

The _____
Science
of
Story

telling.

WILL STORR

'If you want to write a novel or a script,
read this book' *Sunday Times*

William Collins
An imprint of HarperCollinsPublishers
1 London Bridge Street
London
SE1 9GF

www.WilliamCollinsBooks.com

First published in Great Britain by William Collins in 2019

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A catalogue record for this book is available from the British Library

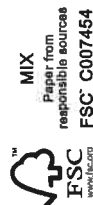
ISBN 978-0-00-827693-5 (hardback)

Typeset in Freight Text by
Palimpsest Book Production Ltd, Falkirk, Stirlingshire

Printed and bound in Great Britain by
GPI Group (UK) Ltd, Croydon CRO 4YY

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For my firstborn, Parker

toyed brilliantly with its audience's desire to know whether its protagonist, the avuncular and rebellious Catholic priest Father Flynn, was, in fact, a paedophile. The long-form journalist Malcolm Gladwell is a master at building curiosity about Loewensteinian 'questions of no importance' and manages the feat no more effectively than in his story 'The Ketchup Conundrum', in which he becomes a detective trying to solve the mystery of why it's so hard to make a sauce to rival Heinz.

Some of our most successful mass-market storytellers also rely on information gaps. J.J. Abrams is co-creator of the long-form television series *Lost*, which followed characters who mysteriously manage to survive an airline crash on a South Pacific island. There they discover mysterious polar bears; a mysterious band of ancient beings known as 'the Others'; a mysterious French woman; a mysterious 'smoke monster' and a mysterious metal door in the ground. Fifteen million viewers in the US alone were drawn to watch that first series, in which a world was created then filled until psychedelic with information gaps. Abrams has described his controlling theory of storytelling as consisting of the opening of 'mystery boxes'. Mystery, he's said, 'is the catalyst for imagination... what are stories but mystery boxes?'

1.3

In order to tell the story of your life, your brain needs to conjure up a world for you to live inside, with all its colours and movements and objects and sounds. Just as characters in fiction exist in a reality that's been actively created, so do we.

But that's not how it feels to be a living, conscious human. It feels as if we're looking out of our skulls, observing reality directly and without impediment. But this is not the case. The world we experience as 'out there' is actually a *reconstruction* of reality that is built *inside* our heads. It's an act of creation by the storytelling brain.

This is how it works. You walk into a room. Your brain predicts what the scene should look and sound and feel like, then it generates a hallucination based on these predictions. It's this hallucination that you experience as the world around you. It's this hallucination you exist at the centre of, every minute of every day. You'll never experience *actual* reality because you have no direct access to it. 'Consider that whole beautiful world around you, with all its colours and sounds and smells and textures,' writes the neuroscientist and fiction writer Professor David Eagleman. 'Your brain is not directly experiencing any of that. Instead, your brain is locked in a vault of silence and darkness inside your skull.'

This hallucinated reconstruction of reality is sometimes referred to as the brain's 'model' of the world. Of course, this model of what's actually out there needs to be somewhat accurate, otherwise we'd be walking into walls and ramming forks into our necks. For accuracy, we have our senses. Our senses seem incredibly powerful: our eyes are crystalline windows through which we observe the world in all its colour and detail; our ears are open tubes into which the noises of life freely tumble. But this is not the case. They actually deliver only limited and partial information to the brain.

Take the eye, our dominant sense organ. If you hold out

your arm and look at your thumbnail, that's all you can see in high definition and full colour at once. Colour ends 20 to 30 degrees outside that core and the rest of your sight is fuzzy. You have two lemon-sized blind spots and blink fifteen to twenty times a minute, which blinds you for fully 10 per cent of your waking life. You don't even see in three dimensions.

How is it, then, that we experience vision as being so perfect? Part of the answer lies in the brain's obsession with change. That large fuzzy area of your vision is sensitive to changes in pattern and texture as well as movement. As soon as it detects unexpected change, your eye sends its tiny high-definition core – which is a 1.5-millimetre depression in the centre of your retina – to inspect it. This movement – known as a 'saccade' – is the fastest in the human body. We make four to five saccades every second, over 250,000 in a single day. Modern filmmakers mimic saccadic behaviour when editing. Psychologists examining the so-called 'Hollywood style' find the camera makes 'match action cuts' to new salient details just as a saccade might, and is drawn to similar events, such as bodily movement.

The job of all the senses is to pick up clues from the outside world in various forms: lightwaves, changes in air pressure, chemical signals. That information is translated into millions of tiny electrical pulses. Your brain reads these electrical pulses, in effect, like a computer reads code. It uses that code to actively construct your reality, fooling you into believing this controlled hallucination is real. It then uses its senses as fact-checkers, rapidly tweaking what it's showing you whenever it detects something unexpected.

It's because of this process that we sometimes 'see' things that aren't actually there. Say it's dusk and you think you've seen a strange, stooping man with a top hat and a cane loitering by a gate, but you soon realise it's just a tree stump and a bramble. You say to your companion, 'I thought I saw a weird guy over there.' You *did* see that weird guy over there. Your brain thought he was there so it put him there. Then when you approached and new, more accurate, information was detected, it rapidly redrew the scene, and your hallucination was updated.

Similarly, we often *don't* see things that *are* actually there. A series of iconic experiments had participants watch a video of people throwing a ball around. They had to count the number of times the ball was passed. Half didn't spot a man in a gorilla suit walk directly into the middle of the screen, bang his chest three times, and leave after fully nine seconds. Other tests have confirmed we can also be 'blind' to auditory information (the sound of someone saying 'I am a gorilla' for nineteen seconds) as well as touch and smell information. There's a surprising limit to how much our brains can actually process. Pass that limit and the object is simply edited out. It's not included in our hallucinated reality. It literally becomes invisible to us. These findings have dire potential consequences. In a test of a simulated vehicle stop, 58 per cent of police trainees and 33 per cent of experienced officers failed to notice a gun positioned in full view on the passenger dashboard'.

Things naturally become worse when our fact-checking senses become damaged. When people's eyesight develops

sudden flaws, their hallucinatory model of reality can begin to flicker and fail. They sometimes see clowns, circus animals and cartoon characters in the areas that have gone dark. Religious people have apparent visitations. These individuals are not 'mad' and neither are they rare. The condition affects millions. Dr Todd Feinberg writes of a patient, Lizzy, who suffered strokes in her occipital lobes. As can happen in such cases, her brain didn't immediately process the fact she'd gone 'suddenly and totally' blind, so it continued projecting its hallucinated model of the world. Visiting her hospital bed, Feinberg enquired if she was having trouble with her vision in any way. 'No,' she said. When he asked her to take a look around and tell him what she saw, she moved her head accordingly.

'It's good to see friends and family, you know,' she said. 'It makes me feel like I'm in good hands.'

But there was nobody else there.

'Tell me their names,' said Feinberg.

'I don't know everybody. They're my brother's friends.'

'Look at me. What am I wearing?'

'A casual outfit. You know, a jacket and pants. Mostly navy blue and maroon.'

Feinberg was in his hospital whites. Lizzy continued their chat smiling and acting 'as if she had not a care in the world'.

These relatively recent findings by neuroscientists demand a spooky question. If our senses are so limited, how do we know what's actually happening outside the dark vault of our skulls? Disturbingly, we don't know for sure. Like an old television that can only pick up black and white,

our biological technology simply can't process most of what's actually going on in the great oceans of electromagnetic radiation that surround us. Human eyes are able to read less than one ten-trillionth of the light spectrum. 'Evolution shaped us with perceptions that allow us to survive,' the cognitive scientist Professor Donald Hoffman has said. 'But part of that involves hiding from us the stuff we don't need to know. And that's pretty much all of reality, whatever reality might be.'

We do know that actual reality is radically different than the model of it that we experience in our heads. For instance, there's no sound out there. If a tree falls in a forest and there's no one around to hear it, it creates changes in air pressure and vibrations in the ground. The crash is an effect that happens in the brain. When you stub your toe and feel pain throbbing out of it, that, too, is an illusion. That pain is not in your toe, but in your brain.

There's no colour out there either. Atoms are colourless. All the colours we do 'see' are a blend of three cones that sit in the eye: red, green and blue. This makes us *Homo sapiens* relatively impoverished members of the animal kingdom: some birds have six cones; mantis shrimp have *sixteen*; bees' eyes are able to see the electromagnetic structure of the sky. The colourful worlds they experience beggar human imagination. Even the colours we do 'see' are mediated by culture. Russians are raised to see two types of blue and, as a result, see eight-striped rainbows. Colour is a lie. It's set-dressing, worked up by the brain. One theory has it that we began painting colours onto objects millions of years ago

in order to identify ripe fruit. Colour helps us interact with the external world and thereby better control it.

The only thing we'll ever really know are those electrical pulses that are sent up by our senses. Our storytelling brain uses those pulses to create the colourful set in which to play out our lives. It populates that set with a cast of actors with goals and personalities, and finds plots for us to follow. Even sleep is no barrier to the brain's story-making processes. Dreams feel real because they're made of the same hallucinated neural models we live inside when awake. The sights are the same, the smells are the same, objects feel the same to the touch. Crazy things happen partly because the fact-checking senses are offline, and partly because the brain has to make sense of chaotic bursts of neural activity that are the result of our state of temporary paralysis. It explains this confusion as it explains everything: by roughing together a model of the world and magicking it into a cause-and-effect story.

One common dream has us falling off a building or tumbling down steps, a brain story that's typically triggered to explain a 'myoclonic jerk', a sudden, jarring contraction of the muscles. Indeed, just like the stories we tell each other for fun, dream narratives often centre on dramatic, unexpected change. Researchers find the majority of dreams feature at least one event of threatening and unexpected change, with most of us experiencing up to five such events every night. Wherever studies have been done, from East to West, from city to tribe, dream plots reflect this. 'The most common is being chased or attacked,' writes story psychologist Professor Jonathan Gottschall. 'Other universal themes include falling

from a great height, drowning, being lost or trapped, being naked in public, getting injured, getting sick or dying, and being caught in a natural or manmade disaster.'

So now we've discovered how reading works. Brains take information from the outside world – in whatever form they can – and turn it into models. When our eyes scan over letters in a book, the information they contain is converted into electrical pulses. The brain reads these electrical pulses and builds a model of whatever information those letters provided. So if the words on the page describe a barn door hanging on one hinge, the reader's brain will model a barn door hanging on one hinge. They'll 'see' it in their heads. Likewise, if the words describe a ten-foot wizard with his knees on back to front, the brain will model a ten-foot wizard with his knees on back to front. Our brain rebuilds the model world that was originally imagined by the author of the story. This is the reality of Leo Tolstoy's brilliant assertion that 'a real work of art destroys, in the consciousness of the receiver, the separation between himself and the artist.'

A clever scientific study examining this process seems to have caught people in the act of 'watching' the models of stories that their brains were busily building. Participants wore glasses that tracked their saccades. When they heard stories in which lots of events happened above the line of the horizon, their eyes kept making micro-movements upwards, as if they were actively scanning the models their brains were generating of its scenes. When they heard 'downward' stories, that's where their eyes went too.

The revelation that we experience the stories we read by

building hallucinated models of them in our heads makes sense of many of the rules of grammar we were taught at school. For the neuroscientist Professor Benjamin Bergen, grammar acts like a film director, telling the brain what to model and when. He writes that grammar 'appears to modulate what part of an evoked simulation someone is invited to focus on, the grain of detail with which the simulation is performed, or what perspective to perform that simulation from'.

According to Bergen, we start modelling words as soon as we start reading them. We don't wait until we get to the end of the sentence. This means the order in which writers place their words matters. This is perhaps why transitive construction – *Jane gave a Kitten to her Dad* – is more effective than the ditransitive – *Jane gave her Dad a kitten*. Picturing Jane, then the Kitten, then her Dad mimics the real-world action that we, as readers, should be modelling. It means we're mentally experiencing the scene in the correct sequence. Because writers are, in effect, generating neural movies in the minds of their readers, they should privilege word order that's filmic, imagining how their reader's neural camera will alight upon each component of a sentence.

For the same reason, active sentence construction – *Jane kissed her Dad* – is more effective than passive – *Dad was kissed by Jane*. Witnessing this in real life, Jane's initial movement would draw our attention and then we'd watch the kiss play out. We wouldn't be dumbly staring at Dad, waiting for something to happen. Active grammar means readers model the scene on the page in the same way that they'd model it if it

happened in front of them. It makes for easier and more immersive reading.

A further powerful tool for the model-creating storyteller is the use of specific detail. If writers want their readers to properly model their story-worlds they should take the trouble to describe them as precisely as possible. Precise and specific description makes for precise and specific models. One study concluded that, to make vivid scenes, three specific qualities of an object should be described, with the researcher's examples including 'a dark blue carpet' and 'an orange striped pencil'.

The findings Bergen describes also suggest the reason writers are continually encouraged to 'show not tell'. As C. S. Lewis implored a young writer in 1956, 'instead of telling us a thing was "terrible", describe it so that we'll be terrified. Don't say it was "delightful"; make us say "delightful" when we've read the description.' The abstract information contained in adjectives such as 'terrible' and 'delightful' is thin gruel for the model-building brain. In order to experience a character's terror or delight or rage or panic or sorrow, it has to make a model of it. By building its model of the scene, in all its vivid and specific detail, it experiences what's happening on the page almost as if it's actually happening. Only that way will the scene truly rouse our emotions.

Mary Shelley may have been a teenager writing more than 170 years before the discovery of our model-making processes, but when she introduces us to Frankenstein's monster she displays an impressive instinct for its ramifications: filmic word order; specificity and show-not-tell.

It was already one in the morning; the rain pattered dismally against the panes, and my candle was nearly burned out; when, by the glimmer of the half-extinguished light, I saw the dull yellow eye of the creature open; it breathed hard, and a convulsive motion agitated its limbs. How can I describe my emotions at this catastrophe, or how delineate the wretch whom with such infinite care and pains I had endeavoured to form? His limbs were in proportion, and I had selected his features as beautiful. Beautiful! Great god! His yellow skin scarcely covered the work of muscles and arteries beneath; his hair was of a lustrous black, and flowing; his teeth were of a pearly whiteness; but these luxuriances only formed a more horrid contrast with his watery eyes, that seemed almost of the same colour as the dun-white sockets in which they were set, his shrivelled complexion and straight black lips.

Immersive model worlds can also be summoned by the evocation of the senses. Touches, tastes, scents and sounds can be recreated in the brains of readers as the neural networks associated with these sensations become activated when they see the right words. All it takes is deployment of specific detail, with the sensory information ('a cabbage') paired to visual information ('brown sock'). This simple technique is used to magical effect in Patrick Süskind's novel *Perfume*. It tells of an orphan with an awesome sense of smell who's born in a malodorous fish market. He takes us into his world of eighteenth-century Paris by conjuring a kingdom of scent:

the streets stank of manure, the courtyards of urine, the stairwells stank of mouldering wood and rat droppings, the kitchens of spoiled cabbage and mutton fat; the unaired parlours stank of stale dust, the bedrooms of greasy sheets, damp featherbeds and the pungently sweet aroma of chamber-pots. The stench of sulphur rose from the chimneys, the stench of caustic lyes from the tanneries, and from the slaughterhouses came the stench of congealed blood. People stank of sweat and unwashed clothes; from their mouths came the stench of rotting teeth, from their bellies that of onions, and from their bodies, if they were no longer very young, came the stench of rancid cheese and sour milk and tumorous disease... [the heat of day squeezed] its putrefying vapour, a blend of rotting melon and the fetid odour of burned animal horn, out into the nearby alleys.

1.4

The brain's propensity for automatic model-making is exploited with superb effect by tellers of fantasy and science-fiction stories. Simply naming a planet, ancient war or obscure technical detail seems to trigger the neural process of building it, as if it actually exists. One of the first books I fell in love with as a boy was J.R.R. Tolkien's *The Hobbit*. My best friend Oliver and I obsessed over the maps it contained – 'Mount Gundabad'; 'Desolation of Smaug'; 'West lies Mirkwood the Great – there are spiders.' When his father made photocopies of them for us, these maps became the focus of a summer of blissful play. The places Tolkien sketched