Abstract

We designed an experimental paradigm to investigate the development of probabilistic and reversal learning from childhood to adulthood.

Based on probabilistic feedback, participants predict whether sweets, which are presented in one of two contexts, cause stomach ache or not in a fictitious group of friends. Subjects between 10 and 22 years of age participate online after receiving instructions via telephone.

Data collection is ongoing, but a preliminary analysis (N = 122) indicates that probabilistic learning performance may not be associated with age whereas reversal learning performance increases with age.

Related publications:
Preregistration: https://osf.io/ep5ua

Motivation

- We grow up in an environment that constantly requires us to reevaluate and adapt learned associations.
- At different stages of our development, we may recruit different cognitive processes to perform such flexible adjustments.
- For instance, adolescents show characteristically strong reactions to negative feedback in reversal learning tasks[1].
- This study attempts to identify the developmental trajectories of the ability to reverse learned associations.
- Research questions:
  - **Are there developmental changes in reversal learning?**
  - **What aspects of reversal learning may explain developmental changes?**

[1] Van Der Schaaf ME, Warmerdam E, Crone EA, Cools R. Distinct linear and non-linear trajectories of reward and punishment reversal learning during development: Relevance for dopamine's role in adolescent decision making. *Dev Cogn Neurosci*. 2011;1(4):578-590.

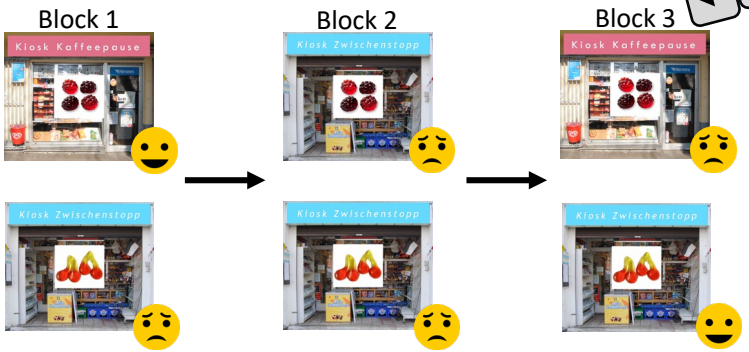
Method and Design

Method

- We designed a **new, web-based probabilistic reversal learning paradigm** with participants between **10** and **22** years of age.
- Participants' **task** is to predict whether sweets, presented in one of two contexts, cause a stomach-ache or not in a fictitious group of friends.

Design

- 3 learning blocks (20 trials/stimulus).
- reversal either after 1st or 2nd block (2 stimuli each), with or without context-change.
- Either 20% or 80% stomach ache.



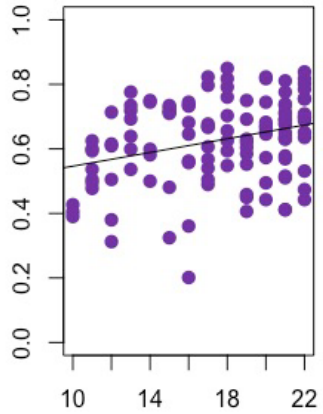
Results and Discussion

Results

Age	10	11	12	13	14	15	16	17	18	19	20	21	22	Sum
N	3	7	6	8	4	7	9	10	8	10	14	20	14	122

- *N*=122, *Mean age* (*SD*)= 18.11 (3.63), *IQR*= [15.6, 21.1]
- After excluding non-learners: No age effect for probabilistic learning: adjusted R^2=-0.006, $F(1, 120)=0.22$, $p=0.63$.
- **Positive association** between **age** and **reversal learning** performance: adjusted R^2=0.089, $F(1, 120)=12.81$, $p<0.001$.

Reversal learning performance



Discussion

- There are more non-learners amongst children, this may affect the results.
- Why does reversal learning increase more strongly with age than probabilistic learning? Are there specific demands of reversal learning?
  - Positive correlation between reactions to negative feedback and reversal learning performance (r=0.29,p=0.0011).

→ Reversal learning may require skills that still develop in adolescence.

- Open questions: What aspects of reversal learning are challenging? How does brain development explain these behavioural effects?