Theory of Cognitive Development Stages 3 and 4

Jean Piaget

Picture Credit: http://cliparts.co/
Operations begin

An operation is an internal transformation, manipulation or reorganisation of mental structures.

Preoperational children can create and store mental representations of external objects, but they cannot easily manipulate and transform them mentally. That ability becomes increasingly evident in the concrete operational stage.
Example: Solving this problem requires operational thinking: the internal transformation, manipulation or reorganisation of an external reality.

Shepard and Metzler (1971) investigated mental visualisation: our ability to mentally rotate objects. Try this yourself.

What do you have to do in order to determine whether the two images in A, B and C are identical?
The Concrete Operational Stage
7-11/12 years
During this stage, children begin to think logically about concrete objects, but cannot yet reason about abstract, non-present concepts.

For instance, the concrete operational child can conserve number.
A child in this stage can visualise rewinding a process by thinking: “If I put the coins back together, there would be a one-to-one correspondence, just as there was at the start.”

This is the opposite to irreversible thinking. This is **reversible** thinking.
A child in this stage can consider **both** the length of the line of coins **and** the space between each coin. This means that his or her thinking is not impaired by **centration**.

This child can **decenter**.
Concrete operational children do not assume that what would comfort them - for instance, a teddy bear - would console a sad adult.
This is just one example illustrating the view that children in this stage are no longer (as) egocentric.
Concrete operational children are...

- aware that others do not share their thoughts and that their minds are theirs alone.
- more capable of understanding the reactions, needs and feelings of others.
In the Concrete Operational Stage, there's no such thing as Santa Claus.
It is during this stage that children display the ability to think logically about the real world. They realise, for instance, that Santa, the Easter Bunny and the Tooth Fairy can’t possibly be real.

Picture Credit: www.sweetclipart.com
• Children’s thinking in this stage begins to include the concepts of time, space, and number, correctly and appropriately used.

Too many people, too little time, too much space.
• Children can also classify elements into multiple categories on several levels.
Despite the improvements of this stage, children’s thinking is still limited.

• They often solve problems through random trial and error, not systematically and logically.

• They tend to think on a concrete level, not an abstract level.

• Deductive reasoning and therefore fully logical thought are difficult for them.

• Imagining what might happen in an unreal situation, a task requiring hypothetical thought, tends to be beyond their cognitive capacities.
The Formal Operational Stage

11/12-16 years

During this stage, children enter the world of abstract thought, becoming more able to hypothesise, deduce and solve problems systematically.
Hypothetical Thought

• This is the ability to imagine an abstract possibility or a complex chain of events in an unreal, speculative situation.

• For example, if you had the design brief for adding an extra eye to the human body, where would you place it and why?
Hypothetical Thought

- Concrete operational children tend to suggest an obvious solution, like putting it in the middle of the forehead.

- Older children who display more creative hypothetical thought suggest more daring and interesting solutions, such as placing it on the hand, where it could be used to see around corners...
Hypothetical Thought

• Test your own skills in hypothetical thought.
• How many future chains of possible cause and effect can you identify?
• How profoundly can you mentally simulate the results of this fundamental change in our society?
What might happen if no more babies were to be born?
No more babies?

Concrete operational children tend to focus on the obvious, immediately perceivable consequences:

- There might be fewer prams to be seen.
- The playgrounds would be empty.
No more babies?

Formal operational teenagers and adults can imagine far more complex chains of cause and effect, such as...

- New cloning technologies
- Test-tube child manufacture
- Widespread depression
- Ovum and sperm factories
- Scientific focus on designing “robot children”
- A hedonistic world-view
- An ageing population and related problems
- Economic decline due to collapse of several industries
Concrete operational children tend to use **random trial and error** in their attempts to solve problems, while formal operational children and teenagers work more **systematically**, **isolating variables** one by one in order to determine their effects.
The Pendulum Problem

What makes a pendulum oscillate faster?

Four possible factors
• string length (long or short)
• weight (heavy or light)
• point of release (high or low)
• force of release (drop the weight, or push it)
The Pendulum Problem

• Piaget found that younger children tackled this problem in a **haphazard** fashion, often manipulating two variables at once and therefore reaching invalid conclusions.

• Formal operational thinkers isolate and test each variable *one by one* and reach valid conclusions. They are **systematic** and **logical**, working out hypotheses and systematically testing them.
20 Questions
Identify the item in the classroom that I am thinking of. Ask questions that display a systematic, formal operational approach to the task
A Concrete Operational Approach

questions or guesses such as:

- Such questions don’t eliminate many possibilities and require luck to be successful.

A Formal Operational Approach

Systematic questions that eliminate many possibilities, such as:

- of the room?
- Is it smaller than a loaf of bread?
Abstract Thought

• In this stage, teenagers are able to consider complex philosophical problems requiring them to discuss justice and ethics.

• They can also tackle mathematical and scientific problems requiring complex formulas and mental manipulations without recourse to concrete examples or objects.
Brief Evaluation

Studies suggest that in fact the high level of abstract thought, deductive reasoning and systematic problem-solving described as formal operational thinking is not evident in all teenagers or in all adults.

People are more likely display this kind of thinking if they are well educated, live in industrialised countries and/or work in a field where this kind of reasoning is commonly required.
Words and Stages - Can you classify them?

goal-directed behaviour    systematic logic
egocentrism    hypothetical thought
beginning of operations    reversibility
decentration    irreversibility
conservation    concentration
abstract thought    pretend play
object permanence