BOĞAZİÇİ UNIVERSITY
SUMMER TERM

PSY 101.01
Introduction to Psychology
Summer term 2025

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PSY 101.01
Introduction to Psychology

Let’s Begin

…with breathing

PSY 101.01
Introduction to Psychology

Topics in Cognitive Psychology

PSY 101.01
Introduction to Psychology

Cognitive Psychology

Cognitive Development: from Piaget to Present

Epistemology= science of knowledge

Origin of knowledge: "how our knowledge is formed, how is it increased?»

Logical analysis of knowledge

Foundation of scientific knowledge

=**Logic «** Set of formal rules allowing from true or false statements to lead to conclusions necessarily true »

⇒Cognitive tools and their development

Epistemic subject: what is common in the process of constructing knowledge

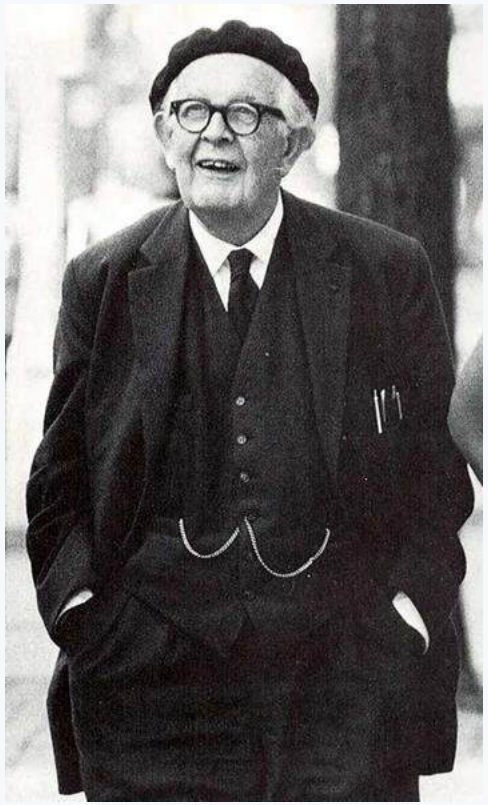
The Piagetian method of interview

To understand:

- functioning cognitive of the child through different problems (experiments)
- The thinking process
- What sort of mistakes does the child/ person make?

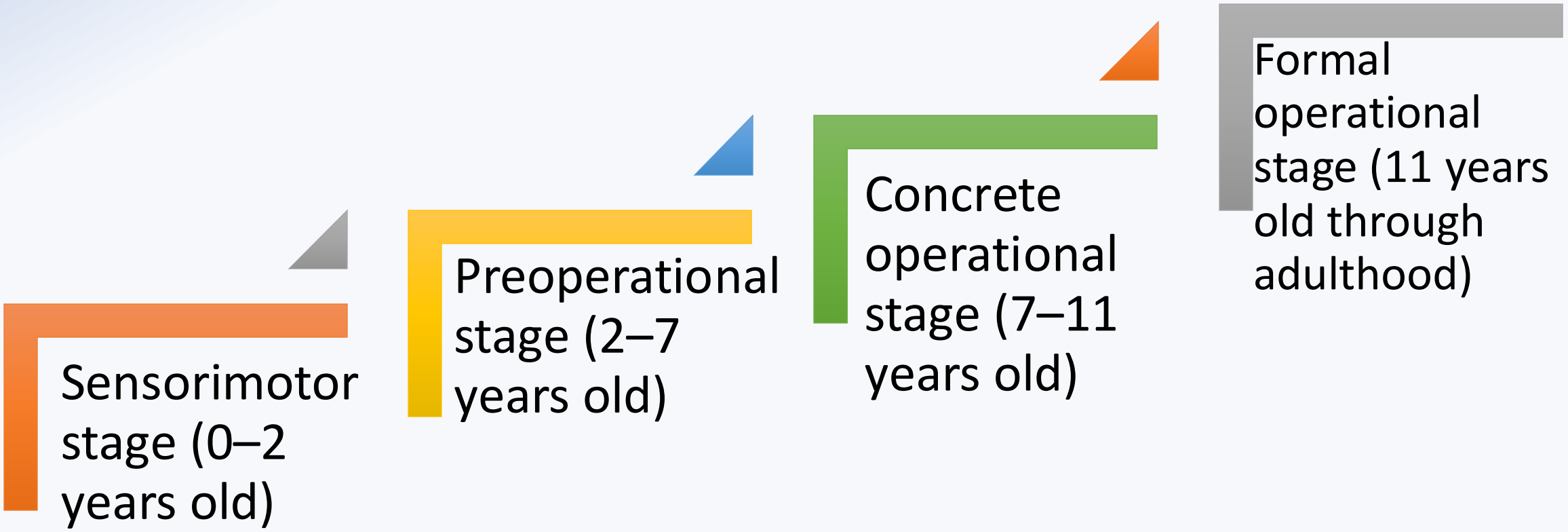
Confrontation at situations with cognitive conflict

- Tests of reasoning



- Stage =the qualitative transformations that can be seen in behaviors and thinking of humans.
    a. The order of succession of behaviors is constant and the stages of development cannot be reversed.
    b. Integrative character: acquired behaviors at one level given are integrated into the structures of the next level.
    c. Each stage is characterized by an overall structure that determines all possible operations.

Piaget: Stages of Cognitive Development



Piaget Stage 1: Sensorimotor stage (0-18/24 months)

- The infant interprets the world around on the basis of his/her senses and his/her actions (often with motor skills)

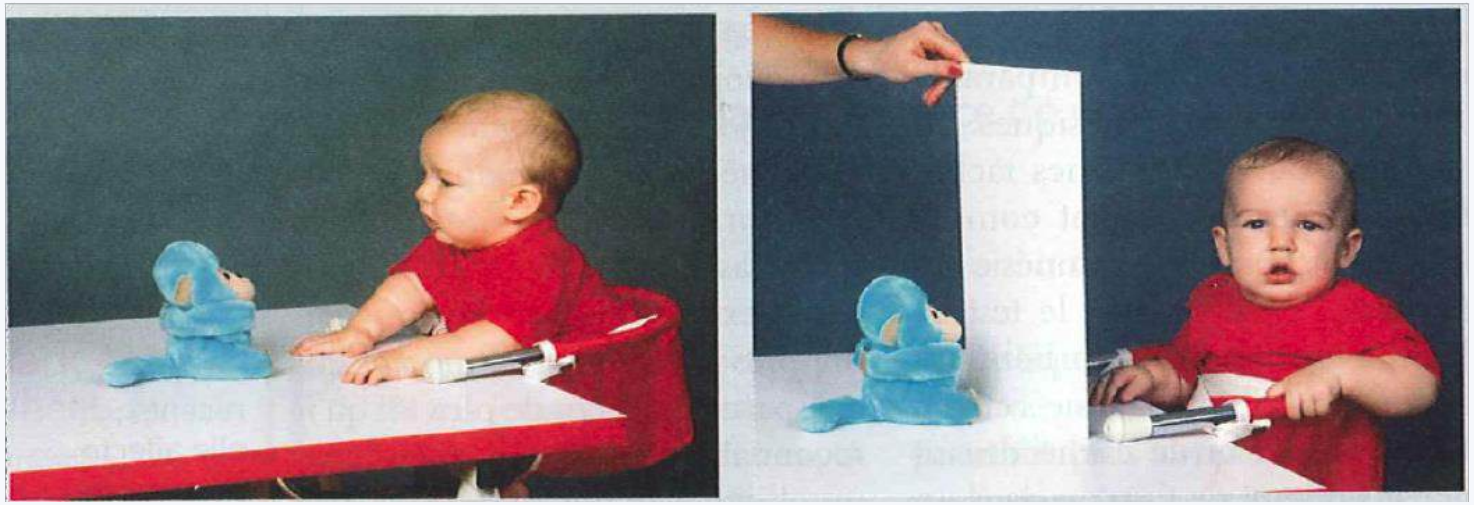
⇒ Development and coordination of sensory and motor skills in infants

⇒ **Intelligence linked to action:** circular reaction concept

- Object permanenance, causality develops,

Piaget and the object permanence

- Definition:
- The object continues to exist even outside the visual field.
- An object exists continuously in time and space: it cannot be at two different points without having existed temporally and spatially between these two points.



Piaget and the permanence of the object

- For Piaget, this ability appears around 9 months
  - Before this age:
    - each disappearance = an annihilation
    - Each reappearance = a resurrection
  - It marks the beginning of intelligence in the baby (ability to represent the absent object)
  - However… modern experiments show earlier!!

Object per -

Object per +

Modern Object Permenance

Piaget Stage 2- Preoperational stage (2–7 years old)

- Appearance of the **representation of objects**
- Egocentrism --> Thory of mind still developing
- Reversibility and conservation not acquired

⇒Logic of representation and perception

⇒Perceptual biases override logic

Piaget Stage 3- Concrete operational stage (7–11 years old)

- Evolution from a simple intuitive form to a logical form of thought
- Concrete operations: manipulable objects
- Mastery of **reversibility**
    - Criterion for passing from intuition to logical thought
    - Ability to mentally perform the same action in both directions while being aware that it is the same action (notion *of invariant / conservation* which allows the return to the previous state)

Piaget Stage 4- Formal operational stage (11 years old through adulthood)

- Abstract thinking
- Ability to represent objects and concepts
- Volumes understood
- Preteen to adulthood

The notion of conservation and Piaget's conservation tasks

Conservation Task	Original Presentation	Transformation
Number	Are there the same number of pennies in each row? 	Now are there the same number of pennies in each row, or does one row have more? 
Mass	Is there the same amount of clay in each ball? 	Now does each piece have the same amount of clay, or does one have more? 
Liquid	Is there the same amount of water in each glass? 	Now does each glass have the same amount of water, or does one have more? 
Weight	Does each of the two balls of clay weigh the same? 	Now (without placing them back on the scale to confirm what is correct for the child) do the two pieces of clay weigh the same, or does one weigh more? 

Conservation tasks

- 2 types of operations appear during the operative stage
  - Logico-mathematics
- For a transformation to be perceived as operational, it is necessary to understand the *invariants*

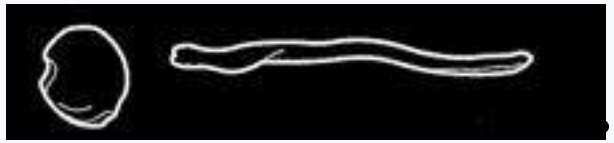
  ⇒Understand that the object retains its properties despite the perceptual transformations

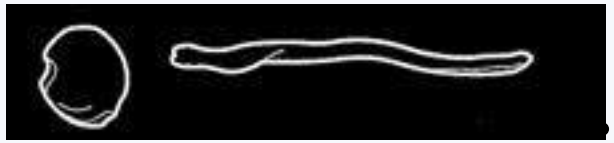
  ⇒*conservation*
- The construction of invariants is evaluated from the Piagetian tests of *conservation*

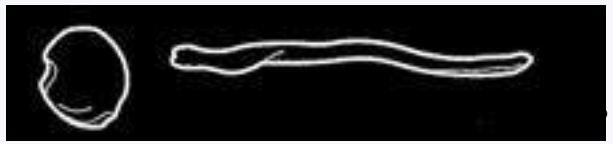
Examples of Conservation tasks

- Preoperational
- Operational

The stages of a conservation task

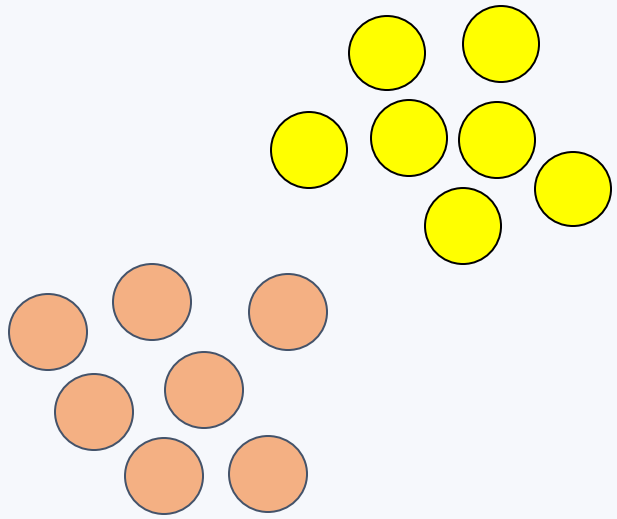






- 1. Initial equivalence
  - The experimenter asks to establish an equivalence as to the property of an object.
  - Make sure that the child accepts this equivalence!
- 2. Processing
  - Transform the initial state of one of the objects by verbalizing it.
- 3. Key question
  - "Is there that much, the same amount of modeling clay here and here?" Or is there more here or there? How do you know ? Explain to me "
- 4. Counter-suggestion
  - Check the solidity of the answer given: "yesterday a child of your age told me that it was the same in two pieces. What do you think ? »
- *5. Second Transformation (etc.)*

- The example of the number



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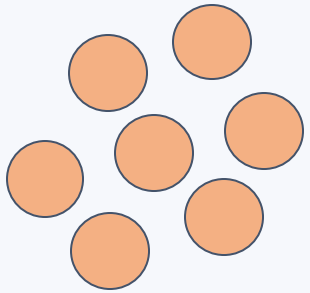
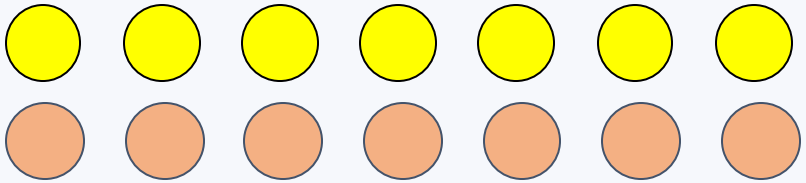


The example of the number

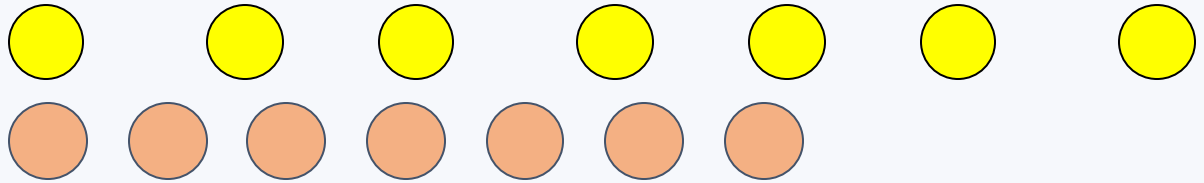
- Initial equivalence
  - Row of same length as model row



The example of the number

4-5 years

- Key question
  - "Is there the same number of green tokens as white tokens or are there more green or more white? How do you know ? »
  - The child is mistaken because of the different length of the model row: simple intuition
  - Importance of perceptual aspects: lack of conservation- Stage preoperative
    - "There's more because it's longer"

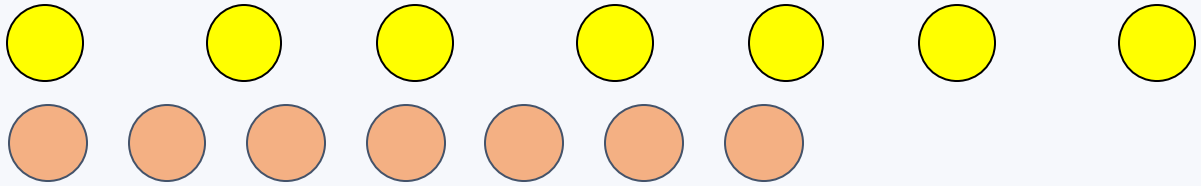


- Counter-suggestion

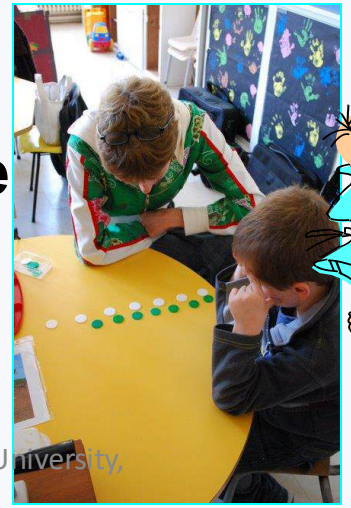
The example of the number

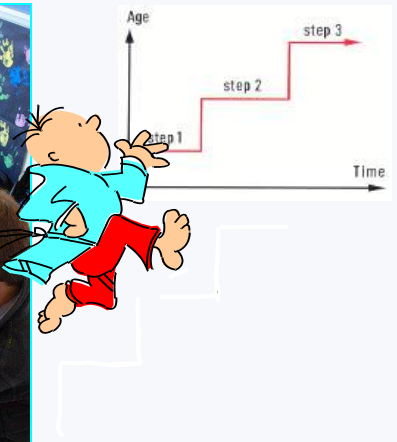
5-6years

- 3. Key question
- Term-to-term correspondence:Articulated intuition
  - R: The child begins to take into account several dimensions at the same time
  - But errs if the transformation is too muchimportant



- 4. Counter-suggestion
  - The child is in an **intermediate stage**
  - Low strength of response





The example of the number

6-7years

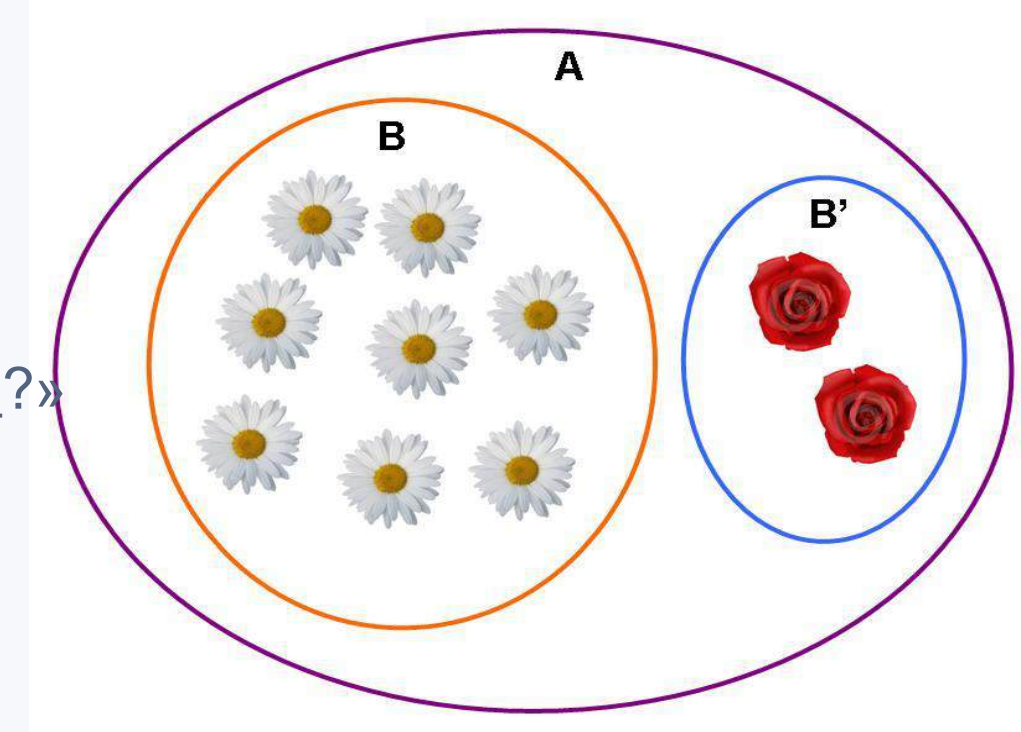
- 3. Key question
  - Operative level : concept of « conservation » acquired
    - The child relies on spontaneous justifications
    - Notion of reversibility
- 4. Counter-suggestion
    - The child resists: he is retaining
    - For Piaget, the number is only accessible from conservation,i.e.around 7 years old
    - Depends on the task

The 3 levels of conservation - In summary

- **Preoperative level – Simple intuition**
  - Non-conservation (perceptual responses)
- **Intermediate Level – Articulated Intuition**
  - Conservation responses if the change to the object is small
  - Sometimes conservation responses (operative reasoning), sometimes non-conservation
  - Low resistance to counter-suggestion
- **Operational level - Conservation**
  - Spontaneous justifications
  - Notion of reversibility
  - Resistance to counter-suggestion
- The levels during the other conservation tests (substance, weight, volume…) – but ages vary

Experiences quantification of inclusion

a. “Show me the roses”, “
b. Show me the daisies”,
c. “show me the flowers”.
d. “Are roses really flowers? »,
e. « Are daisies really flowers? »
f. "Are there more flowers or more daisies?»



Cognitive Development: from Piaget to Present

Cognitive Development: from Piaget to Present

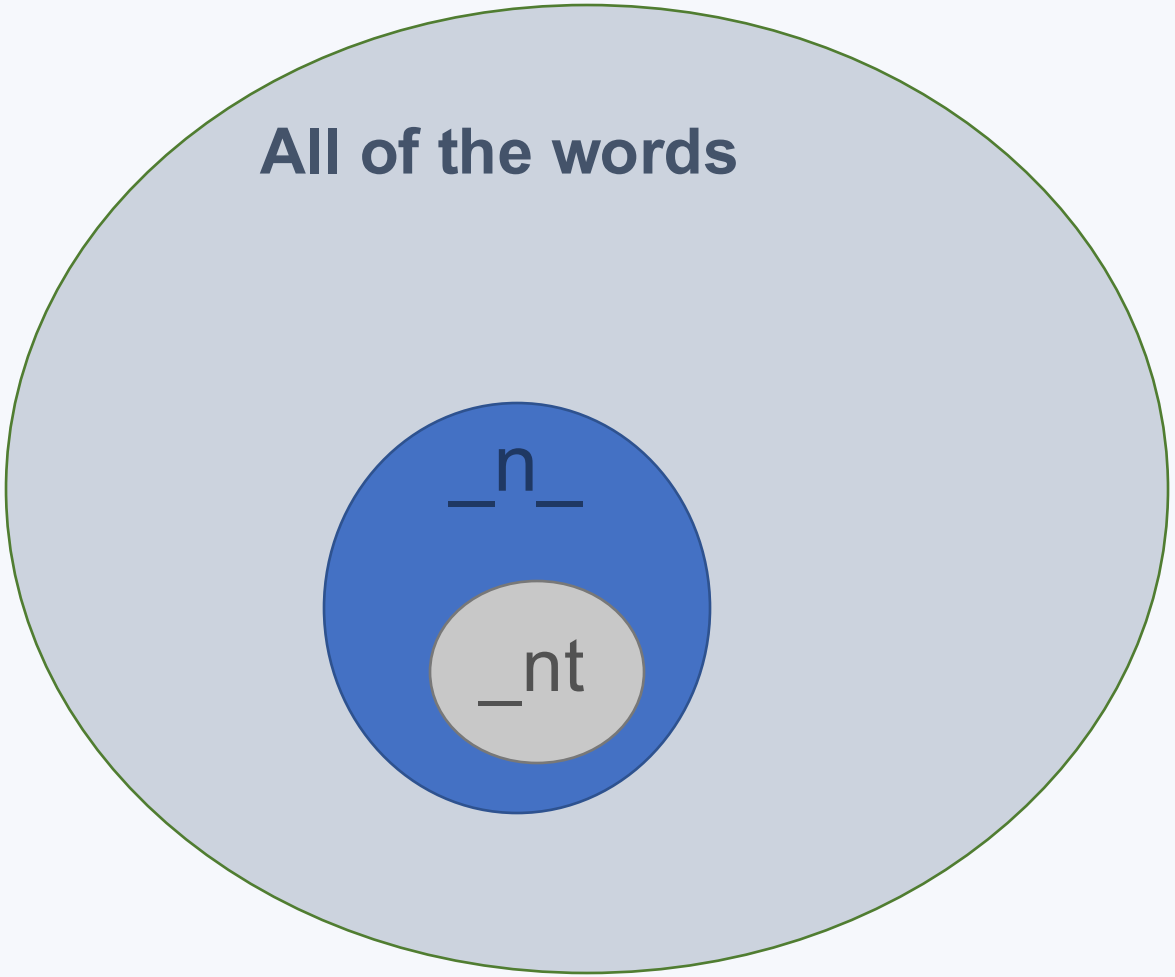
A little problem…

- For four pages of a short story (about 2000 words), would there be words of the form:
  - **_ _ _ _ _ nt**

  Or

  - **_ _ _ _ _ n_**

A little problem…



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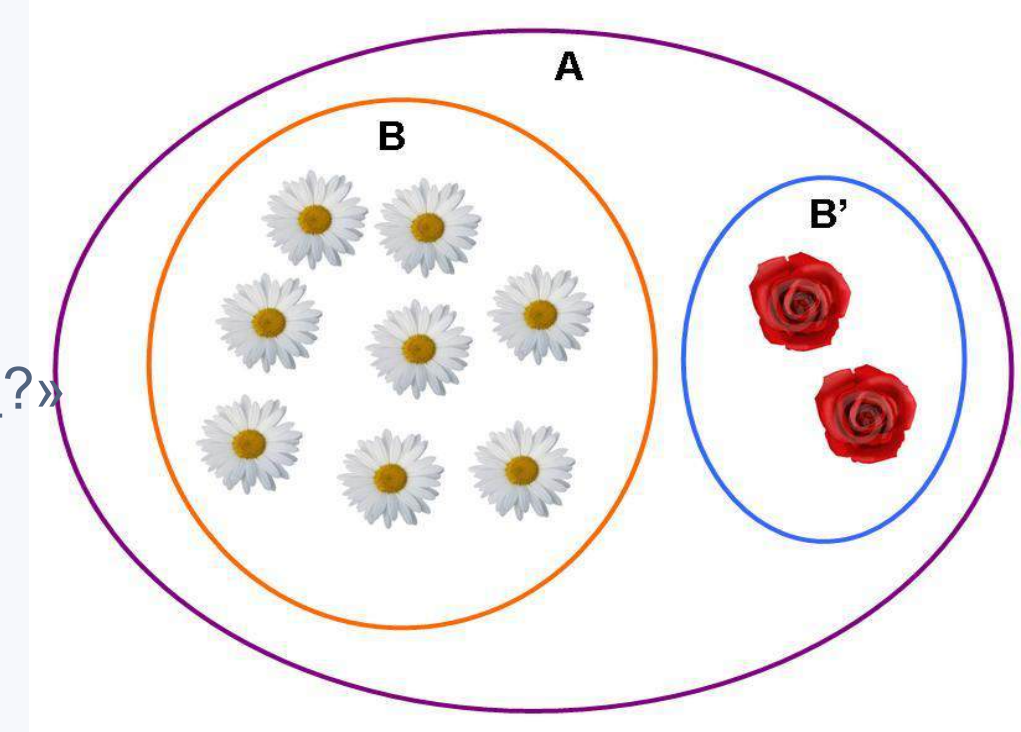
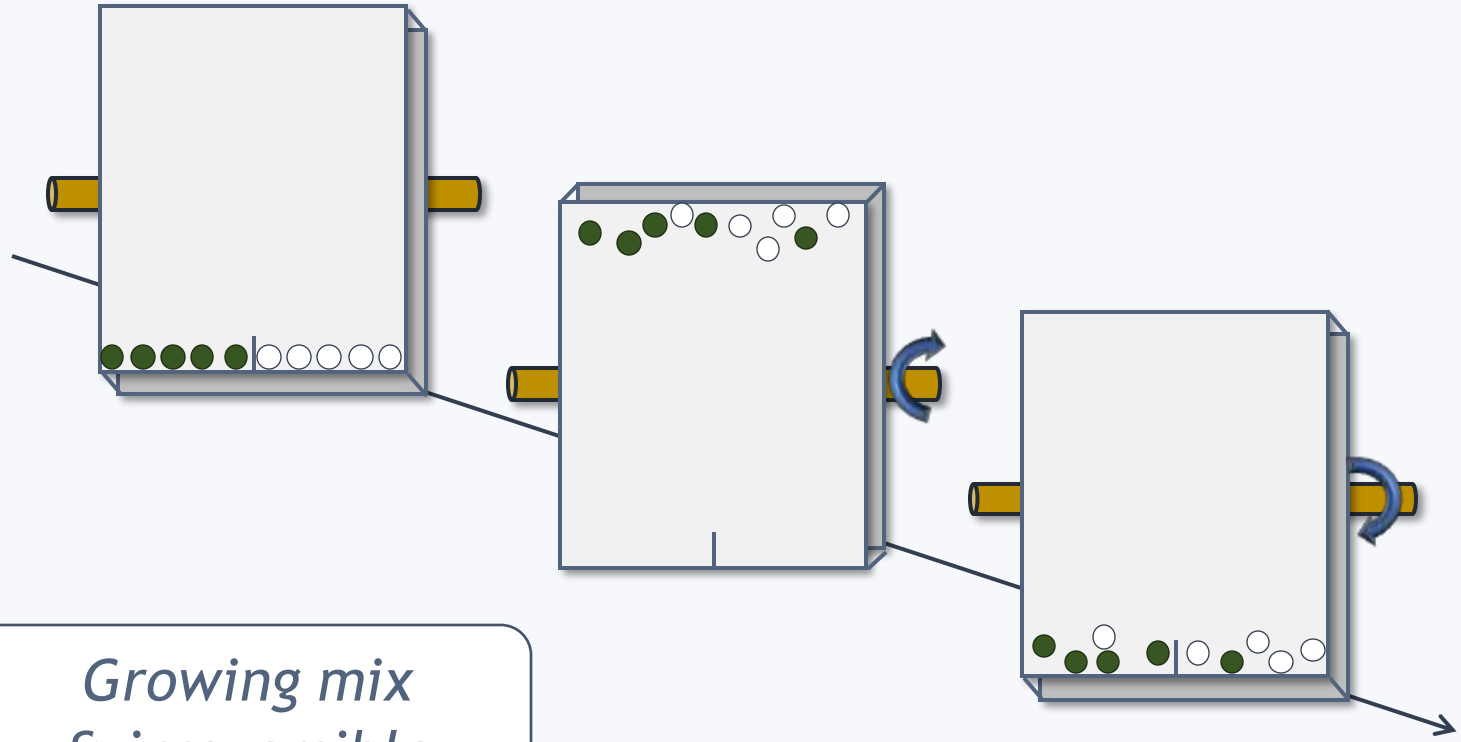


Practical case: The notions of chance and probability

Notion of chance (mixture & irreversibility)



Growing mix & irreversible

Piaget &Insider, 1974

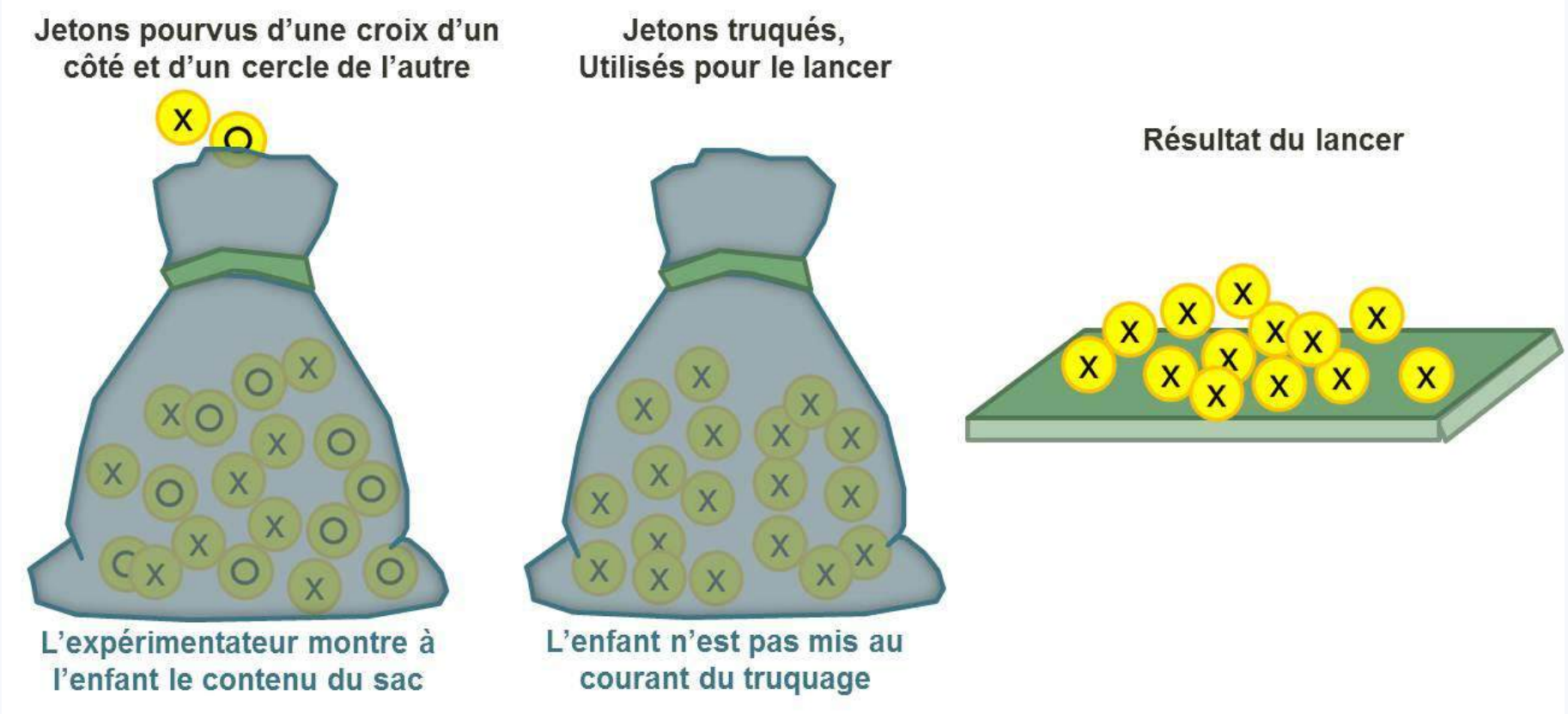
Notion of chance (mixture & irreversibility)

- Return to initial state
  - 4;4 years old: “They will go there (a few cm above their starting position)- And after ? – It will be all over again (exact return) – Look (we experience it and a white pass on the side of the reds).–So. It's like I told you!
  - And if I continue, it will be more or less mixed? –**You don't have to do it anymore**(he puts the pearls in order, as if the mixture were unpleasant)»
- Animism
  - 5;8 years old: “they know where they are driving since they are driving by themselves”
- "*Mixture*»
  - 7;2 years old: “they will mix. Only one red will remain here and one white there –*And on the next move?*– The reds will return here and the whites here (in their initial place).»
- 11 years old: understanding of the notion of chance

Piaget &Insider, 1974

Probability concept

- Probability concept



Piaget &Insider, 1974

Probability concept

- Probability concept
  - From 4-6years, children are not surprised
  - 6;11years : "All crosses -*For what ?*- Don't know. –*And if I continue?*– Perhaps a circle and the others on the cross. –*For what ?*– Because there are already so many crosses –*(Experience)*– Again nothing but crosses –*Is there a trick?*- Oh ! WellNo »
  - From 11 years old: assimilation of the rules that govern probabilities
    - 11;9 years old: All the crosses! You must have something: there is something in it (it turns one). So !

Piaget &Insider, 1974

In conclusion

- Piaget helped lay the foundations of developmental psychology and define the major stages of child development
- Great variability of influences
  - Highlighting the cognitive abilities of children
  - Better understanding of their cognitive functioning
- However, some late errors (which persist into adulthood) and early skills lead to questioning the Piagetian stages

Questioning Piagetian interpretations

CognitiveReflectiontest - CRT

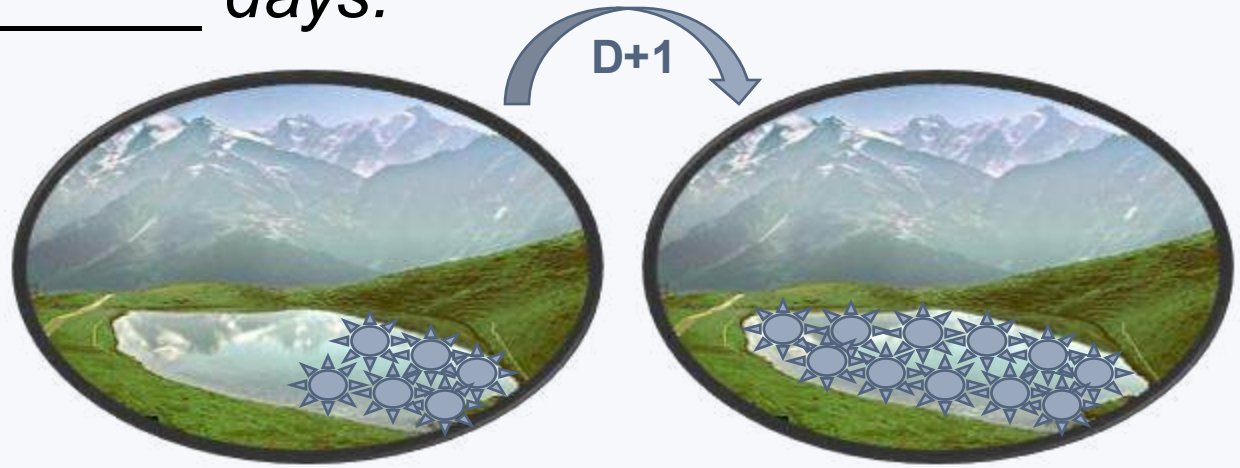
A) A racket and a tennis ball cost a total of €1.10. The racket costs €1 more than the ball.
How much is the ball?_____cts.

Biased response: 10 cts
Ball + Racket = €1.1
Ball = 10 cts
Racket = 1 + 0.10 = €1.10
Ball + racket =
€0.10 + €1.10 = €1.20

Logical answer:5cts
Ball + Racket = €1.1
Ball = 5cts
Racket = 1 + 0.05 = €1.05
Ball + racket =
€0.05 + €1.05 = €1.10

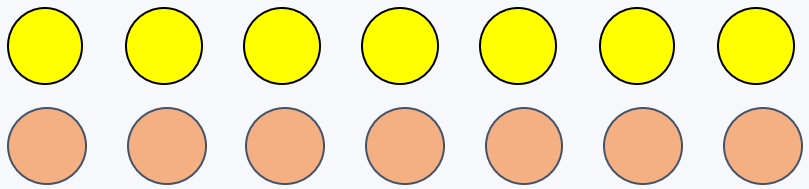
Example – Cognitive reflection test

- *In a lake, there is a patch of water lily. Every day, the plot doubles in size. If it takes 48 days for the plot to completely cover the lake, how many days will it take for it to cover half of the lake?*
  _____ days.



- Late Errors in Reasoning/Formal Thinking Stage
  - However, simple problem

The example of conservation of number



Non-conservative child:
" *There'shave more becauseIt ismorelong* »

- Presence of a **trap :**
- **Conflict** between an adapted strategy and a non-adapted strategy

✓"length = number" → Unsuitable Strategy

✓ Counting strategy → Adaptive Strategy

A. The example of conservation of number

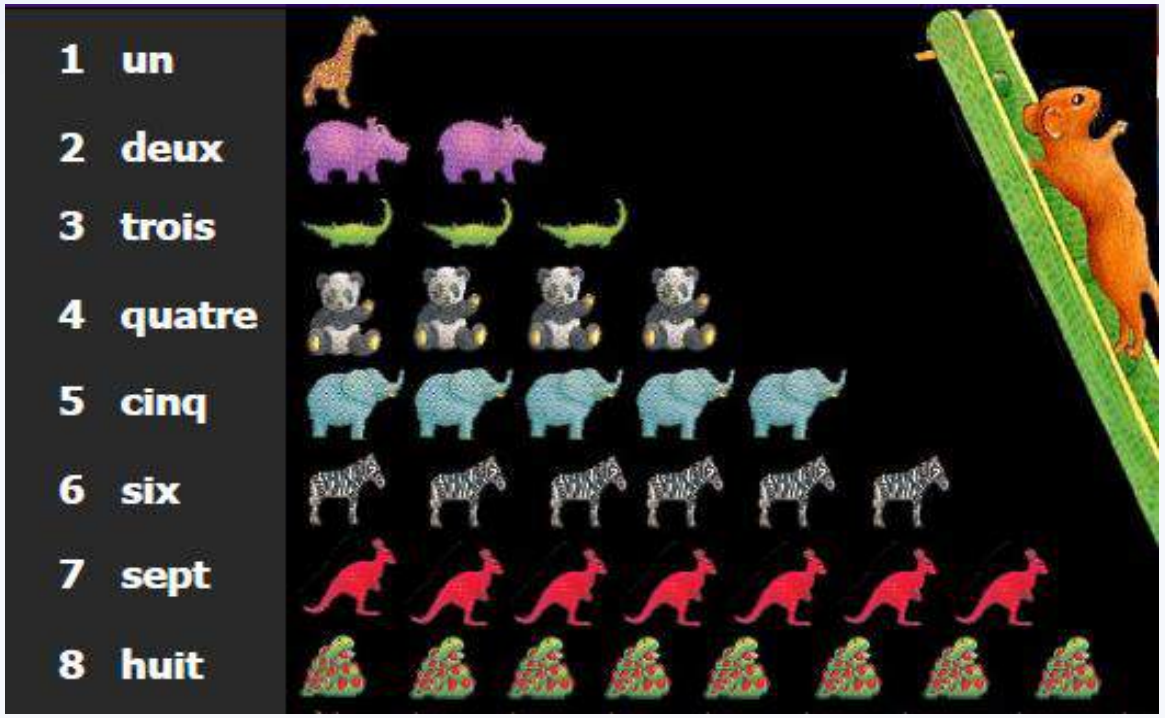
In life daily, the number covary withthe length: is the perceptual strategy **"length = number"**

I go to the shortest queue because there are fewer people

More the row of poplars is longer, the more poplars there are

- The child learns this strategy very quickly, dominant in his environment and his learning

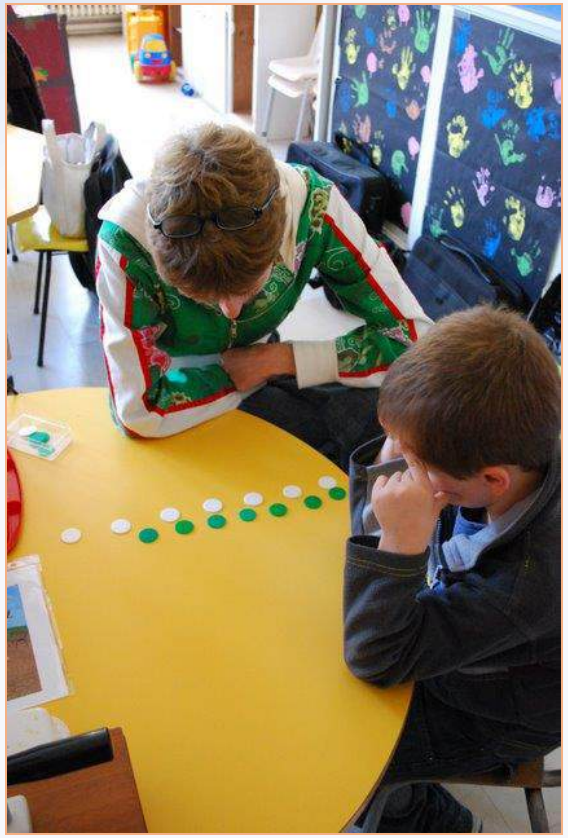
" Morethe row of animals or marbles is long, the more there areTo "



The "length = number" strategy is adaptive and relevant in lifedaily.

⇒ It's strategy automated

…but not to respond to the task proposed by Piaget



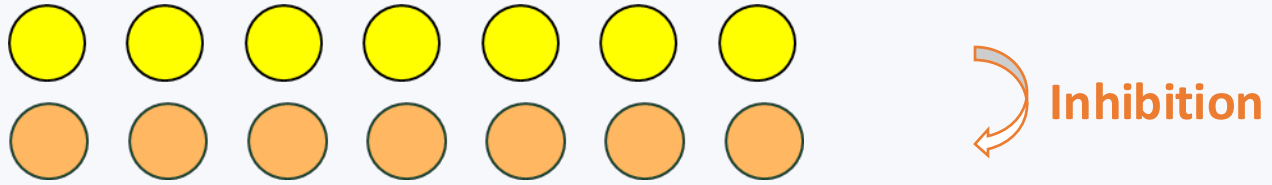
the child “non-conservative” answers based on a **perceptual** strategy, unsuitable…

⇒ Failure

What happens when the child becomes "conservative"?
How does he become able to respond on the basis of an adapted strategy: counting?

The role of cognitive inhibition

- To access the relevant strategy, the individual must <u>inhibit</u>
  - = resist an automated strategy that is unsuited to the task



⇒To pass the test (reach the correct answer):

⇒It takes (1)<u>inhibit</u> the dominant “length = number” strategy (resist the trap)

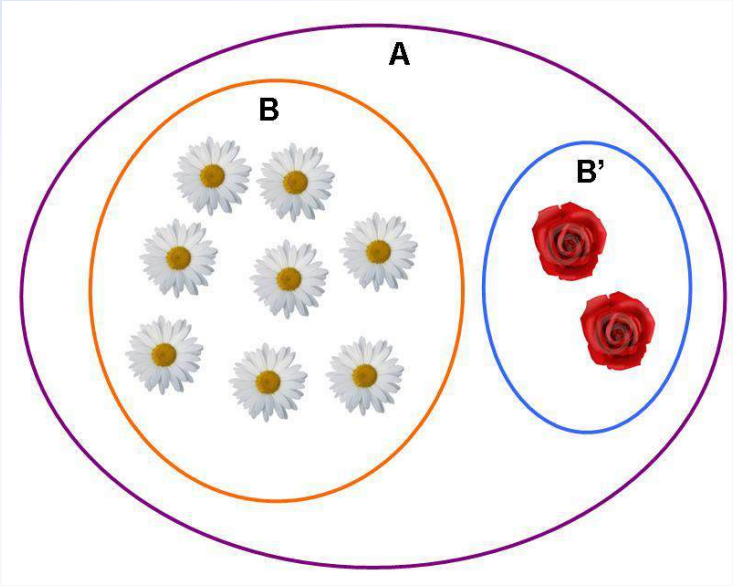
⇒For (2)activating and <u>enable</u> the counting

The role of cognitive inhibition

- Process for blocking or deleting irrelevant information or responses to reach the goal
- = 1 of the components of Executive Functions
- Cognitive processes necessary for the realization of behavior control, directed towards a goal
  - Allow an individual to adapt depending on environmental requirements

- Developmental Pattern: Progress important from 3 to 10 years, then progression more slow (from 12 to about 18 years old) (we will see how come later ☺

The example of including classes



Conflict between an answer **perceptual** (comparison of the 2 subclasses) and an **conceptual answer** (comparison subclass vs. set class)

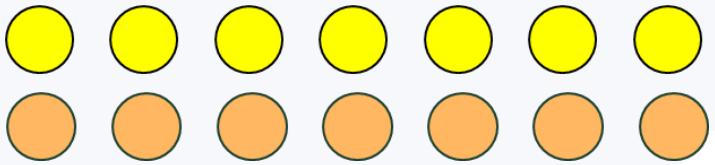
Inhibition of the **perceptual** subclass of the daisies, for enabing bigger class --> logic rule

EXECUTIVE FUNCTIONS

Evaluation of cognitive inhibition capacities

Cognitive development linked to inhibition capacities?

Number conservation task



Link ?

Behavioral measurement of inhibition
⇒ **Stroop**

- Conflict between:
  - ✓Autoplay &
  - ✓The naming of the ink color

[Stroop Task Online]

JAUNE	BLEU	ORANGE
NOIR	ROUGE	VERT
VIOLET	JAUNE	ROUGE
ORANGE	VERT	NOIR
BLEU	ROUGE	VIOLET
VERT	BLEU	ORANGE

IV. Evaluation of cognitive inhibition capacities

Cognitive development linked to inhibition capacities?

Stroop control board: absence of conflict / interference between reading and naming

VERT	JAUNE	ROUGE	BLEU
VERT	ROUGE	BLEU	VERT
ROUGE	JAUNE	BLEU	VERT
JAUNE	JAUNE	VERT	BLEU

IV. Evaluation of cognitive inhibition capacities

Cognitive development linked to inhibition capacities?

- In the task of Stroop:

⇒ Reading time [interfering board] >Reading time[control board]

⇒ Dependent variable (DV):interference score

Practical work

Make groups of two students. One will be experimenter, the other subject. Then we will reverse the roles.

Each student will take two tests.The first one will pass first the test Stroop then the conservation test and it will be the opposite for the latter. Each test has two parts (two boards), to be passed in order.

- **Subject :**

-STROOP's test: you must say aloud the color of the ink in which the word is written

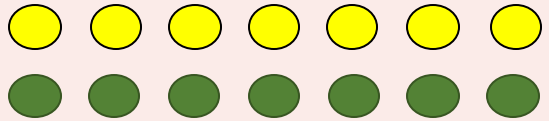
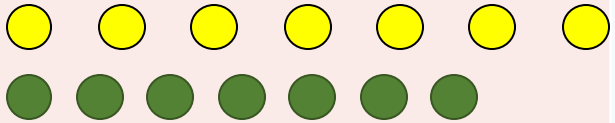
-the conversation test: for each pair of lines, you must say "same" if there is the same number of tokens or "not the same" if the number of tokens is different.

- **Experimenter:**

IThe instructions and correct answers are listed on the 3thboard of each test. You must, on a blank sheet, note the date of birth and the sex of the subject, then note for each plate of each test the number of errors and the time in seconds.

Practical work

Work discussionpractice

Experimental conditions	Lack of conflict	Conflict
Stroop	RED	GREEN
Number conservation test		
Ratewrong answers	<	
TimeAnswer	<	

TD-Link between inhibition capacities and conservation inthe child

- To search for yourself on the basis of the elements given in IV.
- Whatare the important variables in the plan experimental?
- IV?
- DV?

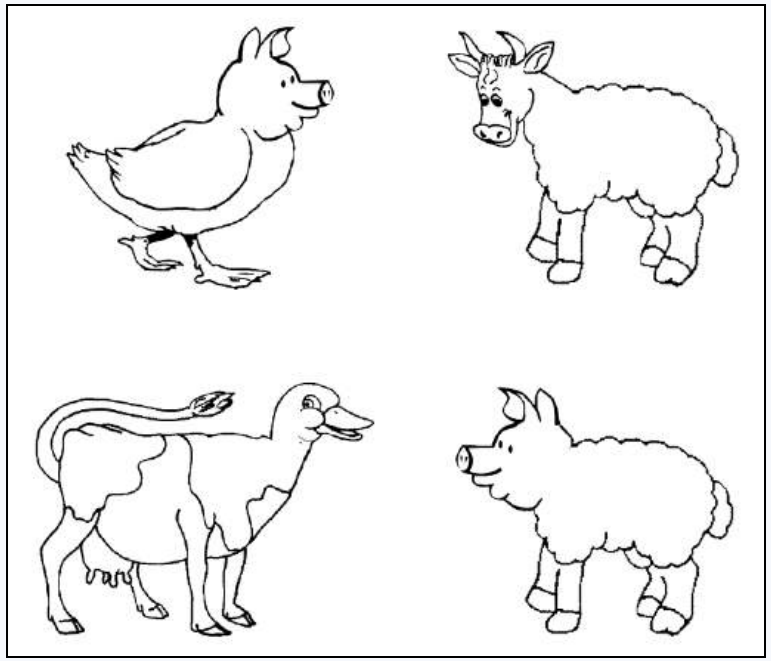
TD-Link between inhibition capacities and conservationat the house ofthe child -ANSWERS

- IV?
  - 2 groups of children: conservative (9 years old) vs. Non-conservative (6 years)
- DV?
  - Keeping the number:
    - Rate of wrong answers to the conservation of number task
  - Stroop:
    - Time of answer
    - Number of errors
    - Interference score
  - Brain imaging: activation of brain regions related to inhibitory control (insula and inferior frontal gyrus)

IV. Evaluation of inhibition capacitiescognitive in children

Stroop not usable in non-reader

⇒ Adapting the task to children: **stroop animals**(Wright, 2003)



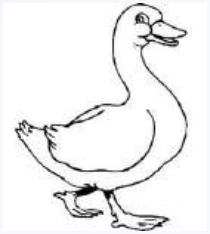
Conflict between:

✓Naming based on animal's head (no longer automatic)

✓ Denomination based onTHE animal body (less automatique)

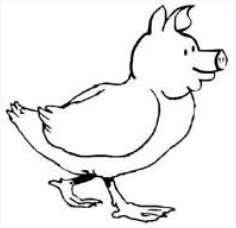
IV. Evaluation of inhibition capacitiescognitive in children

3 conditions



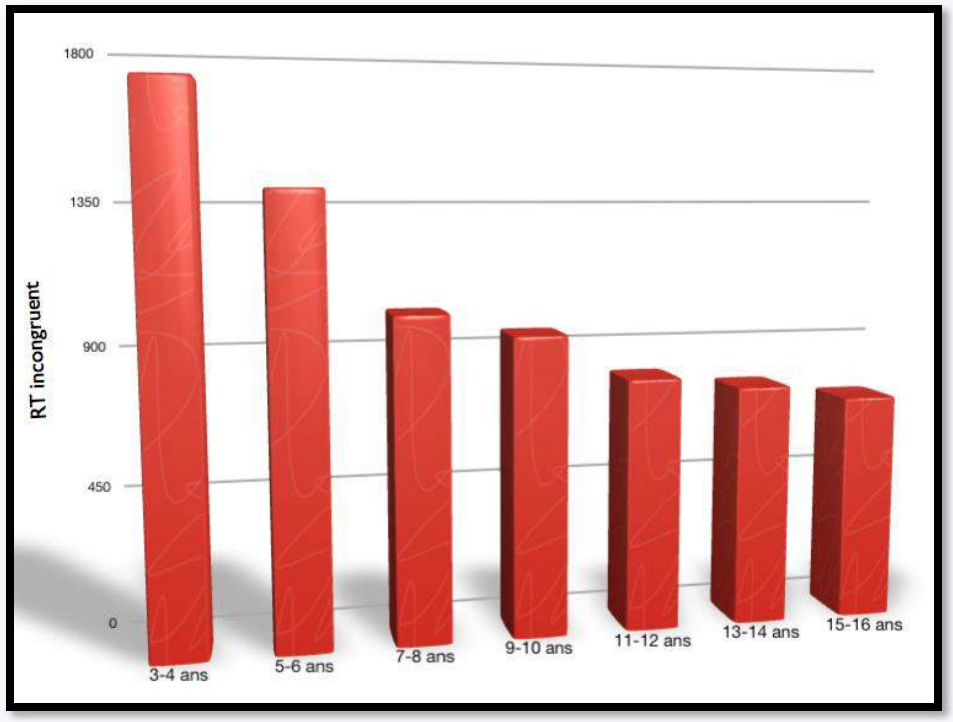
Plank -Congruent

Plank- Control incongruent



Plank-interfering

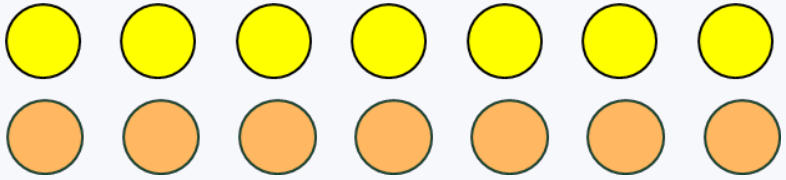
Decreased TR with age for the interfering boards



V. Link between inhibition capacities and conservation in children

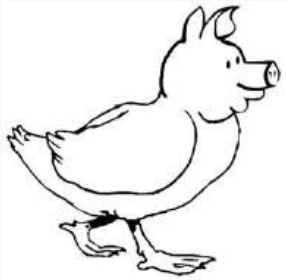
- Article (on moodle). (2012)
- To find out if inhibition abilities are involved in Piagetian tasks, they passed
  - a piagetian task of conservation of number
  - & an inhibition task to children conservative (9 years old) vs. Nonconservative (6 years)

Conservation tasknumber



Link ?

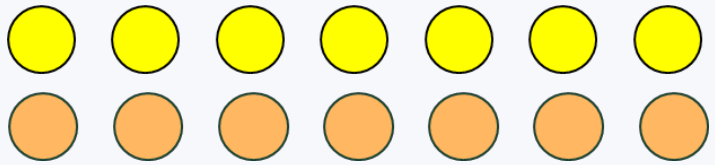
Stroop Animals



V. Link between inhibition capacities and conservation in children

- **Issues :**
  - Is cognitive development linked to inhibition capacities?
  - Is success in Piagetian tasks related to inhibition capacities?

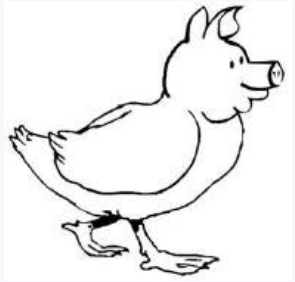
Number conservation task



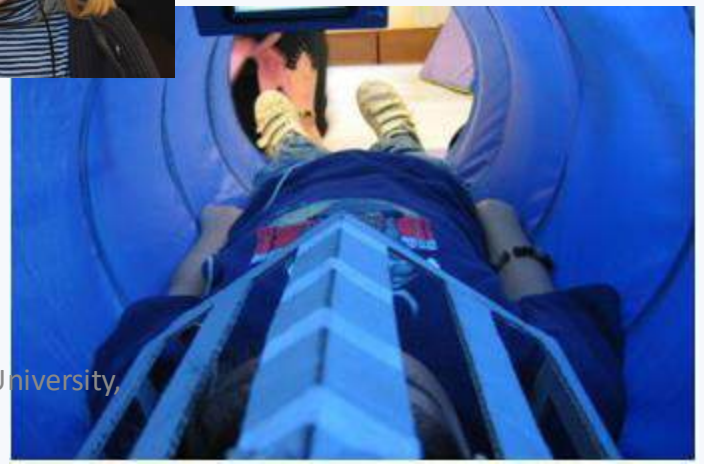
Link ?

Behavioral measurement of capacities of inhibition
⇒ **Stroop**

Stroop Animals



d. Link between inhibition capacities and conservation in children

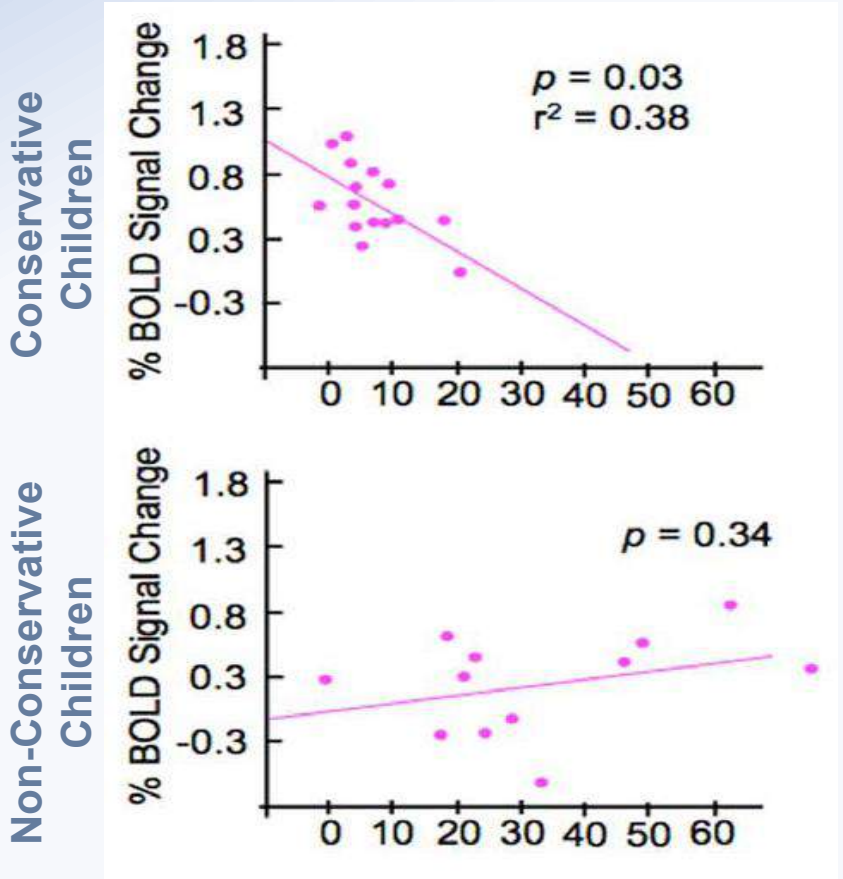


Study in **fMRI** performing the number conservation task

⇒ **Conservtive children and non-conservative**

+task of of **Stroop Animals**

Results

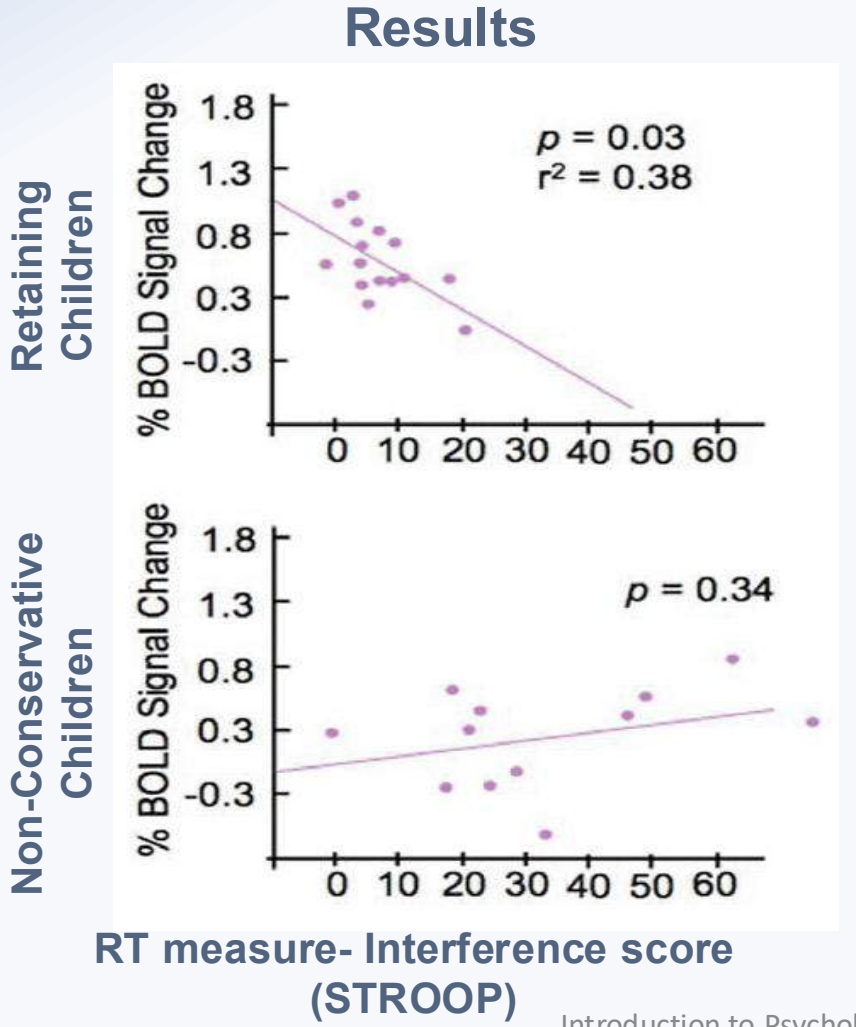


RT measure- Interference Sensitivity (STROOP)

Children conservative:
Activation of the regions involved in **inhibition** increases with the efficiency of the **inhibitory control** at Stroop task.

To complete this task:
⇒ the child must have acquired the notion of reversibility
⇒ & inhibit the "length = number" strategy

V. Link between inhibition capacities and conservation in children



Children Conservative:
Activation of the regions involved in **inhibition** increases with the efficiency of the **inhibitory control** at Stroop.

Findings

- To succeed in the Piagetian task of conservation of number:
- Acquiring the notion of reversibility is not enough

⇒ A child must have acquired the concept of reversibility, which is the ability that Piaget was testing

⇒ & to be ableinhibit the "length = number" strategy

- These two processes are necessarysimultaneously
- **Cognitive inhibition capacities are therefore necessary for success in this test.**

CognitiveReflectiontest - CRT

A) A racket and a tennis ball cost a total of €1.10. The racket costs €1 more than the ball.
How much is the ball?_____cts.

Biased response: 10 cts

Ball + Racket = €1.1
Ball = 10 cts
Racket = 1 + 0.10 = €1.10
€0.10 + €1.10 = €1.20

Logical answer: 5 cts

Ball + Racket = €1.1
Ball = 5cts
Racket = 1 + 0.05 = €1.05
€0.05 + €1.05 = €1.10

Conjunction error and representativeness heuristic

"Linda is 31, single, outspoken and very intelligent. She passed her degree in philosophy. As a student, she became very involved in issues of discrimination and social justice. She also took part in anti-nuclear demonstrations. »

Today ?

- Linda works at a bank counter.
- Linda is a representative in an insurance company.
- Linda works at a bank counter and actively participates in the feminist movement.

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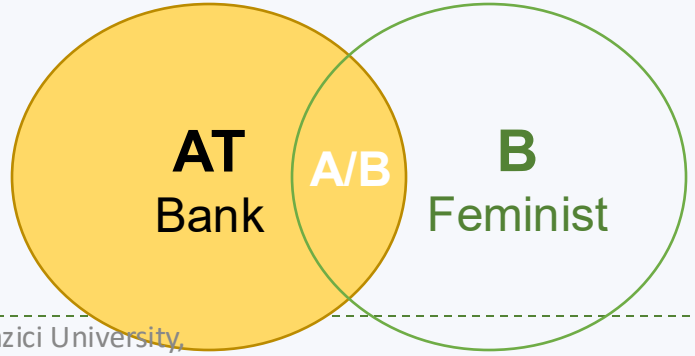


D. Questioning the Piagetian stages

- **Existence of reasoning bias: massively irrational behaviors in adults in the field of reasoning**(Kahneman, 2003; Evans, 2011).
- How can these failures be explained?

There would be 2 main forms of reasoning:

- ***Type 1 intuitive:***fast, automatic, requires little effort; and often emotional. Only the end result is conscious.
  - Works very well, very often, but not always.
- ***Type 2 Rational :***controlled, slower, requiring sustained effort. Draws on theories of deductive logic and the rules of probability
- Difficulty in case of **Cognitive competition** between intuitive scheme (Type 1) and logic (Type 2)

D. Questioning the Piagetian stages

- **Existence of reasoning bias: massively irrational behaviors in adults in the field of reasoning**(Kahneman, 2003; Evans, 2011).
- How can these failures be explained?

And two types of cognitive strategies

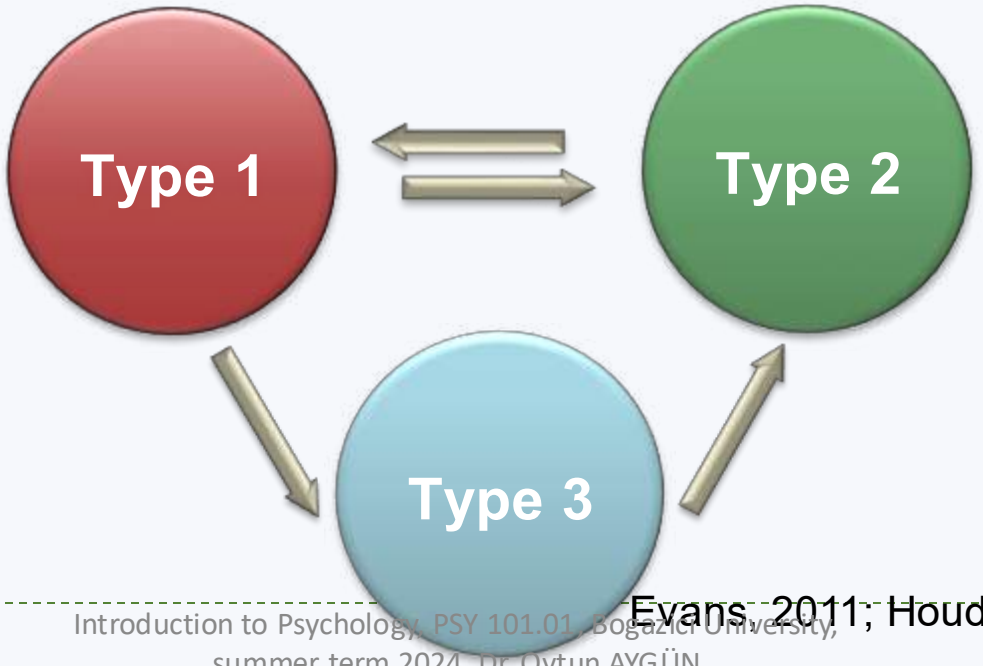
- ***Heuristics***: very fast, economical, cognitively efficient strategies that work very well, very often, but not always.
- ***Algorithms***: slower strategies, more costly in terms of cognitive load but which always lead to the right result.

D. Questioning the Piagetian stages

- **How to switch from Type 1 to Type 2? What cognitive process allows this passage?**
- The optimal strategy consists of (1)**inhibition**of the dangerous scheme (bias) and in (2) the activation of the logical scheme

⇒Type 3 (Evans, 2011;Houde, 2000):<u>cognitive inhibition</u>

⇒Importance of cognitive control



Evans, 2011; Houde, 2000