A brief history of cognitive development

• What’s the point?
  • Source of teachers’ ideas about children, learning
• Historical views of childhood: Why learn this?
  • Research on child dev & education is shaped by historical, cultural beliefs about children.
• Prior to scientific study of human development…
  • Views of childhood governed by religion; economics
• Two views of childhood (medieval-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.

**17th C./Moralist**
- Religious pedagogues: no coddling!
- Children ignorant and crude; “affront to reason”
- Also sweet; in state of grace
  - 1st Western view of childhood as a distinct stage
- Education to “tend and water” fragile minds; nurture “thinking Christians”

*mostly boys*
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 & 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:
  • Shaped by repetition; punishment and reward
    • Principles of education: Use reward (praise) and punishment (disapproval); model good behavior
  • Through *association* and imitation
Basic learning processes

Classical Conditioning

1. UCS $\rightarrow$ UCR

[loud noise] $\rightarrow$ [startle]

2. CS $\rightarrow$ UCS

Neutral stimulus (ex: light) w/ noise

(repetition & pairing: variables in connectionism)

3. CS $\rightarrow$ CR

[light] $\rightarrow$ [startle]

Operant Conditioning

• Reinforcement increases chance of repeating behavior
• Punishment decreases likelihood of repeating behavior
Changing Empiricist views of development

Locke et al.

John Watson
1910s-1920s;
Thorndike

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)

B.F. Skinner
1930s-1980s

The challenger: Chomsky

Theoretically bankrupt but practically applicability

New tradition: Cognitive Developmental Neuroscience
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 & Montesorri 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
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:

```
<table>
<thead>
<tr>
<th>Expression of trait</th>
<th>Cumulative effect of environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>(eye color)</td>
<td>(IQ)</td>
</tr>
</tbody>
</table>
```
Constructivist ideas of cognitive development

• First: Vygotsky’s *socio-cultural* version of constructivism
  ➡ Gauvain: “determines what children think about and...practice and adopt thinking” ALSO “primary system to learn about the world and...develop skills”
  ➡ Culture gives **tools** to “mediate” action in environment
    - language, written symbols, are among those tools
    - internalization of symbols is critical developmental process (e.g., visualize atoms binding into molecules)
    - tools are among those tools
    - not just rakes and baskets: also computers, for ex.
  ➡ Internalization of cultural learning
    - with scaffolding by social agents
Piaget’s version of constructivism

- Most influential theory: We still use many of his tests
  - Innate drive to explore & differentiate
  - Innate reflexes
  - Schemas develop through practice;
  - Stage-like changes (new kinds of representation)
A Piaget Primer

- Why learn Piaget?
  - Historically, constructivism was innovative
  - Exemplary theory: Unites many phenomena
  - Replicable observations of behaviors
  - Influence on educational theory & practice (especially ECE)

- Main question: How does intelligence grow?
- Definition of intelligence: adaptation to reality
- Infant has: reflexes; drive to explore
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!)
    - Keil: What is the “illusion of explanatory understanding?”
  - Kids can learn scientific reasoning skills (wk. 9)
  - Perceptually bound??

- Hypothetical thought:
  - What is Harris’ argument? Age or education?
  - “What would it be like to be a cat?”
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, use abstract rule

Percentage of Function-Based Responses

- No Instruct (3-year-olds: 10%, 4-year-olds: 10%)
- Shape Instruct (3-year-olds: 20%, 4-year-olds: 50%)
- Function Instruct (3-year-olds: 50%, 4-year-olds: 90%)
“...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?? Metaphor: Brain as computer; distinct functional units; learning limits. Not a coherent theory but an approach. Relevant to “Developmentally Appropriate Practices?”

• **IP**: distinct cognitive functions (e.g., attention, working memory, retrieval, inhibition of action) can be understood...
  - ...by detailing limits and relations
  - ...predict errors/inefficiencies in learning and thinking.

• **Neuroconstr**: Describe neural pathways, structures, and modulatory processes that underlie cognitive functions
  - Gauvain: “biological underpinnings...” effects of, for ex., drugs; sleep; motivation on: learning, remembering, attention, etc.
Example: Attention & control of behavior

- Bracken Jones et al: What is the question?
- example of the behavior…
- What did they find? Should teachers care?
  - Can teachers know how children will do? How?
- What’s missing from their account?
- Relevant brain structures: ACC, LPFC
Executive attention in action
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: too vague to explain or predict how education & development interact
  ➡ Information Processing approaches are more useful, but:
    - often based on adult data/models, not child development;
    - tend to oversimplify functional interactions;
    - tend to put cognition “in the head,” don’t consider the structure of a dynamic environment