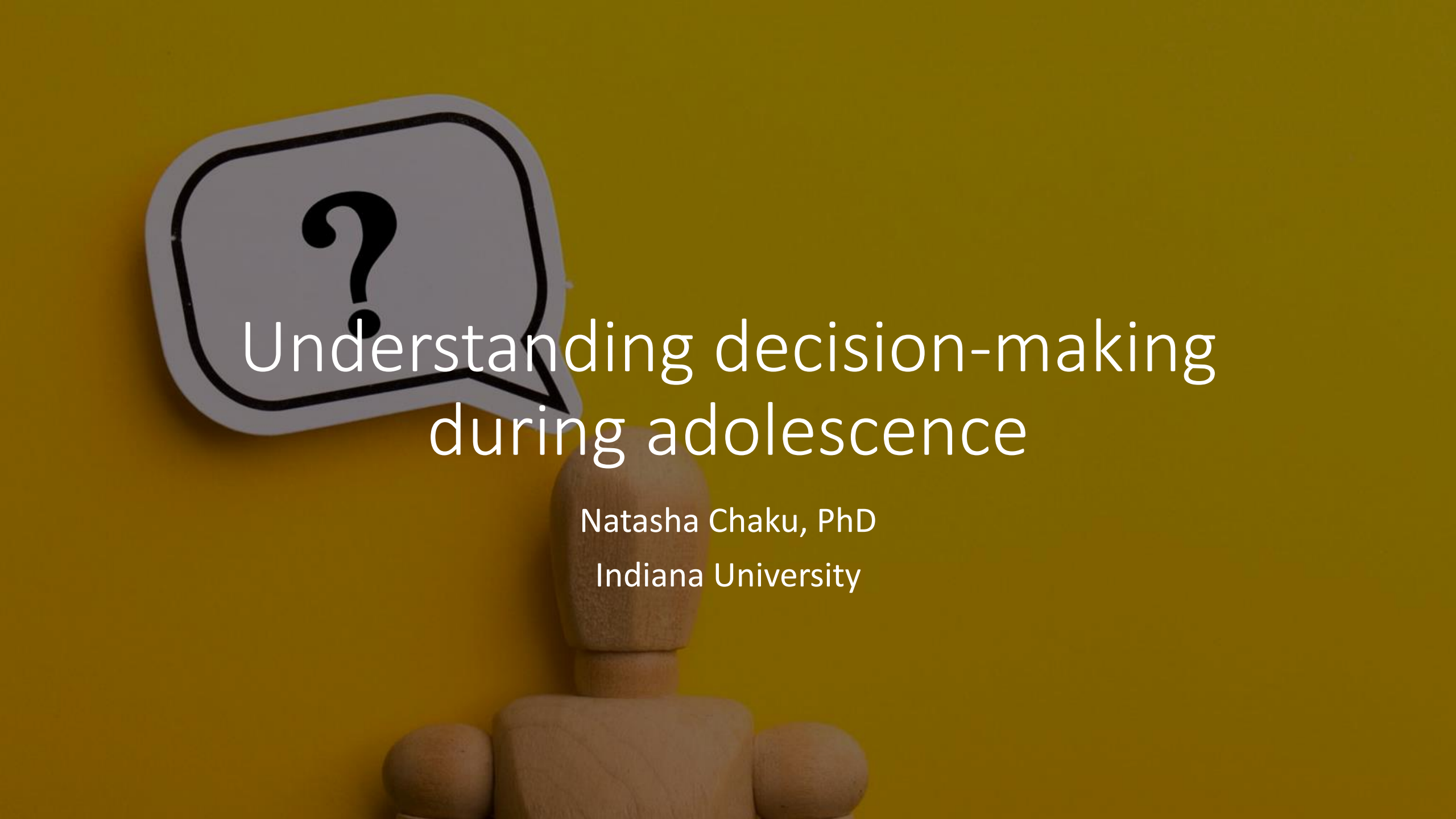


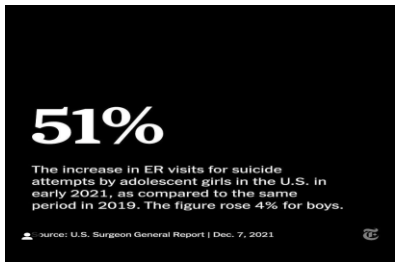
Understanding decision-making during adolescence

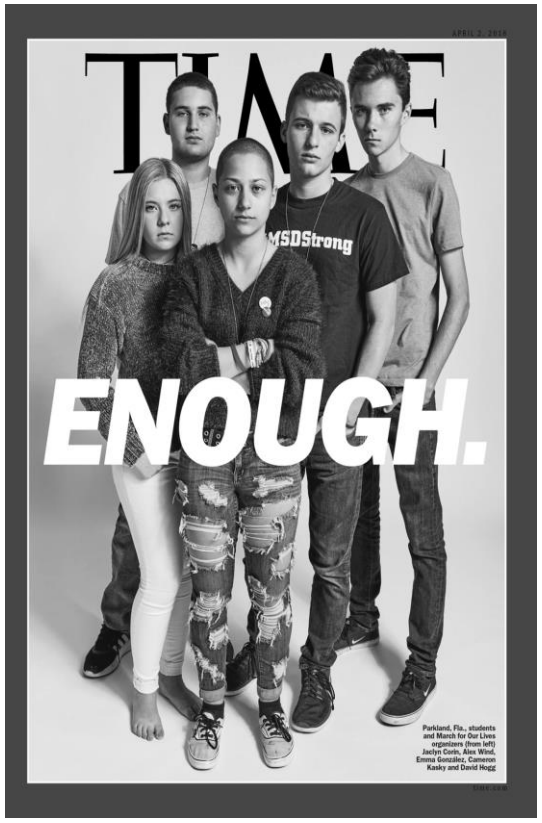
Natasha Chaku, PhD

Indiana University

Adolescence

Unique developmental period characterized by risk…



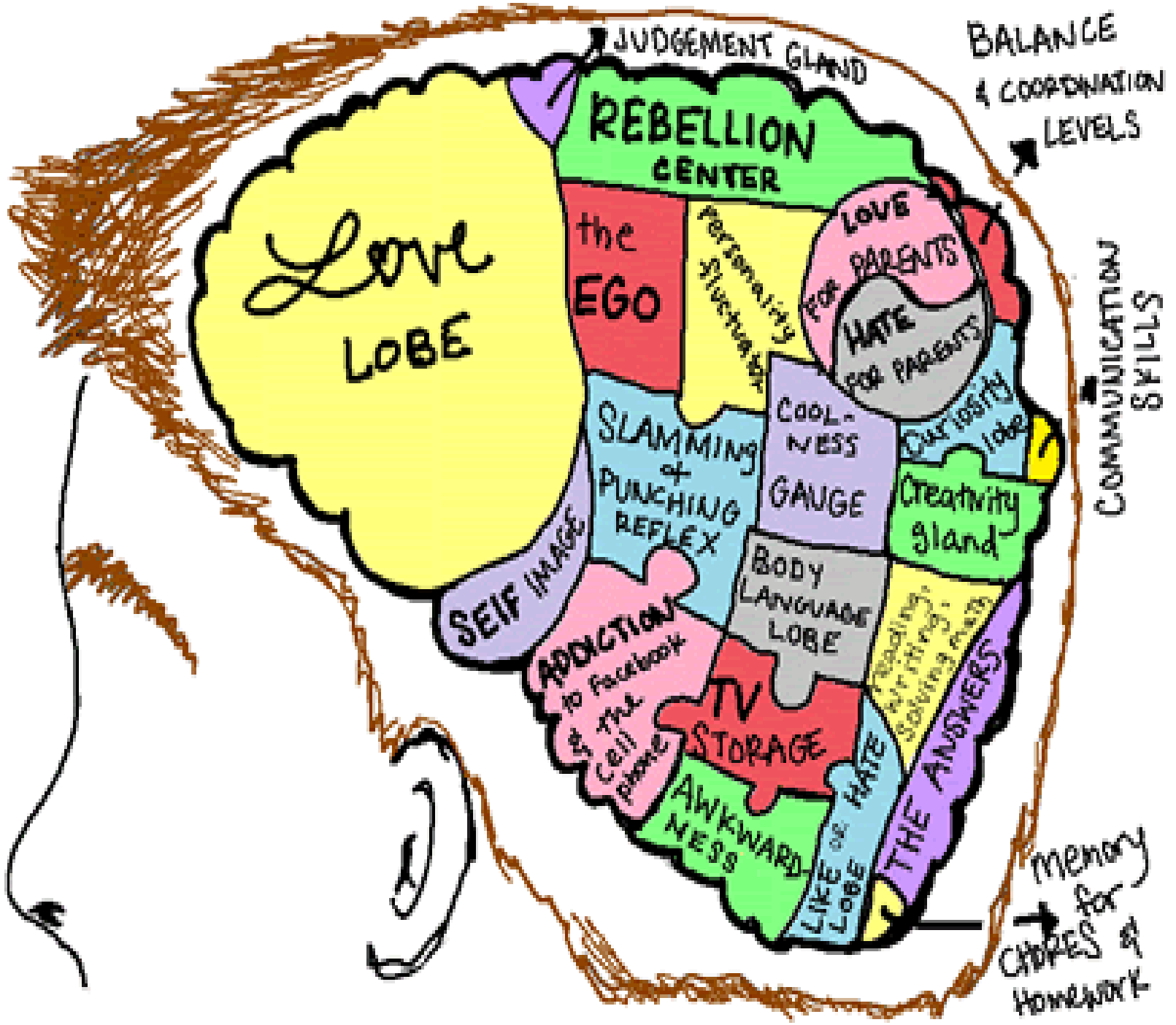


Crone & Dahl, 2012

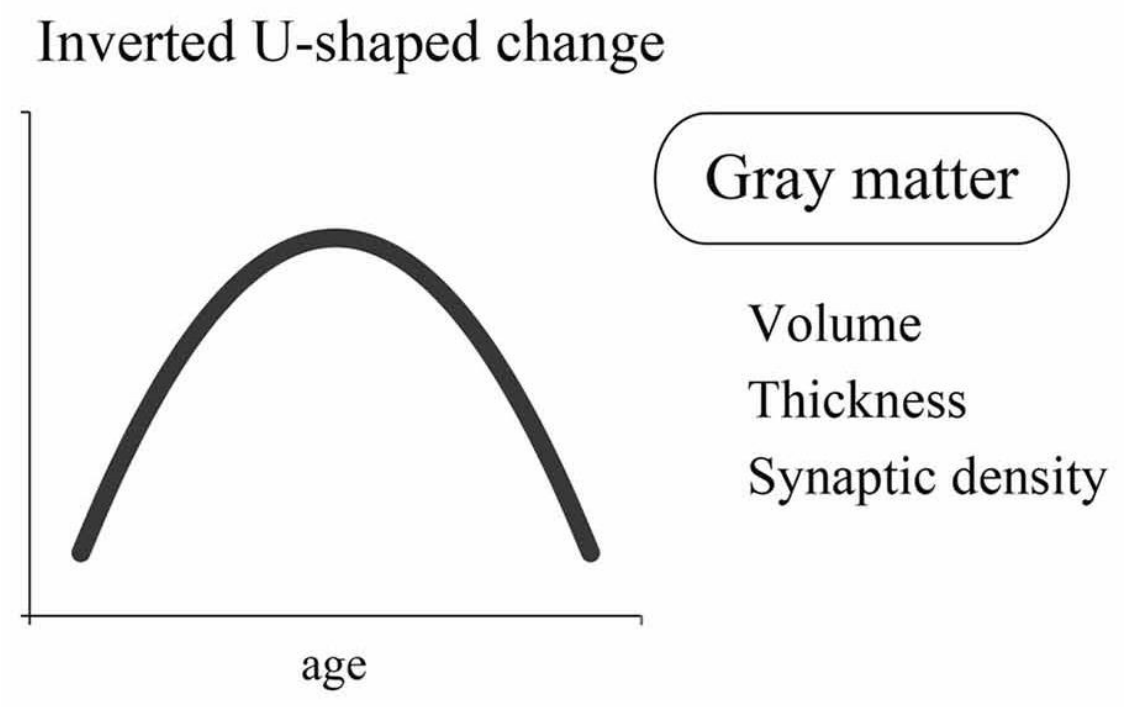
…and **opportunity**

Crone & Dahl, 2012

THE AVERAGE TEENAGE BRAIN

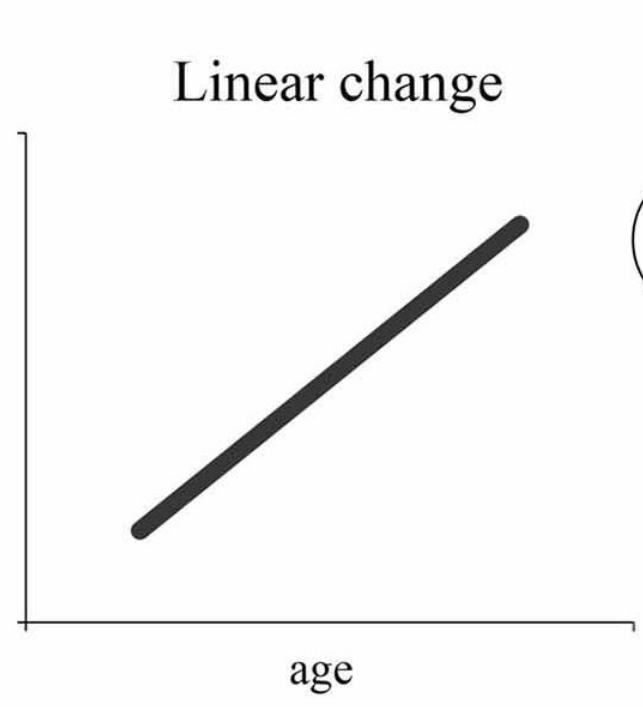


Puberty “rewires” the adolescent brain



Gray matter

Volume
Thickness
Synaptic density



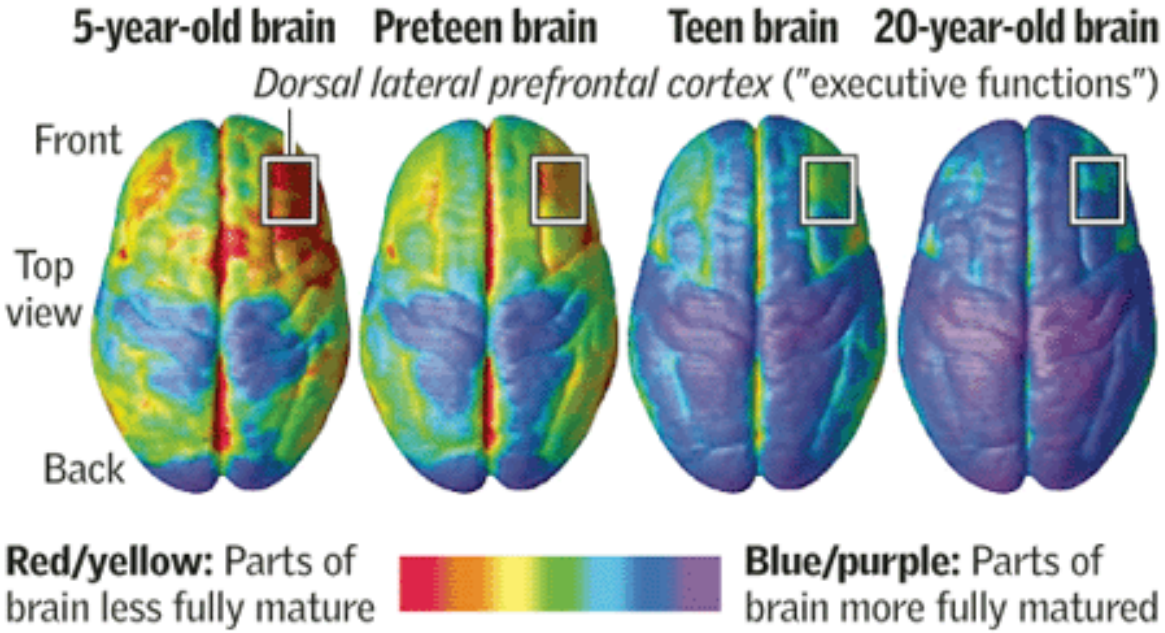
White matter

Volume
Myelination

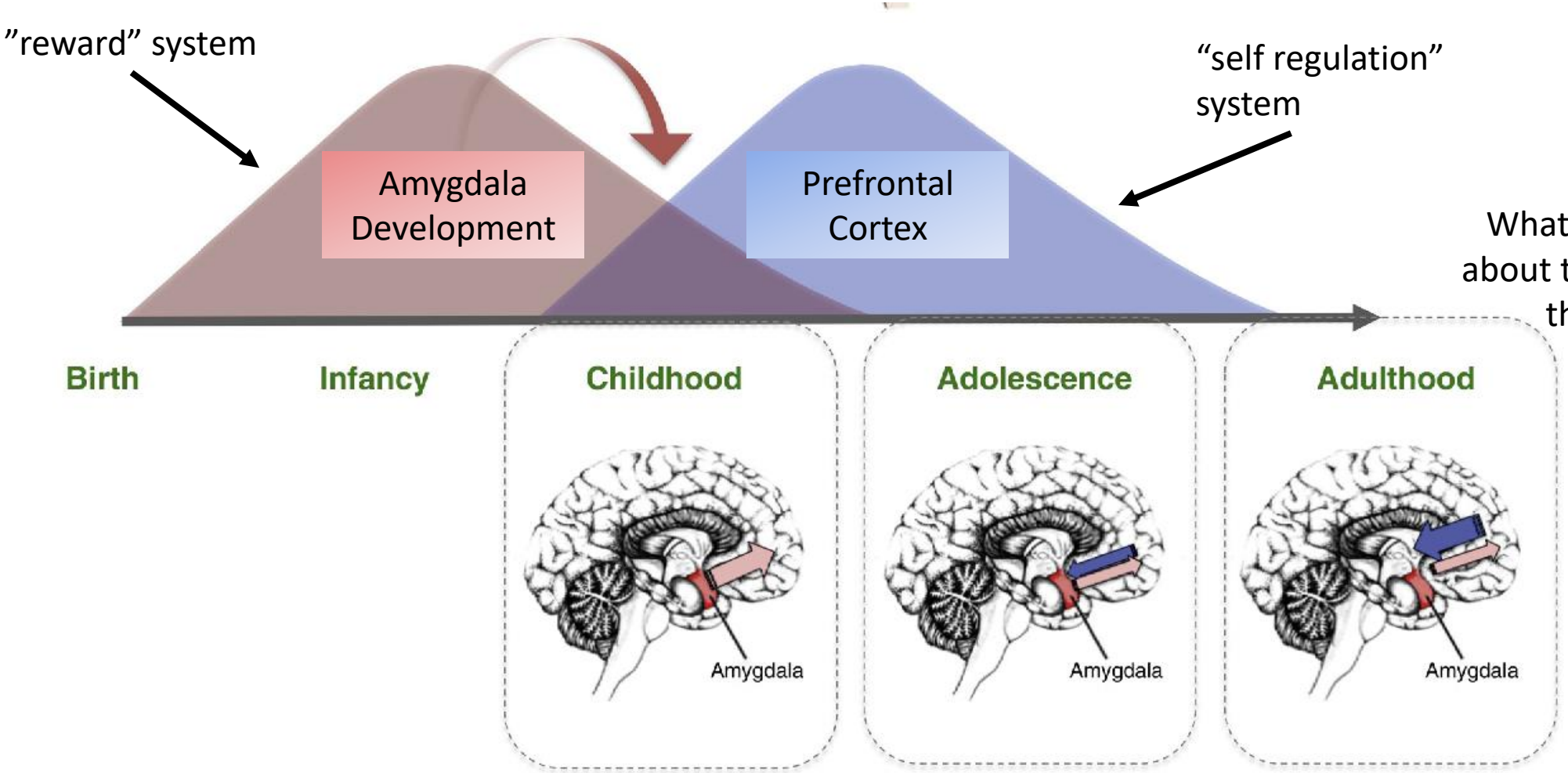
And are generally associated with cognitive development, improvements in logical reasoning, and abstract thinking

Different parts of the brain “develop” at different rates

Developmental processes tend to occur in the brain from back-to-front

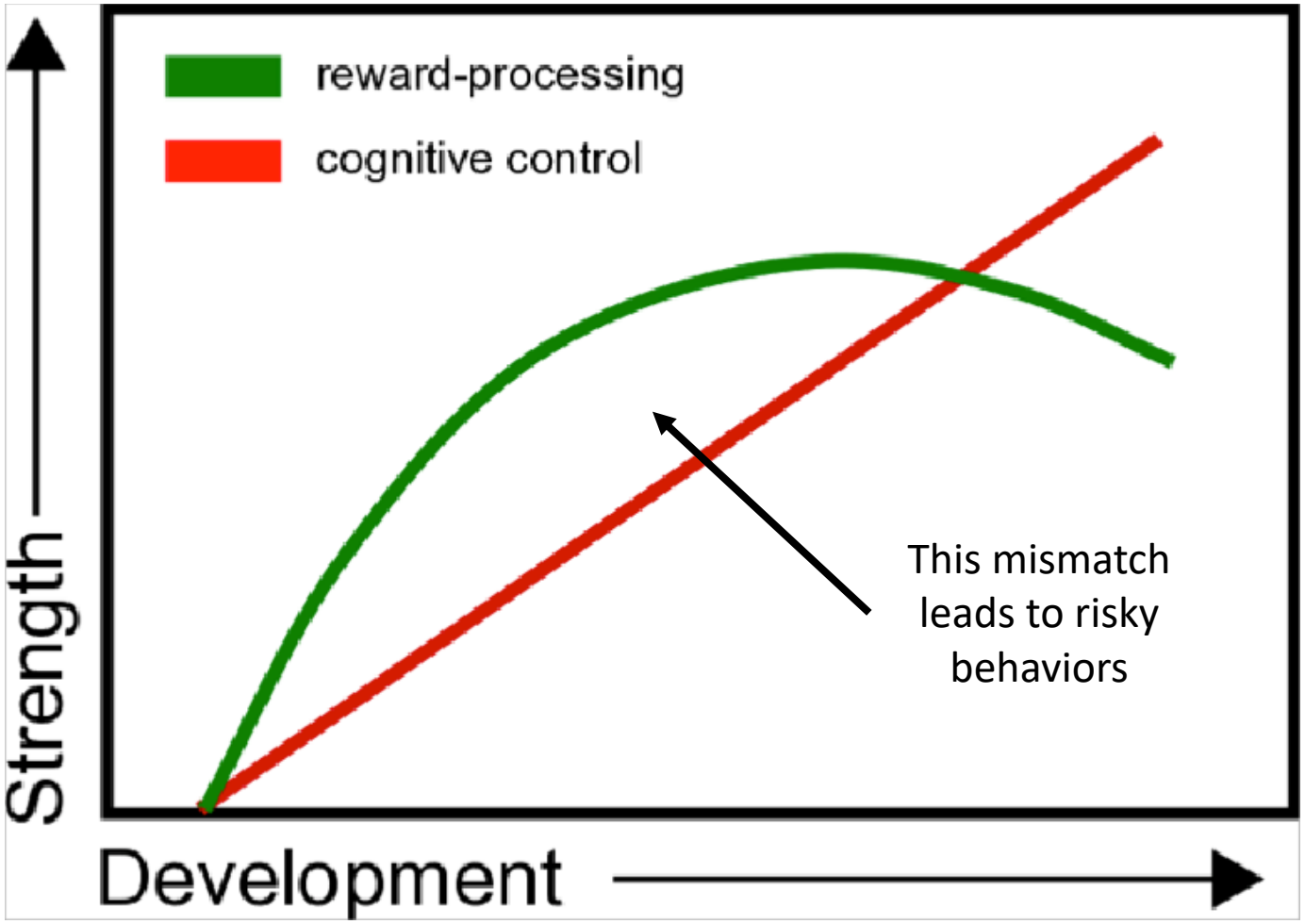


Specifically, the limbic system ‘develops’ before the prefrontal lobes



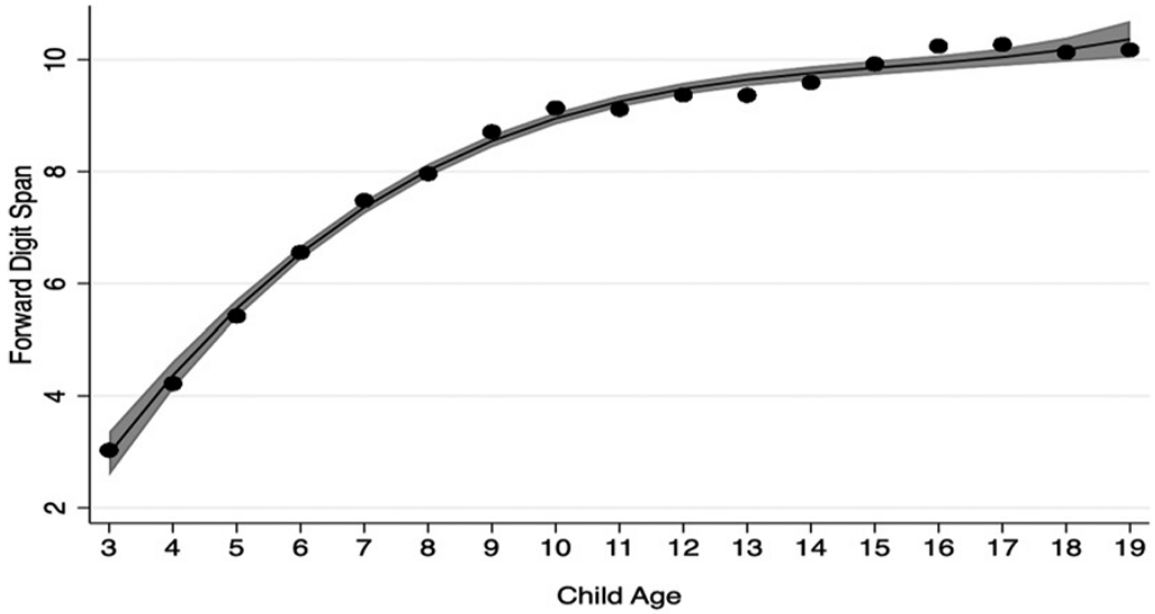
Dual systems hypotheses:

A more responsive, mature limbic system paired with a less mature prefrontal cortex creates a developmental mismatch



But is it true?

- Overall, evidence is limited/ inconsistent
- Adolescents have similar cognitive skills as adults
  → If that's true, why are we calling the prefrontal lobes "immature"?
- They also evaluate risks very similarly to adults
- But in real life, they tend to take more risks



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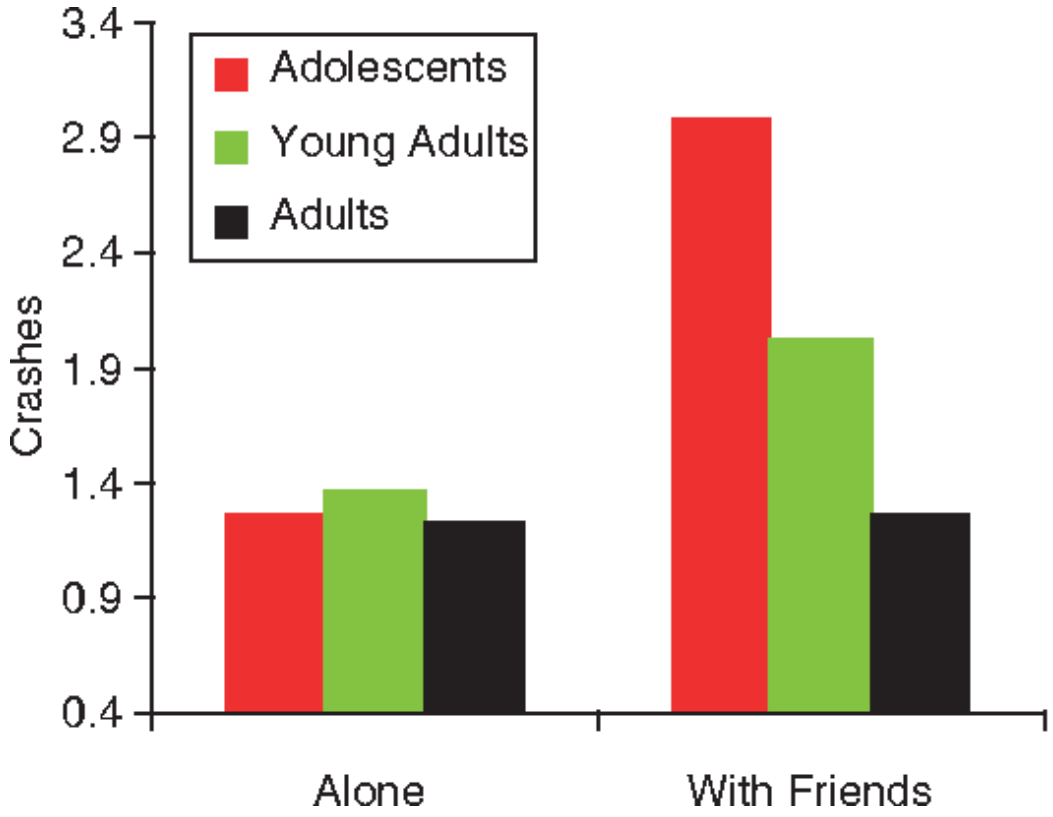

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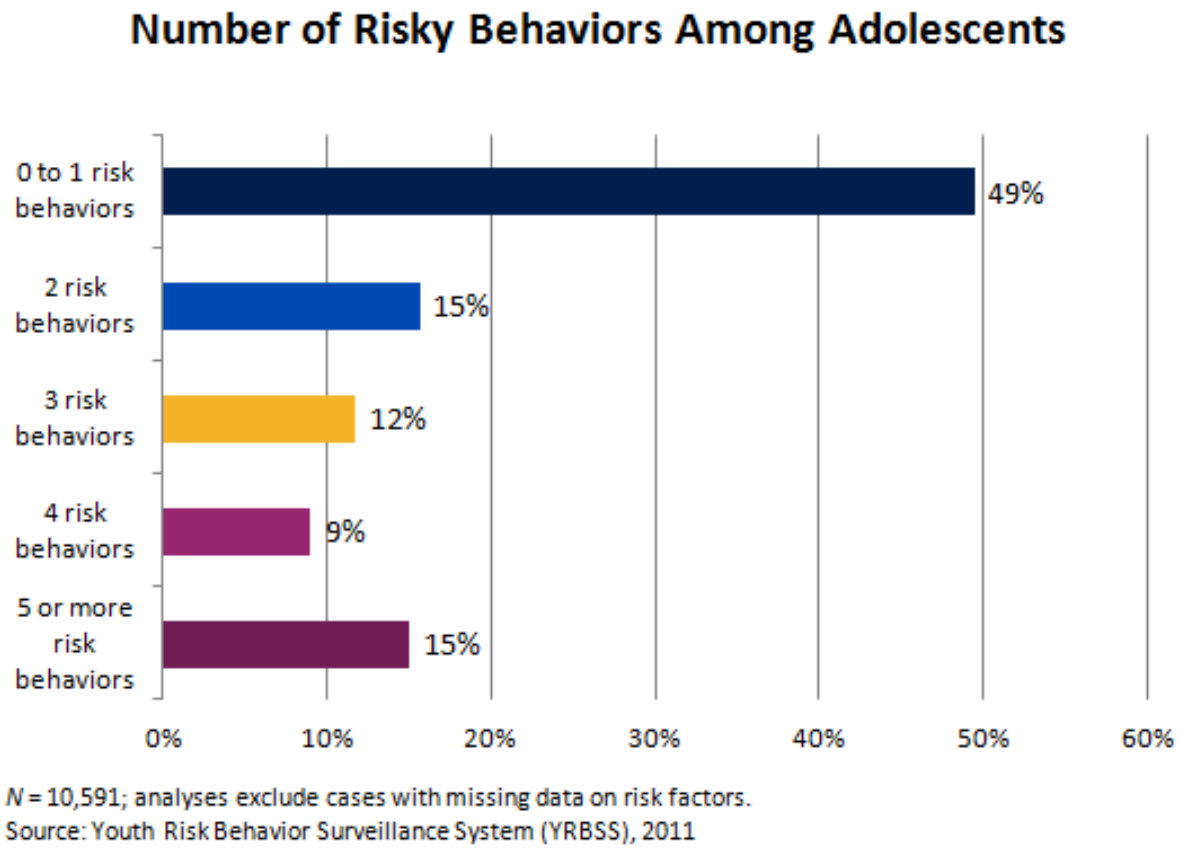
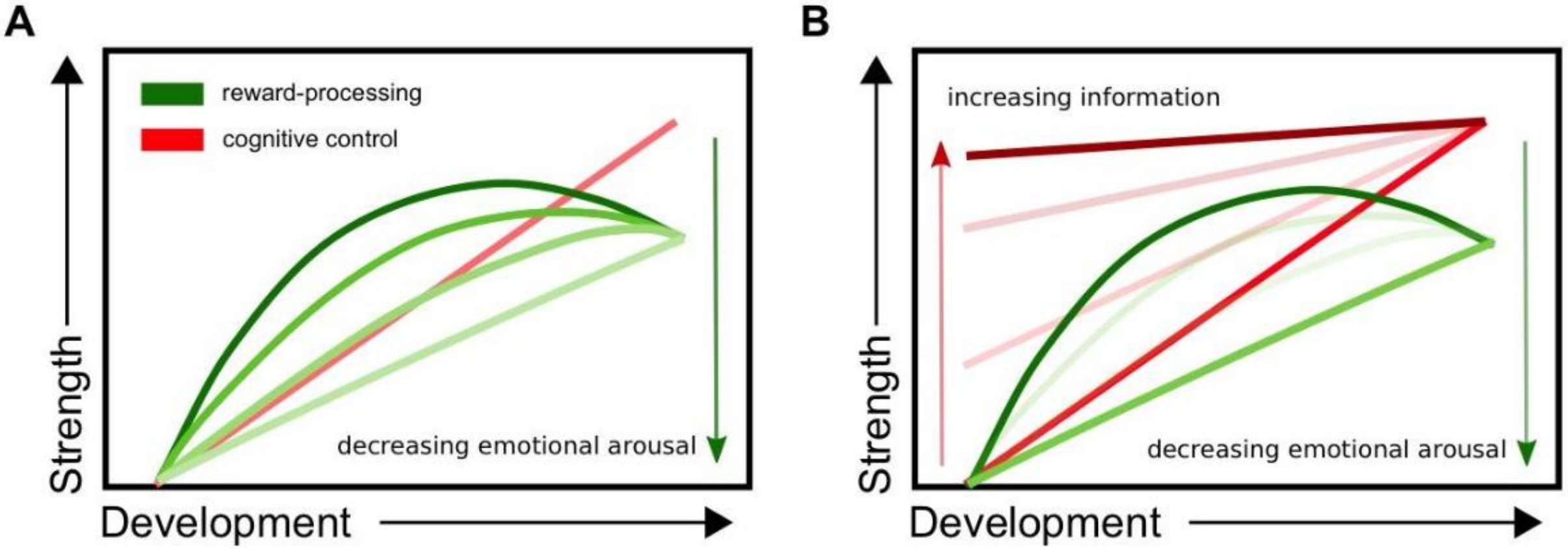


Newer theories prioritize interconnections between brain regions and understanding contextual demands



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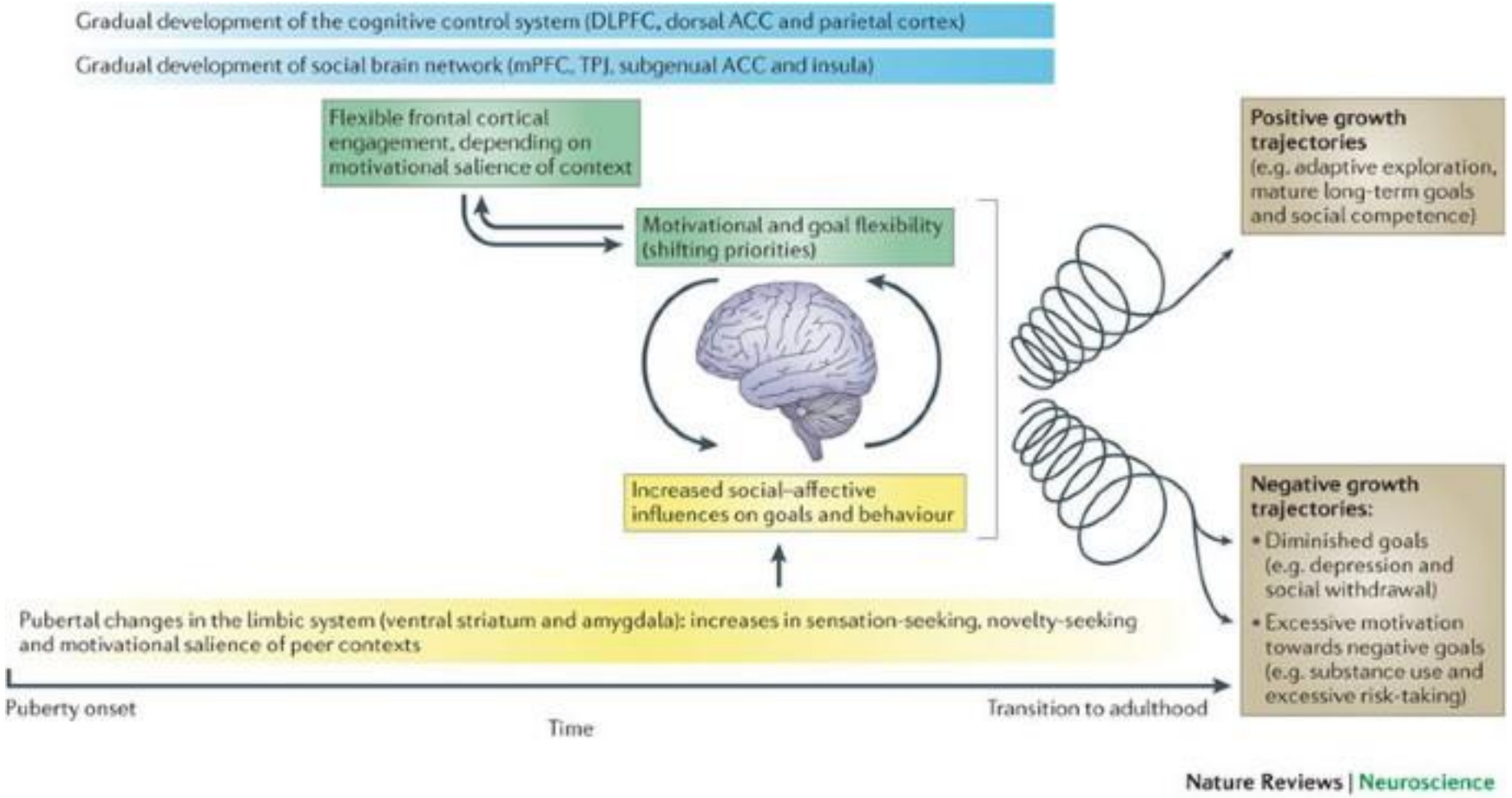
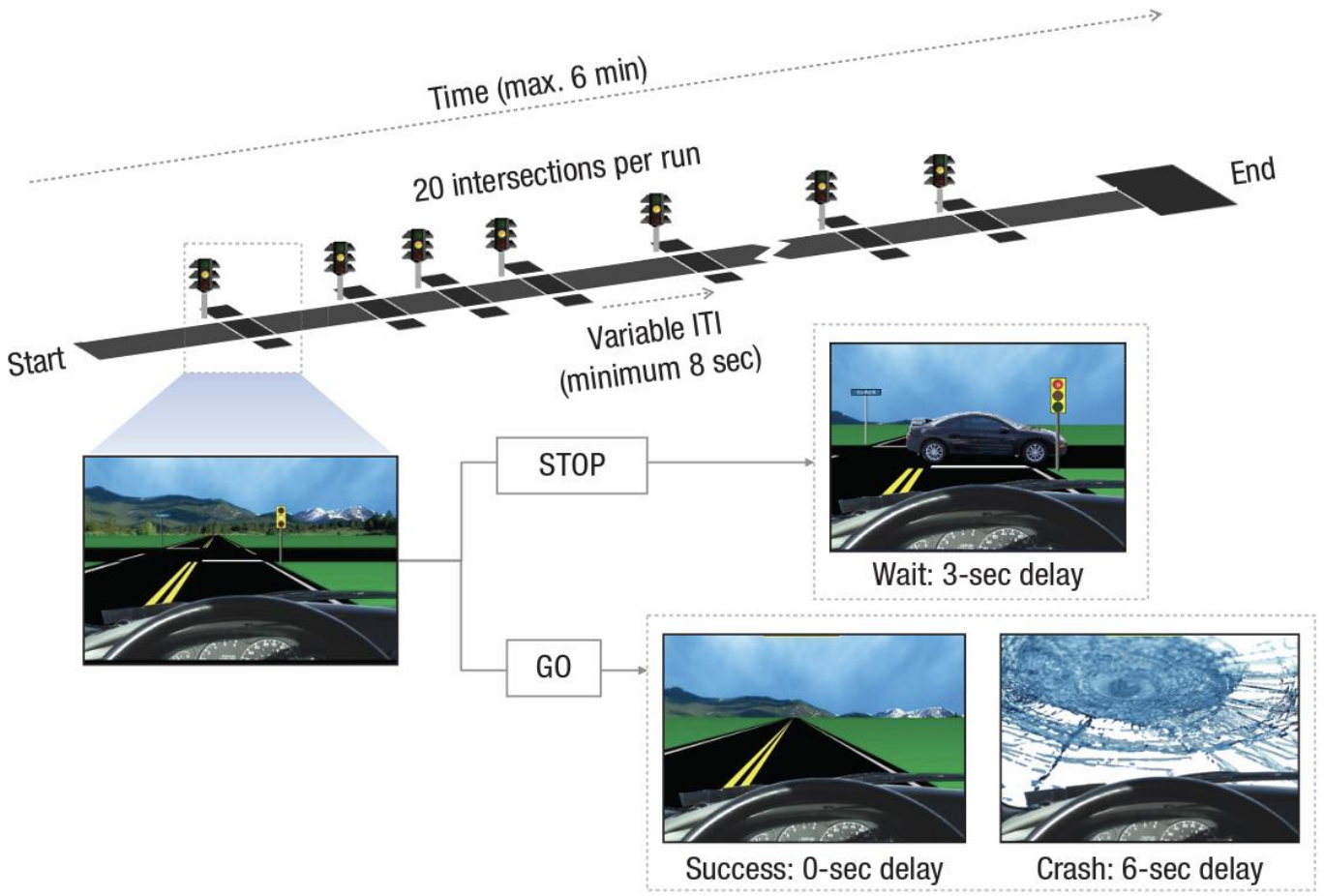
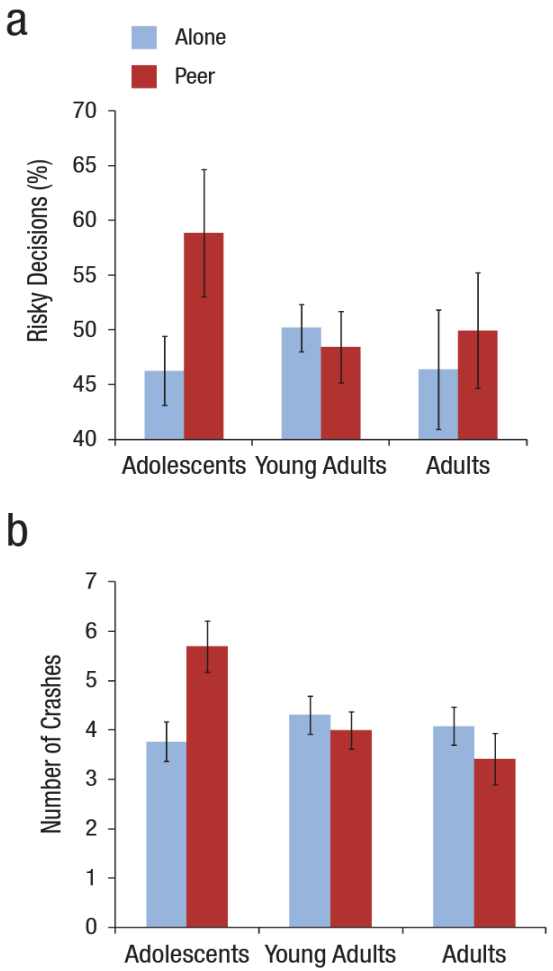
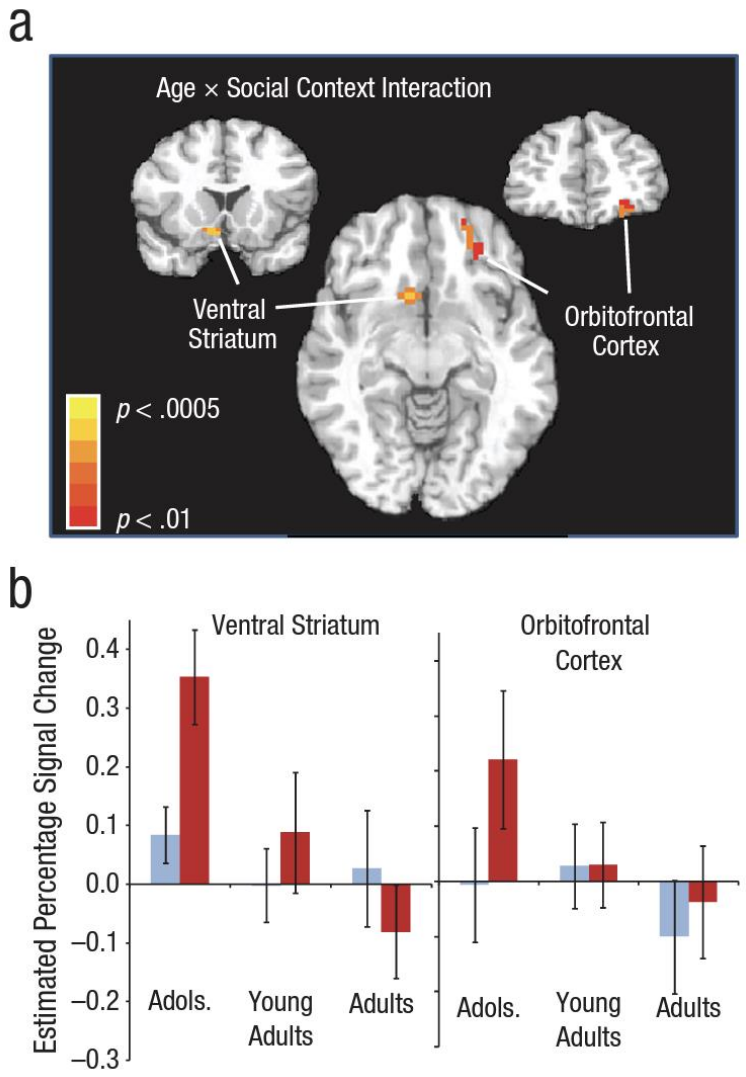


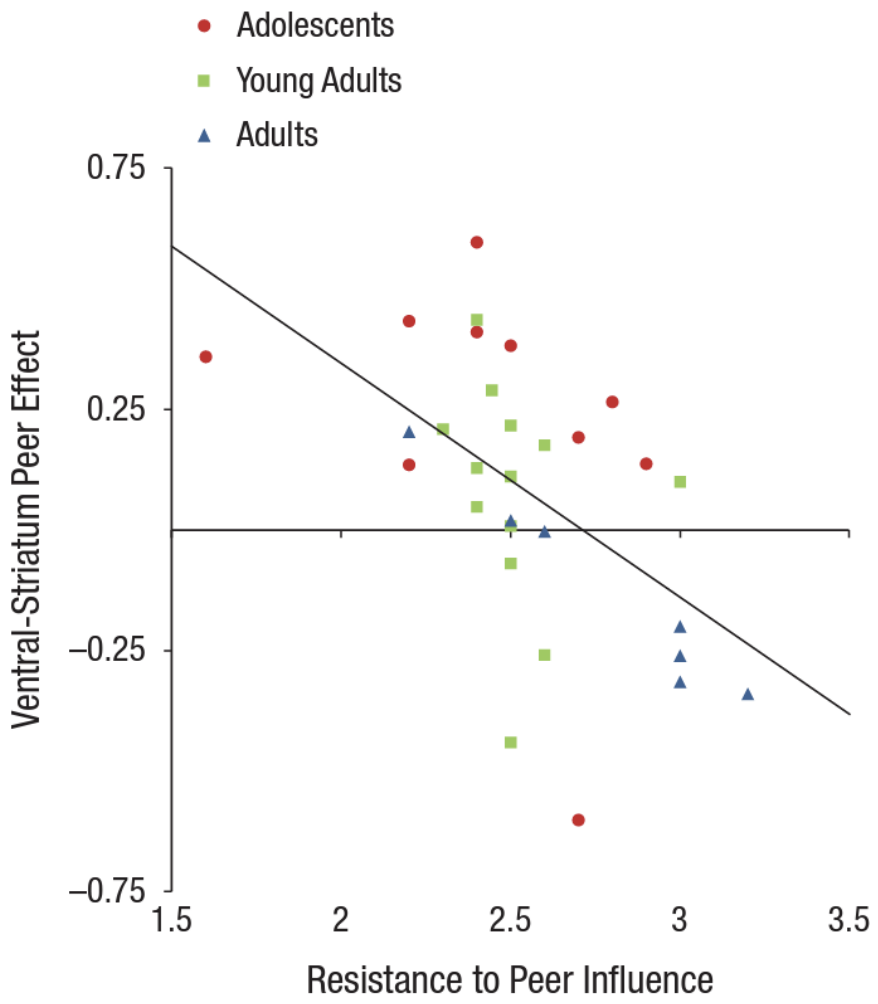
For example…


Time (max. 6 min)
20 intersections per run
End
Start
Variable ITI
(minimum 8 sec)
STOP
GO
Wait: 3-sec delay
Success: 0-sec delay
Crash: 6-sec delay


a
Alone
Peer
Risky Decisions (%)
70
65
60
55
50
45
40
Adolescents
Young Adults
Adults
b
Number of Crashes
7
6
5
4
3
2
1
0
Adolescents
Young Adults
Adults

For example…


a
Age × Social Context Interaction
Ventral Striatum
Orbitofrontal Cortex
p < .0005
p < .01
b
Ventral Striatum
Orbitofrontal Cortex
Estimated Percentage Signal Change
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
Adols.
Young Adults
Adults
Adols.
Young Adults
Adults


Adolescents
Young Adults
Adults
Ventral-Striatum Peer Effect
0.75
0.25
−0.25
−0.75
1.5
2
2.5
3
3.5
Resistance to Peer Influence

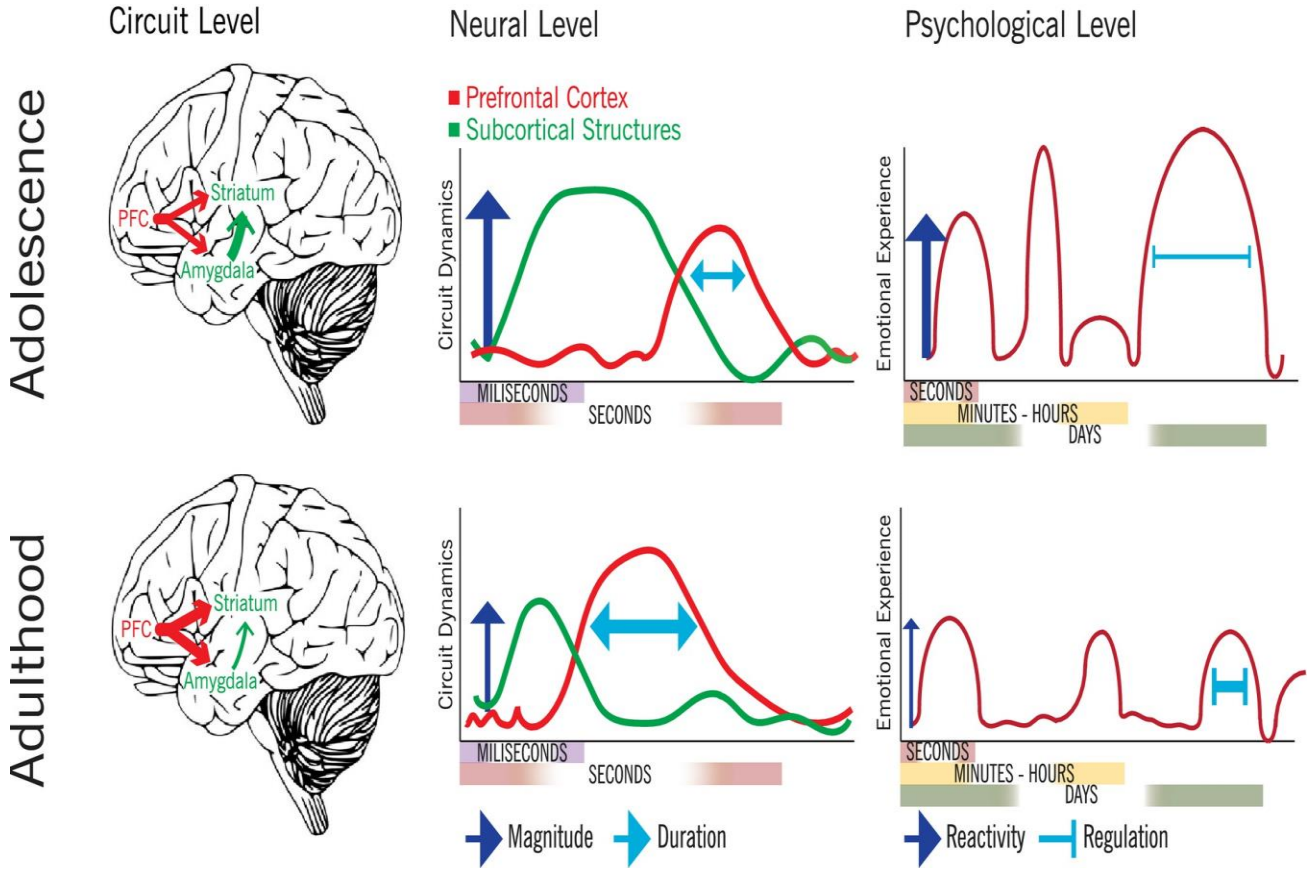
Consider this task

- How can we decrease emotional arousal in this task?

- How can increase information?

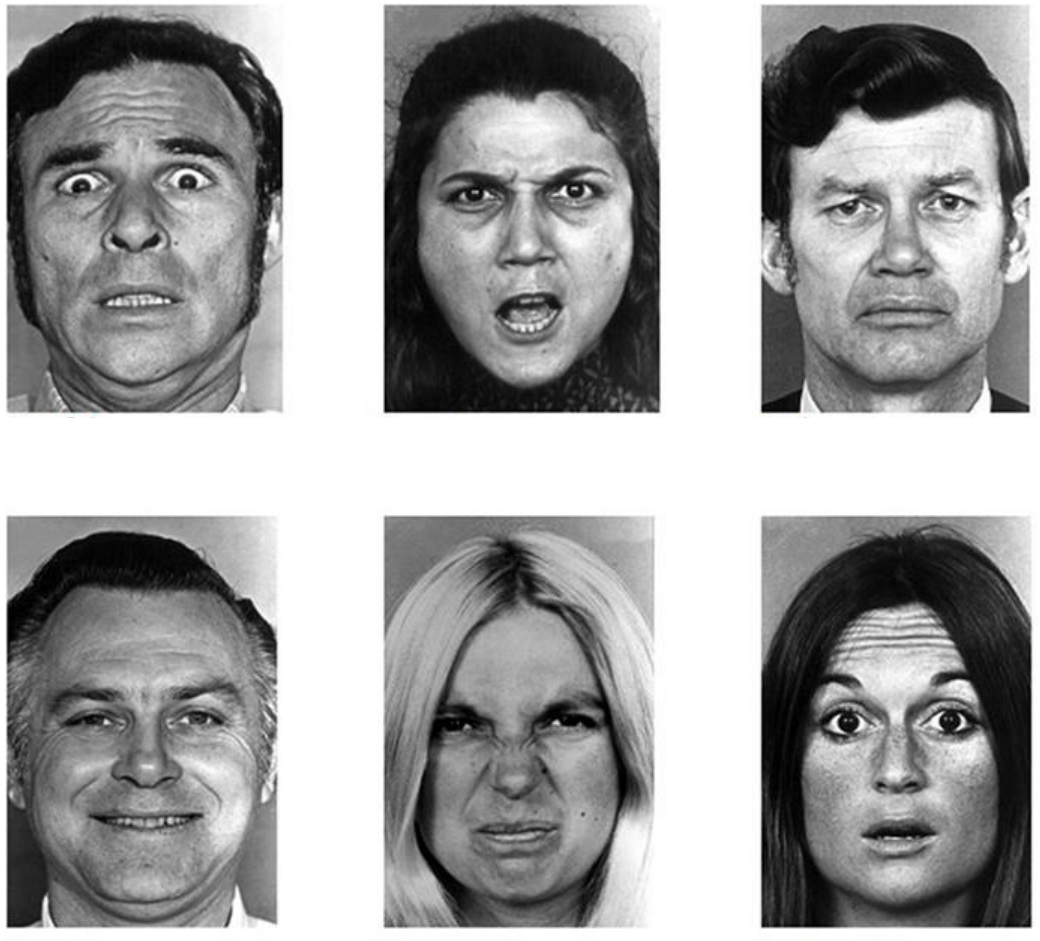
Connecting the brain with behavior…

- **Less reliance on frontal lobes**
  → Behaviour likely to be inconsistent
  → Slower processing speeds and more variable
  → Impulsivity, "gut" reactions
  → problems ignoring distractions



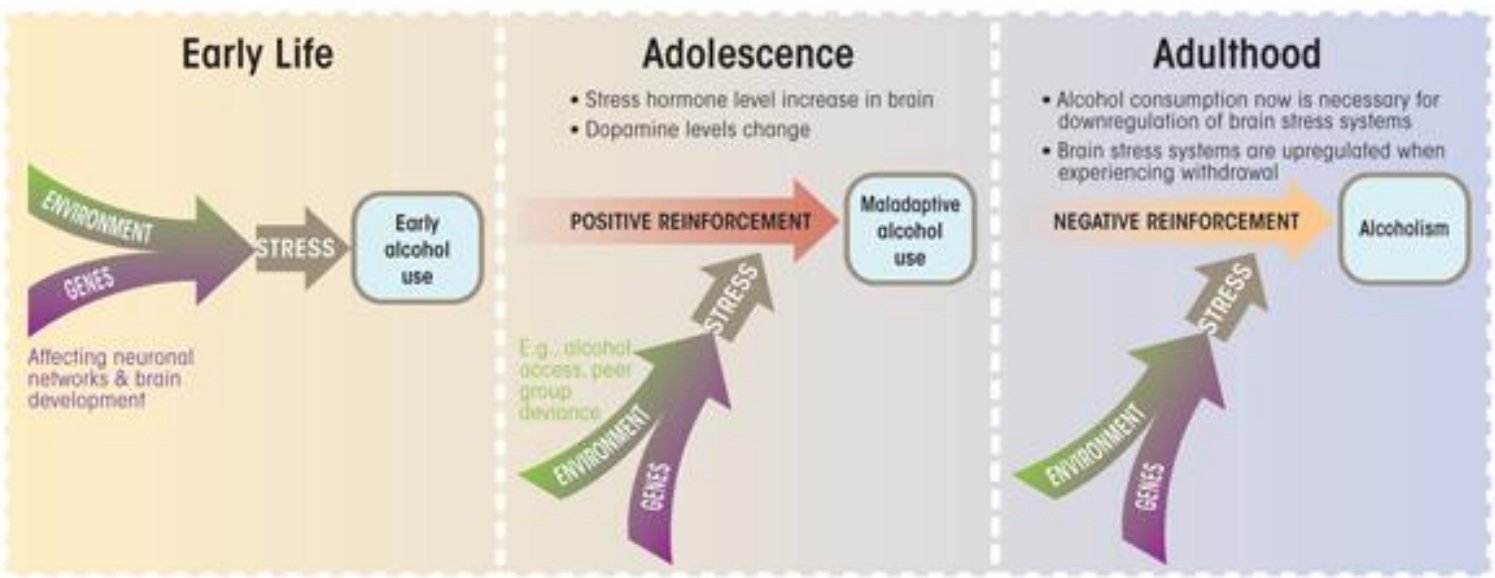
Connecting the brain with behavior…

- **Less efficient connections**
  → Worse at interpreting emotions
  → Less reliance on experience and memory in decision making
  → Are adaptable and capable of huge amount of learning



Connecting the brain with behavior…

- **Sensitized to certain neurotransmitters:**
  → moody
  → less attentive
  → ineffective problem solving
  → more risky behaviors



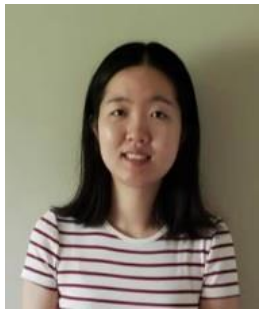
Implications?

- Increasing family, social, and community support can minimize psychosocial stress during adolescents
- Adolescents learn better when responding to rewards rather than through punishment (or removal of rewards).
- Adolescents benefit from safe places to take risks

Questions?

Thank You!

Dr. Adriene Beltz

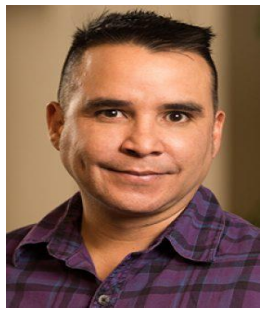


Zhuoran Zhang

Dominic Kelly

Ran Yan

Dr. Alex Weigard



Dr. Nestor Lopez-Duran

LSA PSYCHOLOGY
UNIVERSITY OF MICHIGAN

JACOBS FOUNDATION
Our Promise to Youth

As well as the M(SD) lab
and our participants!