

# The Neurobiology of Well-being And How it Can Be Trained

Robin I. Goldman, PhD

Center for Investigating Healthy Minds

Waisman Center, UW-Madison

# Center for Investigating Healthy Minds



Richard  
Davidson

And other  
Scientists...



# And graduate students...



# And scientific staff...



# Center For Investigating Healthy Minds

## Mission:

To cultivate well-being and relieve suffering through a scientific understanding of the mind.

# Center For Investigating Healthy Minds

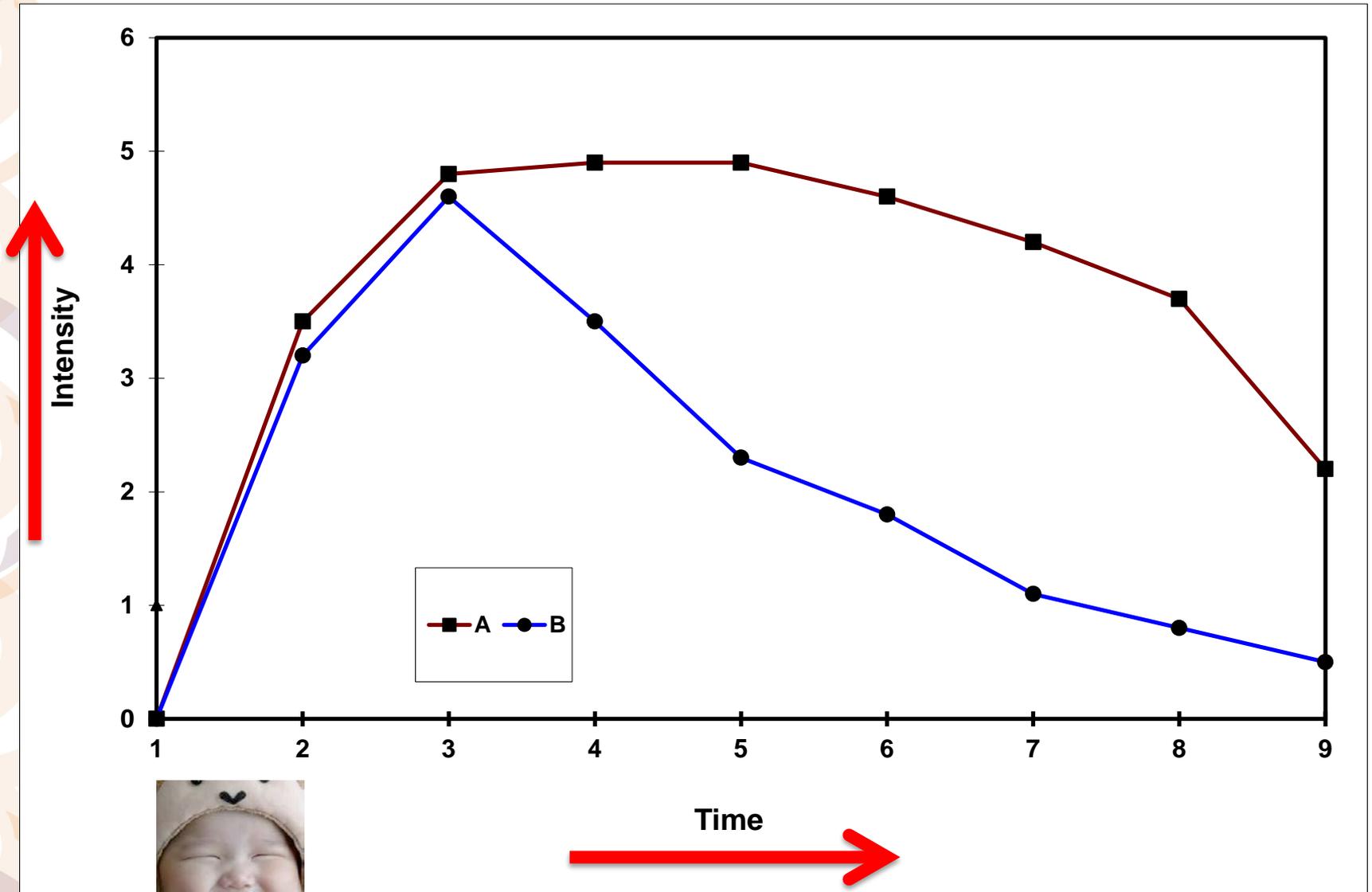
- Currently working on dozens of projects
- But we have two main questions:
  - What factors influence well-being?
  - Can well-being be trained?

# Center For Investigating Healthy Minds

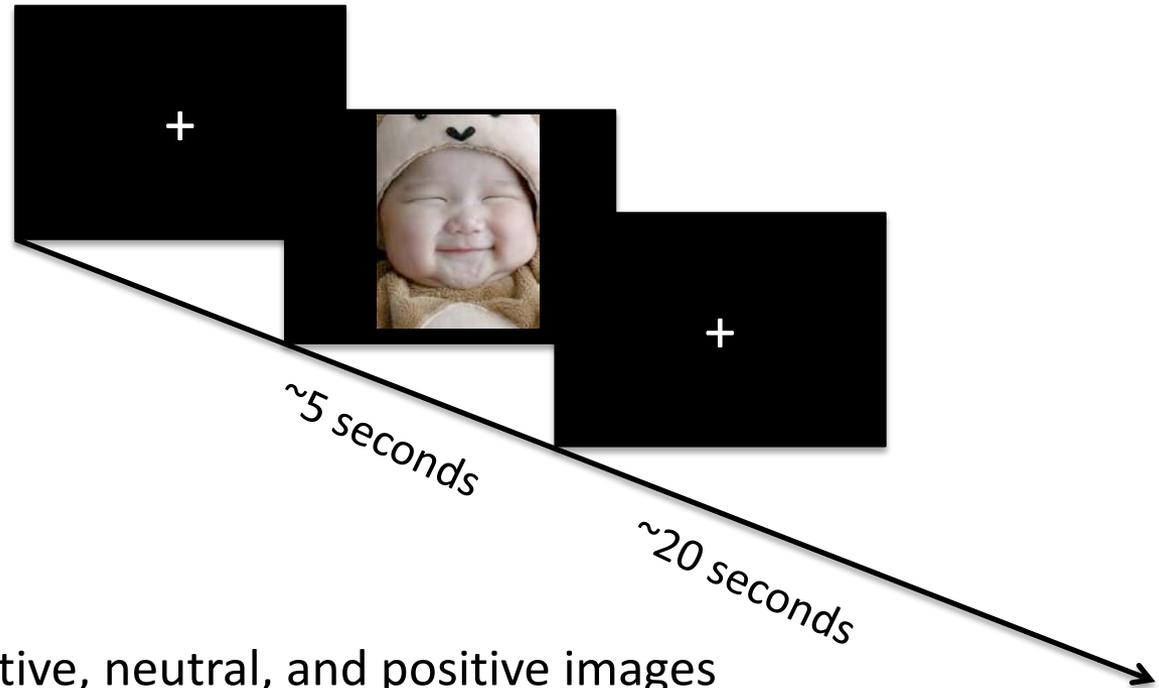
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## Emotion

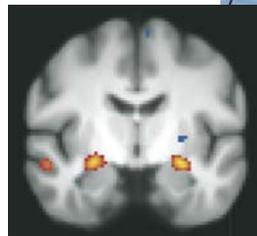
# Variations in Positive Emotional Response



# A Common Study Design in Our Lab

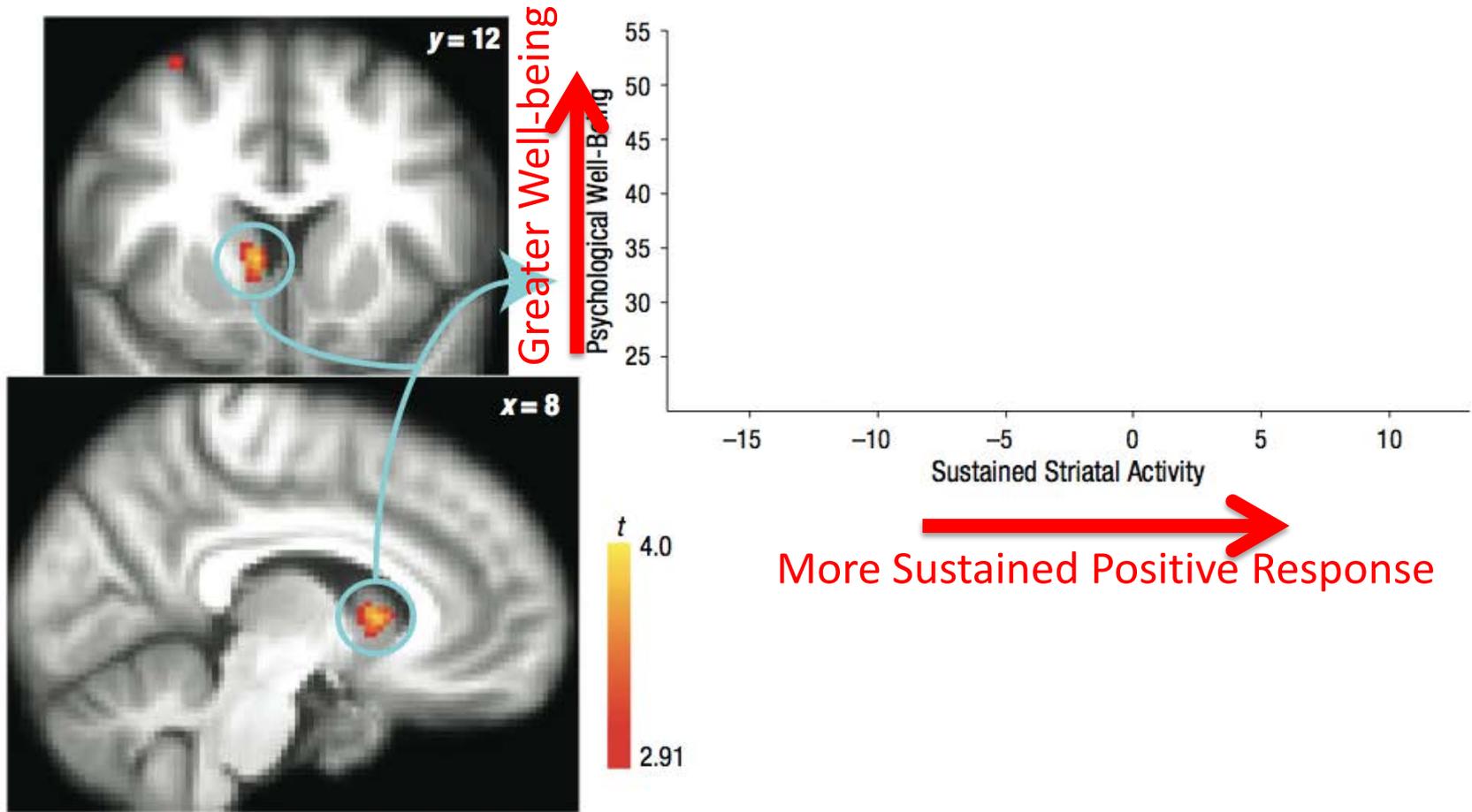


- Show negative, neutral, and positive images
- Measure people's responses
  - Behavioral
  - Physiological
  - Brain





How does your response to positive events affect your well-being?

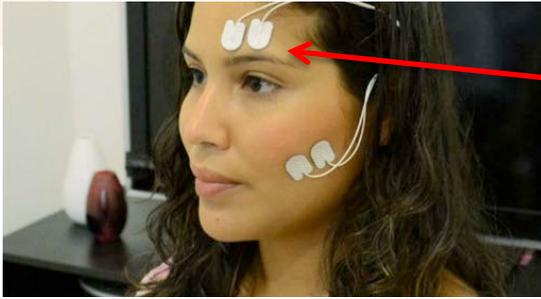


Heller et al, Psych Science 2013

The longer you can sustain your response to positive images, the more psychological well-being you are likely to report.

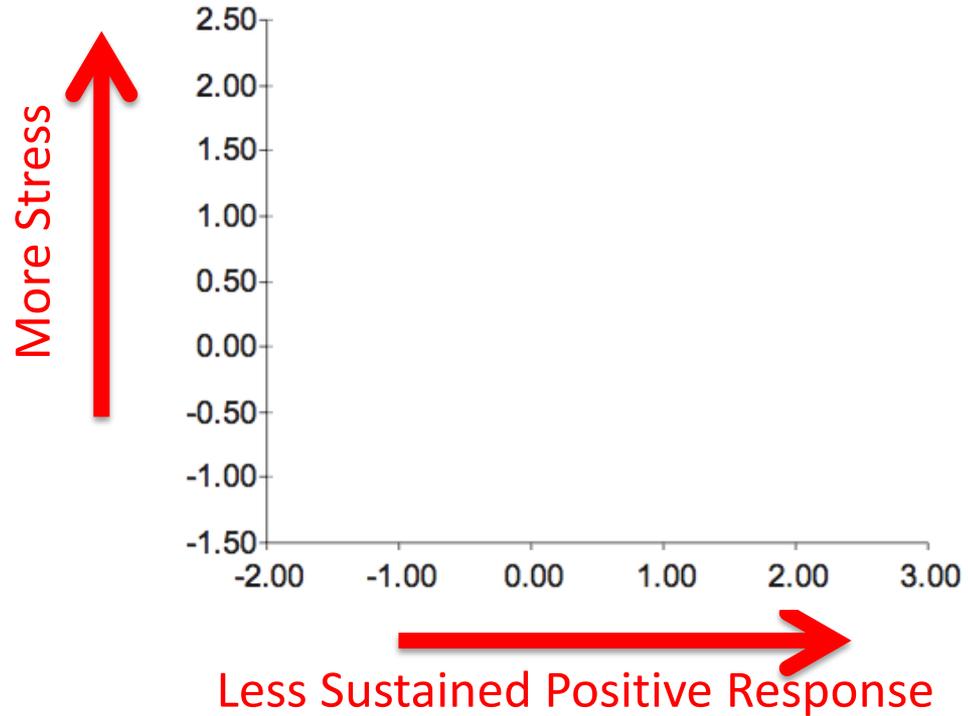
So can everyday stress affect your ability to sustain positive emotion?

We looked at the effect of marital stress on ability to sustain.



Positive emotion = decreased  
“frown muscle” response.

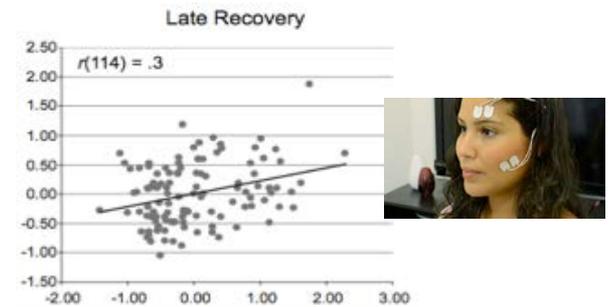
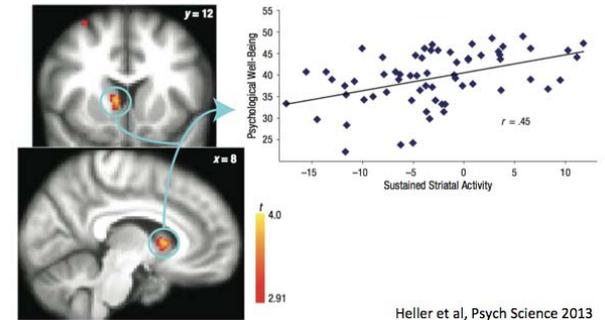
Late Recovery



Greater marital stress results in decreased ability to sustain a positive emotional response.

# So far we know that...

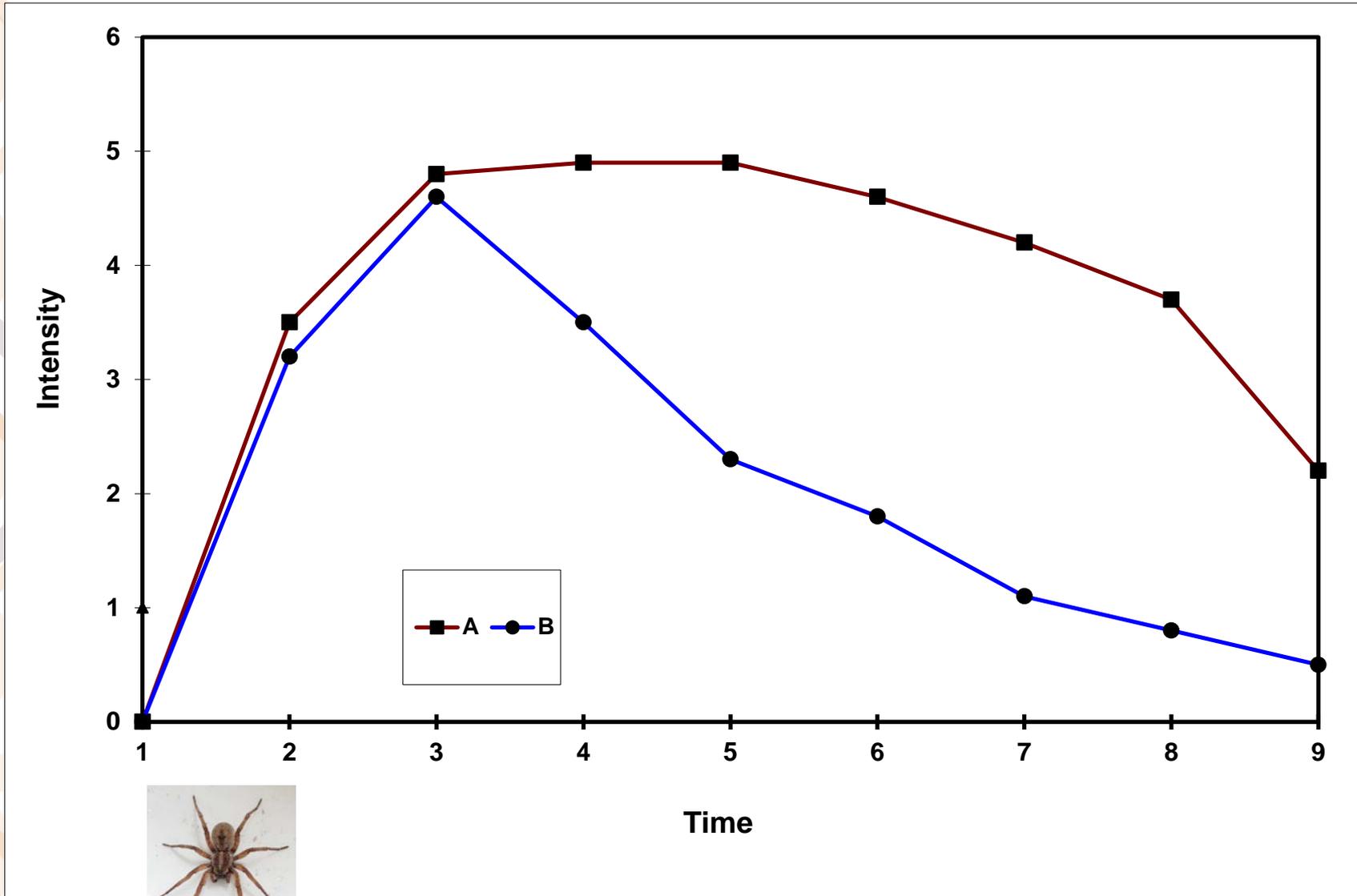
- well-being depends on your ability to sustain positive emotion.
- that ability can be affected by stress.



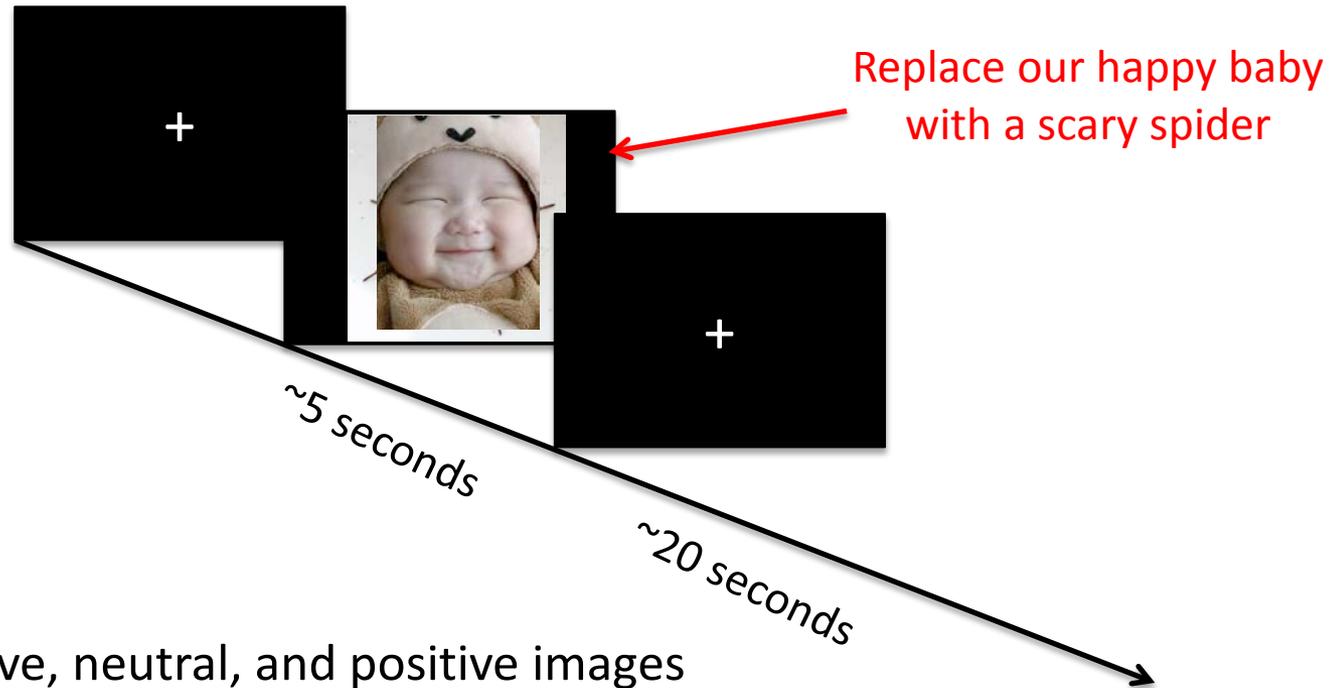


How does your response to *negative* events affect your well-being?

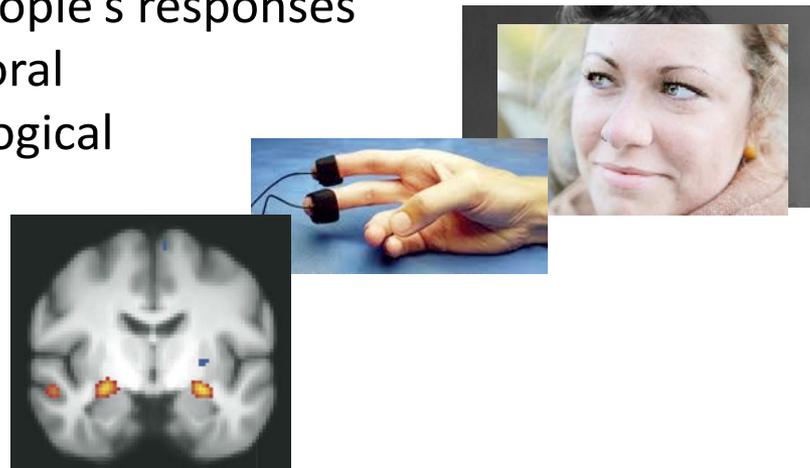
# Variations in Negative Emotional Response



# Return to Our Study Design...



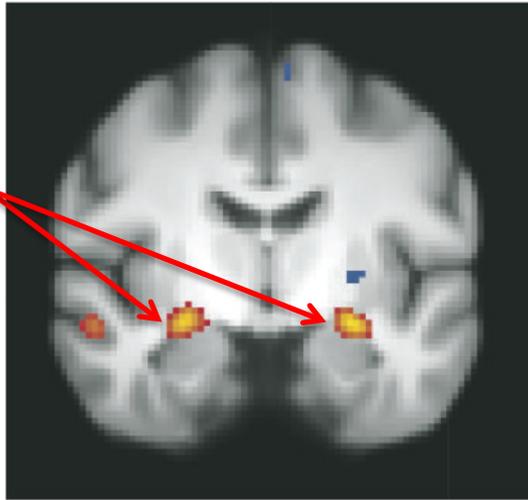
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Does an *inability to recover* from negative events affect your well-being?

(a)

Amygdala  
responds  
to negative  
images



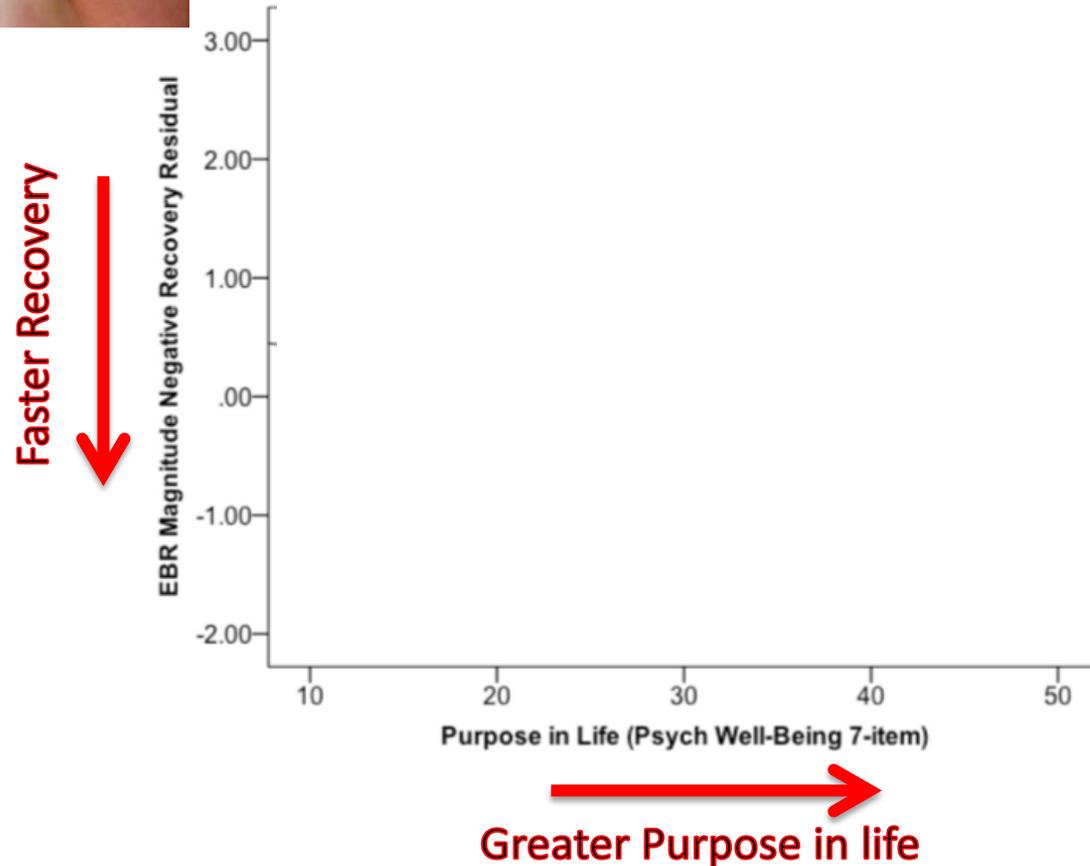
Slower recovery from negative events  
is associated with greater neuroticism.

So can anything affect your ability to  
*recover* from *negative* emotion?

We looked at different measures of  
well-being.



Eye Blink Magnitude is greater when a person is emotionally worked up.



Greater purpose in life is associated with faster recovery from negative events.

# So we know that...

- Well-being depends on your ability to sustain positive emotion and recover from negative emotion.
- Both can be affected by your lifestyle or things happening in your life.

# Center For Investigating Healthy Minds

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# Center For Investigating Healthy Minds

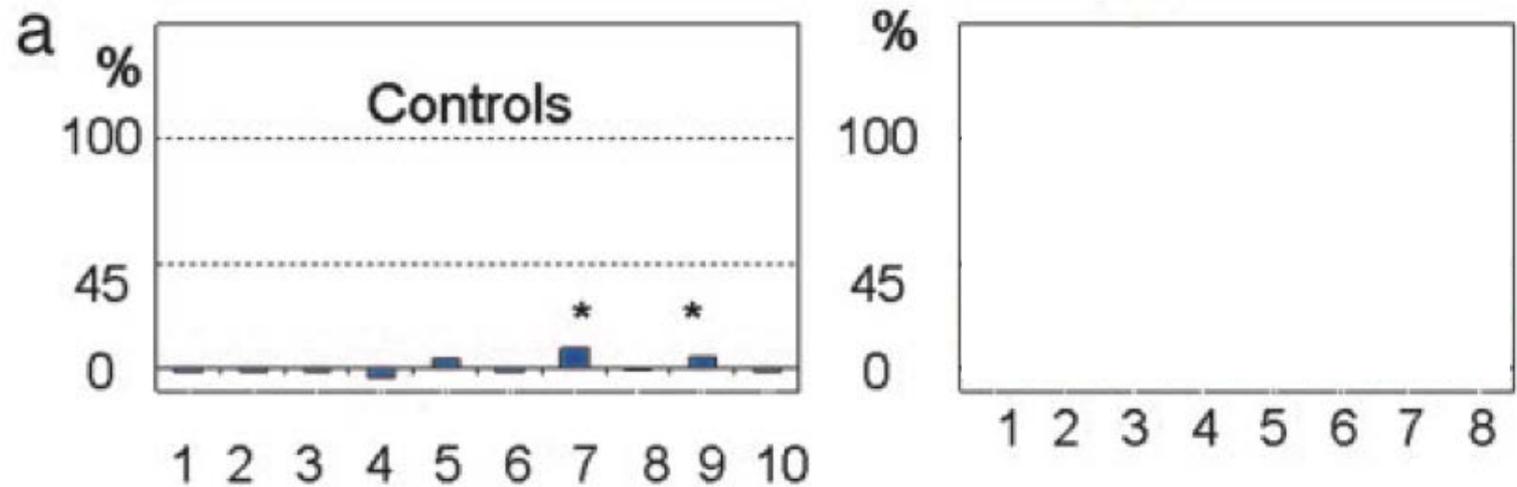
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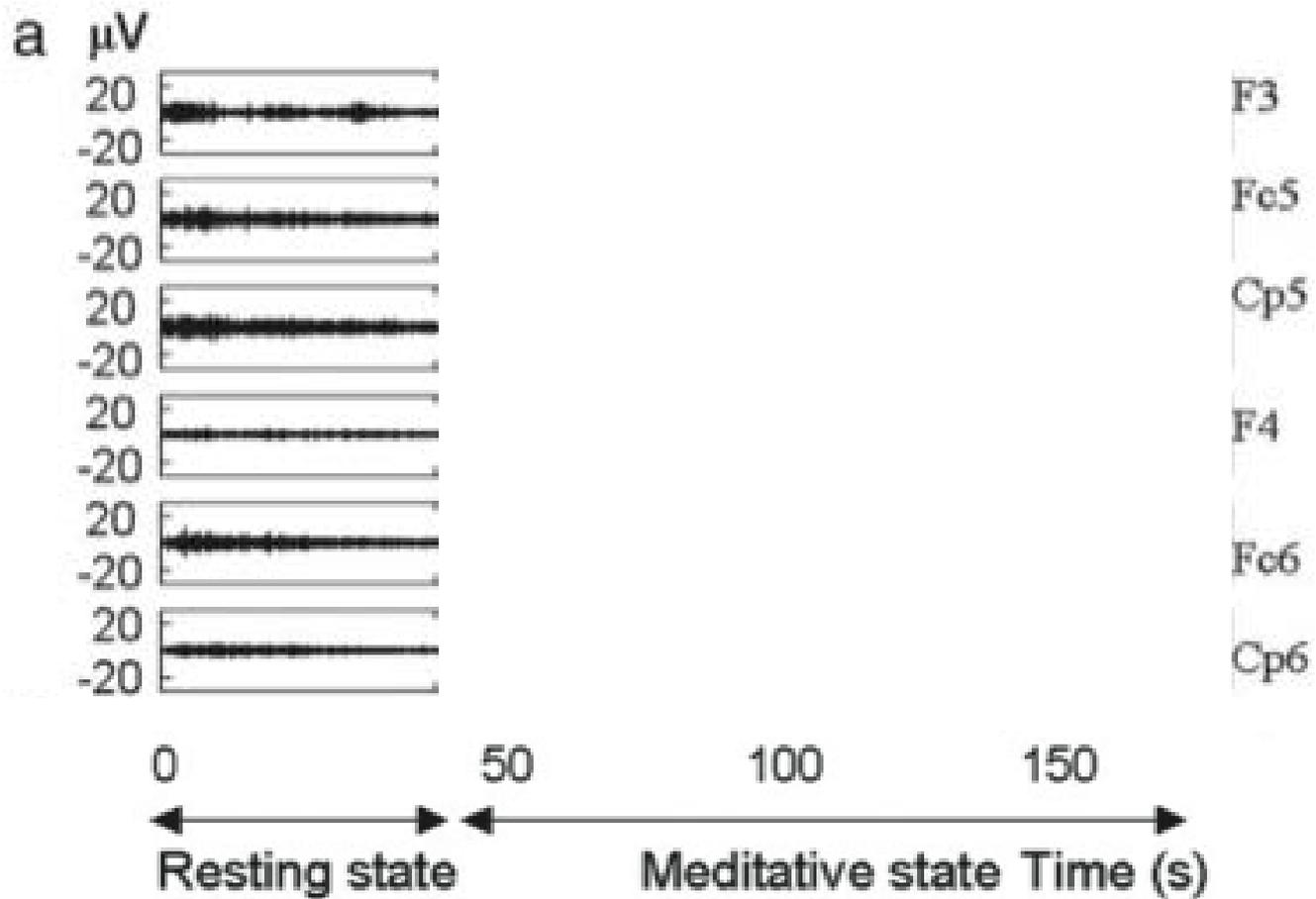


# Compassion meditation in Expert Meditators vs. Non-Meditator Controls

(Experts have 10,000 to 50,000 hours of experience)



**Gamma oscillations** (associated with high levels of attentional focus)

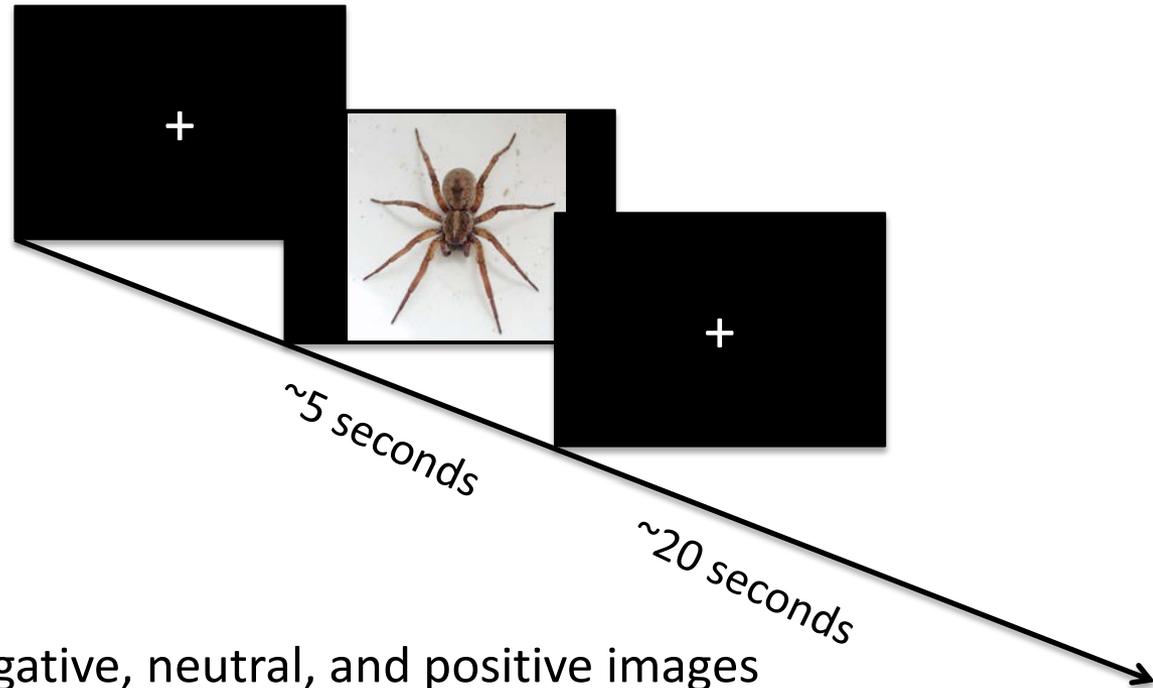




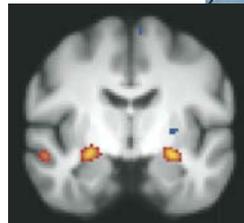
So long-term attention and compassion practice can dramatically alter brain function.

Does it affect a person's emotional response?

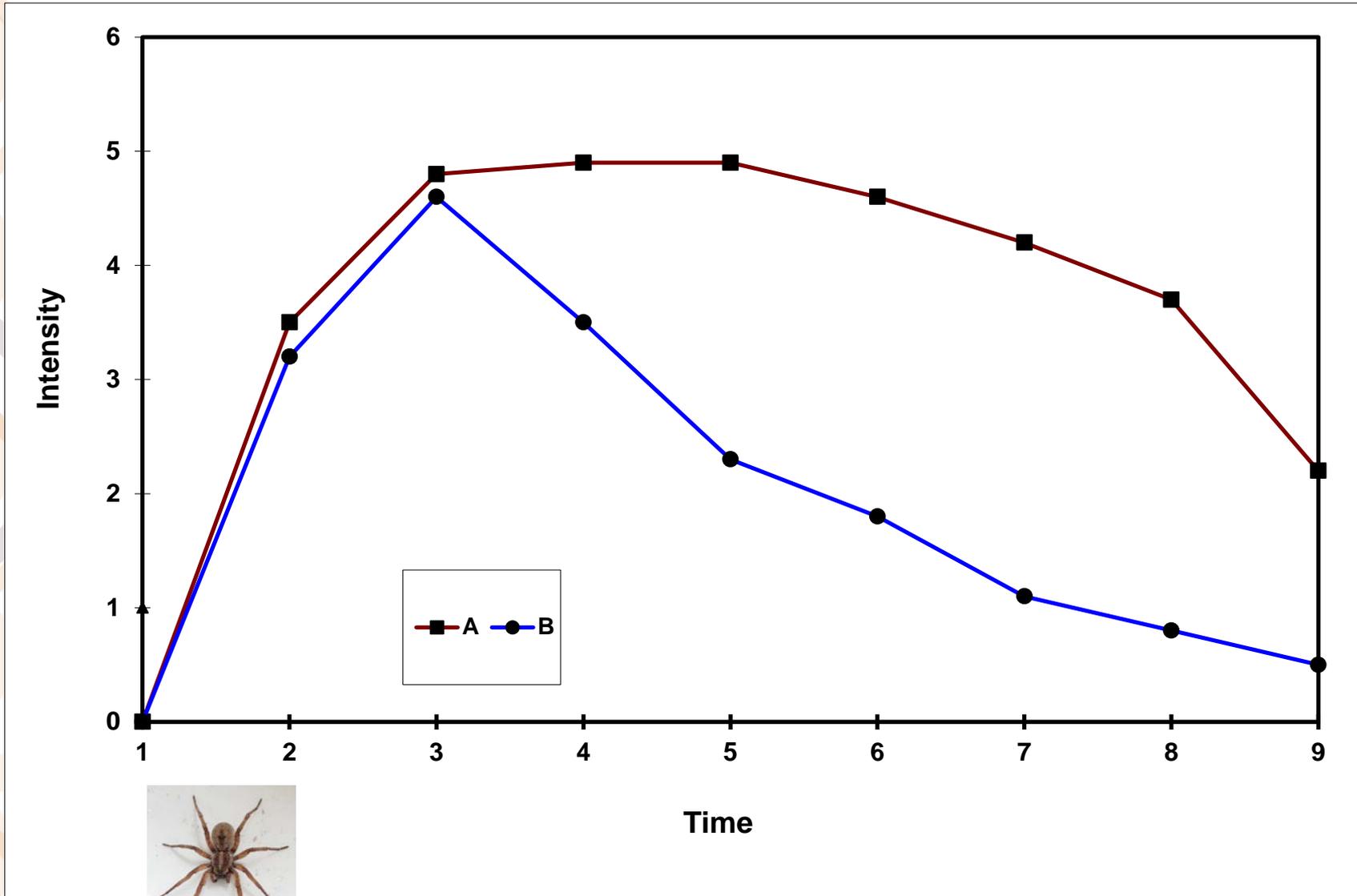
# Let's Return to Our Study Design Again.

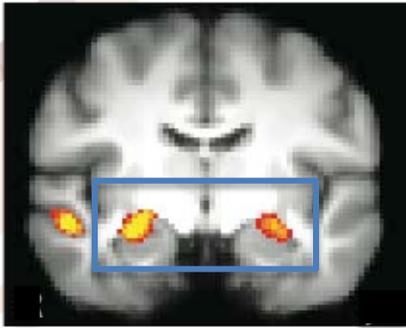


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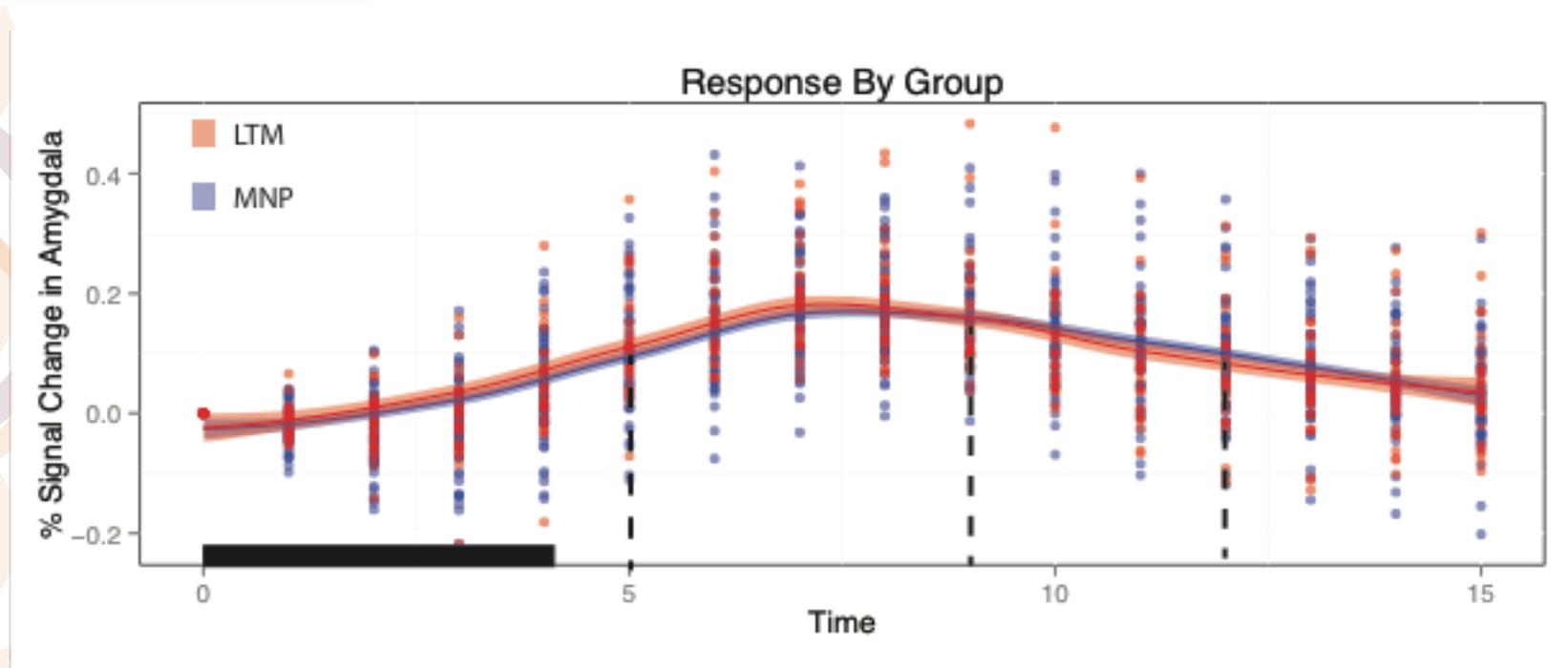


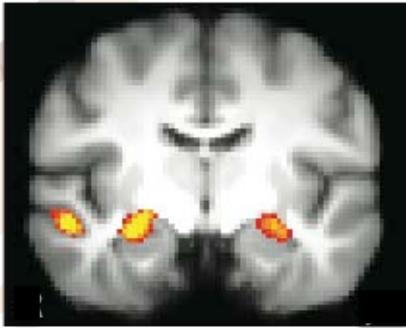
# Variations in Negative Emotional Response



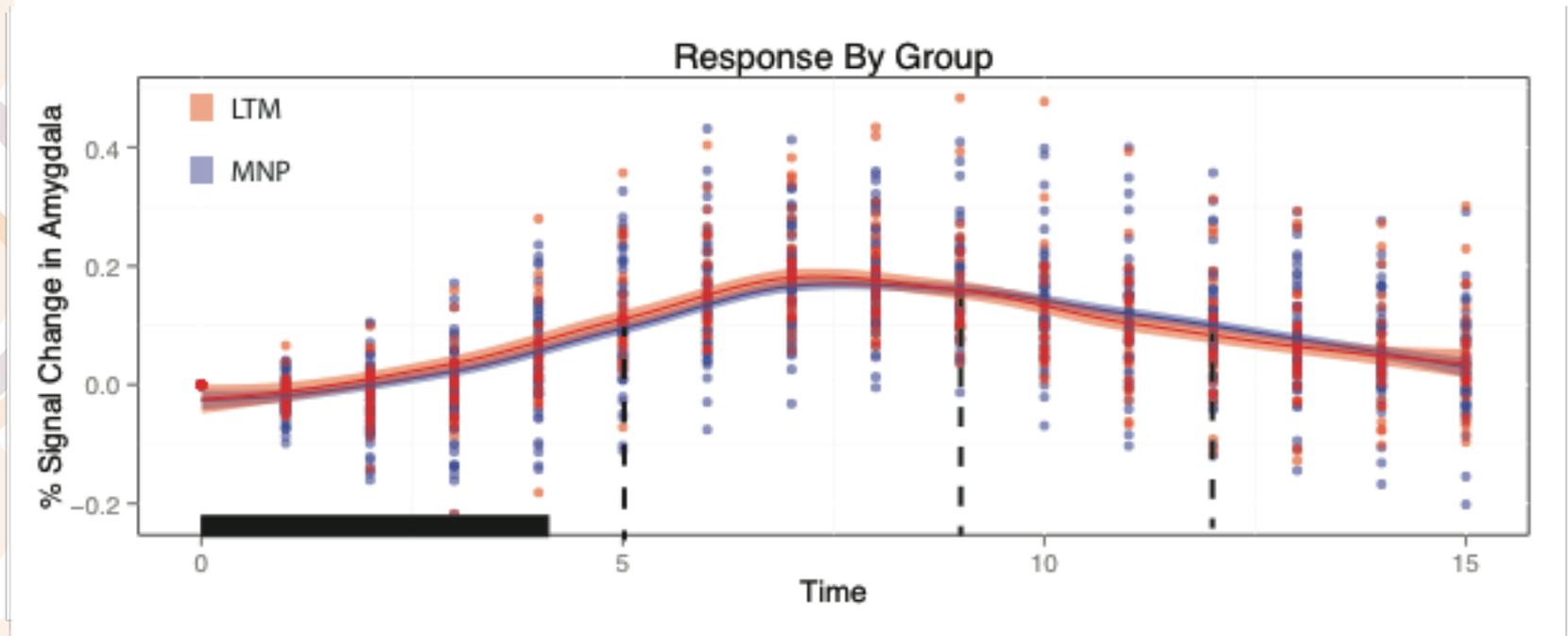


- Long-Term Meditators (LTM)
- Meditation Naïve Participants (MNP)





LTM:  
Least hours  
Most hours



More hours of practice is associated with faster recovery from negative events.

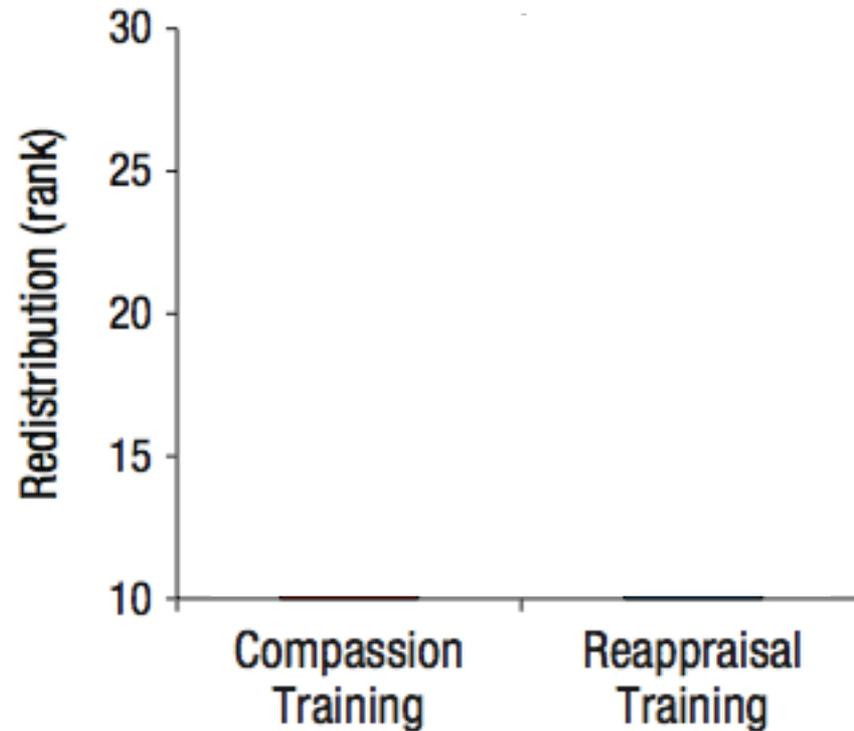
# What do we know so far?

- Well-being is associated with
  - Sustained positive emotion
  - Quick recovery from negative emotion
- Emotional response can be affected by life circumstances (ie. It's not set in stone)
- Mental training is one way to alter emotional response
- But what if I don't have 10,000 hours?

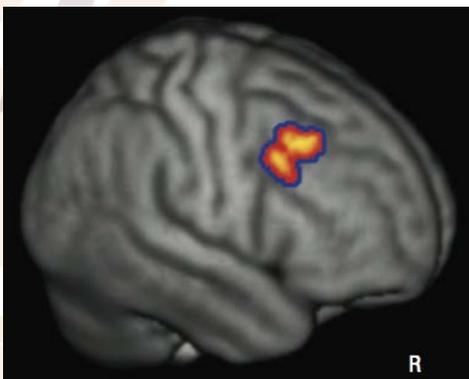
# Can short-term training affect the brain?

- 2 week training for 30 minutes a day
  - 20 learned compassion meditation
  - 21 learned cognitive reappraisal

The Compassion group is more prosocial after 2 weeks of training.



Weng et al., *Psych Science*, 2013



More Redistribution



Redistribution (rank)

50  
40  
30  
20  
10  
0

R DLPFC

- Compassion Training
- ▲ Reappraisal Training

-1.5 -1 -0.5 0 0.5

$\Delta$  BOLD (% Change)

Greater Brain Activity



Participants who completed compassion training show greater brain activity when they engage in more prosocial behavior.



A person's emotional response can be altered by long-term meditation practice.

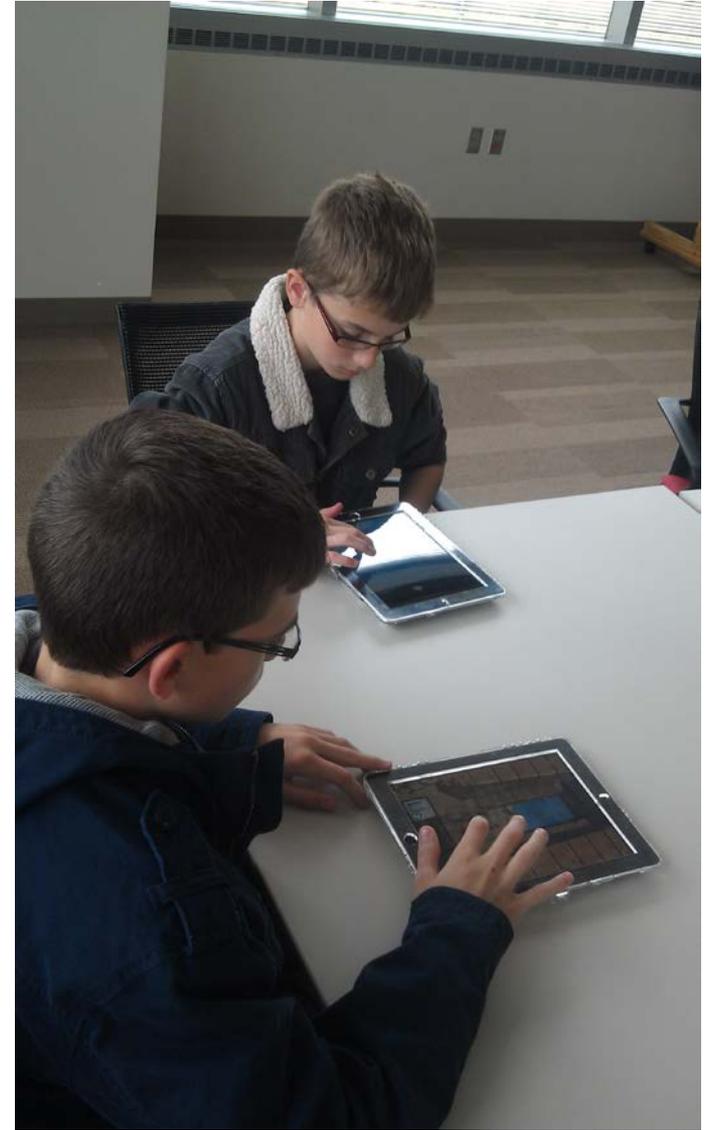
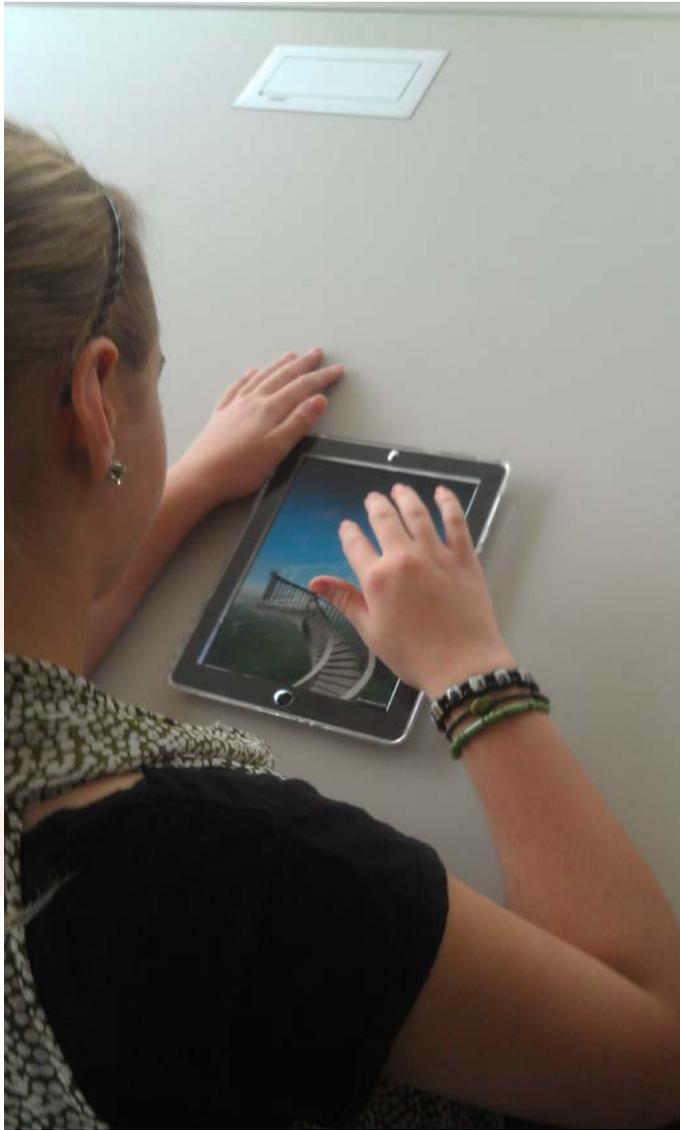
But short term training can also affect the brain and behavior!



Can we make training fun?

Games to promote well-being and prosocial behavior in adolescents.

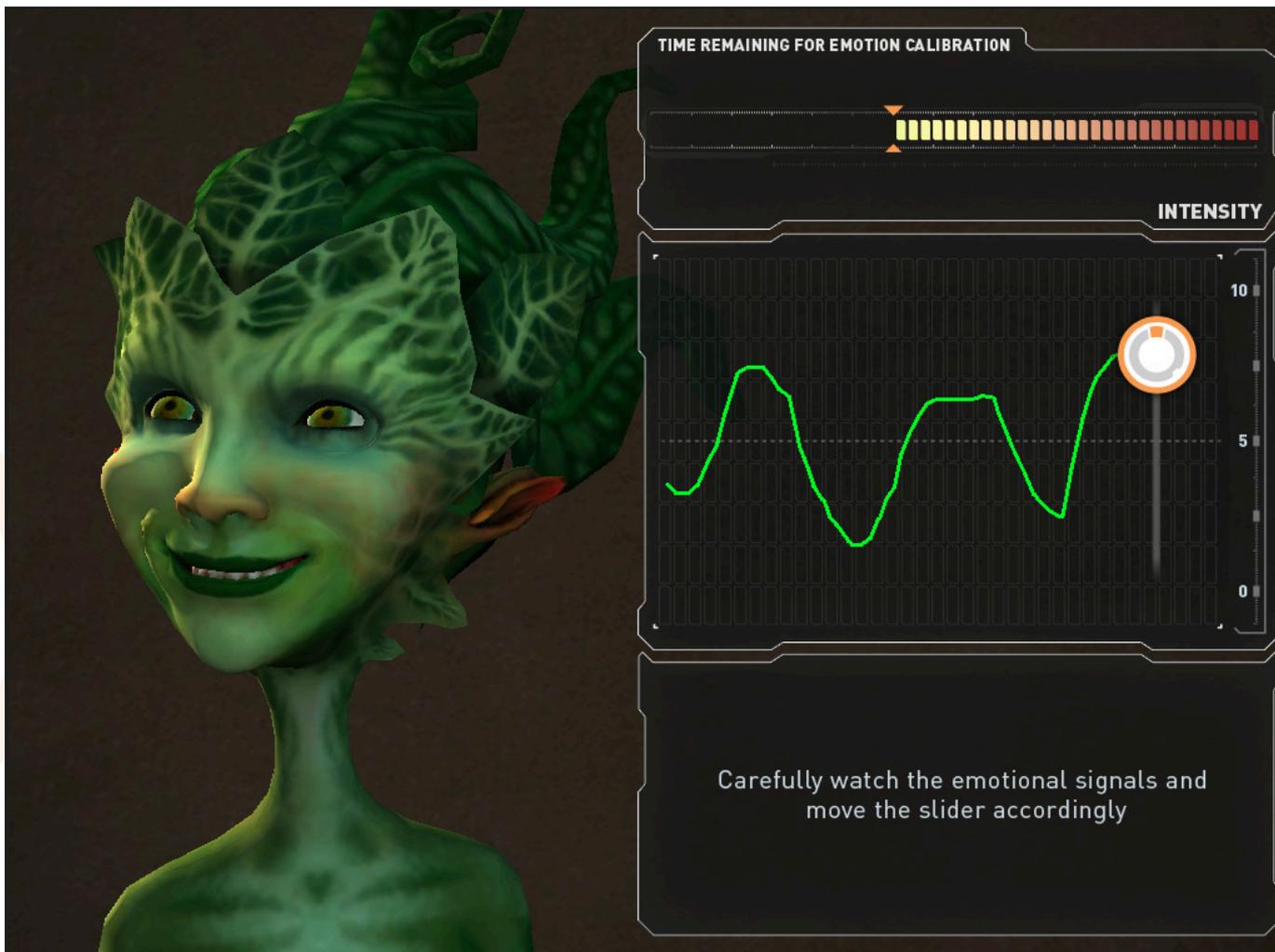
# Extensive play testing with adolescents





# Crystals of Kaydor

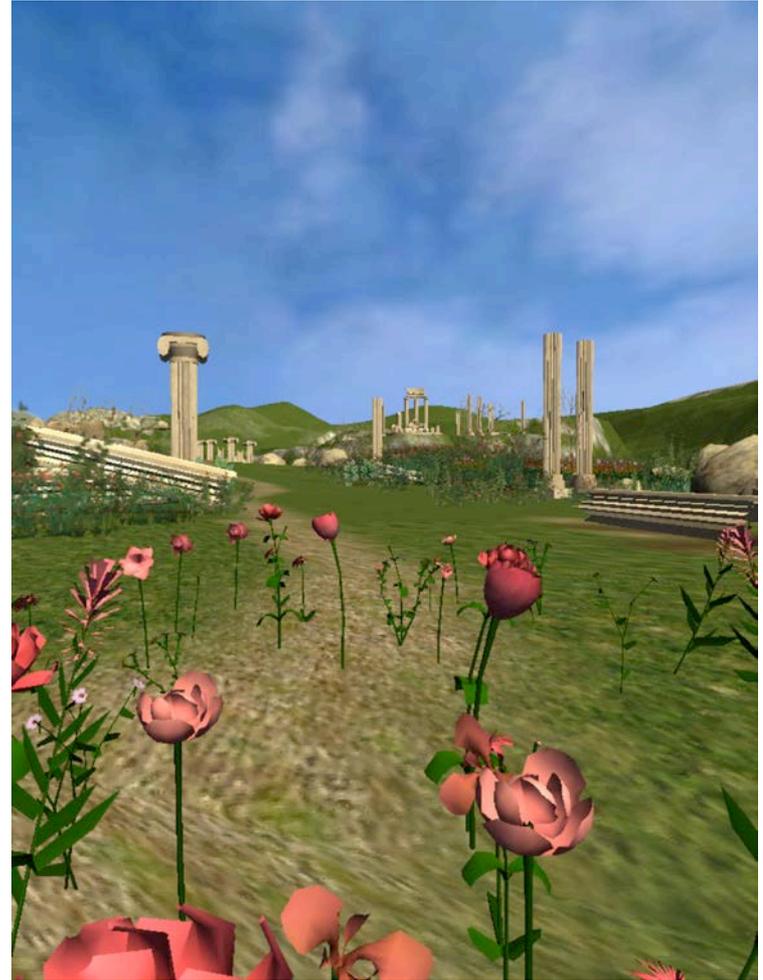
(a game designed to train prosocial behavior)





# Tenacity

(an app designed to train attention and mindfulness skills)

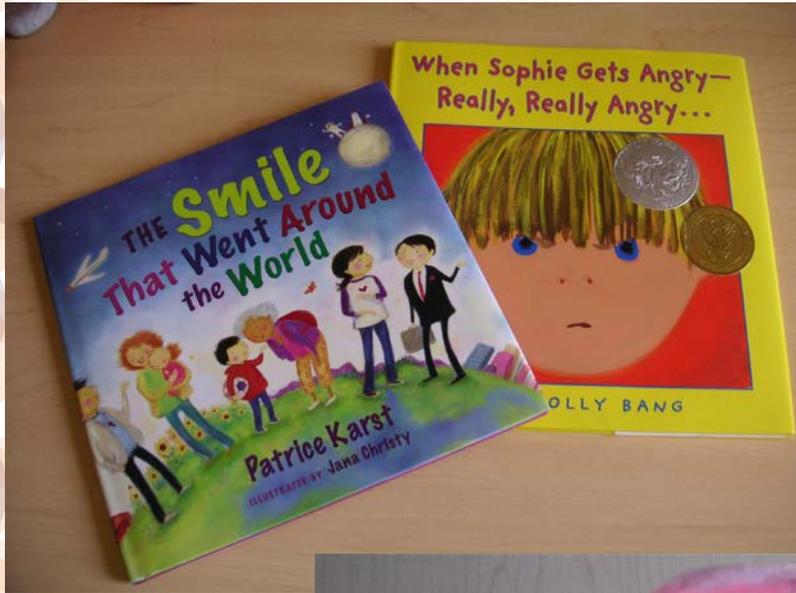


Correct breath counting is rewarded by growth of flowers, and accumulation of achievements.



Are there ways to train well-being and prosocial behavior in pre-schoolers?

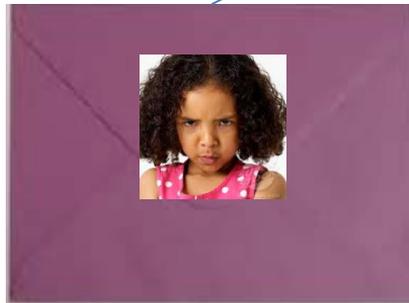
# Pre-school Kindness Curriculum



# Prosocial Behavior (Sharing)



Friend



Difficult Person



Stranger



Person in Need





Some initial hints that prosocial games and curricula can increase prosocial behavior in kids.

But there is a huge amount left to study!

# Well-being in the Workplace



# Take-Home Message

- Well-being is associated with
  - Sustained positive emotion
  - Quick recovery from negative emotion
- Emotional response
  - Affected by Life Circumstances (ie. It's not set in stone)
  - Altered by Mental Training (both short and long term)

# Take-Home Message

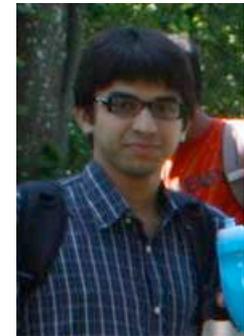
- Can we  
Train Well-Being  
in Children and Adults  
with curricula and video games?

..... Stay Tuned!

# Thanks to the CIHM Scientists



# Thanks to the CIHM graduate students



# Thanks to the CIHM Scientific Staff



# Thanks to the CIHM Administrative, Development, and Communications Staff





[www.investigatinghealthyminds.org](http://www.investigatinghealthyminds.org)

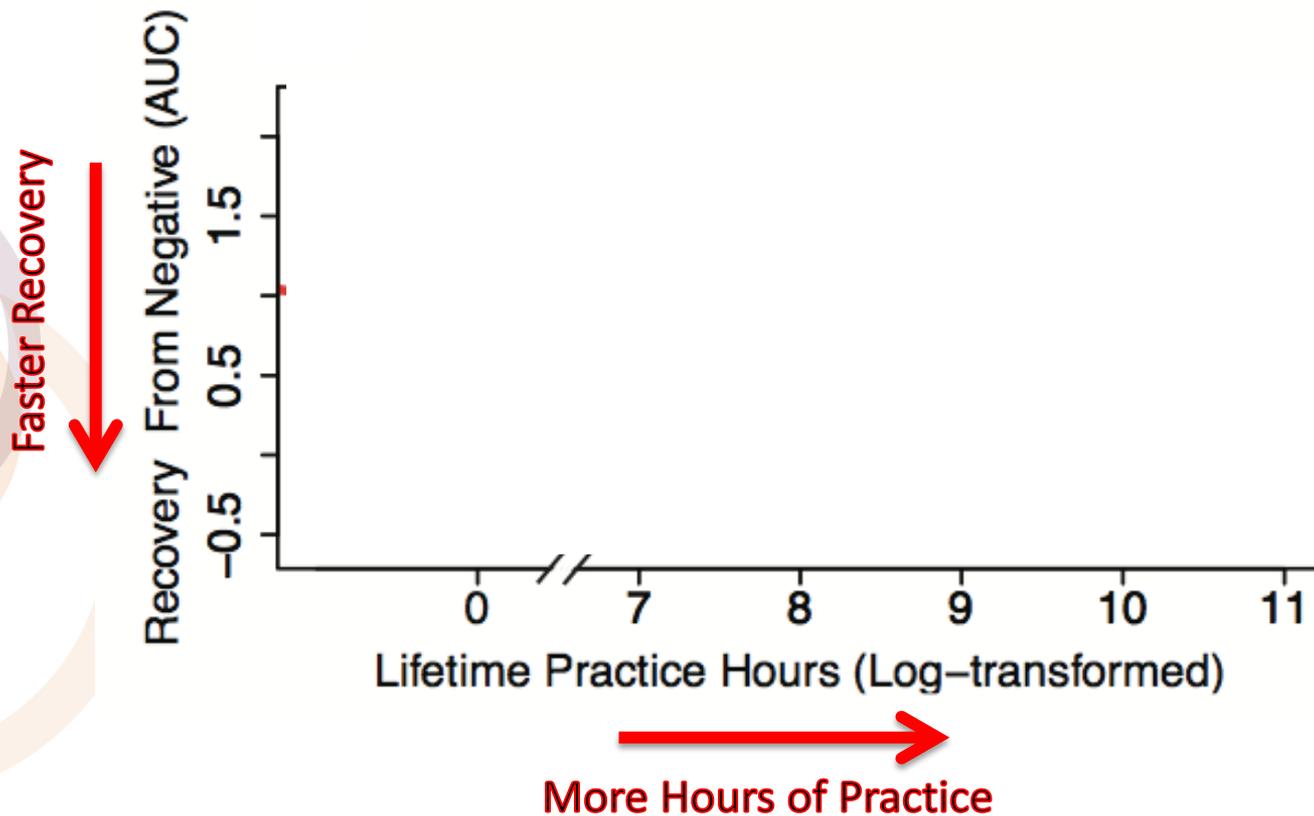
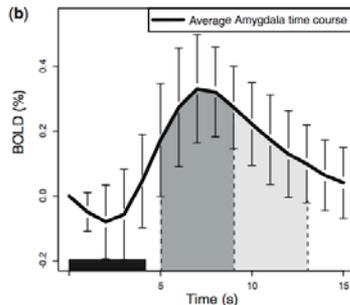
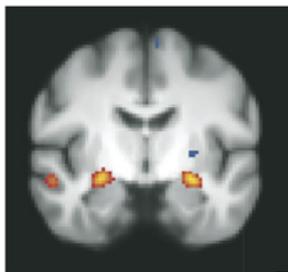
We Barely Scratched the Surface...

**Thank you!**

**Questions?**



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More hours of practice is associated with faster recovery from negative events.

Schuyler et al, In prep