

ENUMERATION

6 Ways to Calculate a Universe in Flux

JAMIE ZVIRZDIN

1 Arithmetic. Children learn early to call chaos to order, to safety-pin themselves to the cloth of the cosmos. I watch my two-year-old son, Max, develop this survival skill in curious ways. On the airplane leaving the Marshall Islands, he is enthralled by a calculator, his comfort toy as we move to our next diplomatic assignment. He's pressing *Enter* over and over, but he's quiet and I can sleep. In an empty apartment in Montreal, my husband and I listen in shock as our son cheerfully recites the powers of two up to 2^{27} —from 2, 4, 8, 16, up to 134,217,728. The same quiet power of two assembles the 2^{44} cells of newborns. Max cries when his calculator breaks.

2 Area. Incrementing by one on his new calculator, three-year-old Max lists 204 countries in alphabetical order, from Afghanistan to Zimbabwe. Countries, superimposed on continents, are unnatural, shifty, violent: they erupt like volcanoes at the borders. Max's preschool teacher pulls me aside and suggests we test Max for autism. In Canada, the second largest country in the world geographically, the thirty-third country on Max's list, we make space for early intervention.

3 Composition. I marvel that 99 percent of my four-year-old is made from oxygen, carbon, hydrogen, nitrogen, calcium, and phosphorus, elements forged in the wombs of stars. On the plane to Nicaragua, our third assignment, my star-child recites the 118 elements of the periodic table, both the stable and the unstable, like a devoted string of Hail Marys.

4 Light. There are eighty-eight Western constellations, eighty-nine if you count both the head and tail of the Snake as it coils around the thighs of Ophiuchus, the Serpent Bearer. I bring my son to work, where he helps my university students

study for their constellation quiz. In Latin, he names all the welkin-walking animals like an astrophysical Adam: Crab, Lion, Peacock, Scorpion. He invokes scientific instruments, parts of ships, gods, monsters.

5 Sound. Max, now seven, learns the names of 728 North American birds from the book *Bird Songs Bible*; the accompanying audio player provides the delicate chainsaw of the Atlantic puffin, the sweet Taboo-buzzer tones of the red-breasted nuthatch. Despite my headache, I understand that sound, identified, is comforting given the cacophony of our lives. We will soon learn the difference between fireworks and gunshots, and I will wish for the birds again.

6 Distance. Weeks before Nicaragua rends itself in violence, Max and I re-create the solar system. The sun is a grapefruit I place on the sidewalk in our Managuan neighborhood, and I hold Max's hand as we walk a thousand meters down the dusty street past Pluto to Eris, our sweat dripping across space-time. When we return, someone's taken our grapefruit, and Max cries. I tell him we must share the sun with everyone. On the plane as we evacuate, calculator in hand, Max whispers planetary distances to himself and smiles. Though airborne, he's grounded in the firmament that formed him, and side by side we'll count the universe until all calculators break.

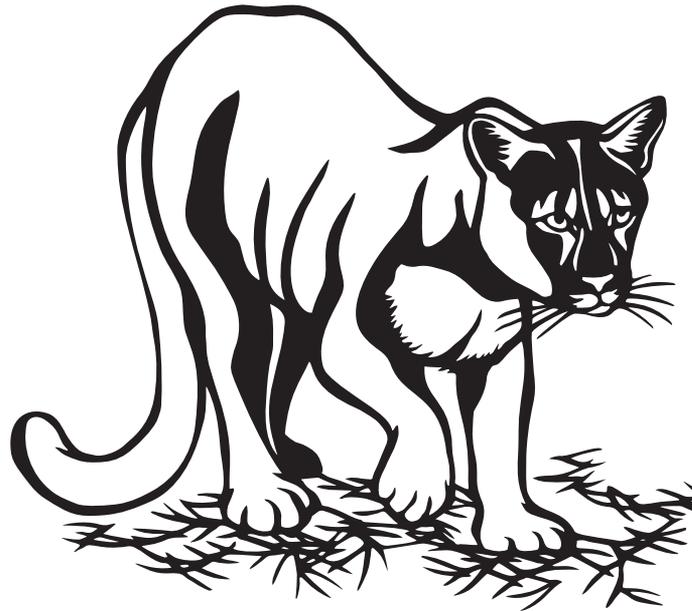
Jamie Zvirzdin researches ultrahigh-energy cosmic rays for the University of Utah and teaches in the Science Writing master's program at Johns Hopkins University. She previously taught astronomy at the American University of Managua and the Pierre and Marie Curie School in Nicaragua.

What would you add to this list? Tell us at www.orionmagazine.org/enumeration.

Slough

That you want to slip deep
into the forest. Pine needles
like the sharpest animal's hair,
a lake at the end of the trees'
illusion tunnel. That the fish
would flip delightedly out
of the water's vast surface.
That the cougar and the bear.
That the shriek of the American
pika, volcanic ash, a yip across
the mountains, a calling. That
you admit this, a doom rustled
to the leafy floor. You are molting,
exuviating what was once safe.
It is not catastrophic to be free.

—Ada Limón



ARTWORK BY NIKKI McCLURE

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ORION BLOG



Essentially Human

For over a thousand years, humans have experimented with essential oil. Surrounded by a landscape of complex aromas, our instinct is to look for a single source from which they derive; to extract them from the bodies of plants; to reduce them to a potency never seen in nature; and to trap them in small bottles. But what happens to our biology, and our identity, when the bottles are opened? In this issue of *Orion*, we follow the movement of essence across porous borders, through the machinery, and into the sudden dark.