

MARTIN GARDNER_____.

Left or Right?

Major Karston picked up the soggy, crumpled sheet of yellow paper and opened it carefully. His hands were shaking. Would the writing, scribbled hastily in pencil a week before, read from left to right or right to left? It was odd or even, plus or minus, a fifty-fifty chance like the toss of a coin—but the destiny of Earth was in the balance.

Our spaceship had left the earth two months ago on a crucial military mission. A surprise attack from one of the primitive cultures in the galaxy—inhabitants from the Zeta-59 planetary system—had caught the Earth in a state of woeful unpreparedness. Our stratospheric defense network had kept most of their crude missiles from getting through, but one of the rockets had slipped past, landed, and totally demolished the giant munitions plant in Alaska.

The factory had been engaged primarily in the manufacture of helixons, small but intricate spiral-shaped devices that form an essential part of our atomic shells and warheads. Its destruction had created a fatal shortage. Our only hope lay in the immediate import of a new supply.

The nearest source of helixons was a planet in the Omicron-466 system, colonized several centuries ago by our own people. It was halfway across the galaxy, but with modern methods of space travel, taking advantage so to speak of fourth-dimensional shortcuts, the trip could be made in a few weeks. Major Karston and I were chosen to command the mission.

Our cargo-transport ship, carrying a crew of seventy-five men

Left or Right

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and officers, had little difficulty evading the enemy ships that hovered outside the Earth (they were clumsy, rocket-propelled types with virtually no speed or maneuverability). The trip to the colony planet was relatively uneventful. But on our way back, while we were cruising through an uncharted portion of the galaxy, the sergeant on radar watch carelessly dozed off and the ship was struck a glancing blow by a small meteor. The blow catapulted the vessel momentarily along the fourth spatial coordinate, flipping the ship over in a series of somersaults before it dropped back into our three-dimensional continuum. Luckily no one was seriously hurt, but there had been some damage to the steering gear that made it necessary to land for repairs.

We finally located a small planet that circled about a pair of moderately sized suns, and managed a successful landing. While the crew worked feverishly on the repairs, Major Karston and I, wearing our oxygen bells and voice transmission devices, sat on the edge of a low ridge of black rock where we could watch the crew.

Suddenly Karston raised his fist, beating it violently against the glass in front of his forehead. "My God, Reilly!" he shouted. "It never occurred to me until now."

I turned and squinted at him, trying with my hands to block off the blinding light from the two suns back of his head. "What never occurred to you?"

"How many times did the ship rotate before it dropped back into our space?" he asked.

I shook my head and said, "I was too frightened to remember anything."

Major Karston's lower lip pulled on his moustache. His expression was grim. "If we turned an even number," he continued slowly, as though trying to visualize something in his mind, "we're okay. If not—" He shuddered.

"I don't understand."

"Look, my dear lieutenant," he said impatiently. "Don't be an imbecile. If you turn a two-dimensional figure on its back, it reverses the right and left sides. Right?"

"Right," I said.

"But if you turn it twice, it's the same as it was before. In other words, an odd number of turns reverses it. An even number doesn't."

"I follow," I said.

"Think back to your high-school courses in non-Euclidean manifolds," he went on. "If a three-dimensional spaceship somersaults through the fourth coordinate, turning over an odd number of times, what happens? Remember Lieutenant Semer's accident a year ago? His heart's still on the wrong side, and he hasn't even learned to read yet."

I was beginning to get the idea. "You mean that maybe our ship, including all of us, got reversed yesterday? I don't *feel* reversed."

"Of course not," he said sharply. "Your eyes, the sides of your brain, everything reverses. You may be left-handed now, but with the brain reversed you'll feel you've been that way all your life. Of course every object in the ship would have been changed too, so we haven't anything to check against."

"Until we get back, I suppose," I said. "Then if we've been reversed everything *there* will seem backward—like in a mirror."

"It isn't funny," Karston said. "Our helixons are of the plus type. That means they twist clockwise. If we return with a shipment of eight billion counterclockwise helixons, they'll be as much use to the high command as eight billion rubber thumbtacks."

Invisible fingers beat a tattoo along my backbone. "Isn't there any way we can find out?" I said.

"No. There's nothing we can do. This planet obviously hasn't enough atmosphere to support life, and even if it were inhabited by intelligent creatures it wouldn't do us any good. There's no way we could make them understand what our language means by 'left.' We haven't any charts for this region, so we can't check by star patterns. We can't learn anything from chemical tests of substances here because all the natural compounds and crystals with asymmetrical molecular structure exist in two mirror-image forms. And there aren't any physical tests because all the laws of physics are symmetrical."

"What about the left-hand rule?" I said. "The north pole of a compass always points left if you hold it under a current moving toward you. We can set up a current, and if our compasses have been reversed, the north pole will still point left. But if it seems to us to point right, we'll know we've been changed."

Karston stood up and shook his head so violently that the bell rattled. "You should review your elementary magnetism, Reilly. If

our compasses are reversed, their entire atomic structure, electron spin and all, will be reversed. They'll orient themselves by a 'right-hand rule.'"

"What *can* we do?"

He spread his arms in a hopeless gesture. The sky behind him was a deep scarlet now from the setting suns, and two long shadows branched out from his feet along the dark rocky surface. "We'll have to hope for the best. Even if we are reversed—and we'll find out soon enough when we reach a charted region—there isn't any way we can somersault back again without running the risk of smashing the ship. And it's too late to go back for another shipment."

Suddenly a thought struck me. "We ejected a load of garbage and wastepaper just before the crash. If we could locate it and thaw it out, we could find those notes you made, and—"

I didn't have to finish. Karston was whacking me on the back of my space jacket and telling me I wasn't as stupid as he suspected.

We finished the repairs and shoved off the following day. After returning to the vicinity of the crash, it didn't take our radar division long to locate the batch of refuse we had left suspended in space. The material was close to absolute zero, so it was hours after we retrieved it before it had warmed enough to be examined.

Major Karston picked up one of the wadded balls of moist yellow paper. They were notes he had made for a speech in which he planned to announce the successful completion of our mission.

With trembling fingers he smoothed the paper flat and I bent over his shoulder to look. I think my heart was pounding louder than our atomic motors. Would we be able to read it? Or would it be in mirror writing, like the "Jabberwocky" in that ancient classic about the little girl who walked through the looking glass?

Odd or even, left or right, a fifty-fifty chance like the flip of a coin—but the fate of our people was hanging in the balance!