A New Vision of how our Minds Work

http://dericbownds.net/NewVisionOfMind.pdf

http://mindblog.dericbownds.net

How we now think our minds work.

Why much of it is wrong.

A new description - predictive brains that construct themselves.

Meditation enables insight into this construction

I'm going to talk today about work that has shown, in just the past 10-15 years, that much of what we thought we knew about how our minds work is wrong.

The first three topics deal with how we commonly suppose our brains work, why much of what we think is wrong, and how we might build a new description. The fourth topic examines the confluence of this modern neuroscientific description with many of the insights of meditative traditions thousands of years old.

Why should we care about or be interested in this stuff other than disinterested curiosity? Because I think working our way through to what is this new understanding of what we are and how we work can strengthen our resilience in surfing the challenging times that are coming ahead. Our basic natures are much less rigid than we commonly suppose, and there is a very rich mental toolkit that most of us don't use to adapt to what is going on around us. So, there is forward looking and optimistic side to what I'm going to be telling you. But there is also a potentially unsettling side to our new understanding, because it saying that much of what we thought to be our essential or genuine nature, our authenticity, is a made up invention.

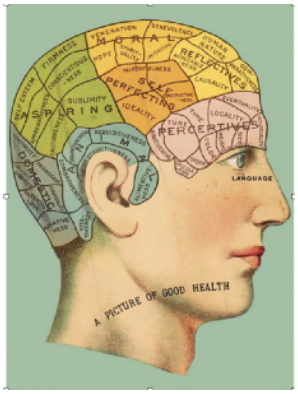
The science is showing that that emotions are not built in, straight out of the box when we are born, but made from more basic parts. They emerge as you create them from a combination of the physical properties of your body and a flexible brain that wires itself to whatever physical and cultural environment it develops in.

Emotions are real in same sense that money is real - a product of human agreement.

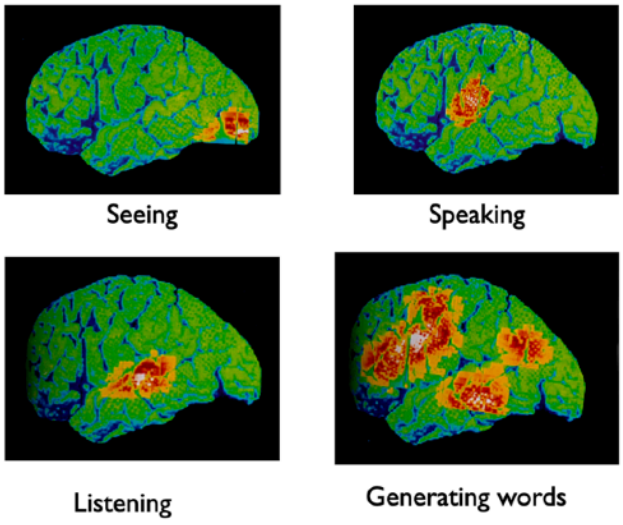
So, I'm going to start with a brief description of what we thought we knew.

What we thought we knew

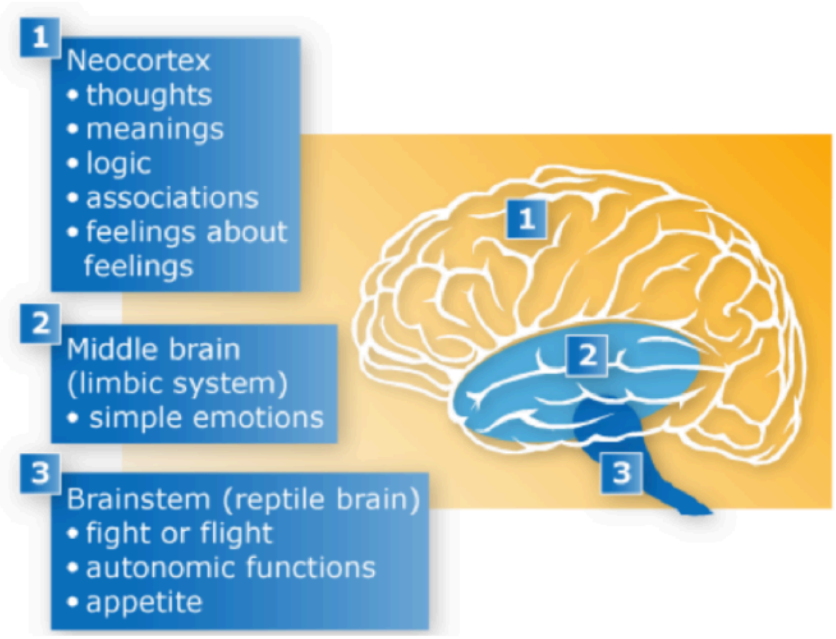
We take the basic emotions we all feel today to be ancient and universal, the result of evolutionary adaptations to conditions of our paleolithic past as hunter gatherer tribes. We have specific evolved hard wired reflexive circuits in our brains for fear, rage, happiness, sadness, etc. that flip on and off like a light switch. They go with unique brain and body fingerprints like facial expressions and changes in heart rate. The narrative of an eternal battle between emotions and reason has been around for millennia. It is embedded in our social institutions and our legal systems.



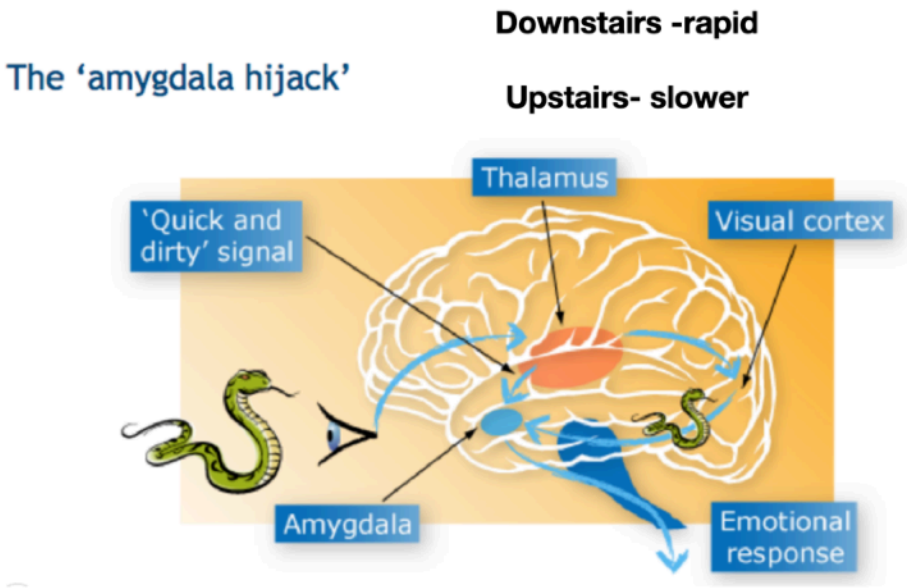
Since the enlightenment writers and scientists have been trying to figure out where these things are going on. In the late 19th century, at the same time phrenologists were assigning all our virtues and vices to areas of the head.



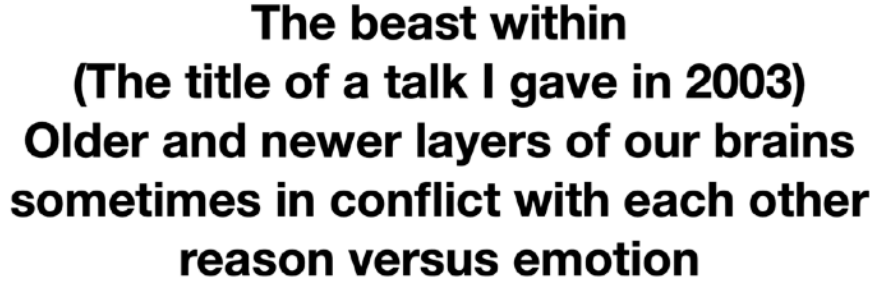
Post mortem examination of the brains of people who had been blind, or unable hear, speak, or generate words were showing damage in specific brain regions, and modern brain imaging show these were the regions active during these activities in normal brains.



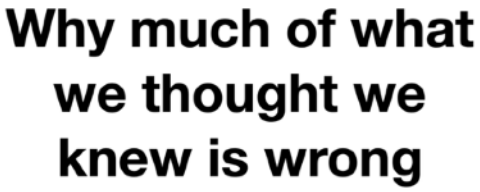
A very influential idea has been that we actually three brains, not just one, the triune brain model. A primitive reptilian brain overlaid by primitive mammalian brain that generated emotions relevant to nurturing newborn animal to maturity, and a new or neocortex, vastly folded, the locus of our more advanced capabilities.



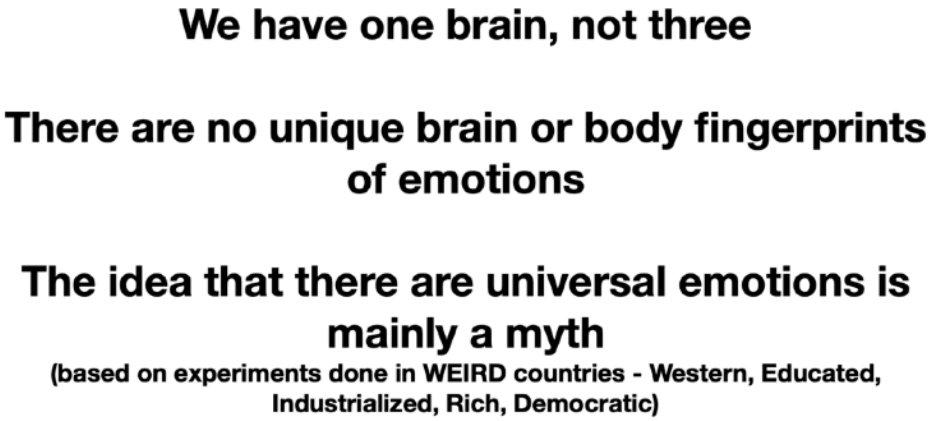
It is a part of our primitive fast reptilian brain that can rapidly highjack our behavior before our newer slower brain can figure out a more reasoned response .



The bottom line is that the prevailing assumption has been that we have a universal human nature with places for everything in the brain… emotions and reasons, etc.



The only problem is that when you look at the actual data for these classical descriptions I've been giving a very different picture comes to light.



We don't, for example, have three brains, older and progressively newer, like layers of geological sediments from different epochs. Reptiles and humans have the same kinds of nerve cells and the same common brain manufacturing plan but over time some parts have gotten larger and reorganized, segregating and then integrating.

Continuous effort over many years has not revealed a consistent, physical fingerprint for even a single emotion. When you attach electrodes to a person's face and measure how facial muscles actually move during the experience of an emotion, you find tremendous variety, not uniformity. You find the same variety—the

same absence of fingerprints—when you study the body and the brain. You can experience anger with or without a spike in blood pressure. You can experience fear with or without an amygdala, the brain region historically tagged as the home of fear. All of the data showing this or that emotion correlates with a particular brain area becoming has turned out to be misleading, and careful studies have shown that during any thought, action, or emotion you can observe changes in the activity of 90% of the brains neurons, the brain is a whole network, acting together. There is what is called representational plasticity: You observe a brain network that becomes active in say, a fear response. You look a month later, and a completely different web of nerve calls becomes active during exactly the same behavior.

Many emotions that we have thought to be universal turn out to vary between different cultures. Brains make more than one kind of mind, much of what we have taken to be a universal human nature is a biased perception based on most of the research having been done of WEIRD cultures.

This not to say there aren't any genetic instructions for our social brain's wiring that incline us to universal behaviors and psychologies, just as there are genetic instruction for where vision, hearing, speech, movement are centered in our brains. Newborn babies can distinguish and react to face icons.

Nature vs. Nurture

Essentialism vs. Constructionism

The debate between nature versus nurture, essentialism versus construction is a continuing one. How many of our basic concepts and emotions are learned from experience, how many are in fact innate?

It is a tricky question. Experiments show that our reasoning about innateness is biased by built in cognitive biases of the human mind. In our intuitive psychology, concepts like "object" and "number" must be learned, but it has been demonstrated that in fact newborns possess these core concepts. People usually assume the expression and recognition of emotions (which are considered embodied) is innate, while in fact it is learned, as I'm going to be mentioning.

Building a new description of what our minds are about

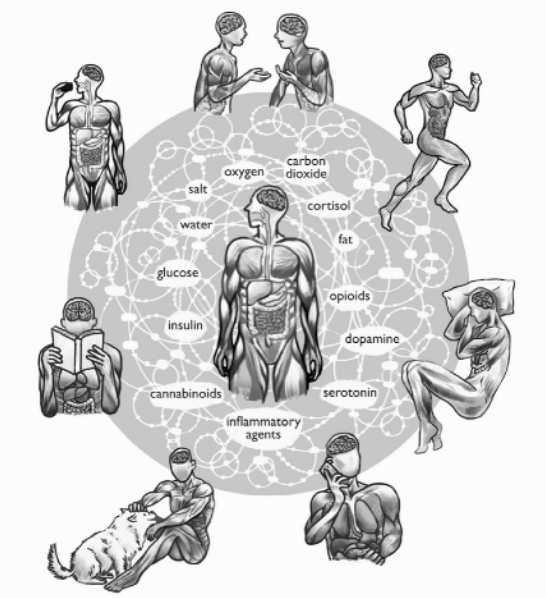
Lisa Feldman Barrett, "How Emotion and Made: The Secret Life of the Brain," Mariner Books, 2018
"Seven and a Half Lessons About the Brain," Mariner Books, 2020
Anil Seth, Being You: A new Science of Consciousness, Dutton, 2021

Now, the material I just covered on our old vision and why it is wrong, as well as this next topic, I'm drawing largely from Lisa Feldman Barrett's popular books, I'm using some of her illustrations and some edited clips from her text. The slide shows another very good book that just came out by Anil Seth at Oxford, I use several of his illustrations. In a short talk like this it is unrealistic to try to get into the original research papers, some of which I try to grind through.

Building a new description of what our brains are about starts with an evolutionary story, when first molecules and then single cells first appeared that could replicate, make copies of themselves. Occasionally a small change or error in the duplicating process makes a copy that is a better replicator and this new variant

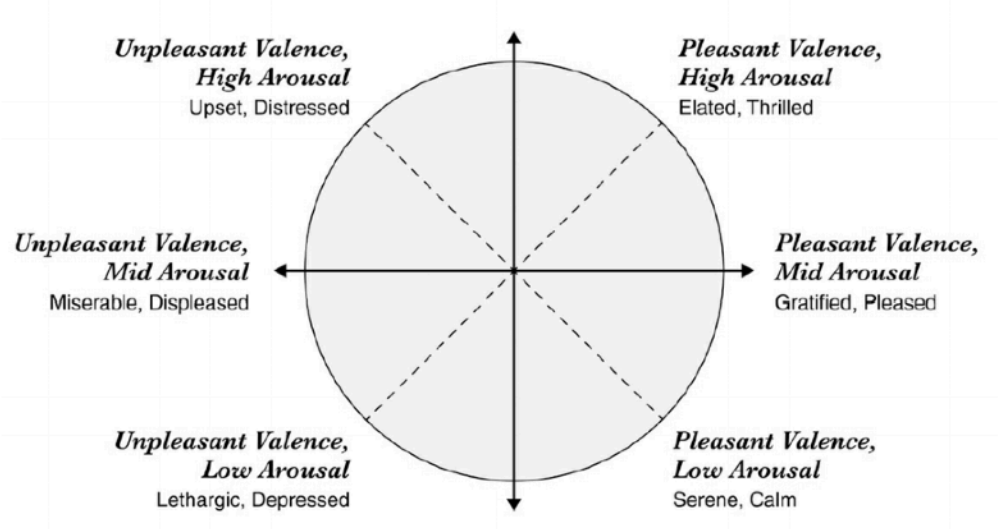
displaced its previous version. An example of this is what has happened with the Covid 19 D variant. The crank of a Darwin machine grinds on eternally.

As more complicated animals appear, they start competing for food, eating each other, get complicated organ systems to regulate sensing, acting, digesting, nervous systems to run the whole show, regulate the body's energy budget. Energy efficiency was a key to survival. Complicated body budgeting called allostasis has been around since the Cambrian period 500 million years ago. It means automatically predicting and preparing to meet the body's needs before they arise based on successful actions taken at other times in similar circumstances, managing the body's response to stresses. Humans and other animals store past experiences to prepare for future action.



Fast forward to complicated bodies like ours, running hundreds of muscles in motion, balancing dozens of different hormones, pumping two thousand gallons of blood per day, regulating the energy of billions of brain cells, digesting food, excreting waste, fighting illness. Your brain's most important job is not thinking, it is running all this stuff. All of our mental thinking capacities are in the service of keeping us well by managing our bodies so that we can pass on our genes. Our very recent invention of human language and fretting about value, purpose, and meaning is just a thin veneer in the service of this massive background computation that keeps us alive to pass on our genes to the next generation.

The origins of our emotions, our affect, lie in this immense regulatory system always producing a storm of sense data inside and outside our bodies. Our feelings, our affect are the summary of all this, which can be measured along two axes, arousal and valence.



Affect is like a barometer telling us how things are going, it's the basement level from which we invent more rapid specific emotions for particular physical and social contexts. Infants initially develop valence based emotions categories like feeling good or feeling bad that gradually differentiate into categories of discrete emotions such as anger and sadness.

Valence and arousal can be generators of what we mistakenly think is all happening upstairs in terms of self narratives. We can confabulate reasons for our feelings. Judges feel more judgmental, issue more harsh sentences to offenders, just before lunch times when their stomachs are issuing grumpy feed me feelings. People can invent reasons for feeling good on a sunny day, provided they are not reminded or told it is a sunny day.

How do we construct our reality?

So, where does this leave us. How do we construct our reality? Let's plunge in and start by seeing how we actually decide what's out there in the world.

Now, tell me what you see here.

And now here, and now back to the first picture.

Hopefully you could make out the snake in the first picture after seeing the second one. Let's do one more example.

What is this:

Then here is a picture.

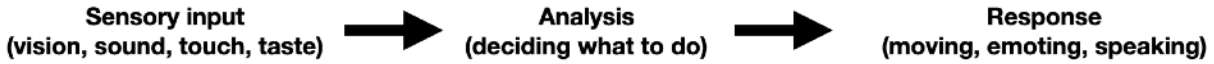
And now back again.

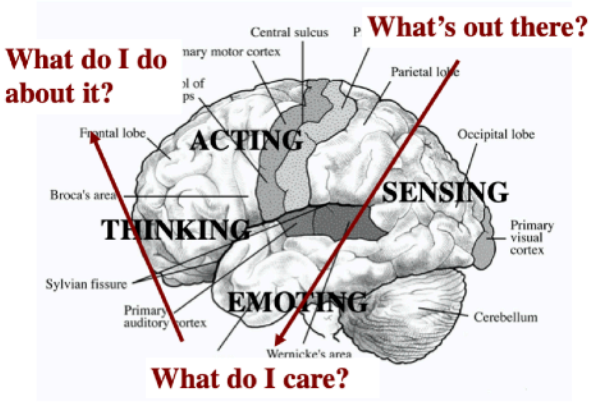
One more,

Now, when you were hopefully seeing meaningless blobs in the black and white pictures you were having what we call attentional or experiential blindness, but then you changed your perception after you saw the second full photographic image. What happened? Your brain added the full photograph you saw into its huge library of prior experiences and then constructed the object you could see the second time you were shown the blobs by using the overlap between the blobs and the stored images to generate, literally hallucinate, the shape that wasn't clearly physically there.

What we see, hear, touch, taste, and smell are largely simulations of the world, not reactions to it. .. Simulation is the default mode for all mental activity…In every waking moment, you're faced with ambiguous, noisy information from your eyes, ears, nose, and other sensory organs. Your brain uses your past experiences to construct a hypothesis—the simulation—and compares it to the cacophony

arriving from your senses. In this manner, simulation lets your brain impose meaning on the noise, selecting what's relevant and ignoring the rest.

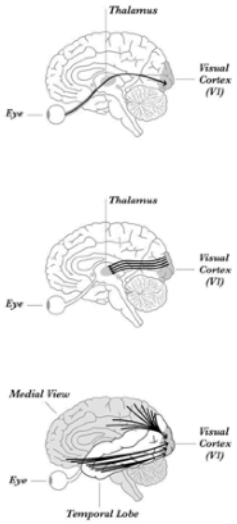




This is a fundamentally different picture from the one I've used in many of my older lectures, and what those of you who took a high school or college biology course learned (input, analysis, output).

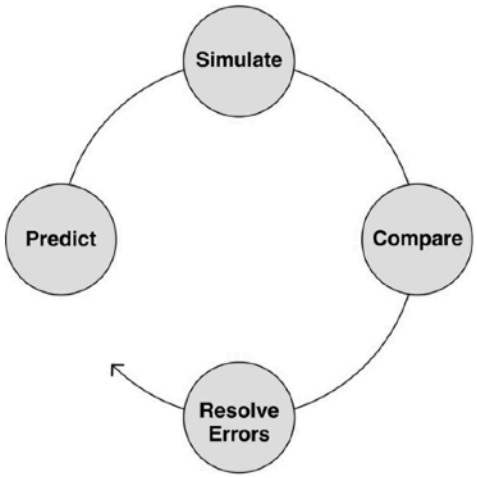
Here is what is actually going on in your brain, shown with respect to our visual system.

The standard picture is that the visual parts of our brain are mainly gathering information from the outside world, analyzing it, and then sending the information forward to the perceiving, deciding and acting parts of the brain. No, that's not what actually happens. 90



percent of all connections coming into V1 (lower image, right arrow) carry predictions about the expected visual scene stored in neurons in other parts of the cortex. Only a small fraction of primary visual cortex V1 activity involves getting current visual input from the world (in the top drawing the arrows pointing from left to right.) Ten times more information goes in the other direction, right to left in the middle drawing, carrying visual predictions from V1 to the thalamus (center image) on through to control centers that decide which prediction best matches the input data, and that is what we actually see, the stored prediction.

The 'quiet' brain is actually very busy, constantly playing scenarios, possibilities, doing simulations in parts of the brain called the default and salience networks. Just dealing with effect of error



signals on these ongoing simulations or predictions is vastly more energy efficient than having to laboriously take each input, analysis it, then act on it, which would also take longer. The drawing shows the process. If there is sufficient difference between what is predicted, and the actual stimulus, the predictive model is revised for its next use.

Here is the bottom line statement:

Everything we do and experience is in service of reducing surprises by fulfilling fantasies.

You are in fact doing something fundamentally different from what your common sense, your intuition, your folk psychology, tells you - that thinking, perceiving, and dreaming are different mental events, yet one general process describes them all. Simulation is the default mode for all mental activity.

Concepts, Goals, and Words

Out of simulations we build concepts, the brain groups together some things and separates others. Your concept of a snake includes not only appearance but caution, danger, avoidance. Concepts are tools for your brain to guess the meaning of incoming sensory inputs. Concepts give meaning to changes in sound pressure against your eardrums so you hear them as words or music instead of random noise. Babies parse sounds streaming in to gradually infer the boundaries between phonemes, syllables, and words. You build up concepts from detailed sensory input (that differs from the current prediction and registers as prediction error) from your body and the world.

Your brain uses this same process to make meaning of the sensations from inside your body. Just like there are parts of the brain that mainly specialize in vision, sound, touch, smell in the outside world, there are parts that sense the insides of our body. Depending on the context you are in, from an aching stomach your brain might construct an instance of hunger, nausea, mistrust, anxiety, longing, i.e. an instance of an emotion. In every waking moment, your brain uses simulations of past experience, organized as concepts, to guide your actions and give your sensations meaning. When the concepts involved are emotion concepts, your brain constructs instances of emotion.

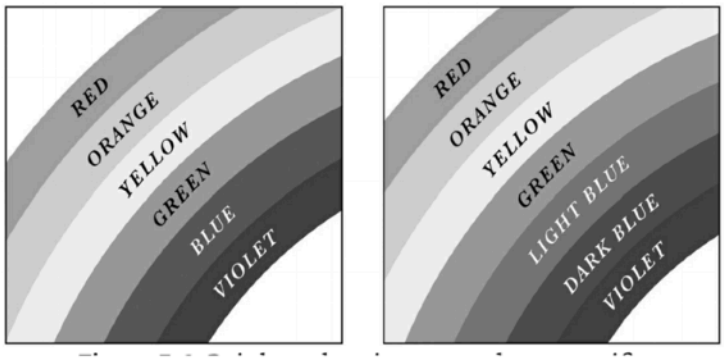
So this theory suggests that the emotions you experience and perceive are not an inevitable consequence of your genes. What your genes have insured is that your brain has wiring for making sense of sensory input from the outside and inside our bodies by forming concepts like "Anger" and "Disgust." These emotion categories do not have a distinctive fingerprint and are not genetically predetermined. One instance of anger need not look or feel like another, nor will it be caused by the same neurons. Your familiar emotion concepts are built-in only because you grew up in a particular social context where those emotion concepts are meaningful and useful, and your brain applies them outside your

awareness to construct your experiences. Heart rate changes are inevitable; their emotional meaning is not.

If you talk to a chemist, "real" is a molecule, an atom, a proton. To a physicist, "real" is a quark or a Higgs boson. They are supposed to exist in the natural world whether or not humans are present—that is, they are thought to be perceiver-independent categories.

Our social brains make a consensus reality

Evolution provides our minds with the ability to create kind of real that is different from that of molecules or atoms, which we take to be observer independent categories, a reality that is completely dependent on human observers. Just get a couple of people to agree that something is real and give it a name, and they create reality. From wavelengths of light, we construct colors. Looking at a rainbow, we see discrete stripes of color, although in nature a rainbow is a continuous spectrum of light with wavelengths ranging from about 400 to 750 nanometers. We see stripes because we have mental concepts for "Red", "Orange," and "Yellow," grouping together certain ranges of the spectrum and categorizing them as



Rainbow color drawings are culture specific
Russian culture distinguishes light (sky) blue from regular blue

the same color. Concepts of color are influenced by culture and language. Russian has words for seven rather than six colors, blue is divided into light blue and dark blue.

Emotions become real to us through two human capabilities that are prerequisites for social reality. First, you need a group of people to agree that a concept exists, such as "Flower" or "Cash" or "Happiness." This called collective intentionality. It is a foundation of every society. Many concepts are similar across cultures, groups have to solve common problems, but some concepts are not. The ! Kung people of the Kalahari Desert do not have the emotion and concept of Fear.

The human brain is a cultural artifact. Culture helps to wire individual brains, which then become carriers of the culture, helping to create and perpetuate it.

There is debate over whether some concepts are innate or learned, as I mentioned earlier, but it seems clear that we learned most of them as our brains wired themselves to our physical and social surroundings.

Universal Aspects of Mind

Affective realism

Concepts

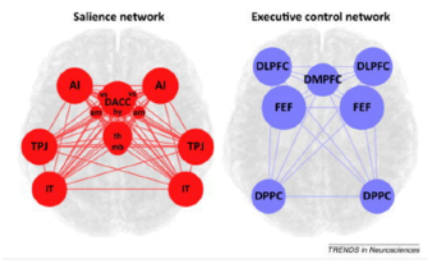
Social reality

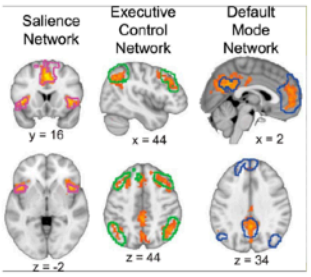
The new view is that there are at least three universal aspects of the mind affective realism, concepts, and social reality. They are inevitable and universal, barring illness, based on the anatomy and function of the brain. Affective realism is saying that you experience what you believe, When a soldier in a war zone perceives a gun in the hand of a kid playing with a stick of wood, when no gun is present, he is actually seeing his prediction or expectation. Our

brains chunk even the smallest physical details into concepts, organizing fleeting bits of sound into music or language, or light to objects in the world, body changes in certain social situations into feelings and emotions. This chunking of our experiences into concepts is what can lead us to assume they are essences, have a particular genetic basis or place in the brain, when in fact no such things are present.

This last universal aspect of mind, Social reality, is that you are born without being able to survive or regulate your body budgeting by yourself. A part of your brain is specialized to wire our brains to fit with the minds of others, to fit with the social world that others have constructed.

The awesome library of predictions, memories, concepts are stored and continually renewed, refined, reshelved all the time. It never stops, even when we think we are sitting with a blank mind doing nothing, not paying attention to anything. We can experience this as rumination or mind wandering. Particular brain networks are associated with this activity. Neuroscientists were a bit amazed that the first global measurement of brain activity showed the brain to be just as active when it was supposedly doing nothing, as when it was engaged on a specific task.

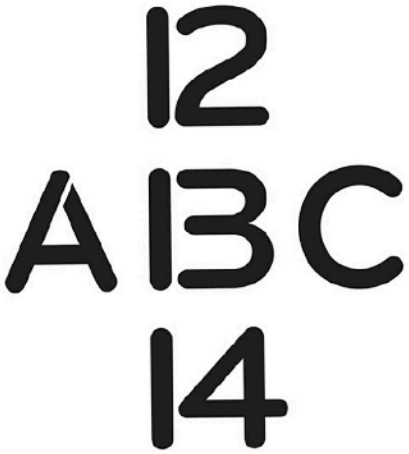




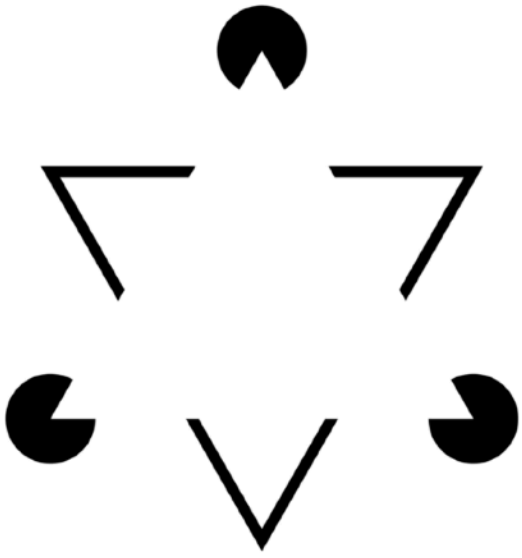
Our background and ongoing modeling, predicting, and deciding machinery are managed by a number of major networks in our brains.

These networks include the default mode system, the salience net work, the executive control network, the attentional network, and others. Attentional, control, default, and salience networks regulate concepts, predictions, constantly buzzing away, like the hubs in the international air travel network .

The control network averages out all the stories that are guessing, predicting, what is going on and letting a winner of the competition emerge. Deciding which of the two option we see here:



Or deciding that the center of this figure a white triangle



How we now think our minds work.

Why much of it is wrong.

A new description - predictive brains that construct themselves.

Meditation enables insight into this construction

So, going back to my initial list of topics, I come to the fourth segment of this talk, which addresses how our new understanding of predictive processing might be useful in our daily lives. We might well take the attitude that we seem to get along reasonably well with what we know to be basically an incorrect folk psychological view of who we are and what we are about. What's not to like?

What's not to like is when the system doesn't work very well, when our predictions and models end up causing chaos for us personally or in the world. The vast background of predictive processing I've

been mentioning is really where it's all going on, where our strengths and weaknesses reside, where our predictive processing frequently inappropriately projects the past on to the present. If we believe our tribe is in its essence is virtuous and the other tribe in its essence is evil things don't go very well.

How much control or influence do we actually have over our predictive minds - what our brains have stored about the way things are - and our constant ruminations and mind wanderings that edit and rearrange them? What can we do if the system isn't working very well?

Many modern psychological therapies attempt to enable us to change our minds, and meditative traditions have been addressing this question for thousands of years. Work on predictive processing over the past 10-20 years has made it increasingly obvious that descriptions of the mind and how to change it, developing in parallel over a thousand years ago in India, Tibet, South East Asia, and Japan, were getting it right. Different meditative traditions have developed largely similar descriptions of mind states that can sequentially accessed by different types of deconstructive meditation that access different layers of predictive processing in our brains.

Focused Attention
Open Monitoring
Non-dual awareness

Non-dual awareness From many to (n)one: Meditation and the plasticity of the predictive mind, Laukkonen and Slagter - Neuroscience & Biobehavioral Reviews Vol. 128, Sept. 2021, pp. 199-217

This brief description I'm giving you is from a recent seminal paper by Laukkonen and Slagter, the reference is on the slide. It considers the major or core meditation techniques in order of their accessibility and progression from beginning to more advanced, and suggests that these techniques form a continuum in which each strategy can influence predictive processing to gradually break down increasingly ingrained expectations. Each style can draw us closer and closer to the here and now and away from more abstract deep processing of our memories and expectations.

Focused meditation enhances present-moment awareness of one source of sensory input such as the breath. It exercises the attentional brain network I have mentioned. A typical instruction for focused mindfulness meditation might be to pay attention to

your breath, and when attention inevitably wanders, gently return it to the simple focus on breathing. Brain imaging shows that during this exercise the activity of the default and salience networks, where mind wandering and self-referential processing detached from the current environment is going on, are dialed down. Activity in the attentional network of the brain predominates.

Open awareness meditation withdraws selective attention in favor of non-judgmental, non-reactive, observational space in which thoughts and sensations appear and pass away. This progressively disables clinging to expectations generated by predictive processing. This observational stance also allows us to make a crucial distinction between seeing and being.

-being an angry, afraid, or desiring person

-observing oneself angry-ing, fear-ing, desire-ing

-choosing whether to cease or continue the emotion

Within this open awareness, the transient appearance of an emotion like anger can be seen, as if from a third person perspective, as a process of angry-ing, different from being highjacked by the emotion and immersed in experiencing yourself as an angry person. The open awareness of seeing the angry-ing versus being an angry person offers the option of choosing between those alternatives. Ditto with being able to distinguish being a fearful or desiring person from observing yourself fear-ing or desire-ing.

You can try this treatment for a social bubble or political tribe that you might belong to, either experiencing yourself as being a democrat or republican versus observing yourself democrat-ing, republican-ing, and possibly becoming more open to trying out or testing the other group's identity.

A further deconstruction of predictive processing occurs in the non-dual meditative process in which the observer present in focused attention and open monitoring meditation, that can verbally report on the meditation experience, that observer vanishes. Subject and object disappear. While it seems like this must be a rarified state accessible only to advanced meditators, there are a few simple exercises that can give ordinary folks like ourselves a brief glimpse of what the experience is like.

I'm going to write out my summary in a slide and read through it, because it is densely packed.

Focused awareness can damp down the brain noise of predictive processing, the expanded awareness of open monitoring can see without being the noise, and a further expanded awareness can remove the dualistic observer altogether, entering the space from which everything rises. Each meditation technique uniquely deconstructs the minds' tendency to project the past onto the present, and reveals the plasticity of the human mind.

The last two slides try to condense everything down to a sentence, a longer and then a shorter one. I'll show them and then stop talking so there is time for discussion.

Being in the here and now reduces predictive processing, reducing the influence of priors, enhancing attentional tonus and ability to surf uncertainty

Which cooks down to the injunction to pay attention in the here and now.