

**Promoting Cognitive and Neural System Recovery
in Early Psychosis**

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Learning Objectives

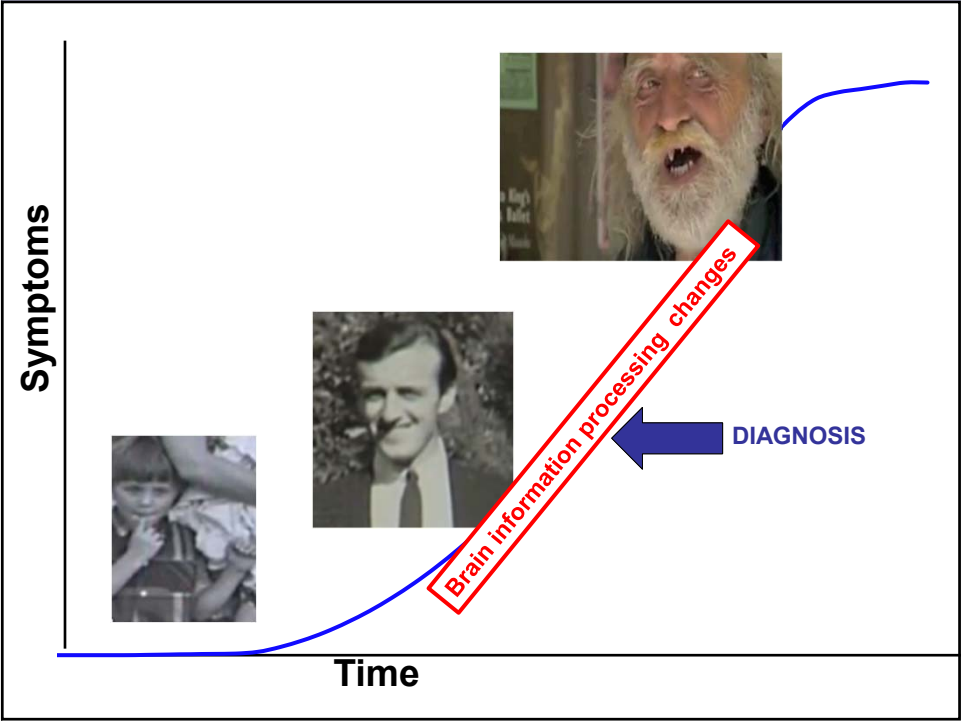
At the conclusion of this continuing medical education activity, the participant should be able to:

- 1. Describe the typical profile of cognitive deficits in early phases of psychotic illness.
- 2. Discuss the principles of neuroscience-informed cognitive training.
- 3. Identify the effects of targeted cognitive training in early phases of psychotic illness.

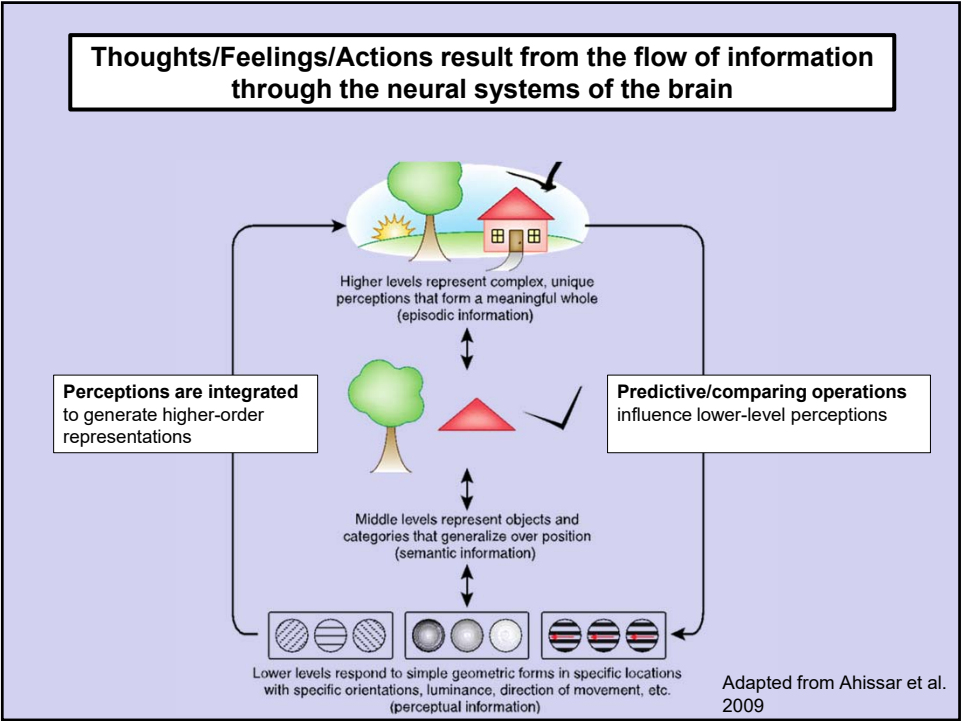
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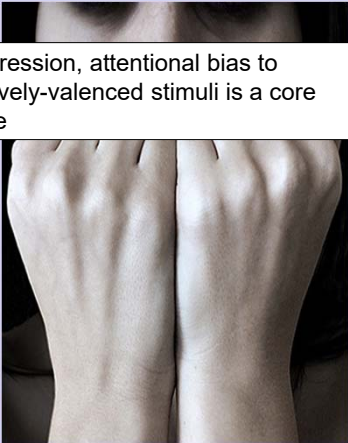


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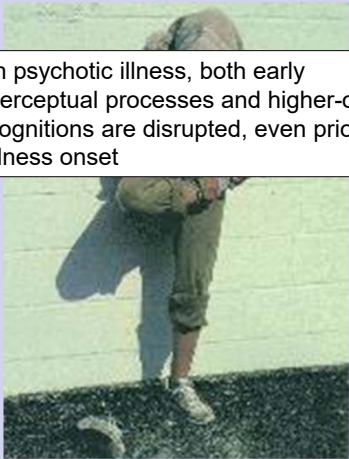


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Psychiatric illnesses result from abnormal information flow through brain systems



- In depression, attentional bias to negatively-valenced stimuli is a core feature



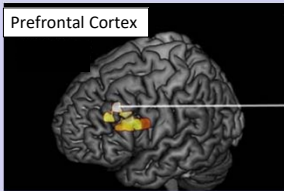
- In psychotic illness, both early perceptual processes and higher-order cognitions are disrupted, even prior to illness onset

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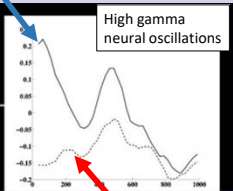
The “Symphony” of brain information flow is impaired in psychosis



Healthy



Prefrontal Cortex



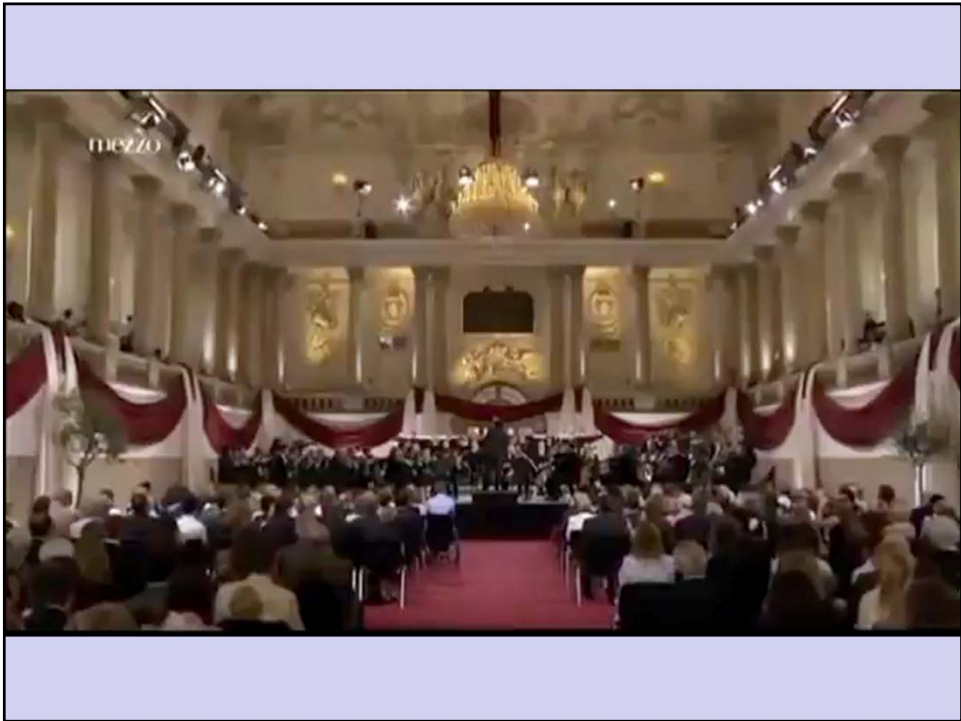
High gamma neural oscillations

Schizophrenia



Alex Herman et al. J Neurosci 2013
Corby Dale et al. Schiz Bull 2015

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But brain systems are plastic



The brain adapts to salient experiences by representing the relevant sensory stimuli and action outputs with disproportionately larger and more coordinated populations of neurons.

Merzenich & Jenkins, 1993; Buonomano & Merzenich, 1998; Merzenich & DeCharms, 1996; Merzenich, 2001

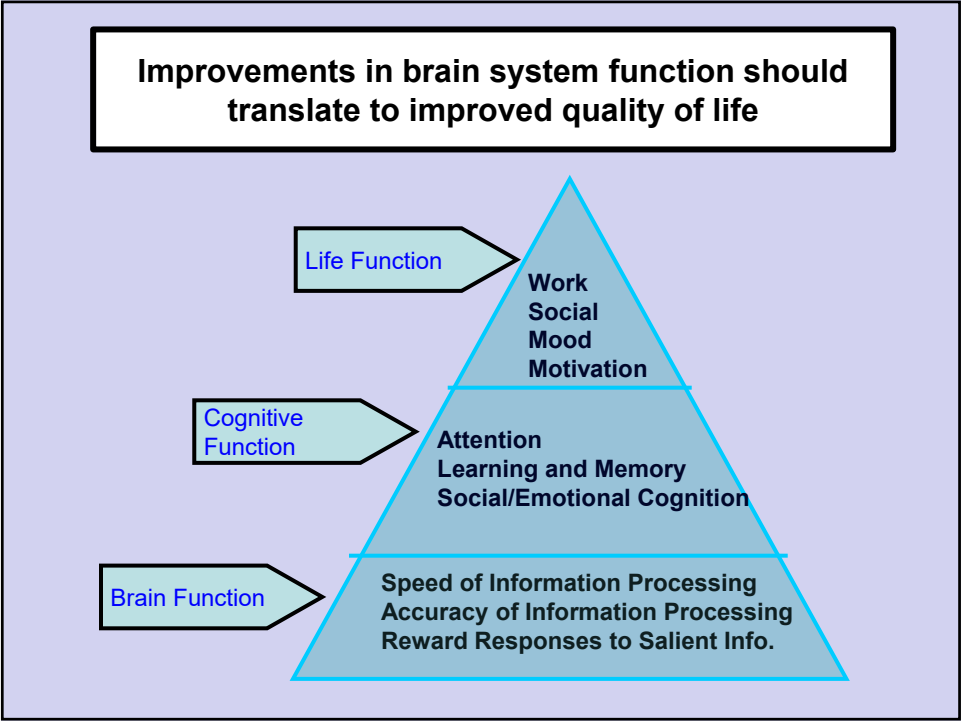
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Can we harness these plasticity processes to “repair” impaired brain systems?

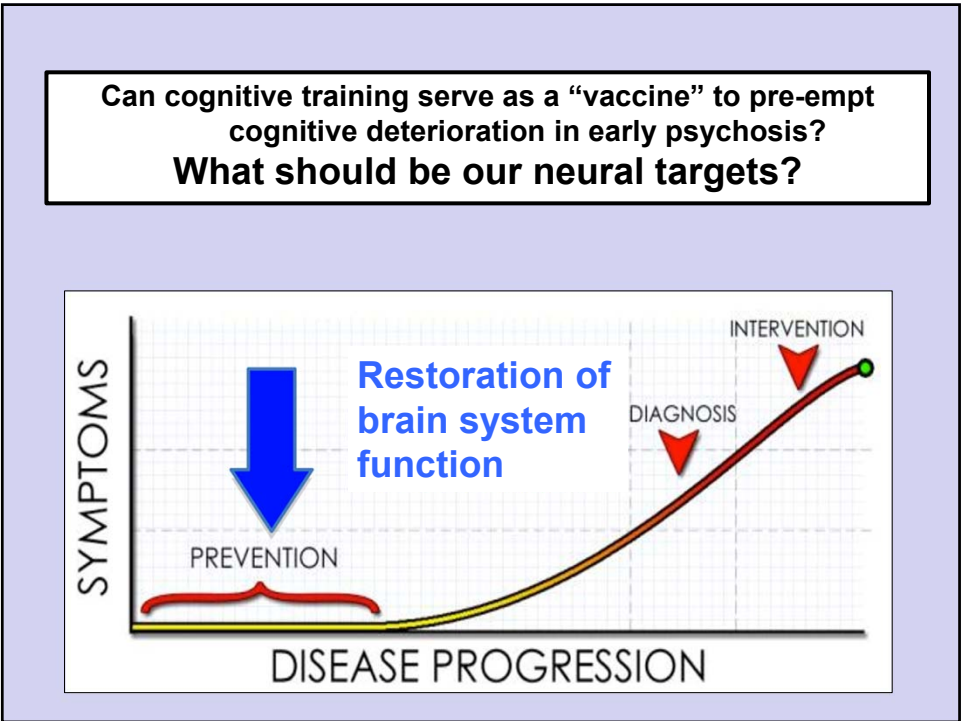
- Significant neuroplastic changes occur across the lifespan in response to **salient learning events**.
- Thus, we should be able to engineer intensive, progressive, heavily rewarded, perceptual and cognitive **training experiences** that improve the accuracy, fidelity, and efficiency of targeted brain systems.

Merzenich et al 1999

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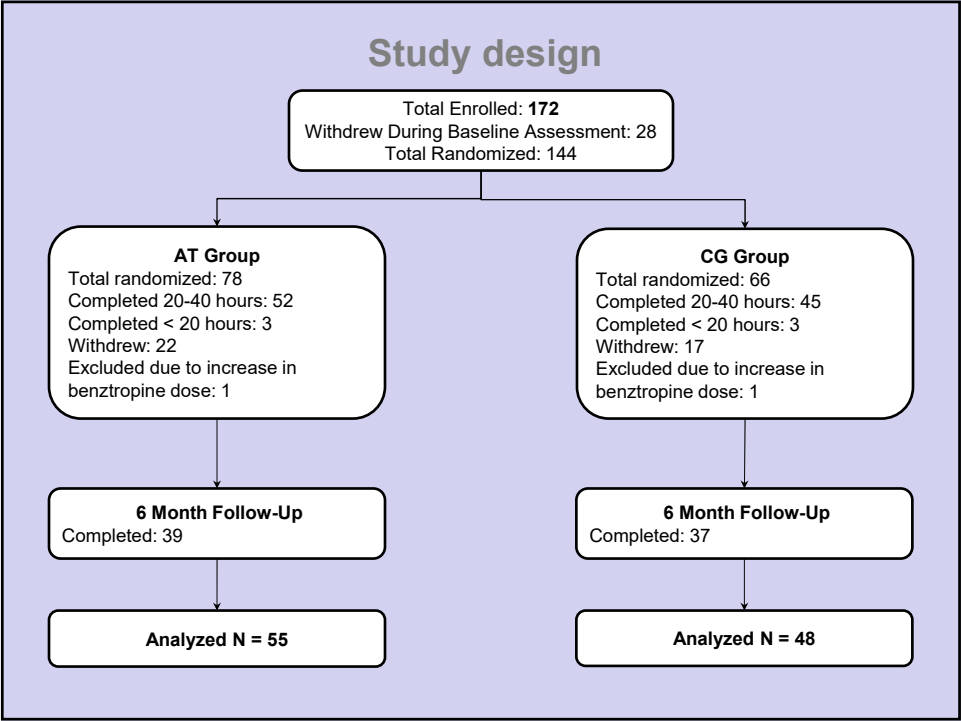
**Neural System Target 1:
Auditory/Verbal Processing in Schizophrenia**

- **Rationale:** Schizophrenia is characterized by widespread disturbances in verbal memory systems that are present prior to the first episode and have prognostic significance (Hill et al 2004).

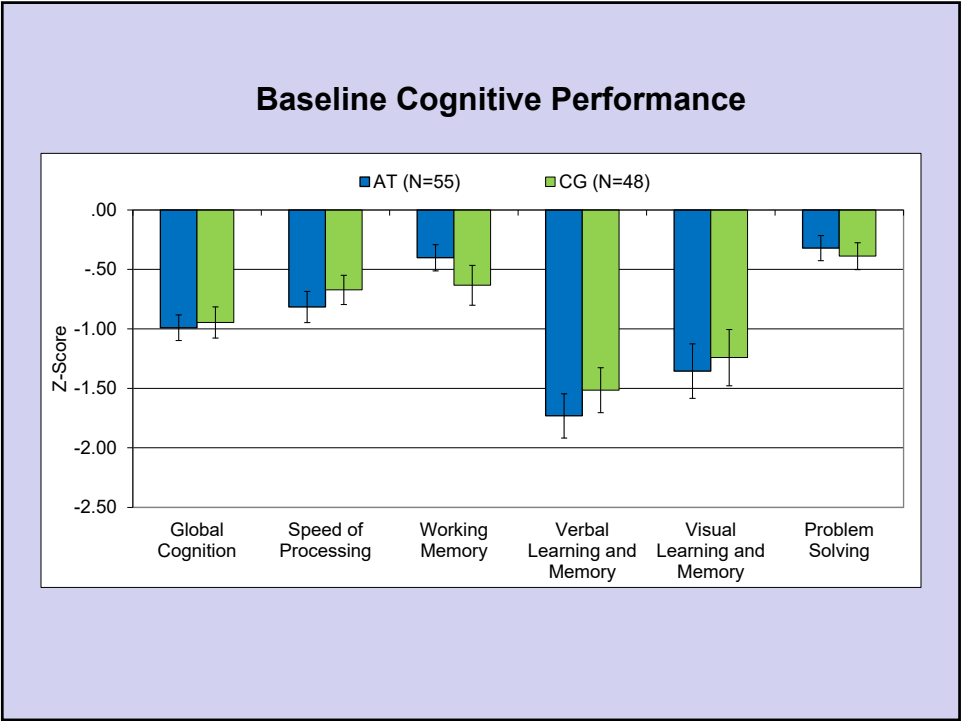
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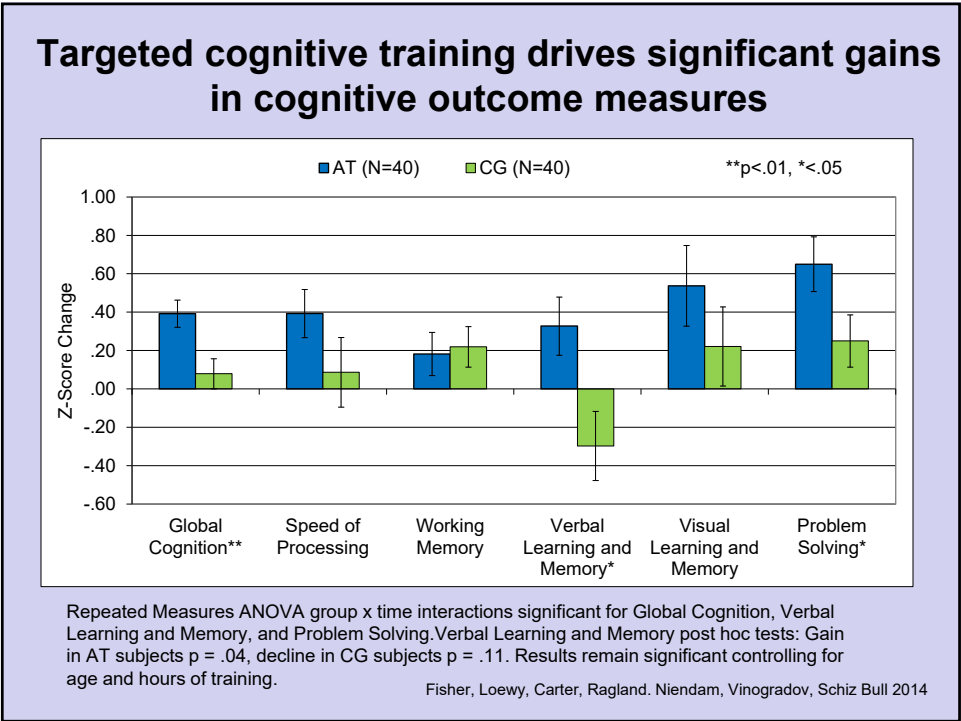
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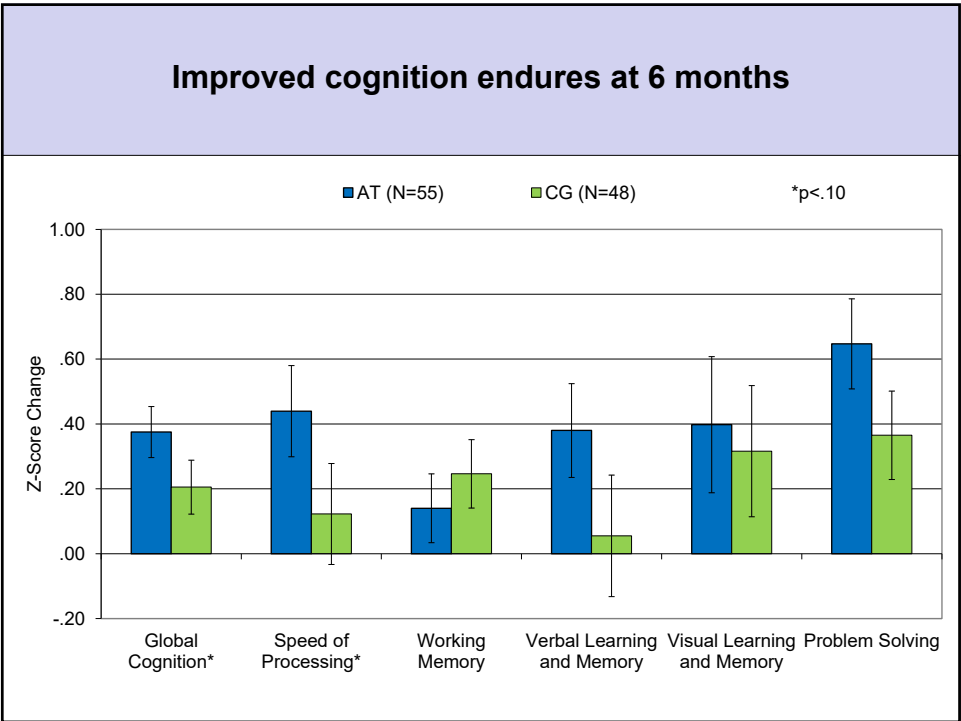
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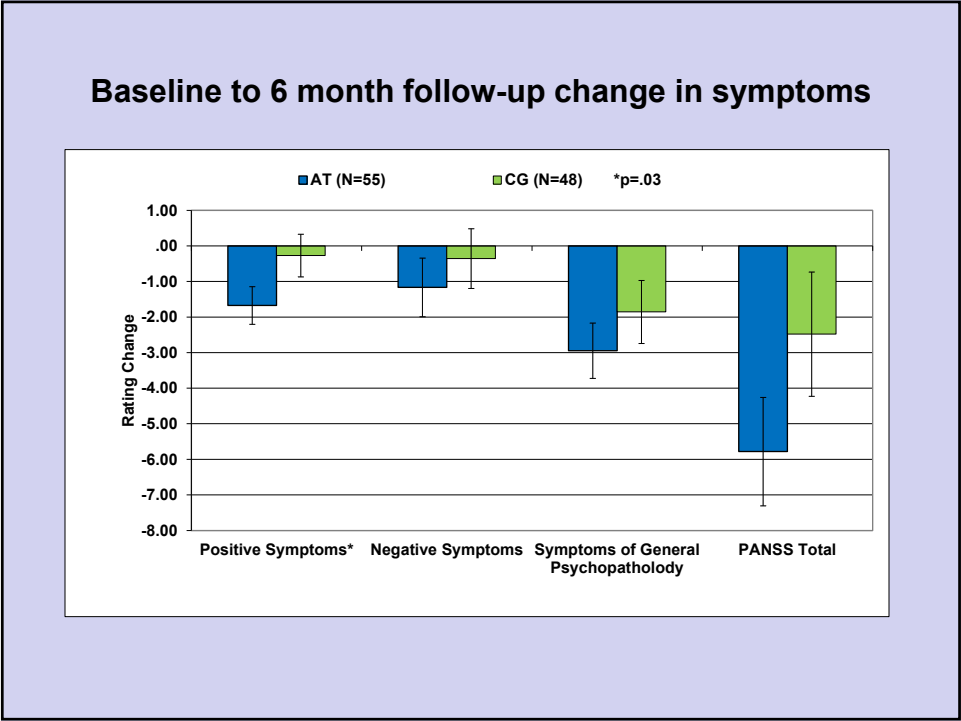
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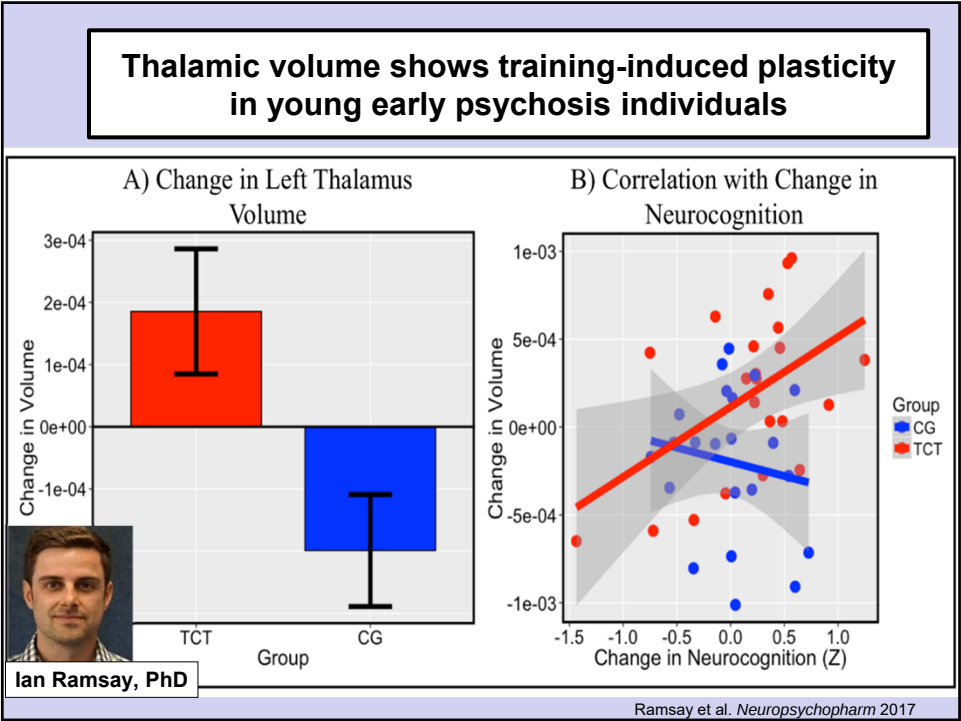
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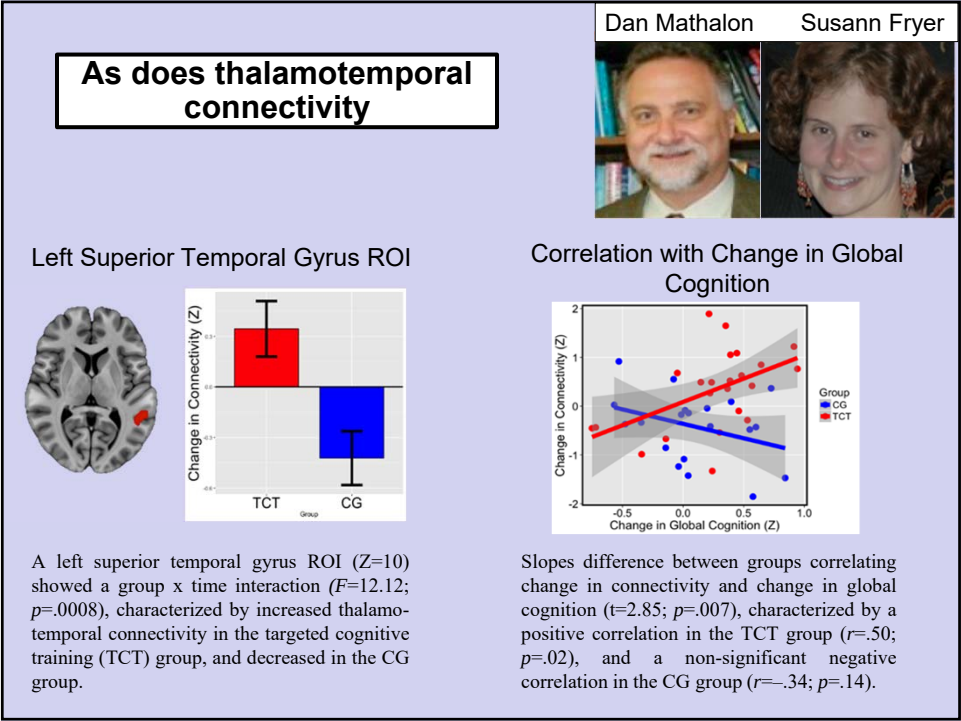
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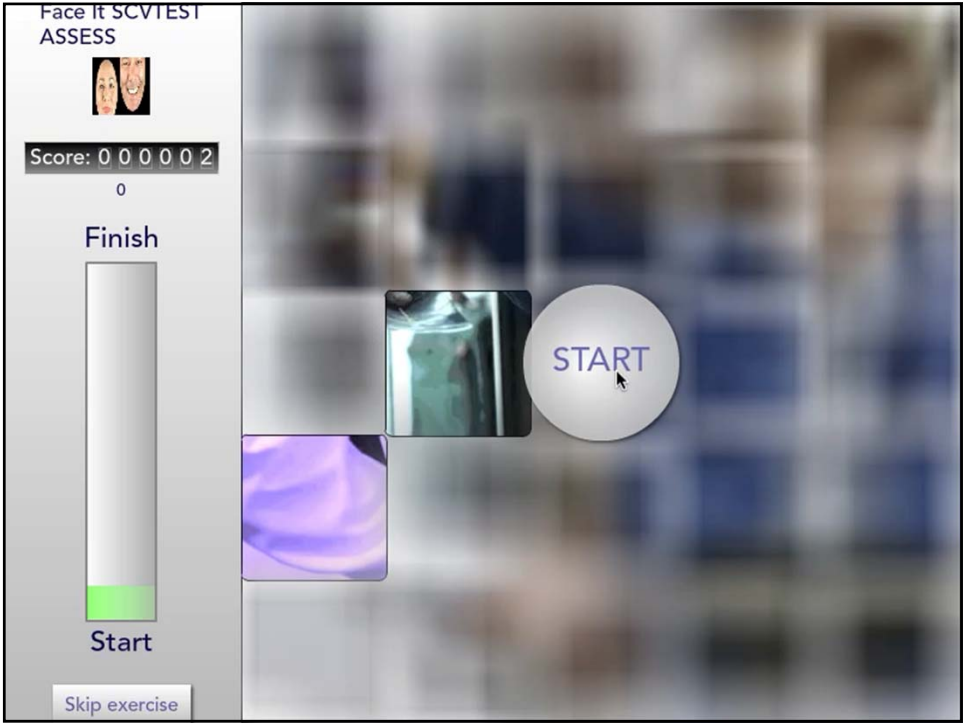


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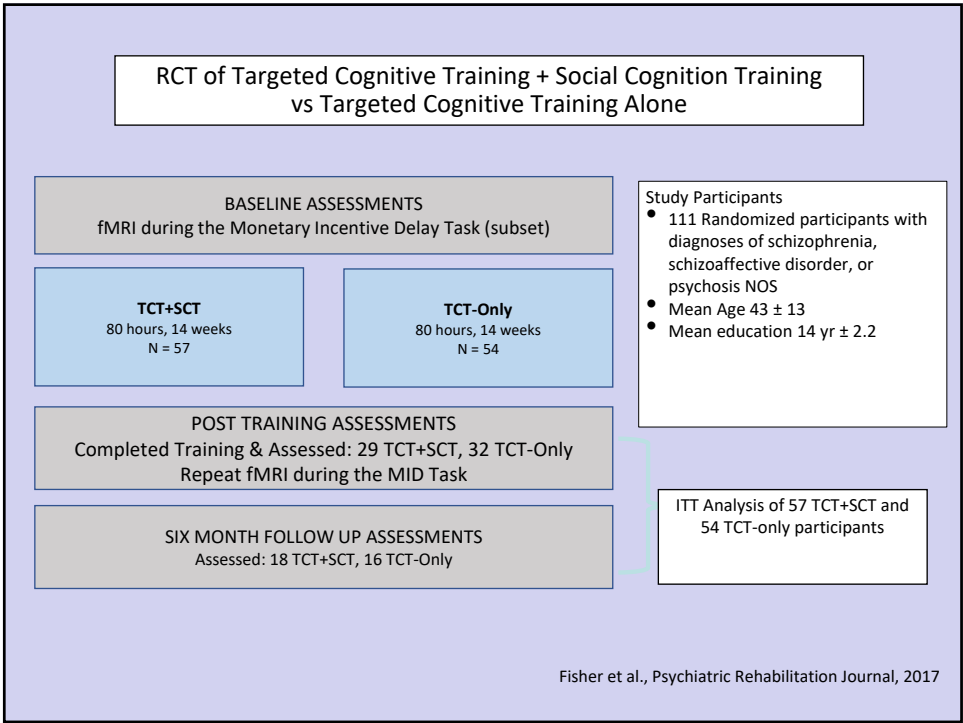


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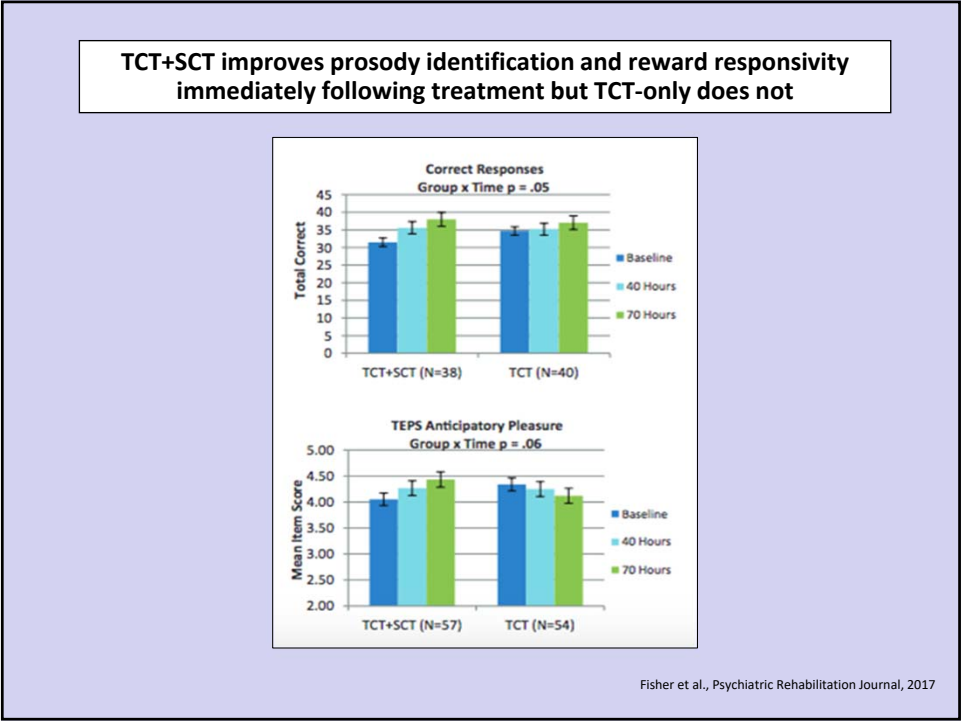




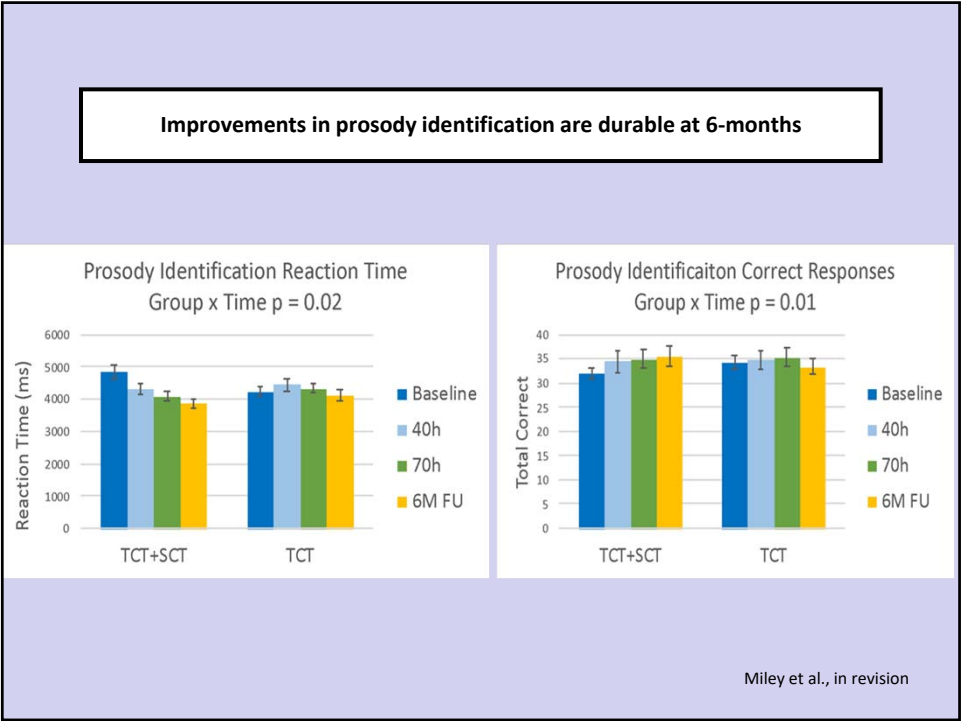
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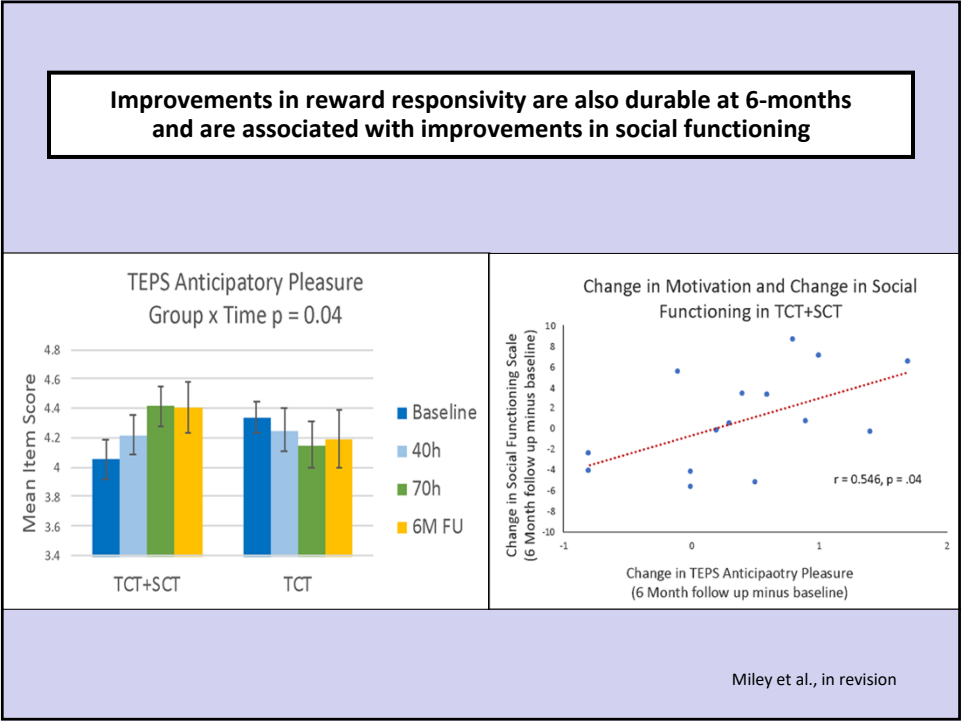
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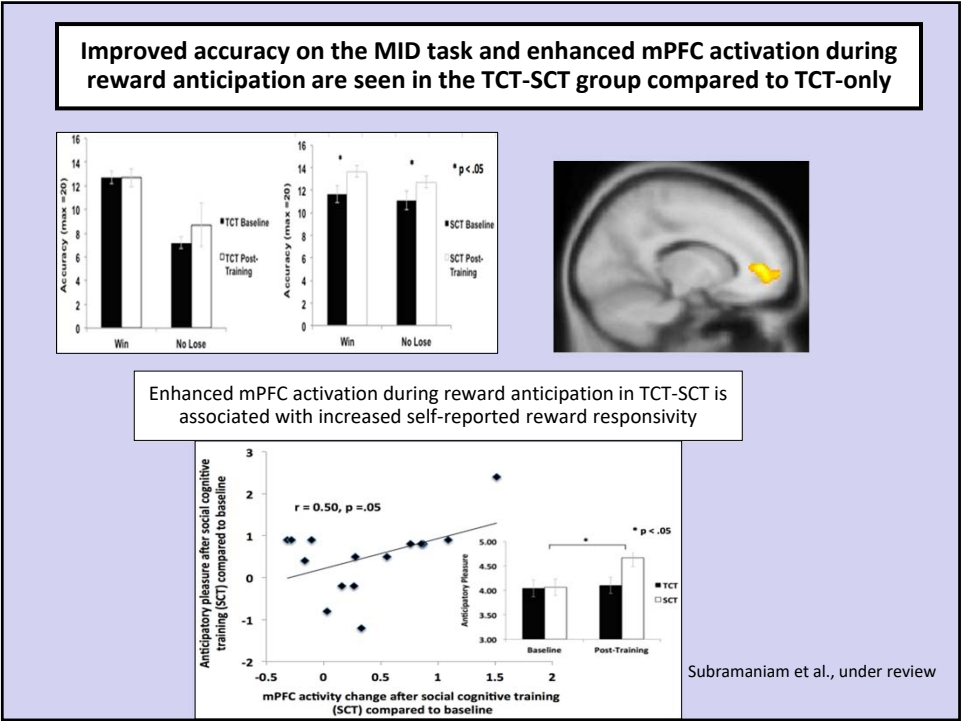
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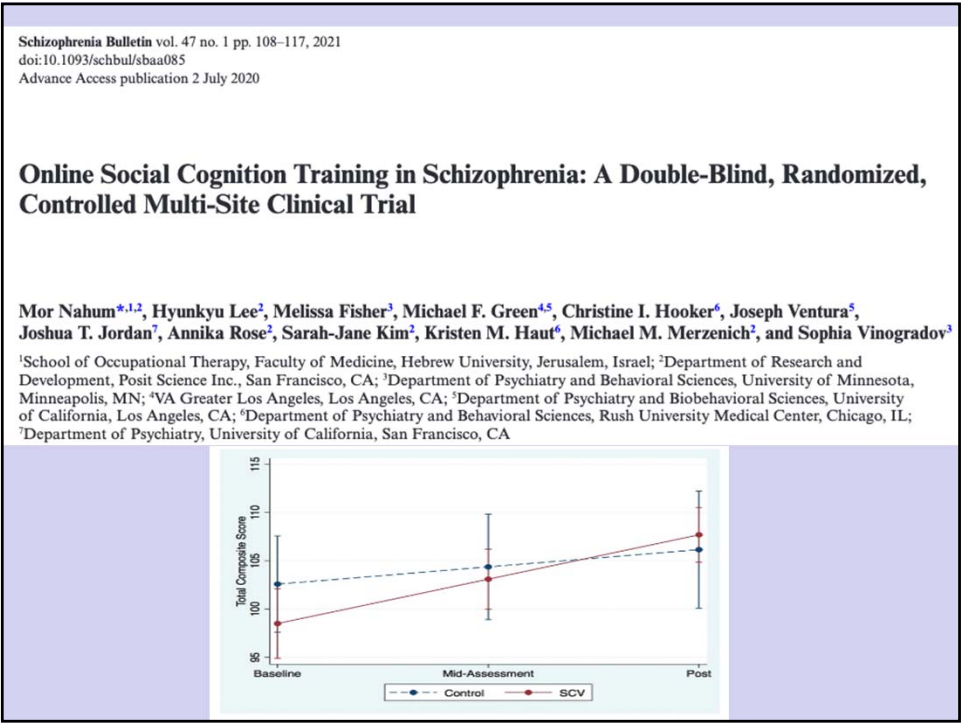
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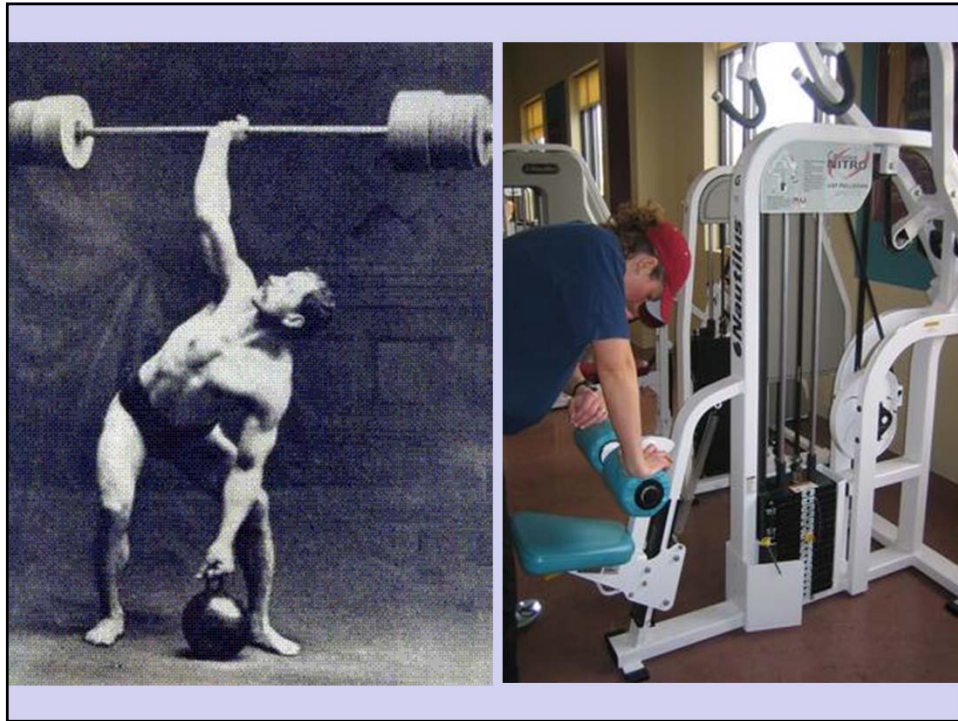


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What Do We Know So Far?

- Targeted cognitive training can be carried out via portable computing device in people with schizophrenia, even at the earliest stages of the illness.
- Cognitive training results in significant gains in verbal memory, processing speed, global cognition, and social cognition.
- After training, we observe associations between neural system plasticity and behavioral change.
- Behavioral and brain system changes are associated with enduring functional gains.

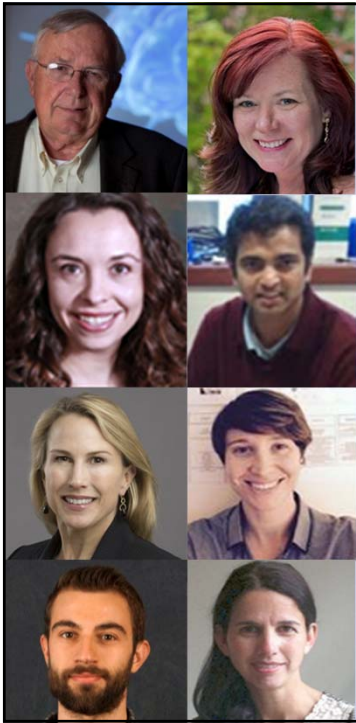
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- **Lots of open questions to be investigated:**
 - How do pre-existing pathological brain system functions constrain plasticity responses?
 - What compensatory processes come into play?
 - Do training-induced gains endure? Which training components are driving the improvements?
 - How can we personalize training to target the specific profile of deficits of a given individual?
 - **How do we enhance motivation and engagement?**
 - **Can we develop a “cognitive vaccine” that can prevent or mitigate the cognitive and neural system deterioration of schizophrenia?**

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