

## Jean Piaget: A Cognitive Account of Development



"My central aim has always been the search for the mechanisms of biological adaptation and the analysis and epistemological interpretation of that higher form of adaptation which manifests itself as scientific thought" (Piaget, 1977a, p. xi).

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## Why Study Development?

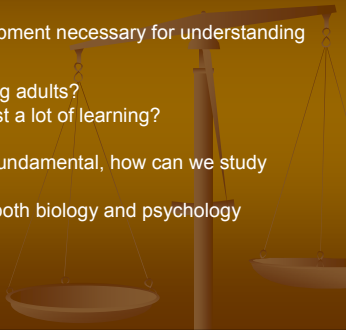
Is the study of development necessary for understanding the adult?

Are children just young adults?

Is development just a lot of learning?

If changes are more fundamental, how can we study them?

Challenge for both biology and psychology



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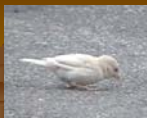
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## Piaget's Biological Interests

To convince university librarian at Neuchâtel to take him seriously, published at age 10 a short paper on his sighting of an albino sparrow



Developed interest in mollusks while still an adolescent

How those from lakes adapt to running water, and vice versa—alterations in shape to deal with the differences in environments

Published many papers, starting in high school



Ph.D. in zoology from the University of Neuchâtel on the classification of mollusks (at age 21)

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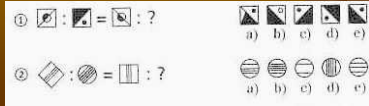
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# Piaget turns to the Mind

Toyed briefly with psychoanalysis (Carl Jung) at the University of Zurich

Moved to Paris and worked at the Ecole de la rue de la Grange-aux-Belles, where Alfred Binet and Théodore Simon had developed intelligence tests

Worked on standardizing Cyril Burt's reasoning tests for Parisian children



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# From Testing to Psychology

In the course of work on IQ tests, he noticed that children of the same age made similar errors on true-false intelligence tests. What could explain this?

Key insight: use mistakes/errors to understand how the normal system operates

In 1921 appointed director of the Institut J.J. Rousseau in Geneva

Began experimental studies on developing minds  
In what ways do they think differently than adults?  
How do their ways of thinking change as they develop?

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# Observational and Interview Studies of Development



Observed and recorded young children in their play

Questioned them to elicit how they understood the world

Piaget: What makes the wind?  
Julia: The trees.  
Piaget: How do you know?  
Julia: I saw them waving their arms.  
Piaget: How does that make the wind?  
Julia (waving her hand in front of his face): Like this. Only they are bigger. And there are lots of trees.  
Piaget: What makes the wind on the ocean?  
Julia: It blows there from the land. No. It's the waves...

Are Julia's explanations intelligible?

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## Genetic Epistemology

*How does knowledge grow?*

Do we just add more information over time? No!  
Children are not just little adults who have not acquired as much knowledge  
They think in qualitatively *different* ways  
Their thinking is not *illogical*, but employs a *different logic*

Piaget: the growth of knowledge is a progressive construction of *embedded structures* of thinking.  
Earlier, less powerful structures of thinking are included in later, more powerful ones

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## Schemata

Thinking involves use of organized structures (schemata) for representing information

Ex. Sensory-motor action schema: a way of obtaining certain types of goals in a range of situations

Ex. Class composition schema: a whole formed of two groups is as large or larger than either group

Drew upon ideas from group theory in mathematics and formal logic

Schemata are structures for actively engaging the world  
If they prove inadequate, they must change

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## Nativism vs. Empiricism

Nativism: (Certain forms of) knowledge cannot be acquired through experience

We must be born with it

Although it may not be expressed until an appropriate maturational stage

Empiricism: knowledge is built up from experience using basic minimal inbuilt capacities

For example, the ability to be classically conditioned or to learn via the law of effect

Same limited alternatives seem to affect biological development: preformationism vs epigenesis

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## Piaget: Neither Nativist nor Empiricist

Children are active builders of their knowledge  
Like little scientists, they constantly construct and test their own theories of the world

"Intelligence does not by any means appear at once derived from mental development, like a higher mechanism, and radically distinct from those which have preceded it. Intelligence presents, on the contrary, a remarkable continuity with the acquired or even inborn processes on which it depends and at the same time makes use of." (Piaget, 1963, p. 21)

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## Constructivism

"I am a constructivist. I think that knowledge is a matter of constant, new construction, by its interaction with reality, and that it is not pre-formed. There is a continuous creativity."

"The essential functions of the mind consist in understanding and in inventing, in other words, in building up structures by structuring reality." (Piaget, 1971, p.27)

"I think that all structures are constructed and that the fundamental feature is the course of this construction: Nothing is given at the start, except some limiting points on which all the rest is based. The structures are neither given in advance in the human mind nor in the external world, as we perceive or organize it." (Piaget, 1977b, p.63).

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## The Constructivist Fallacy

Learning is a matter of hypothesis testing and that requires the ability to formulate the hypothesis before testing it. But if the person can already formulate the hypothesis, then it is not constructed, but innate

"It is *never* possible to learn a richer logic on the basis of a weaker logic, if what you mean by learning is hypothesis formation and confirmation." (Fodor, 1980).

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## Avoiding the Constructivist Fallacy

To avoid the "fallacy":

- Must account for the hypotheses (Piaget's schemata) which are to be tested without assuming they were preformed in the mind
- Not sufficient to propose that they depend upon processes of maturation, since that allows that the directions are all laid down in advance, which is all the sophisticated nativist requires
- Only possibility is to allow that the hypotheses (schemata) are themselves emergent products of environmental interaction

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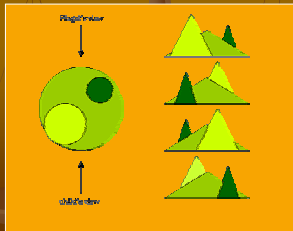
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## Egocentrism of Children

Young children cannot understand how the world looks to someone situated differently

Presented children with a papier-mâché model of three mountains, a big one and two smaller ones

Asked to pick out a picture of how the model will look to someone on the other side, child under six picks a picture of how it looks to him/her.



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## Assimilation and Accommodation

Intelligence is a form of adaptation—a matter of appropriate fit

Individuals use *schemata* to understand features of the world: these are the vehicle of adaptation

These are developed via

- **Assimilation:** incorporation of new material from the environment into a schema
- **Accommodation:** changing the schema to better fit the environment
  - This happens when experience fails to conform to existing schemata

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## Piaget's Four Stages

- Sensorimotor stage (birth - 2 years old)--The child, through physical interaction with his or her environment, develops a set of schema for interacting with objects.
  - Initially tied directly to what the child can interact with (out of sight, gone)
  - Objects not represented



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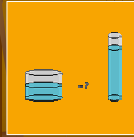
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## Piaget's Four Stages (Cont)

Operations: Mental actions—understand the world by representing it and operating on the representations

- Preoperational stage (ages 2-7)--The child recognizes that objects continue to exist when out of sight.
  - Develops capacities to represent the world in mental images and language and use these to evaluate possibilities.
  - But can only use these to represent the world from an egocentric point of view.
  - Is not yet able to conceptualize abstractly and needs concrete physical situations
  - Fails conservation tasks



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## Piaget's Four Stages (cont)

- Concrete operations (ages 7-11)—Begins to be able to take other points of view. As physical experience accumulates, the child starts to represent things allocentrically, creating structures that explain his or her physical experiences. Some abstract problem solving is also possible at this stage. For example, arithmetic equations can be solved with numbers, not just with objects.
- Formal operations (beginning at ages 11-15)--By this point, the child's cognitive structures are like those of an adult and include theorizing and abstract reasoning. Able, for example to compare his or her value system to another's.

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## Horizontal Décalage

Décalage: similar abilities appearing at different times

- Worrisome because it challenges the idea of common schema in operation

Piaget himself noted cases in which on some tasks children seemed to perform at a higher stage than on other tasks.

For example, show conservation on some tasks but not on others

More worrisome for Piaget—depending on the way the task is framed, children may succeed earlier

If the three-mountain task is done with a familiar scene, 3 year olds are 80% correct rather than 42% correct

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## Piaget's Methodology

Assumes there are processes at work in the child (or the adult) that accounts for the behavior

Given the behavior, especially the cracks in it, propose a set of procedures

Draw inferences from the assumption that those procedures are at work and use them to test the model

Problem: what if there are multiple procedures that could generate the same behavior?

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