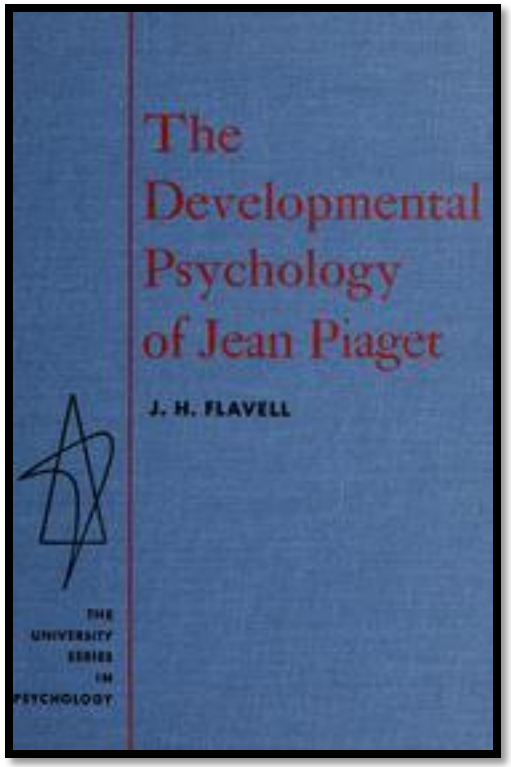
PSY3016: Cognitive Development Lecture 1



The Developmental Psychology of Jean Piaget

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http://faculty.frostburg.edu/mbradley/psyography/jeanpiaget.html

Cognitive development: The next 7 weeks

- Classic theories of cognitive development.
  - Today
- Modern theories of conceptual development, some of it built on top of or in direct opposition to Piaget's work
  - 3.5 weeks
- Return to Language development (and Chomsky)
  - 1.5 weeks
- Cognitive development across cultures
  - 1 week

Learning outcome for every lecture in this series:

- **Scientific argumentation**
- What is the argument for the theory in question?
- To build an argument for or against a theory you have to understand empirical research
- You will primarily be assessed on your understanding of the empirical research in how it supports some argument
- Primarily: Arguments to explain key developmental patterns of behaviors in one way or another
- Also: Arguments for interventions to improve outcomes

What is everyone arguing about?
For Piaget, and for cognitive development as a whole?

Where does knowledge come from?

- How is it that we know anything?

How does knowledge change with development?

How do we use knowledge to understand and reason about our world?

- How does how we use knowledge change with development

What's the big question? For Piaget, and for cognitive development as a whole?

Where does knowledge come from?

For Piaget, this means structured, symbolic knowledge. His concept of adult thought is logico-mathematical operations, operating over structured symbolic representations.

He rejected innate knowledge. How does the child go from no knowledge at birth, to structured symbolic representations?

What should we hope to achieve in the next two lectures?

These lectures are NOT designed to give you a full overview of Piagetian theory, and the empirical work that has followed

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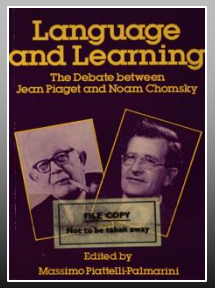
What I would like you to take away from these lectures is:

- an appreciation of what drives important theories
- a sense for the kinds of assumptions that the major theories have had to make or grapple with … and will continue to have to make and grapple with!
- So why don't we start with Piaget!

Readings on Piaget's Theoretical conception



http://en.wikipedia.org/wiki/Piaget's_theory_of_cognitive_development

(Excellent Wiki page which covers all the basic territory)

Miller, P. *Theories of Developmental Psychology* (4th and 5th Editions)

(note that Piaget is dealt with in Ch. 1 of 4th Ed. and Ch. 2 of 5th Ed.)

Essential Reading

Jean Piaget (1896 – 1980)


Jean Piaget

- You have already been acquainted with the basic shape of Piaget's theory in 1st year

PIAGET: STAGES OF COGNITIVE DEVT.

4 MAIN STAGES:

1. **SENSORI-MOTOR**
   (approx. 0 -2 years)

2. **PREOPERATIONAL**
   (approx. 2 – 7 years)

3. **CONCRETE OPERATIONS**
   (approx. 7 – 11 years)

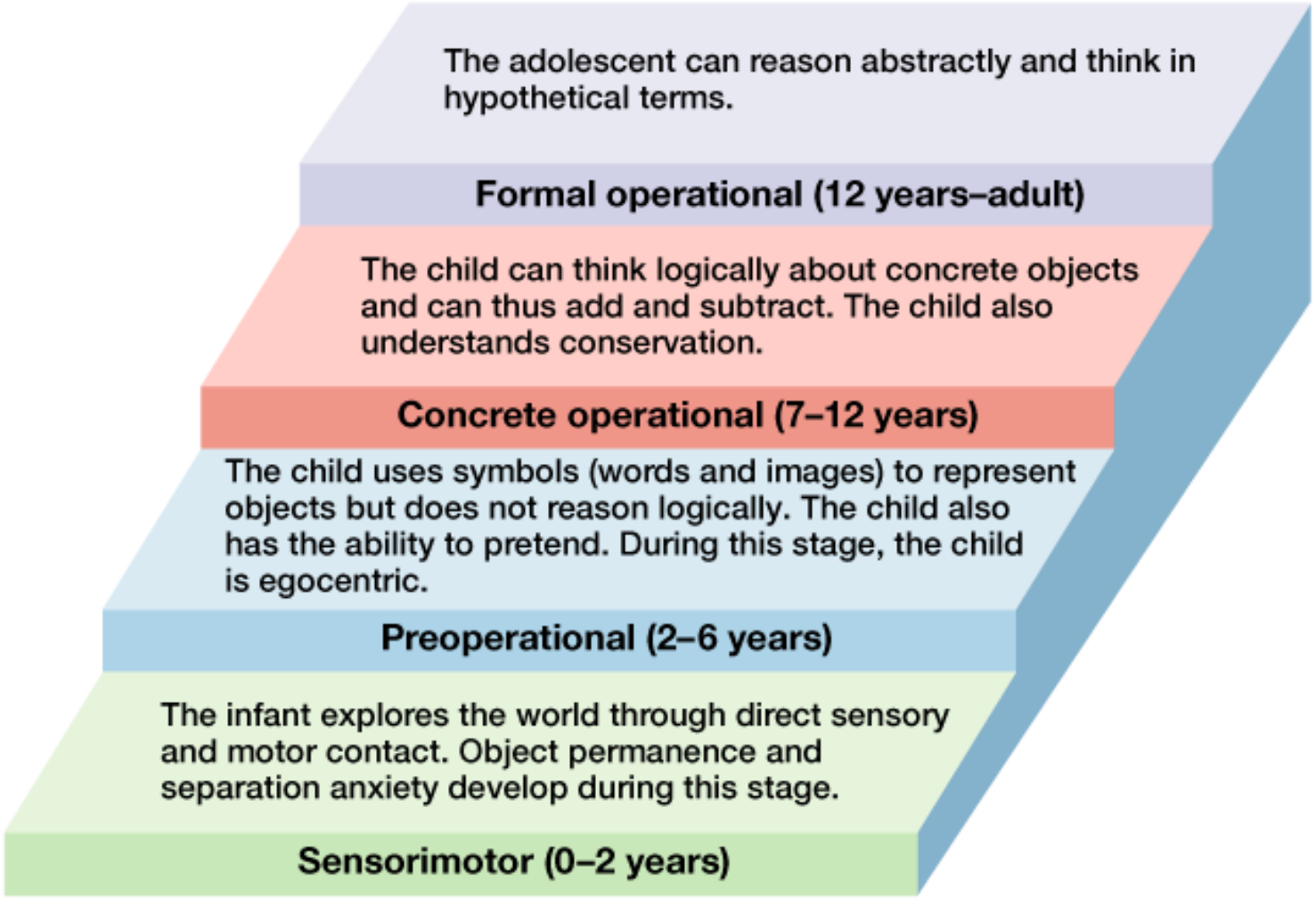
4. **FORMAL OPERATIONS**
   (approx. 11 years +)

WHAT IS A SCHEME?

A cognitive structure; an organized pattern of thought or action which is constructed by the individual to make sense of or respond to some aspect of experience.

- **behavioural schemes**
  e.g. suck, grasp
- **concepts (mental schemes)**
  e.g. "round","dog"
- **operational schemes**
  e.g. add, compare, classify

EXPLORING A RATTLE http://www.youtube.com/watch?v=UtTijWurHis



http://mcmetec5303.wikispaces.com/My+Stance+on+Educational+Technology,+by+Jean+Piaget

Jean Piaget (1896 – 1980)

- You have already been acquainted with the basic shape of Piaget's theory in 1st year

- You have also encountered some of the important processes

- Stage independent processes
- In sensory motor periods, e.g., attempts to grasp a newspaper after only grasping rattles. Adjustment of grasping schema
- As an adult traveling to a new country: adjust your social behavior schemes to a new country

ADAPTATION

Continuous process of adjusting to the environment.

TWO COMPLEMENTARY PROCESSES:

ASSIMILATION	**ACCOMMODATION**
Deal with new experiences in terms of existing schemes.	Modify existing schemes to deal with new experiences.

Jean Piaget (1896 – 1980)

- You have already been acquainted with the basic shape of Piaget's theory
- You have also encountered some of the important processes

- But have you wondered what Piaget was on about?

  What did he care about?

  What did he want to explain?

Jean Piaget (1896 – 1980):
The basic shape of the theory

Periods of Development
- Hierarchical
- Universal
- Transformative

Stages of Development
- Hierarchical
- Universal
- Transformative
- … But smaller!

1. SENSORI-MOTOR
(approx. 0 -2 years)

2. PREOPERATIONAL
(approx. 2 – 7 years)

3. CONCRETE OPERATIONS
(approx. 7 – 11 years)

4. FORMAL OPERATIONS
(approx. 11 years +)

Sensorimotor (approx. 0-2 years)

1. Modification of reflexes
2. Primary circular reactions
3. Secondary circular reactions
4. Coordination of secondary schemes
5. Tertiary circular reactions
6. Invention of new means through mental combinations

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- Scrutiny of the Sensorimotor Period, and the processes described therein, reveals to us the core of Piaget's theory, and his beliefs; it is the 'necessary' part of his theory
  - How children at birth go from not knowing anything, only having reflexes, to constructing knowledge from their environment
- The period of Formal Operations is the 'beautiful' of Piaget's theory
- We are going to largely stick with the necessary part because this takes us the the heart of his theory; to his assumptions and 'needs'
- Before formal operations over symbolic representations, the child must get symbolic representations!

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.;

Stage 1: *Modification of Reflexes* (~Birth to 1 month)

- "At birth, children are a bundle of reflexes, e.g., put a finger in its hand, the baby grasps it, present a nipple, it sucks it.
- But then through this period, reflexes are modified, e.g., the hand position of grasping a rattle vs. a finger vs. whatever else.
- "Behaviors such as sucking, grasping, and looking do not remain reflexes; babies can produce them spontaneously."
- "Piaget claims that there is an innate tendency for humans to exercise their skills"
- Earliest notion of *scheme*: organized pattern of behavior
    - Throughout sensori-motor period it's an organization in the head, but it is only about regularities in action and perception. No abstract understanding of e.g., the nature of objects.

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.)

Stage 2: *Primary Circular Reactions* (~1 to 4 months)

- "By chance, the baby discovers an interesting result from some behavior and then attempts to recapture this result"
- "These circular reactions are called "primary" because they involve response consequences that are centered on or around the infant's body rather than other objects"
- "The performance of circular reactions [re-actions] seems to be accompanied by feelings of pleasure
- For example, the result of successfully grasping something is pleasurable, and so it is repeated. The focus is on the action, not the object that is e.g., grasped.

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.)

Stage 3: *Secondary Circular Reactions* (~4 to 8 months)

- "[…] secondary circular reactions are oriented to the external world"
- "By chance, the infant does something that leads to an interesting effect in the environment: he shakes a rattle, which produces a noise […]"
- "During stages 2 and 3, the infant achieves some simple coordinations of his schemes. The integration of vision and grasping is especially useful for developing circular reactions. Now the infant can see an object, reach for it, and run through his repertoire of "things to do to objects""

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed)

Stage 4: *Coordination of Secondary Schemes* (~8 to 12 months)

- In this stage, "[i]nfants know what they want and can put together schemes to achieve that goal. They have differentiated between means and end"
- *means* = instrumental behavior (scheme)
  ends = goal behavior/outcome (scheme)
- "A special feature of the means–end behavior […] is that it is applied to *new* situations. The schemes are now mobile; they are freed from their original contexts and can be used to achieve a variety of goals"
- Trying to grasp a rattle, and there is something in the way, they can remove the object to get the rattle

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44

Stage 4 Example

Understanding of means-ends behavior leads to being able to anticipate events

At 0;9(16) . . . she likes the grape juice in a glass, but not the soup in a bowl. She watches her mother's activity. When the spoon comes out of the glass she opens her mouth wide, whereas when the spoon comes from the bowl, her mouth remains closed. Her mother tries to lead her to make a mistake by taking a spoon from the bowl and passing it by the glass before offering it to Jacqueline. But she is not fooled.

[Piaget, 1936 (1952, p. 249)]

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed)

Stage 5: *Tertiary Circular Reactions* (~12 to 18 months)

- "In this stage, we see infant scientists at work. The environment is their laboratory. They perform miniature experiments in which they deliberately vary an action in order to see how this variation affects the outcome"
- "Through deliberate trial-and-error exploration, infants extend the means–end behavior of the previous stage to develop new means"
- E.g., dropping objects from different hand positions and heights

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed)

Stage 6: *Mental Combinations* (~18 to 24 months)

- Innovation in how they are combining all their different behavior schemes to solve novel problems.

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.; also see Flavell Ch. 3 & 4)

Stage 6 example

At 1;6(23) for the first time Lucienne plays with a doll carriage whose handle comes to the height of her face. She rolls it over the carpet by pushing it. When she comes against a wall, she pulls, walking backward. But as this position is not convenient for her, she pauses and without hesitation, goes to the other side to push the carriage again. She therefore found the procedure in one attempt, apparently through analogy to other situations but without training, apprenticeship, or chance.

[Piaget, 1936 (1952, p. 338)]

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.; also see Flavell Ch. 3 & 4)

Stage 6: *Mental Combinations*

- Before stage 6, "[…] children have displayed their thinking to the world; now the overt is becoming covert. External physical exploration gives way to internal mental exploration. All of this is possible because children can now use mental symbols to *represent* objects and events"
- Playing with a match box, opening and closing it, the child may open and close her mouth *in correspondence*
- The mouth opening can then stand for the box opening
- It has a "representational stance"

Jean Piaget (1896 – 1980):
What happens in the Sensorimotor Period?

Miller pp. 38-44 (5th Ed.; also see Flavell Ch. 3 & 4)

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- "When faced with a problem that past methods do not solve, Lucienne thinks through the problem, partly by means of movements of the mouth and partly by thinking. She is in transition to a true use of mental symbols"

Jean Piaget (1896 – 1980):
What happens AT THE END of the sensorimotor period?

(see Miller 5th Ed. pp. 38-44)

Sensorimotor (approx. 0-2 years)

1. Modification of reflexes
2. Primary circular reactions
3. Secondary circular reactions
4. Coordination of secondary schemes
5. Tertiary circular reactions
6. Invention of new means through mental combinations

Semiotic function

The ability to use one object or event to stand for another: a *signifier* evokes a *significate*

- Think about how a child comes to engage in symbolic play [e.g., pretending his hand is an airplane]
- By the end of our description, the child had 'acquired' something Piaget described as the *Semiotic Function*
- Piaget has solved, to his own satisfaction, one of the great problems of epistemology, the establishment of nascent mental representation

  (which allows the child to act on the world in a more adequate manner)
- The sensory motor period ends with the child rapidly learning words. After the insight of one object standing for another in physical correspondence, another insight is that there does not need to be physical correspondence for something to stand for something else (e.g., the sound of the *"cat"* has nothing to do with cats

Piaget has solved one of the great problems of epistemology

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, p. 23)

The Psychogenesis of Knowledge and Its Epistemological Significance

Jean Piaget

Fifty years of experience have taught us that knowledge does not result from a mere recording of observations without a structuring activity on the part of the subject. Nor do any a priori or innate cognitive structures exist in man; the functioning of intelligence alone is hereditary and creates structures only through an organization of successive actions performed on objects. Consequently, an epistemology conforming to the data of psychogenesis could be neither empiricist nor preformationist, but could consist only of a constructivism, with a continual elaboration of new operations and structures. The central problem, then, is to understand how such operations come about, and why, even though they result from nonpredetermined constructions, they eventually become logically necessary.

This is *constructivism* at its heart

It is a rejection of any form of *nativism* ("preformation"), and also *empiricism*

To Piaget: what is innate?

The ability to construct one's own knowledge of the world

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I would like to highlight an idea

This notion of "logical necessity" is very important to Piaget's ideas about the development of intelligence

If you like, the development of intelligence has direction; in *a logico-mathematical* sense, it becomes more adequate in so far as it reflects true (truer) relations between the individual and the world

The world is defined by mathematical operations, and so cognitive development is the continuing approximation of reflecting the world's mathematical structure.

There is a kind of *idealism* to Piaget's notion of intelligence

Piaget has solved one of the great problems … or has he?

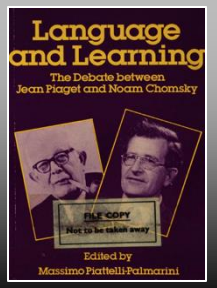
Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, p. 28)

Formation of the semiotic function

So, what is going on in Piaget's scheme?

- You can't get to the semiotic function just via experience, that is anathema to Piaget's complete rejection of empiricism
    - If all there was, were Skinnerian reinforcement, how does symbolic reasoning emerge?
- Piaget is trying to explain not just the form of development (i.e., stages 1 though 6) and its relation to experience, but also the mechanisms pushing it forward: One such mechanism is assimilation/accommodation, etc.

Readings on Piaget's Theoretical conception and critiques



Miller, P. *Theories of Developmental Psychology* (4th and 5th Editions)

(note that Piaget is dealt with in Ch. 1 of 4th Ed. and Ch. 2 of 5th Ed.)

Vygotsky and the Sociocultural Approach

Miller, P. *Theories of Developmental Psychology* (5th Ed.: Chapter 4) (available from the library)

Things no Amount of Learning can Teach

(Chomsky interview by Gliedman, November, 1983)

http://www.chomsky.info/interviews/198311--.htm

Lev Vygotsky (1896 – 1934)

Thought and Language (Lev Vygotsky)
Alex Kozulin, Ed. (1986/1999)

- We are not going to cover Vygotsky's theory in general
  - Brief intro
- We are going to consider some points that characterize his approach, in comparison with Piaget
- Luckily, Vygotsky did this himself: "Piaget's Theory of the Child's Speech and Thought" (Ch.2)
- Vygotsky had lofty ambitions, so let's stick with nature of the relation between thought and language!

Lev Vygotsky (1896 – 1934)

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- Socio-cultural theory: the-child-in-context is the unit of study, it is what develops
- For example, between 3 and 5, it is not just the child that changes, but how the parent interacts with the child, e.g., speaking more abstractly to the child because the perception the child is more capable
- The whole system develops at once
- Child-in-context is constrained by culture, passes culture on, and changes the culture
- What is internalised in the child is the culture. Piaget said the world is internalised across development, Vygotsky says culture is internalised across development

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- Culture provides ways of thinking and tools for thinking
- Language is critical in showing how cultures think and helping children think
- Children speak to others, and then to themselves when solving a problem, and then eventually internalize that speech
- But when more challenging problem, they speak out loud again to themselves
- Think of when you are doing your taxes, or planning an essay, do you mutter to yourself?
- Now back to Vygostky's critique of Piaget
- Egocentrism is at the core of the issue

Infant is autistic

The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself

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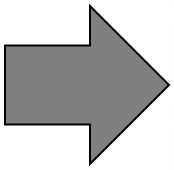
The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself

Infant, confronted with the world, becomes less egocentric – experience and its assimilation increases the opportunity for understanding

Piaget

Infant is autistic

The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself



Infant, confronted with the world, becomes less egocentric – PROCESSES OF REFLECTIVE ABSTRACTION AND CONSTRUCTIVE GENERALISATION CAUSE CHANGE

Piaget

Vygotsky

~~Infant is autistic~~
Infant is social

The world impinges on the infant and he has to assimilate what he encounters, and accommodate himself

The infant struggles to engage with the world, and is assisted in doing so. He appropriates (internalizes) cultural objects (like language) to assist in this endeavor

Infant, confronted with the world, becomes less egocentric – PROCESSES OF REFLECTIVE ABSTRACTION AND CONSTRUCTIVE GENERALISATION CAUSE CHANGE

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Infant, assisted by cultural structures, is extended into the *zone of proximal development*, which allows him to act beyond his current capacity, and thereby extend himself

Piaget

The social world slowly breaks through egocentrism

Enculturation is learning – knowledge is social

Vygotsky

~~Infant is autistic~~

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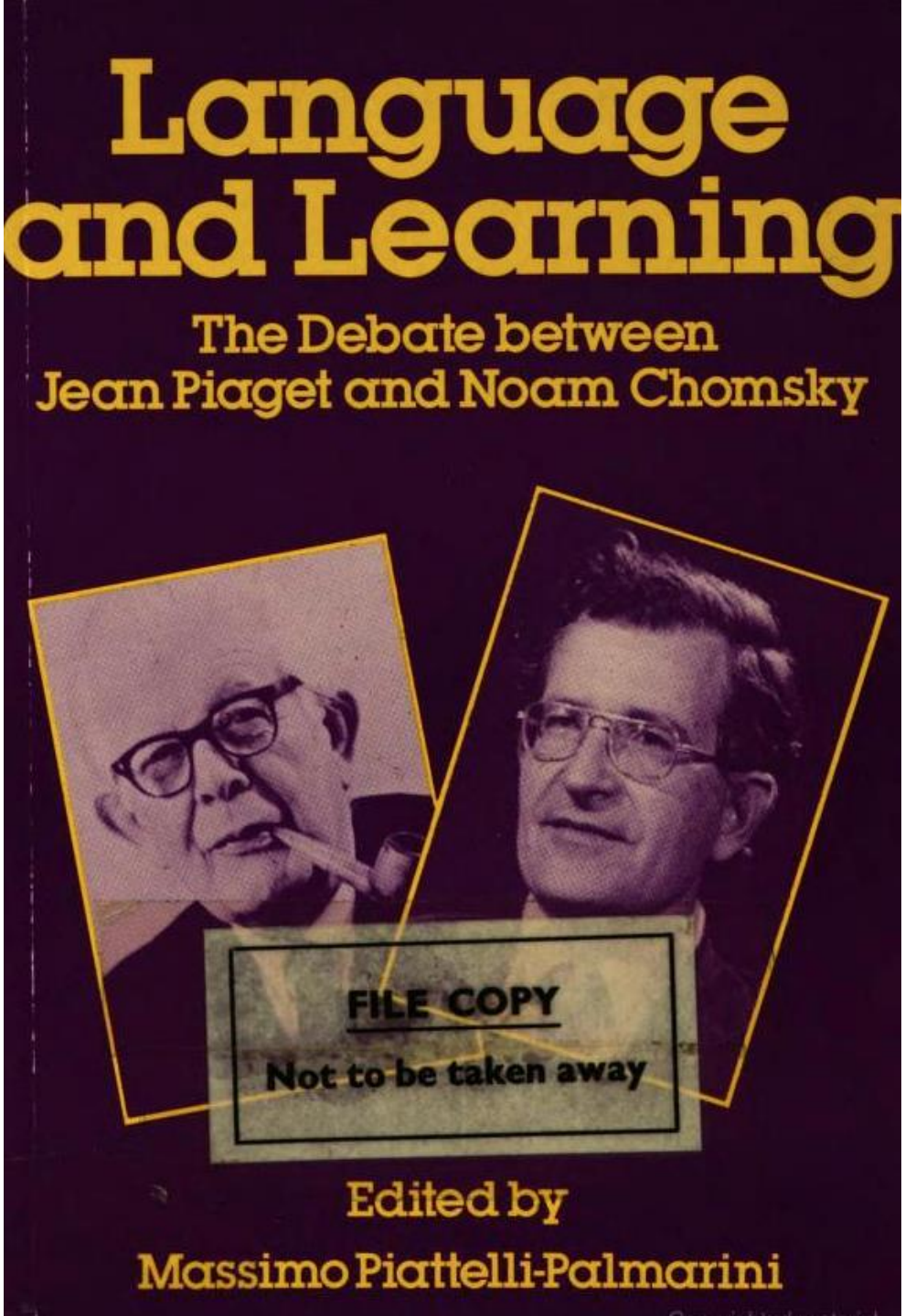
- Piaget says the child constructs knowledge on his own
- Only gradually becomes social: begins egocentric
- Vygotsky says that human knowledge is cultural knowledge, that knowledge is essentially social. The infant is social from the beginning.
- Vygotsky says that Piaget hides behind "the wall of facts"
    - Can't explain how the semiotic function is discovered by the child because it is not.
- Vygotsky says the semiotic function is learned from culture, not self-discovered.


Language and Learning
The Debate between Jean Piaget and Noam Chomsky
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Not to be taken away
Edited by
Massimo Piattelli-Palmarini

Chomsky's not convinced!

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, pp. 35-52)

So this is Chomsky's deep assumption

On Cognitive Structures and Their Development: A Reply to Piaget

Noam Chomsky

In his interesting remarks on the psychogenesis of knowledge and its epistemological significance, Jean Piaget formulates three general points of view as to how knowledge is acquired: empiricism, "preformation" ("innatism"), and his own "constructivism." He correctly characterizes my views as, in his terms, a variety of "innatism." Specifically, investigation of human language has led me to believe that a genetically determined language faculty, one component of the human mind, specifies a certain class of "humanly accessible grammars." The

[...]

development. My guess would be that, as in the case of grammars, a fixed, genetically determined system of some sort narrowly constrains the forms that they can assume. I would also speculate that other cognitive structures developed by humans might profitably be analyzed along similar lines.

Chomsky's not convinced!

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, pp. 35)

"Against this conception Piaget offers two basic arguments"

1. The mutations, specific to humans, that might have given rise to the postulated innate structures are "biologically inexplicable"
2. What can be explained on the assumption of fixed innate structures can be explained as well as "the necessary" result of constructions of sensorimotor intelligence

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- The evolutionary development is "biologically unexplained", yes, but not "biologically inexplicable"
- The same can be said of any human organ – evolutionary development is biologically unexplained!
- *Although it is quite true that we have no idea how or why random mutations have endowed humans with the specific capacity to learn a human language, it is also true that we have no better idea how or why random mutations have led to the development of the particular structures of the mammalian eye or the cerebral cortex*

Chomsky's not convinced!

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- *Little is known concerning evolutionary development, but from ignorance, it is impossible to draw any conclusions. In particular, it is rash to conclude either [A] that known physical laws do not suffice in principle to account for the development of particular structures, or [B] that physical laws, known or unknown, do not suffice in principle*

Chomsky's not convinced!

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2. What can be explained on the assumption of fixed innate structures can be explained as well as "the necessary" result of constructions of sensorimotor intelligence

- *The second argument seems to me a more important one. However, I see no basis for Piaget's conclusion. There are, to my knowledge, no substantial proposals involving "constructions of sensorimotor intelligence" that offer any hope of accounting for the phenomena of language that demand explanation*

Chomsky then takes two approaches:

- critique on history of ideas
- evidence from the specific properties of this mental organ (i.e., knowledge of language)

Chomsky's not convinced!

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critique on history of ideas

- There is no reason why a neutral scientist, unencumbered by traditional doctrine, should adopt the view that cognitive structures of the mind should be studied separately from physical structures developed by the body
- Chomsky defines an approach for doing such investigation (p. 37)

Chomsky's not convinced!

Language and learning: The debate between Jean Piaget and Noam Chomsky
Piatelli-Palmarini, Ed. (1980, pp. 37)

Suppose that we set ourselves the task of studying the cognitive growth of a person in a natural environment. We may begin by attempting to delimit certain cognitive domains, each governed by an integrated system of principles of some sort. It is, surely, a legitimate move to take language to be one such domain, though its exact boundaries and relations to other domains remain to be determined. In just the same way, we might proceed to study the nature and development of some organ of the body. Under this quite legitimate assumption, we observe that a person proceeds from a genetically determined initial state S_0 through a sequence of states S_1, S_2, . . . , finally reaching a "steady state" S_s which then seems to change only marginally (say, by the addition of new vocabulary). The steady state is attained at a relatively fixed age, apparently by puberty or somewhat earlier. Investigating this steady state, we can construct a

Language development unfolds in a regular sequence, just as any other maturing aspect of the child

Chomsky's not convinced!

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"Against this conception Piaget offers two basic arguments"

1. The mutations, specific to humans, that might have given rise to the postulated innate structures are "biologically inexplicable"

2. What can be explained on the assumption of fixed innate structures can be explained as well as "the necessary" result of constructions of sensorimotor intelligence

evidence from the specific properties of this mental organ
(i.e., knowledge of language)

- *The expectation that constructions of sensorimotor intelligence [via some General Developmental Mechanism] determine the character of a mental organ such as language seems to me hardly more plausible than a proposal that the fundamental properties of the eye or the visual cortex or the heart develop on this basis. Furthermore, when we turn to specific properties of this mental organ, we find little justification for any such belief, so far as I can see*

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QUESTION: You mean that school grammars fill in the gaps left by heredity? They teach everything about French or Russian, for example, that can't be taken for granted by virtue of the fact that you're human?

CHOMSKY: That's right. It is precisely what seems self-evident that is most likely to be part of our hereditary baggage. Some of the oddities of English pronoun behavior illustrate what I mean. Take the sentence, "John believes he is intelligent." Okay, we all know that "he" can refer either to John or to someone else; so the sentence is ambiguous. It can mean either that John thinks he, John, is intelligent, or that someone else is intelligent. In contrast, consider the sentence, "John believes him to be intelligent." Here, the pronoun "him" can't refer to John; it can refer only to someone else.

Now, did anyone teach us this peculiarity about English pronouns when we were children? It would be hard to even imagine a training procedure that would convey such information to a person. Nevertheless, everybody knows it -- knows it without experience, without training, and at quite an early age. There are any number of other examples that show that we humans have explicit and highly articulate linguistic knowledge that simply has no basis in linguistic experience.

Noam Chomsky: we will get to him a lot more later!

There are many more such examples

“Sam is waiting for Fred” can be asked, “Who is Sam waiting for?”

“Susan asked why Sam was waiting for Fred.” cannot be asked as “Who did Susan ask why Sam was waiting for __?

How could we learn that from sensori-motor exploration? How could that be constructed from modifications of reflexes? (also, motor disabled children still can learn language)

Additional readings: Noam Chomsky , and we will get to him a lot more later!

Review of B F Skinner's *Verbal Behavior* (1959/1967)

- http://cogprints.org/1148/1/chomsky.htm

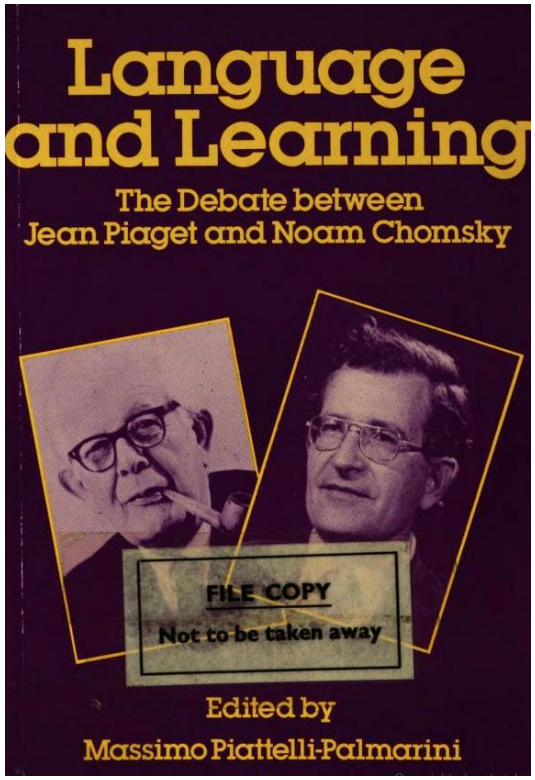
If you like some of the ideas in the interview with Gliedman, see readings, especially about the limits of human understnading, then you may also like the following recent lecture by Chomsky: *The Machine, the Ghost, and the Limits of Human Understanding*

- http://www.youtube.com/watch?v=D5in5EdjhD0

Piaget vs. Vygotsky, & Chomsky: Summed up

- Piaget goes to great lengths to describe the sensorimotor period to explain how the child born with only reflexes and mechanisms of knowledge construction, constructs symbolic mental representations.
  - Sensorimotor period is so critical to Piaget because his theory rejects innate symbolic knowledge and so needs such an explanation.
- Vygotsky says "why go to such lengths? Symbols are provided by the culture. The child does not need to construct them. This is why Piaget's explanation is inadequate"
- Chomsky says "Why reject the idea of innate knowledge of symbolic structure? 1. There is no need to 2. There is no way to explain human knowledge of language (e.g., a form of symbolic representation) without positing innate preformation of some kind. Construction from action will not get you there."

Conclusions



Piaget, Vygotsky and Chomsky:

Different concerns, different assumptions, divergent theories