Using the Mind
To Change the Brain

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Topics

- Your Amazing Brain
- Self-Directed Neuroplasticity
- Paper Tiger Paranoia
- The Optimal Brain
Common and Fertile Ground

Psychology

Neuroscience

Contemplative Practice
We ask, “What is a thought?”

We don't know,

yet we are thinking continually.

Venerable Tenzin Palmo
Your Amazing Brain
Technical Specs

- **Size:**
  - 3 pounds of tofu-like tissue
  - 1.1 trillion brain cells
  - 100 billion “gray matter” neurons

- **Activity:**
  - Always on 24/7/365 - Instant access to information on demand
  - 20-25% of blood flow, oxygen, and glucose

- **Speed:**
  - Neurons firing around 5 to 50 times a second (or faster)
  - Signals crossing your brain in a tenth or hundredth of a second

- **Connectivity:**
  - A typical neuron makes ~ 5000 connections: ~ 500 trillion synapses.
  - During one breath, a quadrillion-plus signals coursed through your head.

- **Complexity:**
  - Potentially 10 to the millionth power brain states
A Schematic Neuron
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The Mind/Brain System

- “Mind” = flow of information within the nervous system
  - Information is represented by the nervous system.
  - Most mind is unconscious; awareness is part of mind.
  - The headquarters of the nervous system is the brain.

- In essence then, apart from hypothetical transcendentental factors, your mind is what your brain does.

- Brain = necessary, proximally sufficient condition for mind.
  - The brain depends on the nervous system, which intertwines with and depends on other bodily systems.
  - These systems in turn intertwine with and depend upon nature and culture, both presently and over time.
  - And as we’ll see, the brain also depends on the mind.
The Evolving Brain

The Triune Brain - (P. MacLean 1990)
Three Goal-Directed Systems Evolved in the Brain

- **Avoid** “sticks,” threats, penalties, pain

- **Approach** “carrots,” opportunities, rewards, pleasure

- **Attach** to “us,” proximity, bonds, feeling close

Although the three branches of the vagus nerve loosely map to the three systems, the essence of each is its **aim**, not its neuropsychology.

Each system can draw on the other two for its ends.
Love and the Brain

- Social capabilities have been a primary driver of brain evolution.

- Reptiles and fish avoid and approach. Mammals and birds *attach* as well - especially primates and humans.

- Mammals and birds have bigger brains than reptiles and fish.

- The more social the primate species, the bigger the cortex.

- Since the first hominids began making tools ~ 2.5 million years ago, the brain has tripled in size, much of its build-out devoted to social functions (e.g., cooperative planning, empathy, language). The growing brain needed a longer childhood, which required greater pair bonding and band cohesion.
Self-Directed Neuroplasticity
First Fact about Your Brain

As your brain changes, your mind changes.
Second Fact about Your Brain

As your mind changes, your brain changes.

Immaterial mental activity maps to material neural activity.

This produces temporary changes in your brain and lasting ones.

Temporary changes include:

- Alterations in brainwaves (= changes in the firing patterns of synchronized neurons)
- Increased or decreased use of oxygen and glucose
- Ebbs and flows of neurochemicals
The Rewards of Love
Pain network: Dorsal anterior cingulate cortex (dACC), insula (Ins), somatosensory cortex (SSC), thalamus (Thal), and periaqueductal gray (PAG).

Reward network: Ventral tegmental area (VTA), ventral striatum (VS), ventromedial prefrontal cortex (VMPFC),17 and amygdala (Amyg).

Brain activations of “selfing” - Gillihan, et al., *Psychological Bulletin*, 1/2005
Key Brain Areas for Consciousness

(adapted from) M. T. Alkire et al., Science 322, 876-880 (2008)
Buddhist Meditation
Christian Nuns in Prayer

Beauregard, et al., Neuroscience Letters, 9/25/06
Mental Activity Shapes Neural Structure

- The flows of mind sculpt the brain.

- Immaterial information leaves material traces behind:
  - Increased blood/nutrient flow to active regions
  - Altered epigenetics (gene expression)
  - “Neurons that fire together wire together.”
    - Increasing excitability of active neurons
    - Strengthening existing synapses
    - Building new synapses; thickening cortex
    - Neuronal “pruning” - “use it or lose it”
The principal activities of brains are making changes in themselves.

Marvin L. Minsky
Perspectives on Neuroplasticity

- Neuroplasticity is not breaking news: For a century or more, it’s been presumed that mental activity changed neural structure: what else is learning? (The news is in the details of how.)

- Most neuroplasticity is incremental; occasionally it’s dramatic.

- Awareness increases neural structure-building. Residues of conscious experience continually sift into implicit memory.

- Your experience matters. Both for how it feels now and for the lasting threads it weaves into the fabric of your brain and being.

- Most experience is background, in the “simulator.” Thus the importance of mindfulness, of searching inside yourself.
The education of attention would be an education *par excellence*.

William James
Third Fact about Your Brain

With that mindfulness:

You can use the mind
to change the brain
to change the mind for the better.
Paper Tiger Paranoia
The Negativity Bias

In our evolutionary history, threats usually had more impact on survival than opportunities. Sticks are more salient than carrots:
- The amygdala is primed to label experiences negatively.
- The amygdala-hippocampus system flags negative experiences prominently in memory.
- *The brain is thus like Velcro for negative experiences but Teflon for positive ones.*

Consequently, the Avoid system routinely hijacks the Approach and Attach systems, and “bad is stronger than good”:
- It takes five positive interactions to undo a negative one.
- People will do more to avoid a loss than get a gain.
- It’s easy to create learned helplessness, but hard to undo.
Negative Experiences Can Have Benefits

There’s a place for negative emotions:
- Anxiety alerts us to inner and outer threats
- Sorrow opens the heart
- Remorse helps us steer a virtuous course
- Anger highlights mistreatment; energizes to handle it

Negative experiences can:
- Increase tolerance for stress, emotional pain
- Build grit, resilience, confidence
- Increase compassion and tolerance for others

But is there really any shortage of negative experiences?
One Effect of Negative Experiences: Health Consequences of Chronic Stress

**Physical:**
- Weakened immune system
- Inhibits GI system; reduced nutrient absorption
- Reduced, dysregulated reproductive hormones
- Increased vulnerabilities in cardiovascular system
- Disturbed nervous system

**Mental:**
- Lowers mood; increases pessimism
- Increases anxiety and irritability
- Increases learned helplessness (especially if no escape)
- Often reduces approach behaviors (less for women)
- Primes aversion (SNS-HPAA negativity bias)
Self-Compassion

- Compassion is the wish that someone not suffer, combined with feelings of sympathetic concern. Self-compassion simply applies that to oneself. It is not self-pity, complaining, or wallowing in pain.

- Self-compassion is a major area of research, with studies showing that it buffers stress and increases resilience and self-worth.

- But self-compassion is hard for many people, due to feelings of unworthiness, self-criticism, or “internalized oppression.” To encourage the neural substrates of self-compassion:
  - Get the sense of being cared about by someone else.
  - Bring to mind someone you naturally feel compassion for
  - Sink into the experience of compassion in your body

- Then shift the focus of compassion to yourself, perhaps with phrases like: “May I not suffer. May the pain of this moment pass.”
Major Result of the Negativity Bias: Threat Reactivity

- Two mistakes:
  - Thinking there is a tiger in the bushes when there isn’t one.
  - Thinking there is no tiger in the bushes when there is one.

- We evolved to make the first mistake a hundred times to avoid making the second mistake even once.

- This evolutionary tendency is intensified by temperament, personal history, culture, and politics.

- Threat reactivity affects individuals, couples, families, organizations, nations, and the world as a whole.
Results of Threat Reactivity (Personal, Organizational, National)

- Our initial appraisals are mistaken:
  - Overestimating threats
  - Underestimating opportunities
  - Underestimating inner and outer resources

- We update these appraisals with information that confirms them; we ignore, devalue, or alter information that doesn’t.

- Thus we end up with views of ourselves, others, and the world that are ignorant, selective, and distorted.
Costs of Threat Reactivity (Personal, Organizational, National)

- Feeling threatened feels bad, and triggers stress consequences.

- We over-invest in threat protection.

- The boy who cried tiger: flooding with paper tigers makes it harder to see the real ones.

- Acting while feeling threatened leads to over-reactions, makes others feel threatened, and creates vicious cycles.

- The Approach system is inhibited, so we don’t pursue opportunities, play small, or give up too soon.

- In the Attach system, we bond tighter to “us,” with more fear and anger toward “them.”
Besides its impacts at the personal and organizational level, threat reactivity is a major source of prejudice, oppression, and war.

Reducing threat reactivity is a key way to make this world a better place.
The Optimal Brain
Reverse Engineering the Brain

What is the nature of the brain when a person is:

- In peak states of productivity?
- Self-actualizing?
- Experiencing inner peace?
- Enlightened (or close to it)?
Home Base of the Human Brain

When not threatened, ill, in pain, hungry, upset, or chemically disturbed, most people settle into being:

- Calm (the Avoid system)
- Contented (the Approach system)
- Caring (the Attach system)
- Creative - synergy of all three systems

This is the brain in its natural, responsive mode.
The Responsive Mode

Diagram:
- Approach
- Gratitude
- Peace
- Avoid
- Wisdom
- Contentment
- Love
- Affiliate
To Survive, We Leave Home . . .

- **Avoid**: When we feel threatened or harmed

- **Approach**: When we can’t attain important goals

- **Attach**: When we feel isolated, disconnected, unseen, unappreciated, unloved

This is the brain in its *reactive* mode of functioning - a kind of inner homelessness.
The Reactive Mode
How to come home?

How to recover the natural, responsive mode of the brain?
“Know the Mind, Shape the Mind, Free the Mind”

- Mindfulness, virtue, and wisdom are identified in Buddhism, other contemplative traditions, and Western psychology as central pillars of practice.

- These map to central functions of the nervous system: receiving/learning, regulating, and prioritizing. And map to the three phases of psychological healing and personal growth:
  - Be mindful of, release, replace.
  - Let be, let go, let in.

- Mindfulness is vital, but not enough by itself.
General Factors for Responsive Mode

- Self-compassion
- Getting on your own side
- Mindful self-awareness
- Seeing the world clearly (Google could help here)
- Taking life less personally
- Taking in the good
How to Take in the Good

1. Look for positive **facts**, and let them become positive experiences.

2. Savor the positive experience:
   - Sustain it for 10-20-30 seconds.
   - Feel it in your body and emotions.
   - Intensify it.

3. Sense and intend that the positive experience is **soaking** into your brain and body - registering deeply in emotional memory.
Benefits of Positive Emotions

- The benefits of positive emotions are a proxy for many of the benefits of Taking in the Good.

- Emotions organize the brain as a whole, so positive ones have far-reaching benefits.

- These include:
  - Stronger immune system; less stress-reactive cardiovascular
  - Lift mood; increase optimism, resilience
  - Counteract trauma
  - Promote exploratory, “approach” behaviors
  - Create positive cycles
The good life, as I conceive it, is a happy life.
I do not mean that if you are good you will be happy;
I mean that if you are happy you will be good.

Bertrand Russell
Factors for Each Motivational System

Approach system
- Be glad.
- Appreciate your resources.
- Give over to your best purposes.

Affiliate system
- Sense the suffering in others.
- Be kind.
- Act with unilateral virtue.

Avoid system
- Cool the fires.
- Recognize paper tigers.
- Tolerate risking the dreaded experience.
“Taking the Fruit as the Path”

Gladness

Love

Peace
Choices . . .

Or?

Reactive Mode

Responsive Mode
Penetrative insight

joined with calm abiding

utterly eradicates

afflicted states.

Shantideva
See www.RickHanson.net for other great books.

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Hanson, R. 2008. Seven facts about the brain that incline the mind to joy. In *Measuring the immeasurable: The scientific case for spirituality*. Sounds True.
Key Papers - 3

Key Papers - 4


