



Jean
Piaget

Theory of Cognitive Development

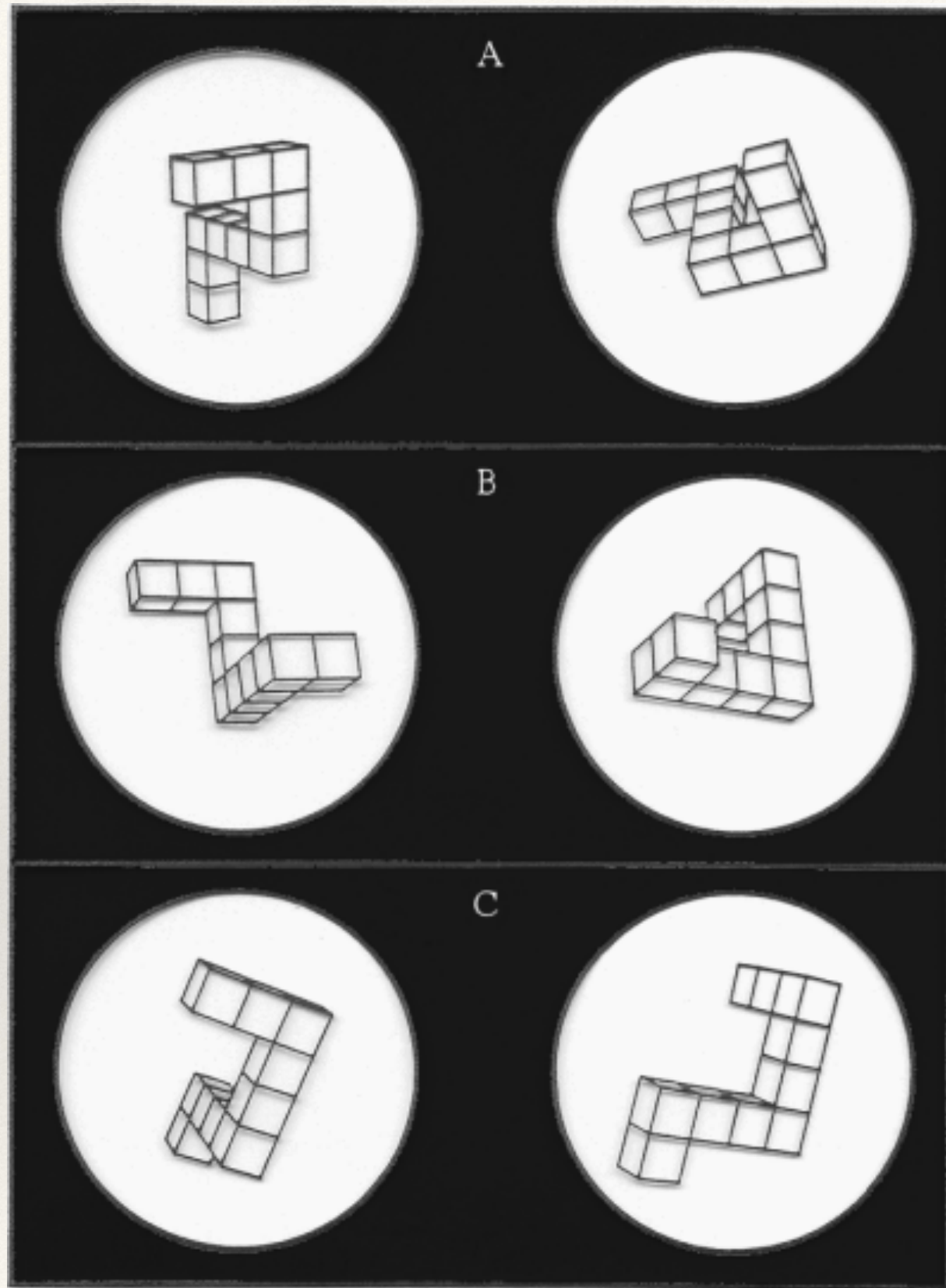
Stages 3 and 4

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.

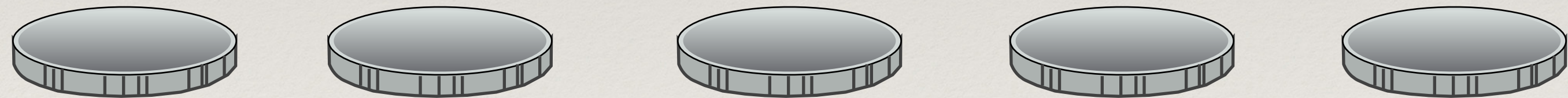
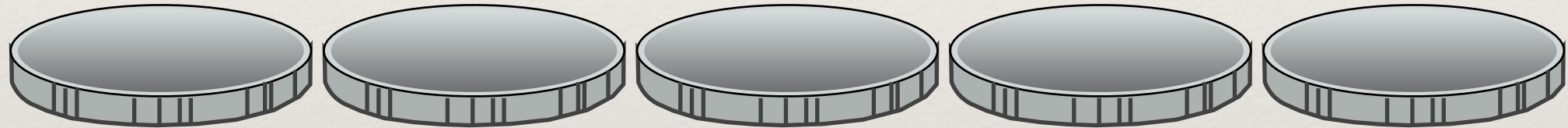
Shepard and Metzler (1971) investigated mental visualisation: our ability to mentally rotate objects. Try this yourself.

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

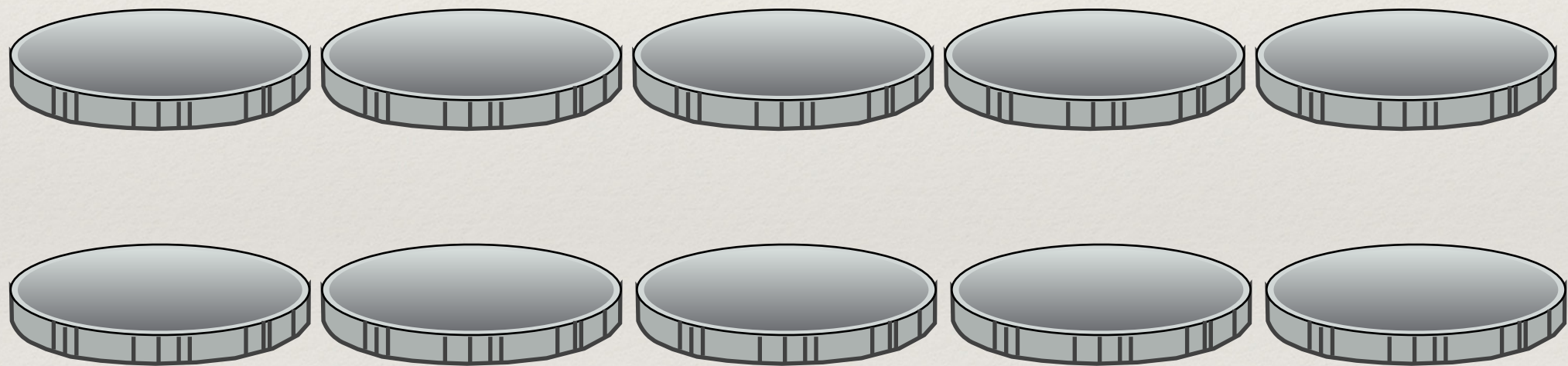
7-11/12 years

During this stage, children begin to think logically about concrete objects, but cannot yet reason about abstract, non-present concepts.



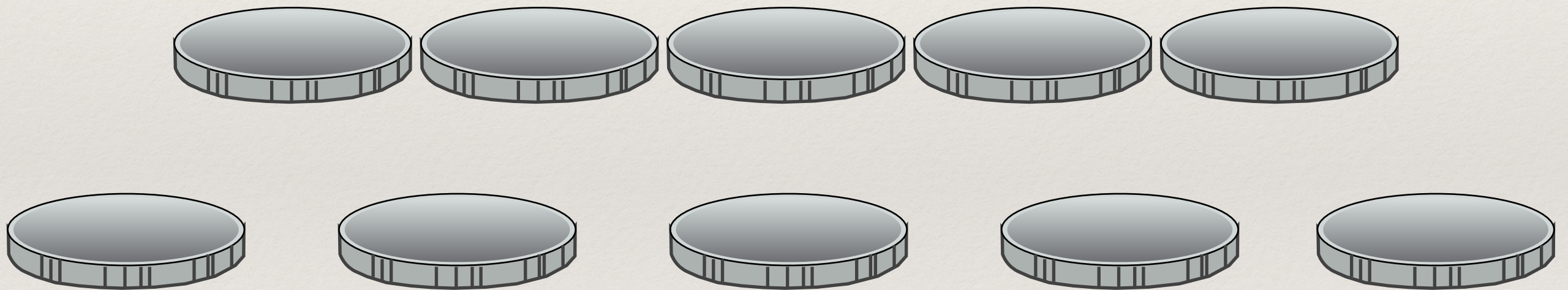
For instance, the concrete operational child
can conserve number.

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](http://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.

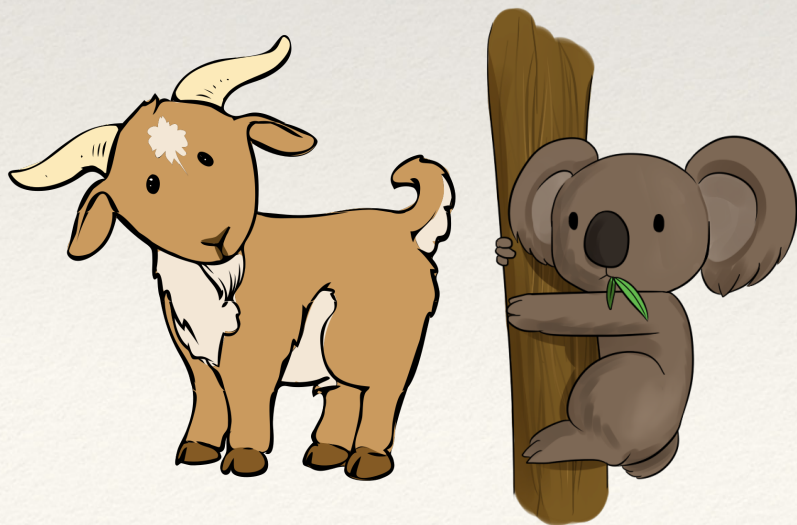
Living organisms

Animals

Mammals

Birds

Plants



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.



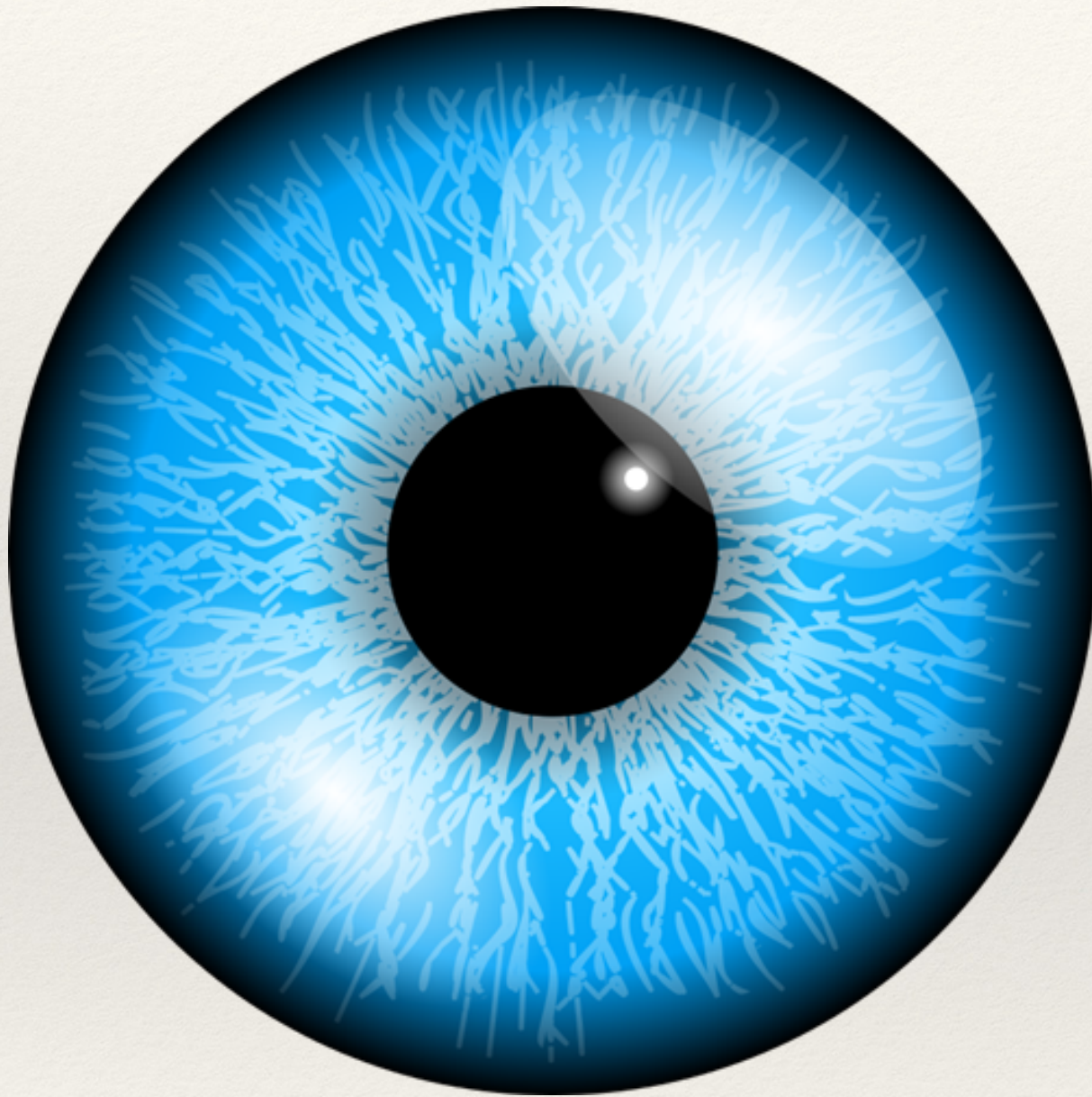
The Formal Operational Stage

11/12-16 years

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

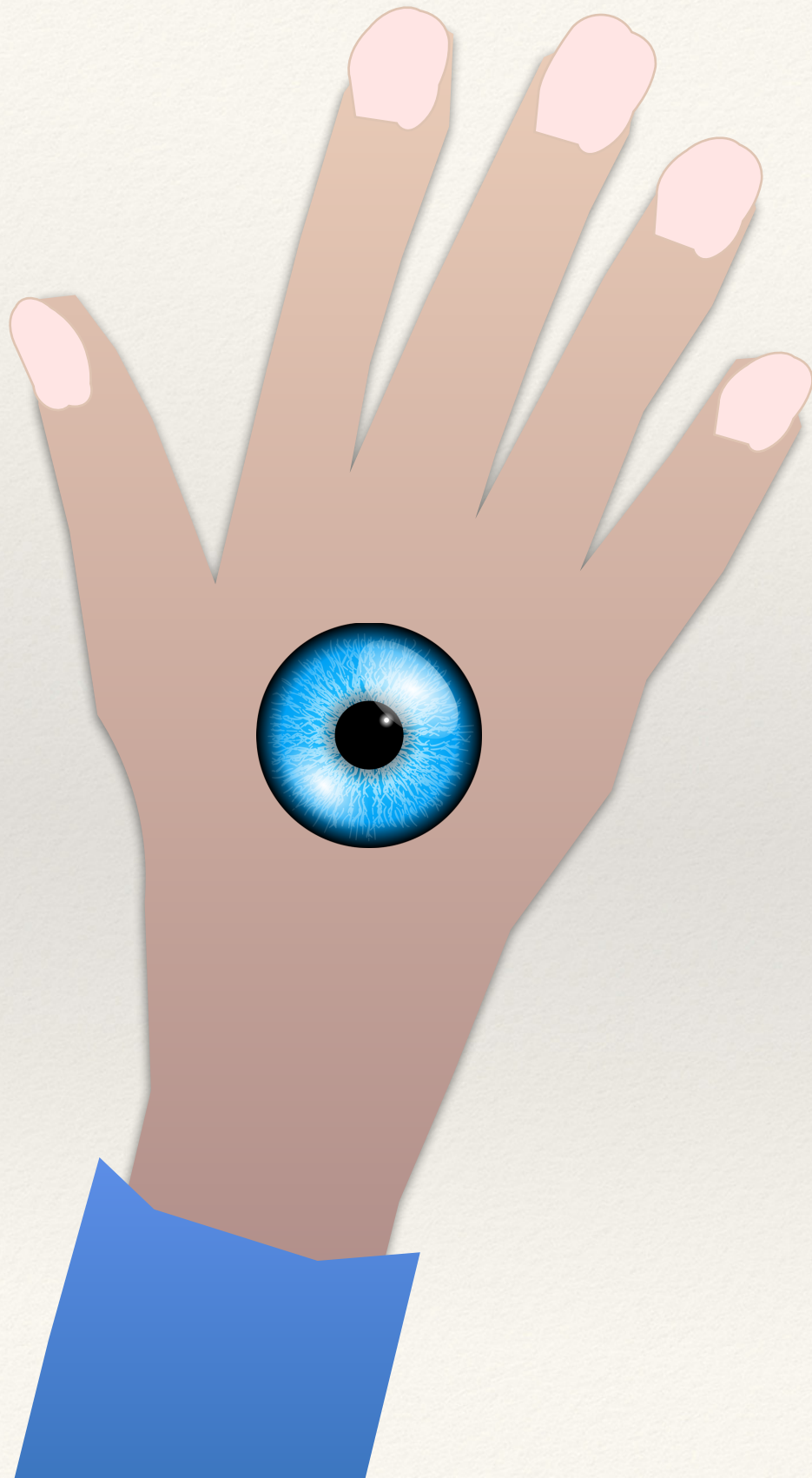


Hypothetical Thought



- 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?

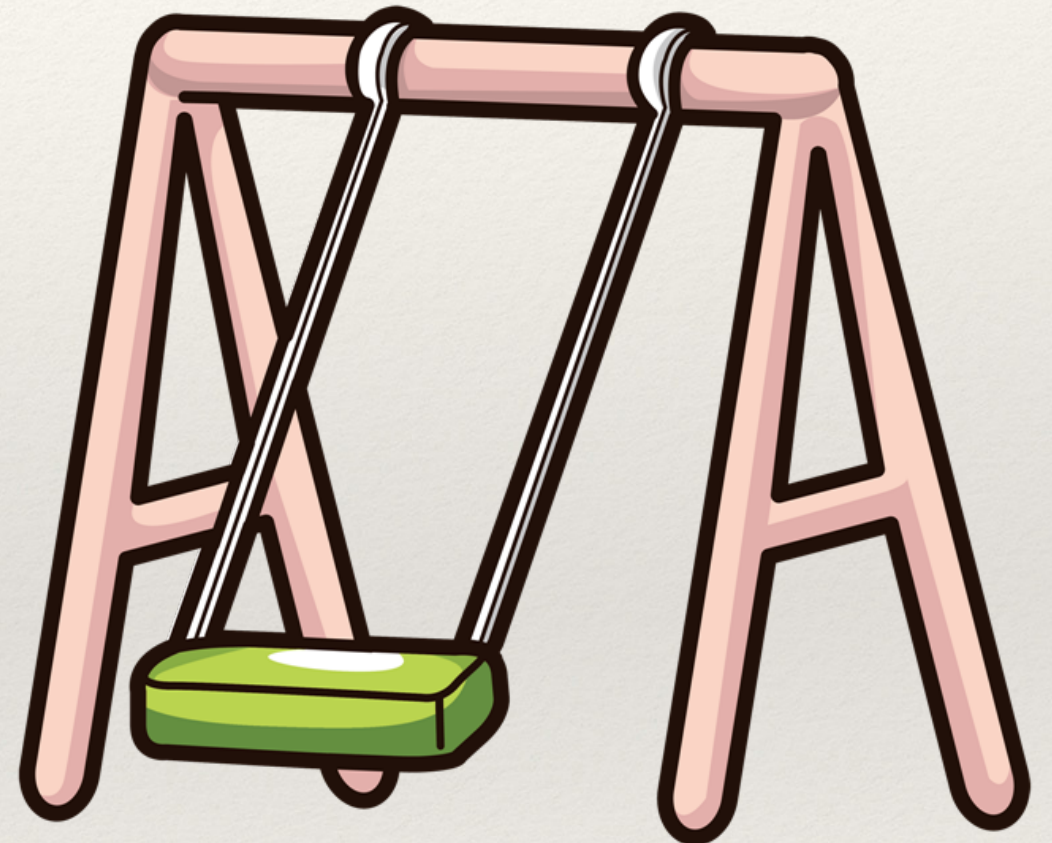
**What might happen if
no more babies were
to be born?**



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”

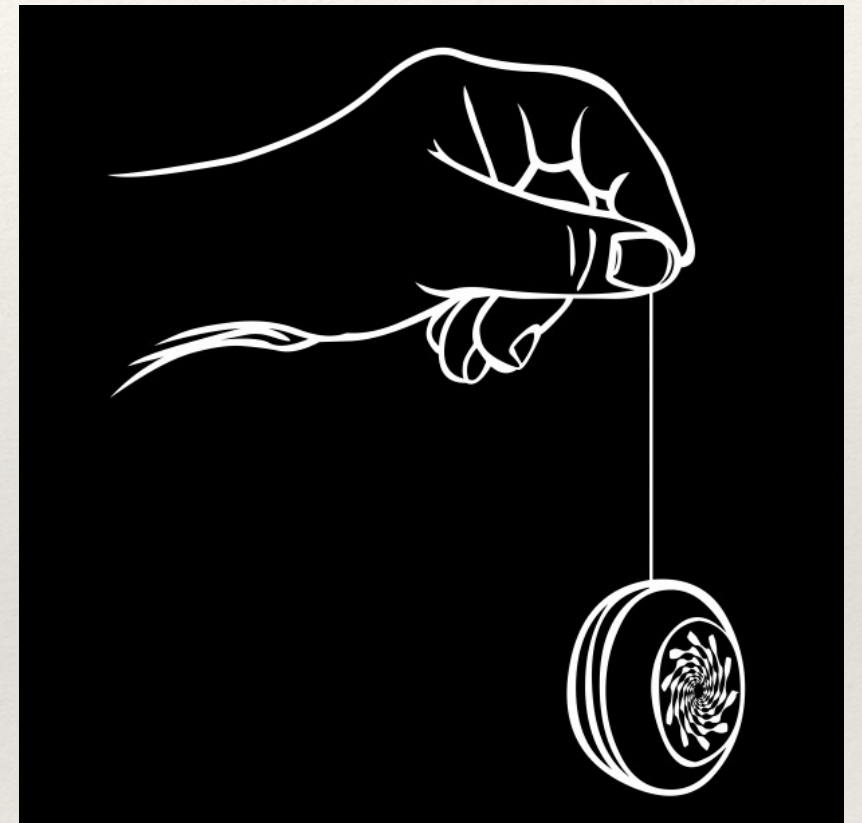
A hedonistic world-view

An ageing population and related problems

Economic decline due to collapse of several industries

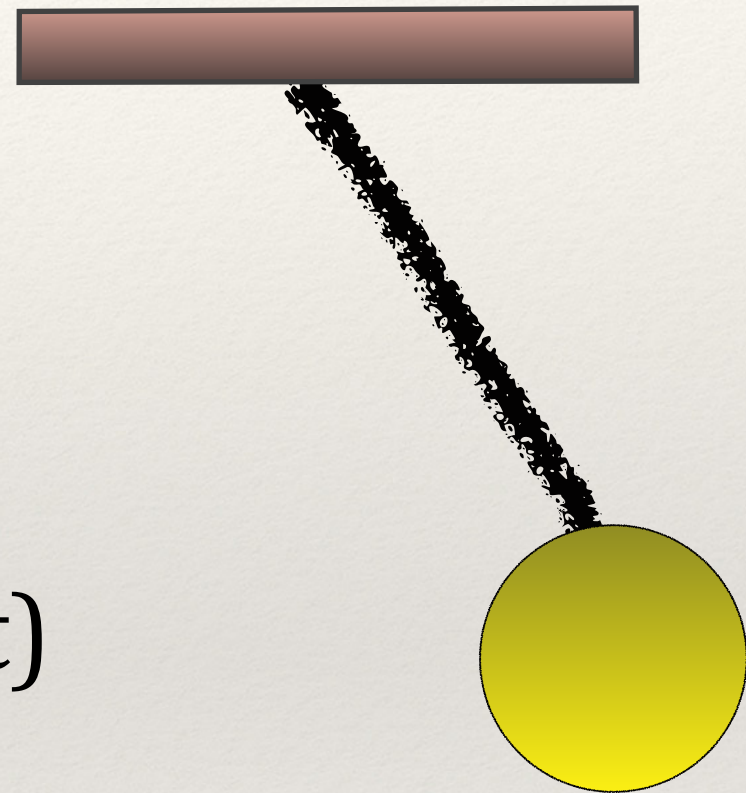
Systematic Application of Logic

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?

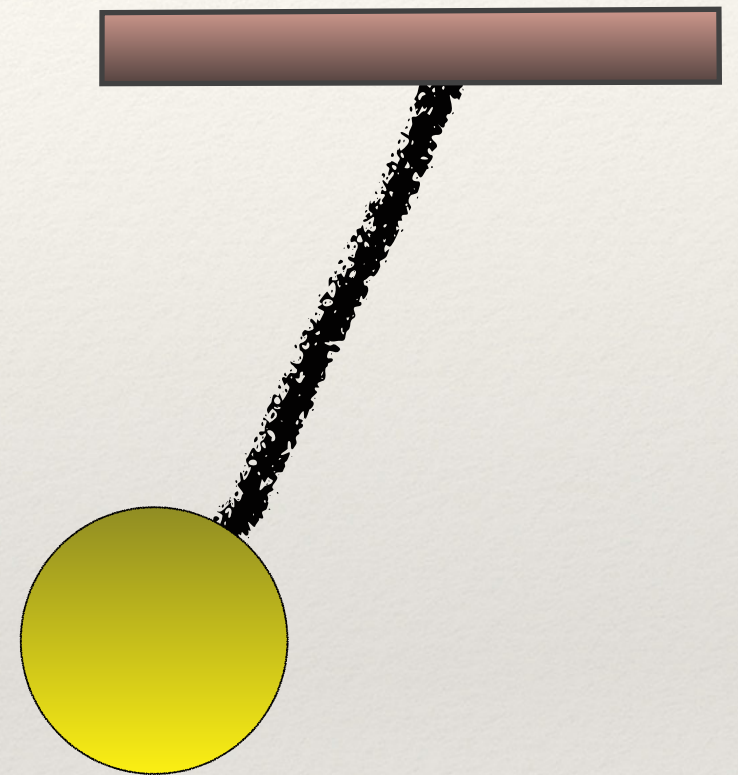


Four possible factors

- 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

I am thinking of a/an...



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

A person with long, wavy hair, seen from behind, is walking on a sandy beach. They are wearing a dark, long-sleeved shirt and shorts. The ocean is in the background with gentle waves breaking. The person's reflection is visible in the wet sand.

- 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

decentration reversibility

conservation irreversibility

abstract thought centration

object permanence pretend play

Solution

Sensorimotor

goal-directed behaviour
object permanence

Preoperational

egocentrism
pretend play
centration
irreversibility

Concrete Operations

reversibility
beginning of operations
decentration
conservation

Formal Operations

hypothetical thought
abstract thought
systematic logic