



Body Begone Rainbow Parakeets

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What are we here to talk about?

- The mind and the body!
- How the mind changes our definition of our own body.
- Some disorders we thought might have been psychc from brain disorders in some situations!
- As always, some weird brain stuff!

Brain



Inside the Wrong Body

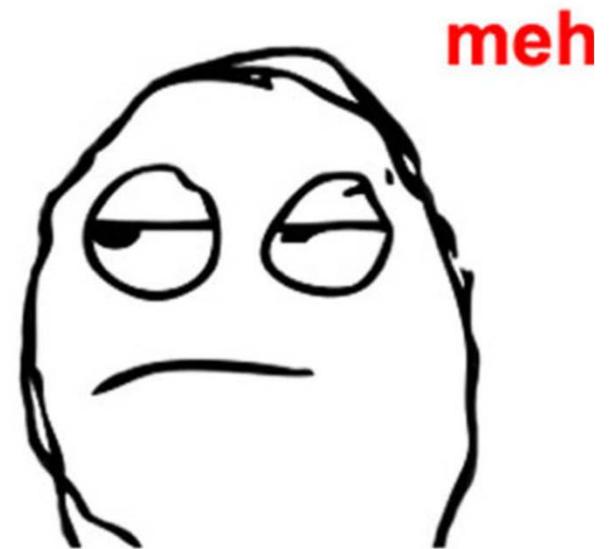


Pictures like these seem to be overwhelming the easily accessible media. No matter what efforts have been placed towards changing these images from being over-represented, they'll still pop up everywhere.



Inside the Wrong Body

What matters is: What would your reaction be?



Inside the Wrong Body

An overview on interoception:

- Are you thirsty? Hungry? Cold? Warm? In pain? Feeling happy? Sad? Bored?
(probably)



- If you find yourself too disturbed with yourself after seeing the pictures, and/or not too sure of the answer to any of the above, then your **interoception** or sense of internal self might be not be in tip-top shape!

Inside the Wrong Body

sensual touch

thirst

temperature

INTEROCEPTION

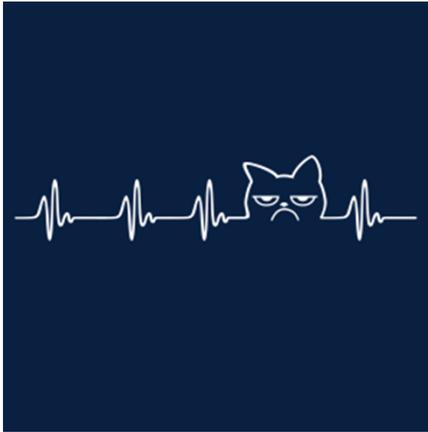
PAIN

hunger

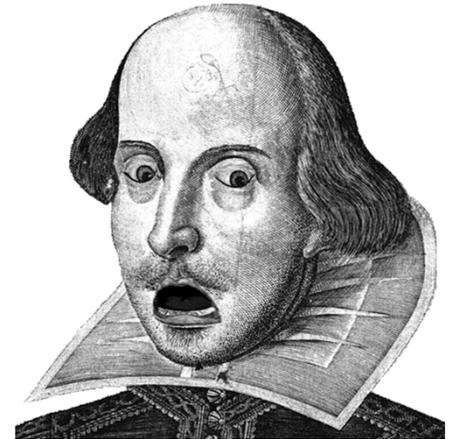
itch

breathlessness

Inside the Wrong Body



If you say you're internally aware,
& find people doubting you with a stare,
All you need to do is show them your best,
And put your interoception to the test!



Let's do the Heartbeat Test! :D (by neuroscientist Hugo Critchley)

We'll tell you why you should care later ;)

Inside the Wrong Body

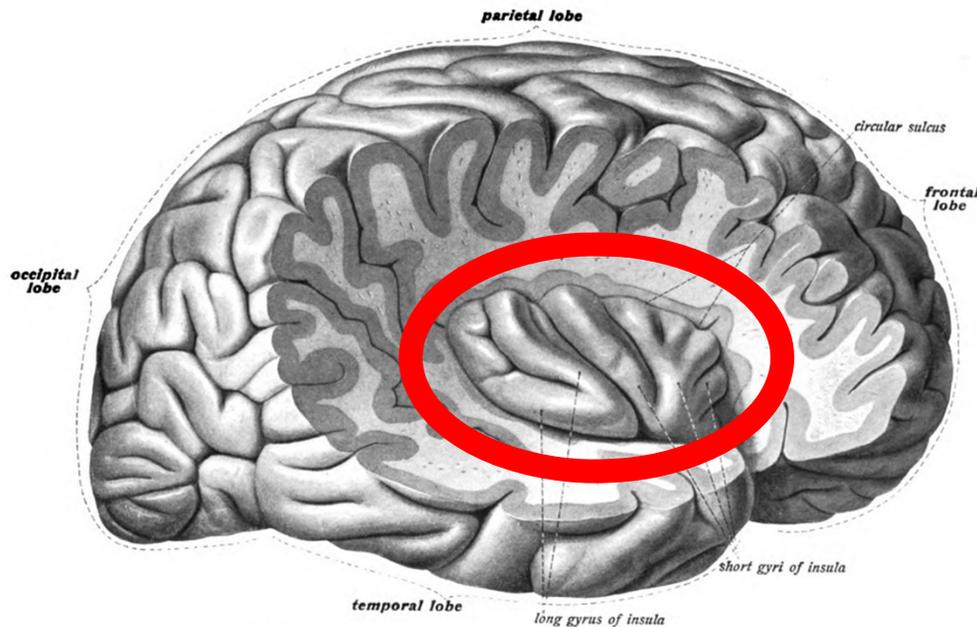
- Why should you care?
 1. A sensory defect in interoception has been identified as one of the **leading causes of anorexia, bulimia and body dysmorphic disorders.**
 2. Knowing the full extent of this can help identify solutions and treatments to disorders affecting 10 - 15% of all Americans.
 3. Because you might be able to understand and keep an open mind to how other individuals process thoughts differently than you do:

Inside the Wrong Body



Inside the Wrong Body

- A little teeni-tiny bit of neuroanatomy:



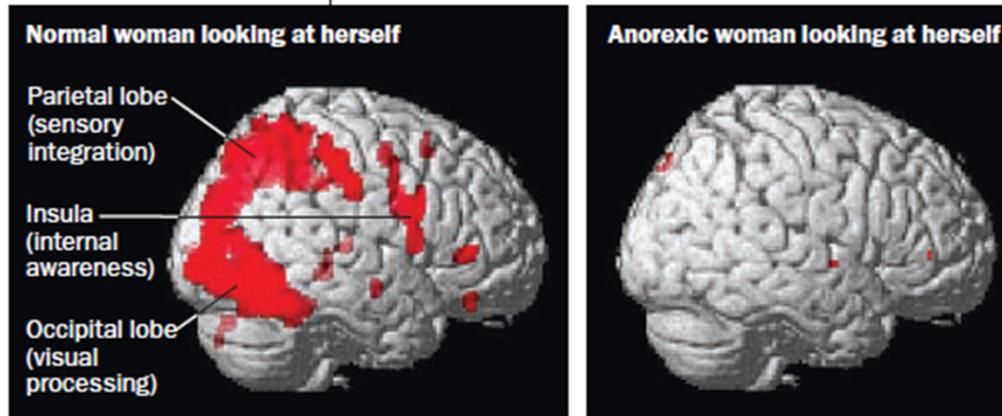
The cute cortex circled in red is the insula:

- Part of the **cerebral cortex** separating temporal lobe from parietal and frontal.
- Involved in **consciousness**, but more importantly **homeostasis** and **emotional perception**.
- Location where interoceptive data and external cues combine!

Inside the Wrong Body

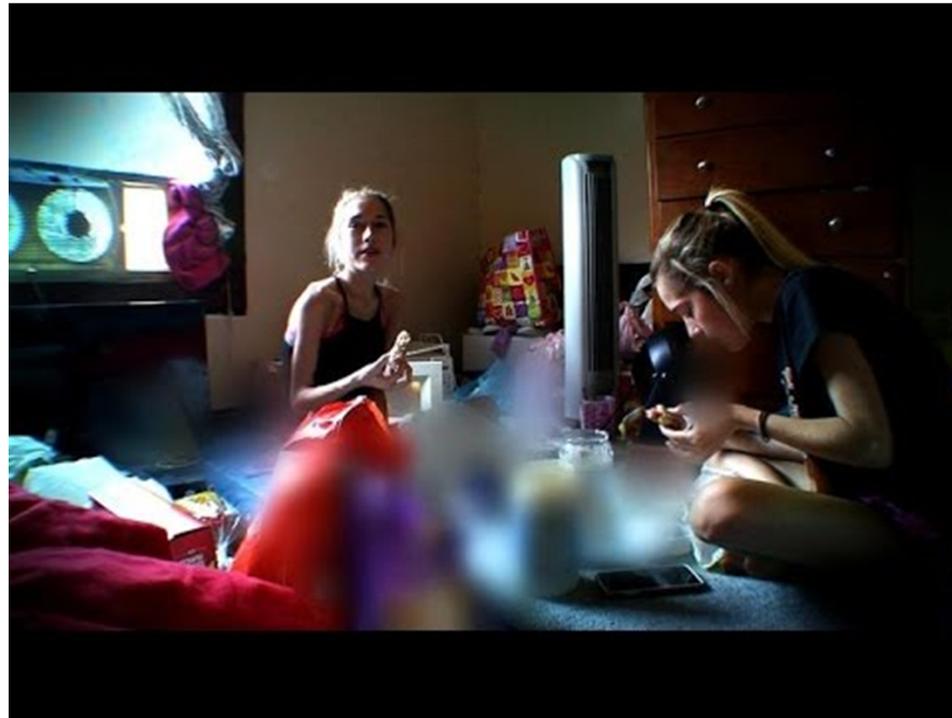
- Remember the test you took earlier? Well ...
- 1. Studies show that people scoring low on the interoceptive test have statistically shown **more anxiety** and **more negative body images** while still having a lower body weight than those who scored higher!

2. This might al



uld be!

Inside the Wrong Body



Inside the Wrong Body

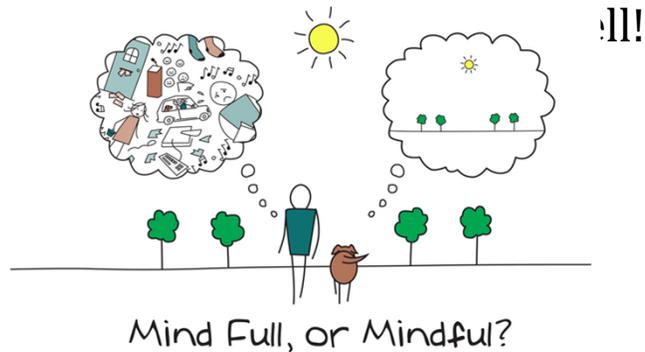
- But what does this mean?
 1. Recovery process for anorexic individuals is **really difficult**, because the problem can be more neurological than psychological. The insula, having poor or no activity at the sight of one's self, may never gain a normal response to self image.
 2. This also indicates that when a person with a body dysmorphic disorder or eating disorder views themselves in pictures or the mirror, they truly **do not recognize that individual as themselves**. This means their internal image is not affected by external cues they receive from their true appearance.

Inside the Wrong Body

- How is body dysmorphia and interoception connected to our class topics?
 1. It's the mind being weird again! In a class speaking of the relationship between brain and body, it is important to understand the role of the brain in the awareness of how the body is presented and internally stabilized.
 2. Going back to the rubber hand: people with poor interoceptive awareness **more easily disembody their own hand** and embody the rubber hand!
 3. Low interoceptive abilities also translate to having **less definitive opinions** that are likely to be altered by the standards of others, which might possibly be an innate contributor to being a **peer pressure target**.

Inside the Wrong Body

- Are we going to end on a sad note, or some advice?
 1. Practice **mindfulness**! Live in the moment and focus on how you really feel internally.
 2. Do some **yoga**! Not only does it guarantee that smoking hot body, but an



Me, Myself and I

Mrs. K



Mr. M



Me, Myself and I

Despite constant rewiring of the brain, the mind typically manages to maintain a consistent self-portrait

We think of our thoughts, feelings and memories as “ours”

We make clear distinctions between internal and external events



Me, Myself and I

How does the healthy brain maintain this unwavering, well-defined self?

Me, Myself and I

Attaining Self-Awareness

18 months - self recognition in a mirror

2 years - can grasp concepts of “I” and “mine”

3 years - can describe their own feelings



Me, Myself and I

We continue expanding personal identity through social interactions for the rest of our lives.



Me, Myself and I

What are the components of our sense of self?

Ability to **recognize one's own face and body** and to know what those body parts are doing at any given moment

Sense of **ownership**—you perceive your body as belonging to you

Sense of **agency**—you feel responsible for your own movements and actions

Awareness of one's own **emotions** and the ability to link disparate life experiences to a stable self-image

Me, Myself and I

So how can we associate these components of self with our physical body?



Me, Myself and I

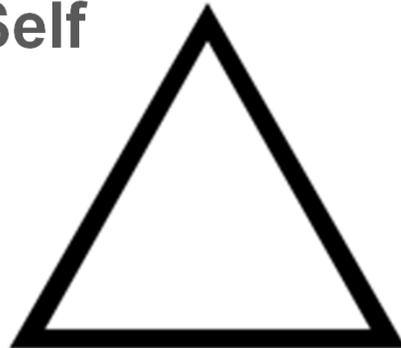
A Three-Part Hierarchy of Self

- Proposed by neurologist Antonio Damasio

Autobiographical Self

Core Self

Proto Self

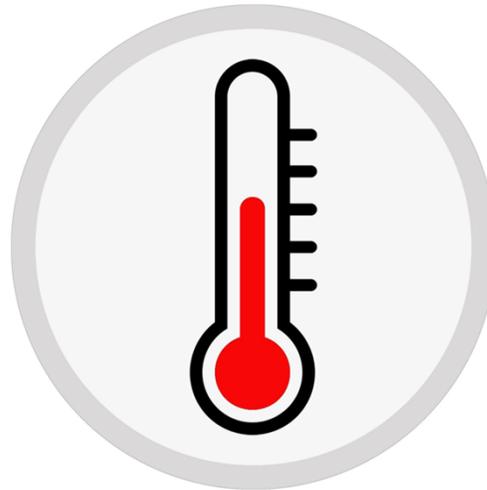


Me, Myself and I

Proto Self

Simple, neural representation of the body

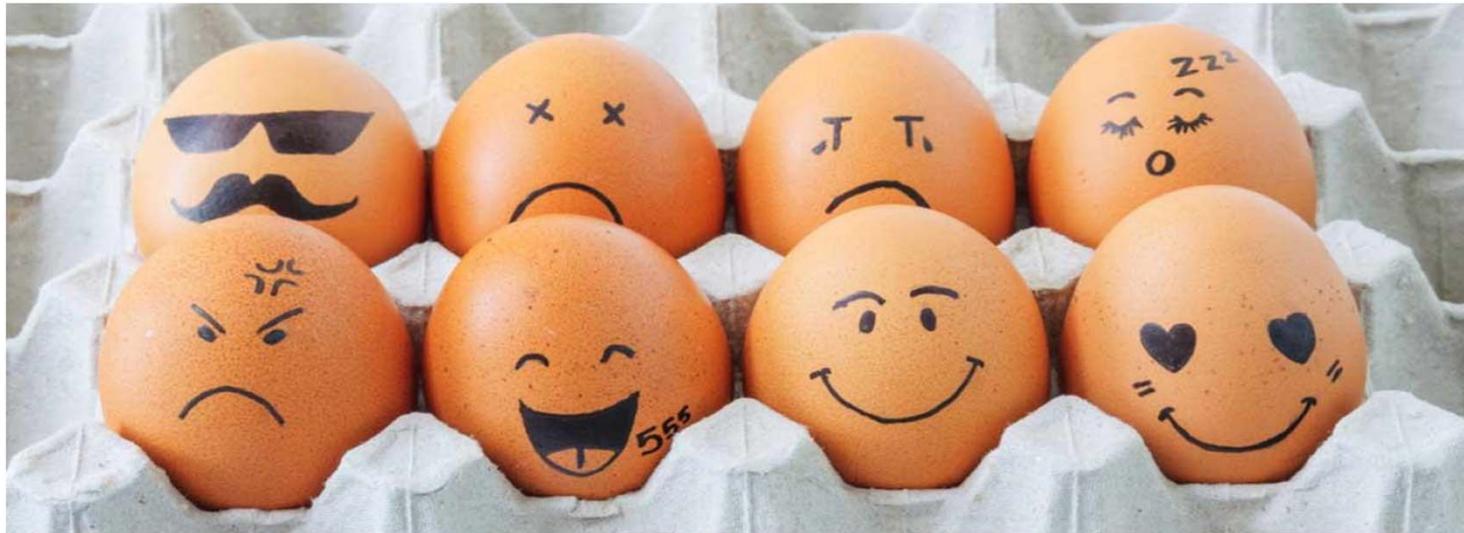
Oversees basic physical functions such as metabolism, body temperature and circadian rhythms



Me, Myself and I

Core Self

Non-verbal impulses—feelings of hunger, sadness or cold



Me, Myself and I

Autobiographical Self

Enables us to evaluate our impulses rationally—referencing earlier experiences and current goals—and to guide our behavior in a targeted way

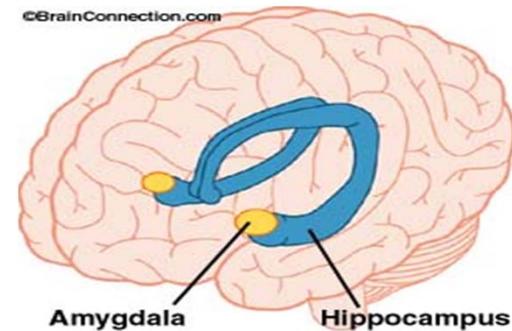


Me, Myself and I

So what exactly is self awareness good for?

It helps people recognize and manage fear, anger and other potentially destructive emotions. Studies show that when people distance themselves from upsetting feelings, the rational parts of their brains (yellow) tamp down emotional ones such as the amygdala—and they feel better.

Many of the areas related to the self are found along the brain's midline, where its two hemispheres meet.



Me, Myself and I

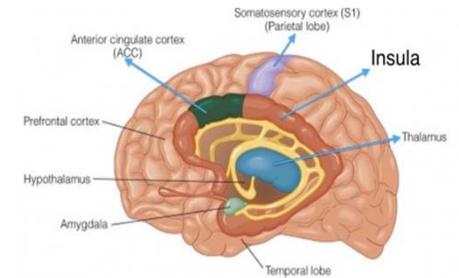
The Tickle Conondrum: To explore the self in the laboratory, scientists often use a two-part model.

Two part due to physical self and cognitive self.

The physical self is where we feel our own body, thanks to sensory feedback from the skin, joints and abdominal cavity. This input generates interoception—our awareness of pain, temperature, itching and hunger, among other internal sensations.

The cognitive self is where we recognize and reference ourselves in the world.

Me, Myself and I



Anterior Insula: Location where interoceptive awareness is depended on.

Physical Self

Hugo D. Critchley and his co-workers at University College London conducted an experiment in which they asked people to estimate their own heart rates as they lay in a magnetic resonance imaging machine.

Study showed that those subjects who were more in tune with their heartbeat, were able to use their insula much better.

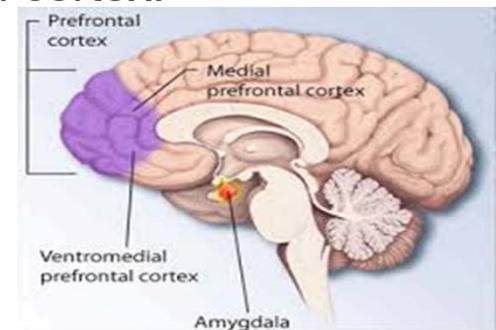
Those who were more particular to physical sensations had more gray matter than normal.

Me, Myself and I

Cognitive Self: Resides in the medial prefrontal cortex located just behind the eyes.

To test this, scientists asked healthy test subjects to judge how well a string of adjectives applied either to themselves or to people they knew.

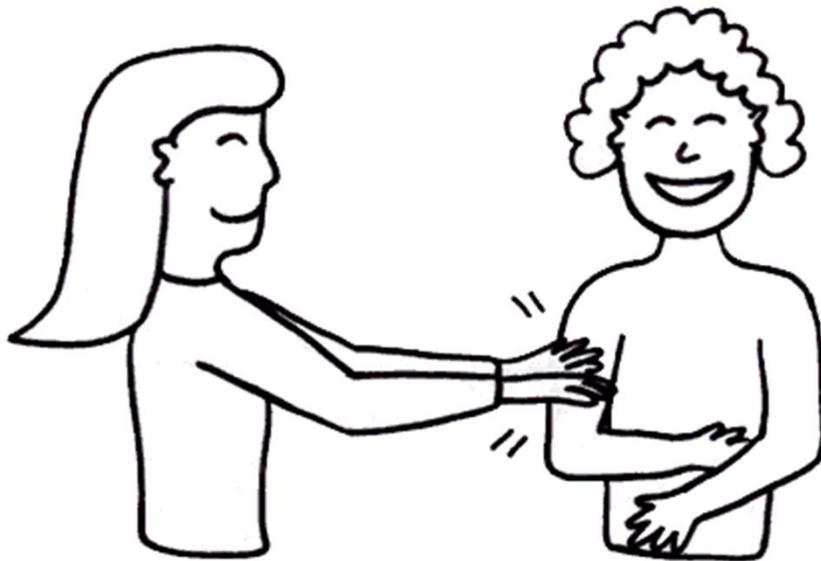
It was only when they related the adjectives to themselves that fMRI scans of the subjects brains showed high activity in the media prefrontal cortex.



Me, Myself and I

How does the brain distinguish between self generated and external stimuli?

Ex. Why can't we tickle ourselves?



Me, Myself and I

Self Generated and External Stimuli: The brain also contains specialized circuits for distinguishing between self-generated and external stimuli.

Participants of this study were asked to play a racing game and the computer would take over the steering wheel occasionally.

Functional MRI scans revealed that as the participants observed their own actions and they activated a network in the prefrontal cortical region and in the inferior parietal lobe.

The prefrontal cortex, in its role as the brain's command center, plans our actions and sends the instructions to other parts of the body.

At the same time, it sends a copy of its instructions to parts of the parietal lobe, which monitor our movements and anticipate the corresponding sensations.

Me, Myself and I

The brain takes special notice if the experience does not match what the parietal lobe predicted—For example, the car turns left when we turn the wheel to the right.

In this way, we can distinguish self-generated stimuli and perceive external input, hence why we can't tickle ourselves.

Me, Myself and I

How does self awareness and emotion connect together?

All animals have a sense of self awareness. It is vital for survival.

If an animal can't tell between what itself is and what the world is, it wouldn't be able to survive well.

Our self-image is all stemmed from the brain. Associated with picturing ourselves: where we are, who we are, and how we feel.



Body Ownership and Agency

Brains and Bodies or, what if you had too many arms?



Body Ownership and Agency are Intertwined

What are Body Ownership and Agency?

- Ownership: the act, state, or right of possessing something.
- Agency: the capacity, condition, or state of acting or of exerting power
- When we look at one of our arms, we recognize it as ours. This is Body Ownership.
- If we raise one of our arms to look at it before we recognize it, this is Agency.

Relationship between Body Ownership and Agency

- “When we are born, we make erratic reaching and kicking movements to map our body and to calibrate our sensorimotor system. During infancy, these movements solidify our self-awareness, and around the time we first walk, we are quick to investigate a sticker placed on our forehead when looking in a mirror, recognizing the foreign object as abnormal.”
- Our sense of what is ours when it comes to our bodies starts when we are very young.

Is it possible to add to Body Ownership through Agency?



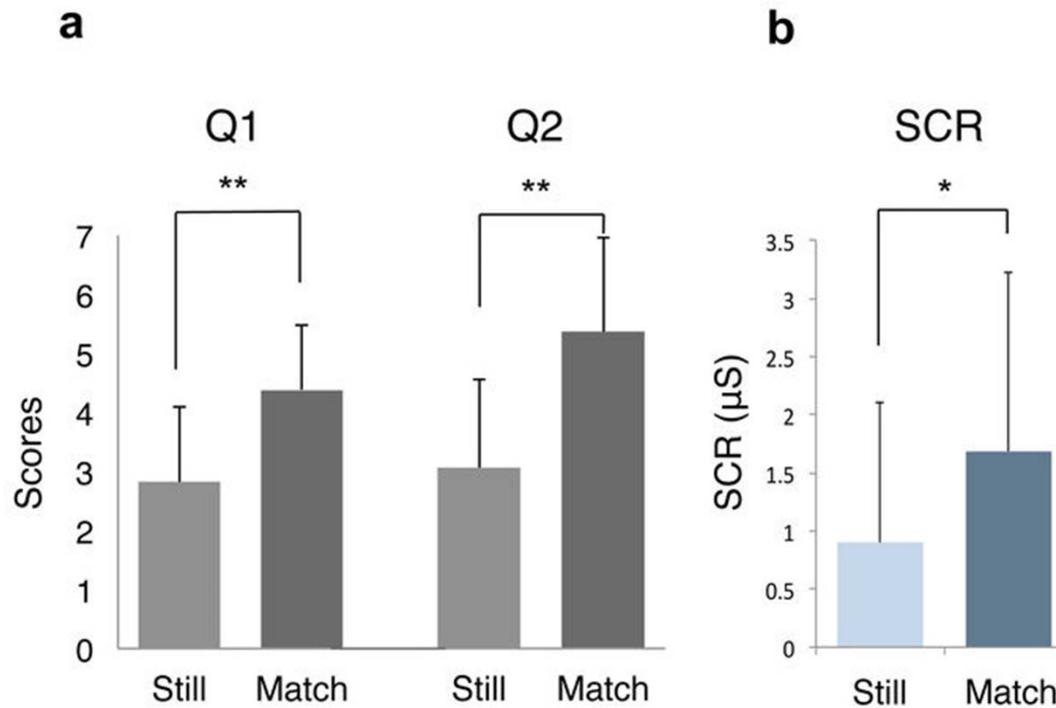
Article: Humanlike robot hands controlled by brain activity arouse illusion of ownership in operators

- “Operators of a pair of robotic hands report ownership for those hands when they hold image of a grasp motion and watch the robot perform it. We present a novel body ownership illusion that is induced by merely watching and controlling robot's motions through a brain machine interface. In past studies, body ownership illusions were induced by correlation of such sensory inputs as vision, touch and proprioception. However, in the presented illusion none of the mentioned sensations are integrated except vision. Our results show that during BMI-operation of robotic hands, the interaction between motor commands and visual feedback of the intended motions is adequate to incorporate the non-body limbs into one's own body. Our discussion focuses on the role of proprioceptive information in the mechanism of agency-driven illusions. We believe that our findings will contribute to improvement of tele-presence systems in which operators incorporate BMI-operated robots into their body representations.”

ROBOT HANDS!

- This experiment functioned similarly to the rubber hand experiment, however, the person was looking through a headset through the eyes of a dummy with two mechanical hands.
- Two lightbulbs in the hands of the dummy would light up and the participants would grasp something in their hands while the mechanical hands would also grab the lightbulb.
- At the end of the experiment, a needle was stabbed into one of the hands and participants were asked: 1) when injected, did the robot's hand feel like your hand, and 2) when operating the robot's hands, did they feel like yours?

Results of the experiment



Results, cont.

- As we can see, those who could control the hands experienced a much more significant response to a painful stimuli than those with no control.
- From this, the conclusion that agency over the hands led to a sense of body ownership can be concluded

The Rubber Hand Illusion

Rubber Hand Illusion → illusions of embodiment

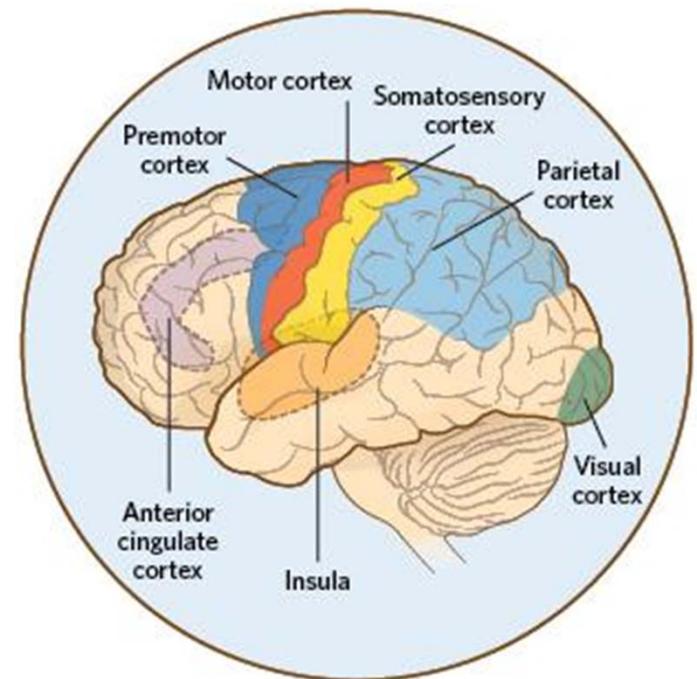
Visual perception of our body is powerful over senses of touch and proprioception



The Rubber Hand Illusion

There is *embodiment* of rubber hand and *disembodiment* of real hand. As we embody the rubber hand and the hammer comes down on it...

1. Increase in brain activity in areas that control bodily awareness and pain anticipation
2. Decrease in temperature and blood flow in the REAL hand

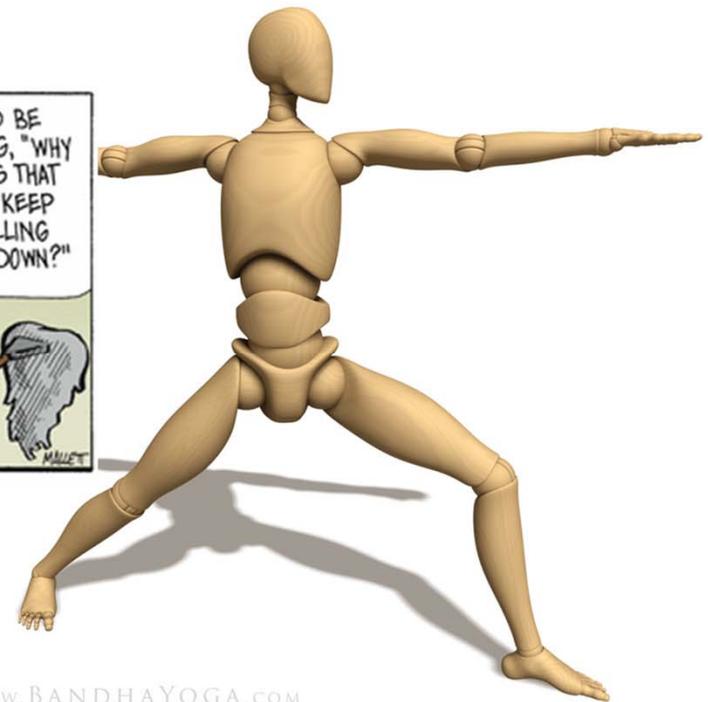


Mice have body awareness. Rubber Tail Illusion?

Same experiment as the Rubber Hand Illusion, but rubber tails on mice.

Same response as humans!

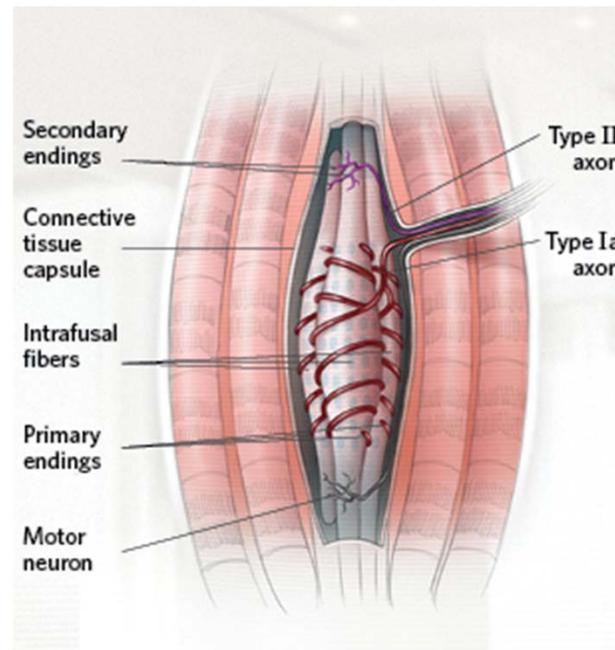
Proprioception and Embodiment



Position and Movement of Limbs

In 1972 Guy Goodwin and his colleagues performed experiments to show that in a blindfolded subject, when muscle spindles were vibrated, the subject would report the sensation that their arm was moving even though it wasn't. Since the limbs were stationary, it was hypothesised that muscle spindles were responsible for the sensation.

Real quick on Muscle Spindles



Where are my arms??

The brain interprets continuous signals from your arms and determines where they are based on the difference in signal strength



When this signaling fails



Citations

Arnold, Carrie. "Inside the Wrong Body." *Scientific American Mind*. N.p., 16 Apr. 2012. Web. 12 July 2017

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