

Fractious, and possessed of unpopular socialist views, he floated from university to university, winding up in the Soviet Union until he fled to escape Trofim Lysenko's destruction of Russian genetics. Yet during all these peregrinations he maintained an uninterrupted programme of research. It is a scandal that Muller did not secure a tenured academic job until he was 55 — he won the Nobel prize a year later.

Muller was one of the best geneticists of the twentieth century, a visionary who predicted the rise of molecular genetics and the use of association mapping to identify genes for human behaviours. He was also difficult to work with, obsessed with credit and depressive to the point of once attempting suicide. Schwartz repeatedly states that Sturtevant, Bridges and Morgan tried to ruin Muller's reputation by stealing his ideas and slandering him, but the evidence is unconvincing. Working

together in the Fly Room, talking science as they worked on flies in what was a continuous lab meeting, it is not surprising that they shared ideas and information. After all, it was Sturtevant who gave Muller the idea of using lethal alleles to measure mutation rates.

The other 'boys' were not slouches. Bridges discovered nondisjunction, thereby proving the chromosomal theory of heredity, and published it as the first paper in the first issue of the journal *Genetics*. He constructed the first map of genes on autosomes, did fundamental work on sex determination and produced maps of *Drosophila* salivary-gland chromosomes that have never been bettered. Sturtevant was the first to establish, while still an undergraduate, that genes are arrayed linearly on chromosomes. He devised the chromosomal fate mapping later used so effectively by the geneticist Seymour Benzer, founded

Drosophila taxonomy and, by studying the action of eye-colour mutations in the fly, became the father of biochemical genetics. But neither Sturtevant nor Bridges was obsessed with priority: Sturtevant was the most modest of men, whereas Bridges, a great womanizer, had more pressing interests.

In Pursuit of the Gene should be required reading for all biologists unfamiliar with the history of genetics. Schwartz shows how quickly science can advance when a group of first-class minds encounters a fertile but unploughed field. Progress in genetics, as in all modern science, was truly a collaborative affair. There was no Darwin of genetics — not even Muller. There was, and is, plenty of credit to go around. ■

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Swayonomics

Sway: The Irresistible Pull of Irrational Behavior

by Ori Brafman and Rom Brafman

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In the Biblical parable in Matthew 25:14–29, a servant who was given five talents of money invested them and returned ten talents, whereas a servant given one talent buried it in the ground without profit. The master gave the risk-averse servant's one talent to his successful rival. The effect was elevated into a principle: "For to everyone who has, more shall be given, and he will have an abundance; but from the one who does not have, even what he does have shall be taken away."

Sometimes named the 'Matthew Effect', marketers call this response 'cumulative advantage'. I think of it as the 'bestseller effect'. Every author and publisher knows that once a book gets a head-start in sales it signals to consumers that other people want that book, causing them to desire it and purchase more, so the richest authors get even richer.

In *Sway*, the brother authors Ori Brafman, an entrepreneur, and Rom Brafman, a psychologist, describe the social and psychological effects that shape our beliefs and behaviours. They hope to trigger their own Matthew Effect with this highly readable book. But predicting the next bestseller is as reliable a business as astrology. That problem affects all books, including, ironically, those about marketing and behaviour: the psychological principles

may explain what happened in hindsight, but cannot be used to predict the future.

Sway is a fun read, and the brothers Brafman are compelling storytellers, pulling in the reader immediately and narrating at a breezy pace. But the book is thin on science and thick on anecdotes. The authors have a propensity for 'just-so' stories, favouring this or that behavioural principle when other explanations exist.

The book opens, for example, with the tragic 1977 crash of KLM flight 4805 during take-off from the tiny Tenerife airport in the Canary Islands. While motoring down the runway, the Boeing 747 slammed into Pan Am flight 1736, also a 747. The crash was the worst disaster in aviation history. What was the cause? The authors argue that it was psychological. The KLM captain Jacob Veldhuyzen van Zanten was a top pilot, featured in airline advertisements, who took pride in getting his passengers to their destination on time. That day he was behind schedule, having been rerouted to Tenerife after a bomb threat at his destination airport, and delayed on the island by fog. Captain van Zanten worried about his reputation for punctuality. "An unseen psychological force was at work," claim the authors, "steering van Zanten off the path of reason." This force was "loss aversion". Behavioural economists have shown that when we make a decision, potential losses hurt twice as much as potential gains feel good. "This principle is key to understanding van Zanten's actions," the Brafmans

explain. He dreaded "the cost of putting up the passengers, the chain reaction of delayed flights and the blot on his reputation for being on time".

Baloney. Van Zanten's plane was one of several large aircraft diverted to Tenerife. They manoeuvred tightly around the runway, the taxiway that ran parallel to it and four small connector taxiways between the two. Several spilled over onto the taxiway, so some planes had to taxi up the runway, turn around, and then take off down that same runway. Van Zanten did this, but after turning around in preparation for take-off, the fog reduced visibility to 300 metres. Unknown and invisible to van Zanten, at the same time Pan Am 1736 had been instructed to taxi down the same runway and take the third exit on its left in order to avoid the KLM flight's take-off.

After clarifying which exit to take — "The third one, sir; one, two, three, third, third one" the controller emphasized — the Pan Am jet counted them off against an airport diagram.

The cockpit voice recorder revealed that the Pan Am crew identified the first two connecting taxiways, but missed the third; the collision happened near the fourth exit.

Meanwhile, in the KLM plane, van Zanten's co-pilot radioed the tower for clearance. The tower did not clear them for take-off immediately. At this moment, a call from the Pan Am jet to the tower caused interference on the radio. The Pan Am crew signalled that they were still on the runway, but because of the radio interference the KLM crew did not hear the message, and began their fateful take-off sequence. The

"People find evidence for what they already believe and ignore anything contrary."

airport lacked ground radar so no one could locate the planes. By the time van Zanten saw the Pan Am plane it was too late. He throttled his engines full and pulled up the nose of the plane, but his fuselage clipped the top of the Pan Am jet, ripping it to shreds. The Pan Am pilot hit his engines and turned sharply into the exit path, but it was too little too late. Total death toll: 583.

The cause of this crash, investigators concluded, was a concatenation of conditions, none of which had anything to do with the psychology of loss aversion: bad weather, crowded conditions, big planes on a small runway, and misinterpretations and false assumptions.

Even if we grant the brothers Brafman the option of looking for an 'ultimate' instead of 'proximate' cause of the crash in the form of cognitive biases and behavioural persuaders that drove van Zanten to make his fateful decision to take off, loss aversion would be low on a causal vector list. Top of my list would be the 'confirmation bias', in which people look for and find confirmatory evidence for what they already believe and ignore evidence to the contrary. Once van Zanten thought he got the "OK" for take-off, everything else made sense. Or, perhaps it was the effect of 'inattention blindness', in which people attend to one task so intently that they miss obvious things in their visual field. Or it could be the 'self-serving bias' and the 'better-than-average bias' that made van Zanten overconfident in his abilities and thus less risk-averse than he might normally be. Maybe there was a 'priming effect', such that van Zanten's brain was primed to hear "take-off" in that garbled radio message. Or how about just the power of expectation?

The real problem here is the hindsight bias. Not for van Zanten, but for observers trying to read into a past event psychological effects that have been measured in the laboratory. The research on cognitive biases and judgemental heuristics — cleverly used in the service of reconstructing past events by the authors of *Sway* — is well grounded in empirical data, but the Brafman brothers face the same problem as the rest of humanity in trying to make sense of seemingly chaotic human behaviour: those very same biases operate in the process of using them to explain someone else's behaviour. Call it the 'meta-heuristic' bias. ■

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A. ENGLISH

Q&A: Travels with a paintbrush

Watercolour artist and explorer **Tony Foster** paints in some extreme places. He has climbed mountains, sketched erupting volcanoes and drawn underwater. As an exhibition of his works of Mount Everest and the Grand Canyon opens in London, he tells *Nature* why he goes to such extraordinary efforts.

Why did you decide to paint remote and dangerous landscapes?

I was a pop artist originally. But I got fed up with using second-hand imagery and thought I should work on things I experienced myself. My first trip followed the journeys of US writer and philosopher Henry Thoreau through the wildernesses in Maine. It seems fairly mundane now. My trips have become more and more extreme.

Your recent paintings are large, yet you paint *in situ*. Does this present unusual challenges?

All the difficulties are magnified by the scale and the location. It's much more laborious to do a big painting than a small one, and difficult physically to haul a 2-metre-wide drawing board around and lash it to the rocks in high winds. At subzero temperatures, the water for my paint freezes so I mix it with gin.

I suffered from altitude sickness in the Himalayas. I didn't realize how ill I was. I got sicker and sicker until I realized I couldn't carry on. I was coughing blood.

Sometimes it is appallingly difficult and miserable. That's spiced by moments of extraordinary joy if things work out.

Natural subjects were traditionally drawn by artists; now photography has taken over. What are your paintings trying to capture?

I'm not striving for accuracy, but honesty. The work looks different if done *in situ*, rather than from a photograph, which doesn't contain enough information. My paintings evoke a much greater emotional

response. The work isn't just about how the landscape looks, it's about what it's like to live in it and to take the journey.

My exhibition pictures are framed with maps, diary notes and souvenirs. Flint arrowheads on the Grand Canyon paintings symbolize that it has been inhabited for thousands of years. The souvenirs under the Tibetan painting are Buddhist objects. One is wrapped up in Chinese newspaper, bound up and sealed to symbolize the suppression of Tibetan Buddhism.

How did you approach your painting of the Grand Canyon?

It's like doing an enormous jigsaw puzzle. If you try to push in bits that are the wrong shape, it will never work. Two of my most stalwart hiking companions are scientists, geologist Bill Brace from the Massachusetts Institute of Technology and Winslow Briggs, a Stanford University plant biologist. Travelling through the Grand Canyon with a world-class geologist really made me look.

I don't think art has to have a purpose, but if my work has one then it is to bring back to people these magnificent places of untouched nature that are sublimely beautiful and worthy of our attention and protection. ■

Interview by **Daniel Cressey**, a reporter for *Nature* based in London.

Searching for a Bigger Subject: Tony Foster
Royal Watercolour Society, Bankside
Gallery, London
2–20 July 2008; then until September 2009
in various galleries in the United States.