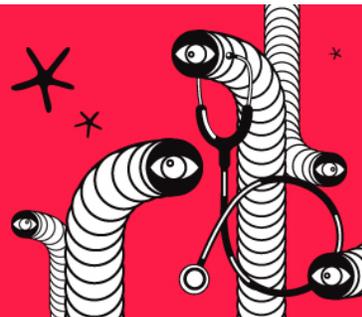


SCOPE

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An Unwilling Agent of Disorder

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Meet James. A 34-year-old stock boy at the local supermarket, James is at war with the universe.

It is a well-known fact to scientists that everything in the universe that is ordered will eventually become disordered. But what does this mean? To better understand this phenomenon, we follow James, who does not buy into this fact, through a typical day in his life. He believes that he alone can bring order to his surroundings, and therein, thwart the universe in its inexorable march toward disorder.

At 6:00 a.m., on a mild Monday in fall, we find James dragging himself out of bed. Upon gaining consciousness, the jumbled mass of his sheets immediately irks him, so the first thing he does is make his bed. When not a crease remains, he is satisfied, and begins to get ready.

For James, grooming is a constant chore. He drags the razor across his face, ridding his jaw of its stubble. He combs his closely shorn hair. With annoyance, he removes a couple of hairs creeping out of his ears and nose. Unacceptable.

Before leaving for work, James dusts his house. Yes, he knows it's weird, as his friends have pointed out. But he's long since accepted himself as a bona fide neat freak. Just the idea of pollen from his houseplants, dander from his cat, textile fibers from his couch, and the tens of thousands of his own dead skin cells that he's constantly shedding, cavorting about his home in his absence, is enough to make James queasy.

He leaves for work, reassured that he has undone the universe's nocturnal attempt to cast both him and his house into a state of disarray as he slept. Content, James begins his daily tally, a running score he keeps between his efforts to impose order and the universe's aim to sabotage them. He thinks of his tally in terms of a concept called entropy. Entropy is simply a way to characterize how much disorder exists in a system. The laws of the universe dictate that this disorder must always increase. As we might guess, James likes to keep the entropy of his systems low. When he awoke, unshaven James and his dusty house were in a state of high entropy. Post-grooming and vacuuming, both man and abode are in a state of low entropy. He calls this: James 1, Universe 0. An auspicious start, or so James thinks.

Here things take a turn for the worse. Sitting in traffic, James decides to apply some cologne—Old Spice, because James is also a traditionalist. Unfortunately, the bottle slips from his hand, and a bunch spills out before he can right it. He tries to sop it up with some napkins, but it's too late. The cologne's fragrance, water and alcohol molecules that were, moments before, tightly bound together, are busy evaporating into and filling the limited air in the car's small cabin. The manly musk is overwhelming in this high entropic state. James has no choice but to crack his window and release the scent's molecules into the outside world where they further disperse. Much more entropy ensues. Universe 1, James 1.



At work, James is assigned to stack the latest shipments of fruits and vegetables. He spends all morning arranging all manner of apples, kiwis, peppers, and more into impeccable series of rows, ascending from large to small in aesthetically mesmerizing, uniform pyramids. Finished, James surveys his work. He officially declares the produce department to be in a high state of order, low state of entropy. James 2, Universe 1.

Just as James is sitting down to a steaming hot cup of coffee on a well-deserved break, he's summoned over the store's loudspeaker to address a sudden outbreak of high entropy among the oranges. A customer removed a load-bearing orange from one of James' pyramids, sending the fruits cascading to the floor where they roll in all directions. Entropy soars in Produce. Universe 2, James 2.

When he finally gets back to his coffee, James finds it cold, its heat having escaped to the break room. The break room's high entropy is James' low point. Universe 3, James 2. James rallies, however. He spends the afternoon fashioning 150 pasta boxes into a resplendent display without incident. At home, he makes quick work of the chaos of leaves littering his front yard, raking them into a tidy pile. He finishes the day in the lead at James 4, Universe 3.

Later that night, James drifts off to sleep with a sense of pride, confident in his role as an agent of order in the universe. But what James doesn't know is that he was doing the universe's bidding all along. In order to lower entropy in a system, as James did via his produce pyramids, pasta-box display, and leaf pile, work must be done. To fuel this work, he turned food from his three meals into energy, the great majority of which was expended as body heat through evaporated perspiration, and all of which was turned into carbon dioxide and water through exhalation, and waste through, well, that's personal.

The release of this energy increased the state of entropy in every environment James occupied, resulting in a true, final tally more along the order of: James 4, Universe 9,567,833...or something like that. You get the idea. The truth is that, as biological organisms, through our constant intake of nutrients and need to breathe in order to fuel the metabolic fire, we are model agents of disorder and dependable raisers of entropy. Even our death, in ceasing these relentless operations, is not a solution. As our bodies decay, our solid tissues turn into liquids and gases, and hungry microbes consume the rest, enlisting our remains as fuel for their own dispersion of heat and waste. What this means for James, in his trivial tussle, is that no amount of work he could do in any given day could ever return him to the exact same ordered state he enjoyed at 6:00 that morning.

While James may be safe in his illusion, scientists know better thanks to all of the problems they've only been able to solve with the knowledge that everything in the universe that can occur, can only do so by increasing its disorder, and thereby, its entropy. It seems to be one of the unbreakable laws of how things work, and is so fundamental that scientists use it to explain concepts like why some chemical reactions happen while others don't, the fact that a perpetual motion machine is not possible, and even the forward motion of time. Perpetual motion machines can't exist, for instance, because, in order for their wheels to turn, they end up disordering the universe a bit, and that disorder comes from the energy expended by the machine. Due to this energy loss, the machine must eventually slow and stop. To fail to do so would violate this law.

And what is time if not a change that can't be turned back? Picture a broken egg piling perfectly back into its shell or a tear flowing back into an eye. This arrow of disorder is irrevocably one way. Otherwise, there would be nothing to stop time from flowing backwards. Some scientists think that this one-way trajectory toward disorder is responsible for the experience of time.

So let this be a lesson to all of the neat freaks and control freaks out there. The order you're imposing is all in your heads. Disorder, and, therein, supreme entropy, is the universe's wish, and we are hardly in a position to hinder. It's best to just embrace it.