



MachineForge

Meet the Cast

STANDARD EDITION

Spark & Anvil

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This book collects 5 chapter books from the MachineForge cast — each character embodies a different curricular primitive; together they teach the full subject.

Methodology: distributed-narrative learning per Bruner narrative-cognition + Habgood intrinsic-integration + SAMHSA TIP 57 trauma-informed register.

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This is Volume 1 of 2 of the *MachineForge* — *Meet the Cast* series; each volume is a complete standalone book you can read on its own.

For everyone who learns by hearing a story first.

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Introduction

The MachineForge cast was authored to embody the curriculum, not decorate around it. Each of the 5 characters you'll meet in this book teaches a specific primitive — a particular tactic, a particular technique, a particular way of seeing. Together they form an ensemble: the cast IS the curriculum.

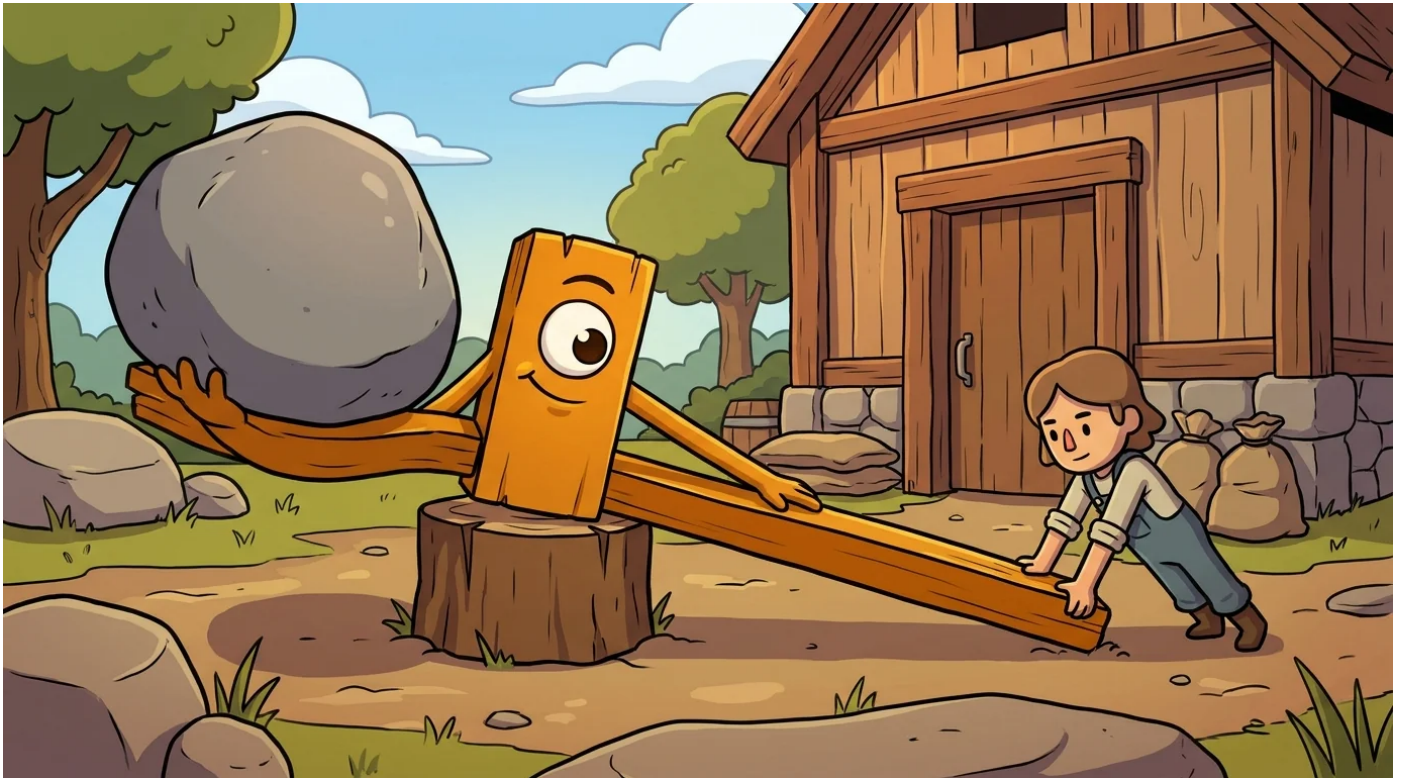
Read in any order. Each chapter stands alone.

Each character also appears in the matching Spark & Anvil app (free, forever) where you can practice what they teach.

— *The editors at Spark & Anvil*

Pry

*LEVER — *push longer to lift heavier. the trade between force and distance.**



The stone by the granary door was bigger than the apprentice who wanted it moved.

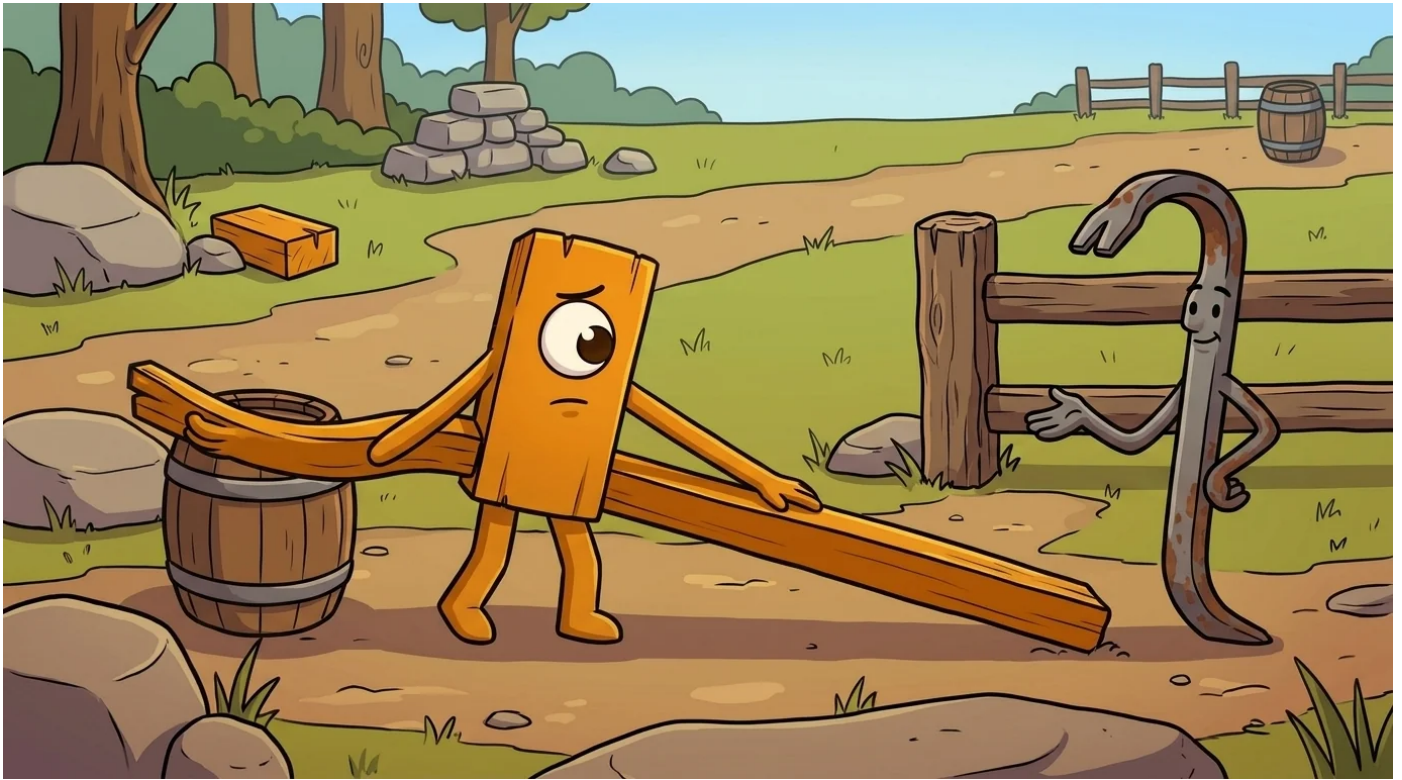
Pry lay across a small wooden block, an amber plank with one long arm and one short one and a single round eye set exactly at the middle, where it balanced. The eye was Pry's pivot. Pry rocked gently on the block, long arm dipping, short arm rising, long arm dipping again — a slow seesaw, waiting.

"Roll the stone onto my short side," Pry said, its voice smooth as sanded wood.

The apprentice heaved the great stone onto the short arm and stepped back, doubtful. Pry only settled, patient. "Now lean on the long side. Not hard. Long."

The apprentice pressed down on the far end of the long arm and walked it slowly toward the floor — a long, easy push — and across the pivot, the short arm swung up, and the stone that outweighed the apprentice lifted clean off the ground.

"Push longer," Pry said, pleased, "to lift heavier."

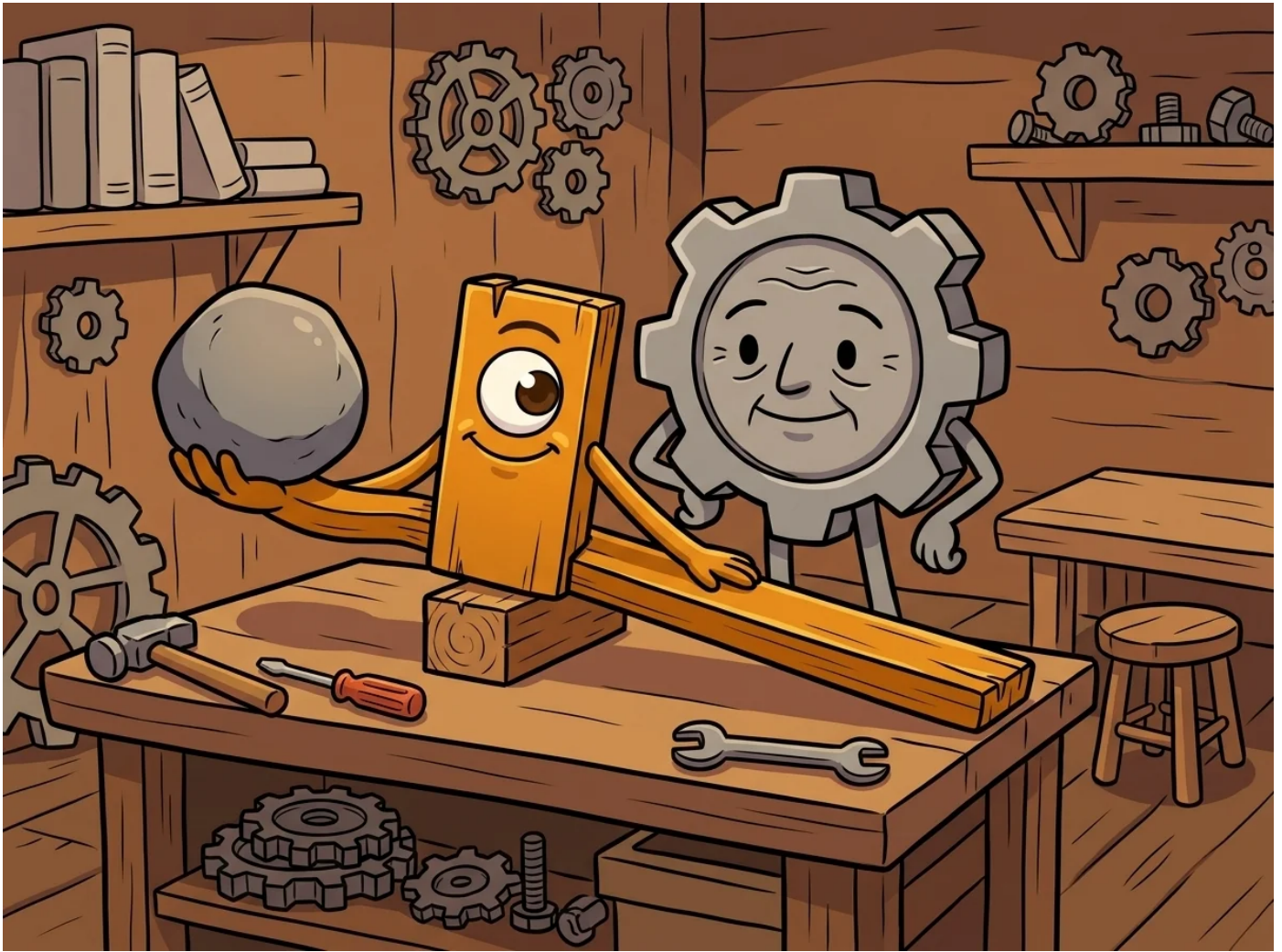


Pry had learned that sentence the hard way, back when it was only a fresh plank leaning against a fencepost, certain that lifting meant straining.

An old crowbar, bent and rusty and wise, had watched it try to buck a barrel straight up and fail. "You're pushing short and hard," the crowbar said. "Push long and gentle instead. Reach out past your pivot."

Pry did not understand until it tried. It slid its pivot close to the barrel, so its own long arm stretched far away. Then it pushed that long arm down a great distance — and the barrel, on the short side, rose only a hand's width, but it *rose*, easily, without a strain anywhere.

Something turned over quietly inside Pry. The push had not grown bigger. It had grown *longer*, and length across a pivot became strength on the other side. It hadn't gotten anything for free — it had traded a long gentle journey for a short powerful one. Same effort, different shape. That trade, Pry decided, was the most honest kind of strength there was.



Pry carried the idea to the MachineForge, the workshop where machines that knew how they worked could earn a bench. Cog, the old grey gear who kept the place, met it at the door.

"Show me," Cog said. He set a round river-stone, far too heavy to lift bare-handed, at the end of Pry's short arm.

Pry slid its block until its long arm reached far out across the floor. It let its own weight roll slowly down the long arm — and the river-stone eased up into the air on the short side, gentle as a held breath, and hung there.

Cog watched the stone float. His fulcrum-old eyes crinkled. "No heaving," he said. "No magic word. You just moved the pivot and let the geometry do the lifting." He tipped his head toward the empty bench. "That's the whole idea. There's room here for you."

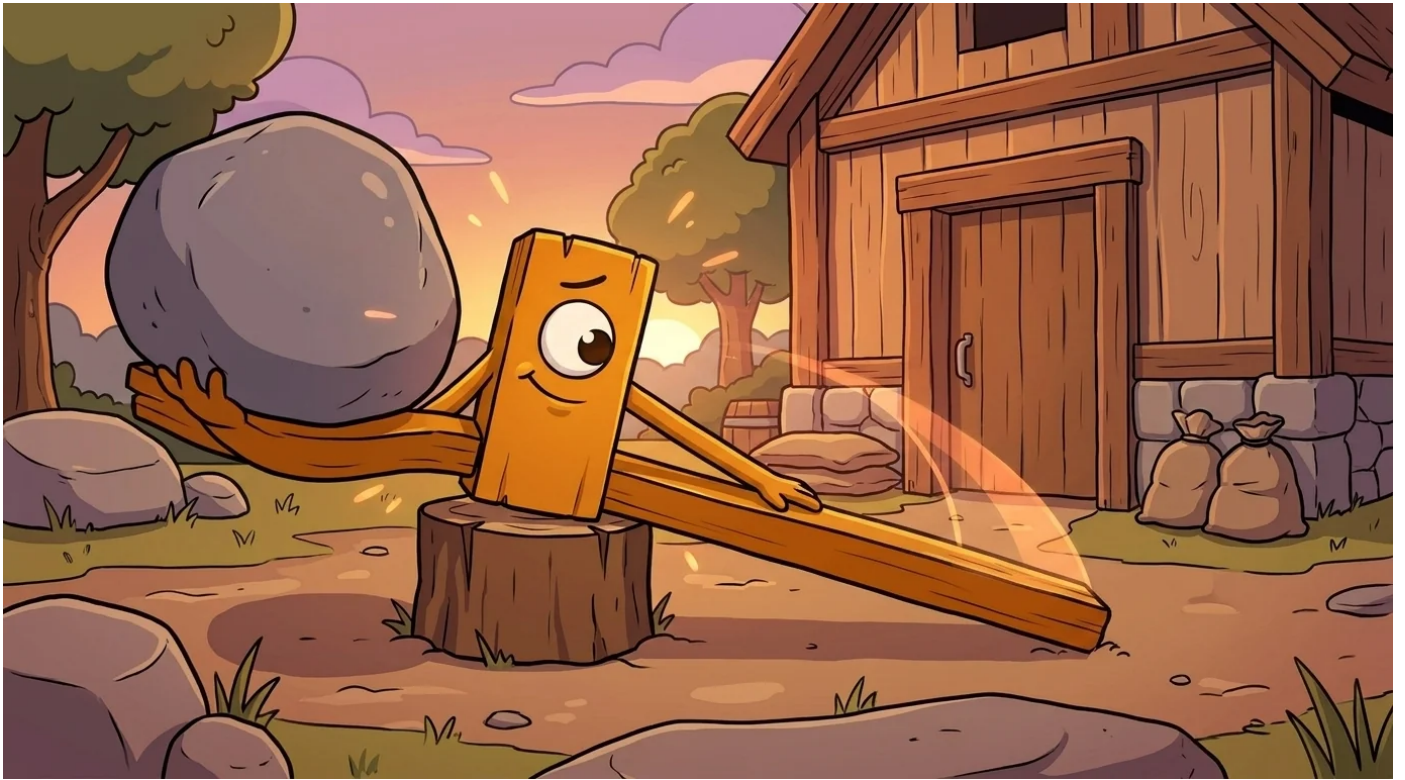


On lesson day the apprentices crowded Pry's bench, and a small one named Pip crowded closest, staring at a stone he clearly thought was hopeless.

"Set the stone on my short arm," Pry told him. Pip rolled it on; it looked immovable. "Now press my long arm down. Slow. All the way."

Pip pressed. He walked the long arm far, far down — much farther than the stone would ever travel — and Pry pivoted around its eye, and the short arm carried the great stone up into the light. Pip's mouth fell open. He looked at his own two hands.

"You didn't get stronger," Pry said kindly. "You pushed a long, patient way, and I handed you a short, powerful lift in return. That's the trade — force for distance, distance for force, and the work you did stays exactly the same. It only changed its shape across my pivot." Pry rocked once more, gently. "Not magic, Pip. Geometry."



Pip stepped back and stared at the stone hanging in the air — the stone he had been sure was too heavy for anyone his size.

A warm, startled happiness spread through him, the kind that makes you stand a little taller without deciding to. And Pry, balancing quietly on its block, felt it too: that soft, spreading joy of watching someone discover they were stronger than they had believed, if only they leaned the long, patient way instead of heaving all at once.

That feeling, Pry knew as the workshop settled into evening, was the real reason it loved to teach. Not the stone. The face of the child who lifted it.

Hoist

*PULLEY — *pull down here, watch it go up there. redirecting force changes direction; combining pulleys multiplies force.**



The bucket of rocks sat at the bottom of the workshop well, and it was heavy, and it was very far down.

Hoist rolled to the well's edge — a round little creature the color of warm bronze, with a rope-groove running all the way around its middle like the crease in a coin. A rope already hung over Hoist's grooved rim, one end tied to the bucket, the other end lying loose on the ground.

Hoist took the loose end and pulled *down*. And the bucket, far below, rose *up*. Hoist grinned. Pull one way, and the load goes the other. That never stopped delighting it.

By the time the bucket reached the rim, though, Hoist's arms were burning. "Up," it panted, "but oof." The direction had changed. The weight had not. Hoist had pulled just as hard as the rocks were heavy — and it filed that ache away to think about later.



Hoist had figured out the *later* part on a windy dock, long ago, watching sailors.

One sailor was trying to raise a sail with a single rope over a single wheel, hauling with all their weight, going red in the face. Another sailor laughed, threaded the rope through a cluster of wheels — down, up, down, up, four times over — and then lifted the same sail with two fingers.

Hoist had wobbled right off the piling in astonishment. It rolled over to the cluster of wheels. "How?" it demanded. "Same sail. Same wind. Two fingers!"

The sailor tapped the four strands of rope now sharing the sail's weight. "Four ropes hold it up instead of one," they said. "Each rope carries a quarter of the load — so you only pull a quarter as hard." Then they tugged, and tugged, and tugged a long, long way. "You just pull four times as much rope."

Something clicked in Hoist so hard it spun. The work never vanished, it understood. You just spread it thin across many ropes and paid it back in distance instead of in aching arms.



Hoist brought that idea to the MachineForge, still buzzing with it. Cog, the old grey gear who ran the workshop, listened, then rolled two setups out onto the floor and folded his arms.

"Show me the difference," Cog said.

Hoist set the first: one fixed wheel, one rope, the heavy bucket. It pulled down; the bucket rose; Hoist ended up puffing. "Direction changed," it admitted, catching its breath. "Nothing else did."

Then Hoist rolled up the second setup — a block-and-tackle, four wheels, four strands of rope all holding the same bucket. It gripped the rope and pulled, easy as anything, and the bucket floated up while Hoist barely leaned. "Same bucket," it said, delighted, "but now the four ropes share it, so I pull light." It pointed at the great length of rope now piled at its feet. "The cost is right there. Four times the rope."

Cog's mouth twitched toward a smile. "You didn't call it magic," he said. "That's why there's a place for you here."



The apprentices gathered when Hoist rigged the flag rope up to the workshop rafters.

"Watch," Hoist said, and pulled down on the rope. High above, the flag climbed *up*. "That's the first trick — I don't make the flag lighter, I just turn your down-pull into an up-lift. Handy when the thing you want to move is over your head." It let the flag back down.

Then it clipped in a second, movable wheel. "Now the second trick." It pulled, and the flag rose while Hoist hardly strained. "Feel it? Two ropes are holding the flag now, so each one holds half. Half the pull." It gave the slack rope a wiggle. "But I pull twice as far. That's always the bargain. Less force, more distance — never something for nothing."

A tall apprentice named Bran squinted up at the ropes. "So how do you know how much easier it'll be?"

"Count the ropes doing the lifting," Hoist said. "Two ropes, half the effort. Four ropes, a quarter. Just count." Bran counted, and Hoist watched Bran's eyes go wide, and it wobbled with the sheer joy of a thing landing right.



When the workshop closed, Hoist stayed a moment by the quiet rigging, ropes hanging still in the dark.

It thought about the first bucket, and the burning arms, and how it had believed for a while that lifting simply had to hurt. And it thought about the four-rope cluster, and the two fingers, and the sailor's easy laugh.

The work had been the same both times. Nothing had been created, nothing destroyed — only moved around, from short and heavy into long and light. Hoist rolled a slow, contented circle on the workshop floor. That was the feeling it chased: not the lift itself, but the small bright *click* of realizing the heavy thing had been doable all along, if you only shared it out the right way.

Ramp

*INCLINED PLANE — *climb the long slow way; less force, same work. the slope spreads the work over distance.**



The grain sack weighed as much as two apprentices, and the loft door was a full story overhead.

Ramp lay across the granary floor, a long flat plank the color of warm tan and cream, one end resting on the ground and the other tilted up toward the loft. When an apprentice tried to hoist the sack straight up the ladder, they made it two rungs and sagged.

"This way," Ramp said gently, and shrugged its long surface into a smoother, gentler slope. "Don't lift me straight up. Walk me up the slope."

The apprentice dragged the sack onto Ramp's low end and pushed. The sack slid up the long incline, slow, but easy — a soft steady push instead of a straining heave — and reached the loft at last. It had climbed exactly as high as the ladder would have taken it. It had simply taken the long, patient road to get there.

"Climb the long slow way," Ramp murmured, well satisfied. "Less force, same work."



Ramp had not always trusted the long way. When it was new it felt small next to the loud machines — the pulleys that flew, the levers that heaved. Nobody, it thought glumly, even called a ramp a machine.

An old mountain switchback set it straight one evening. The switchback zigzagged up a cliff, patient and endless. "Watch a cart come up me," it said.

Ramp watched. A cart that could never have gone straight up the cliff instead wound up the gentle zigzag, a little at a time, and reached the top without ever straining. And Ramp understood, with a slow warm certainty: the height had not been cheated. The work had not vanished. It had been *spread out* — smeared thin over a long distance, so that no single moment of it was too hard.

Ramp stopped feeling small after that. The long slow way, it decided, wasn't the humble way. It was the *clever* way, so clever most people used it every day and never noticed they were leaning on a machine at all.



Ramp came to the MachineForge quietly, half-expecting to be waved off as too simple to bother with. Cog, the old grey gear who ran the workshop, did not wave it off. He rolled a stone barrel to its foot.

"Show me," Cog said.

Ramp made itself steep first. The barrel needed a hard shove to climb even a little. Then Ramp softened its angle, long and gentle — and the same barrel rolled up with a light, easy push, all the way to the same height, just over a far longer path.

"Same barrel, same height," Ramp said. "Steep costs more push over less distance. Gentle costs less push over more. The work never changes — only how you spend it."

Cog set a hand on Ramp's low end, the way you'd rest a hand on a good horse. "People forget you're a machine," he said. "That's their mistake, not yours. There's a bench here for the machine that built the pyramids."



On lesson day Ramp brought out its favorite little red ball for the apprentices.

It steepened itself and rolled the ball up the sharp slope. *Whizz* — the ball shot up fast, but the push it took was enormous. Then Ramp flattened to a gentle grade and rolled the same ball up again. *Slowly, slowly* it climbed, but the push was feather-light.

"Same ball," Ramp said. "Same spot at the top. Different push, different path." A quiet apprentice named Del had been hanging at the back, and Ramp turned to them. "Watch for me out there. Wheelchair ramps at every door. The spiral in a parking garage. A mountain road's switchbacks. A water-slide. All of them, me — spreading a hard climb out into a gentle one." Del's eyes lifted, noticing suddenly, and Ramp felt seen in a way it rarely was.



When the workshop emptied, Ramp lay long and low across the floor in the last of the light.

It thought about the grain sack and the switchback and the red ball, and about all the doorways in the world with a gentle slope cut into the curb that nobody ever thanked. It did not mind so much anymore.

A soft, steady contentment settled along Ramp's whole flat back — the calm of the quiet worker who knows the truth even when no one says it aloud. The long slow way was the kind way, and the clever way, and most days the easier way too. And every so often, like tonight, someone finally looked up and noticed. That noticing, Ramp thought, was worth every unhurried climb.

Spoke

*WHEEL-AND-AXLE — *one turn of the hub, many turns of the rim. radial mechanical advantage.**



Spoke is a living **wheel-and-axle** — a chunky, cartoon-like creature, warm-grey and cream, with a clear hub in the middle and spokes reaching out to the rim. Nobody ever calls Spoke "he" or "she." Spoke is just... Spoke.

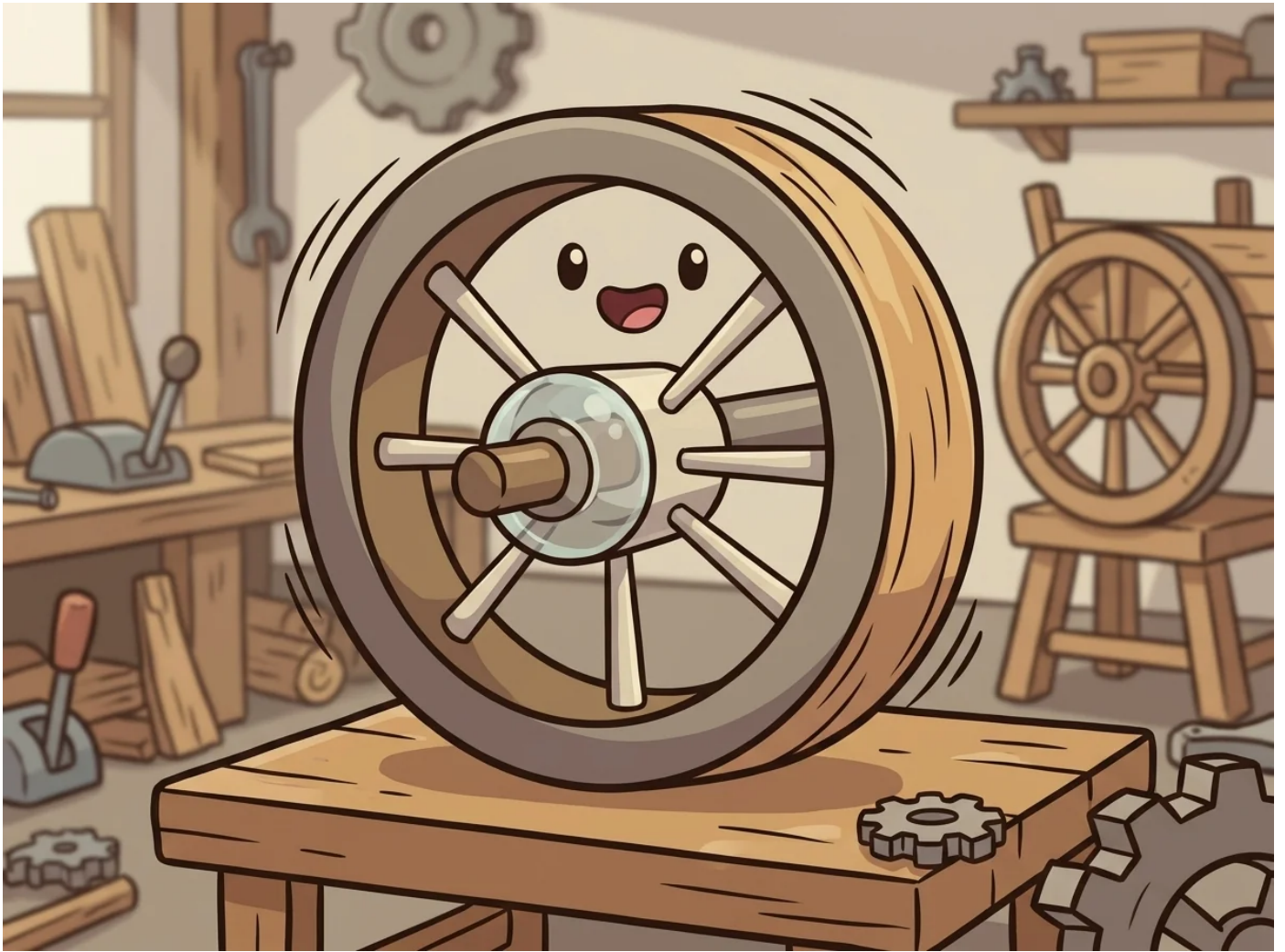
Spoke loves to spin — and loves, even more, to show how the spin *works*. "One turn of the hub, many turns of the rim!" Spoke chirps. That's Spoke's whole craft: the **wheel-and-axle**, a wheel fixed to a rod (the axle) through its middle. Push the big *rim* and the little *axle* spins fast — that's trading power for speed. Push the little *axle* and the big *rim* turns with huge force — that's trading speed for power. "It's a secret trade," Spoke says, wiggling a spoke. "Force for distance, in a circle — the very same idea as Pry's lever, just curved around."



Spinning, for Spoke, is pure joy — the light, happy lift of *starting to turn*.

But Spoke wants you to see it's *clever*, too, not just fun. "Most people think a wheel-and-axle is only for *rolling*," Spoke says. "It's so much more." Push the hub slowly and the rim races around — power becoming speed; lean on the rim slowly and the hub turns mighty — speed becoming power. Same machine, run either direction, physics unchanged.

"And here's the trick that beats a plain roller," Spoke adds, puffing out its spokes. "A log roller just rolls, dragging with friction. But a wheel spins on an *axle* with tiny bearings — friction almost *vanishes*. Much, much better." That one idea, Spoke knows, changed the world.

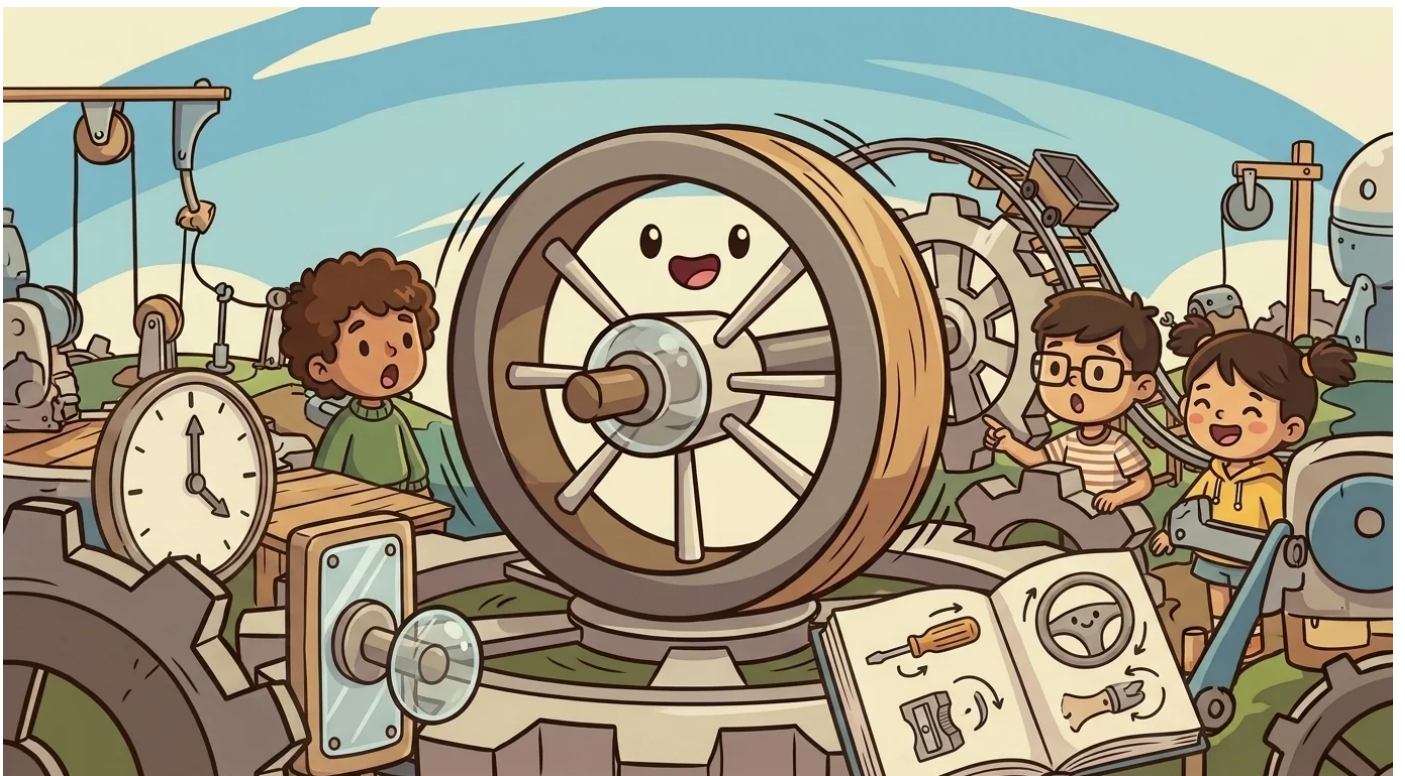


Spoke was born on the workshop's wheelwright's bench — the place where wheels are built.

"Wheel-and-axles made *everything* that rolls or steers," Spoke says proudly. "Carts, carriages, bicycles, cars — and long before those, the potter's wheel, thousands of years ago." One day Cog, a wise old gear and Spoke's mentor, rumbled: "Spoke — what *is* a wheel-and-axle?" Spoke didn't hesitate: "One turn of the hub, many turns of the rim — radial mechanical advantage!" Cog smiled. "You understand. You are appointed. Go teach the world."



In the workshop, Spoke loved to prove it. Turning its hub slowly, the rim zipped around: "I turn the small hub, the big rim flies — power into speed." Pushing the rim slowly, the hub spun with startling force: "I push the big rim, the small hub gets *strong* — speed into power. It works both ways!" Then Spoke rolled from example to example, and *this* was the fun part — showing that wheel-and-axes are *everywhere*. "This doorknob! You turn the big knob (the wheel), it turns a tiny rod (the axle), the latch lifts — almost no effort. A screwdriver: the fat handle is the wheel, the shaft the axle, so a gentle twist drives the screw with force. A faucet handle. A car's steering wheel. An old well-crank — a *windlass*. All wheel-and-axes! And gears," Spoke whispered, "are just many wheel-and-axes working together — big gear, small gear, different speeds, different powers." Once you learn to see it, Spoke promised, you can't *stop* seeing it.



"I never knew a *doorknob* was a machine," a kid breathed. "It's so much cleverer than it looks."

"They *all* are," Spoke beamed — and there it was, the thing Spoke lived for: the bright little spark of surprise on a kid's face as an ordinary, ignored thing suddenly turned *clever* before their eyes, the whole world quietly revealing its hidden gears. Spoke gave one last happy spin and felt the warm, glowing delight it always felt in that moment — that bright, shared joy of a kid seeing the hub-and-rim trick light up everywhere at once. That glowing, shared, the-world-just-got-cleverer joy — Spoke's very favorite feeling in the whole wide, spinning world — was exactly why Spoke loved to teach. "Hub and rim!" Spoke declared. "Radial mechanical advantage!"

Auger

SCREW — *round and round becomes step and step. spiral inclined plane.*



In the corner of the MachineForge workshop, a small bronze creature turned slowly against a block of pine, and the whole room went quiet to watch.

Auger did not hurry. It fit the tip of its threaded body to the wood and began to spin — round, and round, and round. With each full turn it sank a little deeper into the block. Not far. Barely the width of a fingernail. But it never stopped, and it never slipped back.

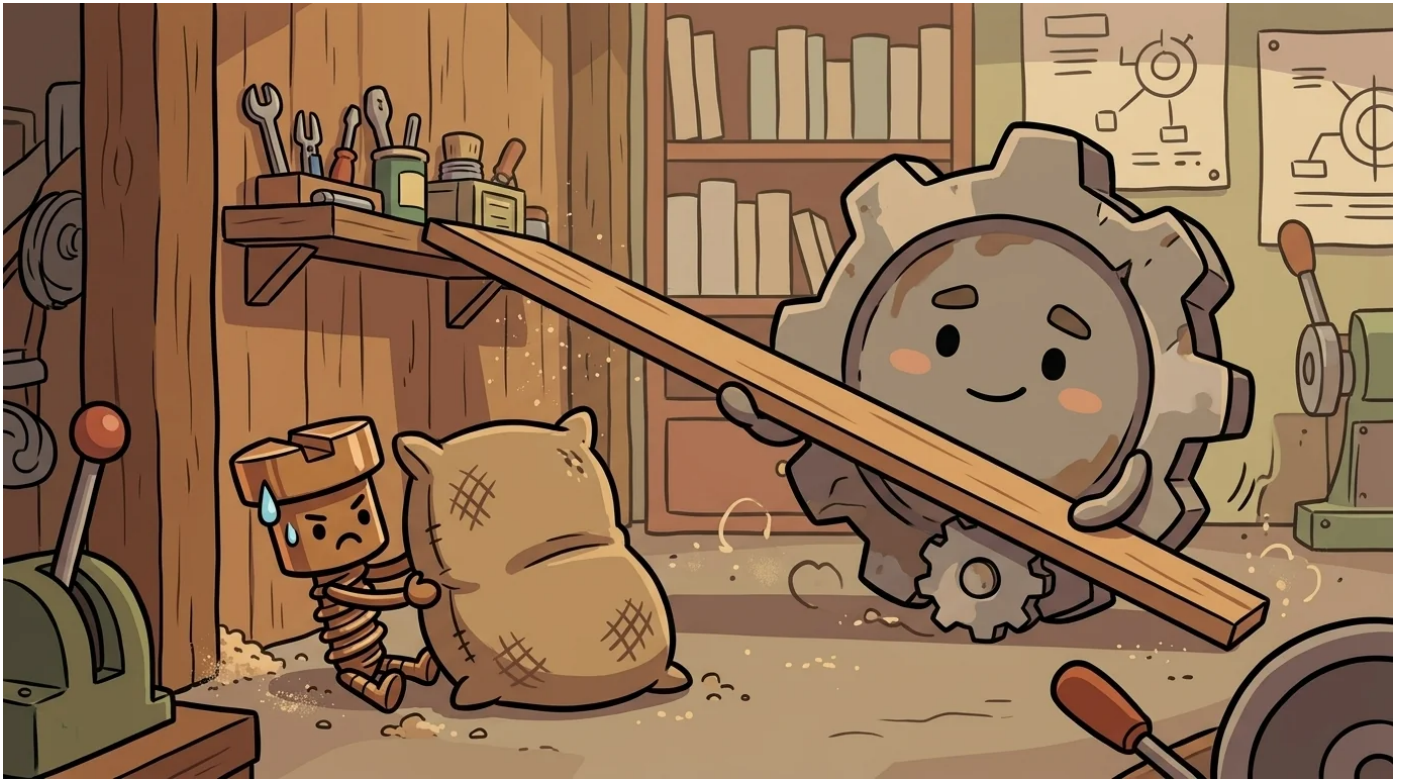
A knot of students leaned in. "It's going in so *slowly*," one whispered.

"Watch the block, not me," Auger buzzed, still turning. Sawdust curled out around its threads in a thin golden spiral. Round and round. Step and step.

After a long minute, Auger had bored clean through. It dropped out the other side and rolled to a stop, humming with satisfaction. The pine had a neat spiral tunnel through it now, threaded like the inside of a nut.

"See?" Auger said. "I only ever did one thing. I turned. Around and around, the same tiny circle, over and over." It nudged the finished block toward them. "But every circle was also a step forward. Round and round *became* step and step. That's the only trick I know — and it's the whole trick."

The students turned the block over in their hands, following the spiral groove with a fingertip, and could not quite believe that going in circles had gotten it anywhere at all.



Auger had learned that trick the slow way, back when it was very small and very frustrated.

There had been a shelf, once — high up, and a heavy sack of grain on the floor below it, and Auger could not for the life of it get the sack up. It shoved. It heaved. It ran at the wall and bounced off. The sack didn't budge, and Auger sat down in the dust feeling useless and round and good for nothing.

Old Cog rolled over — the giant gear who ran the workshop, teeth worn smooth, voice like far-off thunder. Cog didn't tell Auger to try harder.

"You keep trying to do it all at once," Cog rumbled gently. "In one big push. But that isn't your shape, little one."

"Then what *is* my shape?" Auger said, miserable.

"A ramp," said Cog. "Wound up. Look." Cog set a long flat board against the shelf, a gentle slope, and rolled the sack slowly up it — no heaving, just a long, patient climb. "The ramp trades the hard-and-fast for the easy-and-long. It doesn't lift less. It lifts the *same*, spread out over more distance, so each moment costs you almost nothing."

Auger stared at the slope. Then it looked down at its own spiraled body — its threads winding around and around and around — and something turned over inside it, quiet and certain.

"That's *me*," Auger breathed. "I'm that ramp. I'm just... wrapped up."

The stuck, useless feeling didn't vanish, exactly. But it had a shape now, and the shape was a spiral, and Auger could work with a spiral.



Auger arrived at the MachineForge proper on a morning full of clanging hammers and flying sparks, and Cog was waiting at the gate.

Cog didn't ask Auger to lift anything heavy. It asked one question. "What is a screw?"

Auger didn't answer with words at first. It reached into itself and — carefully, thread by thread — uncoiled one loop of its own body until it lay flat on the bench: a thin strip of bronze, sloping gently from low to high. A plain little ramp. Nothing fancy at all.

Then Auger picked up a smooth round peg, laid the strip against it, and wound it back around, spiral by spiral, until it was a screw again.

"That's all I am," Auger said quietly. "A ramp, wrapped around a pole. People think I'm some clever, complicated thing. But unwind me and I'm the plainest slope you ever saw."

Cog's gears whirled, low and warm. "You belong here," it said. "Go teach."



Auger's first student was a boy with a screw and a screwdriver and a deep scowl.

"This is stupid," he said. "I've turned it like a hundred times and it's barely gone in. A hammer would've been done ages ago."

Auger didn't argue. "Push a nail in with your bare thumb," it said. "Go on."

The boy pushed. The nail dented his thumb and didn't move.

"Now turn the screw one more time," Auger said. He did — and it bit deeper into the wood, snug and gripping, without any shove at all. "Feel how it pulled *itself* in?"

"...Yeah," the boy admitted.

"Every turn you make travels a long way around," Auger said, spinning a slow demonstration circle on the bench. "But the screw only steps forward a tiny bit — that little step is called the pitch. You spend a big, easy motion. The screw spends a small, mighty one." It tilted. "Tight threads, close together — slow going, but they push like a giant. Wide threads — faster in, but gentler. Same bargain every simple machine makes. You trade distance for force."

The boy turned the screw the rest of the way in, slow and steady, and this time he was almost smiling.

"So it's not stupid," Auger said. "It's *patient*. It does with a hundred easy turns what your thumb could never do with one hard shove. And once you've seen the ramp hiding in the spiral —" it spun a happy little circle — "you start seeing me everywhere. In a jar lid. In a water-pump. In the thing that lifts a whole river up to a dry field."



Later, when the others had gone, the boy came back holding the screw, quieter now.

"When it's just sitting in the wood," he said, "not going anywhere... how do you *know* the ramp's still in there? You can't see it once it's wound up."

Auger thought about the sack of grain, and the dust, and the stuck feeling that had turned into a shape.

"You feel it," it said. "That's the honest answer. There's a moment — you've been turning and turning, and it seems like nothing's happening, and then it just *catches*. Everything clicks and holds. That catch is the ramp, still doing its slow, patient work, right where you can't see it." It rolled gently against the bench. "The hardest jobs almost never get done in one big push. They get done in a hundred small turns, each one so easy you barely notice — until you look up and find you've climbed the whole way."

The boy nodded slowly, and Auger watched the scowl melt off his face — the same way, long ago, the stuck feeling had melted off its own.

It didn't say the rest out loud, but it hummed it to itself, round and warm and sure: *the slow, going-in-circles moments are usually the ones quietly carrying you forward. You just can't feel how far until you stop and look back.*

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Methodology

Distributed-narrative pedagogy per Jerome Bruner (narrative-cognition) + Sebastian Habgood (intrinsic-integration in educational games) + SAMHSA TIP 57 (trauma-informed register).

Trauma-informed-design framework per Eggleston et al. (2025) and Stoltenburg et al. (2024).

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