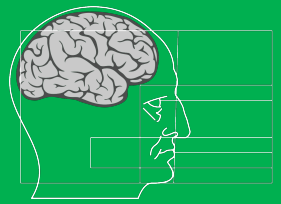


MAX PLANCK UCL CENTRE

COMP 2 PSYCH

International Max Planck Research School

ARC Center for Adaptive Rationality Max Planck Institute for Human Development

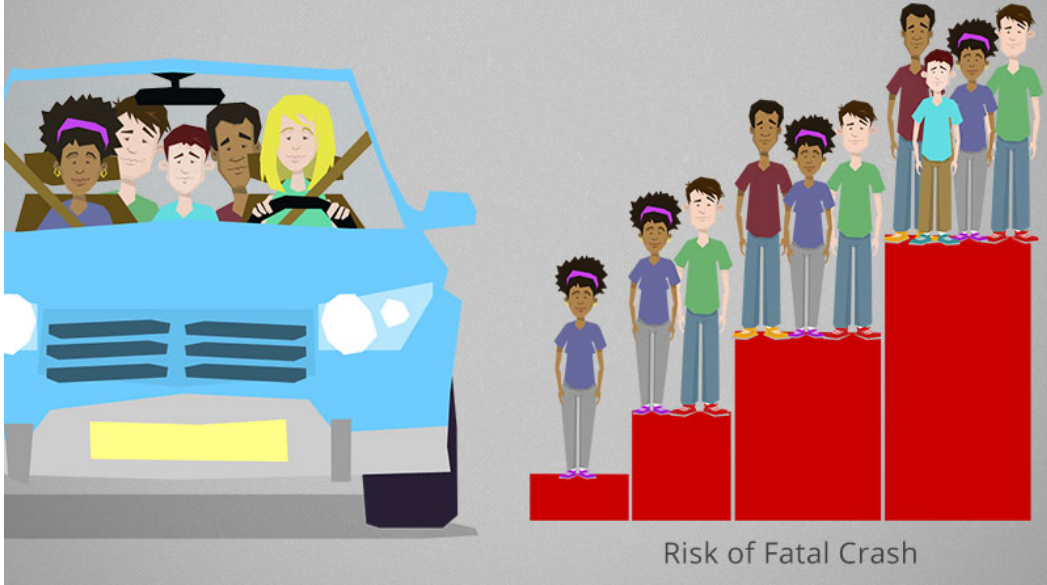
Symposium and Advanced Course on Computational Psychiatry and Ageing Research

International Max Planck Research School COMP2PSYCH

Computational Models of Social Influence in Adolescent Risk Taking

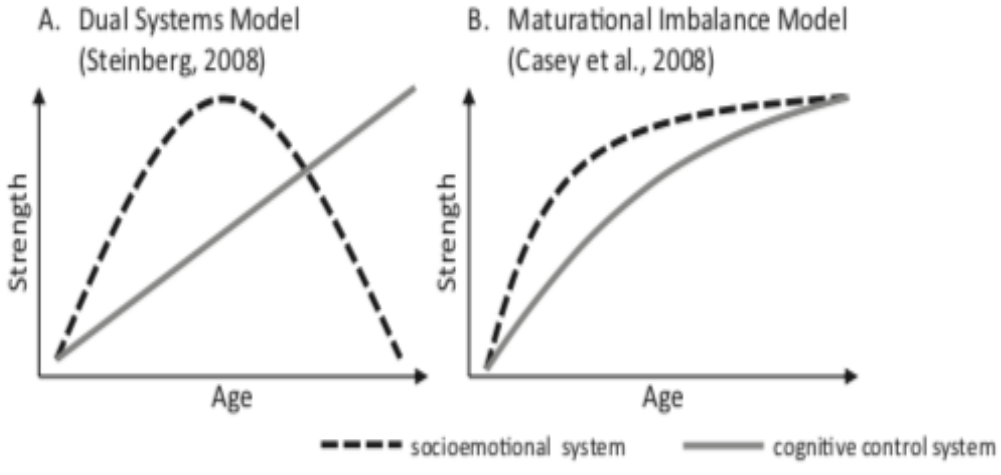
Speaker Simon Ciranka

The more the merrier?
The more the scarier.



The risk of a fatal crash goes up in direct relation to the **number of teens** in the car.

Adolescent Brains – Tuned for Risky Behavior

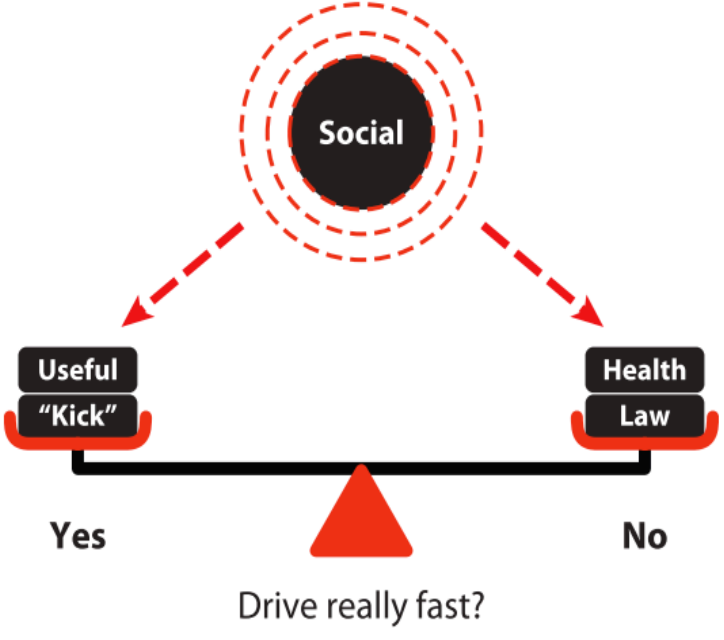


Shulman et al., 2016

<u>Imbalance / Reward Sensitivity</u>

- Risky choices are more attractive because of higher potential gain.
- Social context additionally increases arousal and reward sensitivity

Adolescent Brains – Tuned for Social Information

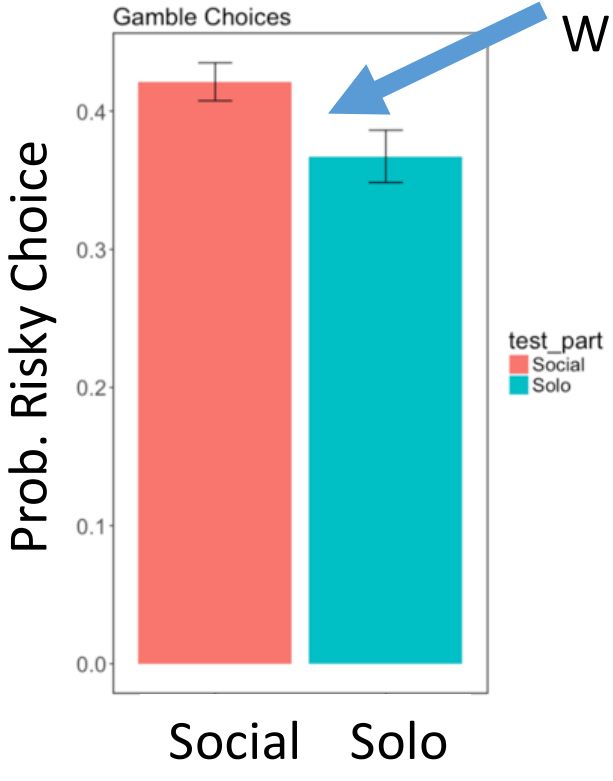


Blakemore & Mills, 2014

<u>Adolescence as a sensitive period for sociocultural processing</u>

- Social Information/status has high weight during adolescence compared to other developmental periods

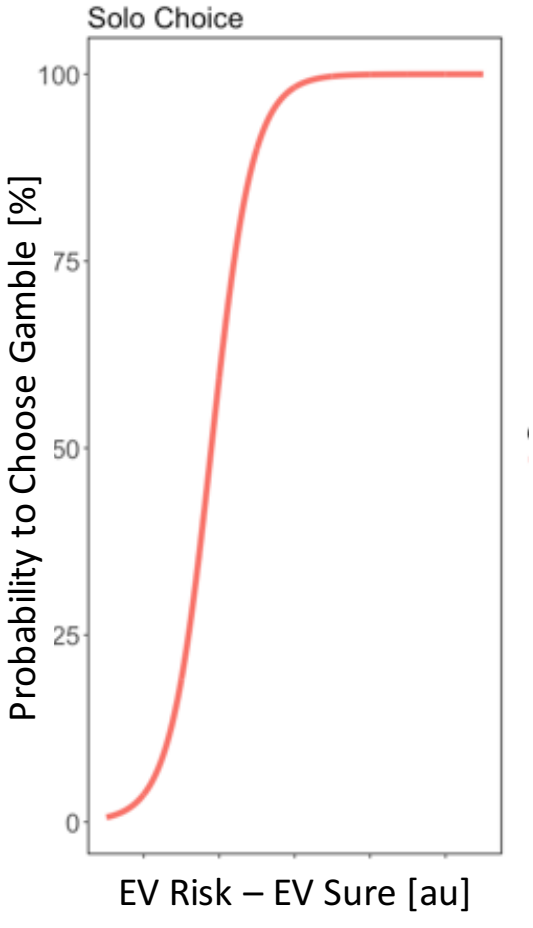
Need for Specificity: Mechanisms of Social Influence in Risk Taking



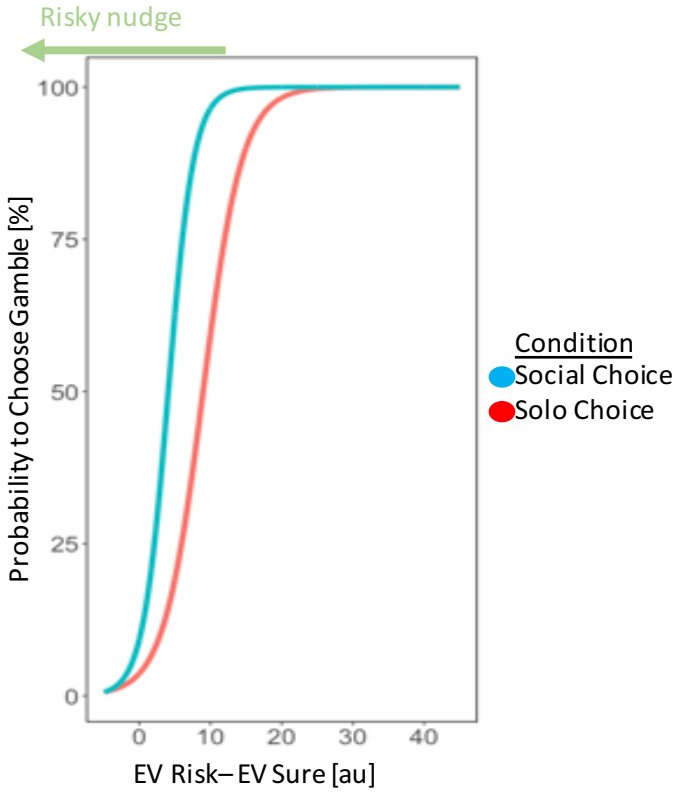
Where does this come from?

Specifying the Hypothesis:

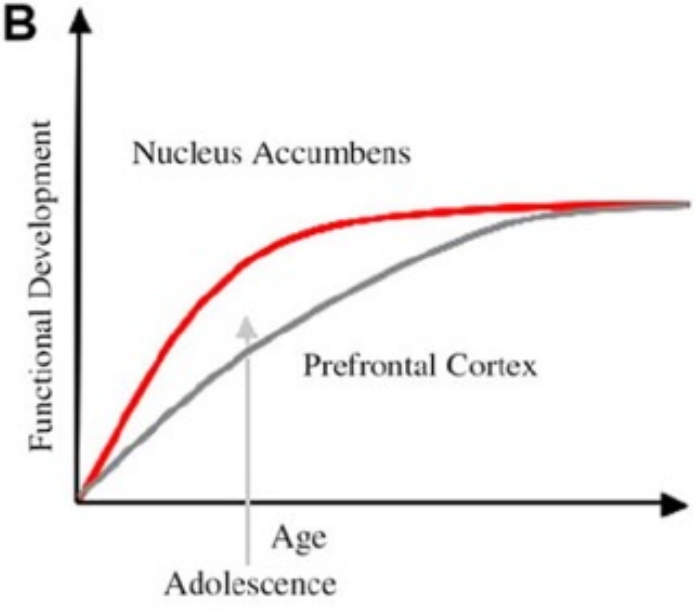
- *1) Formulate model of solo choice behaviour*
  - $EU = p * V^{\alpha}$ $<-Reward\ Sensitivity\ Parameter$
  - $p_{risky} = \frac{1}{1+e^{\left(EU_{risk}-EU_{safe}\right)*\tau^{-1}}}$ $<-late\ Noise$
- 2) Formulate social model that helps to dissect Hypothesis about Risk Taking



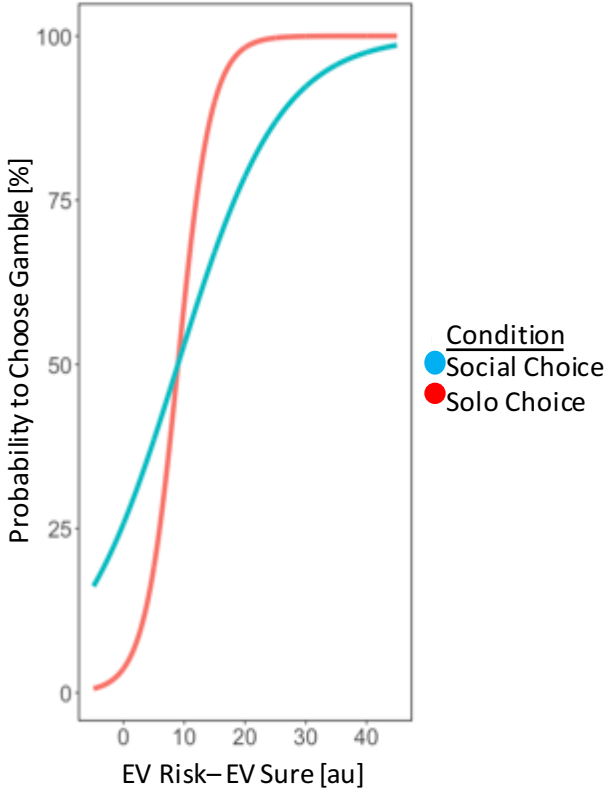
Reward Sensitivity?



- $EU_{Risk|social} = p * V^{(\alpha+\psi)}$

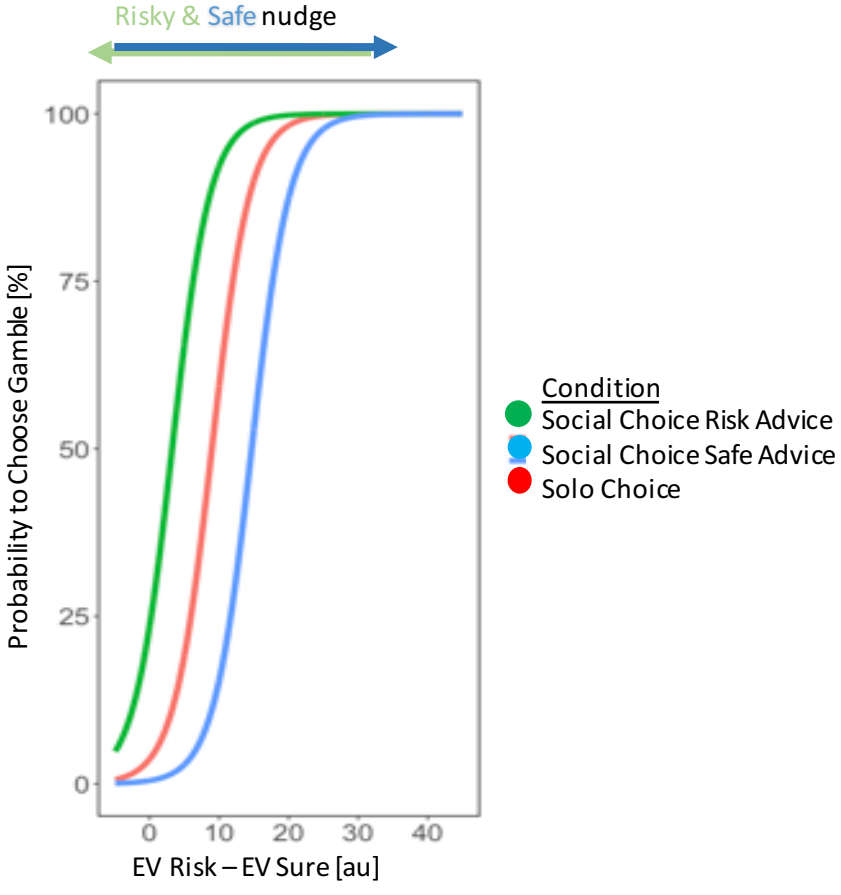


Arousal and Distraction?

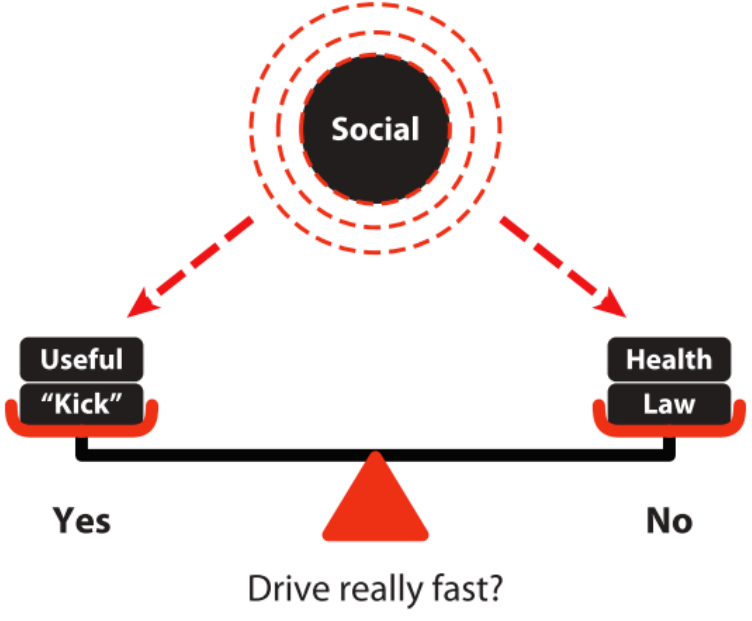


- $p = (1 - \psi) * \frac{1}{1+e^{\left(EU_{risk} - EU_{safe}\right) * (\tau)^{-1}}} + \frac{\psi}{2}$

Social Utility

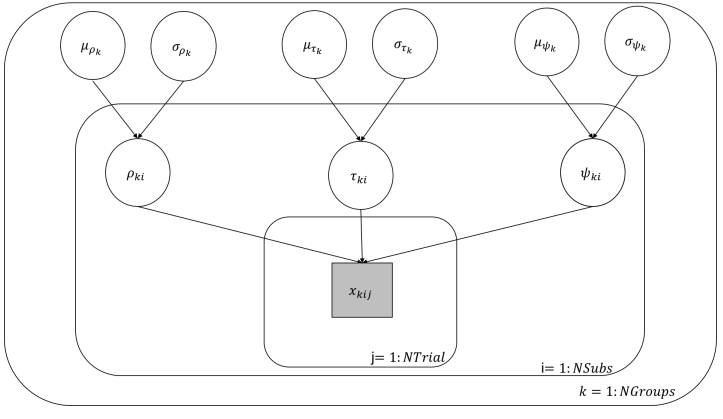


- $EU_{Advised|social} = p * V^{\alpha} + \psi$



Model Quality

- Build Hierarchical Bayesian Versions of the Models
  - Simulate Data under the Different Models
  - Fit Models Back to Simulated Data
  - Judge Correlations between Parameter Estimates and those used for Simulation
  - Compare Model fits in Confusion Matrix



Priors

$\mu_{\rho_k} \sim Gaussian(0,1)$
$\sigma_{\rho_k} \sim Cauchy\ (0,5)$
$\mu_{\tau_k} \sim Gaussian(0,1)$
$\sigma_{\tau_k} \sim Cauchy\ (0,5)$
$\mu_{\psi_k} \sim \begin{cases} if\ k = 1\ Gaussian(-5,1) \\ else\ \ Gaussian(5,1) \end{cases}$
$\sigma_{\psi_k} \sim Cauchy\ (0,5)$

Subject Parameters

$\rho_{ki} \sim Gaussian(\mu_{\rho_k}, \sigma_{\rho_k})$
$\tau_{ki} \sim Gaussian(\mu_{\tau_k}, \sigma_{\tau_k})$
$\psi_{ki} \sim Gaussian(\mu_{\psi_k}, \sigma_{\psi_k})$

Observed Choices

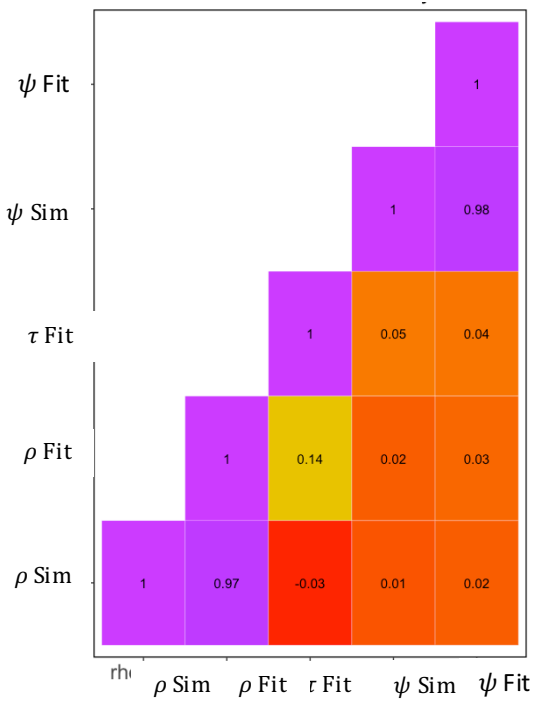
$USafe = \begin{cases} if\ advice = safe\colon\ 5^{\rho_{ki}} + \psi_{ki} \\ else\ :\ 5^{\rho_{ki}} \end{cases}$

$URisk = \begin{cases} if\ advice = risky\colon p_j\ * V_j^{\rho_{ki}} + \psi_{ki} \\ else\colon p_j\ * V_j^{\rho_{ki}} \end{cases}$

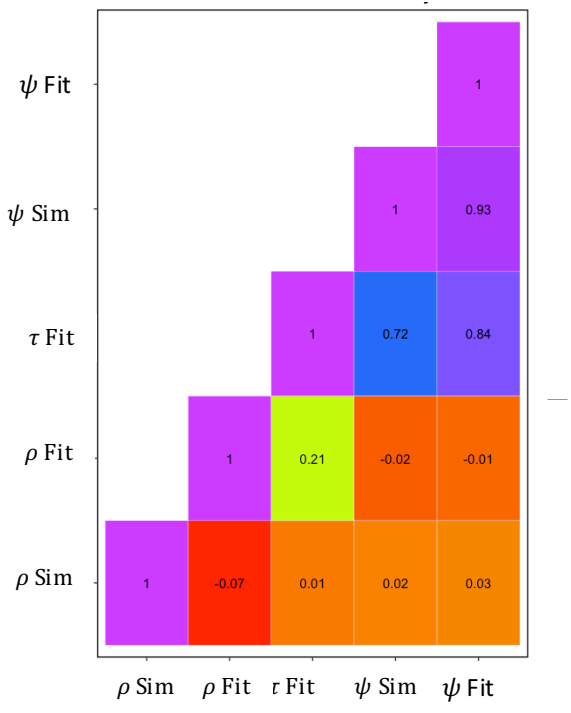
$x_{kij} \sim Bernoulli(\frac{1}{1+e^{-(URisk-USafe*\tau_{ki})}})$

Simulation Results – Parameter Recovery

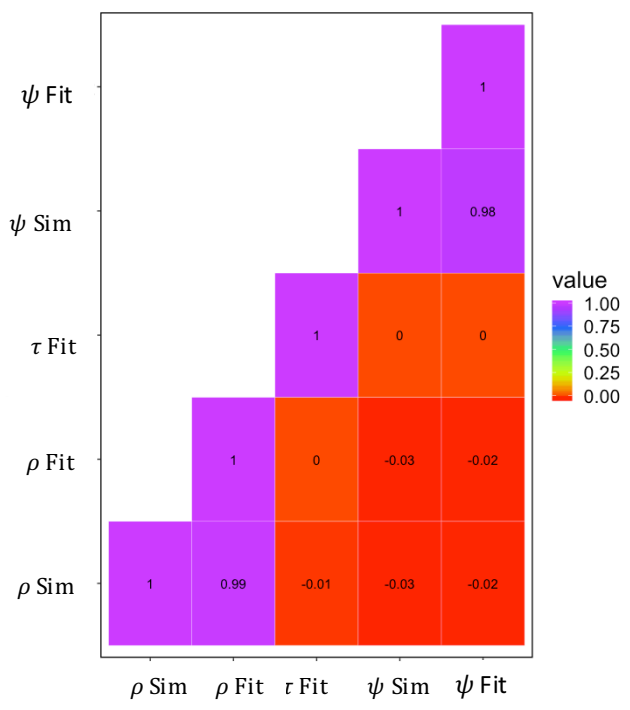
Parameter Recovery Reward Sensitivity Model

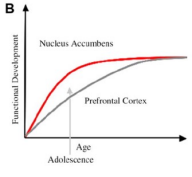


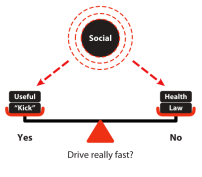
Parameter Recovery Noise Model



Parameter Recovery Utility Model







Simulation Results – Model Recovery