

*How We Decide*¹

by Jonah Lehrer

I. Quotes and Comments:

“Dopamine: the common currency of the mind, the molecule that helps us decide among alternatives.”

Wolfram Schultz: discovers the reward center in the brain in the early 1970s. Dopamine neurons, Schultz called, “prediction neurons, since they were more concerned with *predicting* rewards than actually receiving them.”

When predictions are confirmed, a brief surge of dopamine followed, “the pleasure of being right.” If a prediction fails, “if the expected pattern was violated, dopamine neurons reduced their firing rate. This is known as the *prediction-error-signal*.”

...it’s all about prediction.

*Comment:*² cf. Llinás and Hawkins.

“The cacophony of reality is distilled into models of correlation that allow the brain to anticipate what will happen next.”

Comment: Are beliefs “*models of correlation*”?

“The brain is designed to amplify the shock of mistaken predictions. Whenever it experiences something unexpected The cortex immediately takes notice. Within milliseconds, the activity of the brain cells has been inflated into a powerful emotion. Nothing focuses the mind like surprise.”

Comment: Is humor then the pleasure of an harmless, incongruous, unexpected surprise? I’ll bet that has something to do with it.

“Whenever the dopamine neurons make a mistaken prediction the brain generates a unique electrical signal, known as *error-related negativity*. The signal emanates from the ACC,” (the anterior cingulate cortex) “so many neuroscientists refer to this area as the ‘oh, shit!’ circuit.”

Comment: It’s usually the last one to fire when your car goes off the road.

“The ACC helps control the conversation between what we know and what we feel. It sits at the crucial intersection between two different ways of thinking.”

“...expectations can be quickly adjusted in the light of new events. It [the brain] internalizes the lessons of real life, making sure that neural patterns are completely up to date.”

“This is an essential aspect of decision making. If we can’t incorporate the lessons of the past into our future decisions, then we’re destined to endlessly repeat our mistakes.”

Comment: When this happens, something is preventing the updating of predictions. In general, it’s the lack of feedback. In one important case, avoidance, it’s the avoidance of making a choice that would have provided information on present reality that is the missing feedback. Avoidance behavior, in that way, is its own reward. It reduces the uncomfortable feeling of anticipating an imminent painful experience.

“When the ACC is surgically removed from the monkey brain, the behavior of the primate becomes erratic and ineffective.”

Comment: Monkeys like this learned to change but never learned how to use the new behavior consistently. They reverted to older behaviors that were ineffective.

¹ pgs 34-49

² the comments are mine. R.K.

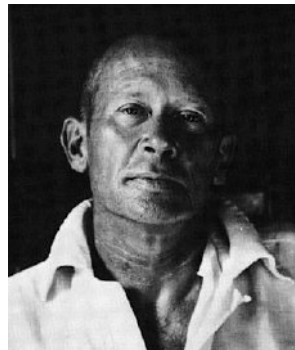
The brain is designed to learn from its mistakes. In this case, it didn't.

“The ACC.... is densely populated with a very rare type of cell known as a *spindle neuron*. The strange form of spindle cells reveals their unique function: their antenna-like bodies are able to convey emotions across the entire brain. Humans have about forty times more spindle cells than any other primate.”

Comment: Related to this is the current interest in what are known as the “gamma rhythm”, a high-frequency brain wave (around 40 cycles/sec.) that is also felt across the whole brain.³ An excellent paper on this is: *On the Same Wavelength* by Laura Colgin.⁴

*since feeling is first
who pays any attention
to the syntax of things
will never wholly kiss you.*

— E. E. Cummings⁵



“We can now understand the surprising wisdom of our emotions. The activity of our dopamine neurons demonstrates that feelings aren't simply reflections of hard-wired animal instincts. Instead, human emotions are rooted in the predictions of highly flexible brain cells, which are constantly adjusting their connections to reflect reality. Every time you make a mistake or encounter something new, your brain cells are busy changing themselves. Our emotions are deeply empirical.”

“When the dopamine system breaks down completely — when neurons are unable to revise their expectations in light of reality — mental illness can result. emotions have been uncoupled from the events of the real world.” When these neurons are working properly, they are a crucial source of wisdom. The emotional brain effortlessly figures out what's going on and how to exploit the situation for maximum gain. Every time you experience a feeling of joy or disappointment, fear or happiness, you neurons are rewiring themselves, constructing a theory of what sensory cues preceded your emotions. The lesson is then committed to memory, so the next time you make a decision, your brain cells are ready. They have learned how to predict what will happen next.”

“Trusting one's emotions requires constant vigilance; intelligent intuition is the result of deliberate practice.”

³ <http://www.web-us.com/40hz/DEFAULT.HTM>

⁴ <http://www.ntnu.no/news/on-the-same-wavelength> Found in the *Excerpts*, pg 330.

⁵ <http://compendium.vuduc.org/aupoem162.html>

II. Just *Comments*:

The brain is designed to learn. It learns by generating predictions on the basis of past experiences and monitoring the effectiveness of those predictions. When the fail, it changes. After many experiences, even beginning with random decisions, this feedback and sorting process consistently increases the success rate, as long as the world itself exhibits a parallel consistency.⁶ The brain is designed, evolved is better, to meet exactly this situation.



It takes a lot of prediction–feedback trials to build good models. Like a model, for example, of what’s good to eat. About our work, we can ask, “How do we built good models of doing psychotherapy?” What kinds of attention and predictions do we have to practice. To get what kind of feedback? How do our brains learn to help others with their pain?

We can begin to study these questions by looking at how we those who have learned it. I’ll tell you about my learning. I learned to bring people into their emotions. I learned that that was an important step in the healing process. I saw it happening in my own personal work. I saw it happening when Perls or Lowen or Pessu or Pierrakos did their work. Emotions were, “the way in and the way out.” (Janov used to say this about pain.)

I learned that knowing how to read the models people had about themselves and the world was a good way to create something that would bring people into their emotions. I did it by paying very close attention to the nonverbal signs of what they were experiencing in the moment. I used that to express my understanding and compassion. I also learned to “read” bodies. I learned to build my own models of their models by paying attention to posture, structure and movement. Later on, I learned to read small habits people have to do the same thing. I called those habits, “indicators”.

I learned to get a lot of feedback by designing little “experiments”. I would test my ideas by saying something and watching for any reaction the client had. I also helped clients become calm and focused on their experiences when we did those experiments. I called the state they got into at the beginning of an experiment, “mindfulness”.

The combination of attention to nonverbal expressions and the use of experiments produced reliably effective outcomes and useful feedback.

I also learned how to respond to the emotions that those experiments evoked. Over the years, working this way, I learned how to support the reorganization of the client’s brain and predictive models through the very touching, ordinary, emotional healing processes that took place. I learned that the brain and body know how to heal and I learned how to midwife those processes.

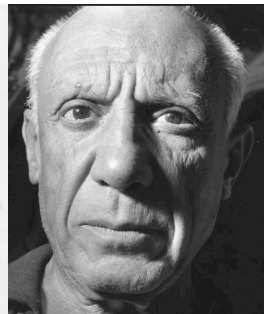
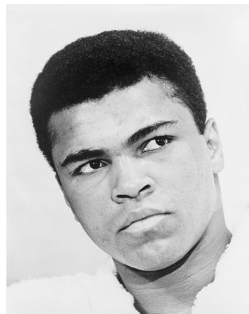
My brain learned to be a good predictor of what works as psychotherapy.

Here’s what it took, if you’ll pardon a some rough mathematical speculation:

I’m estimating that I have probably done process like the one I described on average about fifteen times/session, a hundred of so sessions a year, for forty years. That’s about sixty thousand trails. That means my brain had a lot of chances to learn from my mistakes and successes. I’m convinced that those sixty thousand chances to learn, more than anything else, shaped the skills I came to have. All the reading and studying I did helped me understand that there were reasons for what I was doing. But knowing reasons is not the same as learning through experience. Only

⁶ “Because there is randomness in the universe, organization is necessary. Because there is order in the universe, organization is possible.” — Ruelle, David (1993). *Chance and Chaos*, Princeton, NJ: Princeton University Press

experience changes the brain in a way that binds memory, emotion, thought, and action. Only experience creates skill.⁷ Think of John Coltrane who practiced eight hours a day. Or Michael Jackson and Pablo Picasso whose long learning began at ages four and five. Think of Mohammad Ali who began training at age twelve. Yes! They were gifted. Yes! They had the exceptional physical and mental skills that all the gifted ones inherit. But their gifts flowered and were perfected through the constant training of their dopamine neurons, the deliberate daily exercise of prediction and feedback,. More than anything else, it was that which made them who they were: the most extraordinary examples of human possibility. Nothing else would have been enough.



All children are artists. The problem is how to remain an artist once he grows up. – Pablo Picasso

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⁷ For more about this, have a look at Malcolm Gladwell's book, *Outliers*. Or his article, *Late Bloomers* at: http://www.newyorker.com/reporting/2008/10/20/081020fa_fact_gladwell. Or listen to his talk on Genius at: <http://www.newyorker.com/online/video/conference/2007/gladwell>