the “Oh sh*t!” circuit and the Delete key

In the January issue of Wired magazine, there is a fascinating article on the nature of scientific work. Specifically, it investigates the way scientific progress happens. It turns out that there is an enormous amount of failure involved. A researcher named Kevin Dunbar spent a year observing scientific researchers at their work, and found that:

> *Science is a deeply frustrating pursuit. Although the researchers were mostly using established techniques, more than 50 percent of their data was unexpected. (In some labs, the figure exceeded 75 percent.) “The scientists had these elaborate theories about what was supposed to happen,” Dunbar says. “But the results kept contradicting their theories. It wasn’t uncommon for someone to spend a month on a project and then just discard all their data because the data didn’t make sense.” Perhaps they hoped to see a specific protein but it wasn’t there. Or maybe their DNA sample showed the presence of an aberrant gene. The details always changed, but the story remained the same: The scientists were looking for X, but they found Y.*

Not only did things not go as planned most of the time, but the not-going-as-planned was discounted and abandoned more often than not:

> *According to Dunbar, even after scientists had generated their "error" multiple times — it was a consistent inconsistency — they might fail to follow it up. "Given the amount of unexpected data in science, it's just not feasible to pursue everything," Dunbar says. "People have to pick and choose what's interesting and what's not, but they often choose badly." And so the result was tossed aside, filed in a quickly forgotten notebook. The scientists had discovered a new fact, but they called it a failure.*

It turns out that the brain is wired to tune out anomalous information, stuff that seems not to jibe with how think the world should be. Dunbar performed some experiments and verified this:

> *As he tried to further understand how people deal with dissonant data, Dunbar conducted some experiments of his own. In one 2003 study, he had undergraduates at Dartmouth College watch a couple of short videos of two different-size balls falling. The first clip showed the two balls falling at the same rate. The second clip showed the larger ball falling at a faster rate. The footage was a reconstruction of the famous (and probably apocryphal) experiment performed by Galileo, in which he dropped cannonballs of different sizes from the Tower of Pisa. Galileo's metal balls all landed at the exact same time — a refutation of Aristotle, who claimed that heavier objects fell faster.*
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> *While the students were watching the footage, Dunbar asked them to select the more accurate representation of gravity. Not surprisingly, undergraduates without a physics background disagreed with Galileo. (Intuitively, we're all Aristotelians.) They found the two balls falling at the same rate to be deeply unrealistic, despite the fact that it's how objects actually behave. Furthermore, when Dunbar monitored the subjects in an fMRI machine, he found that showing non-physics majors the correct video triggered a particular*

> *pattern of brain activation: There was a squirt of blood to the anterior cingulate cortex, a collar of tissue located in the center of the brain. The ACC is typically associated with the perception of errors and contradictions — neuroscientists often refer to it as part of the "Oh shit!" circuit — so it makes sense that it would be turned on when we watch a video of something that seems wrong.*

However, the "Oh Shit!" circuit is not the whole story. There is another part of the brain that closes the deal by editing out parts of reality that conflict with our picture of it.

> *But there's another region of the brain that can be activated as we go about editing reality. It's called the dorsolateral prefrontal cortex, or DLPFC. It's located just behind the forehead and is one of the last brain areas to develop in young adults. It plays a crucial role in suppressing so-called unwanted representations, getting rid of those thoughts that don't square with our preconceptions. For scientists, it's a problem.*
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> *When physics students saw the Aristotelian video with the aberrant balls, their DLPFCs kicked into gear and they quickly deleted the image from their consciousness. In most contexts, this act of editing is an essential cognitive skill. (When the DLPFC is damaged, people often struggle to pay attention, since they can't filter out irrelevant stimuli.) However, when it comes to noticing anomalies, an efficient prefrontal cortex can actually be a serious liability. The DLPFC is constantly censoring the world, erasing facts from our experience. If the ACC is the "Oh shit!" circuit, the DLPFC is the Delete key. When the ACC and DLPFC "turn on together, people aren't just noticing that something doesn't look right," Dunbar says. "They're also inhibiting that information."*

Between the Oh Shit! circuit and the delete key, the brain is set up to protect our existing pictures of the world from threatening anomalies. And in a lot of situations, that's probably a good thing. It would be impossible to focus on anything without such a capacity.

But progress in science depends on noticing anomalies. Anomalies are the things that tell us where our existing models are inadequate, and can point the way towards evolving new models.

Given our propensity for censoring out anomalies, Dunbar wondered how any kind of progress happened at all. He sat in on a lot of lab meetings where results were discussed. What he found was that meetings where diverse groups of scientists, people with very different kinds of expertise, were involved were much more effective than discussions among people who shared a common area of expertise:

> *The diverse lab, in contrast, mulled the problem at a group meeting. None of the scientists were protein experts, so they began a wide-ranging discussion of possible solutions. At first, the conversation seemed rather useless. But then, as the chemists traded ideas with the biologists and the biologists bounced ideas off the med students, potential answers began to emerge. "After another 10 minutes of talking, the protein problem was solved," Dunbar says. "They made it look easy."*
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> *When Dunbar reviewed the transcripts of the meeting, he found that the intellectual mix generated a distinct type of interaction in which the scientists were forced to rely on metaphors and analogies to express themselves. (That's because, unlike the E. coli group, the second lab lacked a specialized language that everyone could understand.) These abstractions proved essential for problem-solving, as they encouraged the scientists to reconsider their assumptions. Having to explain the problem to someone else forced them to think, if only for a moment, like an intellectual on the*

margins, filled with self-skepticism.

This is very relevant to the working process for acting that I teach in the class, in particular to the challenge of articulating an underlying objective. As an actor studies a role, he/she becomes an expert on it. The challenge of distilling her understanding of the role into a single phrase, the underlying objective, that captures the urgency and significance of the character’s struggle is an extremely valuable one. It is in that struggle to articulate, to find expression, to communicate, that the actor is challenged to touch in herself the the place in herself that corresponds to the place in the author that prompted her to create the role in the first place.

In finding our way to that expression, anomaly is very important. When most of us approach a text initially, we have an *evaluative* relationship to the figures presented therein: we are interested in the choices they make in the situations in which they find themselves, and the way in which those choices work out. Based on those factors, we form judgments about the figures in question. We are interested in evaluating them as a way of gaining insight about our own lives.

To work on a role as an actor, we need to approach the role empathically rather than evaluatively. We need to understand what makes each step that the character takes the next necessary thing for them. We are not interested in judging them, but rather in connecting with them, getting in touch with what makes them tick. Unfortunately, our first encounter with a script tends to produce an evaluative way of looking at the character. We need to work our way around to an empathic way of looking at the character, but that is not easy. Once the evaluative way of looking at it lodges itself in our minds, we can puncture it only with difficulty.

That’s where anomaly comes in. When we read something in a script that triggers our Oh shit! circuit, we need to pay close attention to that. It's often the key to moving past the evaluative to the empathic.

In our first night of class in the Essentials class, we talk about the role of Blanche in Streetcar Named Desire. I ask everyone to imagine that they are going to play Blanche, and then I walk them through the posing of the initial questions they need to consider. One of them is the character's strengths. The initial ones that come out usually have to do with "I'm charming", "I'm insightful" "I'm clever", "I'm refined". It often takes quite a while before someone comes out with "I'm caring" or "I'm loving", and yet those strengths belong to Blanche indisputably. She cared for her dying relatives through protracted and hideous illnesses, and she feels deep remorse about her contribution to the death of Allan Grey. And Stella affirms these qualities when she defends Blanche to Stanley. These are not the aspects of Blanche that the text puts in the foreground, but they are definitely there. An actor approaching this role needs to pay attention to the clues that Blanche is not merely an unlucky charmer with a lot of education. The success of the piece depends on the actor discovering this vulnerability, that is, on noticing the anomalies that disrupt a purely evaluative view of her. It's in that disruption that vulnerability is born.

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