UT Southwestern Medical Center

The Social Brain in Anorexia Nervosa

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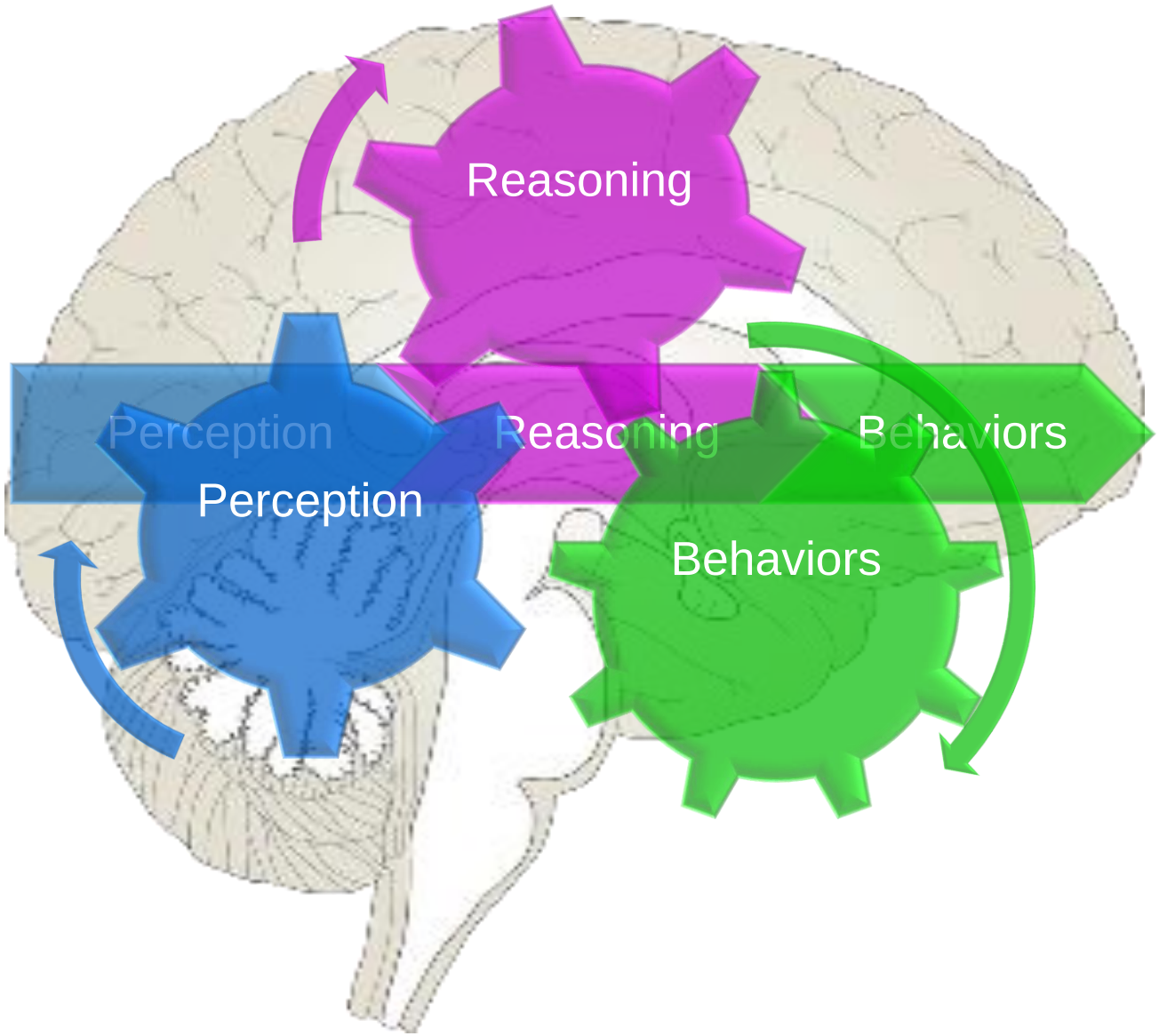

Reasoning
Perception
Reasoning
Behaviors
Perception
Behaviors

Outline

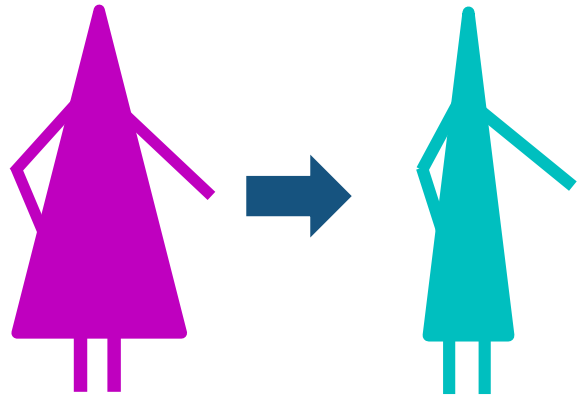
Anorexia Nervosa

Social Perception

1. Neural Factors
2. Cognitive Factors

Future Directions

Anorexia Nervosa in Adults

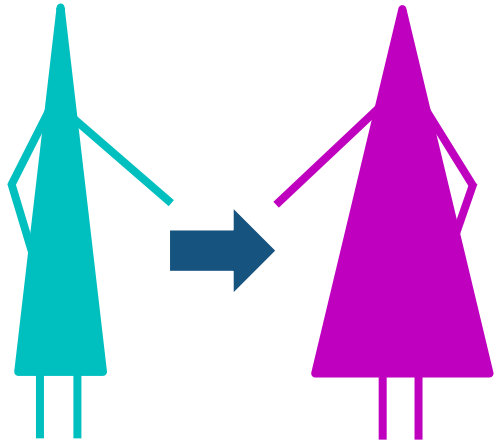


DSM-5 Criteria

- Low Body Weight
- Fears of Weight Gain
- One of the Following:
  - Disturbed body perception
  - Self-esteem based on image
  - Denial that weight is too low

Epidemiology

- 0.5-1% Incidence
- ~5x Women
- 3-8% Mortality
- 50-70% relapse/chronic
  - Years to Attain Recovery



Treatment ⟶ Recovery?

Eat More

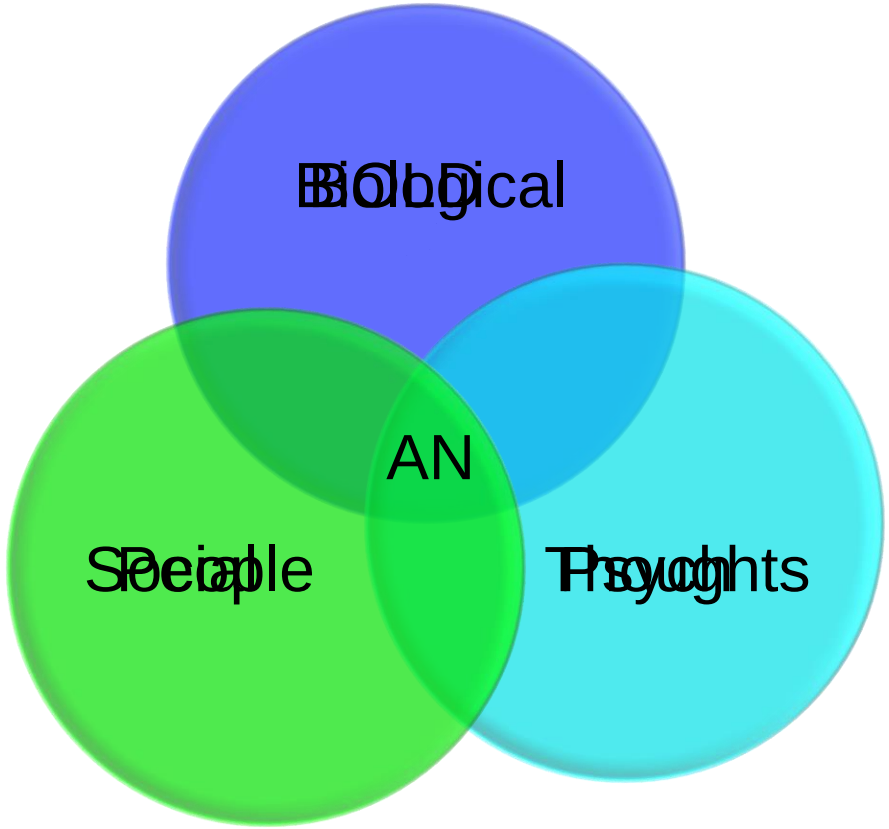
- Meal support works short term.
- More than half of patients relapse.
- Changes ED Behaviors not ED Cognitions

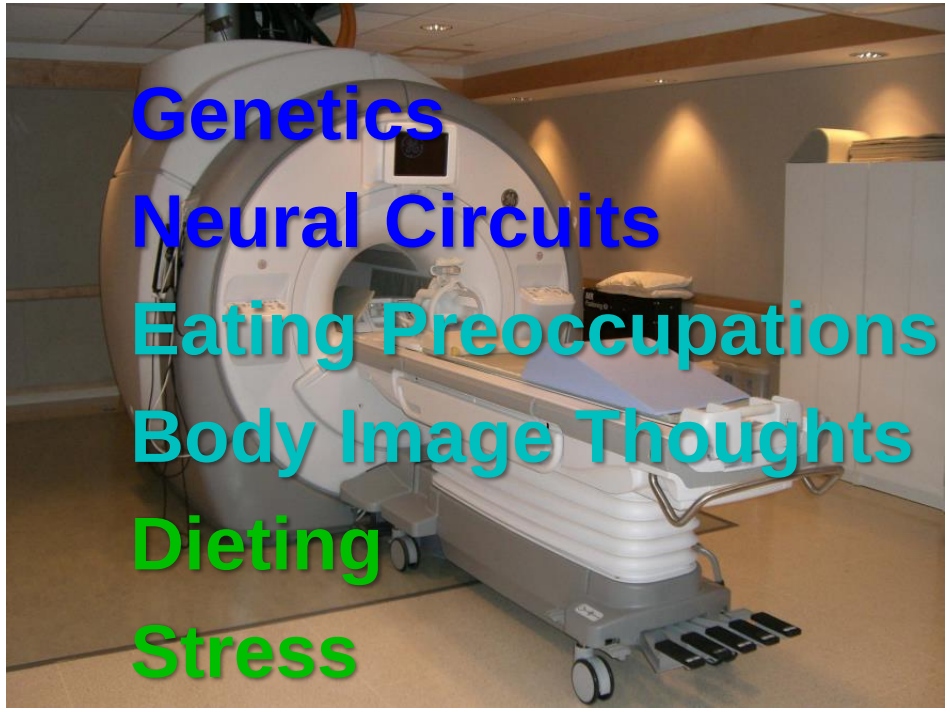
Sustained Recovery??

- Better Social Relationships
- Higher Self-Esteem
- Improved Self-Knowledge

Focus on Social Cognition

Anorexia Nervosa: Biopsychosocial Model





Functional MRI provides a Biopsychosocial Tool

Neurobiology of Social Thinking in Anorexia Nervosa

Cross-Sectional Design

- Social Cognitive MRI Tasks
- Office Assessments
- Three Groups-Adult Women
  - **AN-C**: with anorexia nervosa
  - **AN-WR**: history of anorexia nervosa
  - **HC**: no history of eating disorders

Aim 1: Determine if activation of neural regions during self-perception and social tasks differed in anorexia nervosa.

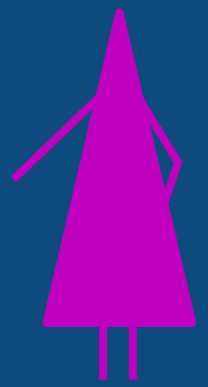
Aim 2: Determine if neural regions differ based on illness state.

Aim 3: Explore whether office measures are related to brain and illness state.

But what is Illness and what is Recovery?

AN-C, met DSM IV criteria for AN in last 6 months. Only included STABLE or recently REFED in ED Program.

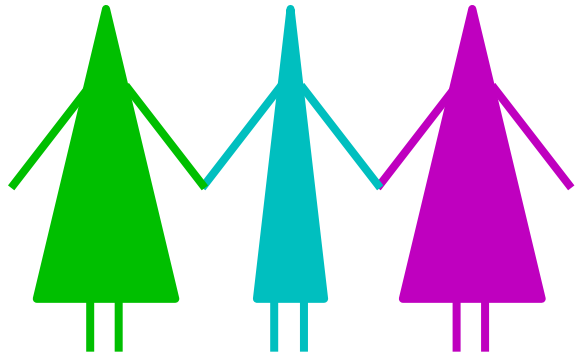
1. Minimize effects of acute starvation
2. Identify neural differences during the illness
3. High risk of relapse



AN-WR, met DSM IV criteria for AN in life, but have now maintained a BMI of at least 19 for previous two years.

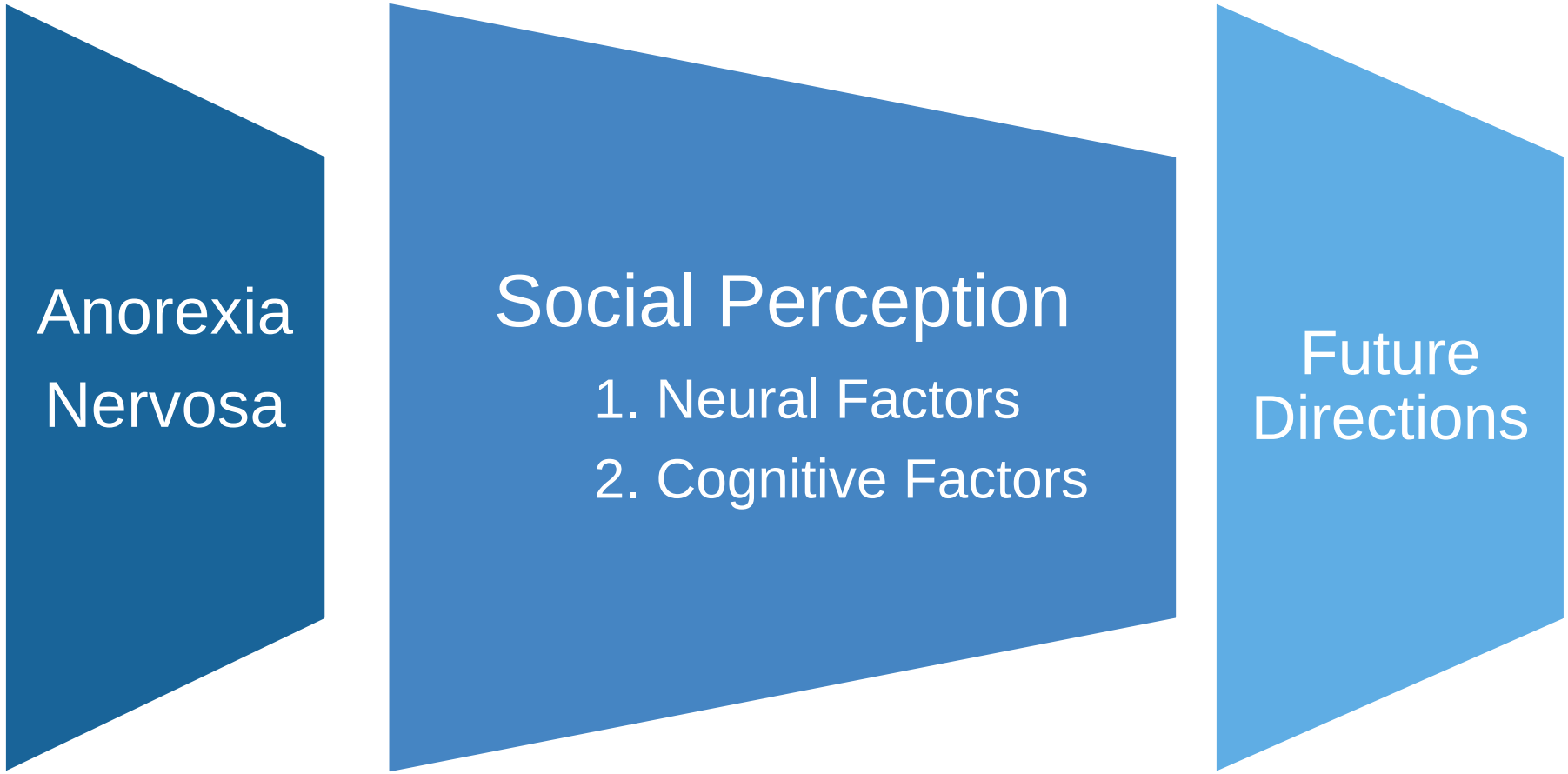
1. Neural differences important in recovery
2. Neural traits related to susceptibility
3. Low risk of relapse

Clinical and Demographic Comparisons



	HC N = 19	AN-C N = 22	AN-WR N = 18	P	Differences
Age (years)	27.9	27.6	29.6	0.483	None
Intelligence (WASI)	122.5	117.8	118.5	0.322	None
Current Body Mass Index	22.5	17.6	22.8	< 0.001	**AN-C < AN-WR & HC**
Eating Attitudes Test (EAT)	3.3	39.0	15.7	< 0.001	**AN-C > AN-WR > HC**
Depression (QIDS-CR)	1.6	6.7	5.1	0.001	**HC < (AN-C & AN-WR)**
Anxiety (SIGH-A)	2.3	10.3	8.3	< 0.001	**HC < (AN-C & AN-WR)**

Social Brain in Anorexia Nervosa

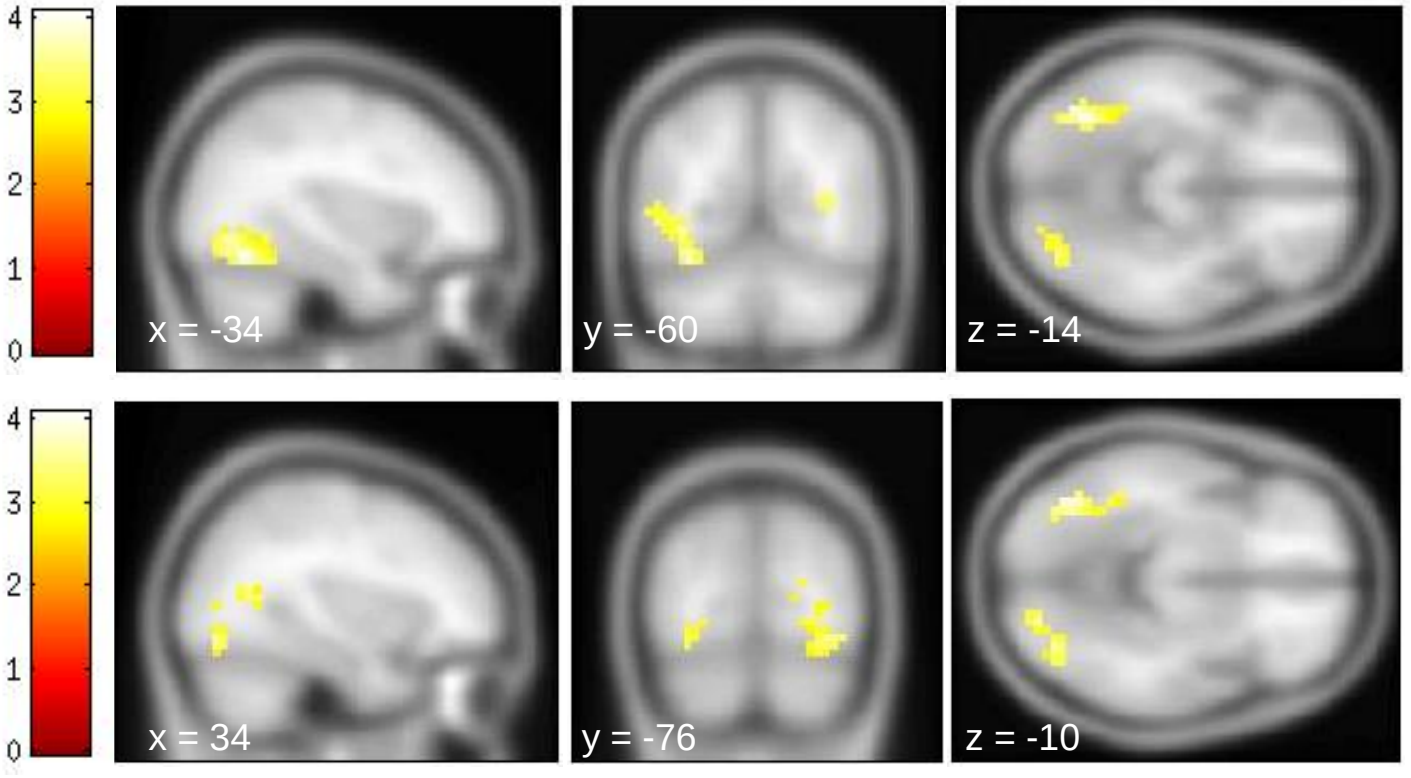


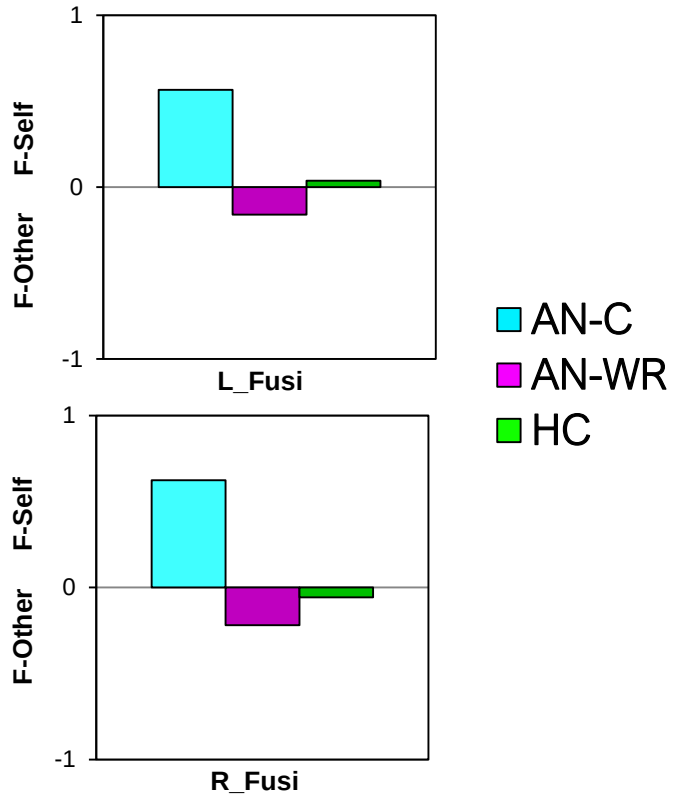
Imaging Task 1: Faces Self – Other

Face Self and Other Task

- 15 Self Headshots
- 15 Stranger Headshots
- Age-Coloring Matched
- Neutral/Positive Expression
- See a picture every 10-30 sec
- Passive Viewing

Physical Self-Perception

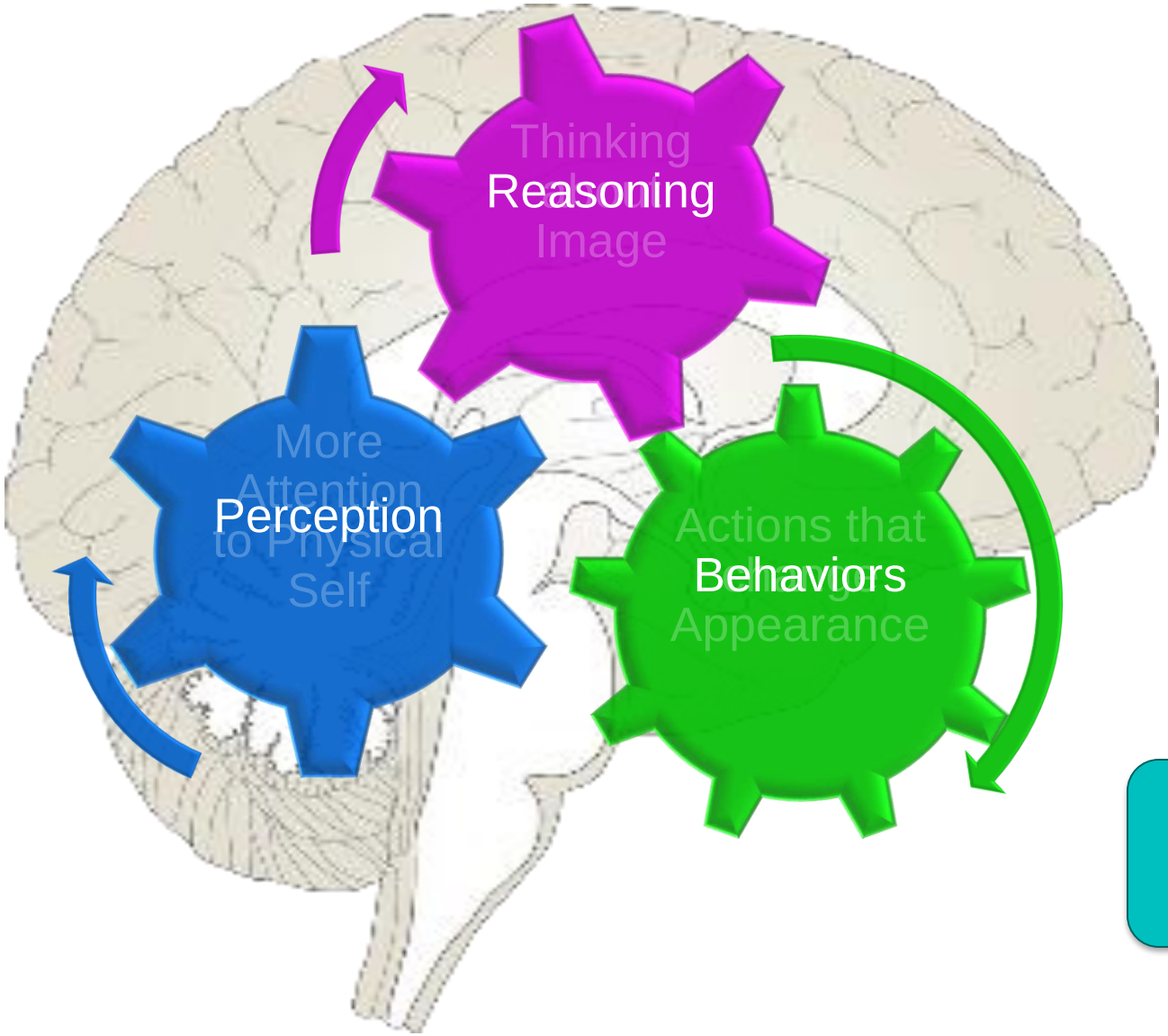




Clusters at $P_{FWE} < 0.05$; voxel $P < 0.005$.

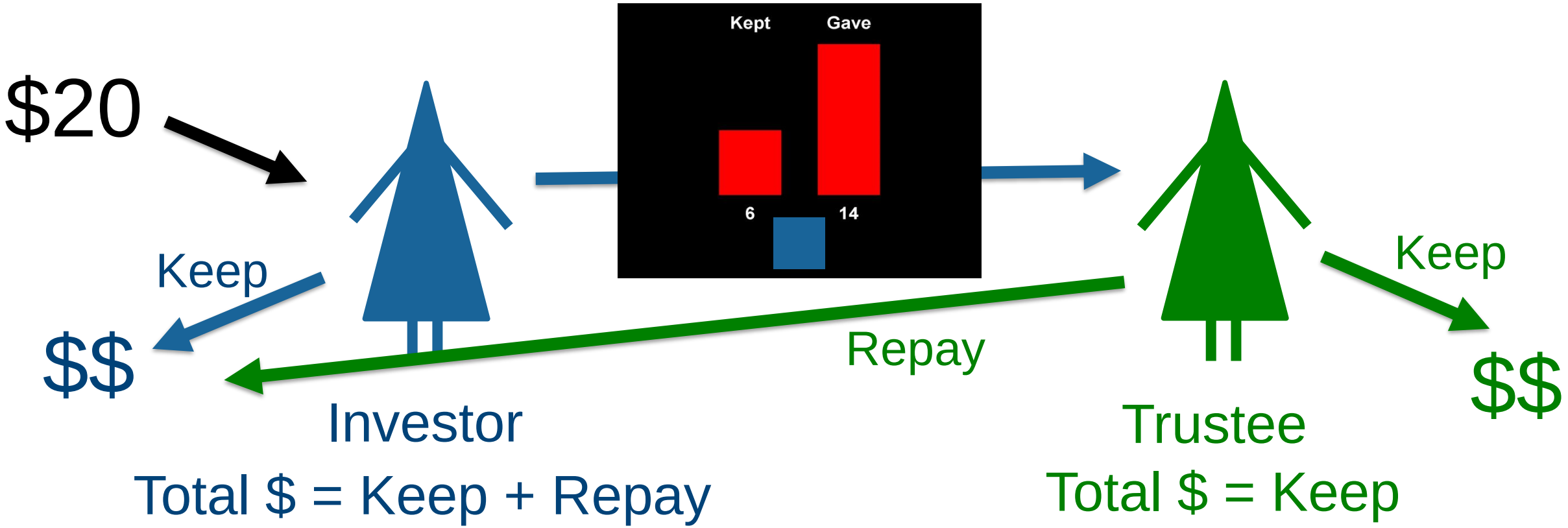
State of Anorexia Nervosa …. AN-C Differs AN-WR & HC ….. increased bilateral fusiform when viewing oneself relative to a stranger

Increased Visual Responses for Self-Image Relative to Stranger Images

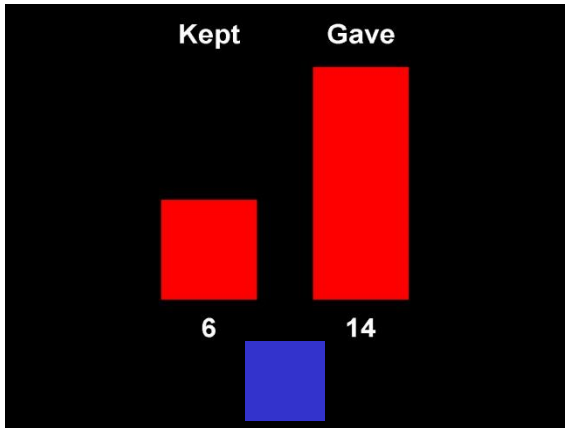


Conceptualization Only!

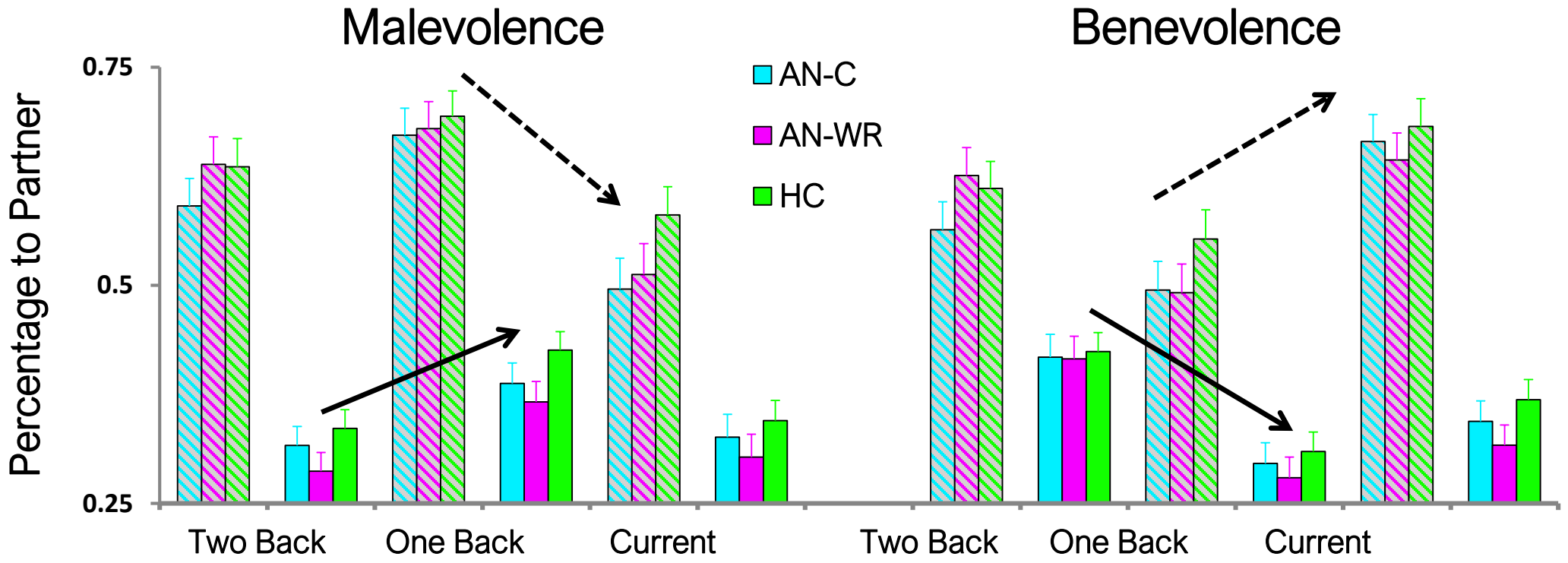
Imaging Task 2: Multi-Round Trust Game



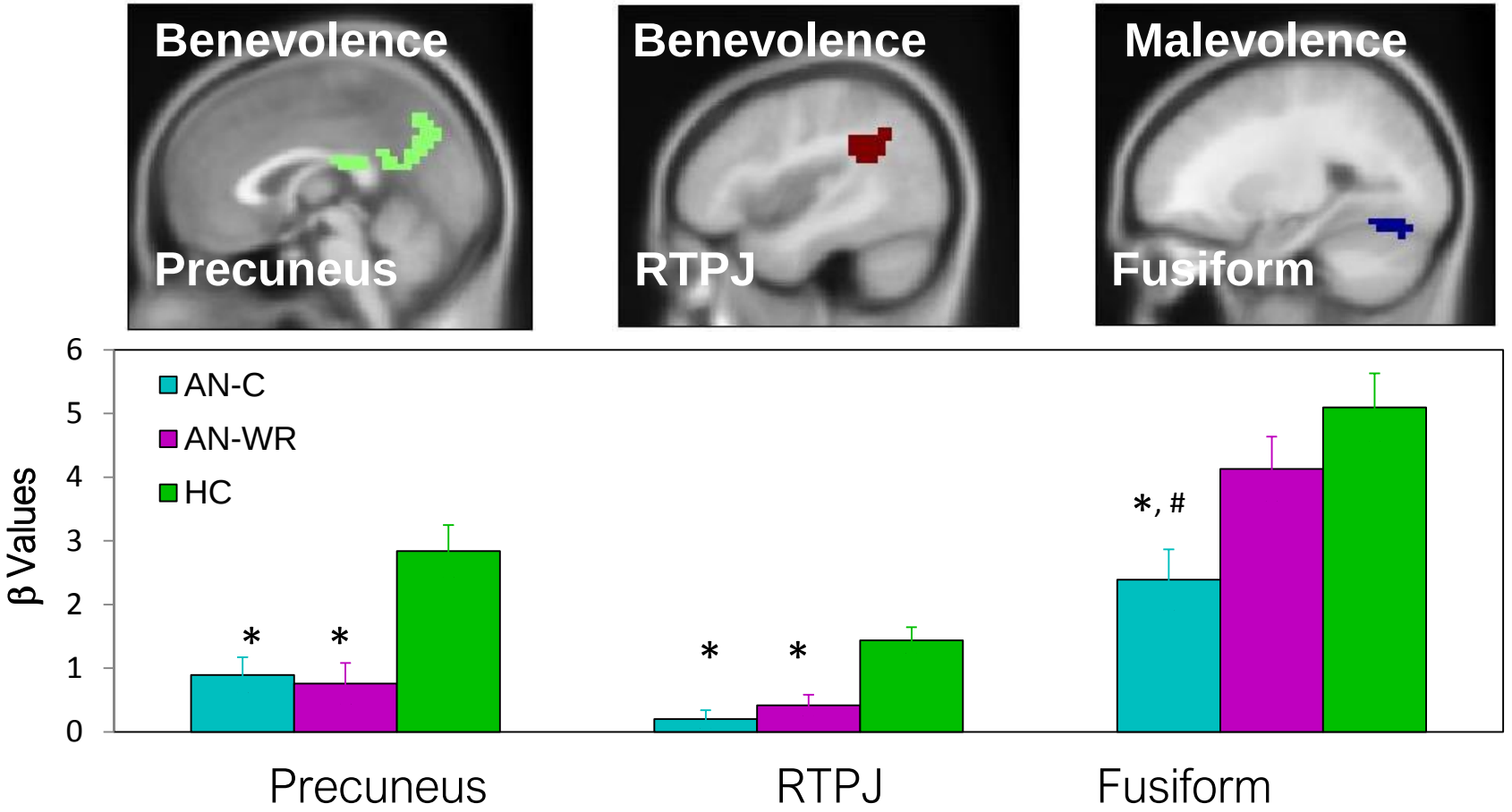
10 rounds: Examine brain function while creating a new relationship.



Is the relationship IMPROVING or WORSENING?

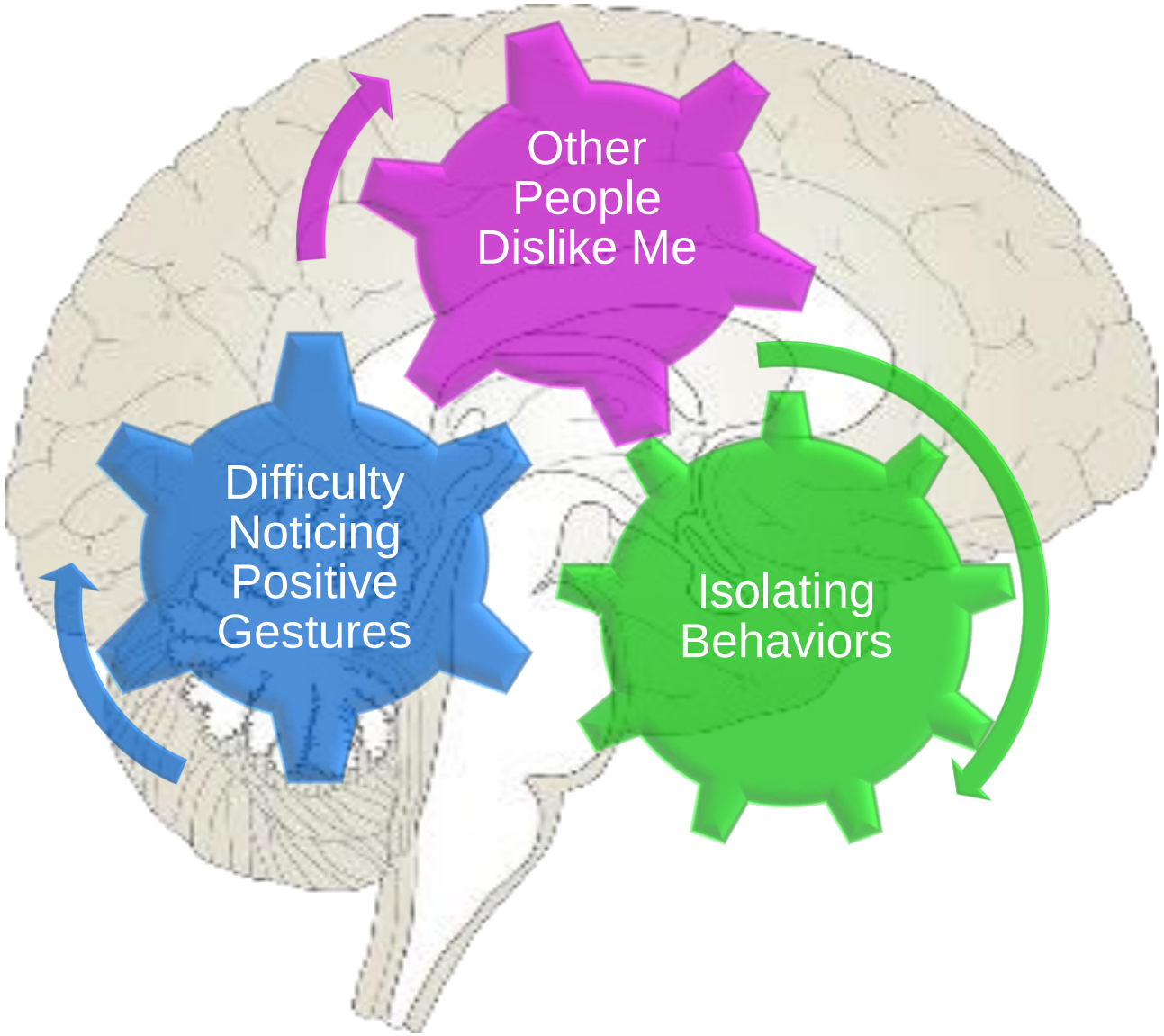


Group Differences in Benevolence and Malevolence



* Differs from HC # Differs from AN-WR
Clusters at $P_{FWE} < 0.05$; voxel $P < 0.005$.

Reduced Social Brain Responses for Kindness



Interpretation Only!

Need More Data…

Conscious Reasoning vs Automatic Perceptions

Social Identity Task #3

Social Identity Task	Verbal Self and Other Appraisals	Behavioral Response
Self:	“I believe I am considerate”	Agree/Disagree
Friend:	“I believe Mary is insecure”	Agree/Disagree
Reflected:	“Mary believes I am realistic”	Agree/Disagree

Social Identity Task Contrasts	Cognitive Process
Self – Friend:	Self vs. Other Perception
Self-Agree – Self-Disagree	Self-Relevance
Reflected – Self:	Social Self-Evaluation

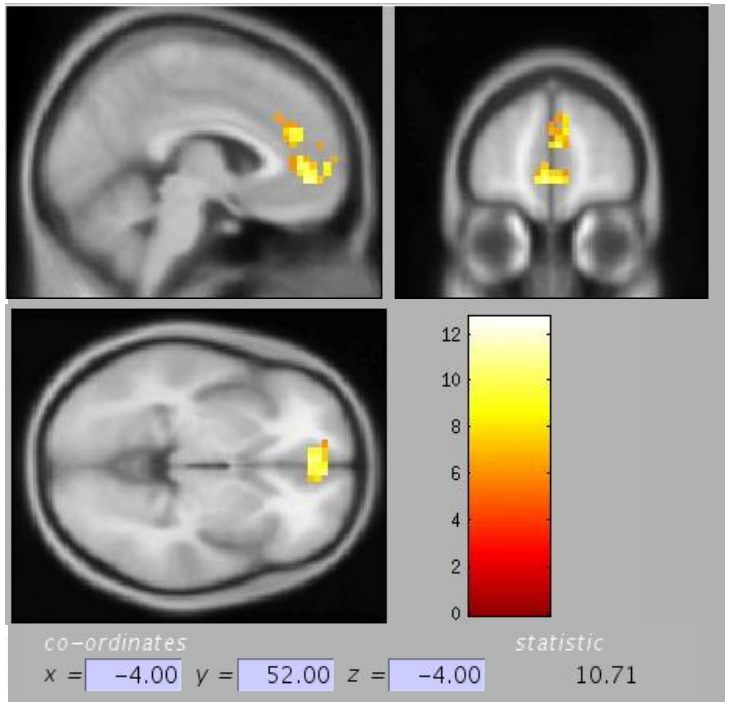
Self-Agree – Self-Disagree: Self-Relevance

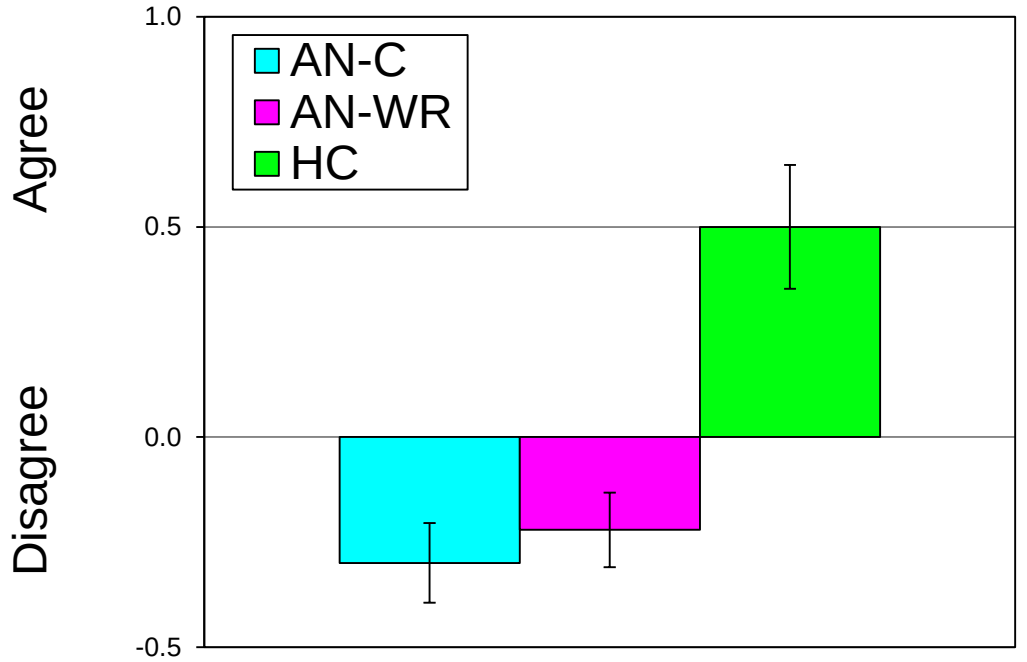
Condition	Statement	Behavior
Self-Agree	“I believe I am critical”	Agree
Self-Disagree	“I believe I am insecure”	Disagree
Self-Agree	“…independent”	Agree
Self-Agree	“…interesting”	Agree
Self-Disagree	“…greedy”	Disagree
Self-Agree	"…moody"	Agree

Words were selected to stimulate cognitive reflection about oneself rather a list of extreme positive and negative traits that evoke minimal self-evaluation.

Self-Relevance: MPFC into Cingulate

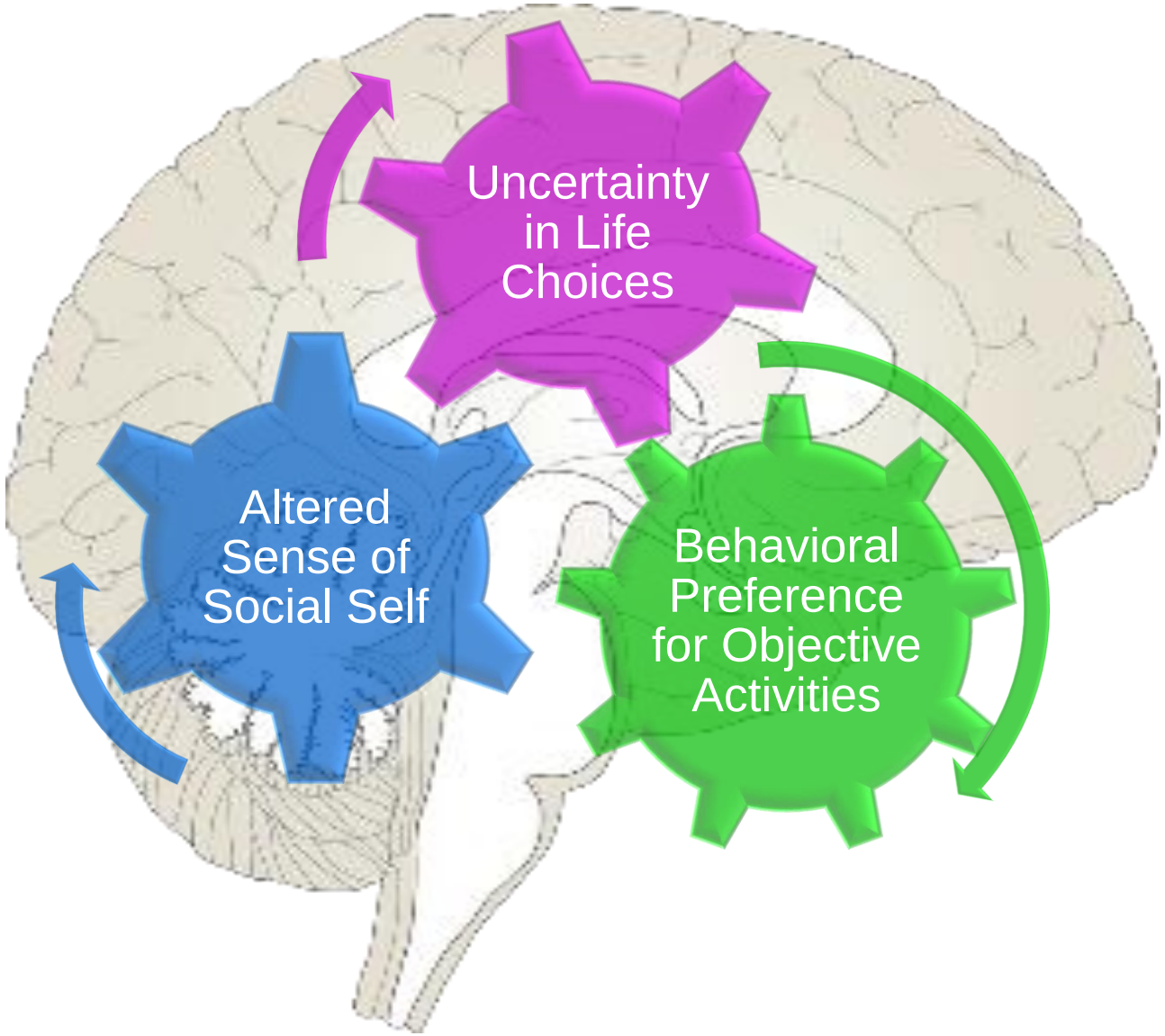
Both AN Groups Differ from HC for Self-Agree – Self-Disagree





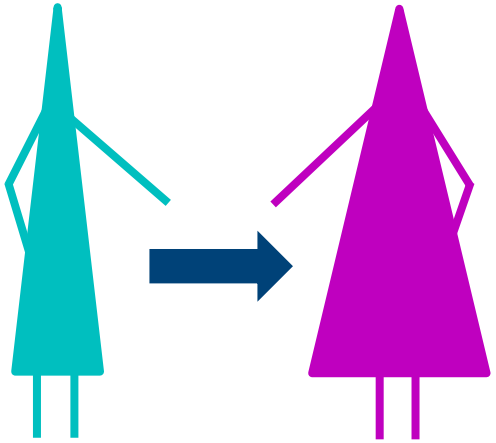
MPFC-Cing: 6283 mm^3, peak MNI (8, 48, 20), peak Z 4.01
Cluster $P_{FWE} < 0.05$, voxel $P < 0.005$
Effect Size r: **AN-C** vs **HC** 0.58, **AN-WR** vs **HC** 0.56

Medial Prefrontal Cortex Responds More to “I am Not” than “I am”



Interpretation Only!

More Data To Connect Perception to Reasoning to Behaviors



Aim 2: Relate Neural Activations to **Recovery** and **Illness** in Anorexia Nervosa

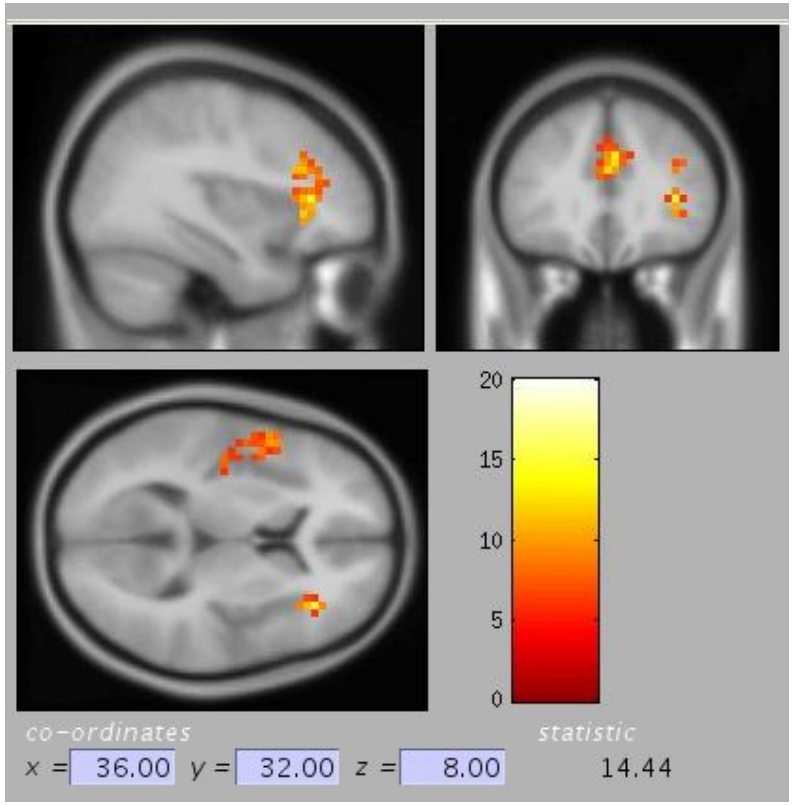
Social Identity Task Contrasts	Cognitive Process	Findings
Self-Agree – Self-Disagree	Self-Relevance	Trait: MPFC-Cing
Reflected – Self:	Social Self-Evaluation	???

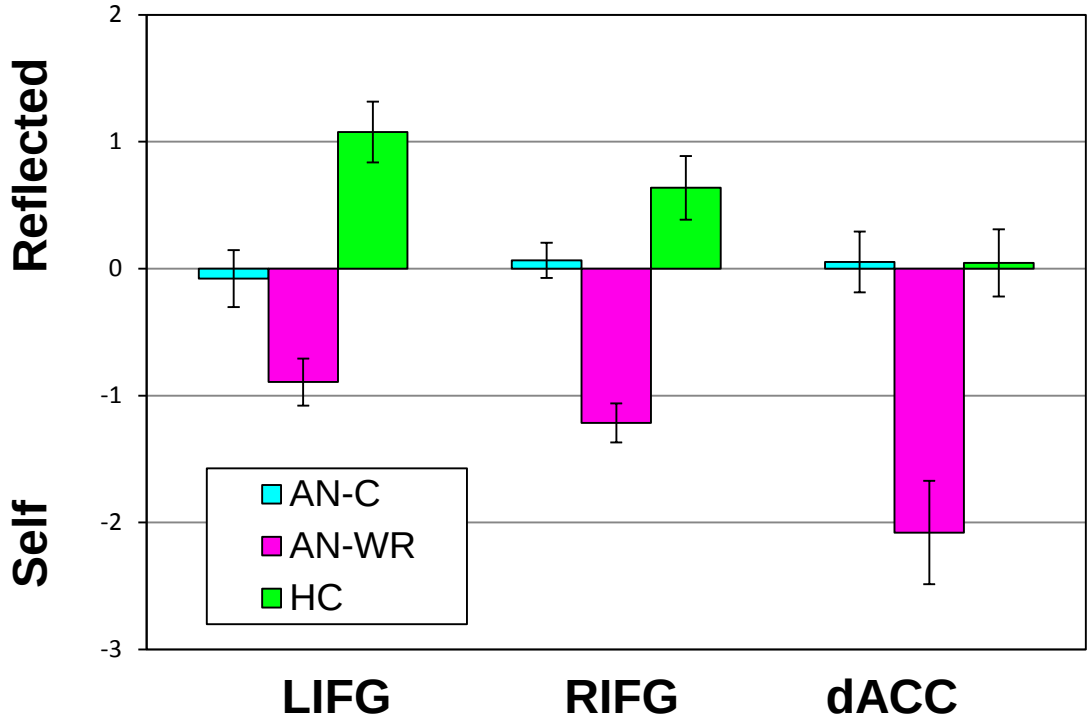
Considering other perspectives (“Mary believes I am reckless”) vs one’s own perspective (“I believe I am cautious”) typically engages more social “other” regions (TPJ and precuneus)**.** This was observed for all groups in two separate studies with different subjects.

McAdams & Krawczyk, Soc Cogn Affect Neurosci 2014 Jan;9(1):12-21.
McAdams et. al, 2016, Soc Cogn Affect Neurosci

Social Self-Evaluation

AN-WR Differ from AN-C and HC for Reflected - Self

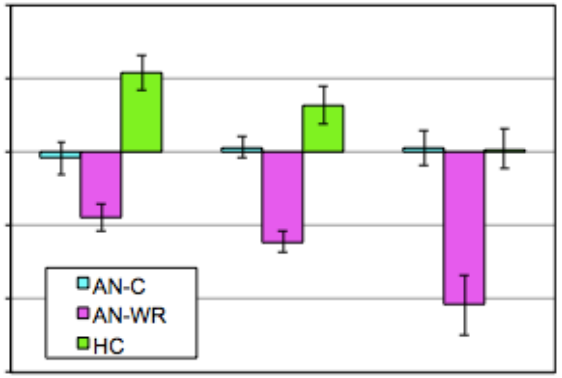




LIFG/LINS: 2356 mm^3, MNI (-56, 8, 4), peak Z 3.95 **All 3 Differ**
RIFG: 3650 mm^3, MNI (36, 32, 8), peak Z 4.29 **AN-WR Differ**
dACC: 6285 mm^3, MNI (4, 32, 32), peak Z 4.07 **AN-WR Differ**
Cluster $P_{FWE} < 0.05$, voxel $P < 0.005$

Recovery: Salience network utilized for self-evaluations more than social self-evaluations…

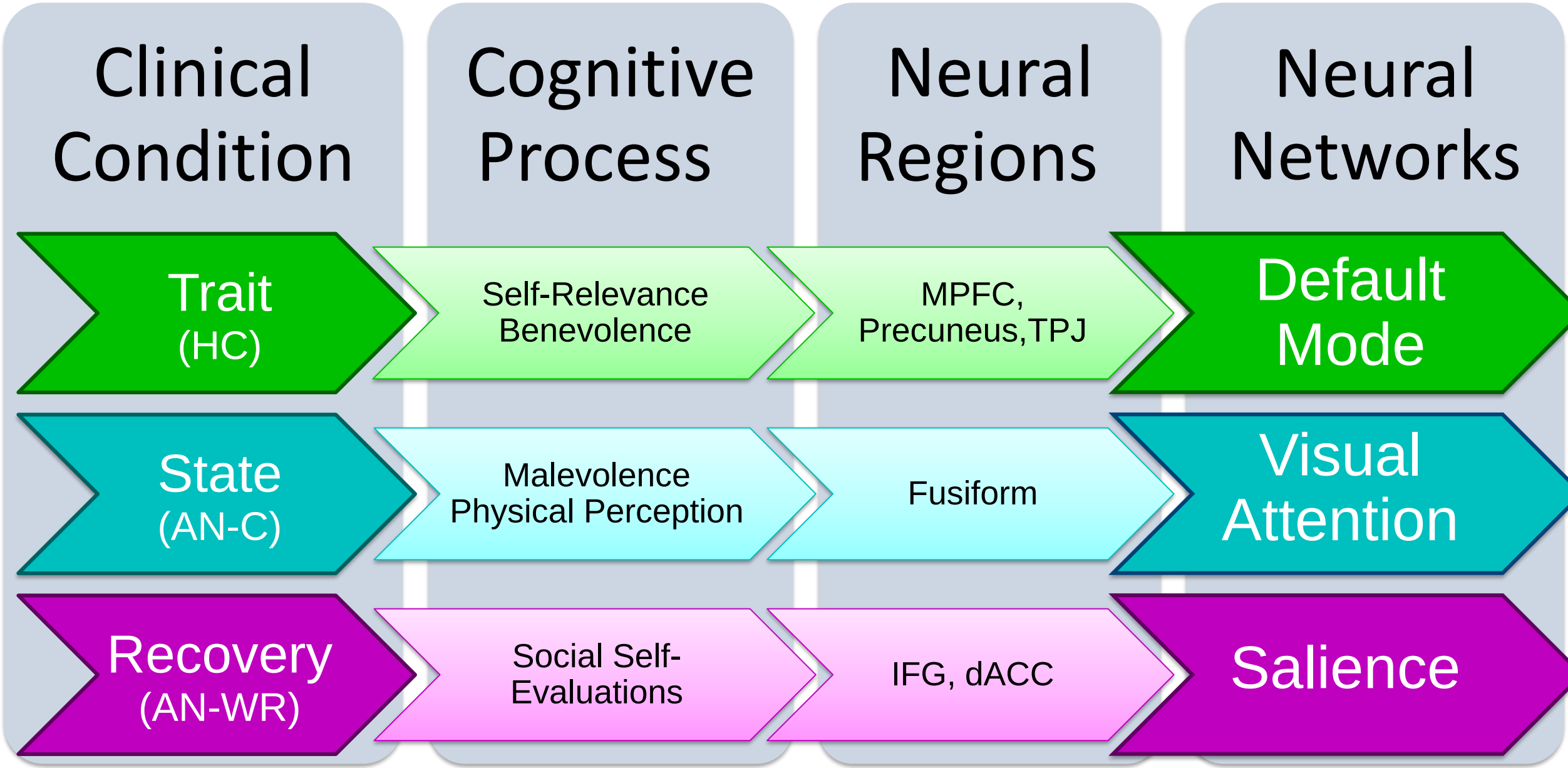
AN-WR differs from **AN-C** & **HC**



Aim 2: Relate Neural Activations to **Recovery** and **Illness** in Anorexia Nervosa

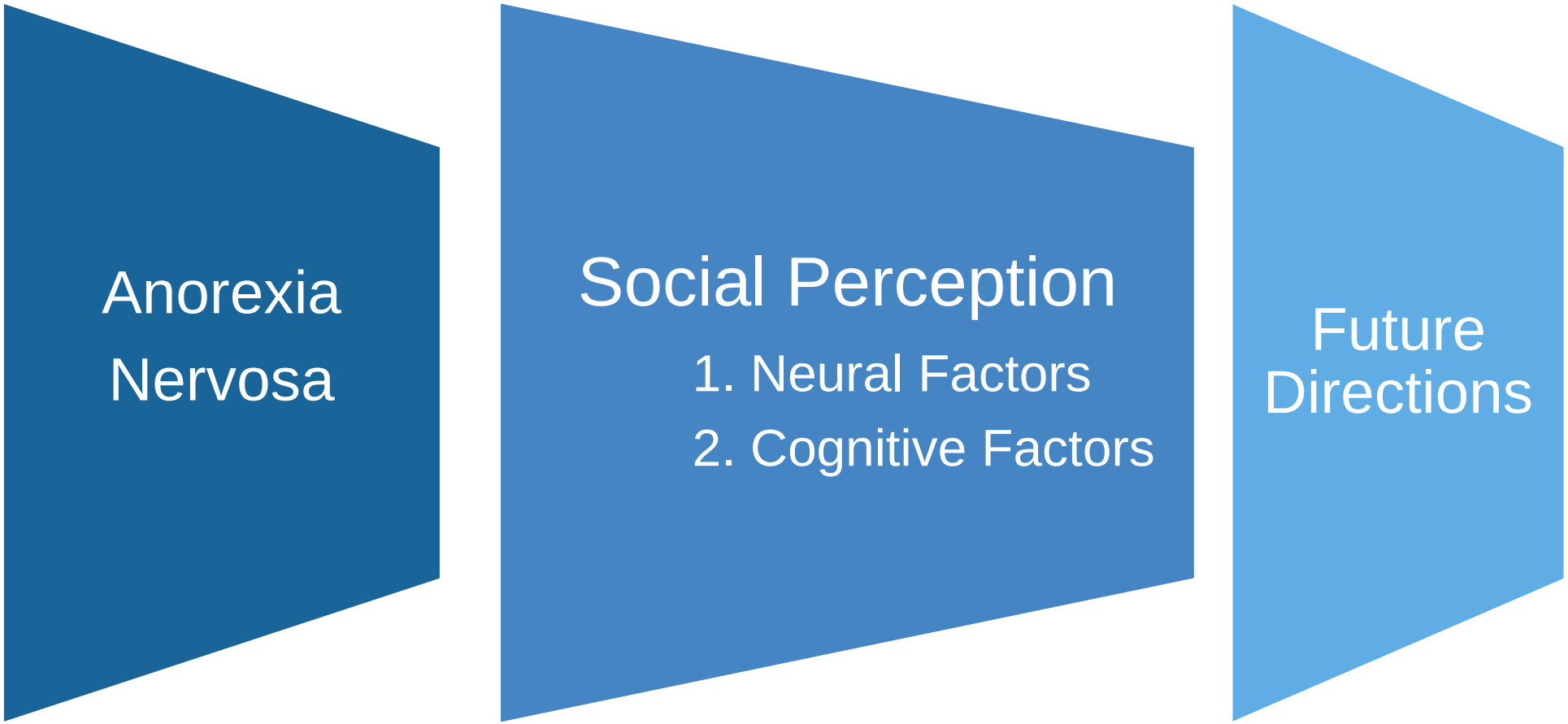
Mediator Biomarker	• Recovery is causally related to these changes. • A better understanding may allow more targeted treatments.
Predictor Biomarker	• Select subtype of anorexia nervosa is able to recover. • AN-C group mixed, and some will recover and some won't.
Trait Suppressed by Disease Biomarker	• All individuals with anorexia nervosa do this but during acute disease, this trait is suppressed. Correlated but not causal.

Next Question: Need within-subject longitudinal data



Neural Networks in Anorexia Nervosa

Social Cognition in Office



What's an Attribution Bias?

Your friend refused to give you a ride home….

Why? _____

I'm messy….	About you (internal)
She hates to drive….	About friend (personal)
I live far away from her…	About situation (situation)

What's an Attribution Bias?

Your friend gave you a present….

Why? _____

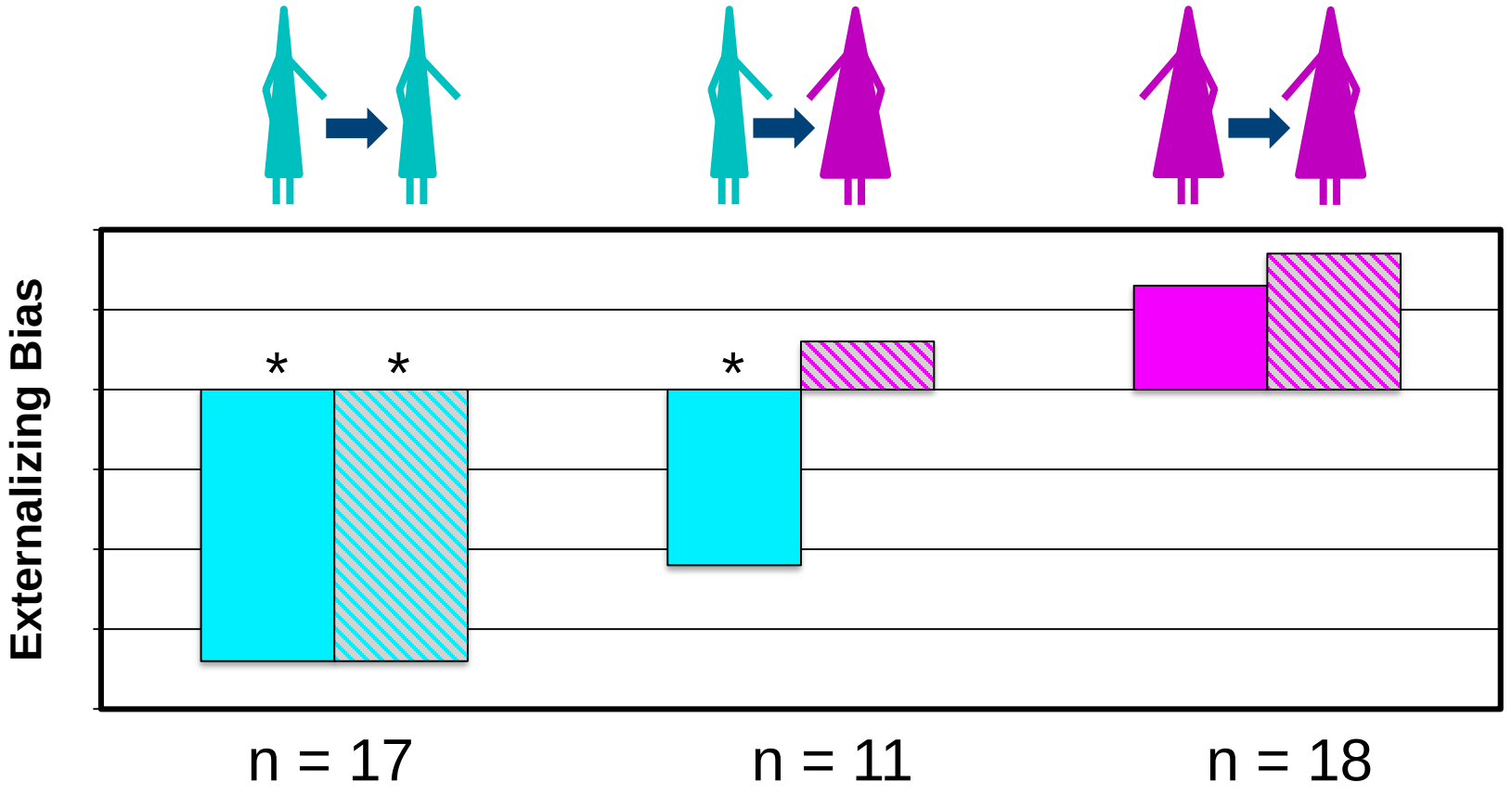
I'm cool….	About you (internal)
She's nice….	About friend (personal)
It's my birthday…	About situation (situation)

Clinical and Cognitive Differences for Attribution Biases

IPSAQ	HC	AN-C	AN-WR	P	Differences
Externalizing Bias	4.3	-2.8	1.5	< 0.001*, ‡	HC & AN-WR > AN-C
Negative Personal Bias	0.6	0.6	0.7	0.546	None
Positive Personal Bias	0.4	0.6	0.5	0.544	None
Positive Internal	8.6	6.7	8.2	0.101	None
Positive Personal	3.2	5.4	3.8	0.119	None
Positive Situational	4.1	3.9	3.9	0.999	None
Negative Internal	4.3	9.5	6.6	< 0.001*, ‡	HC & AN-WR > AN-C
Negative Personal	6.7	3.5	6.2	0.002*, ‡	HC & AN-WR > AN-C
Negative Situational	4.9	3.0	3.2	0.097	None

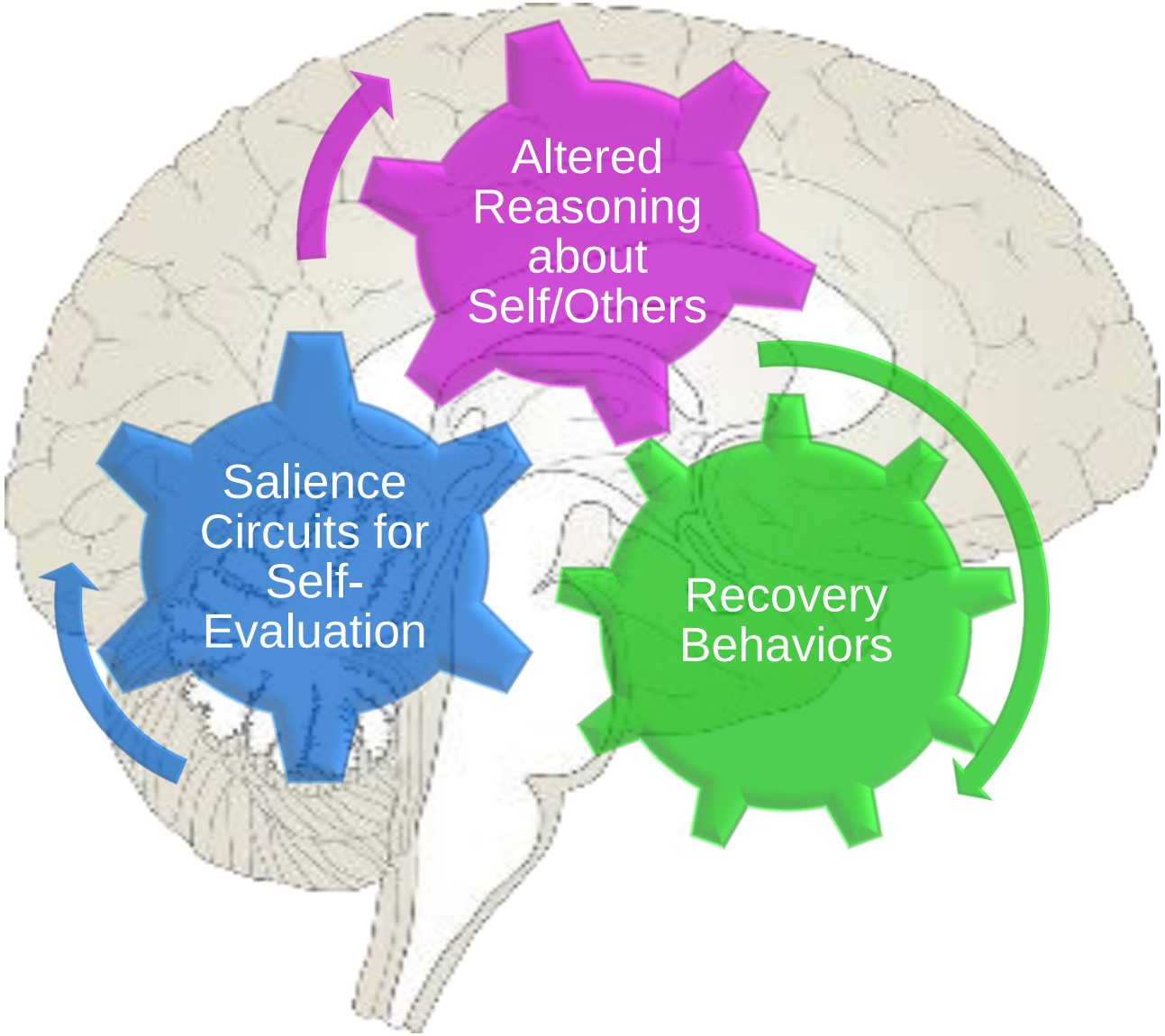
State Effect for Externalizing Bias: **AN-C** differs from **HC** & **AN-WR**

2+ Year Outcomes of AN-C and AN-WR



AN-C group 40% achieved weight-recovery.
None of the AN-WR relapsed (now weight-sustained).
* Externalizing Bias differs for currently-ill relative to recovered.

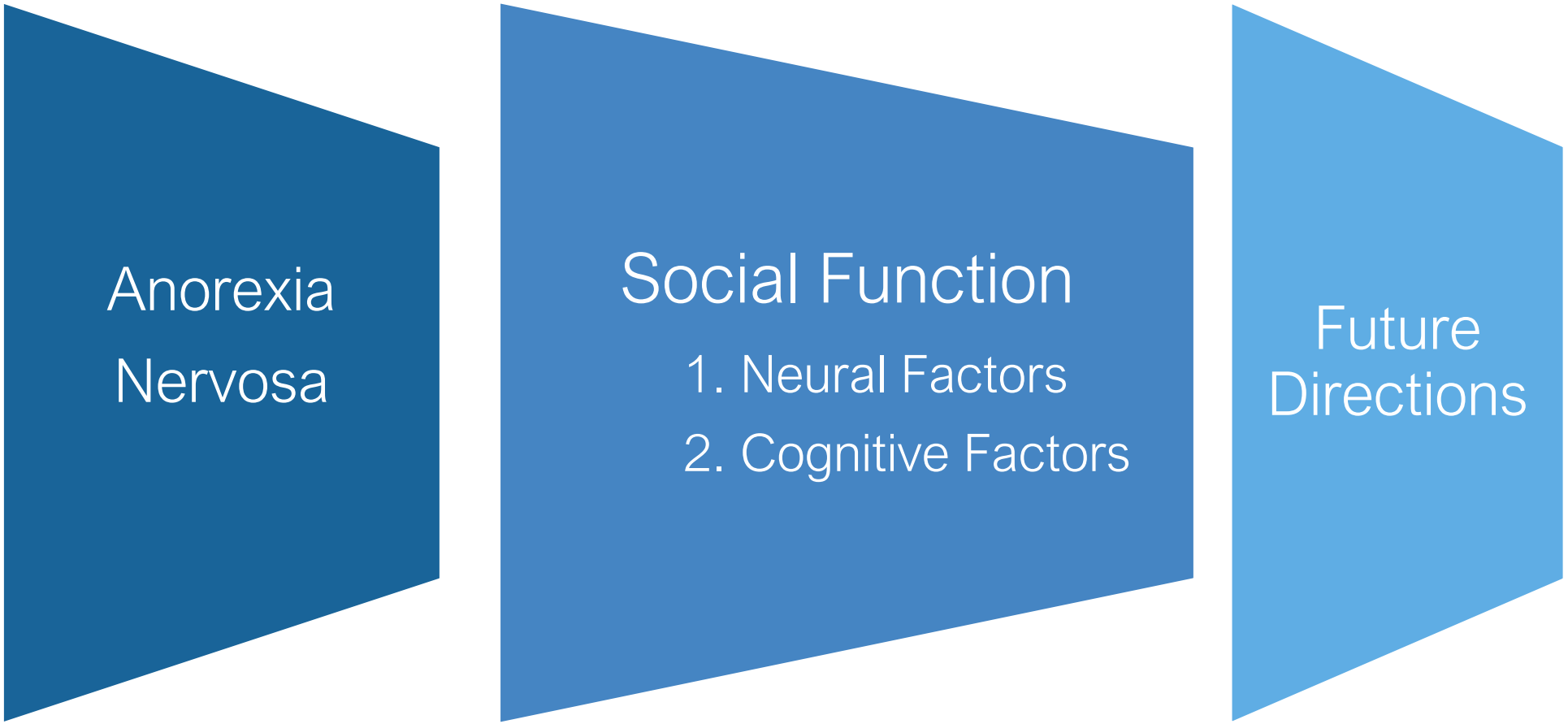
Aim 2: Recovery Includes Reduced Self-Blame and Improved Perspective Taking



Theoretical Model…

Next Steps: Create Changes in Self-Evaluation and Assess Impact on Brain & Recovery

Future Directions



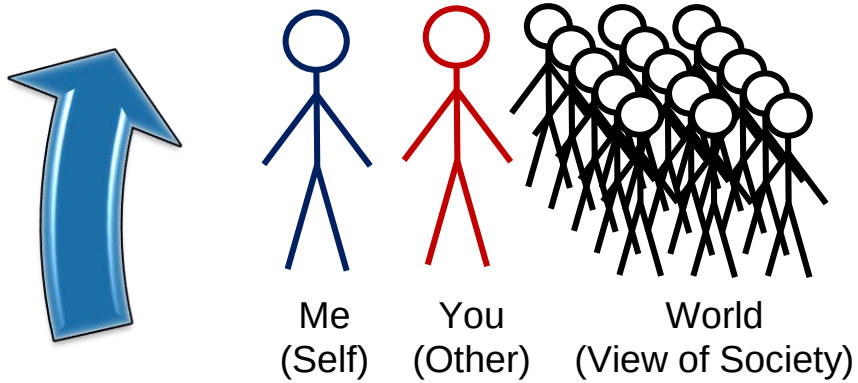
New Targets Related to Self/Other Perception

Brain:

Altered Circuitry for Self/Others

Perception:

I feel wrong, unlike other people.



Cognitions:

"Changing my appearance will change that feeling."

Behaviors:

Diet, Purge, Binge

Quantitative Targets

Neural Activations:

- Default Mode
- Salience

Cognitive Processes

- Positive Social Perceptions
- Social Perspective-Taking
- Interpersonal Attributions

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