



**University of
Zurich** ^{UZH}

Department of Economics / Zurich Center for Neuroeconomics

zGIG Zurich Gehirn und immunologisch Genetik Studie

Neurobiological correlates of lifetime violence experiences on social decision-making

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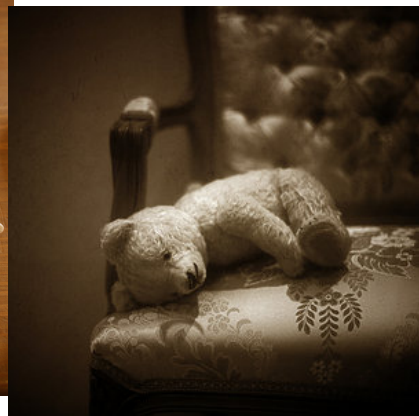
Department of Economics

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Background

- The detrimental effects of violence might be most visible in the news from war-torn countries and the suffering of people fleeing those regions
- More common forms of violent and antisocial behaviors occur with troubling regularity in even the world's most stable and peaceful countries
- Violence and antisocial behaviors generate enormous social, monetary, and health costs to society
- Reducing the frequency and severity of antisocial behaviors and developing better treatments for both victims and perpetrators are important long-term aims





Background

- Developmental trajectories in childhood predict benefits/burdens later life
 - Regulatory skills are associated cognitive performance, education, financial security, health in adulthood
 - Victim of violence/abuse associated to higher risk of antisocial or criminal behaviour, psychiatric & other diseases in adulthood
- Cycle of violence
- Lack of comprehensive data combining measures of life-course events and trajectories with data on biological estates and functions in the same individuals
 - Limits to our knowledge result in limits to our ability to resolve problems or generate improvements.



Antisocial Behaviour and Victimization

- Biological and environmental origins
- Disruptive Behavioural Disorders (DBD), Conduct Disorder (CD) (callous-unemotional traits (CU)), Oppositional Defiant Disorder (ODD)
- Antisocial personality disorder (ASD), psychopathy
- Developmental trajectories
- Potential remediation



Antisocial Behaviour and Victimization

- Age of onset – severity and persistence (prognosis)
- Social and environmental factors : Socioeconomic factors and maltreatment in early life
- Role of brain function: Deficits in IQ and self-regulation
 - Dunedin Study:
 - Measures of environmental and individual factors: family SES, maltreatment, IQ, self control (3-11yo) predicted social and health outcomes later in life (inc, criminal behaviour)
 - Caspi et al “ brain health” measure (from single paediatric assessment) equally predictive



Key limitations of existing evidence

Developmental trajectories – There is an almost complete lack of longitudinal studies investigating anti-social behavior (perpetration or victimization) at the neural level.

Hypothesized Brain Systems

Dysfunctions reported in 4 neuro-cognitive areas

- Empathy
- Acute threat responses
- Value-based decision making
- Response inhibition

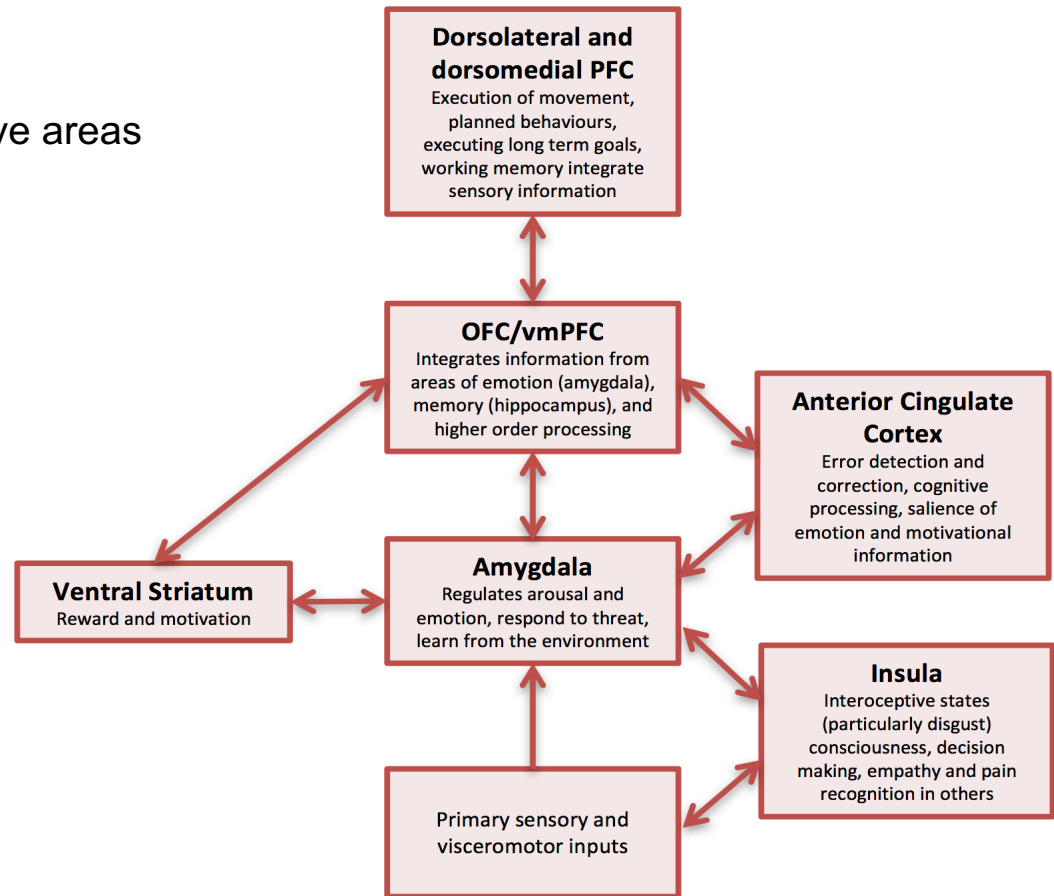


Figure 1. Areas implicated in AB as they connect anatomically and functionally. Adapted from Figure 1 in Hyde, Shaw, and Hariri (2013) *Developmental Review*.

Antisocial Behaviour

- Impaired performance in structured social interaction paradigms (e.g. Ultimatum Games and aggression paradigms)
- Impairment in emotional theory of mind processes that require recognizing and representing the emotional states of others.

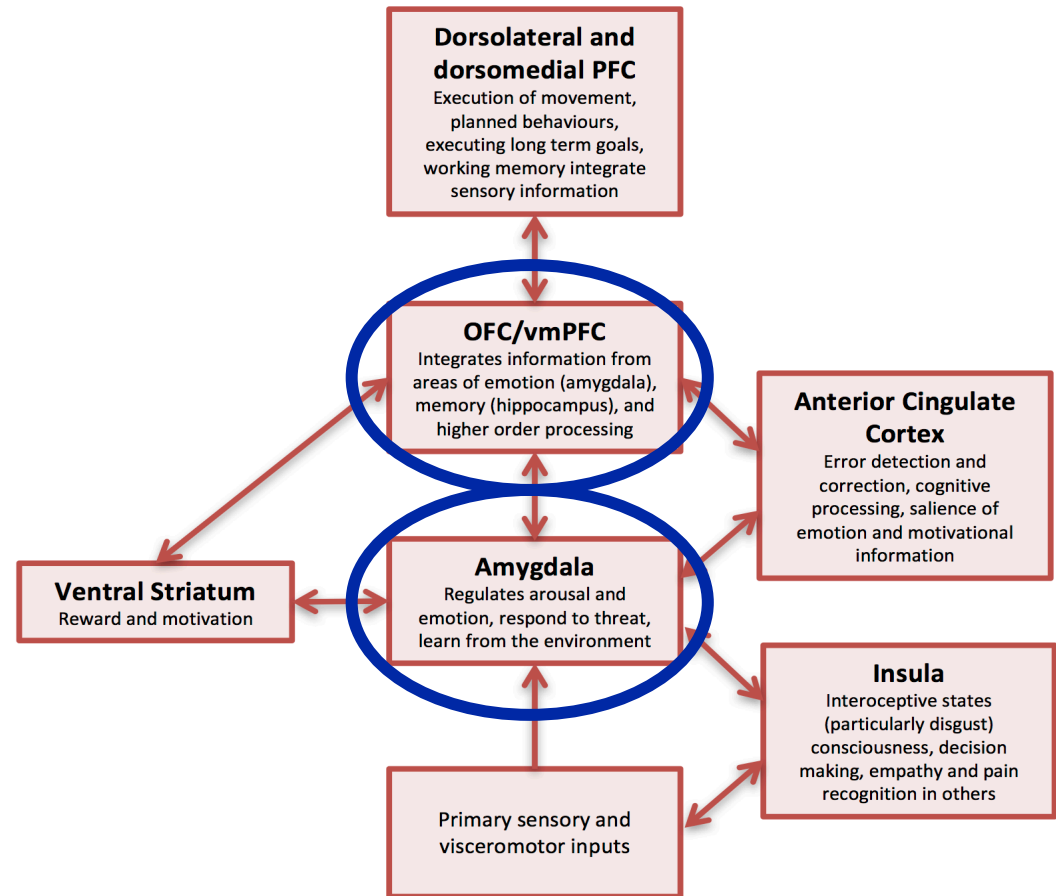


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Antisocial Behaviour

- impairments in value-based decision-making
 - reduced reward sensitivity and learning
 - problems in computing the subjective expected values of objects and actions (frustration, reactive aggression)
 - exaggerated punishment responses
 - dysfunctional avoidance behaviour

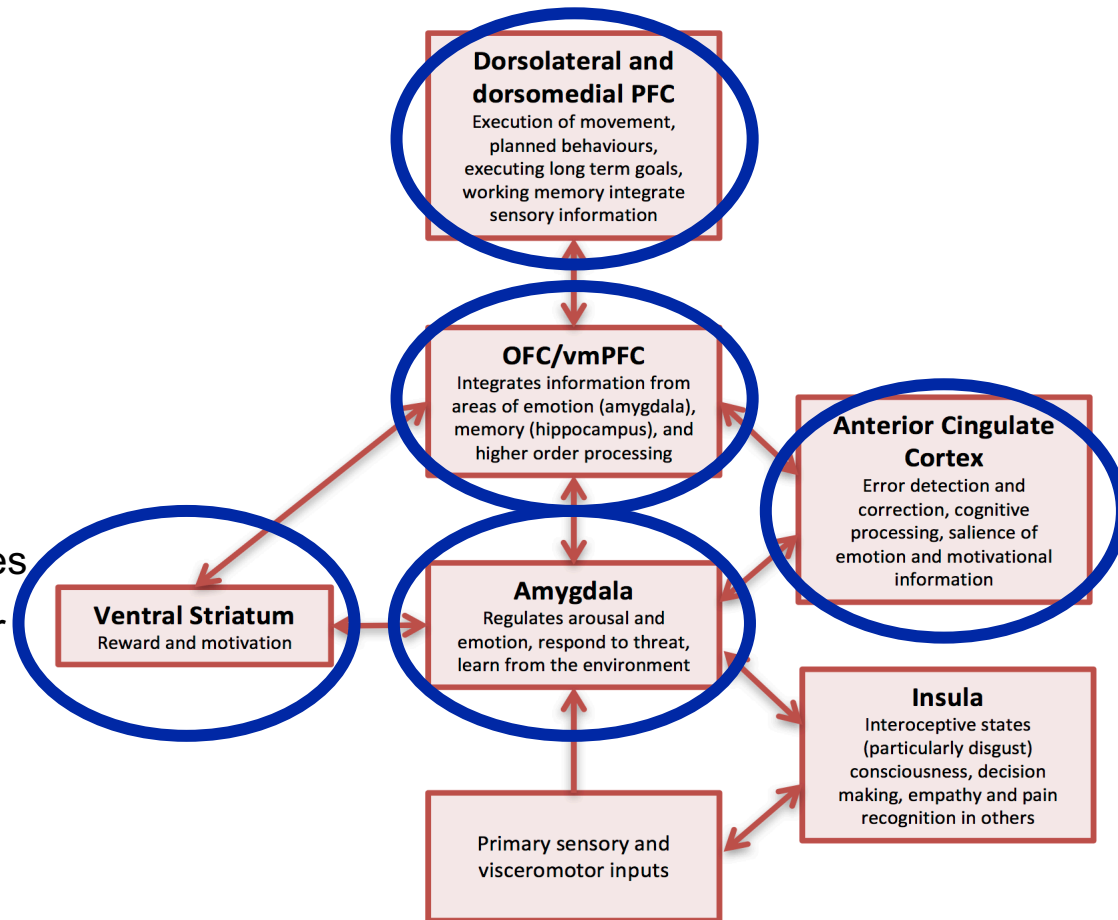


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Antisocial Behaviour

- Inhibition impairments
 - Difficult to disentangle from comorbidity with ADHD
 - AB and response inhibition deficits may be partially dissociable.
 - driving or moderating role?
- studies of AB should account for comorbid conditions such as ADHD

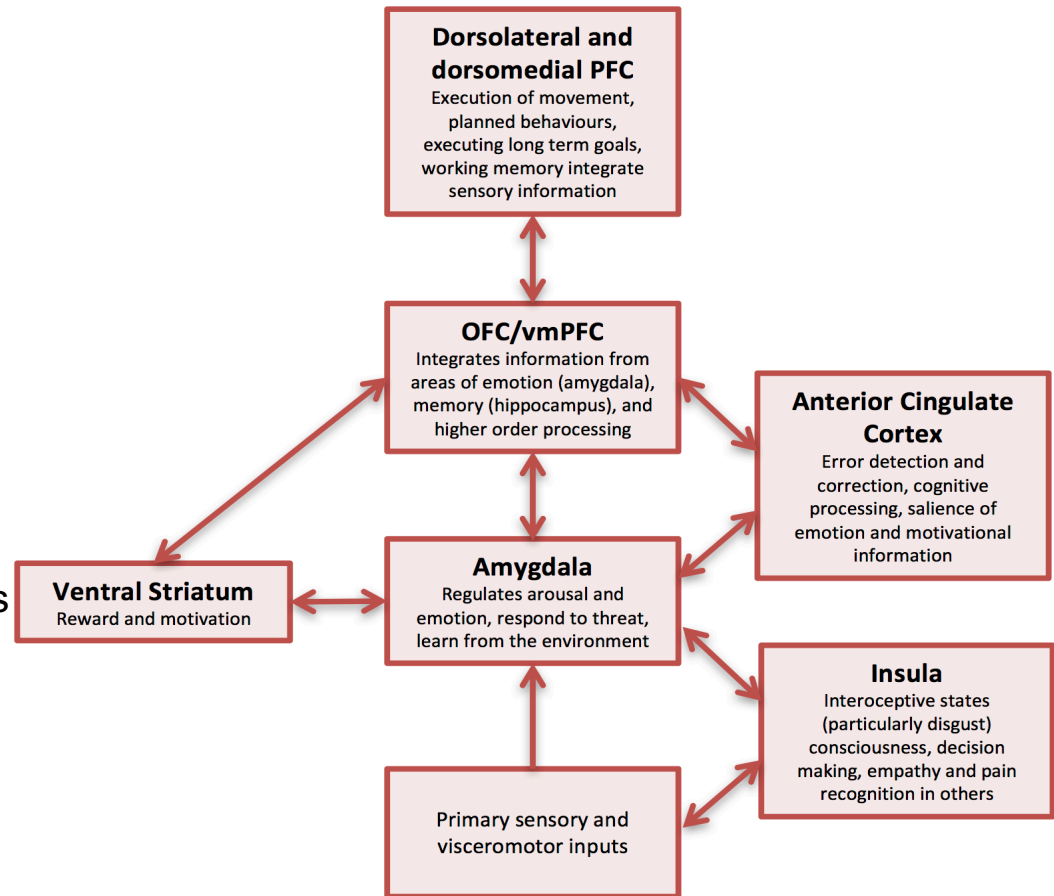


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Overview of some relevant features of z-proso

- 1400 participants followed for 14 years.
- Includes comprehensive information every 1-2 years about topics including family, school, leisure activities, personal attitudes, violence, problem behavior and victimization.
- This allows us to identify people characterized as early-life perpetrators or victims of anti-social behaviour (physical, verbal, online)
- We can conduct sampling stratified on potential confounding variables (ADHD, substance use, intelligence, age, sex, etc).



Background

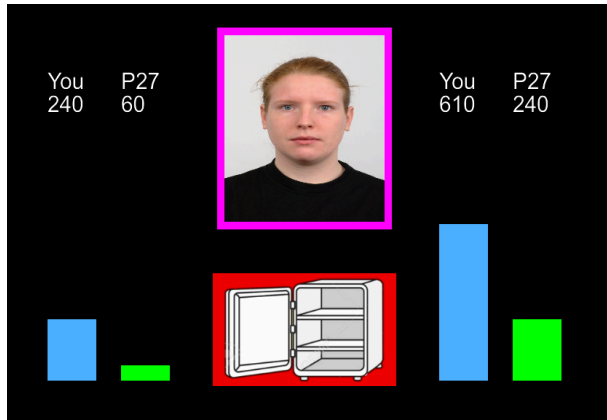
The current study aims to fill an important knowledge gap. The multifaceted dataset we will generate will include the following for 300 young adults.

1. The ongoing longitudinal assessments of life-course development
2. MRI-based measures of brain structure and function
3. Gene expression and physiological indices of the stress-response system
4. Behavioural data on social exclusion and decision making in controlled custom-designed laboratory paradigms.
 - E.g. Our decision paradigm tests aspects of social information processing including emotion perception, learning, value computation, and strategic self-regulation

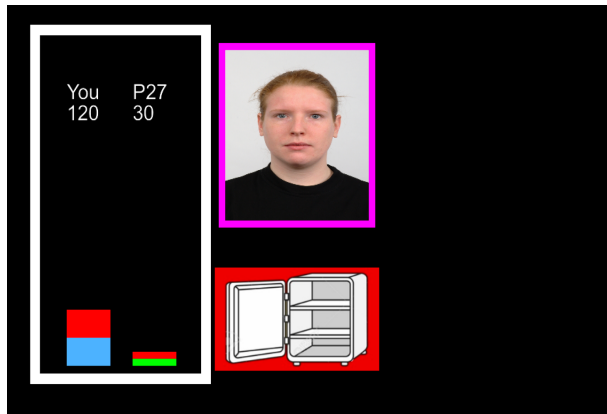
All this will inform us about the biology of social decision-making in relation to specific experiences with and timing of anti-social behaviours



fMRI paradigm– key aspects

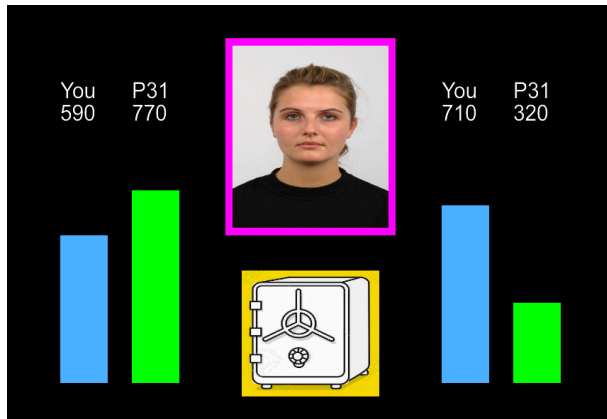


- The pictures of the partner (e.g. P27) allow us to test how participants respond to emotional social signals.
 - The partner can select to send initial Happy, Neutral, Angry, or Sad expressions.
 - The partner may change his/her expression once he or she sees the offer

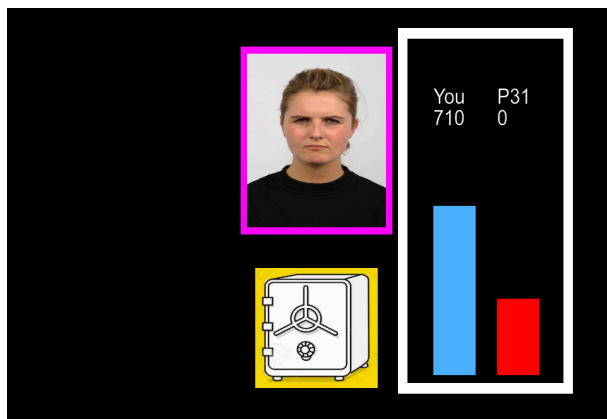


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fMRI paradigm– key aspects

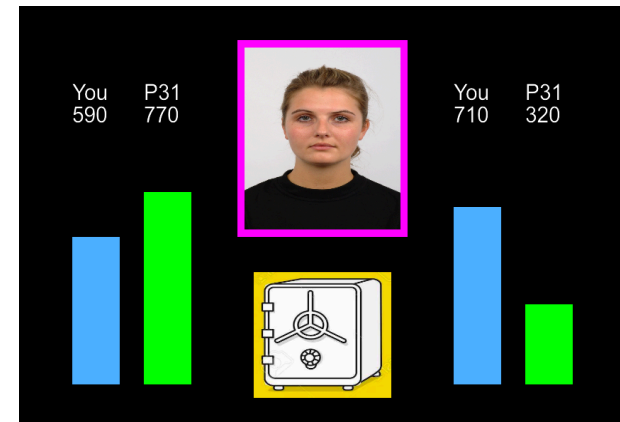
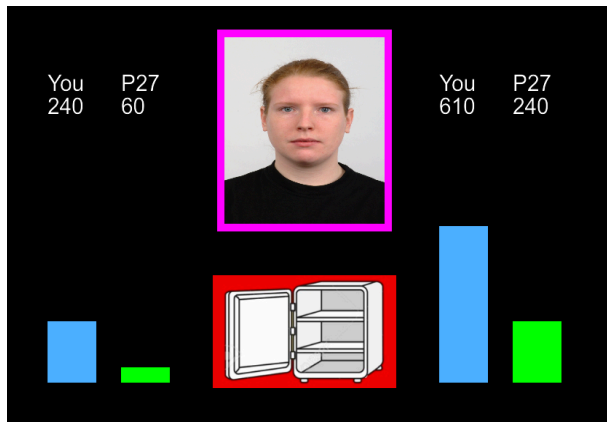


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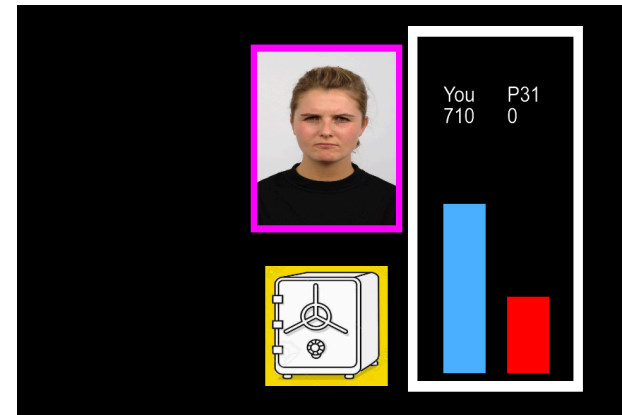
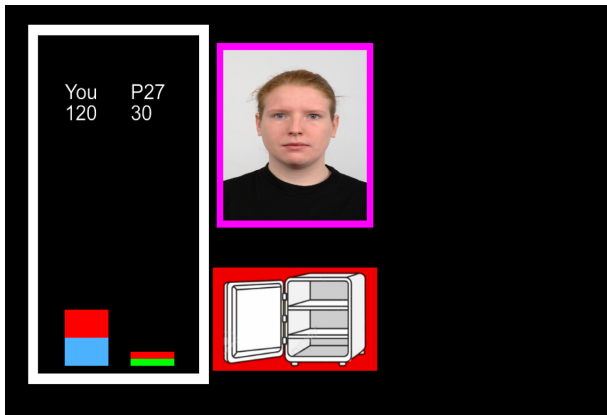
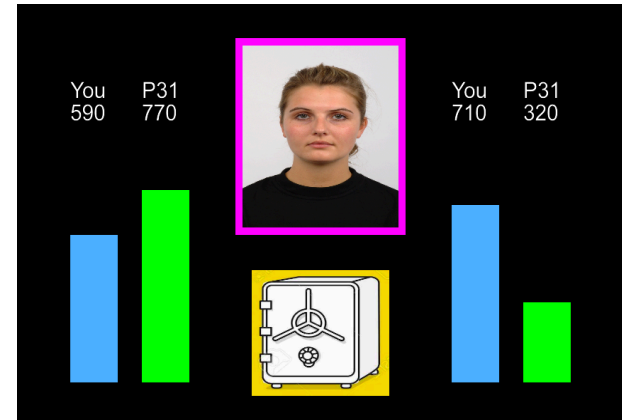
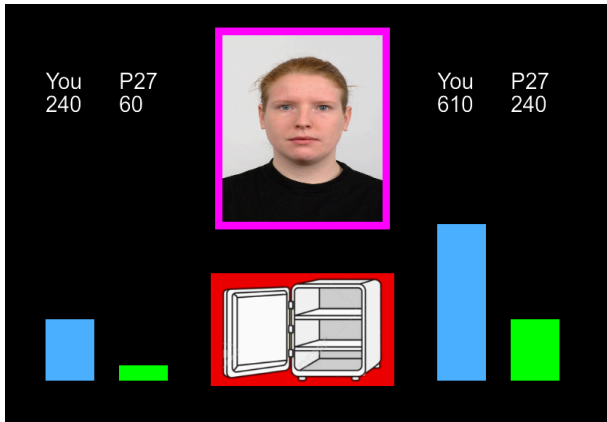


- Two punishment conditions (open/safe), allow us to dissociate prosocial and strategic motives in P1 (the z-proso participant)
 - In Open condition, P1 must consider whether or not the partner will punish them and take away money.
 - In Safe, P1 is immune from punishment so there are no strategic concerns regarding money.

Our decision paradigm tests aspects of social information processing including emotion perception, learning, value computation, and strategic self-regulation



fMRI paradigm– key aspects



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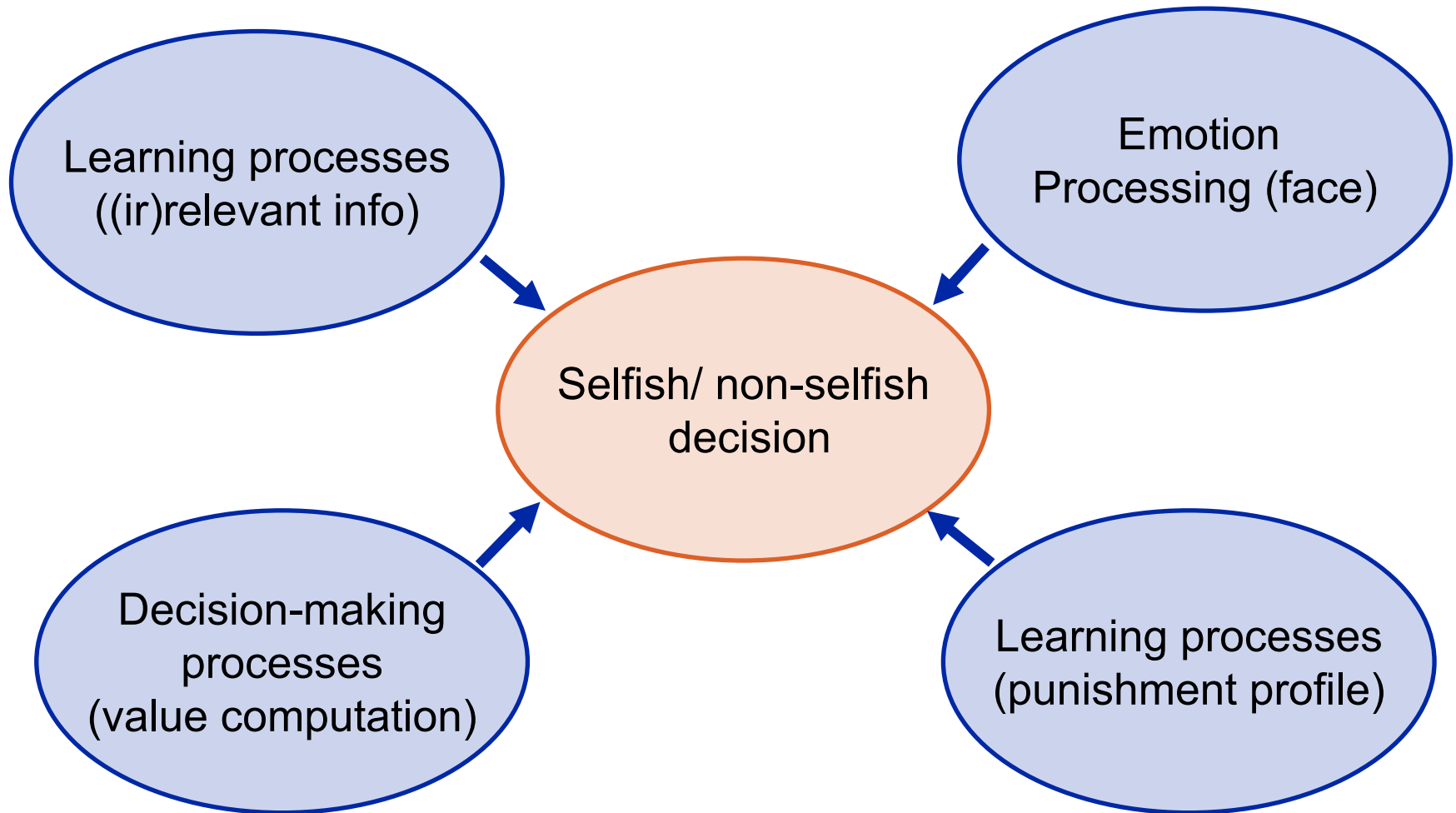


fMRI paradigm - key aspects

- Value computation : best option self/partner
- Emotion processing: beginning trial and feedback
- Learning processes: punishment profile and task condition (safe/open)
- Strategic self-regulation: repeated interactions to assess integration of all these aspects

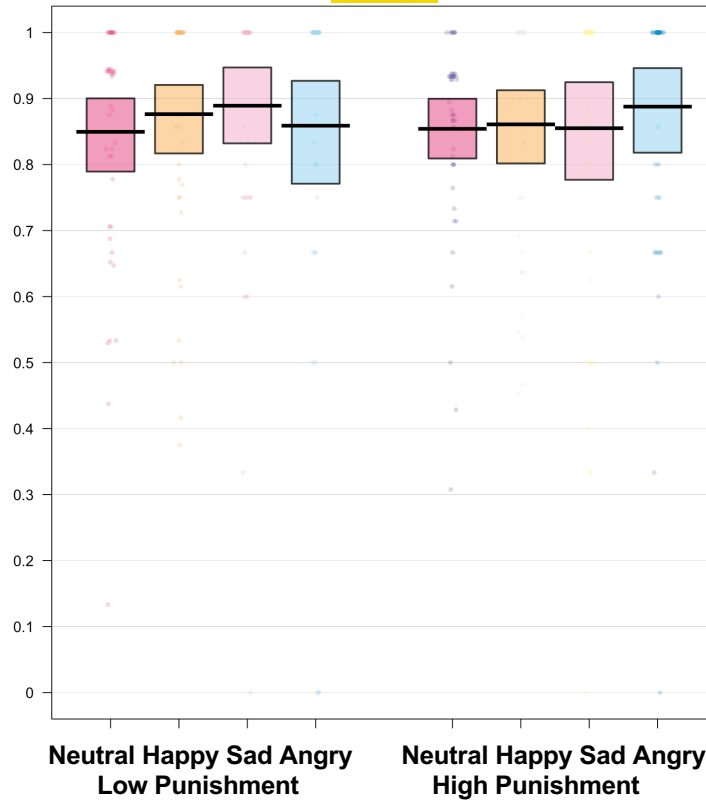
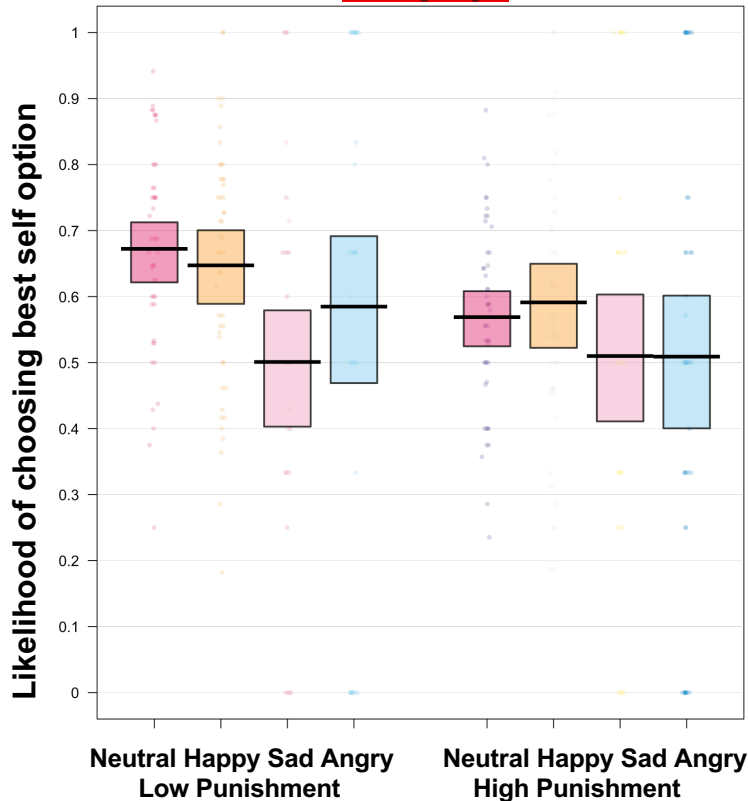
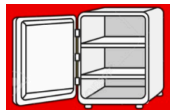


fMRI paradigm - key aspects



Behavioural results in pilot study

Only in the Open condition there is a significant effect of emotion and punishment profile





Punishment Game: key aspects

- Dissociation of motives in P1 based on prosocial (e.g. altruism, fairness) and strategic concerns (e.g. choosing a fair option under the Open condition but not under Safe condition).
- Decision tasks such as this are known to recruit brain circuits thought to support both pro and anti-social behaviours.
- Including repeated interactions with the same partners will allow us to test theories about learning deficits, as well as punishment responses.
- The failure to learn and appropriately adapt one's actions based on feedback from others is thought to be a key factor in anti-social behaviour.



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