

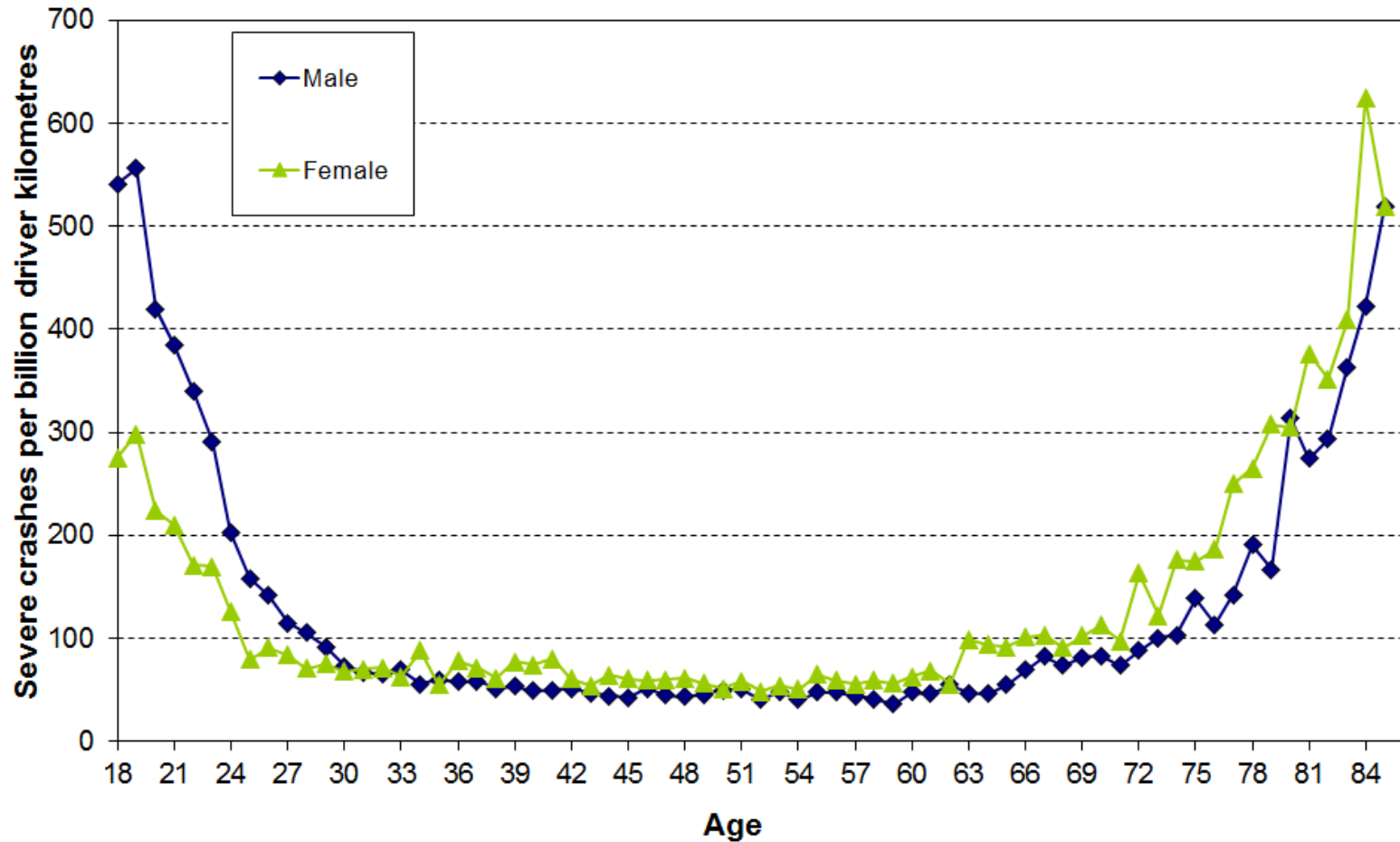


# Minimum Age

# Overview

- Crash risk, age and experience
- Types of crashes in which young (truck) drivers are overrepresented?
- First causes and determinants behind the first causes?
- The determinants *brain development, gender, fatigue, peer group influences* and *distraction*
- Effects of Driver education
- Conclusions and possible measures

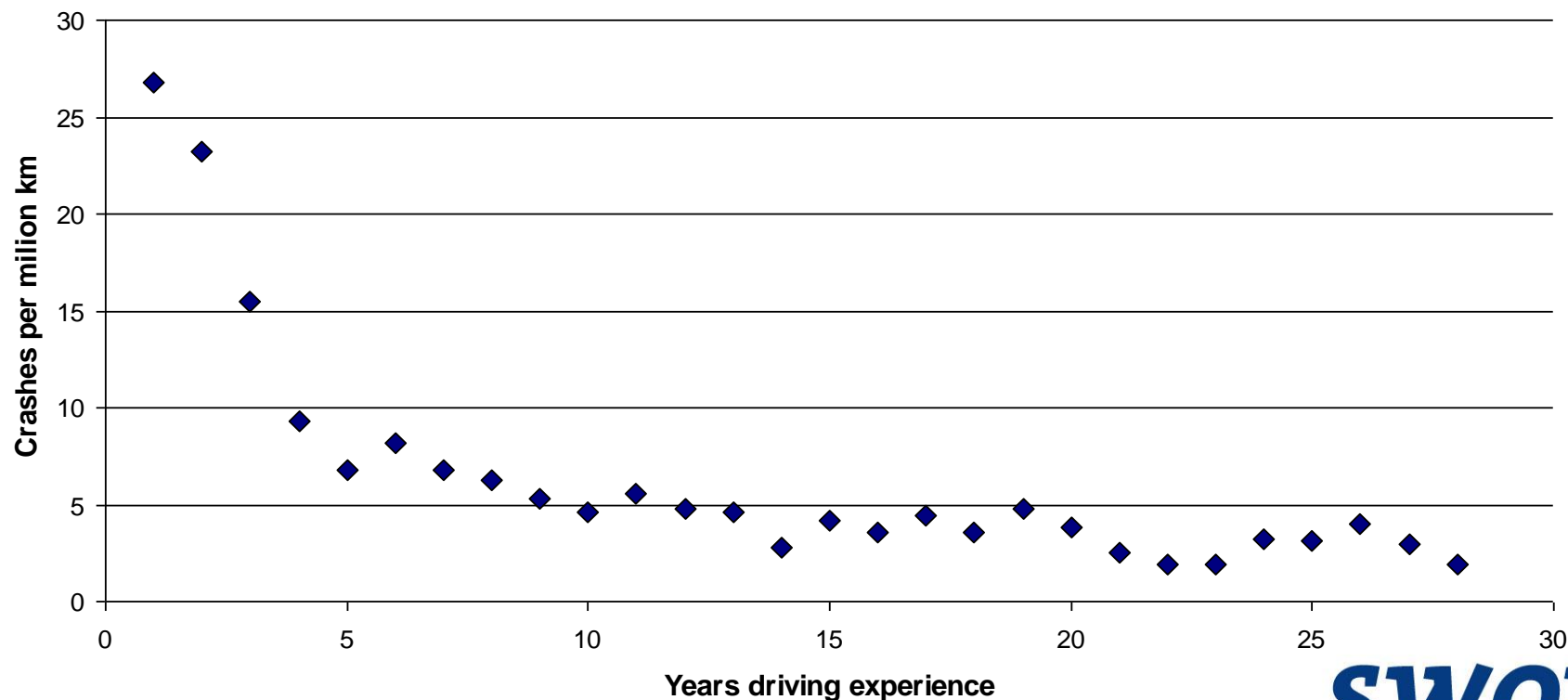
# Crash risk of car drivers



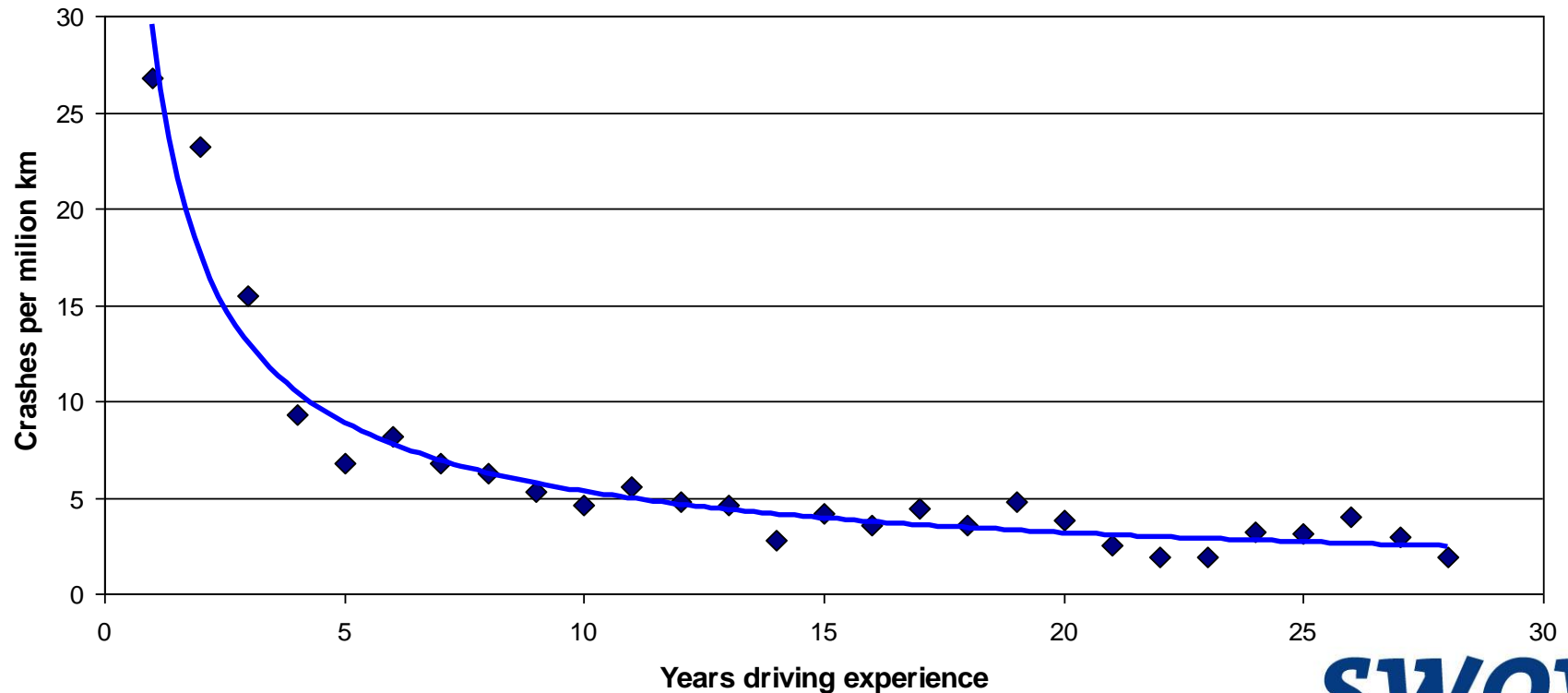
# Crash risk of young truck drivers

- The highest crash risk of all age groups for truck drivers younger than 25 (USA, Cantor et al., 2010)
- The most self reported crashes and the most self reported violations of the youngest truck drivers (New Zealand, Sullman et al., 2002)

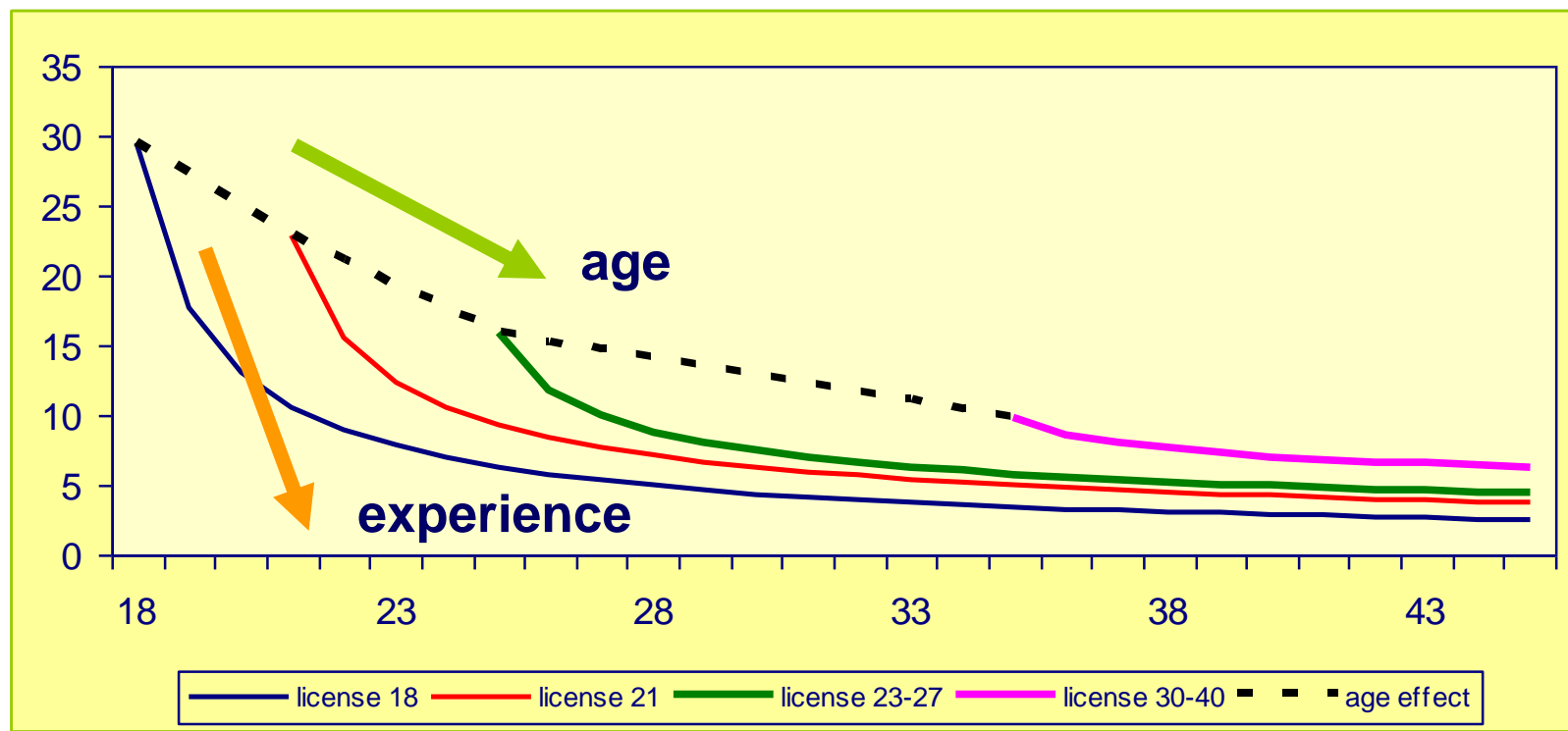
# Crash risk drivers licensed at 18



# Crash risk drivers licensed at 18



# Crash risk, age and experience



# Overrepresentation in cars and in heavy vehicles:

- Single vehicle crashes
- Vehicle-vehicle crashes
  - Head-on collisions
  - Rear-end collisions
- Crashes at intersections
- Crashes in bends

(Clarke et al., 2006; Harrison, Triggs, & Pronk, 1999; Laapotti & Keskinen, 1998; Twisk & Bos, 1999)

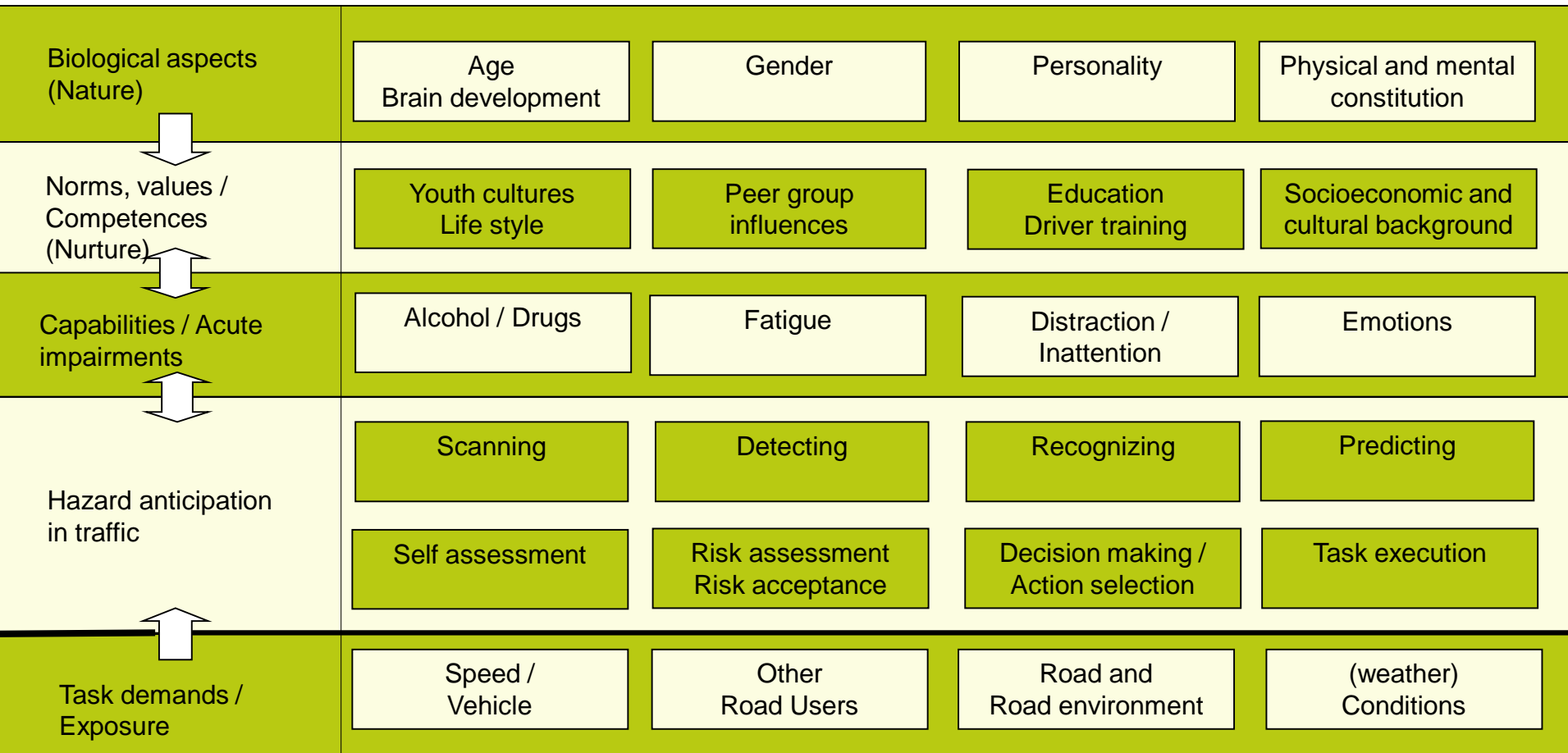


# First causes:

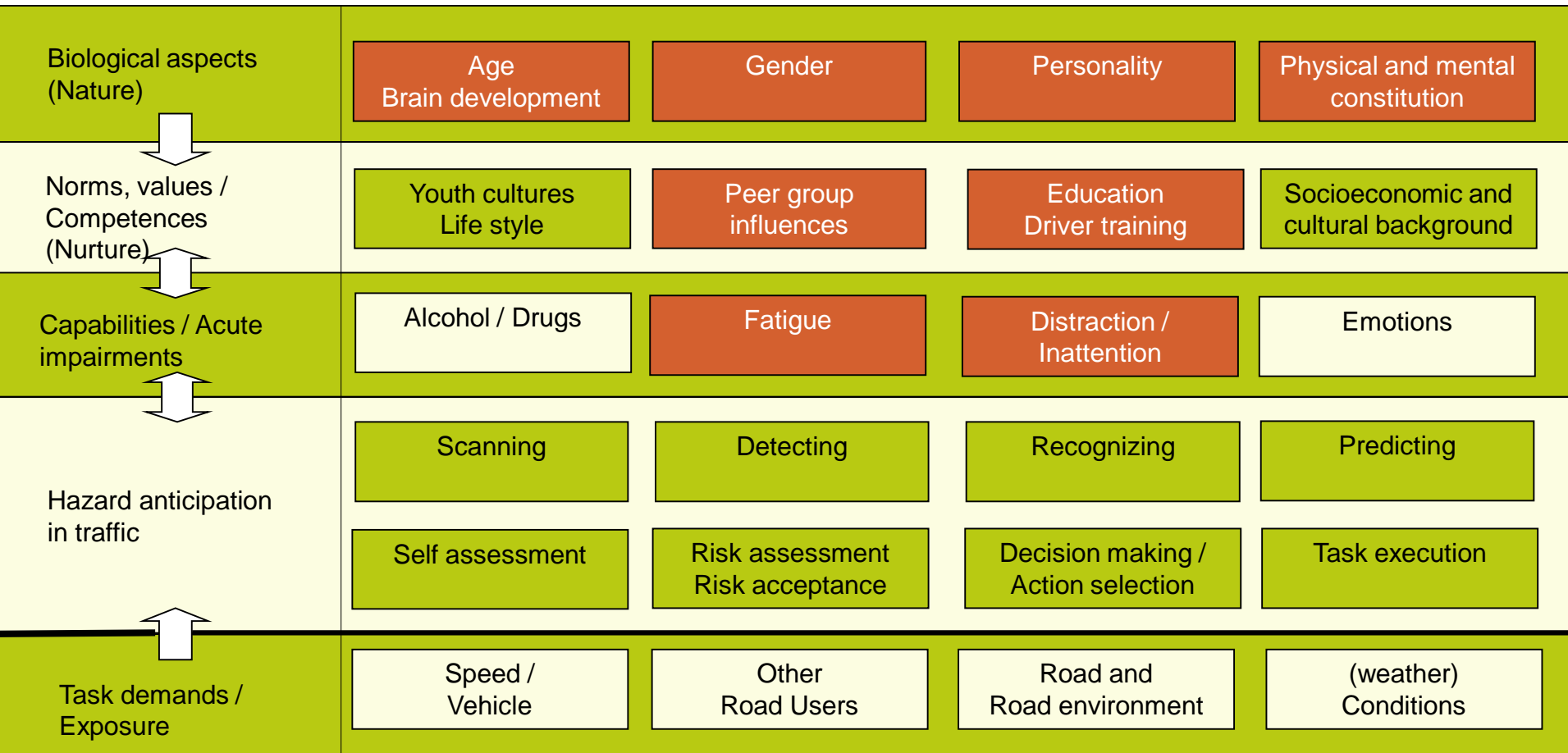
- Poor hazard detection (Do not know what to expect and where to look)
- Inattention/distraction (e.g. use of smart phones while driving)
- Driving too fast for the circumstances (e.g. in bends)
- Deliberate risk taking in order to alleviate boredom or to impress friends (e.g. speeding)

(Sullman, Meadows, & Pajo, K.B. ,2002; Clarke, Ward, & Truman, 2005; Curry et al., 2011; McKnight & McKnight, 2003)

# Determinants



# Determinants



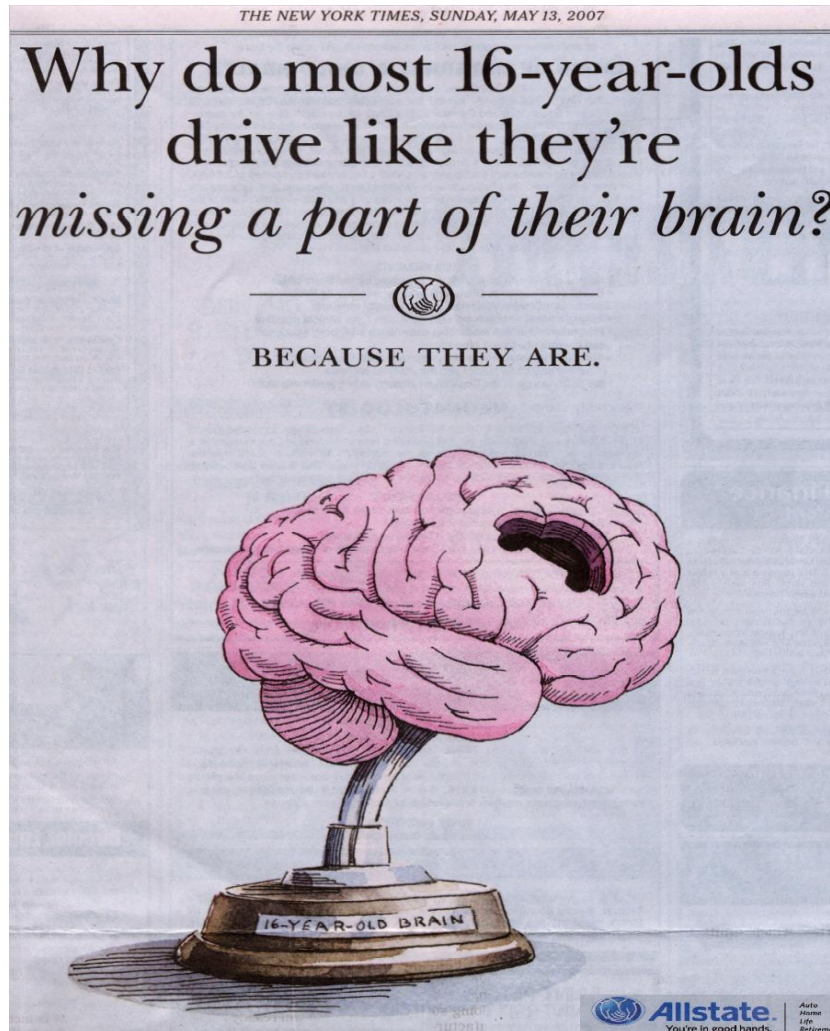
# Adolescents are different

‘Youngsters are passionate, are easily provoked to anger, and are apt to be carried away by their impulses’ (Aristotle, 380 BC).

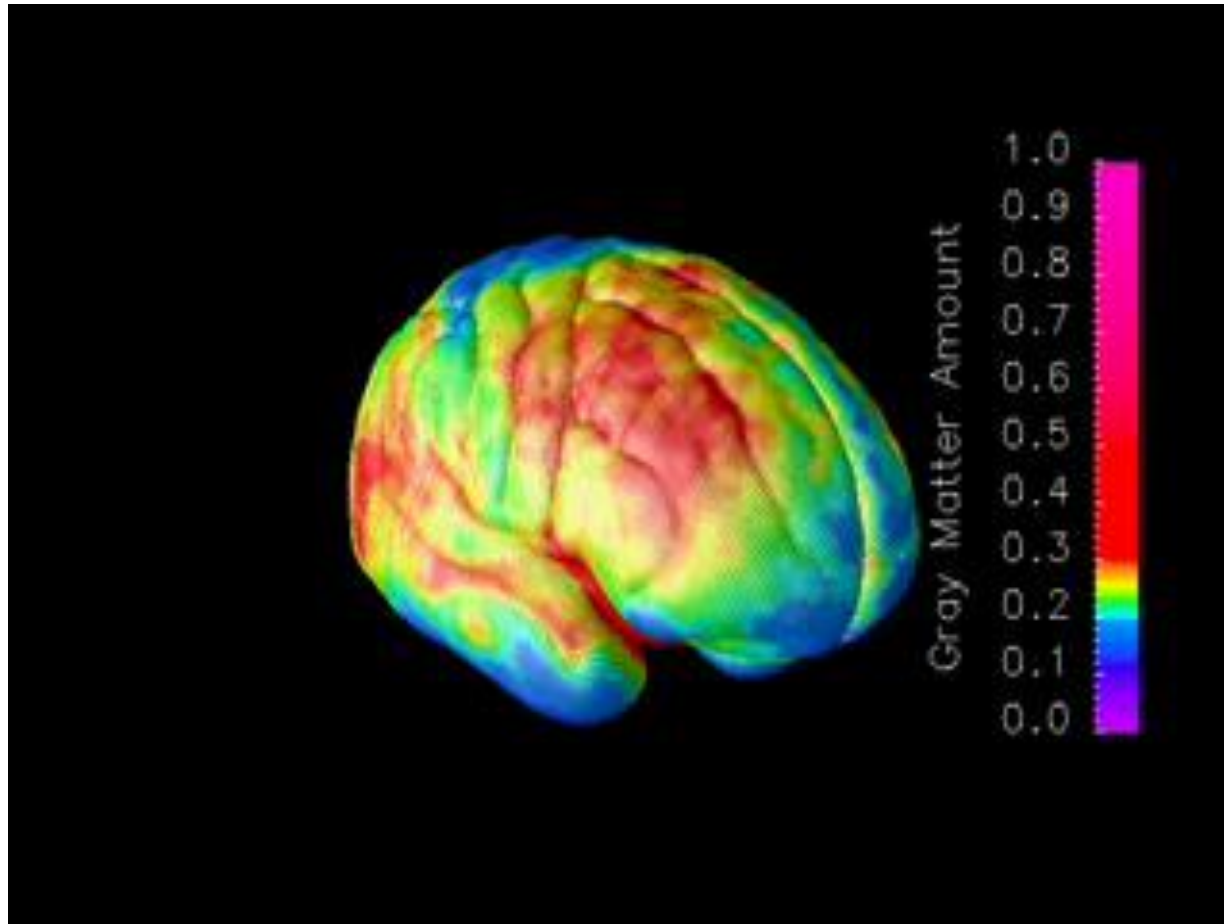
‘I would there were no age between sixteen and three-and-twenty, or that youth would sleep out the rest; for there is nothing in the between but getting wenches with child, wronging the ancientry, stealing, fighting—Hark you now! Would any but these boiled brains of nineteen and two-and-twenty hunt this weather?’ (Shepherd in ‘The Winter’s Tale, Shakespeare)

‘Himmel hoch jauchzend, zu Tode betrübt’ (From ‘Die Leiden des jungen Werther’, Goethe)

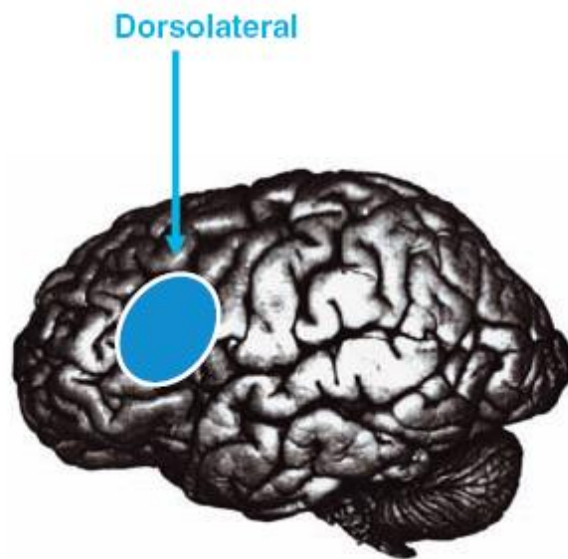
# Brain development



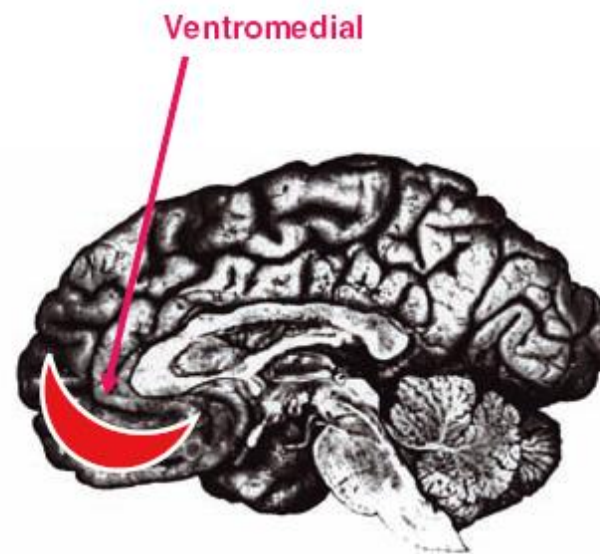
# Brain development



# Brain development

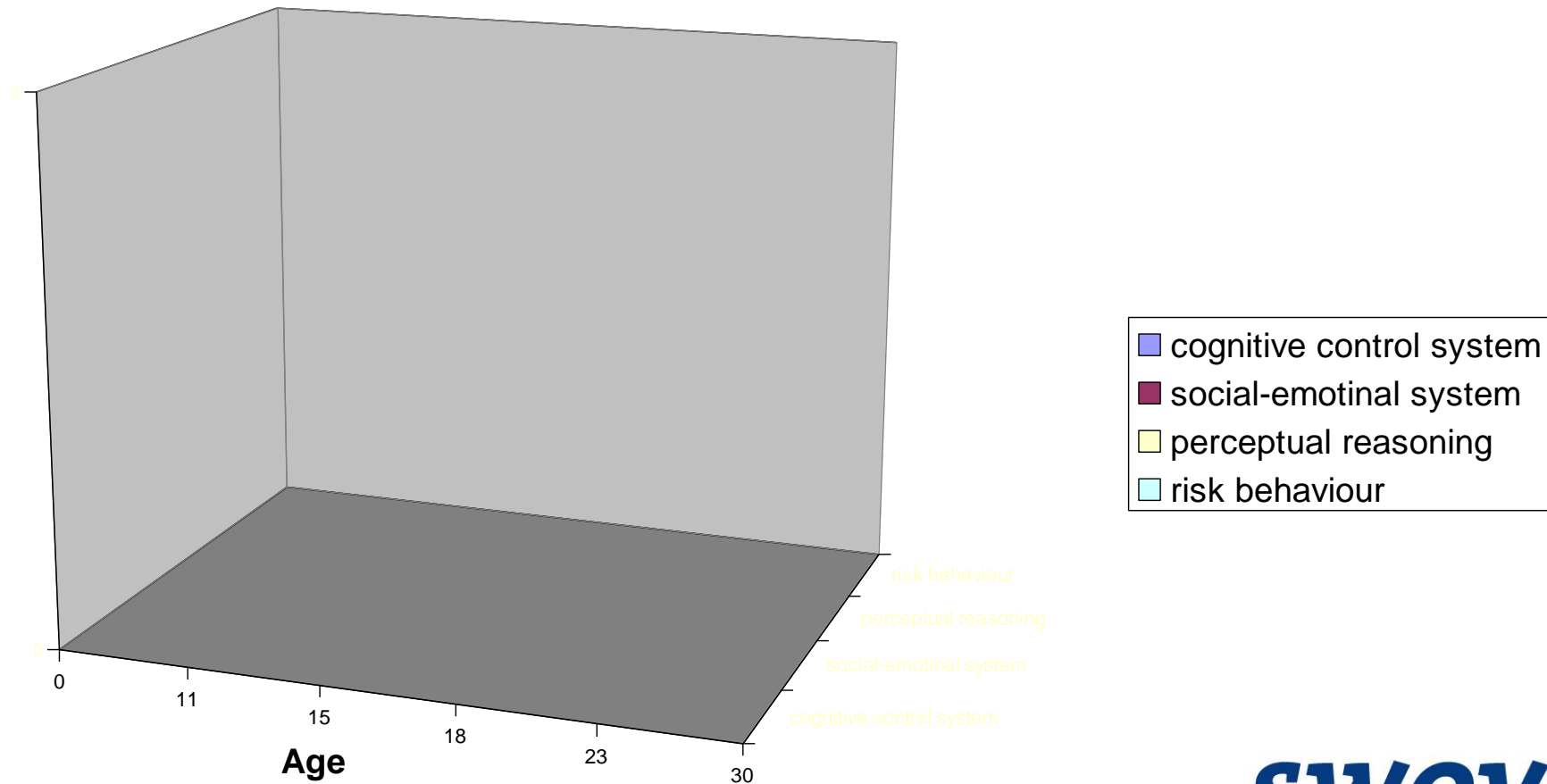


Thinking ahead and inhibition  
of impulsive responses



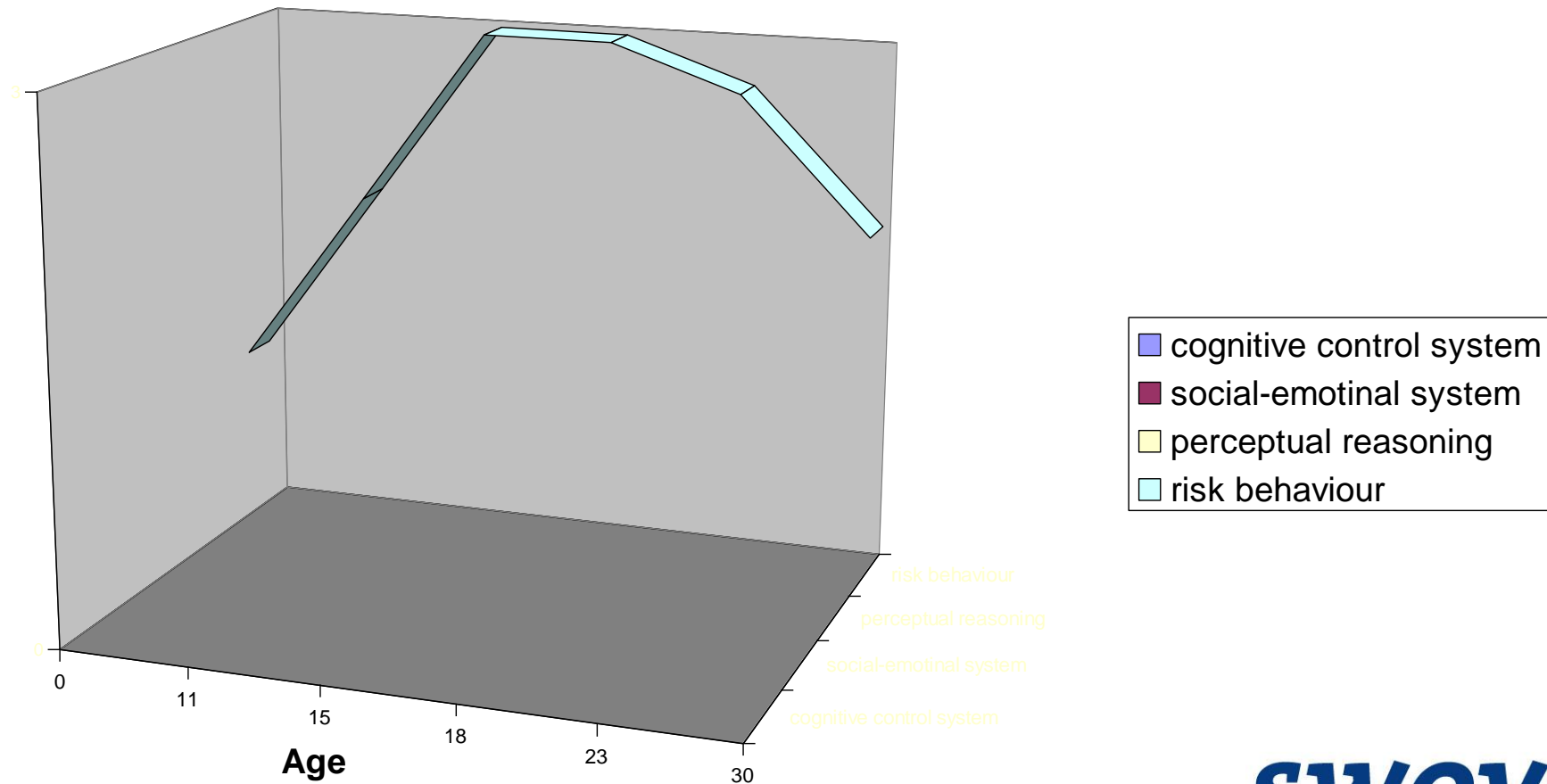
Regulation of emotions;  
learning from experience;  
weighing risks and rewards

# Brain development and risk taking

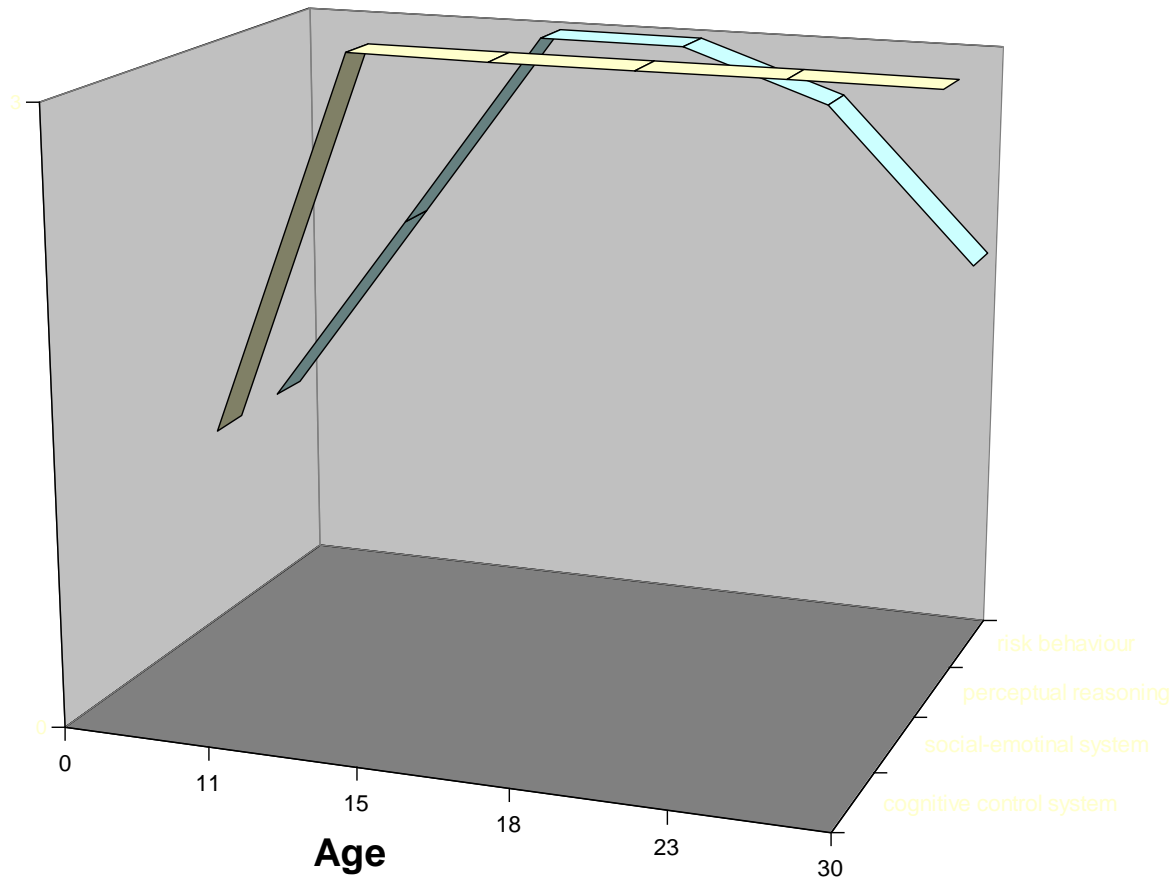




# Brain development and risk taking

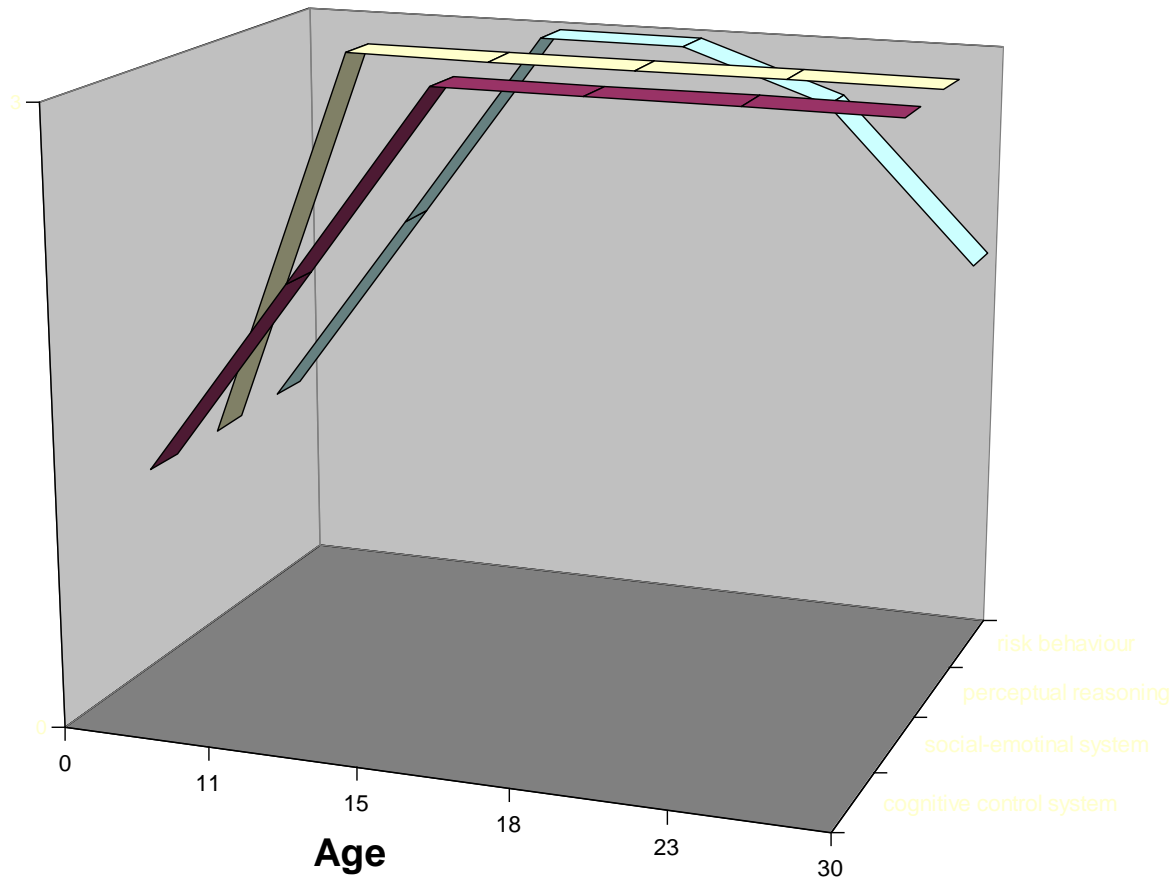


# Brain development and risk taking



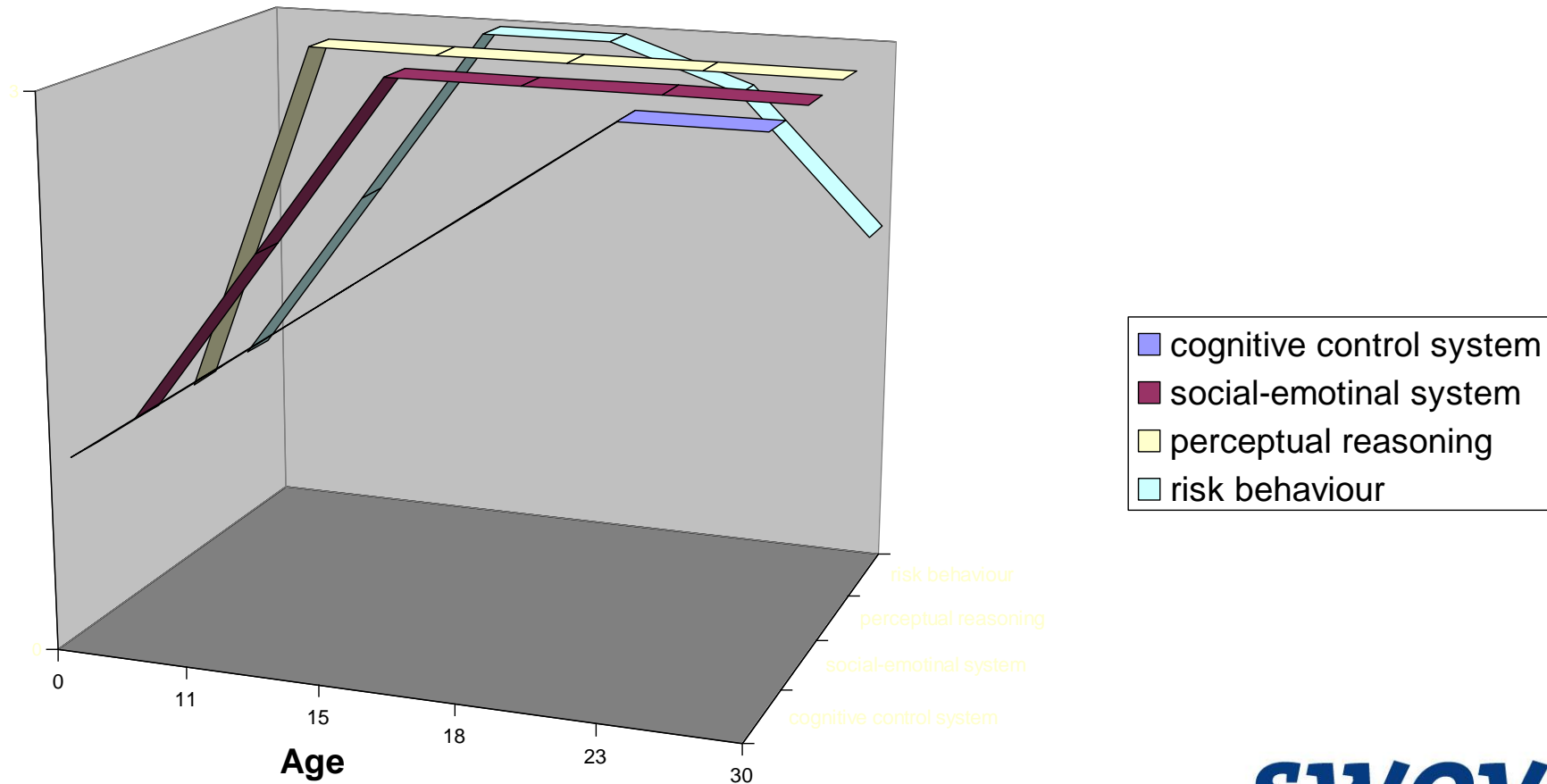
- cognitive control system
- social-emotional system
- perceptual reasoning
- risk behaviour

# Brain development and risk taking

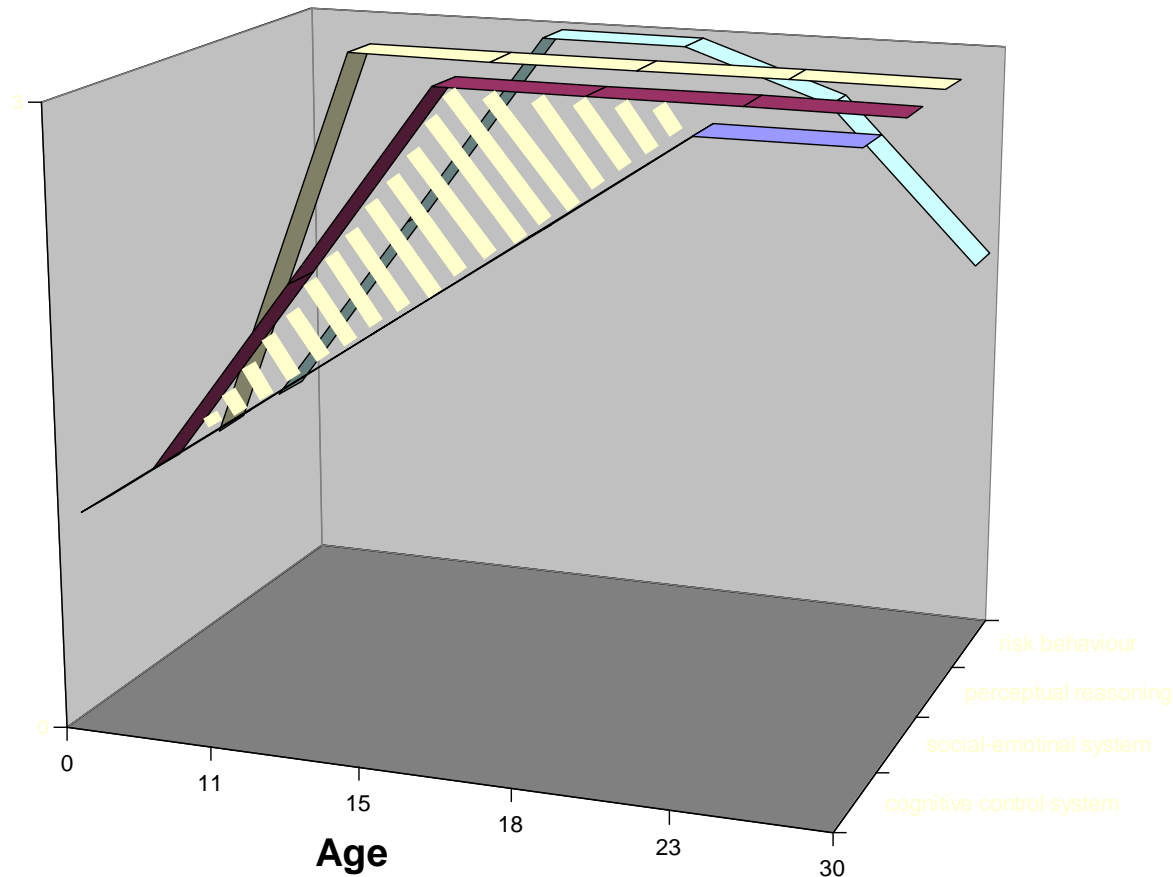


- cognitive control system
- social-emotional system
- perceptual reasoning
- risk behaviour

# Brain development and risk taking

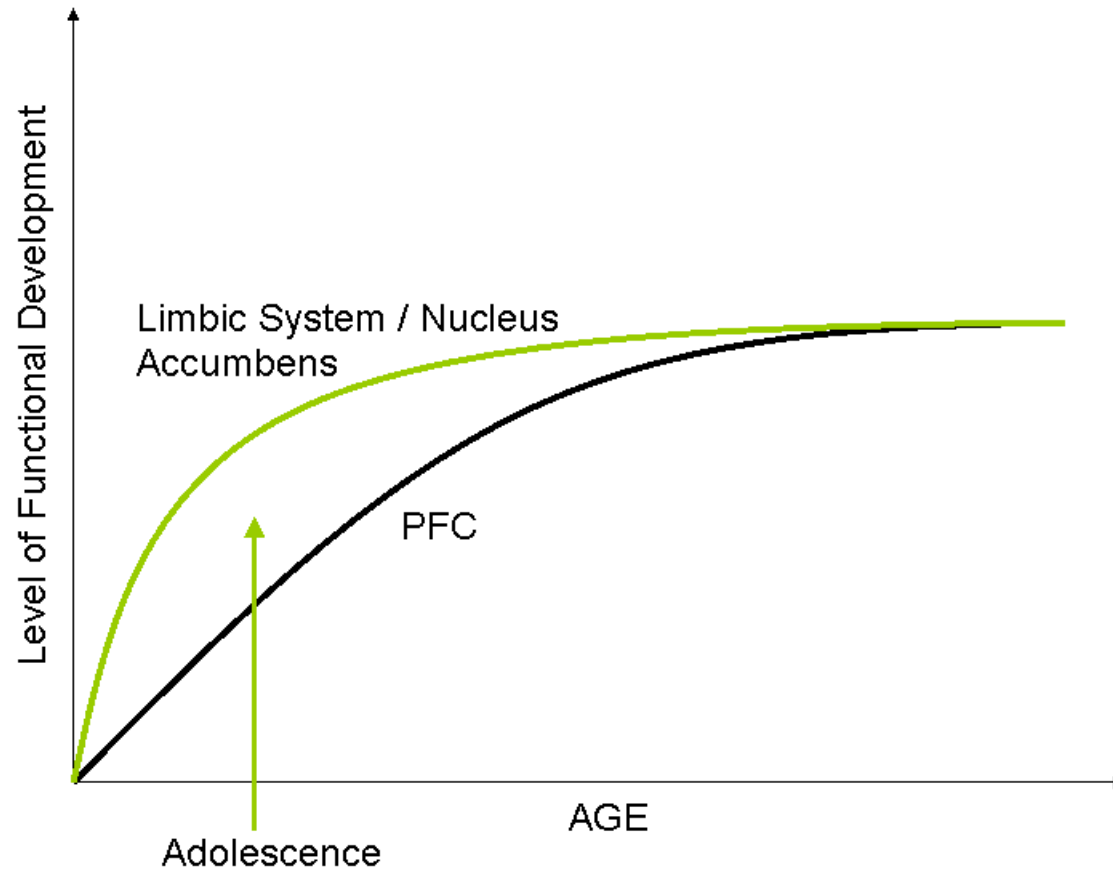


# Brain development and risk taking



- cognitive control system
- social-emotional system
- perceptual reasoning
- risk behaviour

# Brain development



Model of the different developmental trajectories of the limbic system and the PFC that may be the underlying cause of the tendency to take risks in adolescence (Casey et al., 2008)

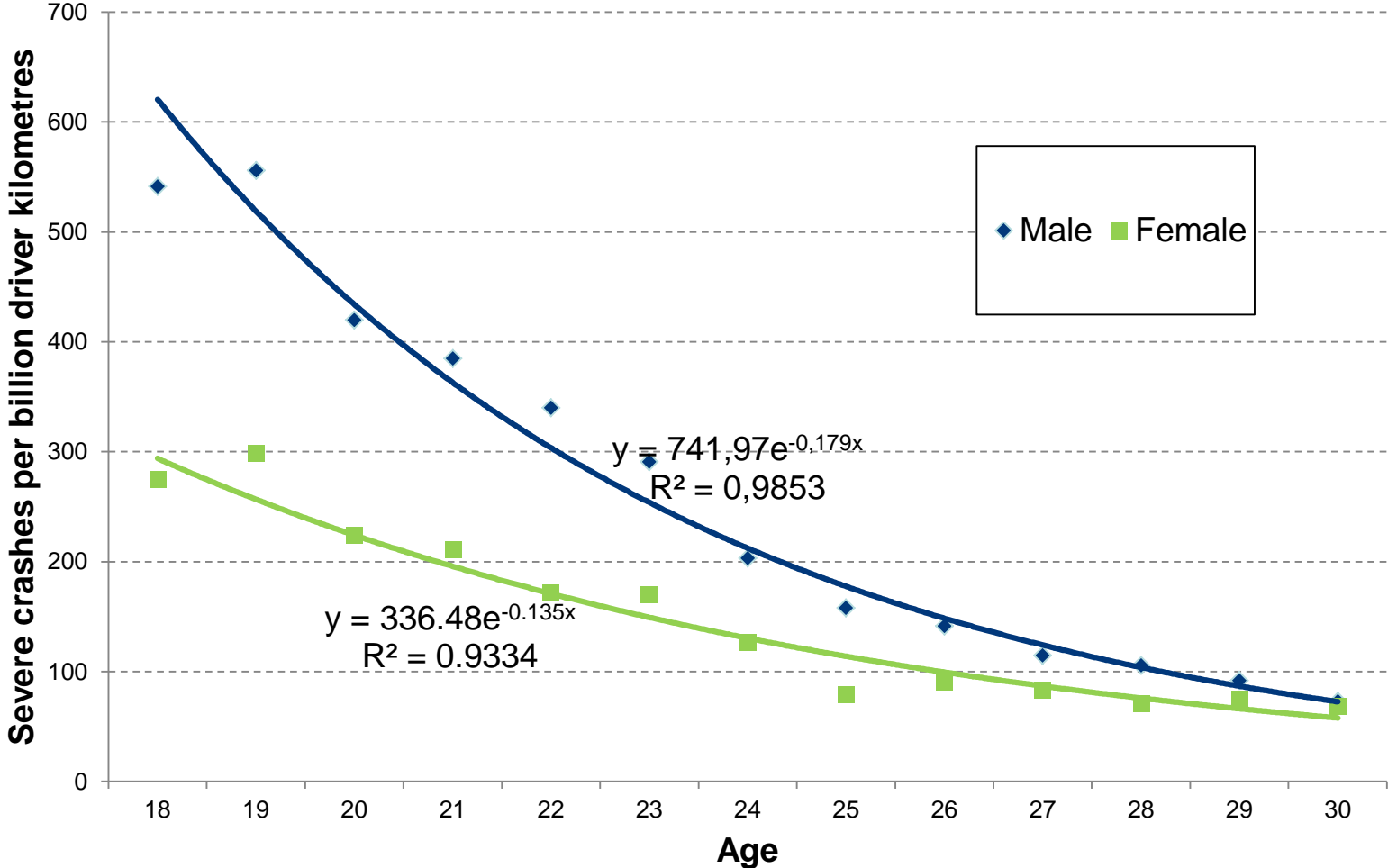
# Brain development

## Adolescents:

- Less risk aversion;
- Less loss aversion;
- Power of friends;
- Preference for immediate reward, and
- Planning is difficult.

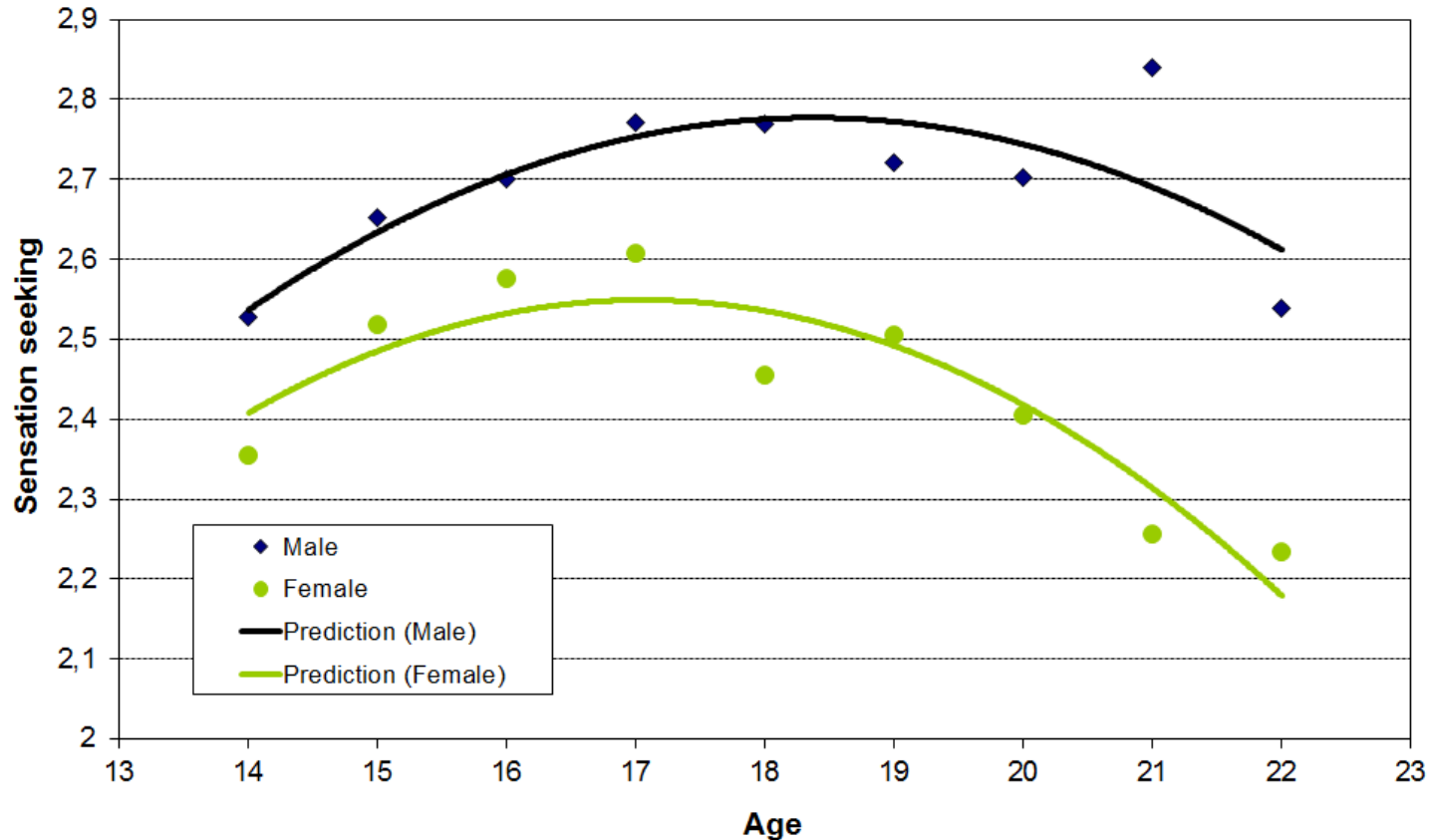
(Barbalat et al., 2010; Crone & Dahl, 2012; Keating, 2007; Steinberg, 2008)

# Crash risk and Gender





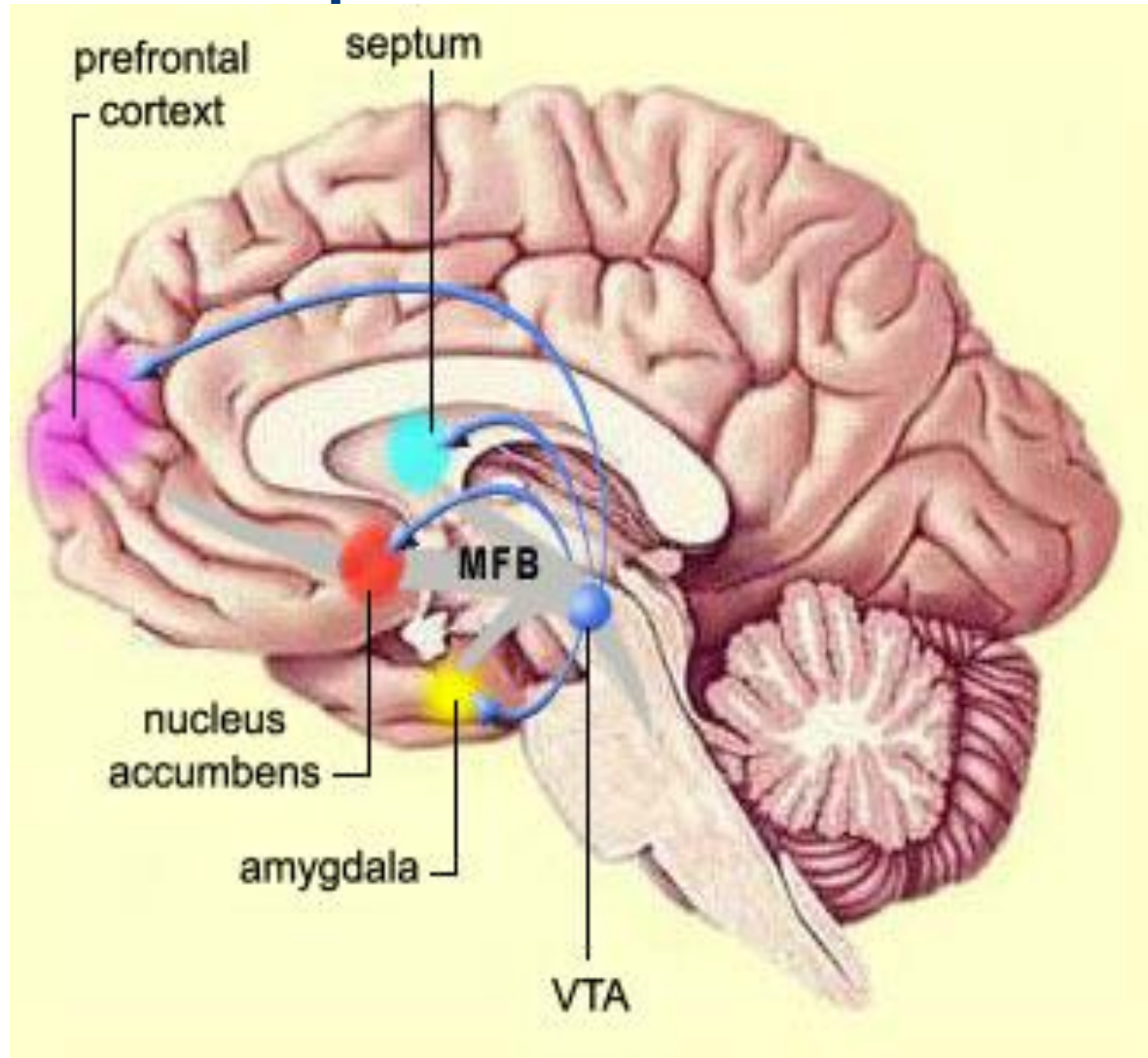
# Gender differences



(Romer & Hennessy, 2007)

# Brain development

Dopamine



# Complex motor skills and brain development

- White matter increases early in childhood and adolescence → High plasticity of the brain → Strong effect of skill training.
- When you want to become a good musician or formula 1 driver, start practicing early in life.

(e.g. Spear, 2013)

# Groups particular at risk due to brain development

- Young drivers that score high on sensation seeking (dopamine)
- Young drivers with (untreated) ADHD

(Jerome, Segal, & Habinski, 2006; Jonah, 1997)

# Influence of peers

- Young **male driver** with young **male passenger** → *highest* crash rate
- Young **male drive** with young **female passenger** → *high* crash rate
- Young **female drive** with young **male or female passenger** → *high* crash rate
- Young **female or male driver** with **older passenger** → *low* crash rate

(Ouimet et al., 2010)

# Fatigue

Young novice drivers have more crashes due to fatigue than older, more experienced drivers because:

- The driving task is more constraining for them;
- Sleep patterns are different during adolescence.

(Groeger, 2006)

# Distraction

Young novice drivers have more crashes due to distraction than older, more experienced drivers because:

- They more often use electronic equipment (e.g. smart phones) while they drive;
- Secondary tasks interfere more with the driving task as the primary driving task is not yet fully automated;
- They have difficulties in assessing if the conditions are safe enough to engage in a secondary task;
- When engaged in a secondary task, the off road glances are substantially longer.

(e.g. Klauer et al., 2014)

# Driver training

- No lower crash rate after formal driver training than after informal driver training; (e.g. Christie, 2001; Elvik et al., 2009; Mayhew & Simpson, 2002, McKenna, 2010)
- Driver training that aims to enhance the skills to regain control in emergency situations such as skid training increases crash rate; (e.g. Christensen & Glad, 1996; Elvik et al., 2009; Glad, 1988; Keskinen et al., 1992)
- Some indications that training of ‘higher order skills’ (hazard perception, risk awareness, risk acceptance, self awareness) can reduce crash rate. (e.g. Carstensen, 2002; Stanton et al., 2007)

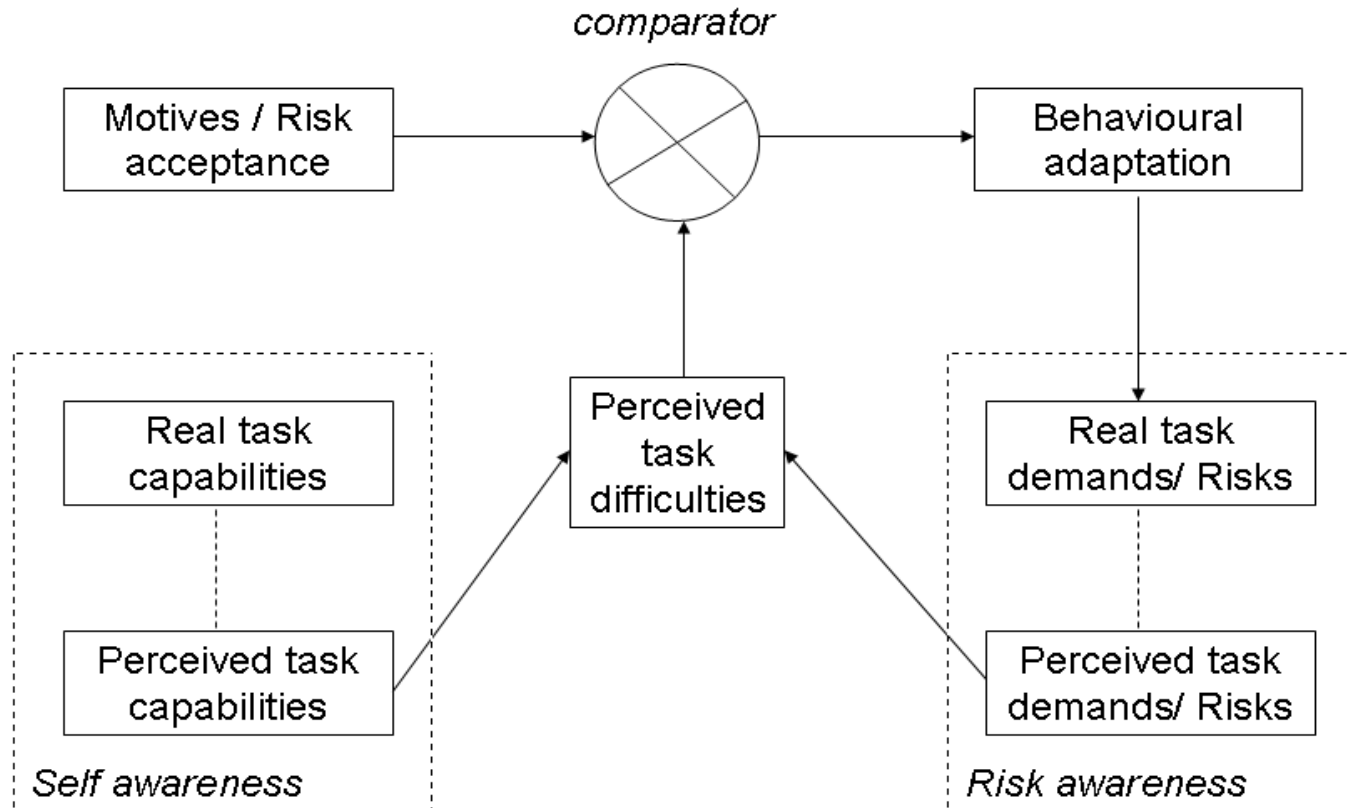


# Calibration

*Technically skillful drivers not necessarily are also safe drivers*

- A driver with moderate vehicle handling skills who does not overestimate his capabilities and/or does not underestimate the risks, drives safer than a driver with good vehicle handling skills who overestimates his capabilities and/or underestimates the risks.

# Calibration



# Driver training and brain development



## THE 'FRONTAL LOBE' PROJECT

A double-blind, randomized controlled study of the effectiveness of higher level driving skills training to improve frontal lobe (executive) function related driving performance in young drivers

FINAL REPORT June 2008



# Conclusions

- Lowering the age limit will presumably result in more crashes;
- This problem cannot be solved by more skill training;
- Driver education in higher order skills may partly solve the problem.

# Other measures than education that may reduce the crash rate

- Only accompanied driver in the first months after licensing;
- Black boxes that register the driving style of young novice truck drivers; (Bolderdijk et al, 2011)
- No driving between midnight and nine o'clock;
- Improvement of safety culture in transport companies.

# Thank you for your attention

