

Developmental Cognitive & Social Psychology

Adolescence

Summer term 2025

Prof: Dr. Oytun AYGÜN

PSY4056

Let's Begin ...with breathing



- Question: What is adolescence?



Exercise: Take 5 minutes to brain storm, make a list of elements associated with adolescence

Question: What is adolescence?

- Importance of group(s) of friends
- Less time spent with family
- New passions
- Lots of emotions (exuberance in language).
- Willingness to change the world



Latin, "*teenager*»= to grow

Recent term (mid 19th century)

Socially and culturally determined phenomenon

In Europe (France): compulsory school => 13 years old (1882), 16 years old (1959)

Regulations for the work of minors (12 years in 1851 / 14 years in 1936)

In Turkey: Currently 6-14 years compulsory education

Regulations for work – below 15 is illegal, with some exceptions if a child is 14 –if finished ilköğretim, at jobs that do not impede their physical, mental, and psychological development as well as going to school

- Period of **transition** between childhood and adulthood
 - Which is accompanied by physical (body and brain), cognitive, emotional and social changes
 - Biologically, socially and culturally determined phenomenon
 - Societal changes – such as the extension of compulsory schooling or the regulation of child labor – and hormonal changes – the earlier onset of puberty during the 20th century – contributed to stretching out this developmental period (Crone & Dahl, 2012).

*Biological
Phenomenon?
Social ? Cultural ?*



Galvan, vanLeijenhorst & McGlennen, 2012

Period of **transition** between childhood and adulthood

Onset ~ Entry into puberty

⇒ Universal biological changes

⇒ Cognitive changes (less detectable)

END ? Entry into adulthood (variable criteria)

⇒ Departure from the family / Life as a couple

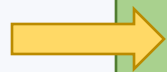
⇒ Financial independence

⇒ Moral and legal responsibility

⇒ End of studies / Beginning of professional life

⇒ Psycho-affective maturity / assertiveness

[When do you become an adult?](#)



Great variation between individuals and gender

type of changes	Start criteria	End criterion
Biological	Beginning of universal biological changes	end of puberty – ability to have a child
Cognitive	Apperance of formal reasoning / abstract thinking	Mastery of formal thinking / abstract thinking
Psychological	Attempts to assert personal identity	Identify as an independent person: affirm and assume their identity and their choices
Legal	12 years old: Legal possibility of leaving a child alone at home	Age of majority: access to the right to vote, 18
Social	More autonomous, roles in the society and construction of a social network outside.	Self-controlassuming responsibilities that entails towards oneself and others, autonomous entity in the society

- 8-12 years: Early adolescence
 - 1st signs of puberty
- 13-18 years old: Adolescence
 - Two periods: 13-15 years old, then 16-18 years old
 - Pubertal transformations
 - Affirmation of a new social place
- ~19-21 years: *Late adolescence*
 - Post-puberty
 - Pubertal development complete
 - Completion of adult identity

Origins of specificities in adolescence

Puberty: definition

⇒ All of *physical transformations* occurring in adolescence

⇒ Maturation of the genitalia and reproductive function

⇒ Appearance of secondary sex characteristics

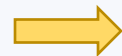
⇒ Growth spurt

⇒ *Brain maturation*

Origins of specificities in adolescence

Puberty: definition

- Beginning of puberty:
 - Girls
 - On average at 10 years old: between 8 and 13 years old
 - Boys
 - On average at 12 years old: between 10 and 14 years old



***Puberty can be +/- long:
from 2 to 6 years depending
on the individual***

***High variability: Shifts
& influences***



Origins of specificities in adolescence

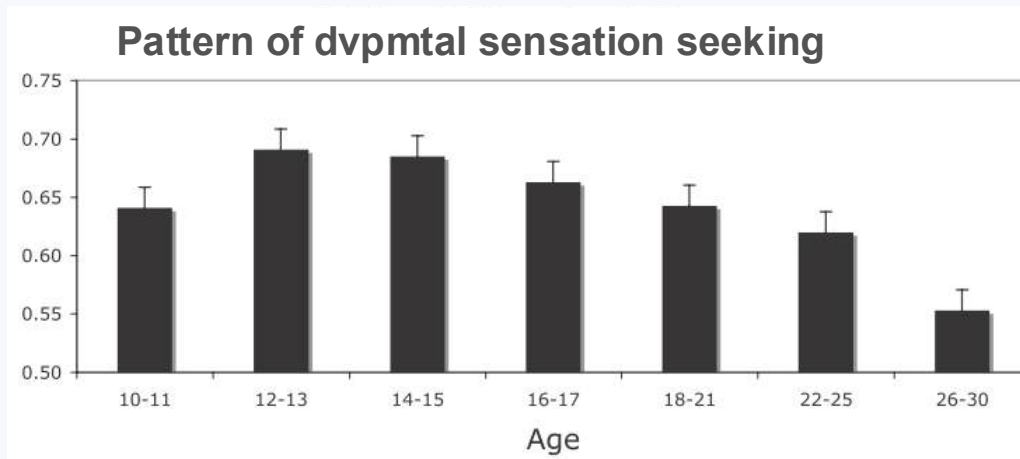
Measurements of dvpmt

- EDP – puberty development scale
- + Sensation Seeking scale (SSS; Zuckerman et al., 1978)
 - Four subscales
 - Disinhibition
 - Looking for new experiences
 - Susceptibility to boredom
 - **Looking for thrills and adventures**
 - **http://expfactory.org/experiments/sensation_seeking_survey/preview**

Origins of specificities in adolescence

Measurements of dvpmt

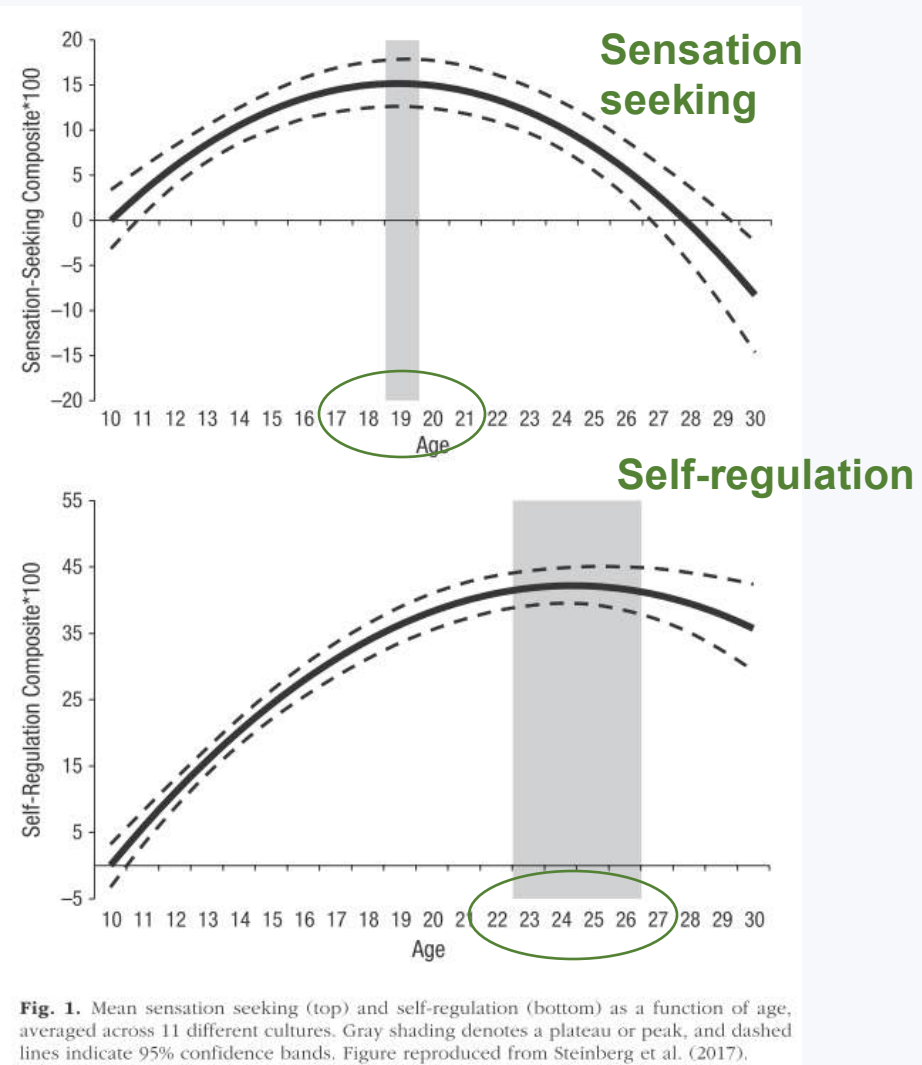
- Here 6 items of the SSS: Evaluation of the search for thrills and novelty
 - "I like new experiences whether they are a little scary"
 - "I do Sometimes things crazy And senseless, just For fu"



**+ Correlation
between pubertal
status and
sensation seeking**

B. Sensation seeking

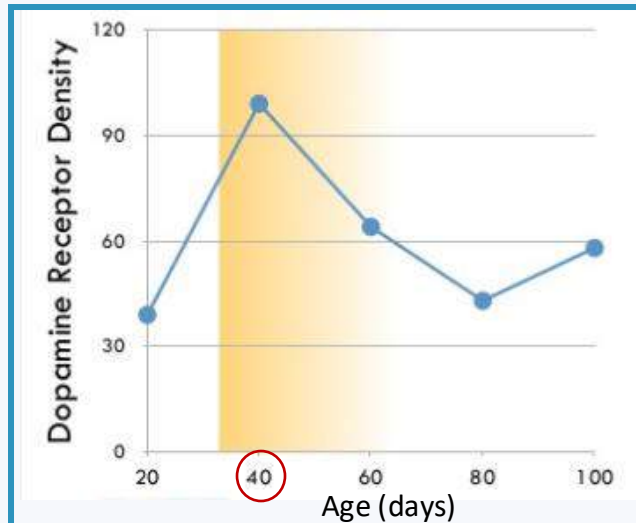
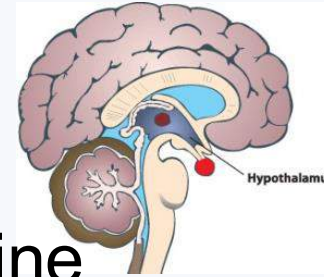
- = Desire to experience new and rewarding stimuli and to take risks
- 5,404 participants - from 10 to 30 years old
- 11 different countries (Steinberg et al., 2017)



Origins of specificities in adolescence

The dopaminergic system

- pre-adolescence: Increased density of dopamine receptors



Stronger receptivity of dopamine receptors during puberty



Andersen et al., 2000

*Search for
novelty &
rewards*

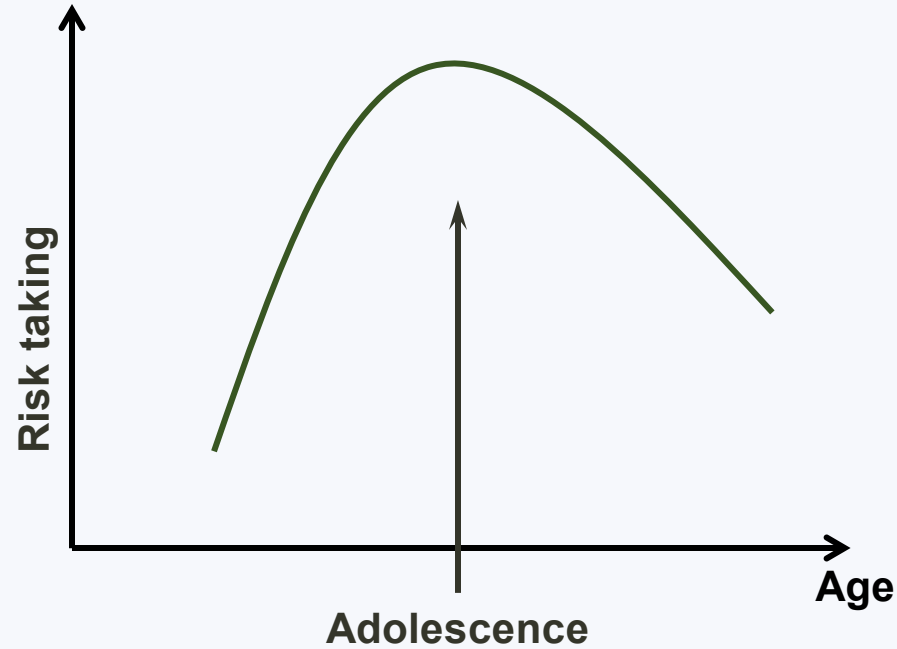
Conclusion

- Adolescence = period of development
- Characterized by specific behavioral, biological, social, development cerebral
- Concordances with cross-cultural and cross-species studies.
- Link between **hormonal changes** in adolescence and **behavior** (relationship and behavioral difficulties, decision-making, etc.)



II. Risk taking in adolescence

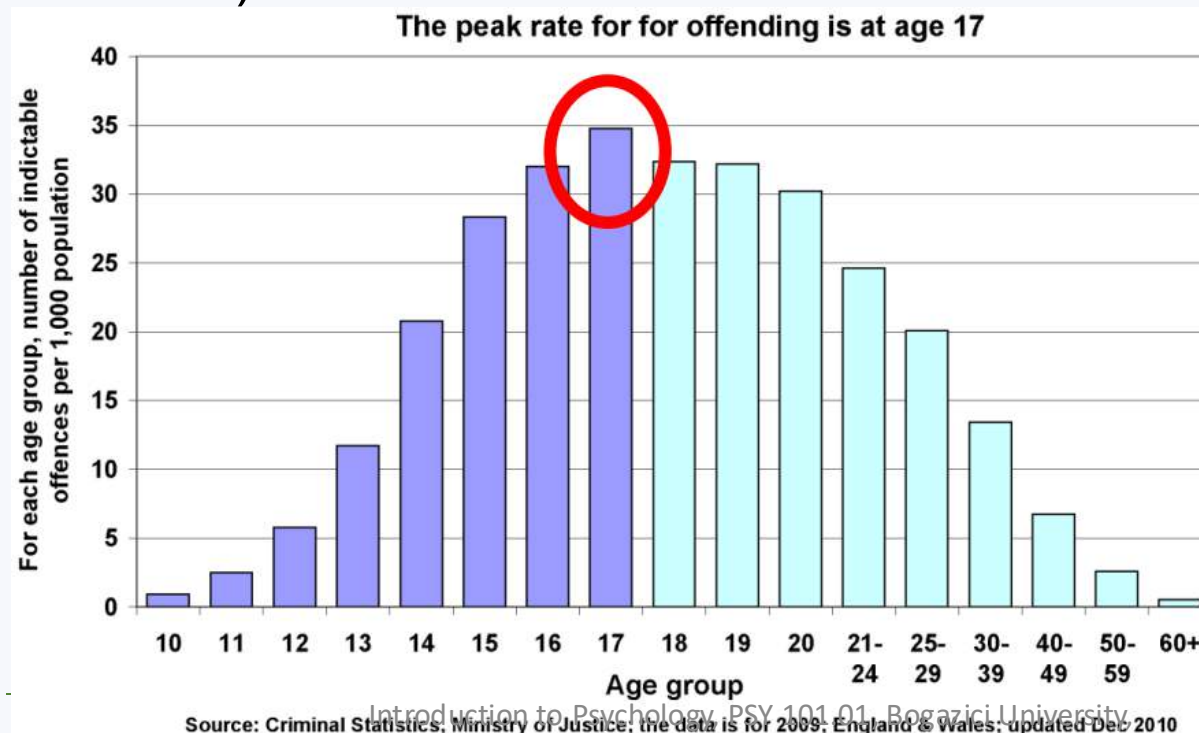
- As a teenager - Paradox
 - Logical skill necessary for appropriate decision-making
 - Mortality and morbidity rate: +200 to 300% compared to children
 - Linked to greater risk-taking (72% results of accidents, homicides or suicides)



Dahl, 2004

II. Risk taking in adolescence

- As a teenager - Paradox
 - Logical skill necessary for appropriate decision-making
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Dahl, 2004

II. Risk taking in adolescence

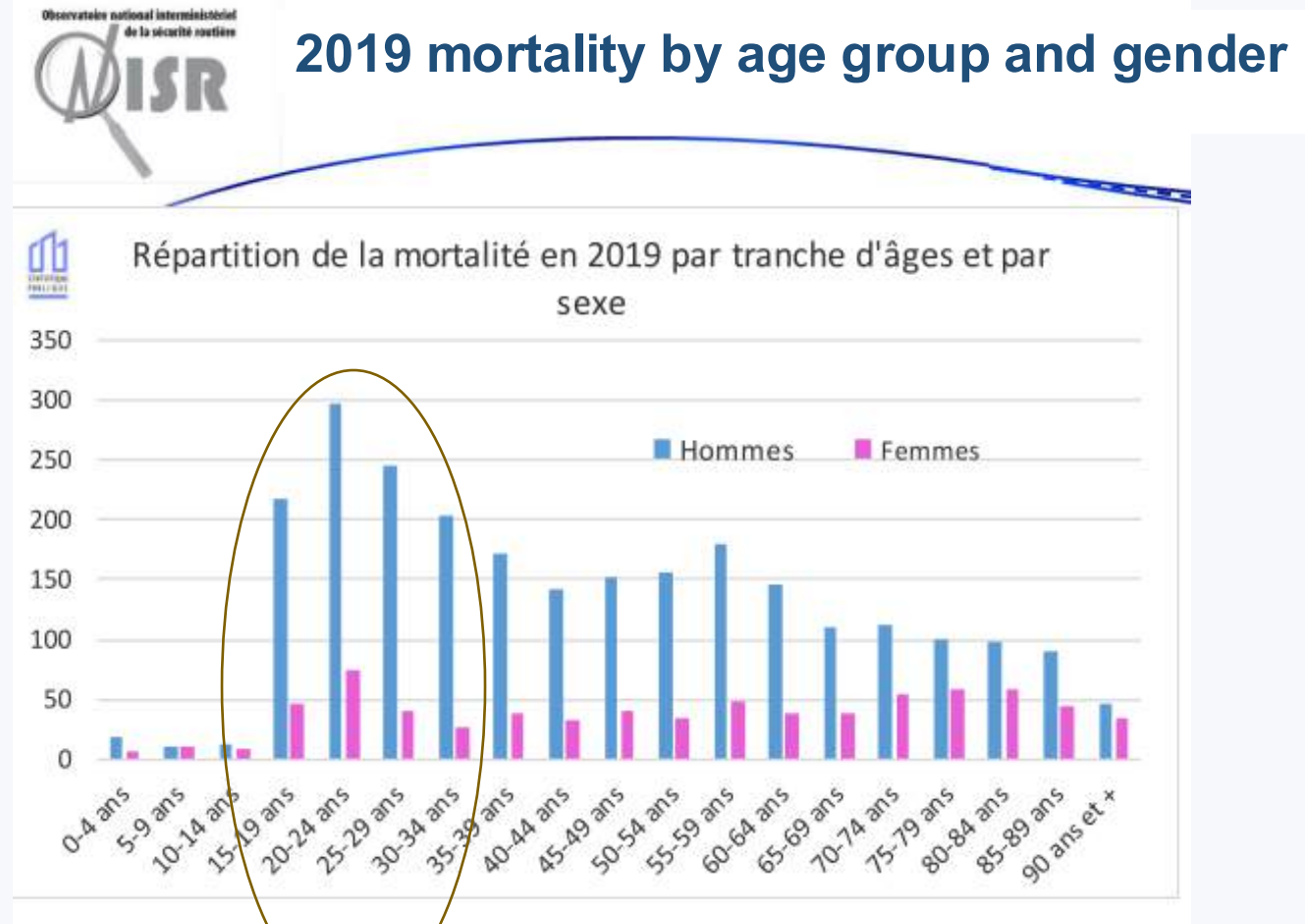
- According to European reports(EMCDDA, INSERM), among 15-16 year olds:
 - 42% have consumed alcohol at least 3 times in the past month
 - 20% have been drunk in the past month
 - In 2012, one of the highest rates for cannabis use was observed in France
 - 39% had used cannabis at least once
 - 24% had used it in the last month
 - 27.5% of 15-16 report a sexual relationship, among them:
 - 70% did not use birth control pills and
 - 25% did not use a condom

II. Risk taking in adolescence

- Road risks

ROAD ACCIDENTS

= 1^{time} cause of death of
15-29 year olds (WHO)



II. Risk taking in adolescence











- Road risks

ACCIDENTOLOGY AND CONSUMPTION OF PSYCHOACTIVE SUBSTANCES:

cannabis use doubles the risk
of being responsible for a
fatal road accident

Observatoire national interministériel
de la sécurité routière
ISR

Données générales 2019 – les usagers

	 Piétons	 EDP motorisé	 Vélos	 Cyclos	 Motos	 VT	 VU	 PL	 TC	 Autres	Total
2010	485 12%	-	147 4%	248 6%	704 18%	2117 53%	146 4%	65 2%	4 0%	76 2%	3 992 100%
2018	471 15%	-	175 5%	133 4%	627 19%	1637 50%	92 3%	44 1%	3 0%	66 2%	3 248 100%
2019	483 15%	10 0%	187 6%	134 4%	615 19%	1622 50%	98 3%	36 1%	4 0%	55 2%	3 244 100%
Progression 2018 - 2019	+3%	-	+7%	+1%	-2%	-1%	+7%	-18%	+33%	-17%	-0,1%
Progression moy-2019	-2%	-	+18%	-7%	-2%	-6%	-22%	-35%	-76%	-14%	-4,8%
Progression 2010-2019	-0%	-	+27%	-46%	-13%	-23%	-33%	-45%	+0%	-28%	-18,7%
Progression 2000-2019	-14%	-	+32%	-59%	-26%	-34%	ND	-47%	ND	-14%	-27,2%

III. Developmental study of decision making

- What factor(s) explain the presence of irrational behavior?
- Are adolescents able to perform beneficial decision-making?

I. Cognitive control and emotional regulation

- Somerville et al., 2011–*Journal of Cognitive Neuroscience*
- **Question:** Is the increase in risk taking the consequence of a greater sensitivity to emotional stimuli in adolescence?
- Alternative ?
- Logic ?

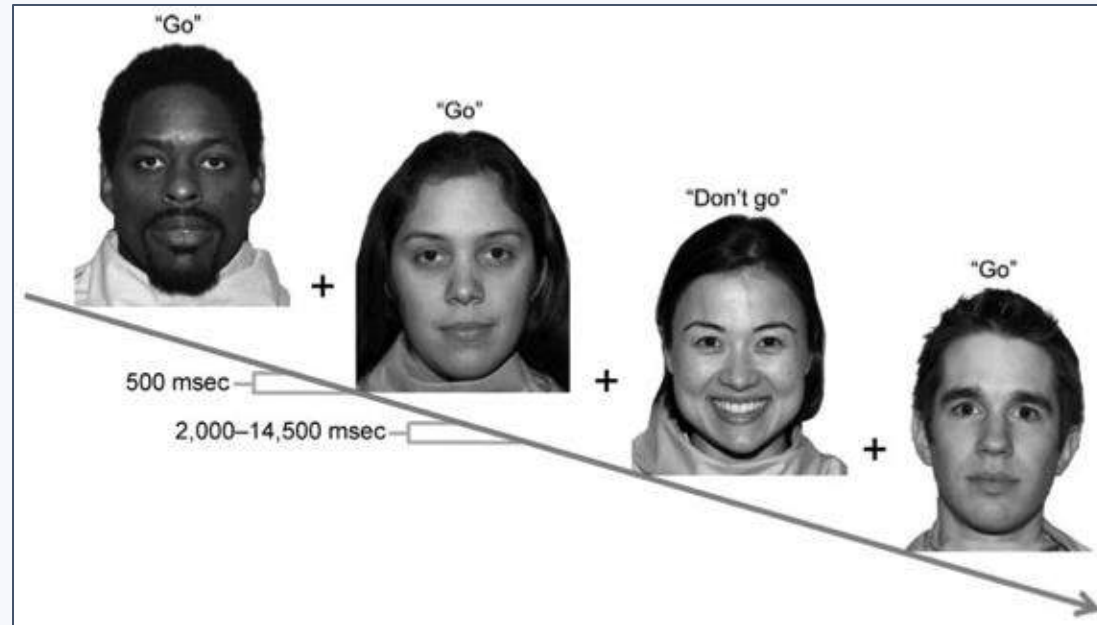
Methodology

- 3 age groups: 6-12 years old; 13-17 years old; 18-29 years old

I. Cognitive control and emotional regulation

Methodology

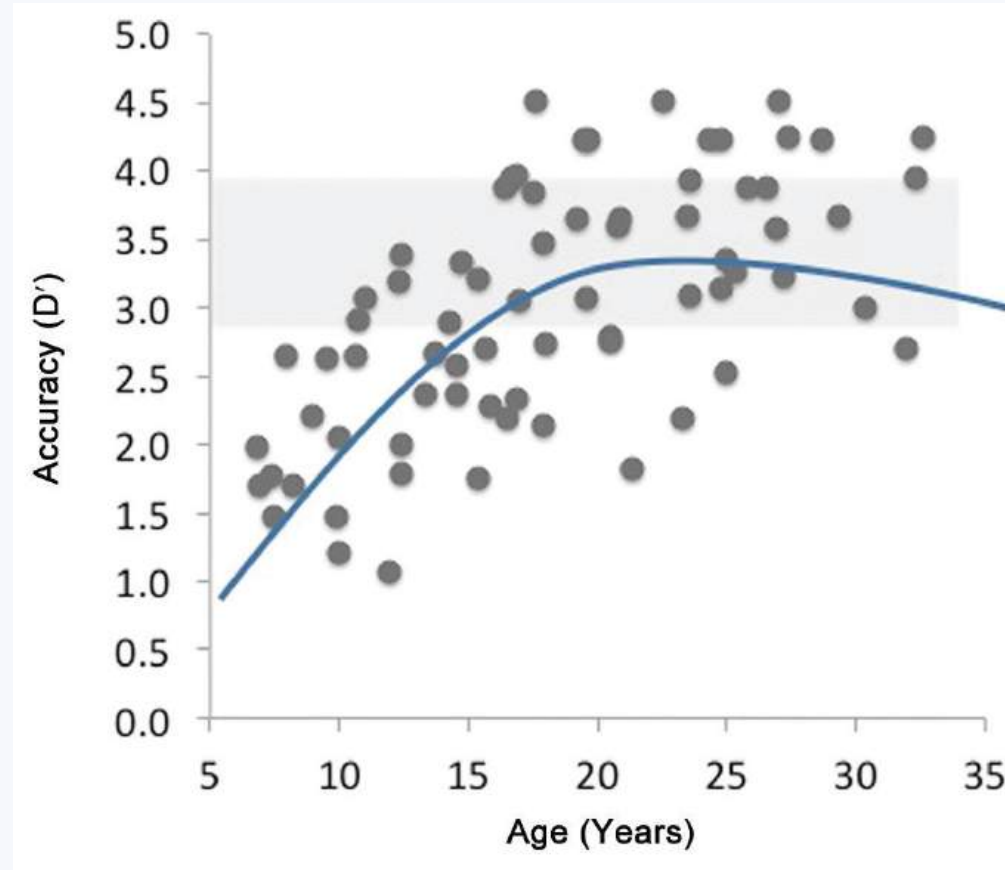
- Go/NoGo emotional
- Face with emotional expressions
 - 2 conditions
 - Joy // Calm
- “false alarm” = Press when NoGo
 - ⇒ lack of cognitive control



I. Cognitive control and emotional regulation

Behavioral results

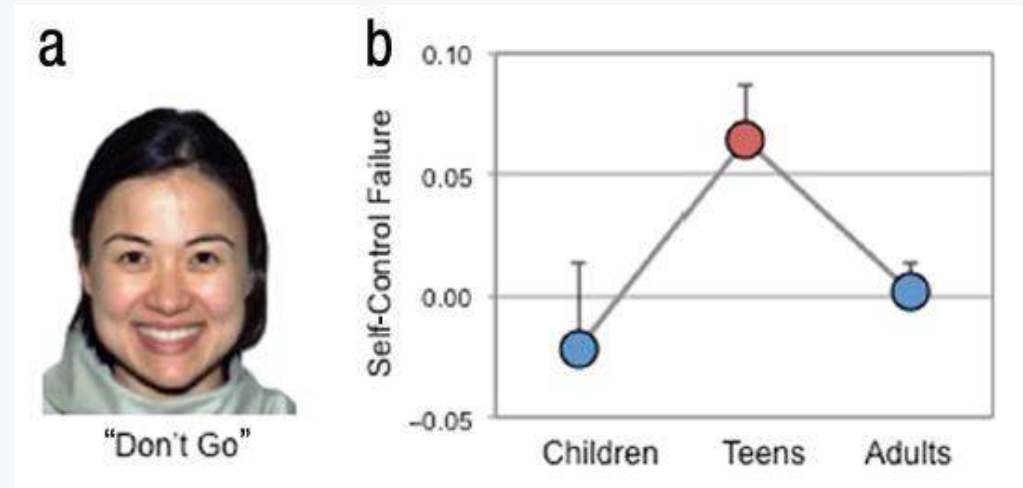
- calm faces
 - Similar behavioral performances between teenagers and adults



I. Cognitive control and emotional regulation

Behavioral results

- faces of joy
- False alarms (impulsive responses):
 - teenager > adults & children



I. Cognitive control and emotional regulation

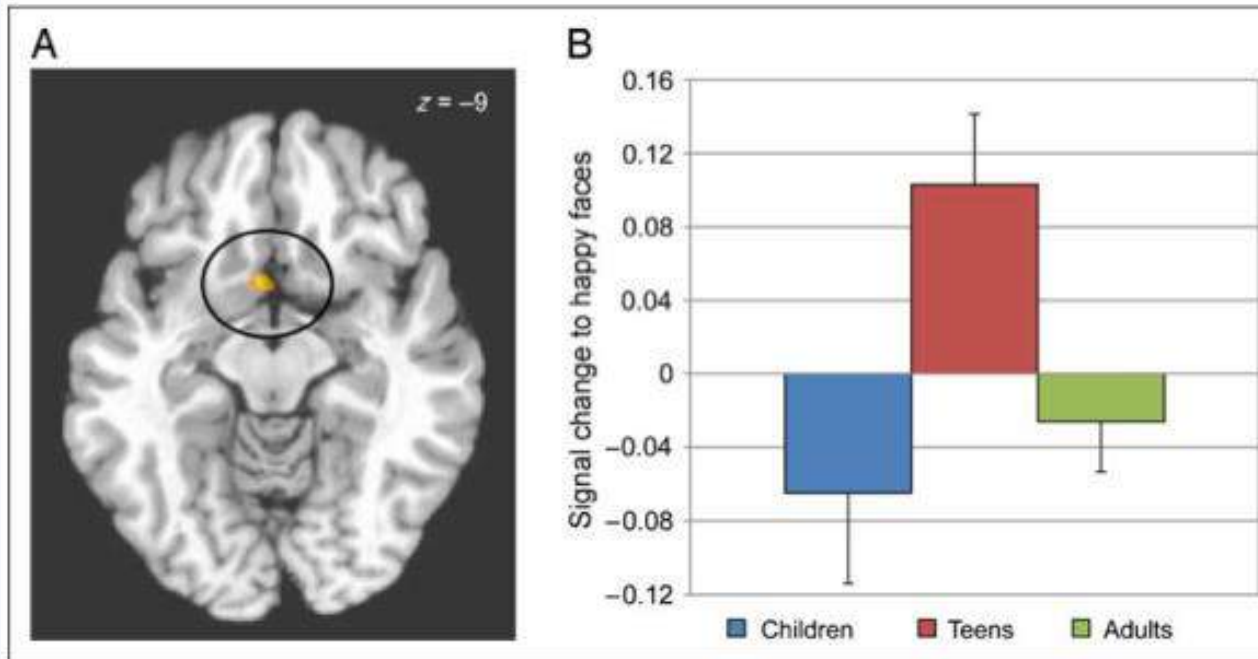
Anatomical Findings

- Negative correlation between PFC activation and % of false alarms
⇒ the activity of the PFC is linked to the cognitive control capacity.
- Lower activation of the lateral PFC in adolescence.
⇒ Worse recruitment of this region



I. Cognitive control and emotional regulation

Anatomical Findings



Faces of joy:
+ strong
activation of
ventral striatum
(**lymbic system**)
in **teens**

I. Cognitive control and emotional regulation

• Discussion

- ⇒ Teenagers' risk-taking reflects a **PFC less mature** (therefore less efficient cognitive control)
- ⇒ But also it is a reflection of a **conflict** with the circuit involving the Ventral Striatum (Limbic System) and therefore of a **strong sensitivity to emotional stimuli**
- ⇒ The increase in risk taking in adolescence is also the consequence of greater sensitivity to emotional stimuli

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Let's Begin ...with breathing

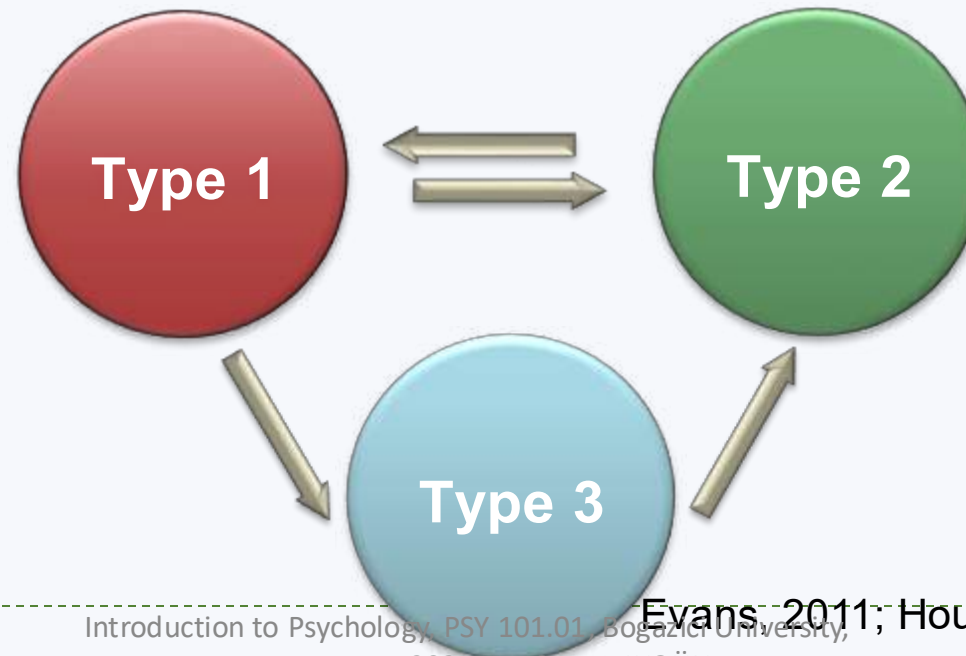


IV. Neurobiological models of decision making

- Two systems participate in decision making
 1. The cognitive control system
 2. The emotional system

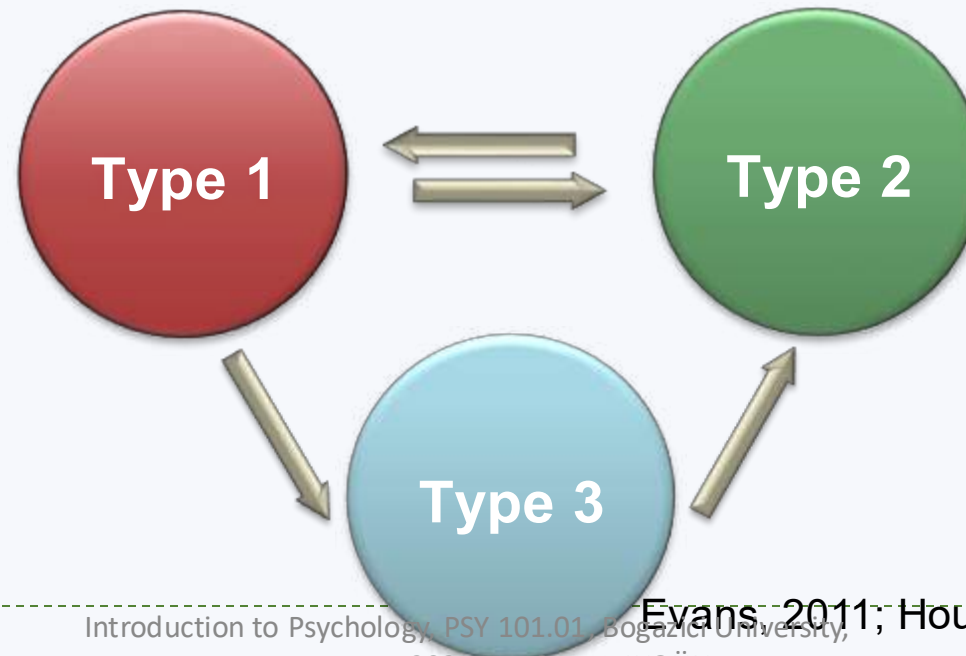
B. Two Types of Reasoning

- Type 1: fast, automatic, requires little effort; and often emotional. Only the end result is conscious.
- Type 2: controlled, requiring sustained effort. They are based on the theories of deductive logic and on the rules of probability
- **How to move from intuitive system 1 to rational system 2? / What cognitive process allows this transition?**



C. Inhibition and reasoning bias

- Cognitive competition between dangerous scheme (Type 1) and logical scheme (Type 2)
 - Type 3 (Evans, 2011; Houdé, 2000): cognitive inhibition
- The optimal strategy consists of (1) inhibition of the dangerous scheme (bias) and (2) activation of the logical scheme

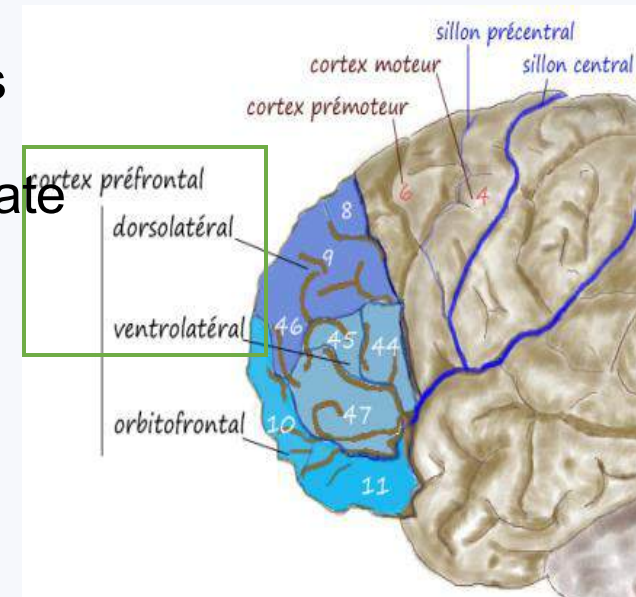


IV. Neurobiological models of decision making

♦ Two systems participate in decision making

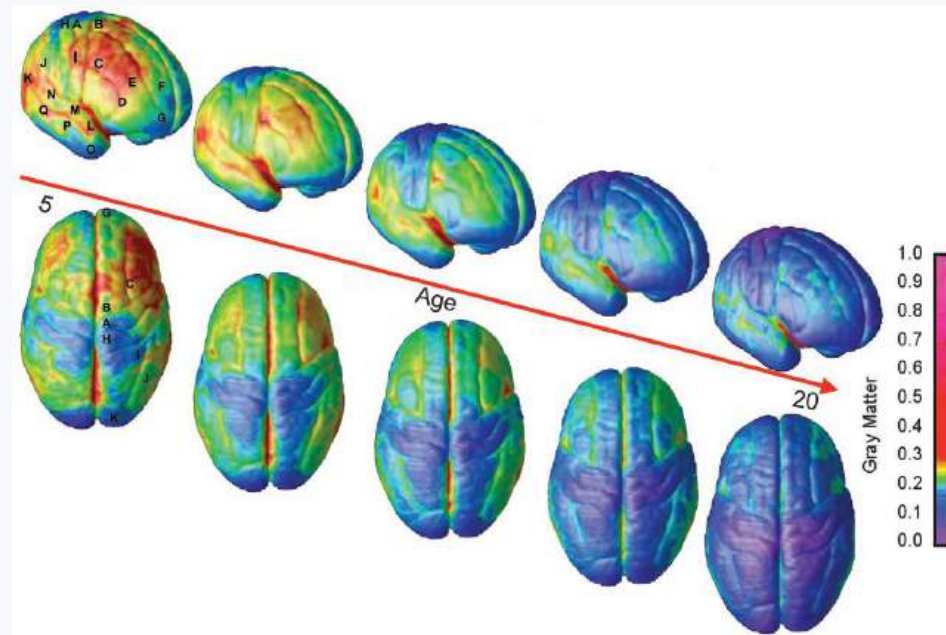
1. The cognitive control system

- Lateral prefrontal cortex
- Processes that allow us to plan our actions and adapt to the surrounding world
- Resistance to automatisms and inappropriate actions and emotions
- Late maturation (=> ~20 years)



IV. Neurobiological models of decision making

- ◆ Two systems participate in the decision making
 - 1. The cognitive control system



Earlier Development of the Accumbens Relative to Orbitofrontal Cortex Might Underlie Risk-Taking Behavior in Teenagers

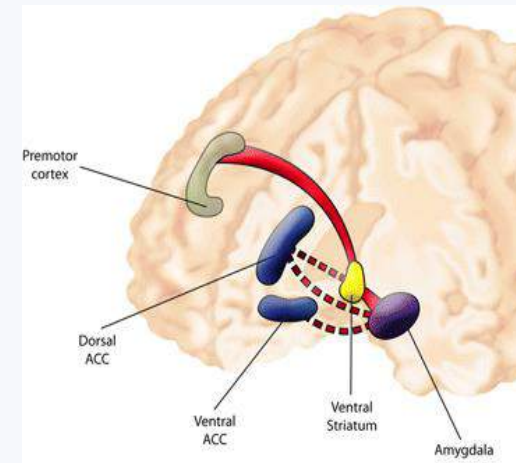
Adriana Galvan,¹ Todd A. Hare,¹ Cindy E. Parra,¹ Jackie Penn,¹ Henning Voss,¹ Gary Glover,² and BJ Casey

Handwritten in Psychology 101, Bogazici University,
summer term 2024, Dr. Oytun AYGÜN

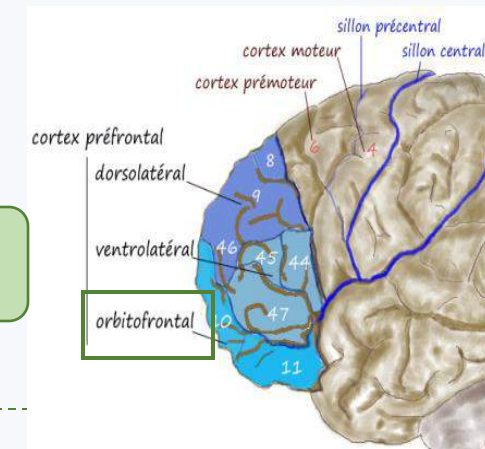
IV. Neurobiological models of decision making

2. The emotional system (limbic regions)

- Ventral striatum (including nuclei accumbens)
 - emotional regulation + sensitivity, anticipation and management of rewards
- Tonsil
- Amygdala
 - Center of fear, processing of emotional stimuli
- Orbitofrontal cortex
 - subjective evaluation and prediction of potential rewards

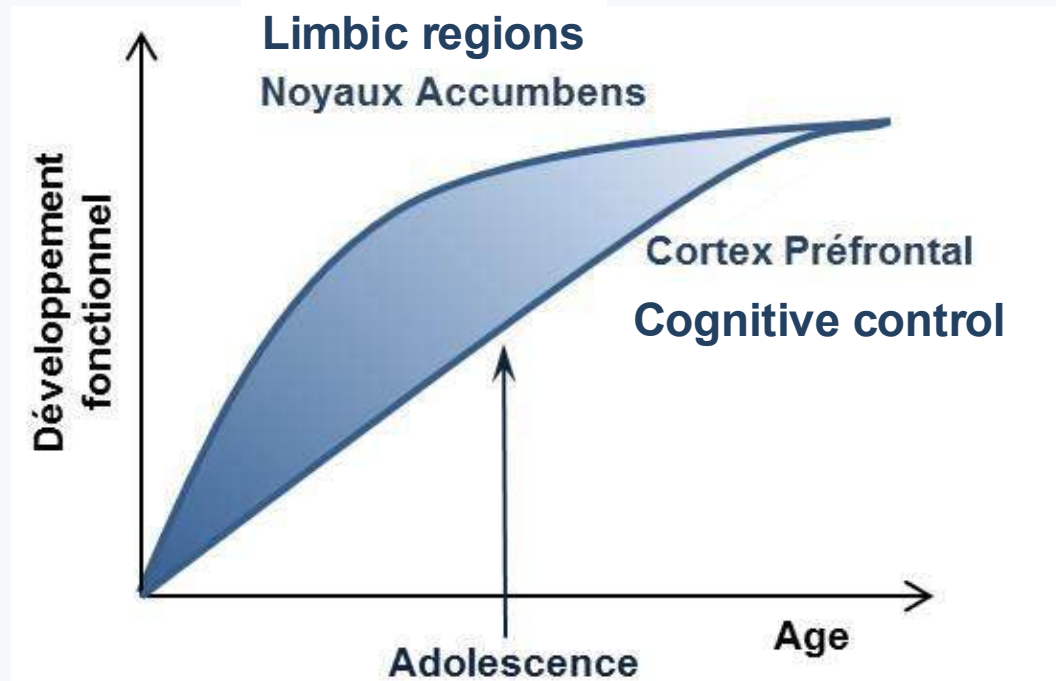


Maturation earlier than the control system



A. Casey, Getz & Galvan(2008)

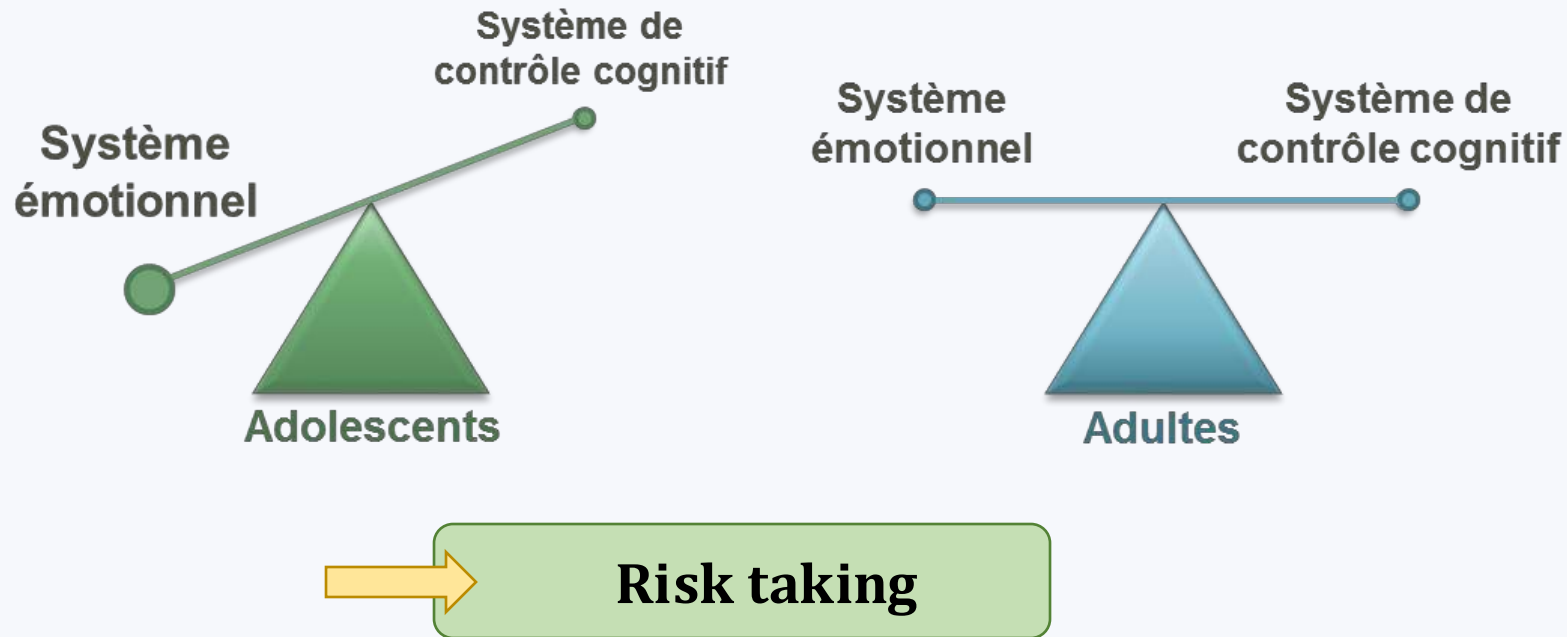
- In adolescence: gap between the maturation of the cognitive control system and the emotional system



During teenagehood:
Increased sensitivity
to rewards
&
Cognitive control
immaturity

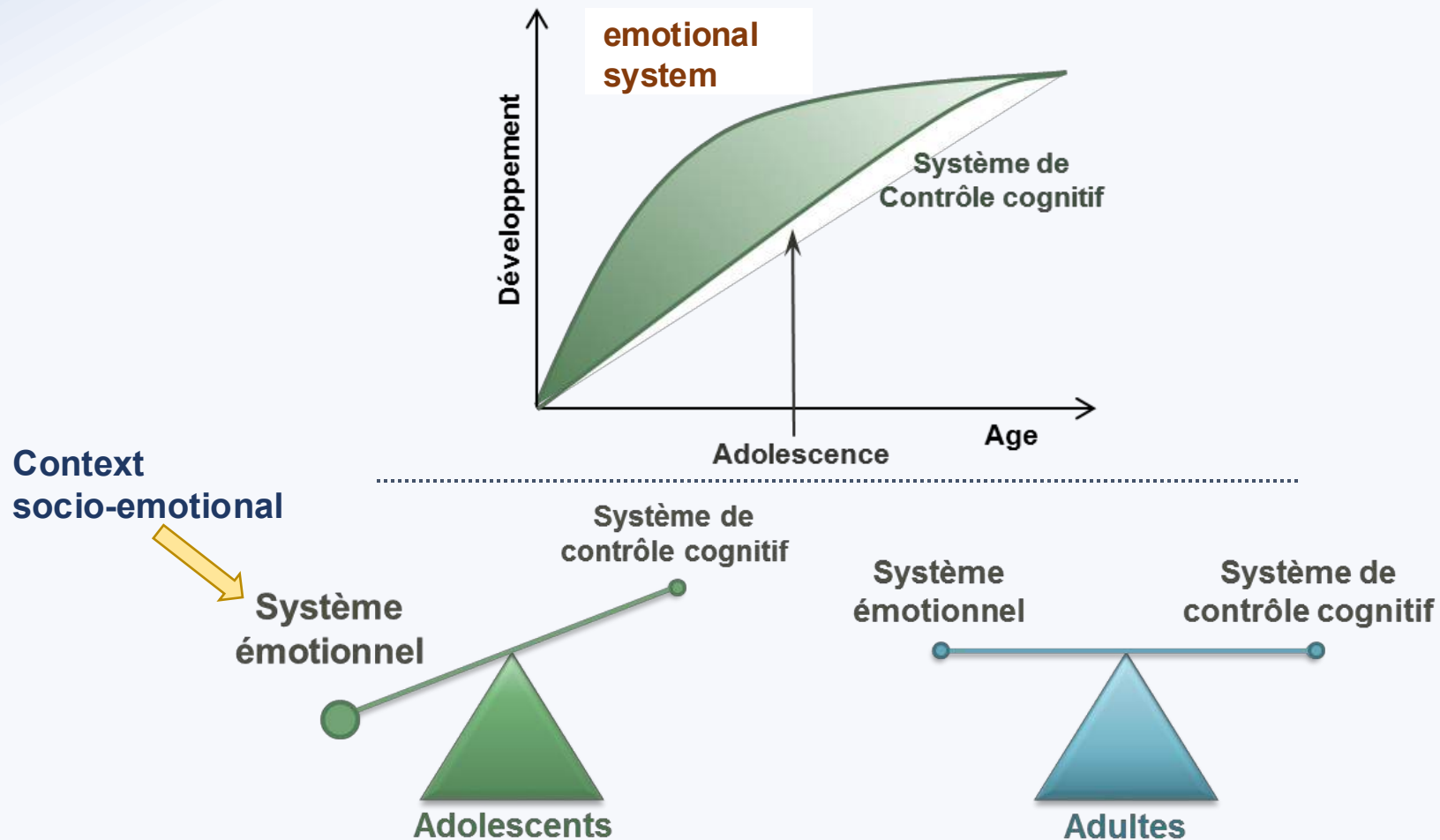
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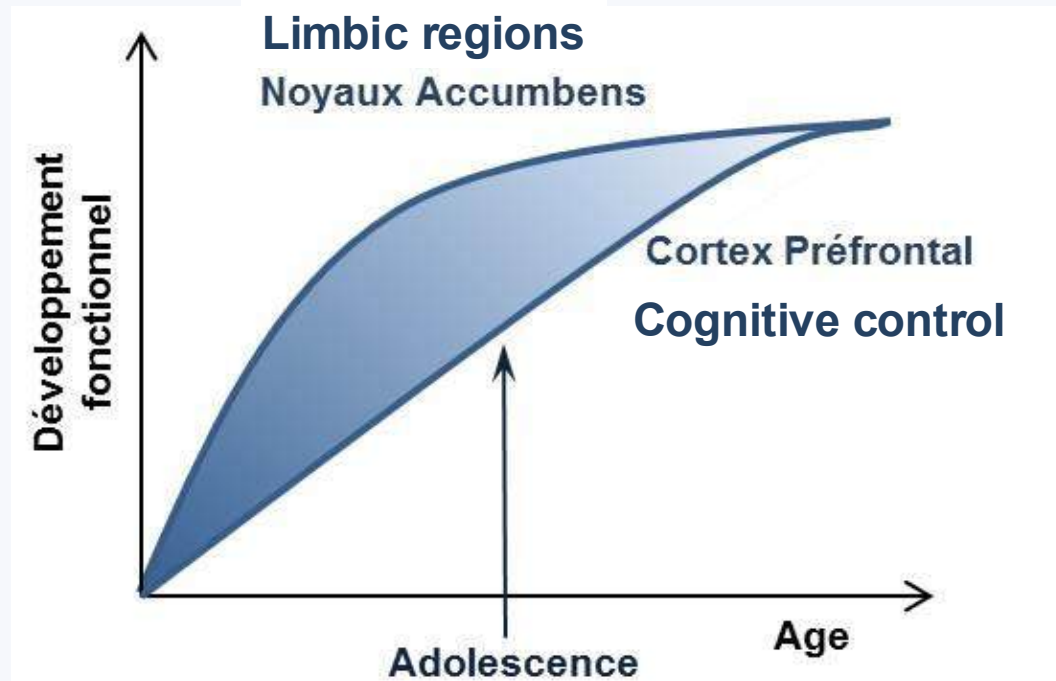
B.Steinberg &Chen(2011)

Consideration of the socio-emotional context



A. Casey, Getz & Galvan(2008)

- In adolescence: gap between the maturation of the cognitive control system and the emotional system



During teenagehood:
Increased sensitivity
to rewards
&
Cognitive control
immaturity

II. Peer influence on preference for immediate rewards

- marshmallow task



~~marshmallow movie~~

II. Peer influence on preference for immediate rewards

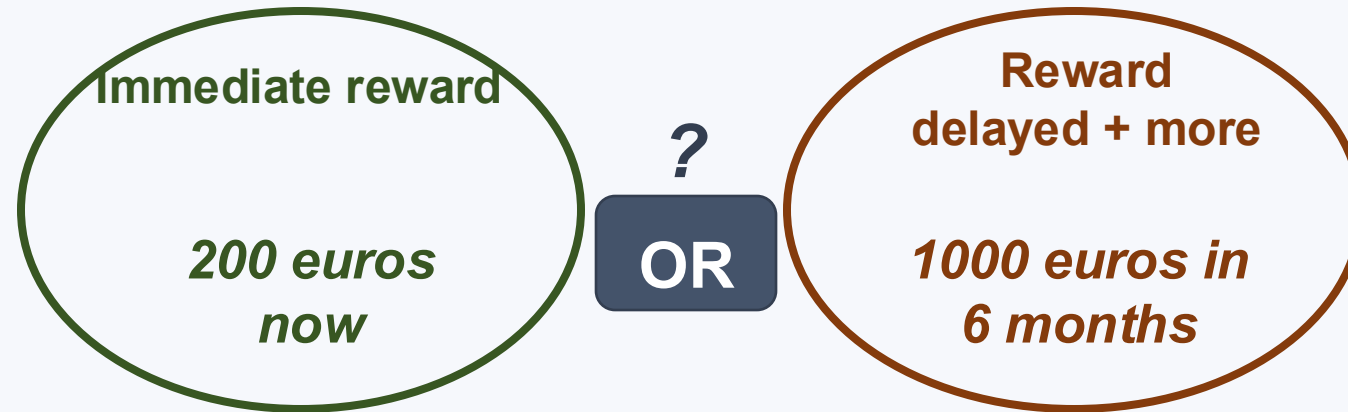
- O'Brien et al., 2011 – **general research question:**
- Through what process(es) does the socio-emotional context affect adolescents' decision-making?
 - Saliency for immediate rewards?
- **Specific question:** Do adolescents show greater sensitivity to immediate rewards in the presence of peers?
- Alternatives?
- Logic ?

II. Peer influence on preference for immediate rewards

- **Method**
- **Population:** *young adults (18-20 years old)*
- 2 groups of subjects
 - Alone
 - vs. in the presence of peers:
 - 2 pairs
 - Authorized Communication

II. Peer influence on preference for immediate rewards

- **Methodology – Delay discounting task**



- Calculation of **point of indifference**= "immediate subjective value" given to the delayed reward
- **Devaluation rate**= degree of devaluation of a reward as a function of the delay

II. Peer influence on preference for immediate rewards

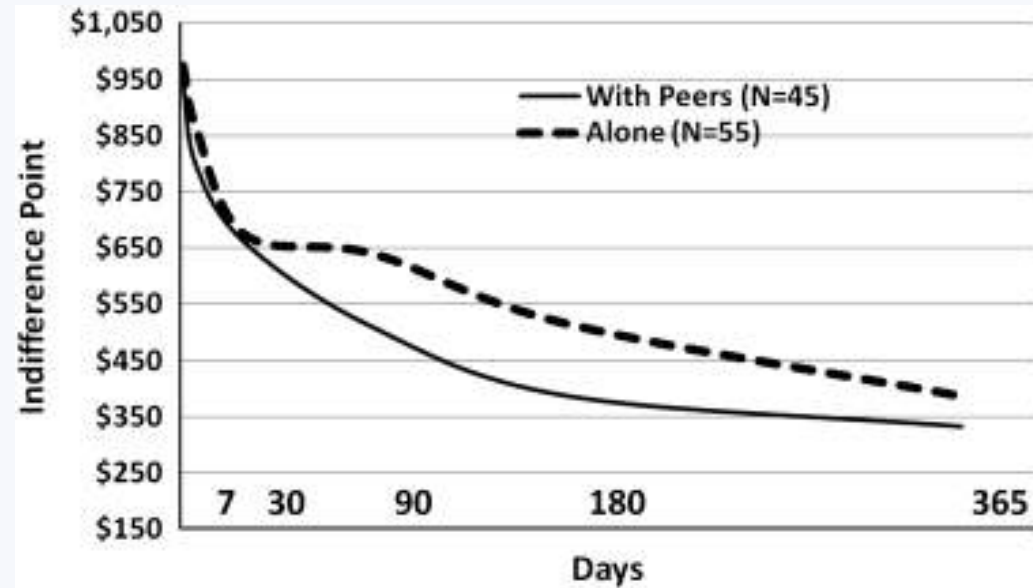
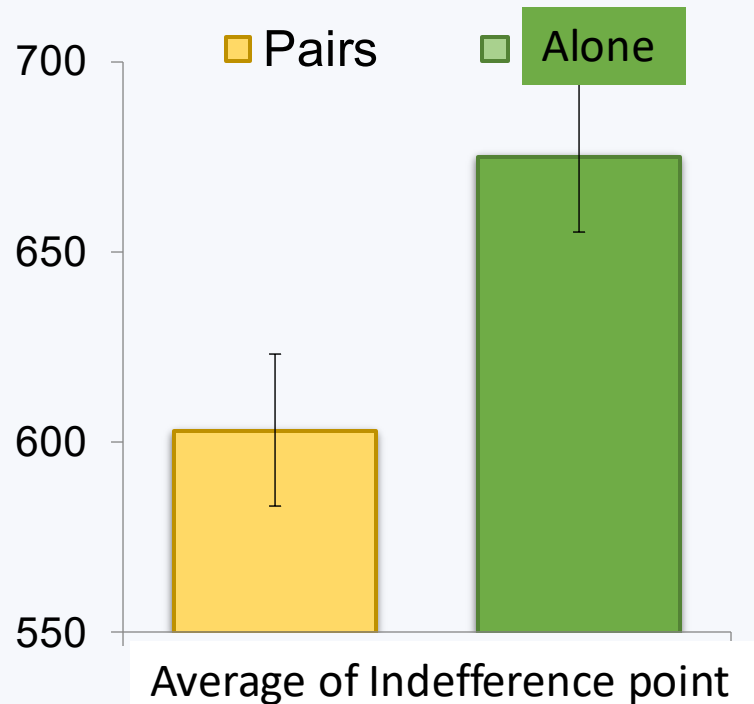
- Example :
 - Indifference point & low devaluation rate = preference for immediate rewards

Today	Or	6 months
200€	⇒	1000€
600€	⇐	1000€
400€	⇒	1000€
500€	⇒	1000€
550€	⇐	1000€
525€	⇒	1000€
538€	⇐	1000€
532€	⇒	1000€
535€	⇐	1000€
534€	⇐	1000€
point of indifference reached = 533€		

II. Peer influence on preference for immediate rewards

Behavioral results

- Indifference point and average devaluation rates



II. Peer influence on preference for immediate rewards

Discussion

- The presence of peers reinforces the preference for immediate rewards and contributes to giving less value to delayed rewards
 - Risk-taking observed in everyday life in adolescence may reflect a preference for immediate rewards
- In accordance with the model of Steinberg & Chen: importance of the socio-emotional context

III. Measuring resistance to peer influence

- Steinberg & Monahan (2007)
- Development of a tool to measure the willingness to resist peer influence
 - Developmental interest
 - Measurement of interindividual variability

III. Measuring resistance to peer influence

- Steinberg & Monahan (2007)
 - For each question, specify the kind of person you agree with more

Some people agree with their friends just to please them.

But

Other people refuse to agree with their friends, even though they know it will make their friends sad.

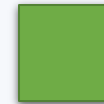
Really true



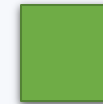
Rather true



Rather true



Really true



III. Measuring resistance to peer influence

- Steinberg & Monahan (2007)
 - For each question, specify the kind of person you agree with more

Some people would be able to commit bad deeds to be on the same side / opinion as their friends

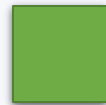
But

Other people wouldn't do bad deeds, even if it's to be on the same side/opinion as their friends

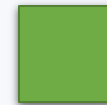
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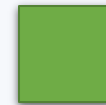
Rather true



Rather true



Really true

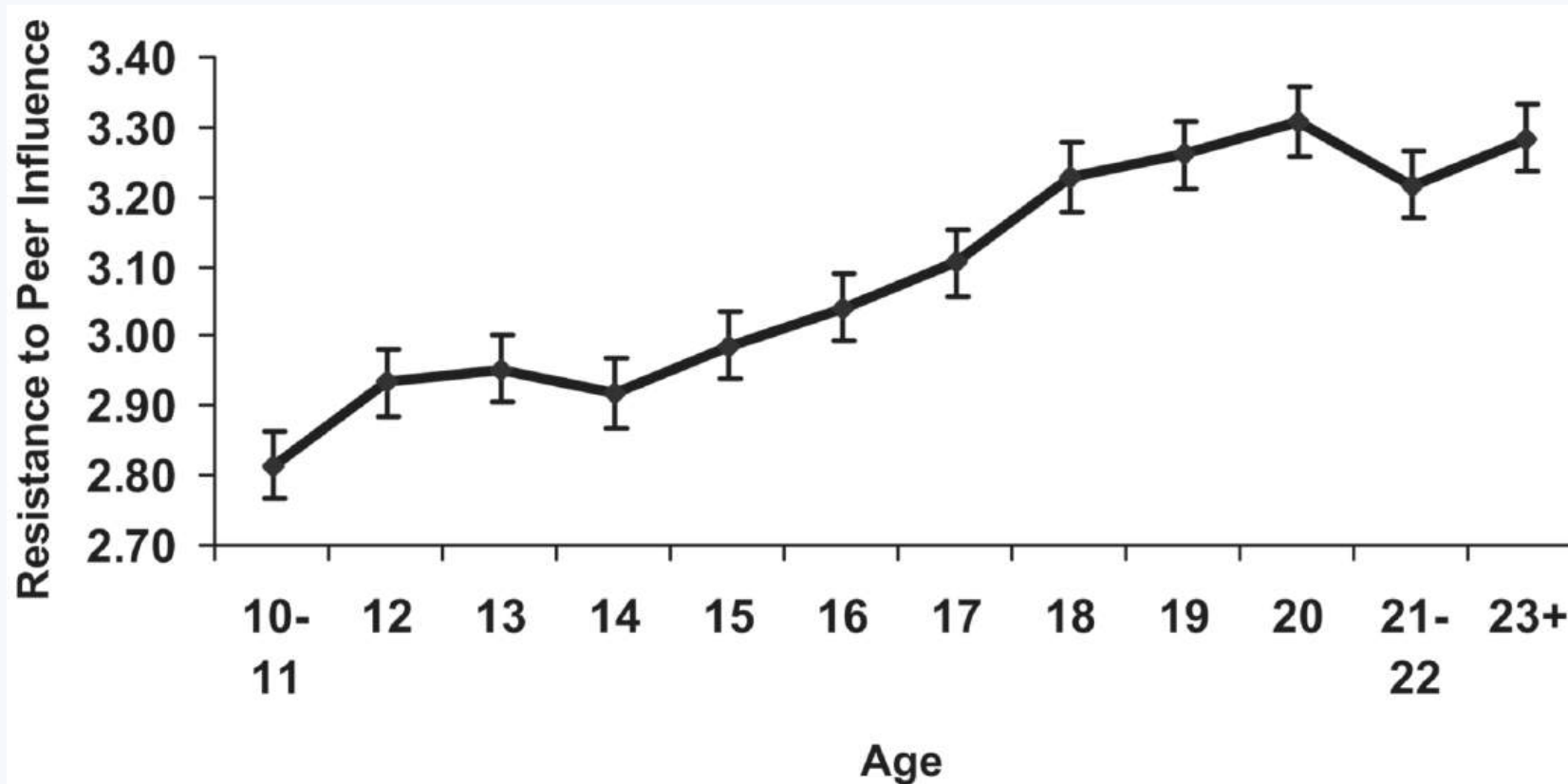


III. Measuring resistance to peer influence

- Steinberg & Monahan (2007)
 - For each question, specify the kind of person you agree with more
- Quoting
 - For each line note the score obtained (from 1 to 4)
 - Attention ! Reversed items: 2, 6 & 10.
 - Calculate the average

III. Measuring resistance to peer influence

- Steinberg & Monahan (2007)
- Developmental pattern



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Let's Begin ...with breathing



V. INFLUENCE OF PEERS ON RISK TAKING

Text study –Chenet al., 2011

V. Influence of peers on risk taking

- **Specific questions**

- Does the presence of peers lead to an increase in risk taking?
- Does this increase in risk-taking reflect an imbalance between the cognitive control system and the emotional system?
 - Can the presence of peers increase the sensitivity of the emotional system to potential rewards?

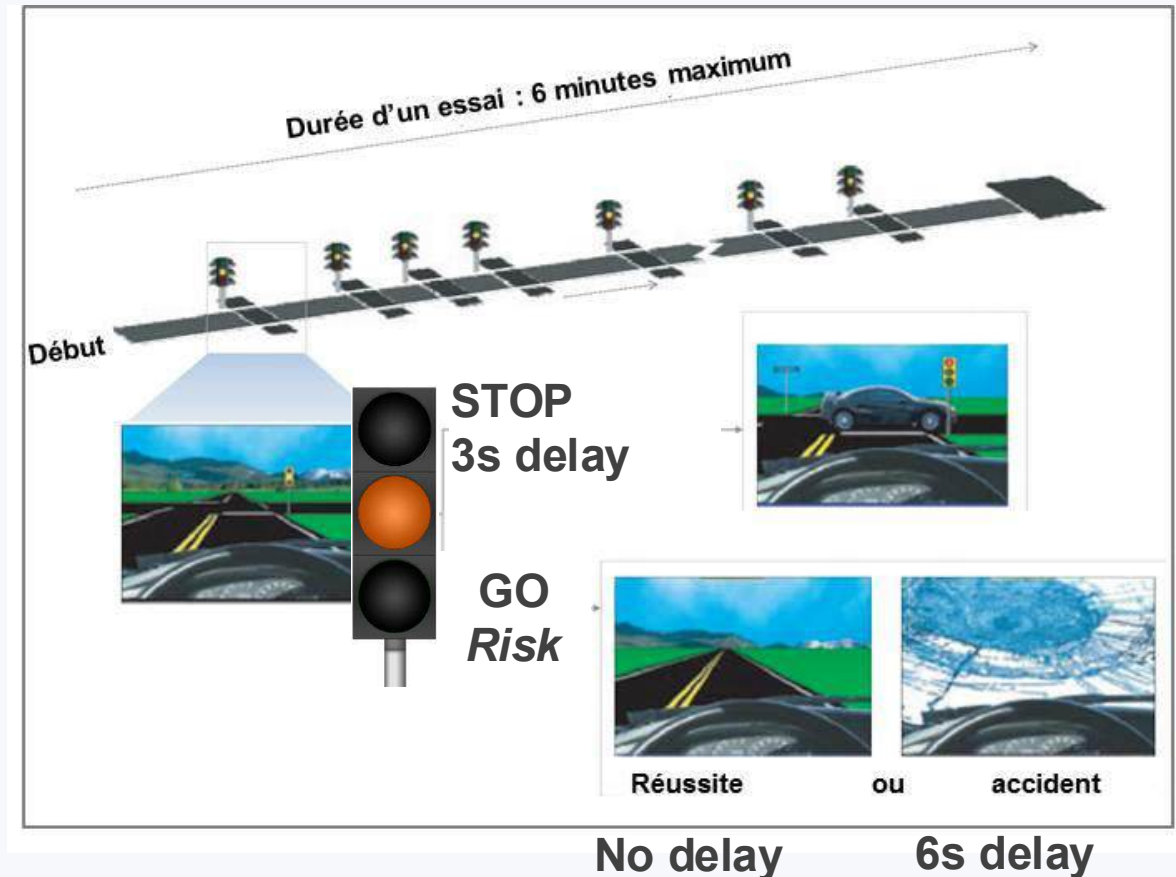
- Alternatives?

V. Influence of peers on risk taking

- Logical?
- If alternative 1 is validated:
 - Teenagers should take more risk in the presence of peers.
 - Regions associated with cognitive control should be less activated in adolescence (immaturity)
 - Regions underlying the emotional system should be more activated in adolescence in the presence of peers only.

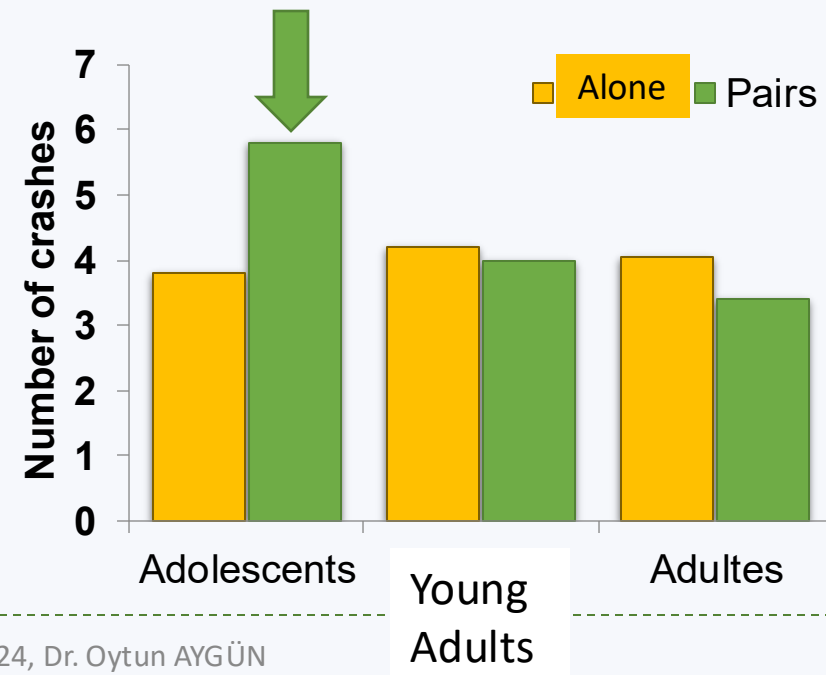
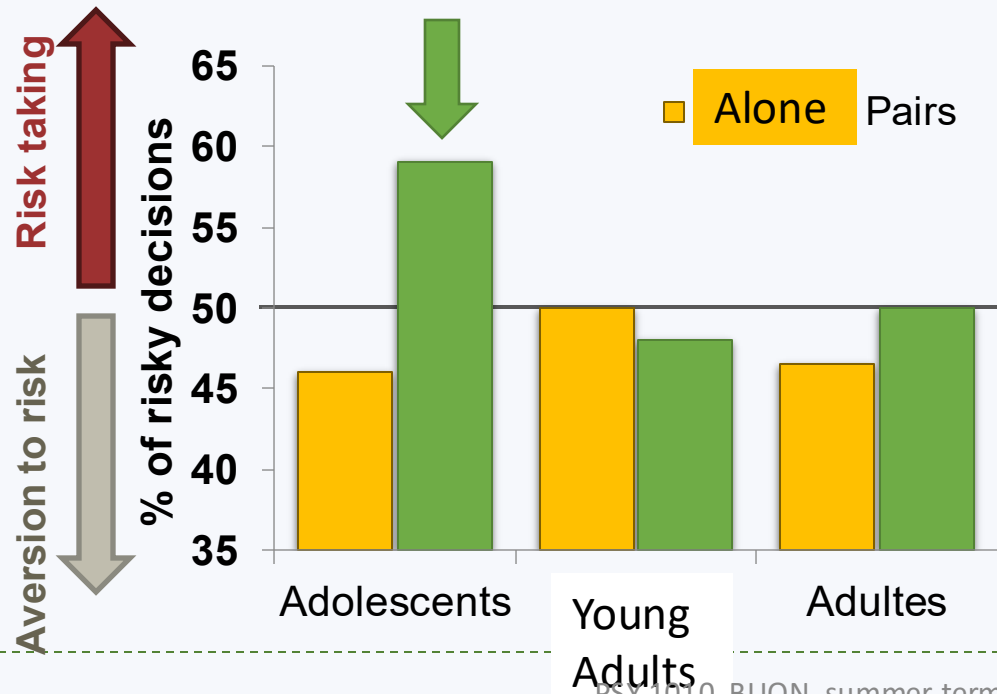
V. Influence of peers on risk taking

- **Method**
- **Attendees**
 - 14-18 years old,
 - 19-22 years old &
 - 24-29 years old
- **Stain** :Car driving simulation (stop light task)
 - The subject earns points when his car moves forward.
- **2 Conditions:** Alone or in the presence of peers



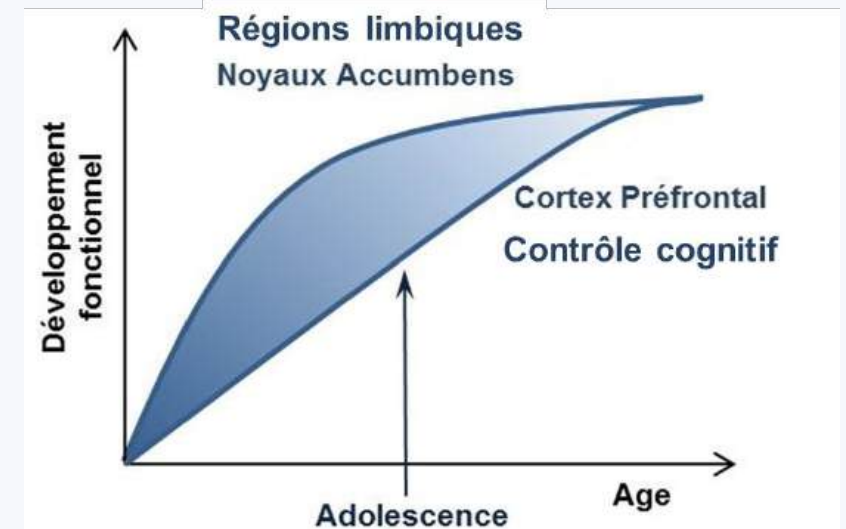
V. Influence of peers on risk taking

- **Results**
- Individual game
 - All ages: low to medium risk taking
- Presence of peers
 - ↗risk taking in adolescence only



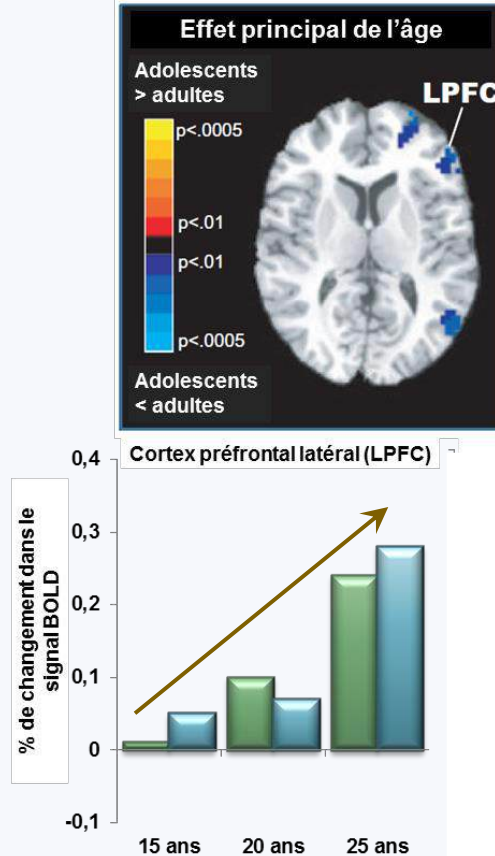
V. Influence of peers on risk taking

- **Reminder:**
- Cognitive control system
 - Prefrontal Cortex (PFC)
- Emotional (motivational) system
 - Ventral striatum (SV) and orbitofrontal cortex (OFC)



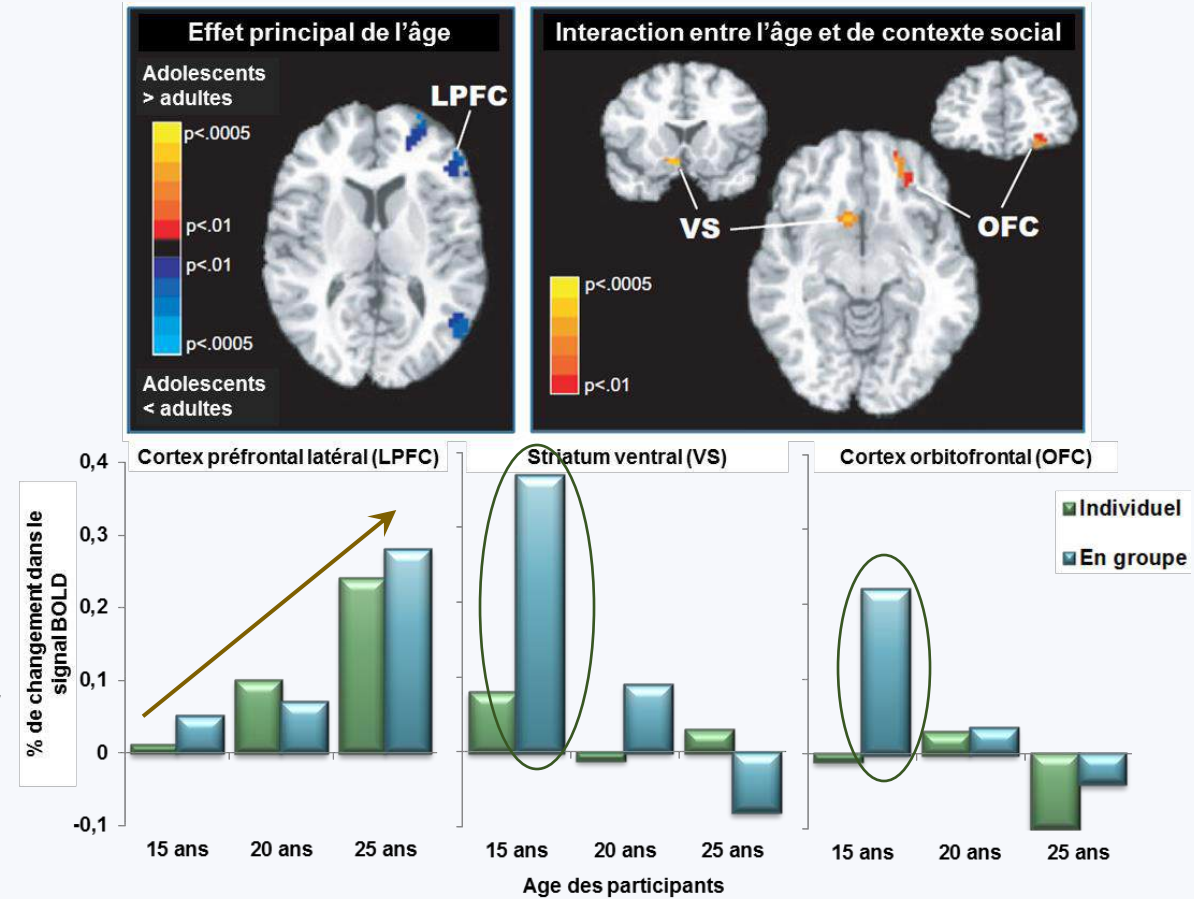
V. Influence of peers on risk taking

- **Results**
- **Lateral PFC**
 - Activation Teens < Adults
 - Not modulated by context



V. Influence of peers on risk taking

- **Results**
- Lateral PFC
 - Activation Teens < Adults
 - Not modulated by context
- VS + OFC
 - Activation Teens > Adults in presence of peers only



V. Influence of peers on risk taking

- **Inferences**
- Teens are more likely to engage in risky behaviors than adults **in the presence of peers**
- Their cognitive control system seems to be less efficient than that of adults
 - But is not susceptible to manipulation of emotional context
- And they seem more sensitive to rewards than adults
- This trend is particularly important when the **socio-emotional context** is salient
 - In this context, the emotional system prevails all the more over the cognitive control system.
 - This leads to an increase in risk taking

In summary !

- In the presence of a socio-emotional context:
 - ↘ cognitive control abilities (less mature system)
 - & 1 Conflict between the emotional system and the control system (Somerville, 2011)
 - ↗ sensitivity to immediate rewards (O'Brien, 2011)
 - ↗ risk taking (stop light task) and greater activation of the emotional system (Chen et al., 2011)
 - ↗ sensitivity to positive emotional items (Somerville, 2011)

In summary !

- All these studies highlight an increased sensitivity of adolescents to rewards in a socio-emotional context.
- What about sensitivity to loss and reactivity to negative emotions?