Toward Understanding Girls with Autism: A Scientist & Father's Perspective

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Autism and Neurodevelopmental Disorders Institute

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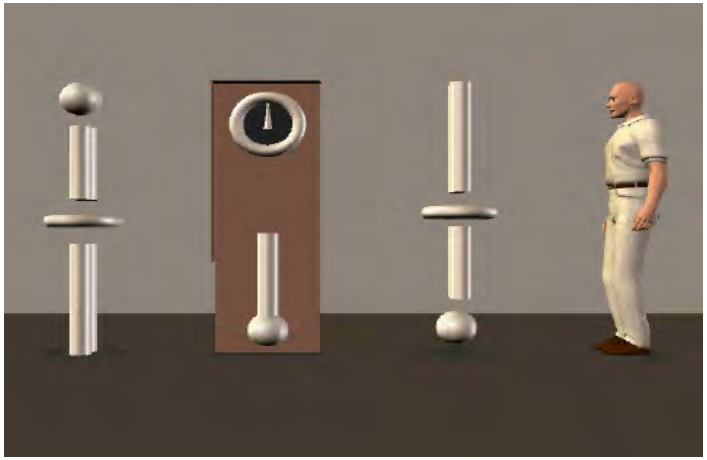
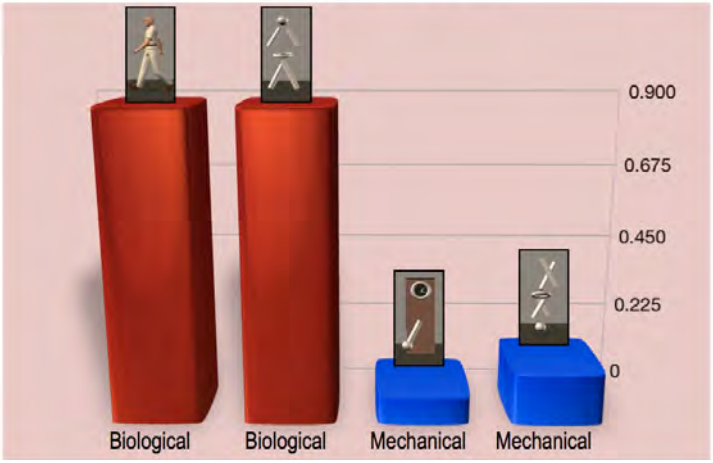
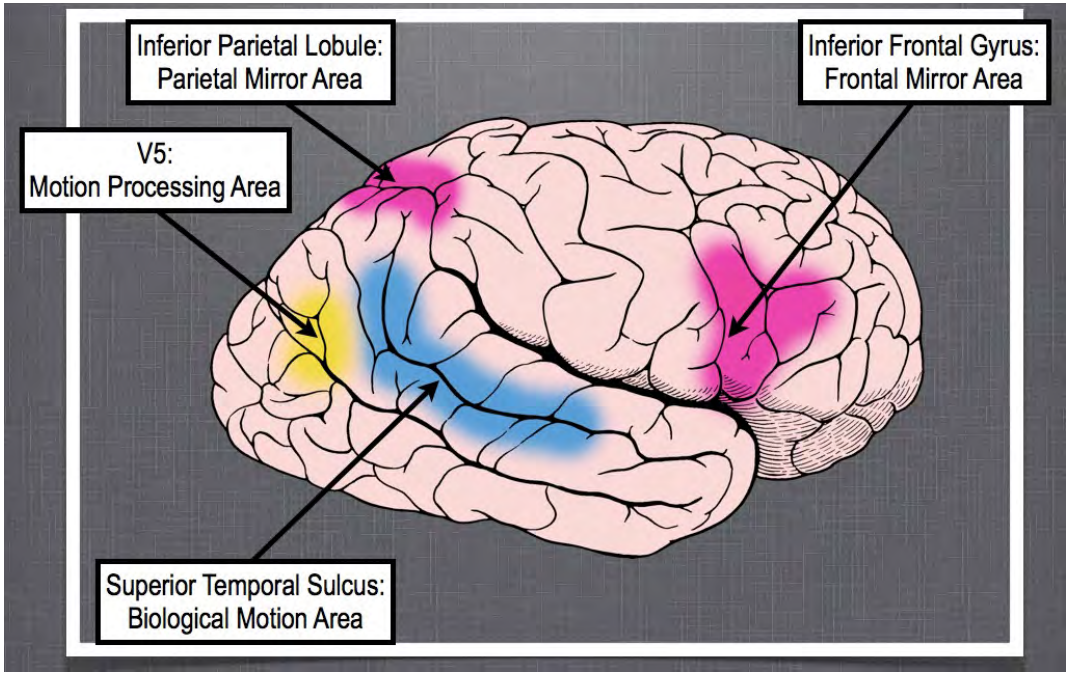
GW AUTISM & NEURODEVELOPMENTAL DISORDERS INSTITUTE

Children's National™

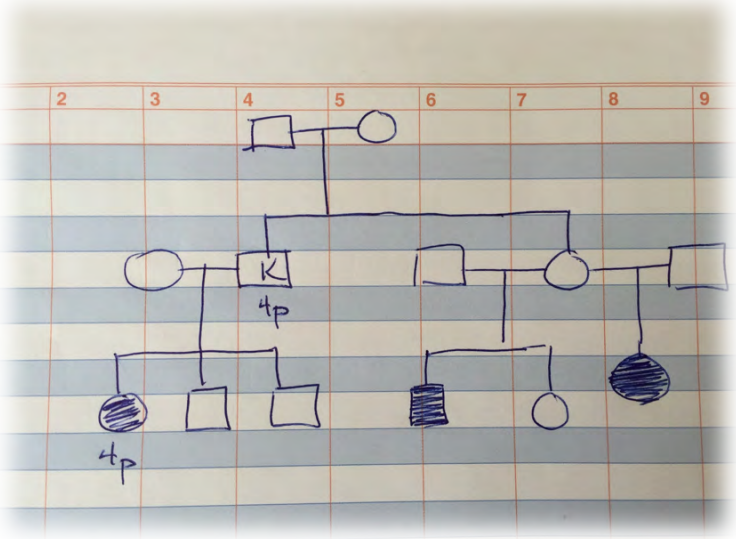
How do we understanding intentions?







Pelphrey et al. (2003) *Journal of Neuroscience*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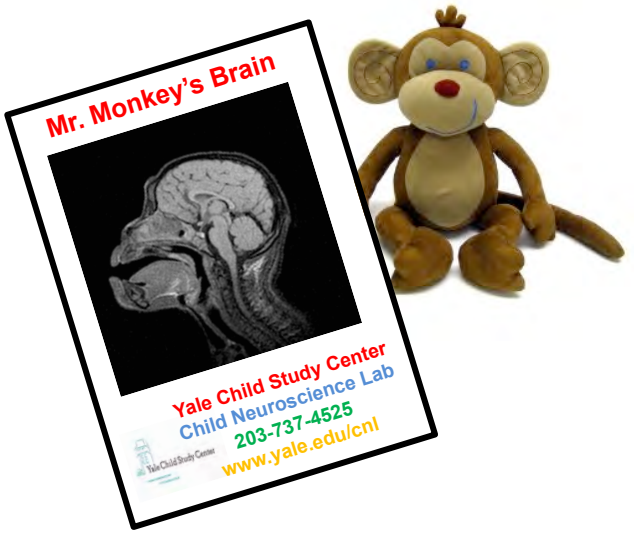
4p
4p

Pretend

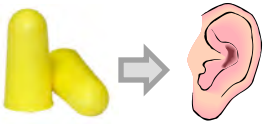
Props



Picture schedules

SIT ON TABLE

EARPLUGS



HEADPHONES

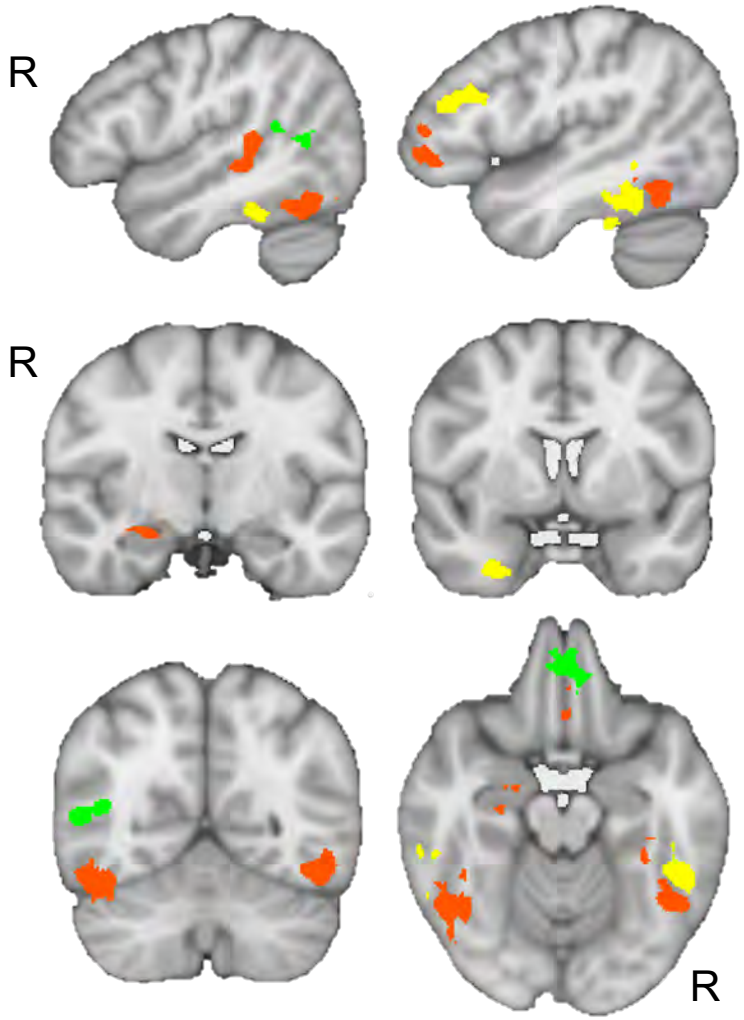
HELMET ON

Pixar

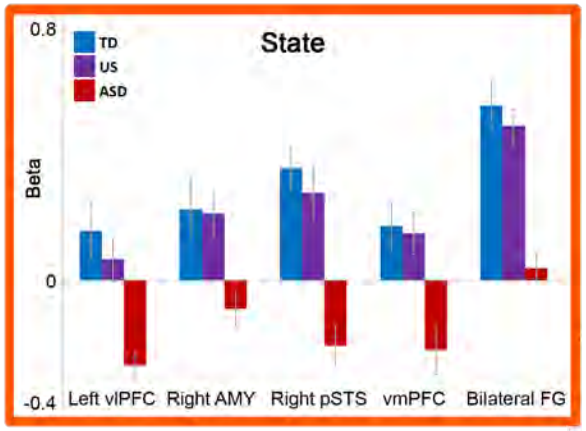
Prizes!

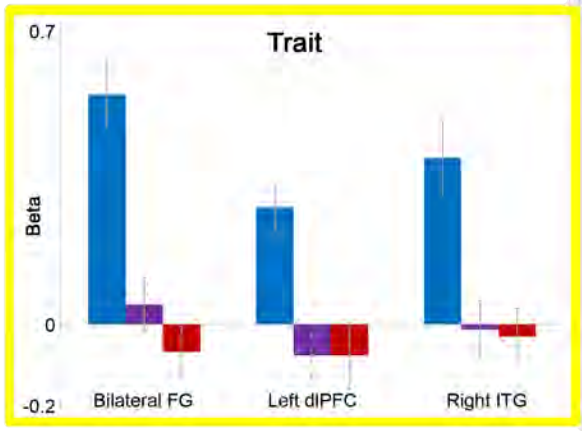
Neural Signatures of Autism

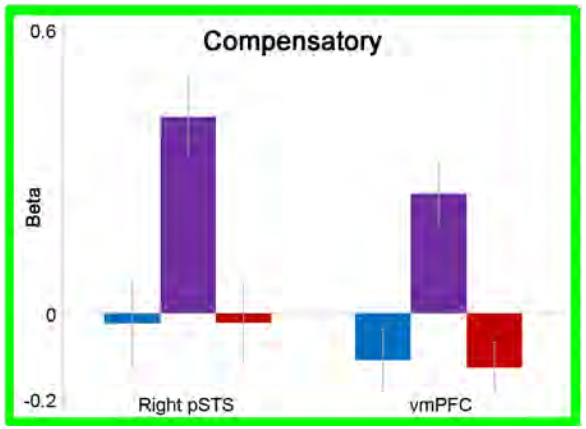
- State markers: dysfunction in children with ASD relative to siblings and typical children.
- Trait markers: shared dysfunction in siblings and children with ASD
- Compensatory mechanisms: enhanced activity unique to siblings



State: ASD < TD & ASD < US
Trait: US < TD & ASD < TD
Compensatory: US > TD & US > ASD



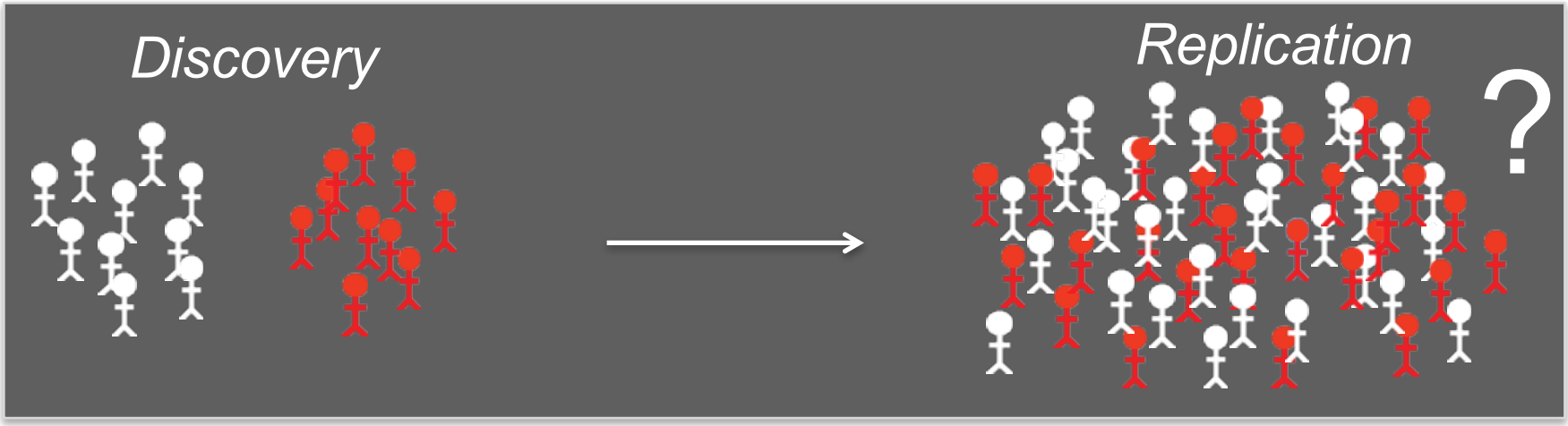




Kaiser et al. (2010) *Proceedings of the National Academy of Sciences*

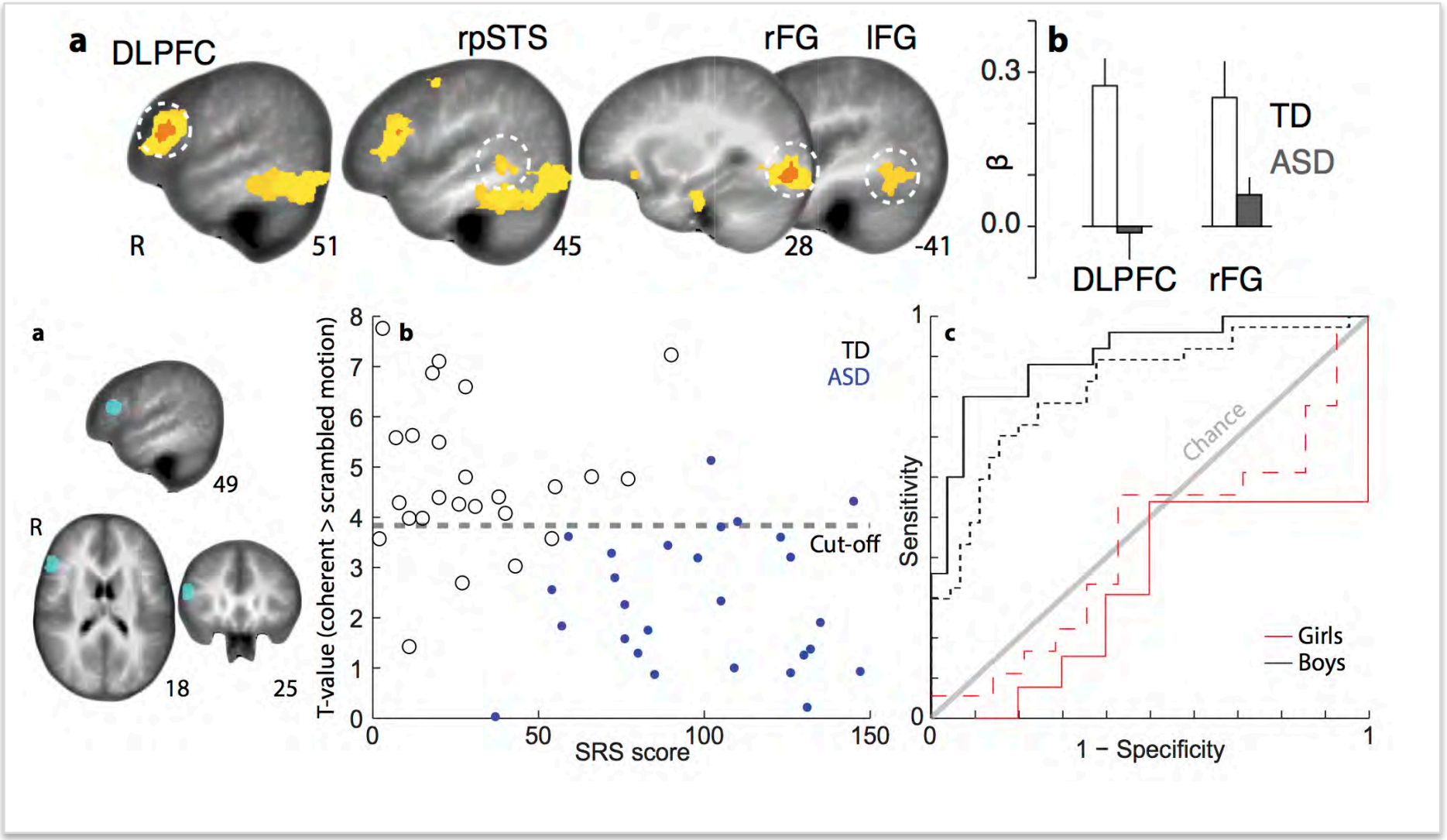
Can we see autism’s signature in the individual brain?

Classification Analysis



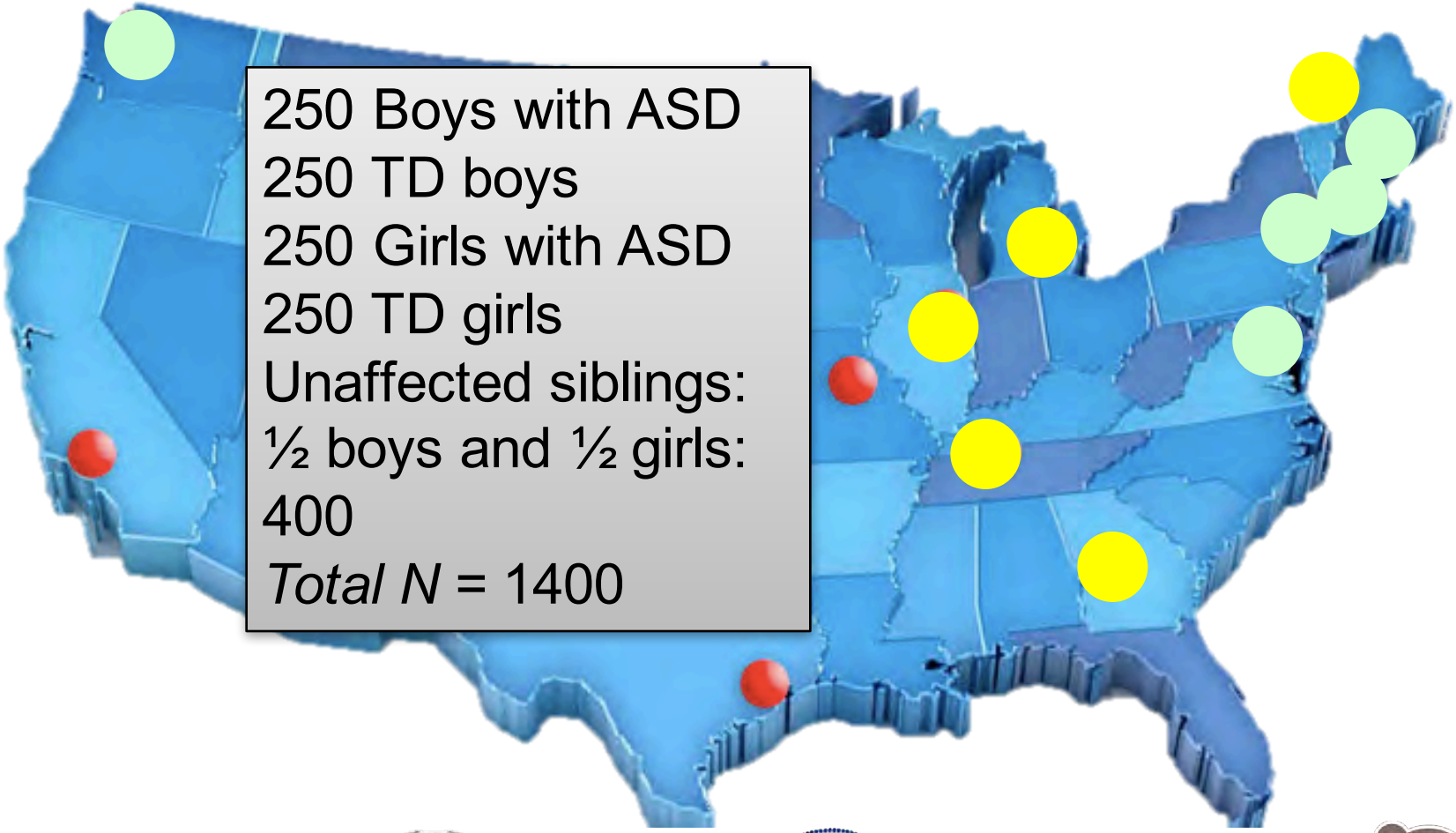
- In each ROI:
  - Trained classifier on Discovery cohort brain responses
  - Predict the diagnostic categories of the Replication cohort
- Significance assessment
  - Permutation testing
    - 1001 permutations
  - FDR control for multiple comparisons

A weak response to biological motion is a marker of autism in boys (but not girls!)



Björnsdotter et al., *JAMA: Psychiatry*, 2016

Autism Center of Excellence: Girls Network



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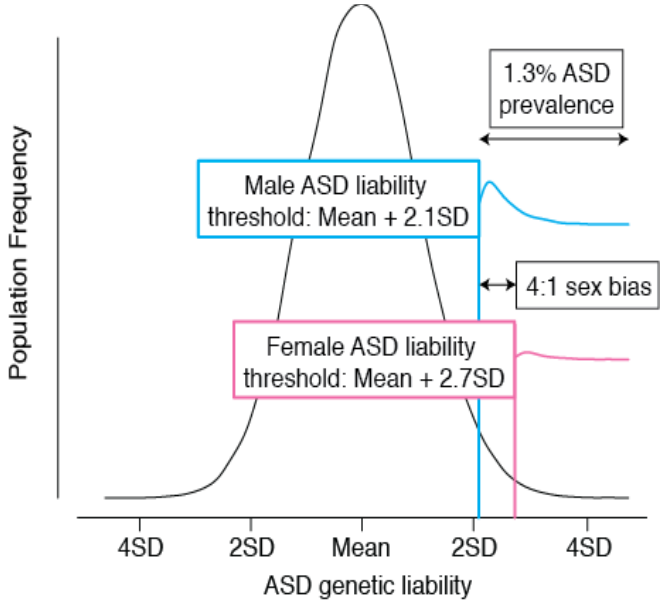
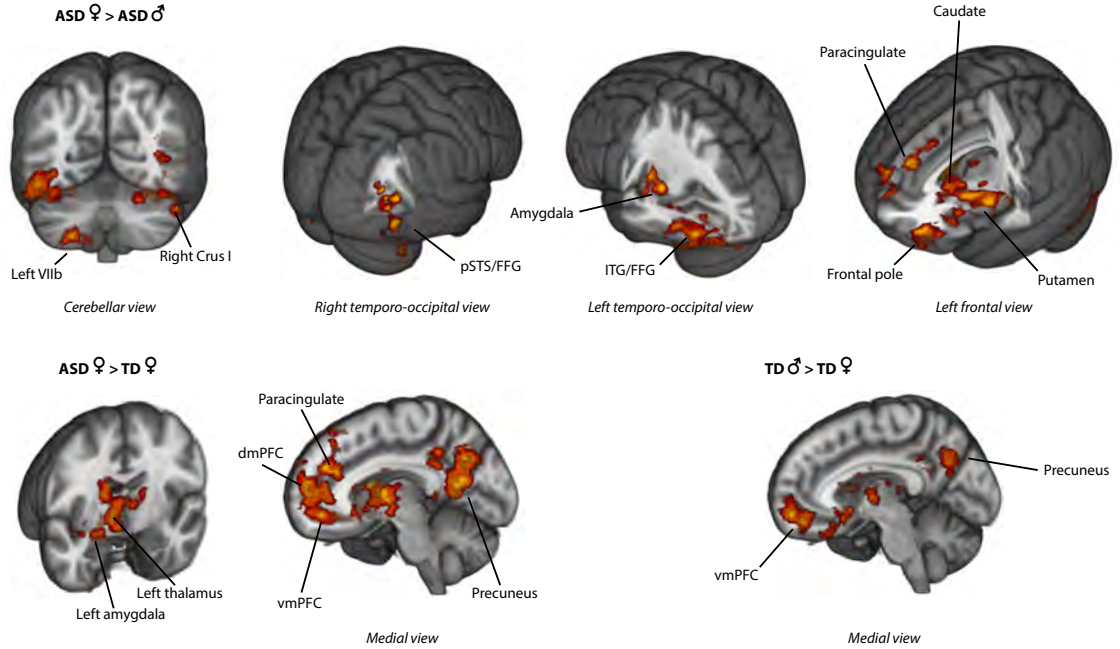
WASHINGTON, DC

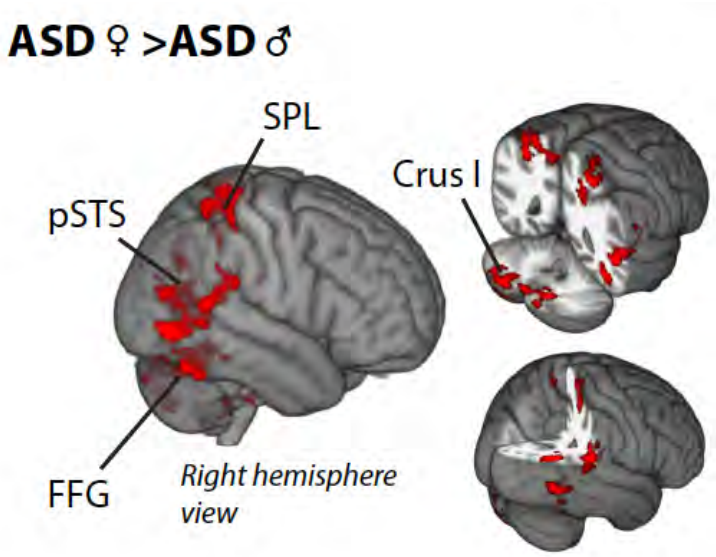
Children's National



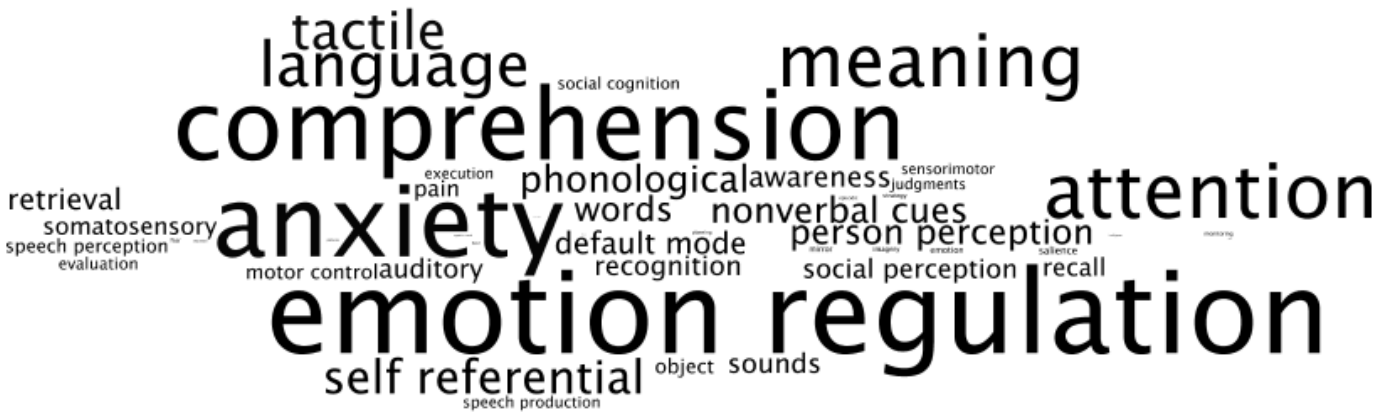
Sex differences in brain response to coherent versus scrambled biological motion



♀: female; ♂: male; **dmPFC:** dorsomedial prefrontal cortex; **FFG:** fusiform gyrus; **ITG:** inferior temporal gyrus; **pSTS:** posterior superior temporal sulcus **vmPFC:** ventromedial prefrontal cortex



Girls

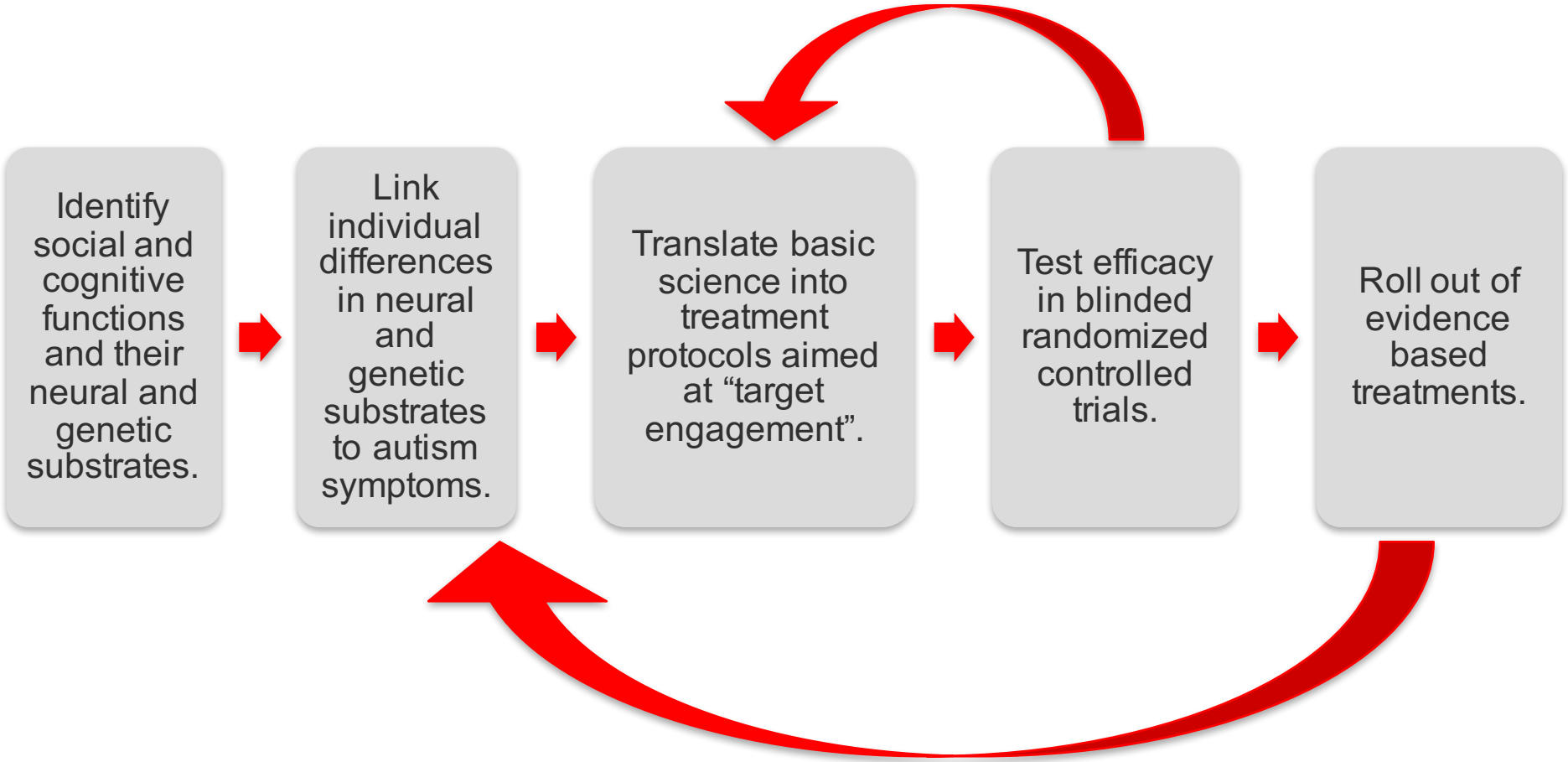

tactile
language
meaning
social cognition
comprehension
execution
pain
phonological
awareness
sensorimotor
judgments
attention
retrieval
somatosensory
speech perception
evaluation
anxiety
words
nonverbal cues
person perception
default mode
motor control
auditory
recognition
social perception
recall
emotion regulation
self referential
object
sounds
speech production

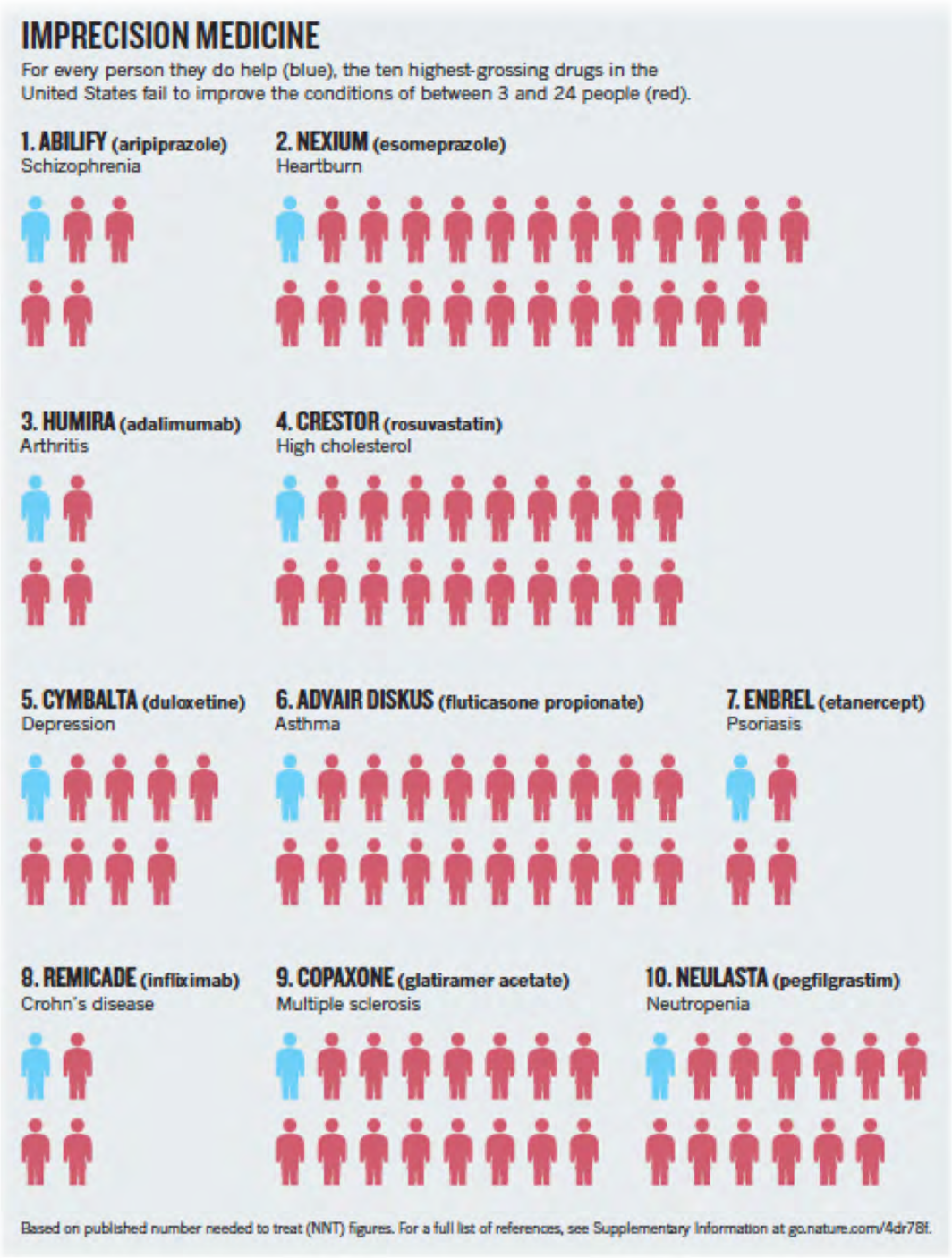
Boys

meaning
motion
language
identity
comprehension
person perception
cognitive control
spatial
response inhibition
salience
recognition
phonological
strategy
episodic
sounds
object
category
social perception
priming
words
recall
judgments
faces
emotion regulation
attention
social cognition
self referential
speech perception
biological
spatial attention
attention
nonverbal cues
retrieval
visuospatial
cues
auditory
monitoring
visual

How do we translate basic science into real-world tools aimed at “target engagement”?

Experimental Therapeutics



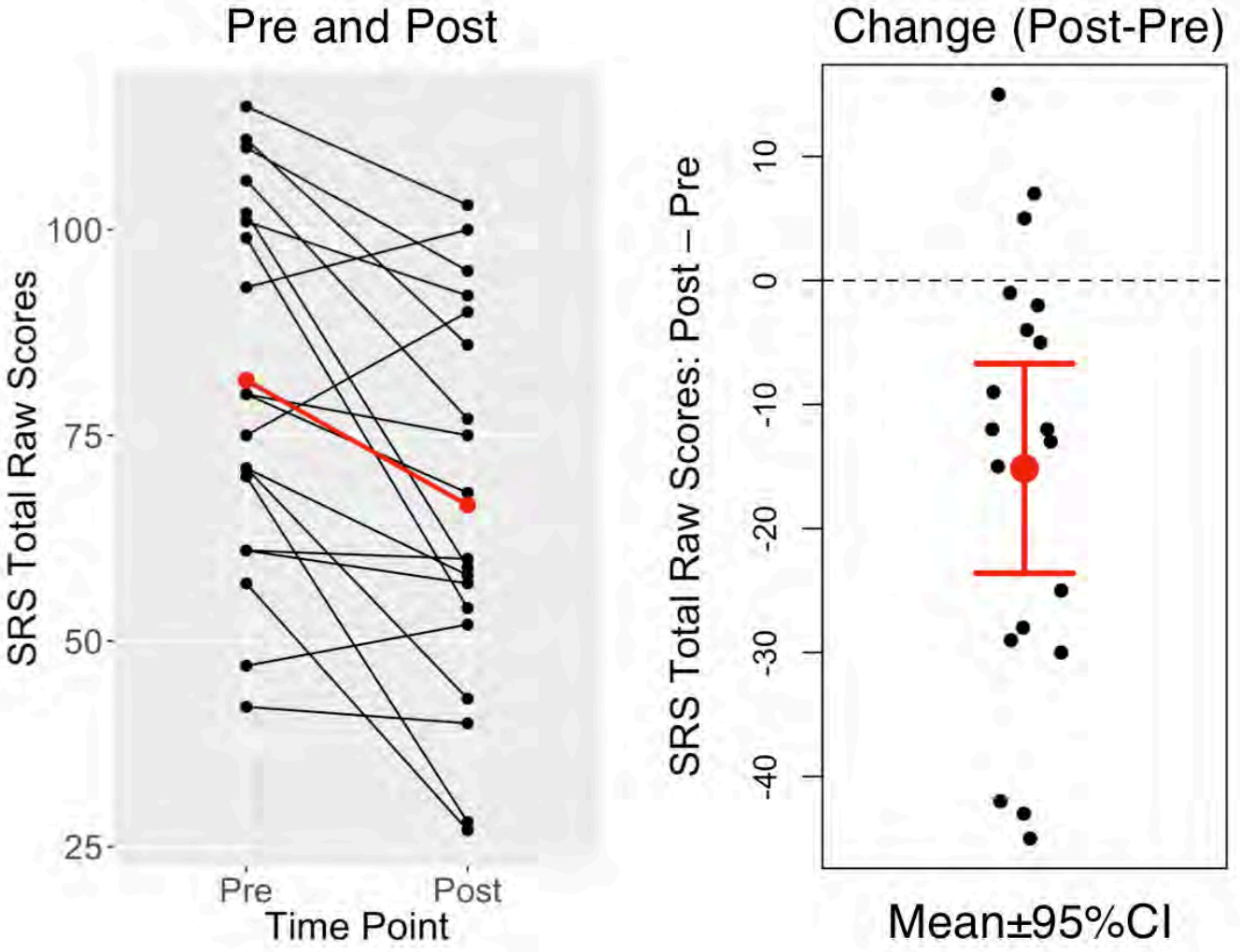


Schork (2015) *Nature*

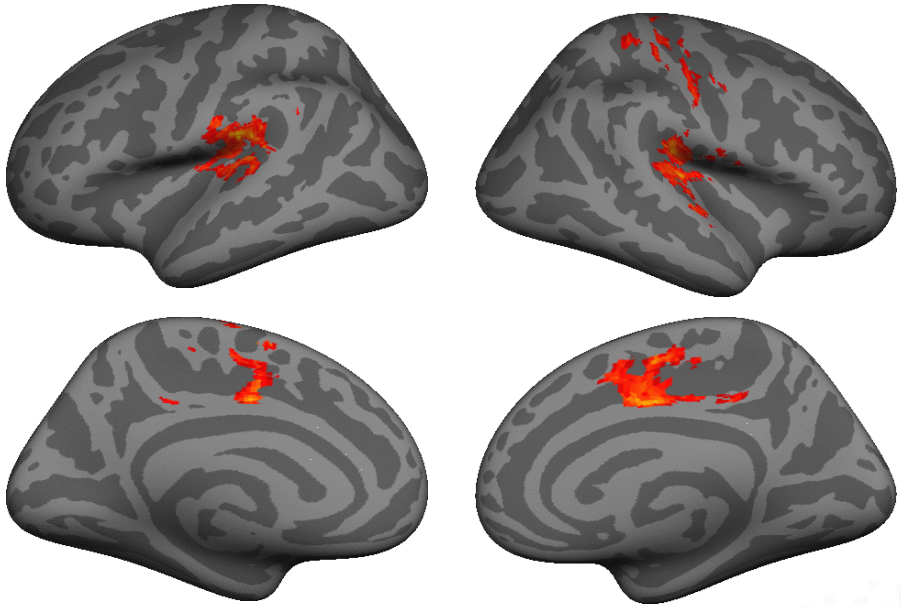
If you have met one person with autism…

Pivotal Response Training (PRT)

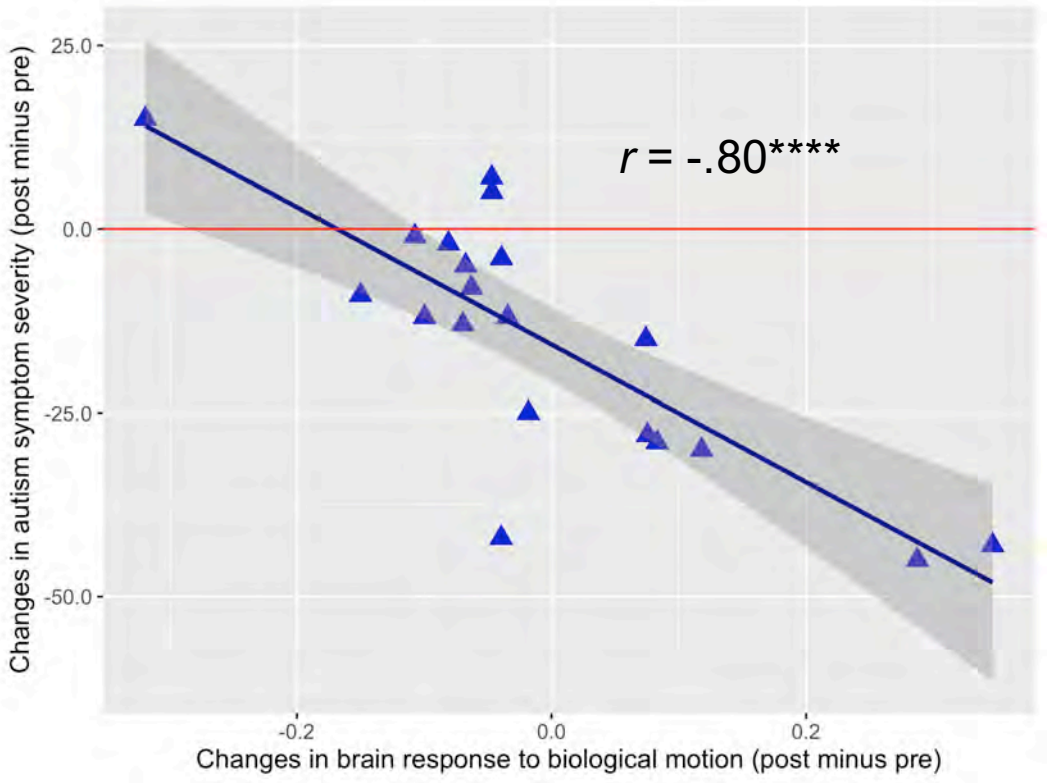
Change in Behavior: Social Responsiveness Scale (SRS)



Yang et al. (in press) *Nature: Translational Psychiatry*



Change in brain, driving change in behavior



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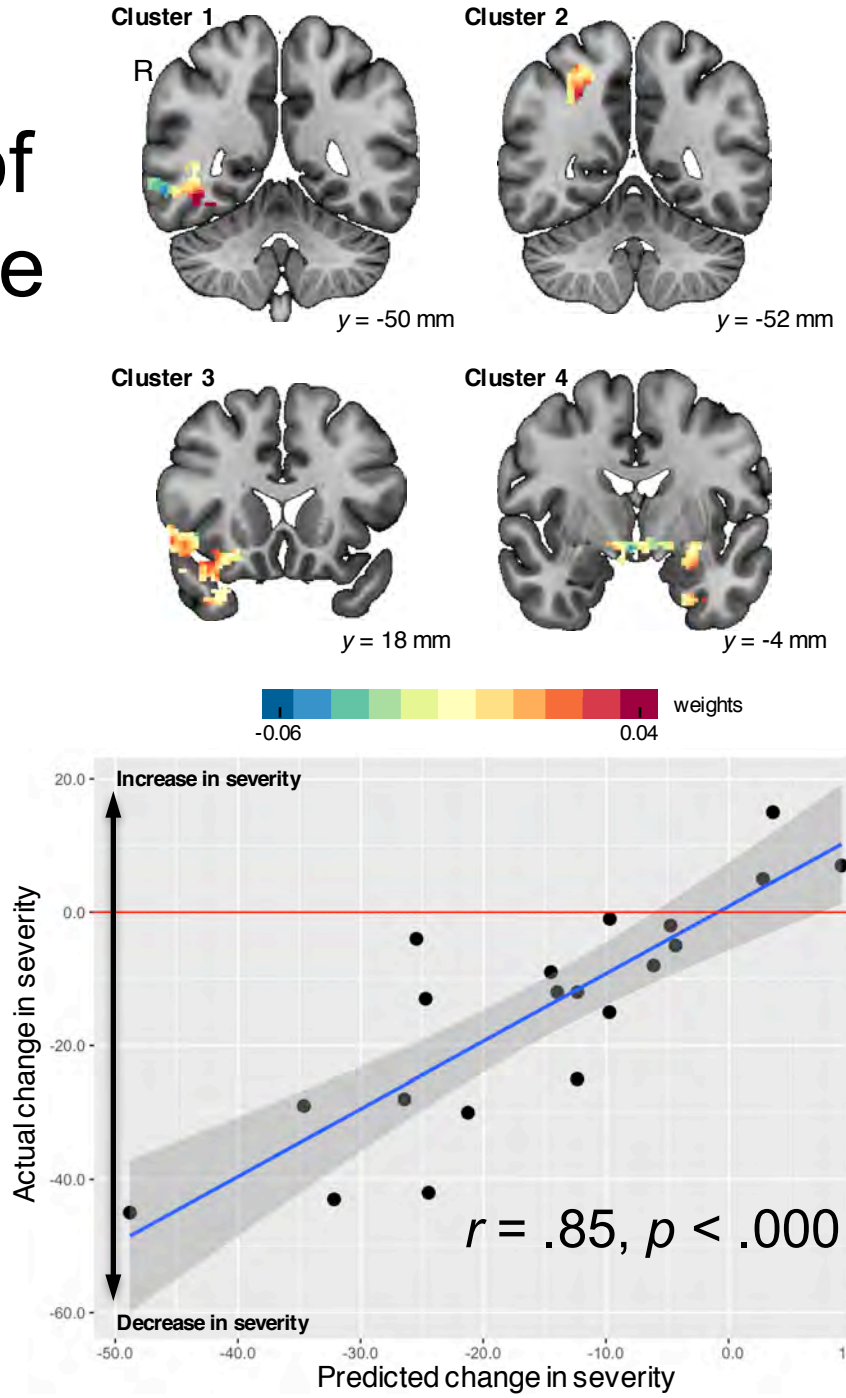
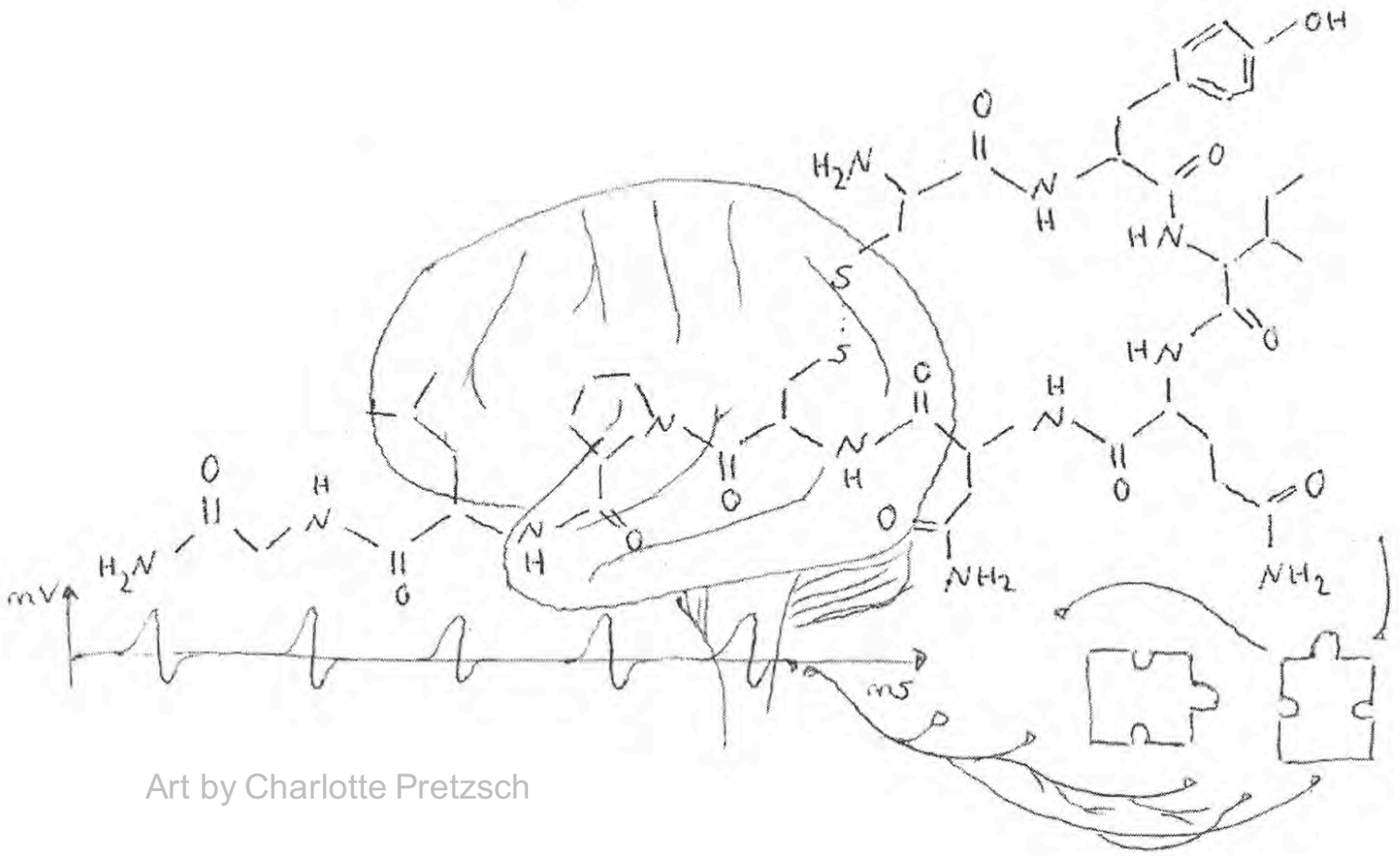
Neuro-prediction of treatment response



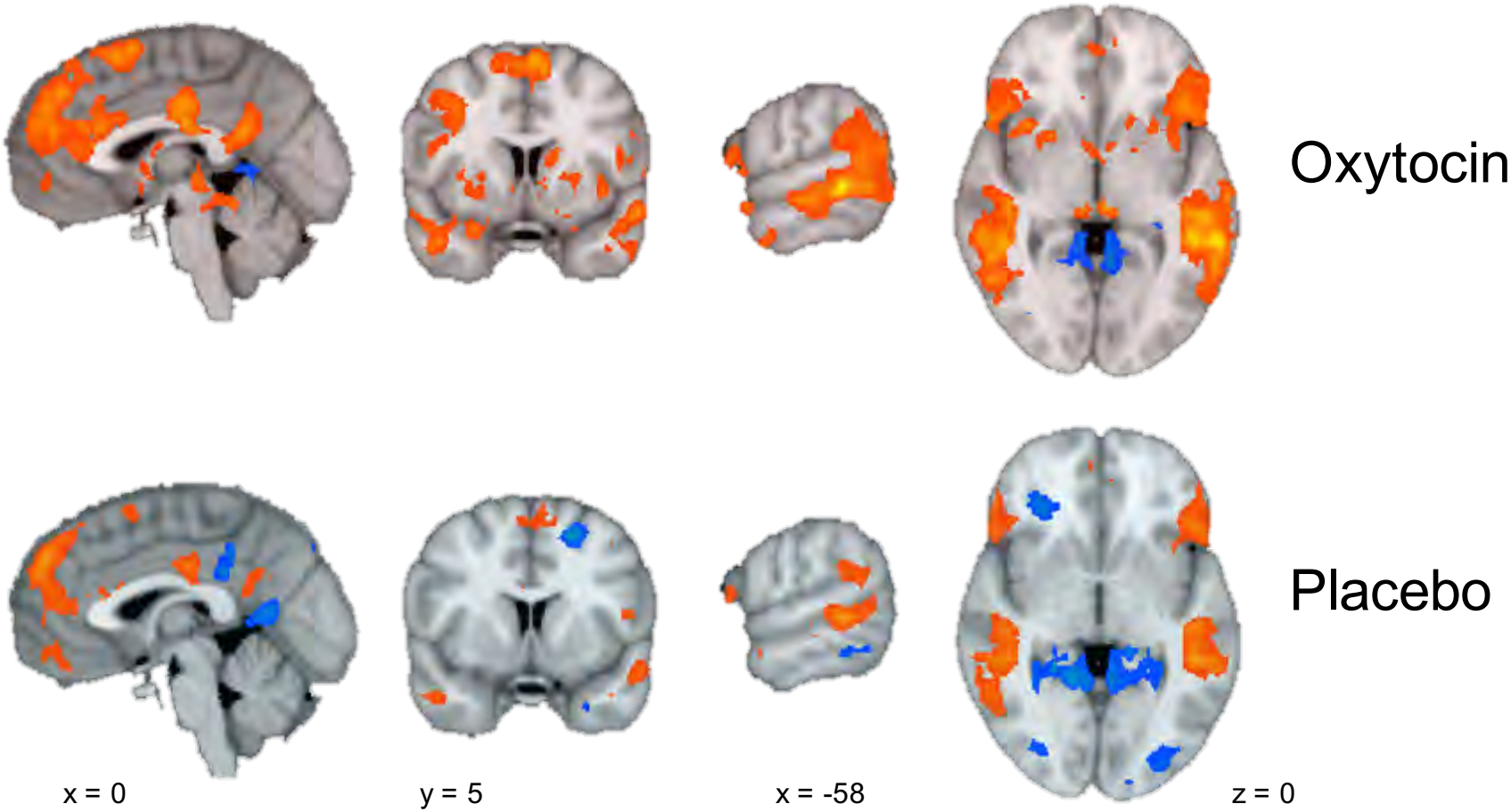
Yang et al. (in press)
Nature: Translational Psychiatry

Can we boost brain responses before treatment?



Art by Charlotte Pretzsch

Intranasal Oxytocin – Social Judgments



Gordon et al. (2013) *Proceedings of the National Academy of Sciences*

SHEN YUN
THEY SAID I COULD BE ANYTHING...
SO I BECAME A NINJA

LOVE
FUN
SPORTS

Neural Prediction of VR Treatment Response in Young Adults

VR Platform

- *Real-Time Interaction*
- *Individual-Driven Avatars*
- *Real Life Context & Environments*
- *Voice Modulation*
- *Face Emotion Capture*

Training Objectives

- ***Recognizing Others***
  - Starting a conversation
  - Casual conversation
- ***Personal Response***
  - Job interview, developing a friendship, dating
- ***Self-Assertion***
  - Work dilemmas, confronting a friend

Treatment outcomes

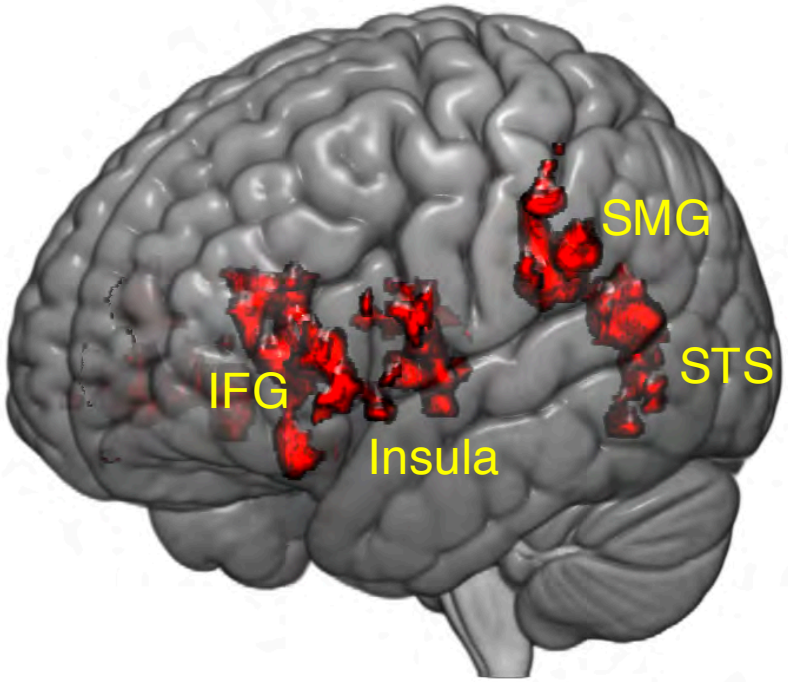
Verbal and Non-verbal Emotion Recognition, WAIS-IV & WMS-IV(ACS)-Social Perception (SP) subtests

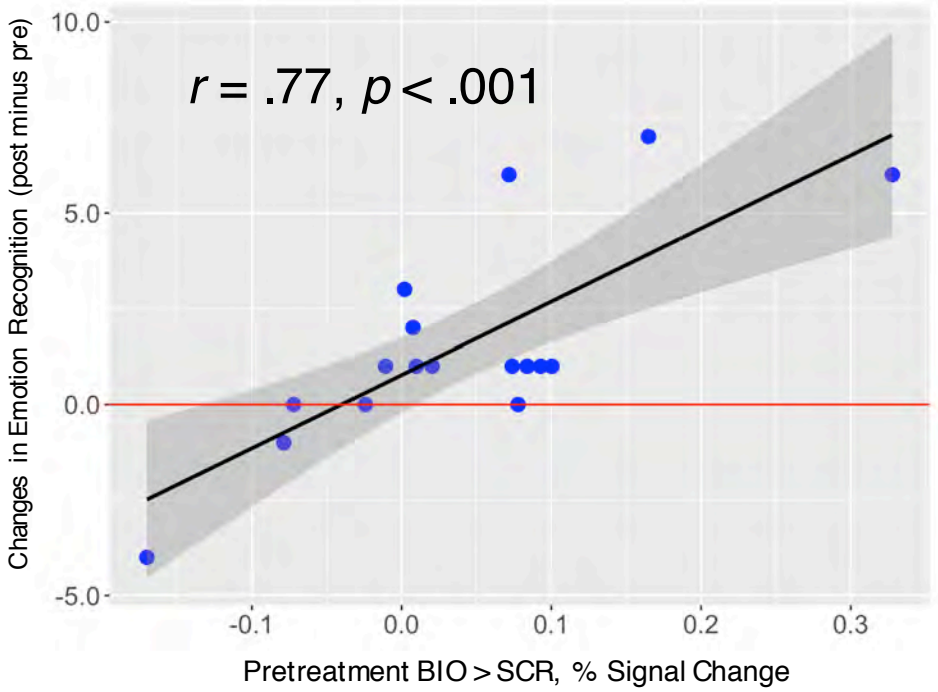
Social Responsiveness Scale (**SRS**)

Friendship network metrics

Neuroimaging

Brain Activation to Biological Motion Predicts Success in Virtual Reality Social Cognition Training for **Adults**!





N = 17, threshold: *Z* > 3.6 (voxel), *p* < .05 (cluster)

Acknowledgments

The Carbonell Family
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NINDS
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Autism Science Foundation

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I thank my colleagues who make this work successful and fun.
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