A brief history of cognitive development

- 6 theories (Byrnes): Some are dead; some still popular with educators. Where do teachers’ ideas about children and learning come from?
- Historical views of childhood: Why learn this?
  - Research on child dev., & education practices, are shaped by historical, cultural beliefs about children.
- Prior to the emergence of a scientific study of human development...
  - Views of childhood governed by religion; economics
  - Two views of childhood (medieval society—17th C.)
## Two Concepts of Childhood*

### Medieval/Populist
- Stage of immaturity ends soon after infancy
- Children were viewed with amusement and “coddled”
- Working-class children provided essential labor; were treated as adults
- Schooling: optional or an annoyance; obtained at any age.

* primarily boys

### 17th C./Moralist
- Religious pedagogues: reviled coddling
- Children ignorant and crude; an “affront to reason”
- Also sweet; in state of grace
  - 1st Western view of childhood as distinct stage of development
- Education needed to “tend and water” fragile minds; nurture “thinking Christians”
Childhood as a distinct stage of development? Three traditions

- Empiricism (J. Locke, 1632-1704)
- Nativism (J.J. Rousseau, 1712-1778)
- Constructivism:
  - Logical: Piaget
  - Social: Vygotsky
  - Computational: Information Processing and Connectionism
Locke’s Empiricism

- Children are *tabula rasa* or “blank slates”
  - Fit with liberal, democratic thinking of Enlightenment
    - Possible to educate all people to become equals

- Learning by children:
  - Occurs through *association* and imitation
  - Shaped by repetition; punishment and reward
  - Principles of education: Optimal use of reward (praise) and punishment (disapproval); model good behavior

- Represented by Thorndike’s associationist ideas
Changing Empiricist views of development

Locke et al.

John Watson 1910s-1920s; Thorndike

B.F. Skinner 1930s-1980s

Pavlov

“give me a dozen healthy infants... and I’ll [choose] any one at random and train him [sic] to become... doctor, lawyer, [or] thief, regardless of his talents [or] tendencies (Watson, 1924)

The challenger: Chomsky

Theoretically bankrupt but practically applicability

New tradition: Neurocognitive development
Basic processes of learning

Classical Conditioning
1. UCS $\rightarrow$ UCR
   [loud noise] $\rightarrow$ [startle]
2. CS $\rightarrow$ UCS
   Pair neutral stimulus (ex: light) w/ noise
   (repetition & pairing: basic variables in
    connectionist learning!)
3. CS $\rightarrow$ CR
   [light] $\rightarrow$ [startle]

Operant Conditioning
- Reinforcement increases likelihood of repeating previous behavior
- Punishment decreases likelihood of repeating previous behavior

How do these correspond to Thorndike’s Laws of Exercise and Effect?
Rousseau’s Naturalism

- Children grow according to nature’s plan
- Society corrupts children; forces conformity:
  - “Man is born free, and everywhere he is in chains”
- Education should emphasize:
  - Safe exploration of environment;
  - Minimal guidance (child chooses activities)
  - Child’s ideas (not imposed judgments/facts)
- Represented (partly) in Piaget’s constructivism; Reggio Emilia & Montessori ECE* approaches
Changing Naturalist views of development

Plato, Kant, Rousseau

Ethologists (e.g., Lorenz)

Gesell: preformationism

Dominance of behaviorism

Chomsky

New Nativism*

Sociobiology; Behavioral Genetics

(*how has education faced this trend?)
Preformationism: “Same as it ever was”

Drawing of a fully-formed human in a sperm cell (Hartsoeker, 1694)
Status of Empiricism and Nativism (Child Development)

- Not either/or:
  - Genes, biological processes, and experience in the environment interact in every aspect of development

- Range of reaction:

![Graph showing cumulative effect of environment on expression of traits]
- (eye color)
- (IQ)

Cumulative effect of environment vs. Expression of trait
Constructivist theories of cognitive development

- Piaget’s constructivism
  - Innate drive to explore & differentiate; schemas develop through practice; stage-like changes

- Vygotsky’s socio-cultural theory
  - Culture gives tools to “mediate” action in environment; internalization of cultural learning; scaffolding agents

- Information processing theory
  - Metaphor: Brain as computer; distinct functional units; limitations on learning
  - Not a coherent theory but an approach
  - “Developmentally Appropriate Practices”
A Piaget Primer

Why learn Piaget?

- Historically, constructivism was innovative
  - Ex: Child’s conception of wind (Zaporozhets)
- Exemplary theory: Unites many phenomena
  - Exs: Object concept, conservation, causal thinking
- Replicable observations of behaviors
- Influence on educational theory & practice (especially ECE)
Piaget’s Theory: The basics

- Main question: How does intelligence grow?
- Definition of intelligence: adaptation to reality
- Infant has: reflexes; drive to explore
Constructivist learning about pulleys...

What makes this kind of activity “constructivist?”

(from Kamii & DeVries, 1978)
Piaget’s Stages of Development

- Sensorimotor (infancy)
- Preoperational (preschool)
- Concrete operational (middle childhood)
- Formal operational (adolescence)
Preoperational thought *a la* Piaget

- Use of “mental substitutes”
  - Language, pretense, imitation, “language play”
- Centration
  - Conservation errors; egocentrism
- Unable to reason or think hypothetically
- Perceptually bound: can’t use abstract relations

*Many educators still accept this description*
A few of the many problems with Piaget’s stages of thinking

- Problems w/ Piaget’s view
  - Adults are illogical (often!)
  - Kids can learn scientific reasoning skills (wk. 9)
  - Perceptually bound??

- Hypothetical thought:
  - “What would it be like to be a cat?”
  - What is Harris’ argument?
    - Age effects? Education effects?
Some ways we are illogical

- **Representativeness heuristic:**
  - on NPR (for example): “Well, I use a deer whistle, and I’ve never hit a deer, so they work! Them scientists don’t know nuthin’!”

- **Which is more likely?**
  - Large bridge will collapse in CA w/in 5 yrs.
  - CA will be hit by big earthquake, which will cause a large bridge to collapse, w/in 5 yrs.
Are preschoolers perceptually bound?

Can they use an abstract rule to match objects by shape or function?
Results: 4-year-olds can adopt and use an abstract rule.
“...like to be a cat?”

- 9-yr-old: “With a human brain? It would be cool, because I wouldn’t have to try disgusting new foods. I wouldn’t have to go to school...but [on the other hand] I couldn’t play GameBoy!”

- 5-year-old: “That would be silly. I’d be ‘meow meow’...I want to do a cow instead! ...and [I’d have] 15 whiskers....and hide in the garage, because cats get scared....and run and hide. ...I would...sleep in a box.”

[Zaporozhets & Elonkin: “...the [preschool] child expresses judgments...as isolated instances in the general flow of practical and playful activity...[but] do not form any particular plan of thinking” (1971:232)]
Information Processing and “Neuroconstructivism”

- What is this??
  - IP: Idea that distinct cognitive functions can be characterized
    - By understanding functions (e.g., attention, working memory, retrieval, inhibition of action) and their relations, we can predict errors/inefficiencies in learning and thinking.
  - Neurocon: Cognitive (IP) functions can be related to neural pathways, structures, and modulatory processes
    - e.g., psychopharmacological drugs can influence learning, remembering, attention, etc.
Example: Attention and the control of action

- Bracken Jones et al: What is the question?
  - example of the behavior...
  - What did they find? Should teachers care?
  - What’s missing from their account?
- Relevant brain structures:
Executive attention in action

QuickTime™ and a Video decompressor are needed to see this picture.
Summary so far...

- Empiricism & nativism: long history & continued influence, but not useful by themselves
- Constructivist models avoid some problems
  - Piaget’s theory, still big in education, has big problems
  - Vygotsky’s model (Byrnes ch. 2): too vague to explain or predict how education & development interact
  - Information Processing approaches (not a theory!) are more generally useful, but:
    - based on adult data/models; don’t address development;
    - tend to oversimplify functional interactions;
    - tend to put cognition “in the head,” rather than as a transactive, emergent product of an embodied organism in a dynamic environment