

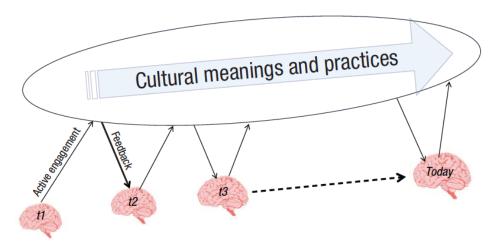
## Cultural Neuroscience:

Connecting Context to Genes and the Brain



#### How is nature nurtured?

- Mechanisms of cultural influence
  - Mimicry of others' behaviors
  - Conformity to others' behaviors and expectations
  - Reinforcement of these behaviors and all neural networks recruited to produce them



Repeated engagement in various tasks

**Neuroplasticity** 

Enlargement of relevant brain regions









Repeated engagement in *cultural* tasks

**Neuroplasticity** 

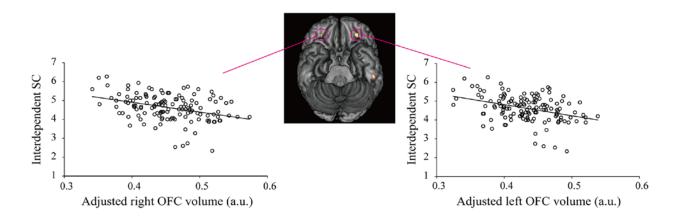
Enlargement of relevant brain regions

- Independence
  - Self-promotion
  - Self-actualization
  - Freedom and autonomy
- Involving
  - Increased recruitment of prefrontal functions (e.g., value-based decision, strategizing, forming of preferences)

- Interdependence
  - Self-sacrifice
  - Obligation and duty
  - Social harmony
- Involving
  - Decreased recruitment or "down-regulation" of the prefrontal functions

## Interdependence is associated with decreased prefrontal volume

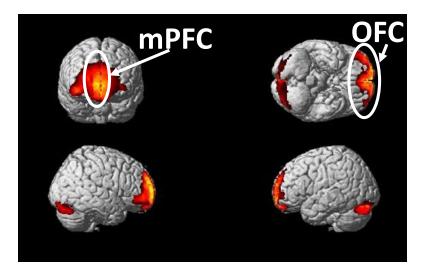
- 135 Japanese adults (20-39 years old)
  - Structural magnetic resonance imaging (MRI) scan
  - Voxel-Based Morphometry (VBM)
    - Fully automated, whole-brain, unbiased, MRI-based technique capable of detecting regionally specific differences in brain tissue composition
- Questionnaires
  - Independent versus interdependent self-construal



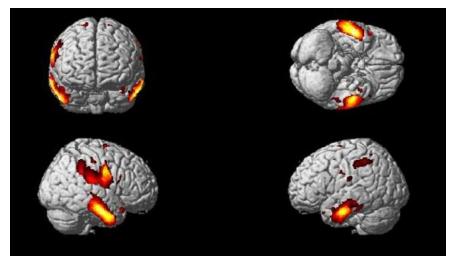
## Culture and regional brain volume: Comparing Americans with Asian-born Asians in the US

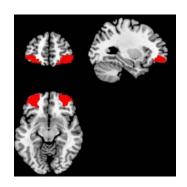
- 66 Asian-born Asians and 66 European Americans
- All students at the University of Michigan
- All right-handed
- 70% women

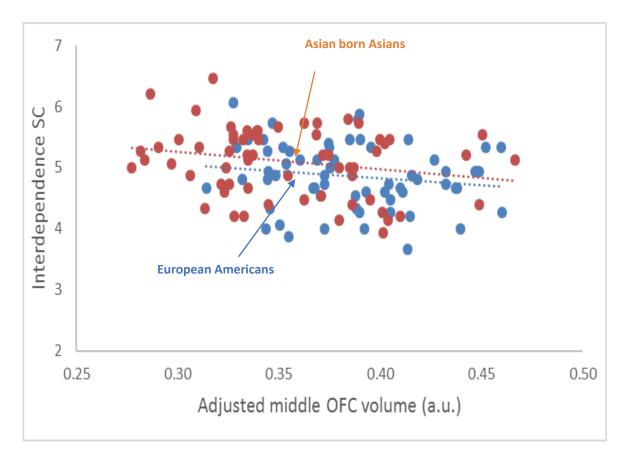
**Euro > Asian** 



#### Asian > Euro







Yu, Abe, Liberzon, King, Yoon, & Kitayama (under review)

### Thorny issue: Causality

• Our hypothesis: "Cultural training" causes the prefrontal volume to increase or decrease over time.

- However, so far, evidence is correlational.
- What if we use genetics to test the involvement of environmental influences?
  - If the cultural difference in the prefrontal volume is mediated by cultural learning, it should be more pronounced for those carrying *gene variants that support cultural learning* than for those who do not carry these variants.

#### Dopamine System Genes

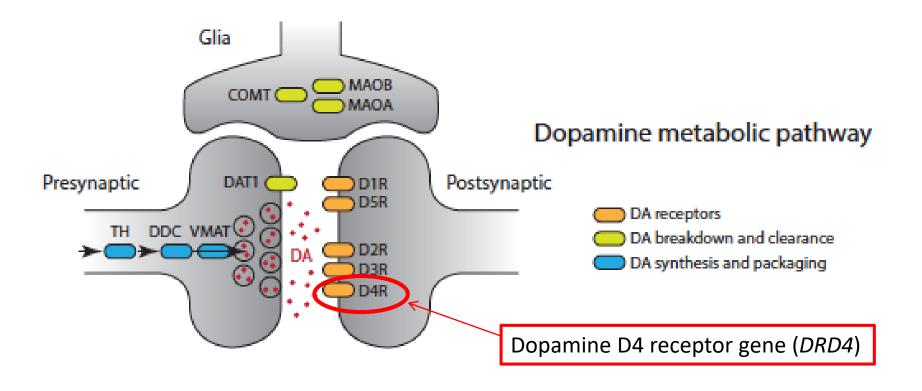
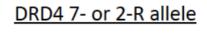


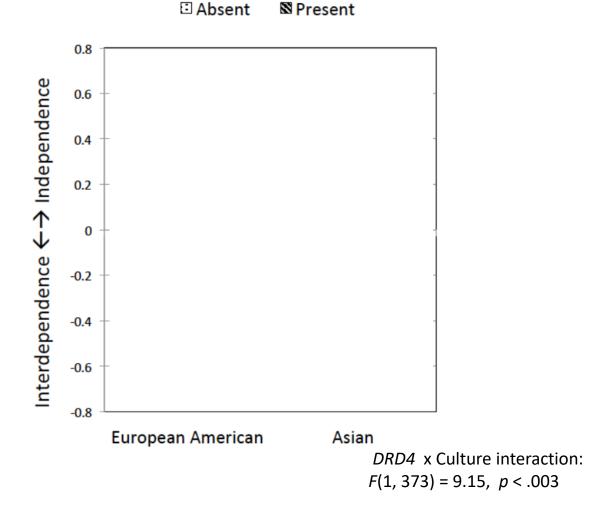
Figure 4. Dopaminergic (DA) pathway genes. Adapted from Saez et al., 2014, Frontiers in Neuroscience.

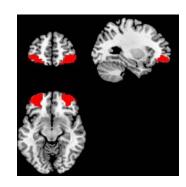
#### DRD4 as a crucial gene

- Peculiar structure
  - Polymorphic region in the Axon III of this gene
  - VNTR: 10 repetition variants of 48 bases
  - Most common
    - 4R, 7R, and 2R
- Peculiar functional characteristics
  - Dopamine signaling
    - 4 R < 2R < 7R
- Recent evolution
  - 7R: approximately 50,000 years ago
  - 2R: approximately 20,000 years ago
- 7 and 2Rs serving as "plasticity alleles"
  - Carriers are more sensitive to cultural influences

### Independence - Interdependence

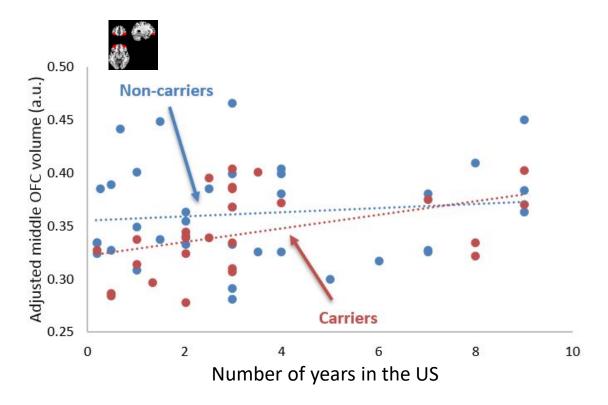






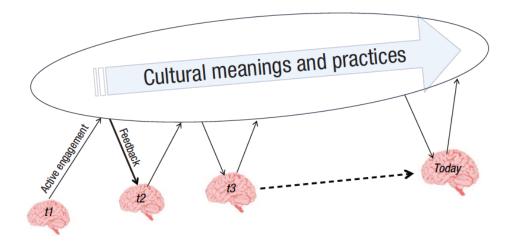
# Asian-born Asians in the United States

 Once in the U.S., their PFC may begin to increase in volume – especially for those carrying the 7 or 2 repeat variant of *DRD4*



#### Conclusions

- Culture can powerfully shape certain structural properties of the brain
  - Gray matter volume and cortical thickness (current data)
  - Anatomical connectivity (unpublished data)
- Applications to negotiation?
  - Independent (adversarial, argumentative) approach vs. interdependent (conciliatory, relation-building) approach
  - Match vs. mismatch of of default mentality
  - Are global, multi-cultural, multi-perspectival styles of negotiation possible and if so how can they be nurtured?





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