On Turning
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Here on the third planet orbiting elliptically around our sun, in a solar system circling the central core of the Milky Way galaxy twenty-five thousand light years away, we forget we are moving at speed, turning on our earthly axis. Our faces bathed in sunlight, then moonlight, now sunlight again.

We are just one of a trillion planets, living in the outskirts of a galaxy of one hundred billion stars. These stars are just like our sun, which spans almost sixty thousand light years across.

Ours is a spiral galaxy, with stars scattered in beautiful arms reaching out from the centre. It spins like a children's toy pinwheel, trailing starlight in its wake. Our sun moves at seven hundred and ninety two thousand kilometres per hour, and we keep up with it on its trip around our galaxy, which takes it two hundred and twenty-five million years. Twenty of these galactic years have passed since its birth. More of the galaxies along our sightline spin towards the left than the right, and no-one knows what set them turning.

At the centre of our Milky Way is the point around which all the stars in the galaxy move, a dark core that doesn't even allow us to see it. It is a black hole so dense, with a large mass and a small volume, that it pulls gas and stars towards it. As they approach its edge, the event horizon, they are swallowed up, turning faster and faster like water being sucked down a drain. So dense is the black hole that not even light gets away from its hold.

We have never seen the shape of our galaxy. But we have sent our Hubble telescope far into the night, beyond the interferences of our atmosphere, and seen pictures of galaxies just like our own. When we look up into the northern hemisphere's night sky, as we have done since we became beings who could ask ourselves questions, we see the whole picture shift around one point in the blackness, a point we called the pole star. It has helped us navigate the waters of the planet for thousands of years.

The movement of stars means the role of the pole star passes from one celestial presence to another — they take it in turns. When finally we could take time-lapse photography of stars during their night trajectories, we saw the smudges of light circling the place in the sky that seemed to stand still.

But nothing really stands still. For us to revolve around our sun in three hundred and sixty-five days, we move at one hundred and seven thousand kilometres each hour.

Our planet not only turns on its axis to give us the day and nights, but tilts too, giving us the seasons. We see the changes in the coming of snow and rain, in buds blossoming and in long, hot days cooling as the leaves on trees turn from green to red to yellow and brown, from life to death. In death, the chemicals that make up each leaf are returned to the soil to be used again.

We are spinning like a top at sixteen hundred kilometres per hour through our days and nights. Our motion gives rise to the winds and to the gyres, the great wheels of water that circulate cold and warmth through paths carved into the seas.

Our gravitational attraction to the moon and sun, and the very spin of the earth, generate the rhythmic movements of our seas. They turn from neap to spring tide, their amplitudes and phases of perigee and apogee turning the minds of the ancients to wondering — likewise the minds of fishers and philosophers.

Our very blood is tidal, the salt content in our veins is the same as that of the sea. Human females bleed in concert with the phases of the moon; moon, month and menses are all related in our language. At least that is how it seems, until you learn that the oestrous cycle of chimpanzees is thirty-seven days, five days for rats and mice. We are all mammals together under the same sun and moon.

Inside the earth's molten iron core, movements churn out an electric current, generating our magnetic field from internal lava flows. Disrupted by a kind of deep quake, our north and south magnetic poles drift and suddenly reverse, turning upside-down. Some say it is due to the movement of the continents and the action at pressure points between continental shelves. Even our landmasses slide, turning over the surface of the planet. Once people thought that the dinosaurs disappeared in response to such a magnetic reversal, as if they suddenly lost the ability to find their way home, but statistics tell us otherwise.

In each cell of our bodies — and those of most creatures great and small — two strands of DNA turn and turn about an axis, like a twisted ladder, coding all of life. As we revolve, we evolve.

The first beings turned slowly into newer ones — *homo erectus* into *homo sapiens neanderthalensis* and *homo sapiens sapiens*, us. Neanderthals made stone tools, probably buried their dead and they cared for each other, evident in skeletons with major healed injuries. Today, in a German Neanderthal theme park you can visit a morphing station, where you can have your photograph taken and digitally altered to recede your chin, slope your forehead and bulge the back of your head. You can turn into a Neanderthal in one holiday afternoon.

Unlike us, Neanderthals stopped their spread across Europe when they reached large bodies of water. Some say they didn't have our thirst for adventure, we who launched ourselves across the ocean in boats, even though we had no idea what might lie beyond the horizon.

We turned the wheel to steer our passage as we sailed over the dark, deep waters, and we used it to harness the energy of a rushing stream. Waterwheels turned to mill seeds, crush ore and pound fibre. When a moving stream was not available, we roped oxen to the stone and turned their movements to our production.

Pictured on a six thousand year-old clay pot excavated in southern Poland is what might be a cart with four wheels, two shafts and a yoke to harness an animal. The remains of an auroch were found with the clay pot; the horns of this now-extinct animal were worn down as if they had been tied with a rope to a yoke. As we turn over the buried horns in our mind, we wonder how they came to be there, buried with the stories that accompanied them.

Horses, which were first domesticated as a source of meat, were ridden and then used to pull carts with solid wheels. Proto-Indo-European tribes became mobile herders and took their language with them on wheels, seeding Germanic, Baltic, Slavic, Celtic, Latin, Hellenic, Iranian and Sanskrit tongues. When solid wheels gave way to spokes, lighter wheeled chariots made for speedy victors in battle and pushed languages even farther afield.

The Olmecs of Mexico only used wheels as children's toys; their their rugged jungle slopes were unsuitable for wheeled carts. Potters turned wheels to form clay vessels. We rolled turned wood pins to make pastry and hand-turned spits to roast meats. Spinning wheels turned fibres into yarn to clothe us.

The yarns we spun ourselves turned the long, cold nights into the warmth of shared story upon story. Ovid sang of metamorphoses, Homer's *The Odyssey* had Circe turning men into swine. We heard tales of spinning straw into gold, turning frogs into princes and water into wine. Kafka's Gregor Samsa woke to find himself turned into what the German translates as a 'monstrous vermin'. Nabakov said he must have been a beetle, as he had wings.

The bards had turned for inspiration to the natural world, where caterpillars turn into butterflies, tadpoles into frogs and flowers into fruit. We celebrate fertility with maypole dances, turning around a brightly ribboned pole, which stands for an ancient tree in a forest glade.

We turn over the leaves of a book, and over a new leaf when we decide to change the way we behave towards others. If we have turned a blind eye or a deaf ear, or have turned green with envy, we might turn towards those we have turned against in the past. If things don't go well we can turn up our noses and turn on our heels, turn tail and leave.

We turn a profit in our commerce and our bodies turn over new cells every day. The turnover of cells means we rarely remain who we were when we began. Our primitive bone-marrow cells become mature and turn our blood into a fighting force against invaders.

Inside our very atoms, and those that make up every element in the world, electrons turn in a cloudy haze around a nucleus of protons and neutrons. In our simplest hydrogen atom, the centrifugal force of the spinning electron keeps the two particles from coming into contact with each other, just as the earth's rotation keeps it from plunging into the sun.

If we break up the atom even further to look inside, it stops being a hydrogen atom or a helium atom or a sodium atom; it is simply the parts of its sum. It is like a watch that ceases to be a watch when we take it apart and line up all its pieces on a bench. We have the parts for a watch, but it no longer looks like a watch and it cannot tell us the time.

The Large Hadron Collider at CERN, the European Organisation for Nuclear Research, just outside Geneva, Switzerland is the biggest instrument that humans have ever made. On the twenty-seven kilometre round track, buried one hundred metres deep in the earth and crossing the Franco–Swiss border, two beams of subatomic particles called hadrons are sped up with particle accelerators and shot in opposing directions. When they collide on their journeys around the track, the exploding debris is recorded with particle detectors.

CERN is trying to recreate the conditions that began our universe and to detect the particles predicted by our current understanding of the physics of the cosmos. In July 2012, a little piece of history was made when the signature of a tiny particle called the Higgs boson was detected in the mix. These particles are what give atoms their mass and are why mass was formed in the Big Bang, the explosion that created space and made the gas that seeded the galaxies. It sent them turning, turning, turning, hurtling across the darkness, towards the place where all the galaxies in our part of the universe seem to be circling, turning in a dark flow around the Great Attractor and beyond.

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