Developmental Psychology

PIAGET (…and his critics)

1 Philosophical Background

Study of 'epistemology' dates to ancient Greek philosophers. Focus on question "how do we come to know the world?" or "where does knowledge come from?".
Cognitive Psychology is the modern study of the processes and structures underlying knowledge
(i.e. thinking and remembering).

1.1 Where does Knowledge come from?

Three main positions:
1) Empiricism
- "blank slate" - Aristotle
- mental processes are seen as qualitatively similar in the child and the adult human.
- child has had less experience of the world and therefore has less knowledge

e.g. Behaviourism.

2) Rationalism
- "innate ideas" - Plato
- we are born with knowledge structures which subsequently 'unfold' or are discovered through the process of thinking.
- more recently, emphasis on maturation and self-contained knowledge 'modules' which come 'on-line' at different stages in development.

3) Constructivism / Interactionism
- Kant's synthesis of empiricist and rationalist ideas.
- born with very basic mental structure which imposes some regularity on sensory information.

e.g. Piagetian theory.

Important to note that these distinctions persist in theories of cognitive development to this day.

2 Key Points of Piaget's Theory

Piaget strongly influenced by Kant's constructivist theory of knowledge. Formulated theory as alternative to and rejection of behaviourist (empiricist) theories of development, which account for development in terms of learning based on associations between stimuli and responses.

In contrast, Piaget claimed that knowledge cannot simply emerge from sensory experience; some initial structure is necessary to make sense of the world.

Combined the biological notion of adaptation with Kant's constructivism to produce a theory of the development of adaptive knowledge which he called "genetic epistemology" (the study of the growth of knowledge).

According to Piaget, children are born with a very basic mental structure (genetically inherited and evolved) on which all subsequent learning and knowledge is based.
Rather than seeing development as a **quantitative** increase (e.g. behaviourists see development as an increase in associations formed on the basis of an unchanging set of processes), Piaget saw cognitive development as involving **qualitative** change: the very foundations of thought change and become more sophisticated as the child's intellect develops.

2.1 Logic and Rationality

- assumed that human intelligence is reducible to the laws of formal logic. Logic and the methods of physics are the rational basis for any objective, true knowledge of the world.
- Rational thought is seen as the 'goal' of cognitive development.
- child acquires knowledge of the world by 'replicating the discoveries of physics' (and of psychology).
- at any point in development, the level of the child's thinking can be assessed in relation to the laws of formal logic.

2.2 Action

- physical activity seen as crucial in initial stages of cognitive development.
  - all early knowledge about the world comes from actions upon objects in the child's environment.
  - the function of reflexes is to bring the child into active contact with objects and surfaces.
- ultimately, Piaget sees all thinking as a kind of action; at the more advanced stages, action is thought about rather than necessarily carried out.

2.3 Schemas

- a specific set of actions (physical or mental) applied to a particular situation.
- schemas can be applied to other situations (as when we assimilate new information to a particular scheme) in a process of generalization.
- schemas can be combined to form more sophisticated sequences of actions.

2.4 Stages

- thinking (intelligence) develops through an invariant sequence of stages.
- at each stage, a new kind of thinking (i.e. a new level of logic) replaces a more immature one.
- each stage can be characterised by the type of logic to which the child's thinking conforms.
- idea of an invariant sequence of development is central to this model, the actual ages when children achieve different levels of understanding is not.

2.5 Domain Independence

- Piaget's theory was intended to cover all areas (domains) of mental life (perception, language, morality, number etc.).
- used the word 'intelligence' to describe this generalized quality of thought.
- contrasts with recent nativist views (e.g. Chomsky) and with Karmiloff-Smith's theory.

3 What is the 'Starting State'?

Piaget specified the minimal initial cognitive structure that the child possesses at birth as being:
- a set of perceptual capacities
- a set of reflexes
- three generalized adaptive processes:

1) Assimilation
- bringing new information into an existing body of knowledge by "filtering or modifying" the input.
  (e.g. incorporating the concept 'dog' into the higher level concept of 'animals').

2) Accommodation
- altering the knowledge structure to allow assimilation of new information which is inconsistent with current knowledge. (e.g. extending an existing concept to allow for a new, inconsistent example).

3) Equilibration:
- Piaget believed that all human thought seeks order and is uncomfortable with contradictions and inconsistencies in knowledge structures. In other words, we seek 'equilibrium' in our cognitive structures.
- there is a conflict between our drive to acquire knowledge about the world (via *assimilation*) and a resistance to altering our structures of knowledge (via *accommodation*).
- equilibration is the process through which this conflict is settled.

Note that behaviourist theories also acknowledge the role of perception and reflexes in development. The key difference at this initial stage is in the three adaptive processes

4 Piaget's 'Clinical' Method

Developed method of investigating cognitive development known as the 'clinical method'.
Children presented individually with a range of tasks using a variety of materials designed to probe the level of logic underlying their thought (examples below).
Piaget just as interested in reasons (older) children gave for their answers as in the answer itself because:
- did not count an answer as correct unless child showed evidence of correct reasoning (i.e. excluded answers where child said "I just guessed")
- was equally interested in reasons given for wrong answers

5 The Stages of Development

According to Piaget, there are four identifiable stages in the development of cognition:

5.1 Sensorimotor Stage

Birth to approx 2 years.
Period of rapid cognitive growth.
On basis of set of reflex movements, a set of perceptual systems and three adaptive processes, infant quickly begins to build up direct knowledge of world around, by relating actions to results of those actions
Through assimilation and accommodation, actions become progressively adapted to the world (e.g. grasping schema).

Circular Reactions:
Before 1 month, behaviour just reflex actions.

From 1 to 4 months
- **primary circular reactions**
- begins to notice when a reflex action brings about an interesting (stimulating) result and attempts to repeat it (e.g. repeatedly opening and closing hand, sucking thumb)
- intentional actions largely centred on own body and not yet oriented to the environment.
- begins to adapt her actions towards fulfillment of needs (e.g. opening mouth differently for teat and spoon).

NB: a circular reaction that can be repeated is a very simple kind of *internalised action* and is therefore the earliest form of *schema*.

Between 4 and 8 months
- **secondary circular reactions**
- also involve repetition of actions that have been encountered through trial and error, but tend to be oriented towards actions in the environment (e.g banging, reaching for and grasping objects).

From 8 to 12 months
- can coordinate two or more circular reactions together into a more adaptive action pattern
- allows them to use existing action schemas together to solve novel problems (e.g. retrieve a hidden object by first pushing away a cover and then grasping the object).
- child is combining simple schemas into more complex, articulated and more adaptive schemas.

Between 12 and 18 months
- **tertiary circular reactions**
- acquire new behaviours through active experimentation and exploration in the world
- still use trial and error, but in more systematic way

18 months
- start of **mental representation**
- child can solve problems by manipulating internalised representations of objects (i.e. instead of trial and error, child can think through a problem)

Egocentrism:
Infancy characterised by extreme egocentrism:
- no understanding of world other than own, current point of view
- main development during this stage is understanding that objects exist and events occur in the world independently of one's own actions ('object concept', or 'object permanence')

Object Permanence:
Typical test for understanding object permanence is a 'Search Task': an object is hidden and the child then tries to find it.
'A-B' search task reveals progressive acquisition of object concept during sensorimotor stage.
- two possible hiding places presented to child (e.g. two handkerchiefs on a tabletop).
- object hidden under first hiding place (A) then moved to second hiding place (B) (secretly or in view of child).
- developmental sequence of acquisition of object concept revealed by child's responses to task:

Substage III: 4 - 8 months
Child will not search for a hidden object at all, even when she sees it places under A. Eventually attempts to recover a partially concealed object.

Substage IV: 8 - 12 months
When object is hidden under A, will attempt to retrieve it. However if after a few of these trials object is first hidden under A and then moved to B (in the child's view), will persist in looking under A. ('A-not B' error or the 'Stage IV' error).
For Piaget, error is clear evidence of egocentric understanding of the situation: child learns a response based on actions of first uncovering and then grasping the object, but cannot generalize action sequence to new situation, even though the situations seem very similar to us.

Substage V: 12 - 18 months
Child has now mastered the basic A-B task, and reliably searches in correct location even after a sequence of visible displacements of hidden object. Significant because can now represent existence and position of an invisible object. Earliest instance of fully internalised thought; detached from visible and tangible world.
But, only the case for objects they have seen being hidden. In a variant of the A-B task, Piaget first placed the object in a container, then moved object and container under a hiding place. Object dropped out of container under hiding place and container removed. Children search in container but do not go on to look under hiding place. Can represent position of a hidden object, but cannot track sequence of movements that would lead them back to true hiding place.

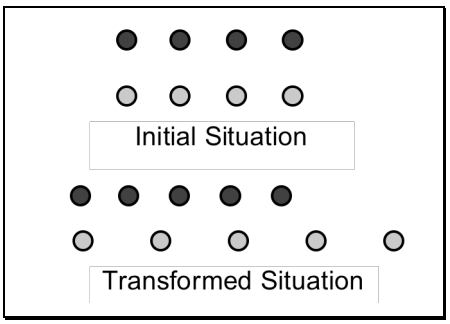
Substage VI: 18 - 24 months
Child experiments with objects rather than just reproduce familiar routines on particular objects. In the modified A-B task, on finding that object is not in container, will experiment with other possible locations and eventually find object.

5.2 Preoperational

By 2 years, children have made some progress towards detaching their thought from physical world. However have not yet developed logical (or 'operational') thought characteristic of later stages. Thinking is still intuitive (based on subjective judgements about situations) and egocentric (centred on the child's own view of the world).

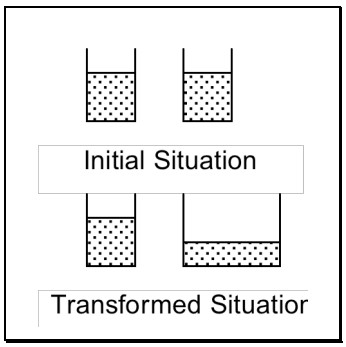
Conservation:
Intuitive and alogical aspects of pre-operational thought revealed most clearly in tasks on 'conservation'. In physics, notion of conservation is that as one aspect of a situation changes, another stays the same (e.g. conservation of matter). Conservation tasks present children with very simple physics experiments to see if they understand this important logical principle. Some examples of conservation experiments are:

Number: Two identical rows of identical counters presented to child. Child asked whether both rows have same number. Preoperational child can answer this correctly. Experimenter spreads one row of counters out or pushes them together. Child asked initial question again.



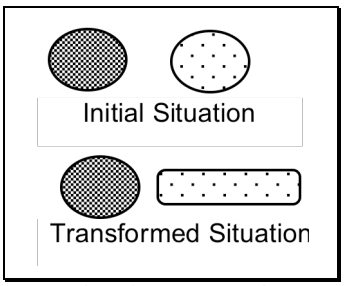
Young preoperational children say that the number of counters in the two rows is now different (e.g. "there are more because that line is longer").

Liquid: Child shown two identical beakers with the same amount of liquid in each. The liquid from one beaker is poured into a wider (or narrower) beaker.



Child now says that there is less (or more) liquid in the second beaker (e.g. "it looks lower").

Mass: Child is shown two identical balls of clay. One of the balls is rolled into a sausage shape.

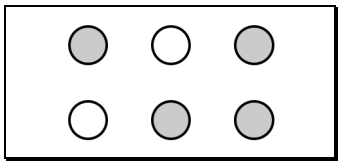


The child now says that the sausage has more clay than the ball ("that one's bigger now").

So, what do these tasks tell us about the limitations of preoperational thought in general?
Piaget drew a number of related conclusions:

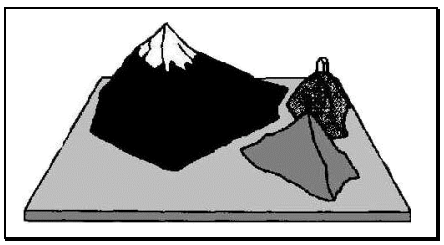
1) Understanding of these situations is 'perception bound'. Child is drawn by changes in the appearance of the materials to conclude that a change has occurred.
2) Thinking is 'centred' on one aspect of the situation. Child notices change in level of water or in length of clay without noticing that other aspects of the situation have changed simultaneously.
3) Thinking is focused on states rather than on transformations. Child fails to track what has happened to the materials and simply makes an intuitive judgement based on how they appear 'now'.
4) Thinking is 'irreversible' in that the child cannot appreciate that a reverse transformation would return the material to it's original state. Reversibility is a crucial aspect of the logical (operational) thought of later stages.

Class Inclusion:
Another indication of the lack of logical thought is the preoperational child's inability to think hierarchically; to think simultaneously about subordinate and super-ordinate categories. E.g. child shown a set of counters four of which are red and two of which are blue.



Child asked: "Are there more red counters or more counters?". Preoperational child answers that there are more red counters (e.g. ...because only tow are white").
Child centres on most salient perceptual characteristic of situation, & fails to consider hierarchical aspect of question (i.e. total number of counters versus relative number of different coloured counters).

Perspective:
Due to preoperational egocentrism, child can only appreciate one perspective on a situation: her own. Piaget devised 'Three Mountains' task to test children's understanding of perspective.



Child views a model of three mountains from one side, and is asked to determine what another person sitting on other side of model can see by choosing from four pictures of different sides of model. Preoperational child chooses picture showing own view of model.

5.3 Concrete Operational

A major turning point in the child's cognitive development, because marks beginning of logical/operational thought.
Operational thought is:
- relatively free from perceptual world
- relatively decentred
- conforms to physical laws such as reversibility and transitivity (if A > B and B > C then A > C).

But operational thought only effective here if child asked to reason about materials that are physically present. Will tend to make mistakes or be overwhelmed when asked to reason about abstract or hypothetical problems.

5.4 Formal Operational

In contrast, formal operational thought is entirely freed from physical and perceptual constraints. It becomes possible to reason abstractly and hypothetically about the world. This stage sees emergence of scientific thinking, formulating abstract theories and hypotheses when faced with a problem.

6 Methodological Criticisms

Since early 1970s, an increasing amount of evidence has suggested that P's methodology may have under-estimated many of the child's abilities.

6.1 General

clinical method criticised:
- carried out his studies with a handful of participants – in the early studies he generally used his own children
- no set procedure and no statistical analysis
- cross-sectional so can't draw strong conclusions about process of development from stage to stage

BUT: bear in mind that Piaget considered the method appropriate for his aims:
- method requires flexibility, to allow the researcher to explore the basis of each individual child's reasoning
- consistent with structuralist theory of the time and with the aims of genetic epistemology

(see Boden, 1996, for more on this).

6.2 Sensorimotor

A problem with Piaget's sensorimotor tasks is that require an active response from infant (e.g. removing cloth and grasping object). Child may be limited by other factors (e.g. immature motor skills) rather than lack of understanding of situation.

Recent research has used a habituation technique to probe child's understanding of object permanence.

Baillargeon et al. (1985)
- habituated child to screen that moved back and forth like a drawbridge through a 180° arc.
- a yellow box placed behind the screen.
- child then shown one of two test situations:
  1) *Possible Event*: the screen is rotated up from a flat position until it rests against the box where it stops before returning to the original position.
  2) *Impossible Event*: the screen rotated up from flat position and appeared to move through the box before returning to original position.

→ infants as young as 3.5 months looked longer at the impossible event.

Suggests infants were surprised at this event and expected screen to come to rest against box even though it was out of sight.

6.3 Preoperational

It has been suggested that Piaget's tasks at this stage may have underestimated the child's abilities due to a number of factors including:
- complicated language.
- unfamiliar materials.
- lack of context.
- children misinterpreting experimenter's intention.

More recent studies have attempted to ask questions more clearly and to present situations to which children can relate more easily.

Light, Buckingham & Robbins (1979)
- children shown two identical beakers with same amount of food in each.
- experimenter then points out that one of the beakers is chipped, and suggests putting the contents in a third, different shaped container for the sake of safety.

→ more children correctly say that there is still the same amount of food.

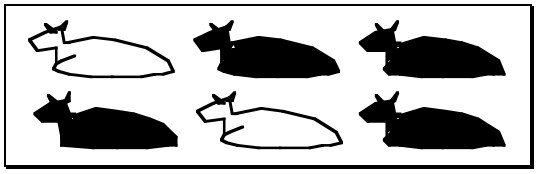
Suggests that context of task may be important for children's understanding of the situation. As far as children are concerned, adults rarely do something without a reason (e.g. they wouldn't pour liquid from one place to another unless they wanted to change something; they wouldn't ask a question unless something had in fact changed).
By providing a clear reason for making the change (e.g. the chipped beaker) this allows some children to concentrate more on the materials.

McGarrigle (see Donaldson 1978)
- presented children with Piagetian conservation tasks.
- instead of experimenter, a character called 'Naughty Teddy' performs transformation (means that the act of transforming the situation is divorced from the experimenter's second question).

→ 70% of 4 - 6 year olds passed this version of the task.

Suggests that differences in 'meaning' children ascribe to situation might cause them to pass or fail task.

McGarrigle (see Donaldson 1978)
- suggested that class inclusion task is hard, because question doesn't make super-ordinate category salient.
- presented children with a modified version of the task making super-ordinate category more salient.

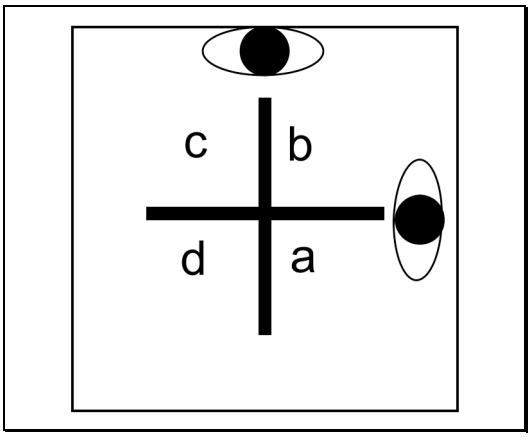


- one group of children asked typical question: "Are there more black cows or more cows?".
- another group of children told that ALL the cows were sleeping, and then asked: "Are there more black cows or more sleeping cows?"
  (note that this is still a class inclusion question).

→ only 25% of the first group answered correctly.
→ 50% of the second group answered correctly.

Although performance not perfect with modified task, results show that at least a proportion failed the original task because of the way it was presented.

Hughes (see Donaldson 1978)
- devised a version of the Piagetian perspective taking task which would make 'human sense' to a child.
- children shown a board with two barriers.
- toy policemen placed at the end of each barrier.
- child asked to place a model boy in the layout where the policeman can't see him.



Many preoperational children succeeded in placing model boy in section 'd' suggesting that they could understand the perspective of the two policemen.

Das Gupta & Bryant (1989)
- showed children sequences of pictures depicting simple, familiar events in which an object was transformed in some way.
- two types of event were shown:
  1) an object goes from it's basic state to a changed state (e.g. a cup became a wet cup).
  2) an object goes from a changed state to it's basic state (e.g. a wet cup becomes a dry cup).
- children asked to choose one item out of three that caused the object to change (e.g. water, cloth, feather)

-> 3 year olds generally picked the same item (water) for both transformations.
-> 4 year olds generally choose different and appropriate items for each transformation.

Suggests that 4 year olds can understand a simple, familiar transformation and follow it mentally in both directions (reversibility).

6.4 Summary

Taken together, these methodological reassessments call into question the reliability of Piaget's findings. It may be that some of his tasks were easier and some harder, but for relatively trivial reasons (e.g. the child misunderstands the experimenter's intention).

All of the experiments with pre-operational children introduce tasks that have "human sense", in that they use language, materials, contexts and activities that are familiar to the child. We say that these tasks are **embedded** in contrast to Piaget's disembedded tasks.

A counter-criticism, however, would be that Piaget was specifically interested in 'disembedded' thought, on other words he was specifically testing the child's ability to decentre from familiar contexts and to generalize their knowledge to new and unfamiliar situations.

7 Theoretical Criticisms

7.1 The Role of Culture in Development

Emphasises that the child's cognitive development can only be properly understood in the context of their culture and interactions with others.
See Vygotsky lectures.

7.2 Structure versus Process

Piaget's theory emphasises the structure of the child's knowledge at each of the stages of cognitive development, and does not elaborate much on the processes underlying development. Information Processing theories of development try to specify the processes involved in cognitive development explicitly by applying models of memory.
See Information Procssing lecture.

7.3 Nativism - Modularity

Also formulated as a reaction against radical behaviourism, but goes further than Piaget to suggest that a large proportion of mental structure is innate.

Piaget saw early thought as undifferentiated and fused together; cognitive development is a process of differentiation, where thought becomes generalised and specialised. The modular view is that the brain is already differentiated and specialized at birth, consisting of modules that have evolved to perform distinct cognitive tasks. Not all the modules are (fully) functional at birth, some come into operation later as a result of maturation of in response to certain kinds of structured input.

Three main figures associated with modularity:

Fodor (1979)
Whereas Piaget's response to the behaviourists might be: "You can't get something from nothing", Fodor might say to Piaget: "You can't get a more powerful way of thinking out of a less powerful one".

Fodor's is a general and very radical critique of Piagetian theory. According to Piaget, each successive stage of development sees the child operating with a more powerful set of logical operations than the previous stage. Fodor has attempted to show that this would be impossible; a more powerful logical system can't simply emerge from a less powerful one, just through the process of learning and experience.

BUT: fails to account for developmental processes - if modules present at birth, how does cognition change?

Chomsky (1957) - Language Acquisition Device.
Focused on language development, but made waves for Piaget, because Piagetian theory is supposed to account for all areas of learning including language. Chomsky argued that a general constructivist theory could not account for language learning. Child is exposed to degenerate linguistic data, therefore must be applying linguistic structure from 'inside'.

Proposed a 'Language Acquisition Device' (LAD) which is a mental module specifically dedicated to detecting and analysing linguistic information from the child's environment.

Gardner (1983) - Multiple Inteligences
Collected together data on performance on many different types of task. Suggested that the brain is divided into several specialised systems which deal with different kinds of information. Proposed seven distinct 'intelligences' that we posses:

- Linguistic
- Logical-Mathematical
- Spatial
- Musical
- Bodily-Kinaesthetic
- Interpersonal
- Intrapersonal

Gardner proposes a set of eight criteria which are used to determine if a particular ability constitutes a distinct intelligence:
- Potential isolation by brain damage
- The existence of idiots savants, prodigies etc.
- Identifiable set of specific operations
- Distinctive developmental history
- Distinctive evolutionary history
- Support from experimental psychology
- Support from psychometric findings
- Encoding as a distinct symbol system

7.4 Modularization

Karmiloff-Smith (1992) started off within a Piagetian framework, but recognized the problems raised by evidence from psychopathology that very specific abilities can be affected, while the rest of cognition remains unaffected (e.g. savant syndrome, Williams Syndrome).

However, not convinced by strict Fodorian position, because doesn't account for developmental change and implies a rigid structure which is not consistent with cognitive flexibility.

Proposed a synthesis between constructivist and nativist positions. Cognition begins general, but specific abilities become differentiated, modularised and localised in the brain.

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