Chapter 8
The Development of Communication

Go NPR!

http://www.radiolab.org/story/91584-time/

- Segment from radio lab on time compression
- *Listen from 7:21-9:48 for compression of audio clips of child's verbal behavior from birth to age 12

Part 1

Pages 253-271

Structure V. Function?

- Structure of language changes
  - Babbles into words into sentences
- Still mostly concerned with function of language
  - The relationship between language and the environment
  - The effects of language on the environment and people in it
  - What are the conditions under which language develops?
  - What are the effects of rules on our behavior?

Psycholinguistics vs. Behavioral psychologists
"Miracle theory" vs. "Impossible theory"
Looking at language in fundamentally different ways

Structural Approaches

- Psycholinguistics = Chomsky (amazing political philosopher and activist, not a scientist)
  - Syntax is the basic structure of language
- Distinguishes between knowing and behaving
  - A child "knows" all of the grammar/syntax/structure of language but don't become competent speakers until 4 or 5
    - It's in there somewhere?!
  - Competence what a child could do, not what they actually do

Nativism (Psycholinguistics)

- Structure of mind = structure of language
- Linguistic universals
  - Humans possess them
  - We think in a way that is uniquely human and our way of thinking determines our language
    - Language reflects the mind; language is born from thought
  - Regardless of language all languages have nouns and verbs; that's because the structures of our mind work that way
  - The human mind creates order in language
    - What's the causal variable here?
    - Biology!

Nativism (Psycholinguistics)

- Language Acquisition Device (LAD)
  - The biological structure that is responsible for language development
    - Lack of programmed consequences
  - This is NOT brain activity (we know this happens), but it is viewed as a hypothetical structure whose existence is inferred from the human ability to learn language
    - Set of "rules" that allow a child to speak and understand an infinite number of utterances. A "miracle"
- "Little Linguists" discovering a new language
  a. Listen to sounds made
  b. Form a hypothesis about how the sounds should be used
  c. Testing the hypothesis by using the sound
  d. Confirming or discarding the hypothesis

The Shift in Psycholinguistics

- Has inched a bit toward a more naturalistic approach, but still maintains nativist roots
  - Universals
  - Innate

  - https://www.youtube.com/watch?v=xfiHd6DyuTU
    - 2:56 Chomsky- Universal grammar
    - Describes nativist/psycholinguist perspective of language development

The Functional Approach

- Good ol' Skinner starting problems
  - *Verbal Behavior* published in 1957
- Behavior reinforced through the mediation of other people who have been conditioned by a verbal community to do so
  - Four term contingency
  - FUNCTION of behavior, not form
- Not limited to vocal speech. Includes:
  - Body language and gestures
  - Writing
  - Reading
  - Vocal Imitation
  - Dog nudges bowl, food reinforcement comes from you. Socially mediated

Verbal Operants

- Think shaping here!
  - E.g., Successive approximations to “mom”
    - Any babble… “mamama” … “mama” … “mom”

Verbal Operants

- **Mand:** under the control of a setting event, such as deprivation or aversive stimulation, and reinforced by the stimulus that causes the deprivation/aversive stimulation.
  - Requests/De**mands**; asking for water, open the door
  - KK – earliest form of verbal behavior (crying)
- **Tact:** classes of verbal operants in which a responses of a given form is evoked by a particular object, event, or property of event and are reinforced by generalized conditioned reinforcers (attention)
  - Comments; Do you hear the plane? I went to the store. Wow! That's a big elephant!

2:52 Short video example of Mand

- https://www.youtube.com/watch?v=IQ9DJrZIgvM
  - Baby sign language used to mand for water

Verbal Operants

- **Intraverbals:** controlling stimulus is speaker's (or another speakers) own verbal behavior
  - Chains of verbal behavior, songs, sayings; Four score and___, Red, white, and ___, ABCDEF___, Twinkle, twinkle little ___
- **Autoclitic:** based on or depends on other verbal behavior, and clarifies or alters the effect of verbal behavior upon the listener
  - Grammar; I think v. I know; Ex: I don't mean to be rude, but…., If I was a better person I wouldn't say…..
- **Textual**: discriminative stimulus is text or printed
  - Reading
- **Echoic:** controlling stimulus is verbal behavior, and the response matches the form of this stimulus
  - Imitation

Naming

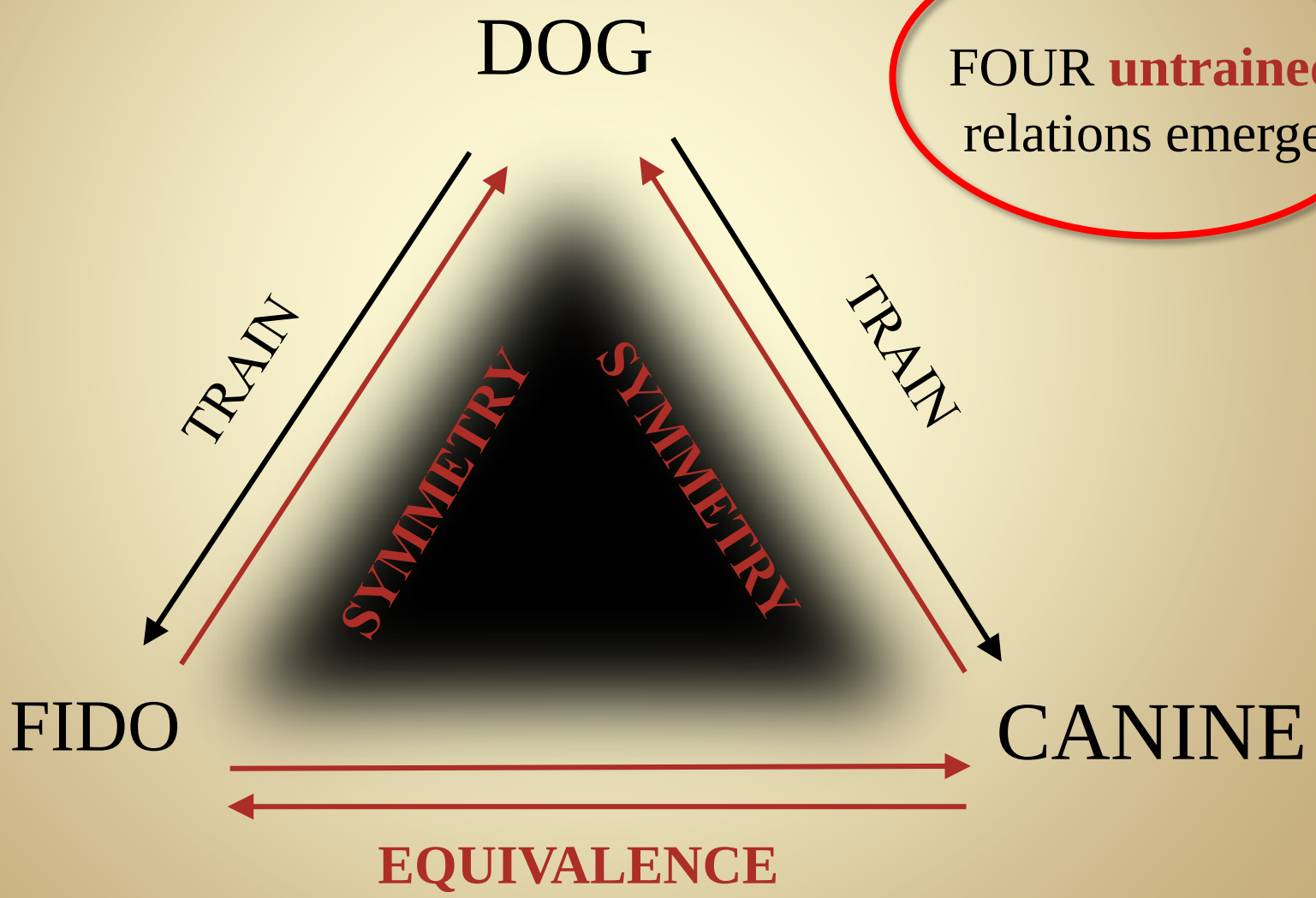
- Skinner's operants cover the basics, but what about the emergent, generative properties of language?

Stimulus Equivalence and Relational Frame Theory

Stimulus Equivalence

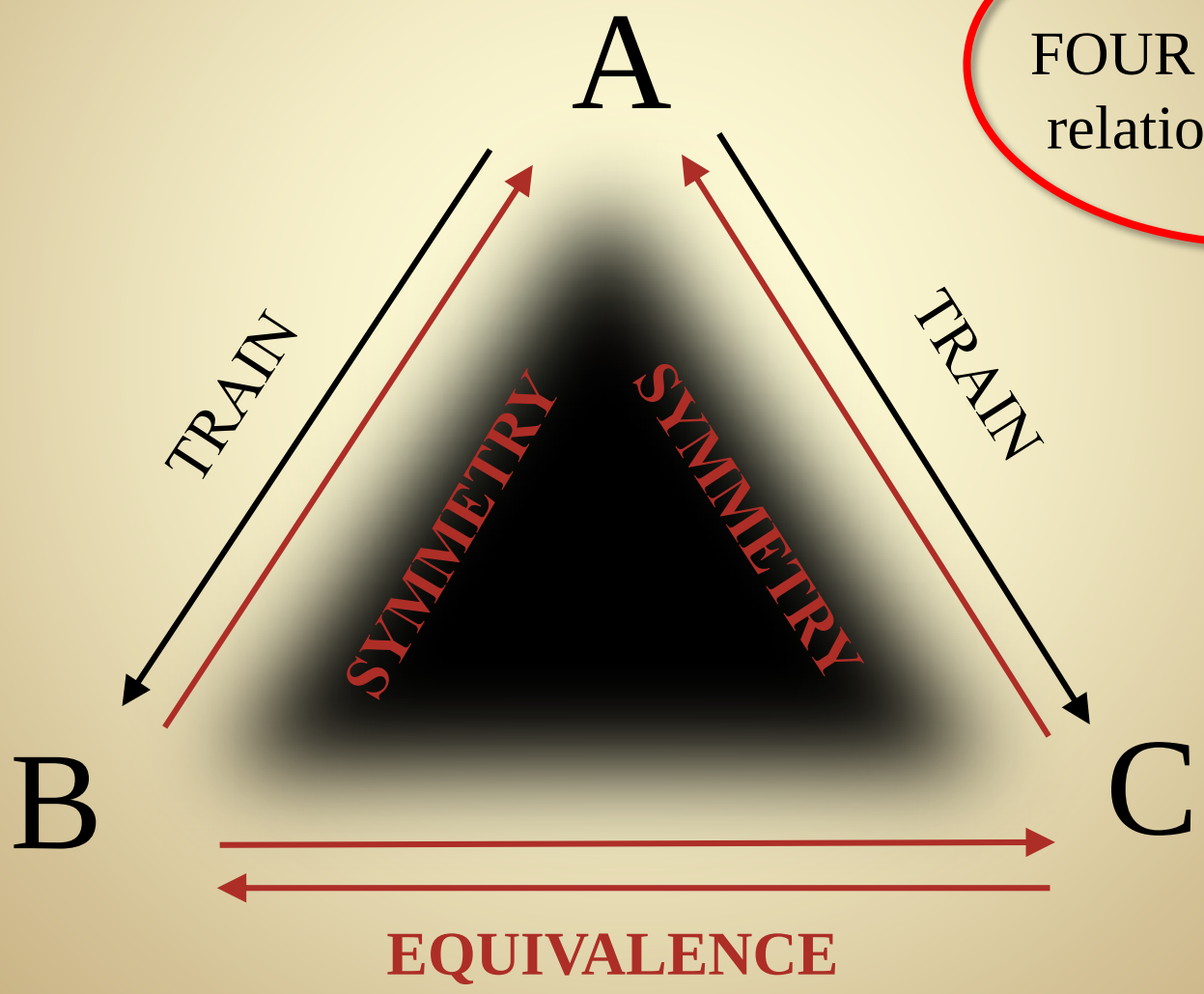
- IN HUMANS, this occurs without direct training
- A child knows that his pet's name is Fido. He knows that Fido is a dog. He also knows that dogs are the same as canines. This child may also call Fido a canine without being taught to do so.
  - Identity: A = A (Fido is Fido)
  - Reflexivity: if A = B then B = A (Fido is this dog, this dog is Fido)
  - Symmetry: A = B & B = C, then A = C (Fido is a dog, a dog is a canine, then Fido is a canine)
- Few relationships are learned
- Many relationships emerge
  - "More bang for your buck"

Equivalence



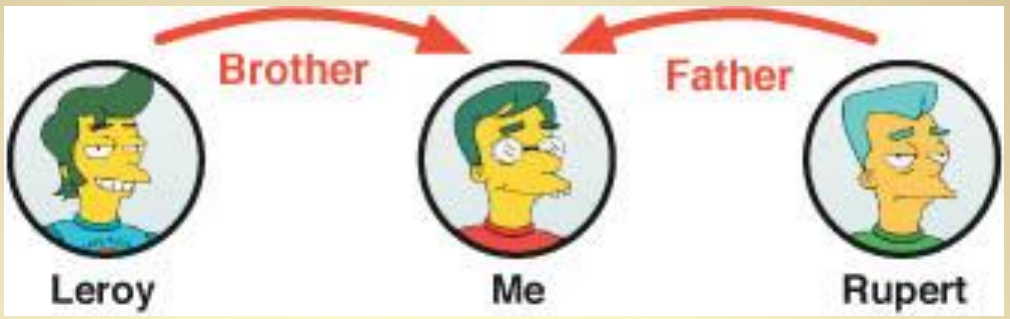
Equivalence

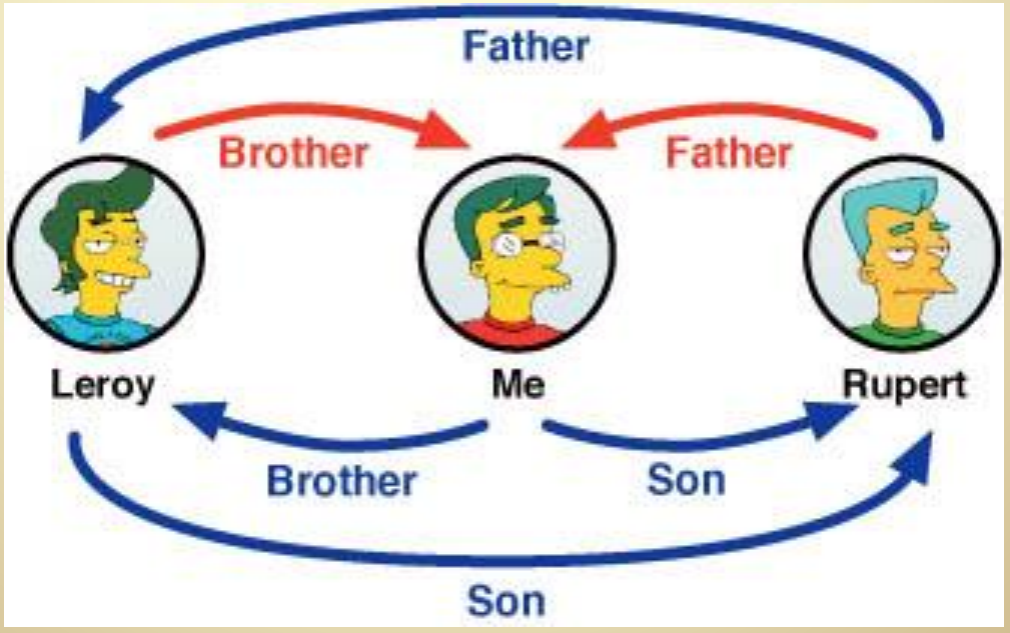
FOUR **untrained** relations emerge

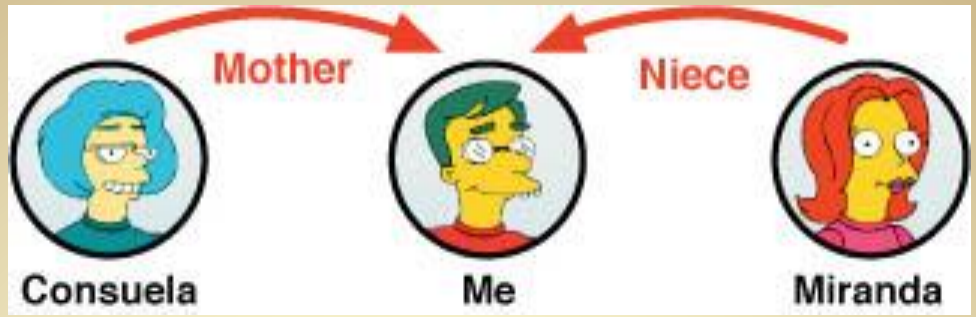


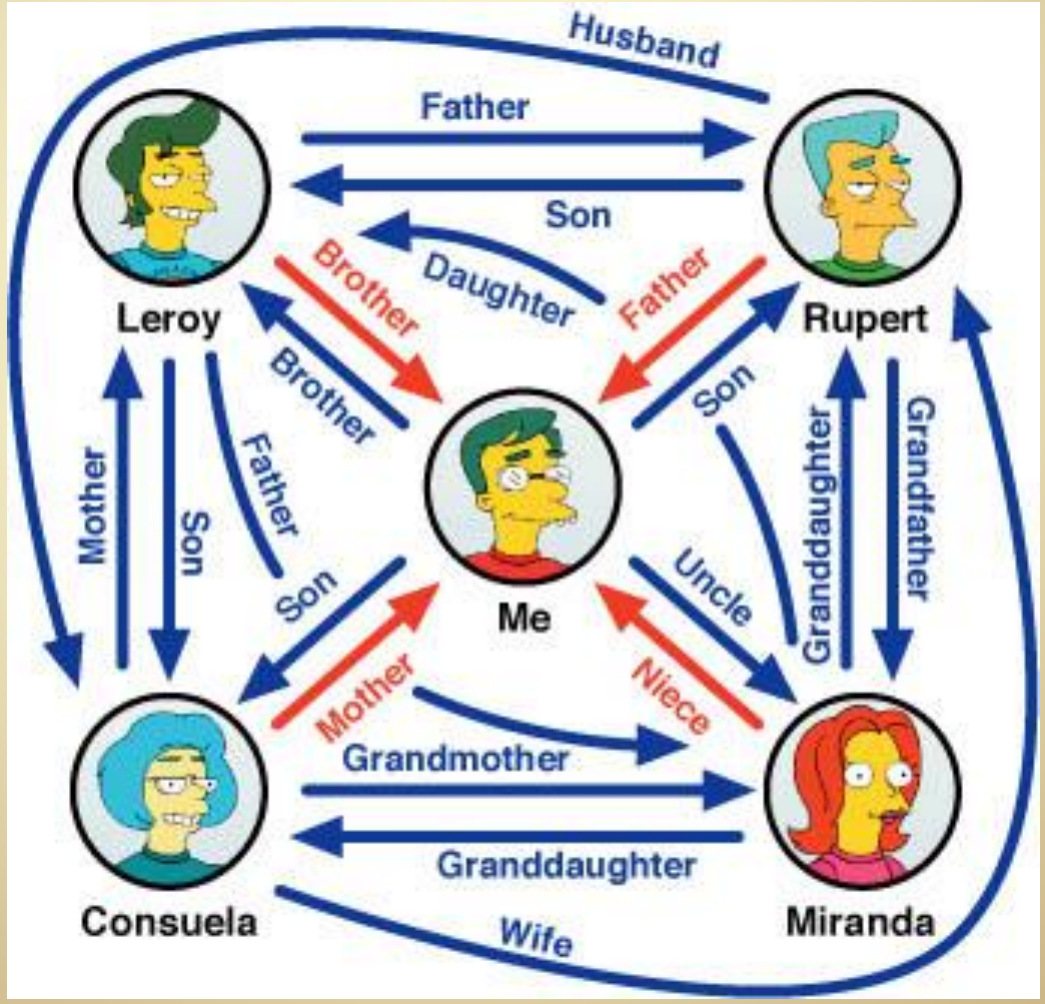
Relational Frame Theory (RFT)

- This defines the core of human language and cognition, at the center of what it means to be human
- Verbal stimuli are related through learned "frames"
  - "picture frame"
  - What is framed and associated is language


Brother
Father
Leroy
Me
Rupert


Father
Brother
Father
Leroy
Me
Rupert
Brother
Son
Son


Mother
Niece
Consuela
Me
Miranda


Husband
Father
Son
Brother
Daughter
Father
Leroy
Rupert
Brother
Son
Mother
Son
Father
Son
Granddaughter
Grandfather
Me
Uncle
Mother
Niece
Grandmother
Granddaughter
Consuela
Miranda
Wife

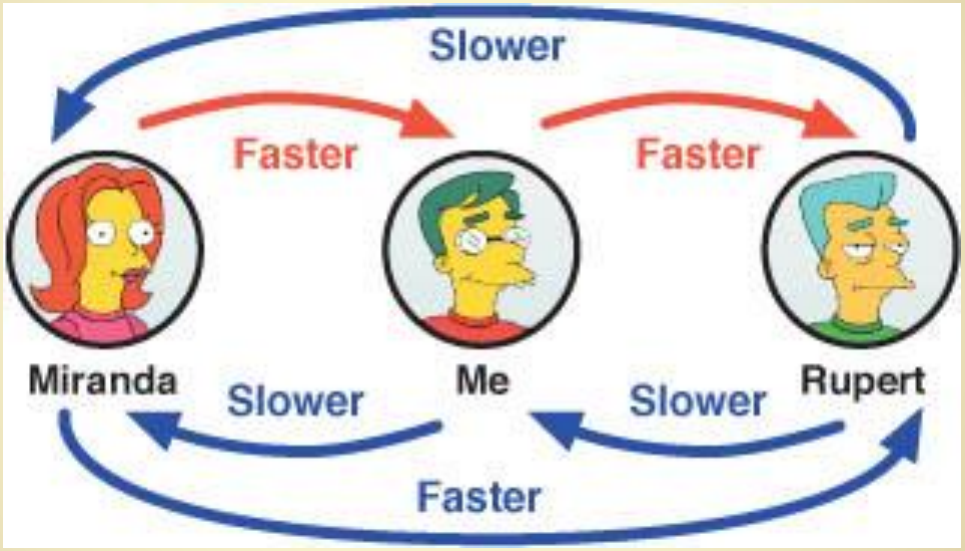
Other ways of framing:

- Same and different
- Faster and slower
- Bigger and smaller
- Worse and better
- Causality
- Earlier and later
- Closer and further
- Mine and yours
- Here and there

…and so on.

Relational Frame Theory (RFT)

- Important features of RFT
  - Arbitrarily applicable responding
    - Not formal properties, but arbitrary ones
  - Transfer of stimulus function
    - Shock experiment
  - Context looms large in terms of function
  - https://youtu.be/BMVx4C5ay0A?t=16m40s
    - Video example of arbitrarily applicable responding and transfer of stimulus function (watch from 16:40-18:36)
- Past, future, pain, fears, anxiety, emotion



Example of relational framing: https://youtu.be/BMVx4C5ay0A?t=24m28s
Watch from 24:28-25:53

Equivalence Everywhere!

- All of our language exists in relation to other language
  - Language just comprised of stimuli that can be correlated and associated just like others
  - Missing in children with language delays
- Teaching simple equivalence relations show massive impact on academic performance and IQ
- Teach VERY young children to form functional equivalence classes
  - Charlie experiments – less then 3 years old ("prelinguistic")!
- Even teach animals, although it takes thousands of trials
  - Sea lion = Reflexivity trained extensively, then generalized to new relations
  - Rats, pigeons, although most of these just show symmetry

Behavioral Systems Perspective

- Ever-changing reciprocal relationship between genetic makeup, history of interactions, and environment
  - Genetic Factors
    - Complex language unique to humans (although other species may be said to communicate of a simple level)
    - Vocal apparatus allows for a wide variety of sounds
    - Brain "lights up" and is involved but we aren't sure how. That is inherited but we need not deal with that in an account of learning.
  - **Functional** Environment-Behavior relations
    - Increasingly complex language to gain access to increasingly powerful reinforcers

Behavioral Systems Perspective

- What is the function?
- COMMUNITCATION!
  - Reinforcers obtained through social mediation

As always, we are more concerned with function rather than formal structure

Example: http://www.ted.com/talks/deb_roy_the_birth_of_a_word?language=en

19 minute TEDtalk: father puts videos around house to take data on development of his son's verbal behavior!

Early Stages of Language Development

- At birth
  - Flooded with a variety of sounds
- Within first month
  - Detects boundaries between one basic unit of sound (a phoneme) and the next
- Very early on
  - Detects differences in speech sounds
  - Show differential reactions to these sounds
    - Watson (1969) (girls=auditory; boys=visual) Girls talk earlier
    - DeCasper & Fifer (1980) (sucking rate for mother's voice as reinforcer)
  - Perceive variation and some sounds may be reinforcing

First Vocalizations: The Cry

- First cries are reflexes
- Fake crying – consequences take over by 3rd week of life
- Operant crying
- Cooing (3 to 5 weeks of life)
  - (https://www.youtube.com/watch?v=0yCSrb26MLc) 45 sec- example of cooing
- Babbling (3 to 4 months)
  - 6 months – native speech sounds
  - Occasional absence in autism
  - https://www.youtube.com/watch?v=IyV2j4BsEM8 52 sec- example of babbling
- Echolalic babbling
  - Intonation of adults
  - https://www.youtube.com/watch?v=-cq8fvTAnlk 2:43 video example of echoalic babbling
- Vocables, Gestures & True Words (10-12 months)

3 types of **newborn** cries:

1. Hunger
2. Pain
3. Anger

Crying can be Shaped

- Ainsworth, Bell, & Stayton (1972) found:
  - Mothers who were quickest to respond to their infants' crying had children who cried the least

- Gerwirtz & Boyd (1977) found:
  - Mothers who responded quickly were able to other more desirable cues
  - Mothers who delayed responding inadvertently wound up shaping their children to cry longer and more intensely
  - Learned the function of communication

Who Shapes Babbling into Words?

- Babble = attention from Mom & Dad
  - Behavior of babbling strengthened
  - Babbling provides the variability to be selected by consequences
  - DS spanish
  - A note to all of you wonderful men: most studies done with mothers. Doesn't mean that it's just mothers that reinforce vocalizations
- Reingold, Gierwirtz , & Ross (1963) found:
  - Infant vocalizations could be increased with contingent social reinforcement
  - Researcher smiled, tickled, and said "tsk, tsk, tsk" whenever the infant vocalized
    - Vocalizations increased

Others Aren't the Only Ones Who Reinforce These Sounds

- Automatic reinforcement – the sounds themselves and the motor movements to produce them become conditioned reinforcers.
- 5 Step process:
  1. Parents use the sound of child's native language.
  2. Because of reinforcers provided by parents, sound of native language become secondary reinforcers themselves.
  3. When child babbles, one of these sounds (a response) is emitted.
  4. The consequences of the response is hearing the sound (secondary reinforcer)
  5. The response is automatically reinforced.

Automatic Reinforcement Leads to Acquisition of Verbal Sounds

- Sundberg, Michael, Partington, & Sundberg (1996)
  - Paired some sounds, but not others with reinforcement (i.e., tickling)
  - The sounds paired with reinforcement were soon acquired and increased in frequency, even though the production of sounds was not directly reinforced
- Smith, Michael, & Sundberg (1996)
  - Infant received positive reinforcer when an experimenter produced a specific sound
  - This produced an increase in the child's production of this sound
    - Thus, the child was automatically reinforced when he produced the sound himself

Symbolic Gesturing (2ish)

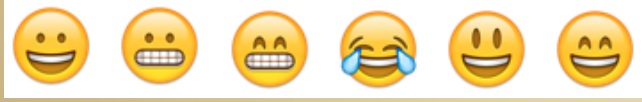
- A child begins to use gestures to represent things
- Symbolic gesture can precede the acquisition of the equivalent word by many months!
  - Sign language
  - Blow when something is hot
  - Flap arms for bird
  - Show p. 269
- Dealing with function. Different form, same consequences
  - Typically starts with mands, then tacts, then intraverbals

First Words

- Talking is tough stuff!
  - One phoneme can use 70 muscles!
- First words often “mama” “dada” or pet names;
also “up”
“bye-bye”
and “give”

The Holophrastic & Telegraphic Stage

- The Holophrastic Stage (during 1st word stage)
  - When a child uses a single word to stand for entire concepts
    - "Wawa" = water; wants water, water on floor
  - Parent decides what the function is, as there are no grammatical or syntactic clues
    - Intake process (DS, AD)
- The Telegraphic Stage (18 to 24 months)
  - The child begins to put words together to make sentences
    - "More wawa," "cookie gone," "give dat"
  - WHY? Two words more likely to be reinforced (verb+noun)
  - Law of least effort
    - We do the least effortful behavior to get our reinforcer – ALWAYS!
    - "pay" for each word in effort



Part 2

Pages 271-289

Language Development as Skill Learning

- The environment, mediated particularly by the primary caretaker, shapes language development

- Moerk (1986) identified four behavioral characteristics mothers use in teaching any skill to children.
  - These characteristics are used "intuitively" by mothers to teach language to their children
  - Intervention for language delay is this on steroids!

Moerk's Four Behavioral Characteristics in Teaching Language

1. High intensity of repetitions of each of the sentence types by the caretaker.
   - Repetitiveness is very important
     - Boy = "look at the car" "see the car?" It's a big car!"
   - Priming (or prompting)
     - "What is it? A car!" "Say 'car"
   - Combining massed practice with spaced rehearsals
     - mothers enhance language skills by massing 3 to 5 repetitions of an utterance closely together. Then, they back off, allowing the child to rest

Moerk's Four Behavioral Characteristics in Teaching Language

- The effects of frequency of repetitions by parents on their children.
  - Research findings show that there is a relationship between the frequency of use of a sentence type by parents & the order of appearance of the sentence type by the child.
    - "at"
    - Children hear each major sentence type 100,000 times per month!
    - Average 3-year-olds say over 1,000 speech sounds per hour!

Moerk's Four Behavioral Characteristics in Teaching Language

3. Knowledge of results (feedback to the child)
   - Caretakers provide frequent feedback to their children
     - Positive feedback may take the form of praise, but it need not be limited. It also may be a behavior of the caretaker to demonstrate understanding of the child's utterance (giving child requested toy)
     - Negative feedback (not reprimand)
       - Expansions – "wawa", "Oh, you want **water**"
     - Modeling
       - Child provides a better approximation

Moerk's Four Behavioral Characteristics in Teaching Language

4. Information acquired by the teacher of the learner's failure or success, which allows the mother to modify her talk.
   - Dynamic and bidirectional interaction
   - Mothers (sorry fathers) have been shown to anticipate with great accuracy the skills of their children
     - Allows them to adjust their modeling and feedback to levels that are appropriate to the child

Language Skill Learning in the Home

- Hart & Risely (1995) study of everyday language of children at their homes.
- Study of 42 children & their families were observed & audiotaped for 1 hr every month for almost 3 years.
  - Began at 9 months and continued until about 3 years old
- Finding supported at least 3 of Moerk's claims about the role of the mother in language teaching.

Language Input to the Children

- Hart & Risely (1995) study proved an enormous amount of language spoken by children in all 3 groups (based on income).
  - Welfare families – heard 620 words per hour (6,200/wk; 10m/yr)
  - Working-class families – heard 1,250 words per hour (12,500/wk; 20m/yr)
  - Professional families – heard 2,150 words per hour (21,500/wk; 30m/yr)

- Then measured cumulative vocabulary of the children as they developed

The Effects of Exposure on the Development of Language

- One important point is that despite the huge difference in the amount of language the children heard, all of them learned their language.
  - A clear linear relationship shows that the more parenting, the higher the child's IQ at 3
  - A clear relationship to the impact of language in first 3 years of life and test scores 6 years later (although less)

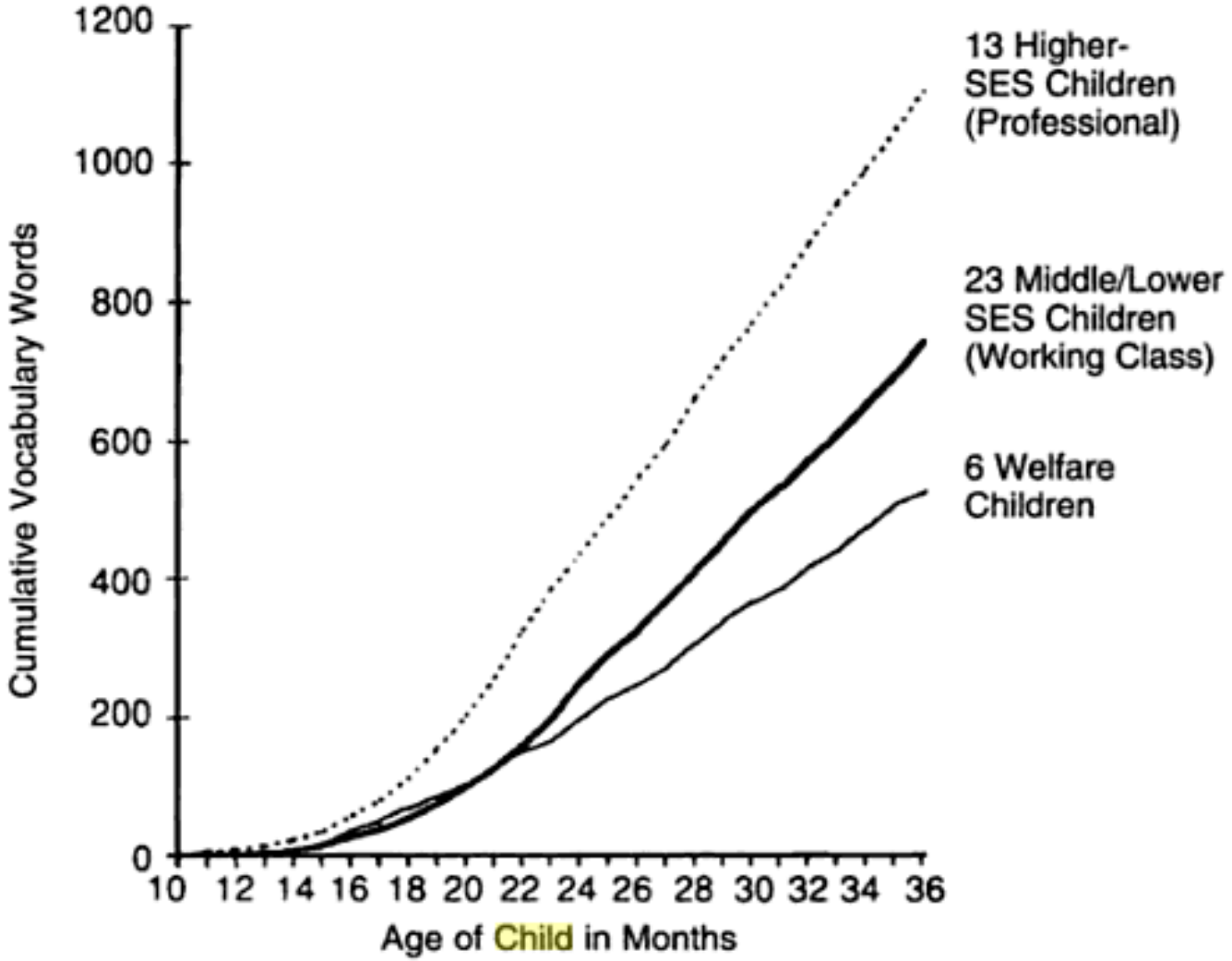
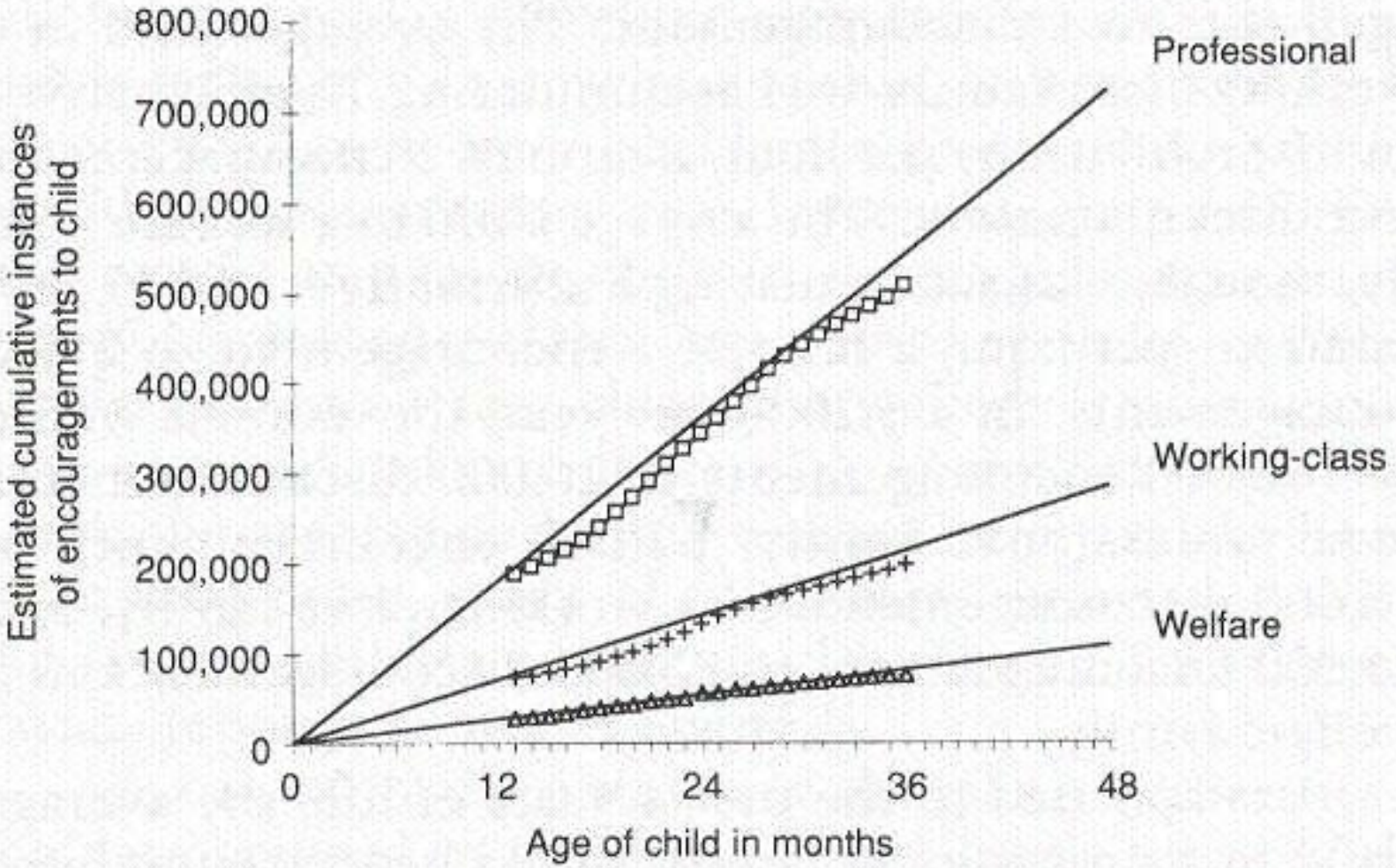


Figure 8.1 Vocabulary and Socioeconomic Class

SOURCE: From Hart & Risley, *Meaningful Differences in the Everyday Experiences of Young American Children*. Copyright 1995. Reprinted with permission of Paul H. Brookes Publishing Co.

NOTE: At each month, the average number of vocabulary words was recorded for that and all prior months for three groups of children from the time the children were 10 months old until they were 36 months old. The children were grouped by the socioeconomic status (SES) index assigned to the occupation of their parents. The 13 higher-SES children (dotted line) were in professional families, the 23 middle- to lower-SES children (heavy solid line) were in working-class families, and the 6 lowest-SES children (light solid line) were in families receiving welfare.


Encouragements
Estimated cumulative instances of encouragements to child
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
0
12
24
36
48
Age of child in months
Professional
Working-class
Welfare

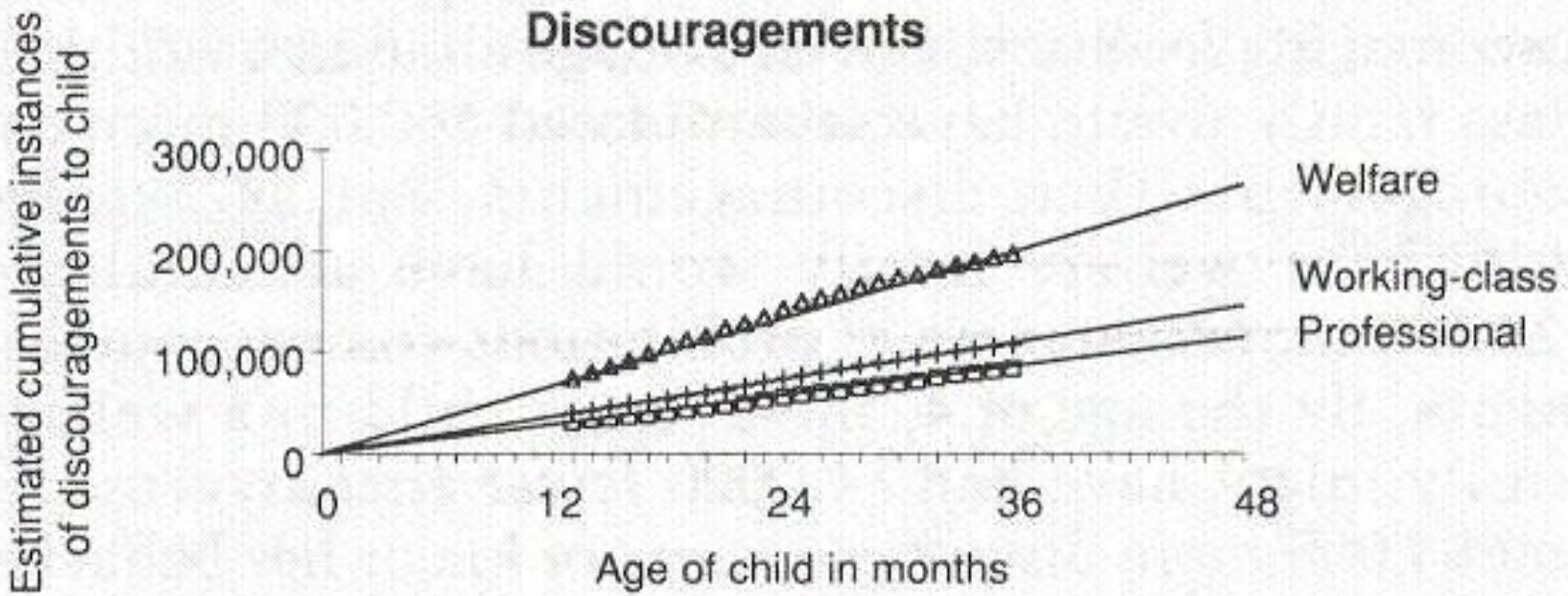
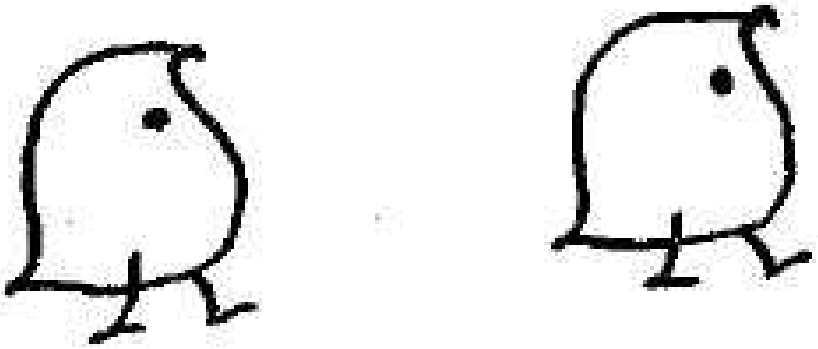


Figure 20. Estimated cumulative differences in confidence-producing experience by 4 years of age. Note the reversal of the lines in the bottom graph, reflecting the prevailing negative Feedback Tone in the welfare homes. (See Appendix B for a detailed explanation of this figure.)

The Role of Imitation

- Selective Imitation
  - Behavior that matches some part of the model's utterance
  - Whitehurst & Novak (1973)
    - Model "The boy is on the bike" then showed novel pictures. The sentences structure generalized
      - Many like this
  - 1:06 video example of Wug/Wugs test https://www.youtube.com/watch?v=MgB2iMuEZAA

THIS IS A WUG.



NOW THERE IS ANOTHER ONE.

THERE ARE TWO OF THEM.

THERE ARE TWO _____.

The Role of Imitation

- Overregularization (overgeneralization)
  - Using the regular form of a verb for an irregular verb
    - Runed, sitted
  - Based on what the child has heard and imitated
  - 23 sec video example of child telling story with lots of overregularization! https://www.youtube.com/watch?v=2lyNB-HEoyY

The Role of Reinforcement in Imitation and Communication

- Generalized Imitation – imitation as a response class and conditioned reinforcer
  - Jimmy the puppet – children were reinforced for imitating some actions, then, in the absence of reinforcement, they imitated many other actions
  - Same idea with language studies – just "vocal" rather than "motor"
  - Stimulus fading
  - https://www.youtube.com/watch?v=wU2cDET2fIY
  - https://www.youtube.com/watch?v=B37yJxFkQ80

- The following contingency is likely in language interactions:
- $S\underline{d} \rightarrow R \rightarrow S^{r}\pm$

- Mother: "Ball" → Child: "Ball"→ Mother: "Yes, that's right."

Three Functional Phases of Parent-Child Language Interaction (Hart and Risley)

- First Phase: Becoming Partners (11 months)
  - Children as listeners
- Second Phase: Staying and Playing (19 months)
  - Child utters as many words as nonwords
  - Many interactions
- Third Phase: Practicing (28 months)
  - Prompting, reinforcing imitation, modeling

Interactive Storybook Reading and Language

- One of the most enjoyable yet most important things parents can do with their children is to read to them. There are 7 steps designed to maximize language interaction.

1. Ask open-ended "what" questions, such as "what's this?"
2. Follow the child's answers with more questions.
3. Repeat what the child says.
4. Help the child as needed.
5. Praise and encourage the child.
6. Shadow the child's interest.
7. Have fun.

- Data is clear