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

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Center for Investigating Healthy Minds

Richard Davidson
And other Scientists...
And graduate students...
And scientific staff...
Mission:

To cultivate well-being and relieve suffering through a scientific understanding of the mind.
Currently working on dozens of projects
But we have two main questions:
  – What factors influence well-being?
  – Can well-being be trained?
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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?
The longer you can sustain your response to positive images, the more psychological well-being you are likely to report.

Heller et al, Psych Science 2013
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.

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

Lapate et al, Psychophysiology 2013
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

The graph illustrates the intensity of negative emotional response over time, with two lines labeled A and B. The intensity on the y-axis ranges from 0 to 6, while the time on the x-axis ranges from 1 to 9.

Line A shows an initial increase in intensity, peaking around time 3, and then declining. Line B has a similar pattern but reaches a slightly lower peak.

The graph is accompanied by an image of a spider, which may be relevant to the context of the study.
Return to Our Study Design...

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

Replace our happy baby with a scary spider
Does an *inability to recover* from negative events affect your well-being?
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.

Schaefer et al, PLOS One 2013
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.
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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)

Lutz et al, PNAS 2004
Lutz et al, PNAS 2004
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.

• Show negative, neutral, and positive images
• Measure people’s responses
  • Behavioral
  • Physiological
  • Brain
Long-Term Meditators (LTM)
Meditation Naïve Participants (MNP)

Schuyler et al, In prep
More hours of practice is associated with faster recovery from negative events.

Schuyler et al, In prep
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

Weng et al., *Psych Science*, 2013
The Compassion group is more prosocial after 2 weeks of training.

Weng et al., *Psych Science*, 2013
Participants who completed compassion training show greater brain activity when they engage in more prosocial behavior.

Weng et al., *Psych Science*, 2013
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)

Time remaining for emotion calibration

Intensity

Carefully watch the emotional signals and move the slider accordingly
Correct breath counting is rewarded by growth of flowers, and accumulation of achievements.

Tenacity
(an app designed to train attention and mindfulness skills)
Are there ways to train well-being and prosocial behavior in pre-schoolers?
Pre-school Kindness Curriculum

- Attention
- Breath
- Caring practices
- interDependence
- Emotions
- Forgiveness
- Gratitude
Prosocial Behavior (Sharing)

Friend
Difficult Person
Stranger
Person in Need

Flook et al. 2015
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 (i.e., 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
We Barely Scratched the Surface...

Thank you!

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

Schuyler et al, In prep