3rd Week Retrospective

• Optimizing Learning and Memory
  – Time on Task
  – Focused Attention
    • 10,000 hours for expertise
  – Distributed Practice

• Diverse Topics
  – Scientific Method
  – Behavioral Science
  – Language
  – Speech Science
  – Tutoring
  – Reading
3rd Week Retrospective

- Technology Assisted Reading Acquisition (TARA): Children Acquiring Literacy Naturally
- Language and Speech are Special
- Value of the Face; Baldi, Pattern Recognition
- Barriers to Critical Thinking
- Baldi Guides Vocabulary Learning
- Puzzle of Language Acquisition
- What’s Needed for Spoken Language Acquisition?
- Solving the Puzzle of Spoken Language Acquisition
Language and Speech are Special

independent language organ

independent course of development

not standard perception and learning

Noam Chomsky
Univ. of Maryland, Jan. 26, 2012
Value of the Face
Barriers to Critical Thinking

- Direct Experience can be Misleading
- Overconfidence
- Confirmation Bias
Baldi Guides
Vocabulary Learning
Virtual Teachers

• Upside
  – Available 24/7
  – Can be Engaging
Virtual Teachers

- **Upside**
  - Available 24/7
  - Can be Engaging

- **Downside**
  - Expensive Programs
  - Require Maintenance
  - No Personal Interaction
  - Not always Effective
  - Need Huge Time on Task
Gavagai -- Puzzle of Language Acquisition
What’s Needed for Spoken Language Acquisition?

- Sensory Input
- Signal analysis
- Category Learning
- Syllabification
- Recombining Syllables
Solving the Puzzle of Spoken Language Acquisition

• Sensory Hardware
• Categorization
• General Learning Principles
  – Statistical Learning
  – Generalization
Saffran et al., 1996 study

- Habituation Task
  - 8-month-old Infants
  - Sequence of 3-syllable words
    - E.g., dapiku
  - 2 minute familiarization
- Test
  - Old words versus New words
  - Old words versus Part words
  - Listened longer to New and Part Words than Old Words
Saffran et al., 1996 study

• Sequence

• Four words
  – tupiro golabu bidaku padoti

• Four Nonwords
  – tupada

• Four Part Words
  – tupiku
Fuzzy Logical Model of Perception

- Multiple Sources of Information
  - Bottom-Up
  - Top-Down
- Continuous Information
- Optimal Use (Integration) of Sources
Emergentist Coalition Model

• mapping of words onto referents
  – children rely on multiple cues
• weight given to these cues change across development.
• Example
  – Infants initially rely mostly on perceptual cues
  – Then rely more on speaker’s intent and linguistic cues
Why early experiences matter

Newborn Brain
Average weight 333 grams

2 Year Old’s Brain
Average weight 999 grams
Childhood decides everything
John-Paul Sartre
Explosive Brain Development

Neonate
Six months
Two years
Matata and Kanzi
Kanzi, the Bonobo
http://www.youtube.com/watch?v=jKauXrp9dl4
Fig. 1. Brain growth and first language (L1) acquisition. Human brain weight is presented as a function of age, where 100 in the ordinate corresponds to the mean adult value (10). Approximate times of milestones in normal speech development are also indicated.
Brain regions corresponding to the four levels of language.
Critical Periods

- Auditory System
- Visual System
- Language System(s)
  - Speech
  - Sign
  - Reading (Hypothesized)

Dr. Andrew Melthoff

http://www.youtube.com/watch?v=y4MCqFkbQXI

Still face experiment

http://www.youtube.com/watch?v=apzXGEbZh0
Still Face Experiment
http://www.youtube.com/watch?v=apzXGEbZht0

Implications:
Speech Perception versus Production

• Early Studies
  – Brain Damage

• Wernicke’s Area
  – Speech Perception (Comprehension)
  – Ventral Stream

• Broca’s Area
  – Speech Production
  – Dorsal Stream
Speech Perception

- Pattern Recognition
  - FLMP
  - ECM

- Motor Theory
  - Production Intervenes in Perception
  - Mirror Neurons

- Equivalent Representation
  - Both use Same Information
Language Acquisition around 8 minutes in shows development of saying water

Roy (Ted Talk) documents about 70 instances in which his son attempted to pronounce “water” before he was able to pronounce it correctly. Many of these instances illustrate that he was able to perceive and understand the spoken word but simply unable to produce it.
The MacArthur-Bates Communicative Development Inventories (CDI) has been used to measure comprehension and production vocabulary. It uses a checklist to ask parents to report their child’s word comprehension, word production, and grammar. The checklist for comprehension asks the parents to indicate which of the words on the list are understood by the child. The checklist for "Words Produced" is interpreted to mean that the child's utterance could be understood out of context by at least a caregiver.
FIG. 2.6b. Variability in word production as a function of comprehension vocabulary size. From Fenson et al. (1994).
Percent of Normal Distribution Scores in Each Interval
Table 1. The individual results of 1089 children giving the number of words produced, the number of words understood, and the number of cases contributing to each row of the analysis.
What’s Needed for Literacy?

Written Language!

- See Things
- Signal analysis
- Learn Categories
Development of Infant Visual Tracking. Activity 1 from What Babies Can Do DVD.3gp
http://www.youtube.com/watch?v=cCFzqcje838&playnext=1&list=PL54EF5B2904E8CA12
Babies can see more than you might think!

1 month  20/120
4 months 20/60
8 months 20/30  http://www.ski.org/Vision/babyvision.html
<table>
<thead>
<tr>
<th>Age</th>
<th>Image Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Image</td>
<td>WORD</td>
</tr>
<tr>
<td>4-week old at 24 inches</td>
<td>![Blurred Image]</td>
</tr>
<tr>
<td>8-week old at 24 inches</td>
<td>![Blurred Image]</td>
</tr>
<tr>
<td>3-month old at 24 inches</td>
<td>![Blurred Image]</td>
</tr>
<tr>
<td>6-month old at 24 inches</td>
<td>![Blurred Image]</td>
</tr>
<tr>
<td>Adult at 24 inches</td>
<td>WORD</td>
</tr>
</tbody>
</table>
One-Month Old Infants Can See

Two-Month Old Infants Can See
Babies can categorize objects.
Can Infants Learn to Read

• Make Eye Movements
• Have Good Acuity
• Can Categorize Objects
• But Can They Read?
Naturally Acquired Literacy?

Linguists regard speaking, signing, and language Comprehension as primary faculties of language, i.e., innate or inherent and biologically determined, whereas they regard reading and writing as secondary abilities. Indeed, the native or first language (L1) is acquired during the first years of life through such primary faculties while children are rapidly expanding their linguistic knowledge (2). In contrast, reading and writing are learned with much conscious effort and repetition, usually at school.
Current Dogma

• Speech is Natural
  – Is Acquired Unintentionally

• Reading is Artificial
  – Must be Taught

“Unlike its component parts such as vision and speech, which are genetically organized, reading has no direct genetic program passing it on to future generations.” Maryanne Wolf (2007). Proust and the squid: The story and science of the reading brain. New York: HarperCollins.
http://www.youtube.com/watch?v=1Vys9jvXwcU
17 month old baby reading

http://www.youtube.com/watch?v=MaJ4OvDCqkl
Smart Baby Reading at 12 Months (Part 1)

http://www.youtube.com/watch?v=PRdQCsPvxco
1 Year Old Baby

http://www.youtube.com/watch?v=wOUxUtEc2DQ
Smart Baby Reading at 12 Months (Part 2)

http://www.youtube.com/watch?v=hBxNQ_cmB0c
Reading Chinese
NBC Today Show Expose

- Little Brains Can’t Read
- Aren’t Really Reading
- Doesn’t Help Later Reading
Can Infants Learn to Read

- Make Eye Movements
- Have Good Acuity
- Can Categorize Objects
- But Can They Read?
- How do we read?
How don’t we read?

Aoccdrnig to a rscheelahcr at an Elingsh uinervtisy, it deosn't mttaeer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer are in the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae we do not raed ervey lteter by itslef but the wrod as a wlohe.
wish wash
short shoot
wide wife
while whole
whose where
week weak
tree true
step stop