, skateboard, snowboard, tech-stock, hybrid car, fuel economy, Utility vehicle, credit-card, iPod, iTune, Xbox, playstation, perseverance package, landmine, data mining
• (Q3) How does the brain process language?

Dyslexia
• Dyslexia
  – Learning disorders related to reading.
• News (1:38)
  – http://www.youtube.com/watch?v=p7gCU8F-Y8I
• Brain (1:13)
  – http://www.youtube.com/watch?v=8S9qMT9bs
• Kinds of dyslexia (2:19)
  – http://www.youtube.com/watch?v=n9cdViiKfY&feature=PlayList&p=40E6BD5825B4DB3&playnext=1&playnext_from=PL&index=3

Understanding Sentences
• Semantics: meanings of words and sentences
• Syntax: rules for combining words into sentences
  – Different physiological mechanisms support semantics and syntax

Speech perception and the brain
• Broca’s area
• Wernicke’s area

Speech Perception and the Brain
• Broca’s aphasia - individuals have damage in Broca’s area (in frontal lobe)
  – Labored and stilted speech and short sentences but they understand others
  – http://video.google.com/videoplay?docid=9178936581278081395&q=Broca%27s+aphasia&total=6&start=0&num=10&so=0&type=search&plindex=0

Speech Perception and the Brain
• Wernicke’s aphasia - individuals have damage in Wernicke’s area (in temporal lobe)
  – Speak fluently but the content is disorganized and not meaningful
  – They also have difficulty understanding others
  – http://video.google.com/videoplay?docid=7590914168187986085&q=Wernicke%27s+aphasia&total=3&start=0&num=10&so=0&type=search&plindex=0
The Universality of Language

• Deaf children invent sign language
• All cultures have a language
• Language development is similar across cultures

The Universality of Language

• Languages are “unique but the same”
  – Different words, sounds, and rules
  – All have nouns, verbs, negatives, questions, past/present tense

Studying Language in Cognitive Psychology

• Noam Chomsky (1957) *Syntactic Structures*
  – Human language coded in the genes
  – Underlying basis of all language is similar

Studying Language in Cognitive Psychology

• Noam Chomsky (1959)
  – Children produce sentences they have never heard and that have never been reinforced

• DVD: Secret life of the brain Episode 2 (19:21-27:12 or so)
• We don’t need the left hemisphere?
• Still, we can learn language?

http://www.pbs.org/wnet/brain/episode2/faq/page2.html
(Q3) Do language affect our perception?

Culture, language, and cognition

- Does language affect perception and cognition?
- Does the nature of a culture’s language affect the way people think?

The Sapir-Whorf hypothesis

- the varying cultural concepts and categories inherent in different languages affect the cognitive classification of the experienced world in such a way that speakers of different languages think and behave differently because of it.

- There wasn’t much evidence that supports this hypothesis.
- But there is some indication that language affects cognition

Categorical perception effect

- Forming categories (e.g., speech sound, color, or any other categories that group things, events, and people) modify people’s perception.
- Categories create a contraction of features within a category and an expansion of features that divide between categories.

In (a), you learn to classify 1-5 into A and 6-9 into B.
As you learn A and B categories, 1-5 and 6-9 become perceptually similar.
In contrast, 5-6 become perceptually distinct.

In (b), you learn to classify 1-4 into A and 5-9 into B.
As you learn A and B categories, 1-4 and 5-9 become perceptually similar.
In contrast, 4-5 become perceptually distinct.
Categorical perception effect

- “r” and “l” distinction in Japanese

Japanese adults cannot distinguish “r” and “l” speech sounds.

But Japanese babies initially can. As the babies learn Japanese, they variation of “r” and “l” is lost, because the Japanese language does not distinguish them.

What does this mean?

- Our ability to perceive color (distinguish colors) is influenced by the language we use.
- Language influences our perception
  - We tend to think that perception is independent of language, but actually it is not.
- We say that Eskimos have many different names for “white.”
- This may be because they really see many different gradients of “white.”