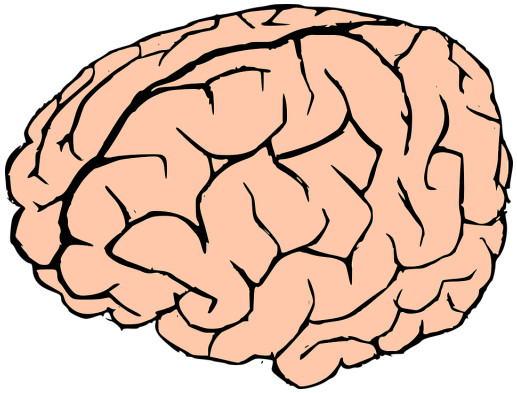
User's Manual for the Human Brain DRAFT

author Tomas Vykruta



Introduction

When we are born, unfortunately no instruction manual is issued for our most important, complex and powerful tool, our brain. In very recent times, researchers have reverse engineered how the brain works. I have taken this research and written a simple user's manual designed for regular people with busy lives. It's specifically focused on the less understood functions that we call *emotions and reasoning.* This is an engineer's manual, scientific and opinionated.

How Happiness Works

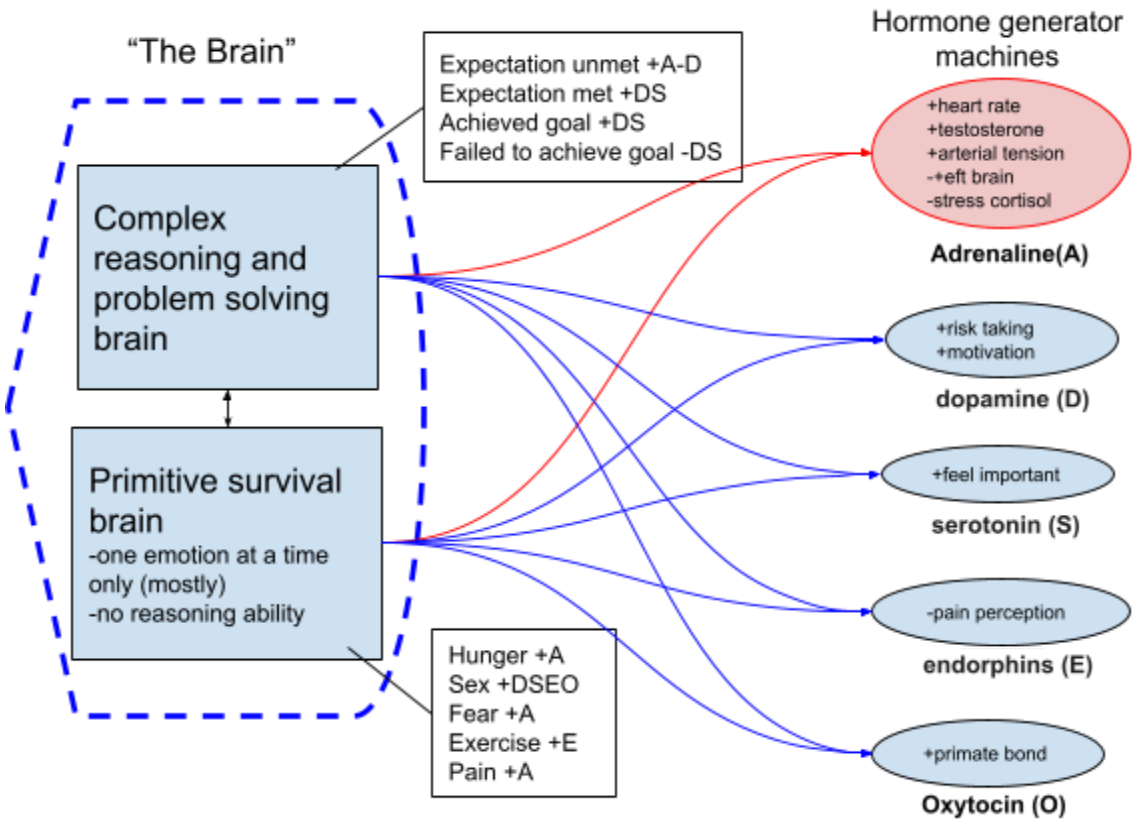
For tens of thousands of years, ever since the first early human asked the question "*What am I?*", humans have sought to unlock the secret of happiness. Yet, today we're not much closer than we were thousands of years ago to achieving this goal. In fact, some believe we experience less happiness now than in prehistoric times. There is a very good reason why we cannot find the answer. **Spoiler alert:** It is not because happiness is some mystical, spiritual state of being beyond the reaches of science. Quite the opposite, it is a lot simpler than we make it out to be.

First we must learn a little bit about how the brain works, then we will unlock these secrets.

Distinguishing Magic

As a systems engineer at Google, my job is to design and build systems that solve complex problems. This problem is solved by creating a set of much simpler subsystems with simple responsibilities and connecting them together. The *composition* of these *simple* systems is what we perceive a very complex machine capable of what seems *indistinguishable from magic.*

Hello, brain.
As it turns out, the human brain is not so different. The diagram below is your brain decomposed into its simple, functional subsystems. The most important thing to note is there are actually 2 brains, not one. The **reasoning** brain and the **primitive** brain.

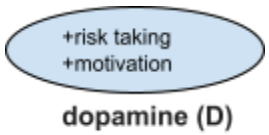


(above) Brain Diagram

Reading the brain diagram

On the left, we have the two brains. *Yes, there are two brains in your head, not one!* **On the right** are the hormone generators. Think of them as little machines that can be turned on or off. Inside the blue circle are the biological effects of the hormone. Below it is the hormone name.

.

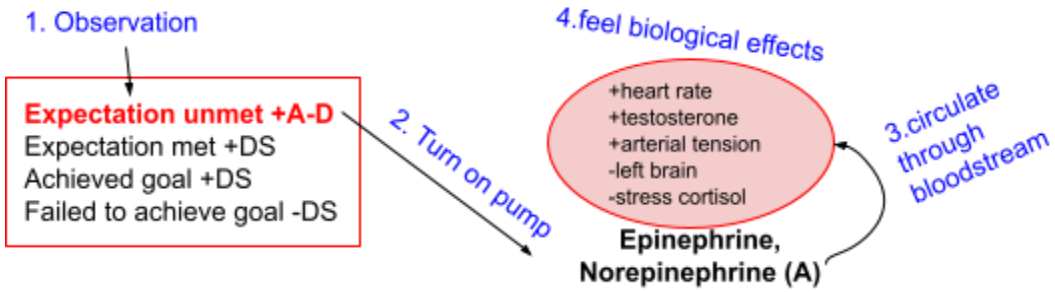


(above) Dopamine hormone generator. Its biological effects are: increased risk taking and motivation.

Each hormone machine pumps that hormone directly into the bloodstream for circulation. Other cells in the body can optionally react to the hormone. Or they can ignore it. Hormones are chemical messengers.

Example: When the *dopamin generator* is activated, it starts dumping *dopamine* into the bloodstream. The biological effects are *increase in risk taking and motivation.* You can imagine situations where these are not desirable attributes, such as when encountering a hungry mom polar bear with cubs.

Next to each brain there is a short list examples of *observations* the brain "sees" and the resulting hormone machines it activates or deactivates. Of course, there are many more possible *observations*.



Above:
(1) The reasoning brain observes an unmet expectation.
(2) Turns on the anger hormone machines (adrenaline)
(3) The bloodstream quickly circulates them throughout all the tissues in the body
(4) Biological effects are felt: increased heart rate, testosterone, arterial tension, etc.

Note that anger is not a result of what actually happened in the physical world. It's a result of an unmet expectation. Don't believe me? Think of some examples of when you got angry and you'll see this is true!

+DS indicate increase hormone generation of dopamine and serotonin. **+** means or more, **-** means stop or less.

*For example, in the **reasoning** brain, when an e**xpectation is met** such as offering a hand to someone, and they shake in reciprocal, this leads to +DS: start generating **D**opamine and **S**erotonin. **D**opamine increases our tolerance for risk and motivation while **S**erotonin increases our feeling of self importance. This "feels" great! Conversely, if a hand is not offered back in reciprocal,* adrenaline (the anger hormones) *are generated. Increased heart rate, muscle tension, This "feels" terrible!*

It's not the physical hand-on-hand contact we long for, it's meeting our expectation.

If you were to inject yourself with a hormone you'd experience exactly the same biological effects.

Hormones: Chemical messengers

The human body secretes and circulates 50 different hormones. It's an impressively small number given the complexity of primate behaviors. Here are 6 homrones you should definitely know. (see all 50 hormones).

Dopamine the “super hero” hormone

Dopamine motivates us to take action toward goals, desires, and needs, and gives a surge of reinforcing pleasure when achieving them. Procrastination, self-doubt, and lack of enthusiasm are linked with low levels of dopamine. Studies on rats showed those with low levels of dopamine always opted for an easy option and less food; those with higher levels exerted the effort needed to receive twice the amount of food.

Serotonin the “self confidence” hormone

Serotonin flows when you feel significant or important. Loneliness and depression appears when serotonin is absent. It’s perhaps one reason why people fall into gang and criminal activity — the culture brings experiences that facilitate serotonin release. Unhealthy attention-seeking behavior can also be a cry for what serotonin brings

Oxytocin the “love” hormone

Oxytocin creates intimacy, trust, and builds healthy relationships. It’s released by men and women during orgasm, and by mothers during childbirth and breastfeeding. Animals will reject their offspring when the release of oxytocin is blocked. Oxytocin increases fidelity; men in monogamous relationships who were given a boost of oxytocin interacted with single women at a greater physical distance then men who weren’t given any oxytocin. The cultivation of oxytocin is essential for creating strong bonds and improved social interactions.

Endorphins the “morphine” hormone

Endorphins are released in response to pain and stress and help to alleviate anxiety and depression. The surging “second wind” and euphoric “runner's high” during and after a vigorous run are a result of endorphins. Similar to morphine, it acts as an analgesic and sedative, diminishing our perception of pain. It’s a natural morphine.

Adrenaline (Epinephrine and Norepinephrine) the “anger” hormone

The are the hormones of **anger**. The biological effects are: increase in blood pressure and heart rate, sweating, pupil dilation, increase in blood sent to the skeletal muscles, constriction of blood vessels, contraction of heart muscles, dilation of the lungs.

As a fun research exercise, you can google for “what hormone is released during ____”. Then google for “biological effects of ___”. For example, oxytocin is the hormone of sex and childbirth. It forms strong bonds between primates and causes cervix muscles to contract to help push out a baby in child birth.

There are two brains, not one

Note the two blue boxes on the left: **reasoning, or decision brain** and the **primitive, or survival brain**. While they can communicate with each other, you should think of them as two independent brains. Each one is wired directly to the hormone making machines and can turn them on or off.
Note some very fundamental differences between the two brains:

- The two brains did **not evolve at the same time**. The primitive brain evolved over 500 million years ago. Simple creatures like frogs have it. The reasoning brain (the prefrontal cortex) only evolved in more recent times with mammals.
- The two brains have **mutually exclusive responsibilities**. The reasoning brain does not **directly** deal with hunger, sex or fear.
- The **Primitive Brain** cannot do any reasoning, it can only directly respond to observations/stimuli. If it detects a threat, it responds by releasing adrenaline. This “brain” evolved long before the reasoning brain. There is truth to the saying that people *Think* with their sexual organs.
- The **Complex/Reasoning brain** is always reasoning about everything, that is its job, Given two options, it will try to find the better of the two even if the two options are equally good, which can be frustrating to say the least!.
- The **two brains can communicate** with each through a brain interface, but their communication is quite limited. For example the *reasoning* brain cannot tell the *primitive brain* tno not feel hungry even if the host body is obese.
- The **primitive** brain has **precedence over the reasoning brain**. This is why we experience emotions like fear while watching a horror film. The reasoning brain cannot stop the primitive brain from being scared.

Testosterone and sex

Testosterone appears to be a major contributing factor to sexual reproduction motivation in male primates, including humans. The elimination of testosterone in

adulthood has been shown to reduce sexual reproduction motivation in both male humans and male primates. Testosterone has been shown to increase by lifting weights, for example. it also plays an important role in female health and sexual well-being.

How Happiness Works

Now we can return to happiness and answer the question why happiness has remained an elusive emotion that comes and goes.

It's because ***there is no such thing as happiness.*** In reality, what exists is a finite number of hormones that generate a biological response that we associate as **positive**, These hormones are released as a result of some observation happening in one (or both) of the two brains. Some examples of happy hormones are dopamine, serotonin and endorphins. We can experience just one at a time, or a combination of them.

By using the word *happiness,* we incorrectly group these very diverse set of hormones into a single *thing* called *happiness*. Clearly, it's not a single thing at all. It's many things, and they are independent of each other. So it's no wonder that we cannot agree on what happiness is or even clearly define it.

To put this in perspective, we can look at emotion or sensation called ***pain***. There is no confusion about what pain is, everyone agrees. This is because pain is a single response to a single action in the **Primitive Brain**.

If we stop using the word happiness instead start describing which hormonal effects we're feeling, the confusion about *happiness disappears*.

You can *feel* the biological effects of endorphins, serotonin, or dopamine. You cannot *feel* the effects of *happy* because it's not a single *thing*.

What we describe as happiness

We can now analyze a few examples of what people associate with happiness and explain them in terms of the brain subsystems.

Moments of *presence*

Moments of presence or *Mindful Moments* happen when, for example we are snowboarding. Why do we feel happy when hurling ourselves down a frozen mountain at dangerous speeds in uncomfortable boots and little or negative benefit to our well being? Because it's a special time that our reasoning brain is **not** reasoning about the past, nor future, it is forced to be in the present.

During this rush down a mountain, our reasoning mind is receiving a **rapid succession of small goal achievements,** each turn we navigate without falling over generates positive hormones. Our vains are literally pumping full of dopamine, serotonin and even endorphins from the physical strain. Don't forget about **adrenaline**!

Conversely speaking, while your reasoning brain is reasoning about the present or past, it's actually *impossible* to achieve goals to produce those positive hormones, since, well, you're not achieving anything, you're just reasoning. If you are eating a meal while reasoning about the future, at least your Primitive Brain can generate some positive reward hormones, but don't be fooled, that happy feeling has nothing to do with your reasoning brain and everything to do with your primitive brain.

This *mindfulness state* is associated with meditation, gurus, mental wizards and mystical *spirituality*. These folks, through rigorous mental exercise have trained to control their reasoning brain so well they can voluntarily stop it from reasoning about the past or future. Mindfulness training is not *spiritual* in the sense of *spirits* being involved, but it is a very desirable brain ninja skill nonetheless.

Design flaws with the system

The brain is far from perfect. Here are just a few glaring flaws.

Hormone Generator Machines are Dumb

It's important to note that the hormone generating machines are *dumb*. They only have two states: on or off. The serotonin released as result of a simple accomplishments like walking the dog is the same serotonin that is released for a major life event like university graduation. Our body cannot distinguish between the two types of a accomplishments.

There may be *more* serotonin from graduation, but the feeling is indistinguishable. This is important to note, because walking the dog has no significant impact on our well being, while university graduation has a profound, transformational effect (money, success, love, freedom, travel, experience, friends).

Good Hormones Gone Bad

Using drugs or committing crimes can release very high doses of serotonin even though these actually have a negative impact on our well being (loss of job, deteriorating physical health, loss of friends and love).

We are then asking our *reasoning brain* to do something it wasn't' designed to: stop pumping positive hormones when achievements are met. No wonder it's so hard to avoid a life of crime once you're in it.

Ths design flaw is that the *Reasoning* brain has very limited ways of interacting with the rest of the host body, it can only interact with turning on or off release of a few hormones. It's doing the best it can with this.

Reasoning brain cannot be turned off

The reasoning brain cannot be ***voluntarily*** turned off. When our primitive brain is idle and we are not actively solving a physical or cognitive task, **the reasoning brain will endlessly reason about the past or future. Our creator forgot to include an off switch.** This can lead to anxiety, stress and depression, as these are long durations with no positive hormones released.

With hours of endless, boring, **silent meditation** you can learn at least partial voluntary control. It's a smart investment!. Or can stay busy keeping busy with other activities to occupy the primitive brain or reasoning brain. It's up to you..

How Anger Works

Anger suffers from the same design flaws mentioned above. Anger is irrational. Very minor things can lead to extreme anger (small mistake on a food order), or very major events can lead to very low anger (identity theft).

Anger is not a consistent feeling like pain. Pain is definitive and universal. Getting kicked in the stomach hurts everyone universally.

Anger is very personalized. As shown earlier, it's actually a response to an unmet expectation. For example, if McDonald's takes 10 minutes to make your order you might respond with a lot of anger. If a fancy steak house takes 30 minutes, you'll be pleased. *It is not the actual thing that makes you angry; it's the expectation of a thing being met or not met.*

Think of some examples of anger and you will see how this fits in.

Anger can be categorized by the impact of the thing that upset you on your actual life. Someone spreading false rumors about you at work leading you to getting fired can have disastrous consequences for the rest of your life. Someone at work being "braggy" and annoying you has no consequence at all. Zero. Yet we respond in about the same way. This is why anger is irrational.

Back to happiness. A big part of what we perceive as happiness is control. When in control, we have serotonin in our blood. Questioning our emotions, specifically questioning anger can lead to a feeling of control. The moment you feel anger coming on, say, someone at the gym has terrible B.O., which upsets you, ask yourself a fast quiz. *How much negative impact on my life? Is it intentionally against me? Are they aware it's happening? Can I help them out by making them aware of this problem?*

You will very quickly gain control over the emotion realizing it's irrational. This will then activate the accomplishment portion of your brain which releases serotonin, and voila, a moment of anger becomes a moment of "happiness".

You don't have to live in a monestary your whole life to discover this secret. You just have to become aware of it.

There are moments where anger is just and serves a purpose. If someone is threatening your girlfriend/wife, the consequences can be disastrous if you let the situation escalate. The same anger test will check positive for all the points mentioned earlier:
How much negative impact on my life? LOTS Is it intentionally against me? YES Are they aware it's happening? YES Can I help them by making them aware of what they're doing? NO
When this happens, it is a red alert to take immediate action. You will still get some feeling of control upon completing the test, but the goal is not self indulgent happiness, the goal is to resolve the situation as quickly and strategically as possible, and often times the solution is not a pleasant one.