Intense World Theory and The HGF Model

Miura Hawkins
Computational Psychiatry Seminar HS 2014
12.12.2014
Henry Markram

- EPFL: Mind Brain Institute, Center for Neuroscience and Technology - Director
- Blue Brain Project, HBP
- reverse-engineering the brain
- autistic son
Intense World Theory

- product of observation of his son's development

- ASD is result of "hyperfunctioning in local neural microcircuits"

- fast, strong connections (hyper-reactivity, hyper-plasticity)

- microcircuits become autonomous—> hyper-perception, attention, memory, emotionality
Intense World Theory

- strong reactions drive brain to overly selective state, becoming more and more extreme with experience
- decoupling from “painfully intense world” is a coping mechanism: internal world is limited but will offer few surprises
Intense World Theory

- social difficulties—complexity cannot be encoded from the first few examples alone, incorrect associations will be made
- savants—autists who are able to express themselves still. amazing abilities may be trapped in the minds of autists who do not communicate
- diversity—different microcircuits are affected
- attention—overwhelming stimuli ignored
Hierarchical Gaussian Filter

Parameters

- $\mu_3, \sigma_3$: volatility Gaussian
- $\mu_2, \sigma_2$: tendency Gaussian
- $\kappa$: strength of $x_2, x_3$ coupling
- $\omega$: updating of $x_2$
- $\Theta$: perception of volatility
- $\zeta_1, \zeta_2$: reliance on advice, decision noise

Diaconescu et al. 2014
What do we predict?

- $\mu_3, \sigma_3, \mu_2, \sigma_2, \kappa, \zeta_2$ — normal
- $\omega$ — low updating of advice correctness
- $\theta$ — low perception of volatility
- $\zeta_1$ — low weighting of advice vs. pie chart
normal behavior, with varying $\omega$ and $\zeta_1$
varying low $\omega$ with constant low $\zeta_1$ and $\Theta$
varying $\zeta_1$ with constant low $\omega$ and low $\theta$

blue values tend to follow input (pie chart) and orange values tend to follow advice
Conclusions

- testing ASD subjects on social learning task could shed light on validity of Intense World Theory
- dynamic $\omega$ could also be interesting—high at first and then quickly solidified circuits stop updating
- ASD patients who have managed to avoid decoupling might behave differently: “Spectrum”
Thanks!


http://www.nature.com/polopoly_fs/7.2931.1329911181!/image/Markram.jpg_gen/derivatives/landscape_630/Markram.jpg