

# The Age of Magic

**How a century of discoveries returned the medium of reality — and with it humanity's oldest way of creating**

J. Konstapel · Leiden, 30 July 2026

## I. How an age creates

Every civilization is remembered not for its machines but for the way it creates.

The Stone Age shaped stone. The Bronze Age mastered metal. The Industrial Age learned to push matter with energy. The Information Age learned to push symbols.

Look closely at the last two and you notice something strange: beneath all their variety they share a single verb. **Push.** Combustion pushes hot gas against a piston. A rocket pushes its own thrown mass backwards. A factory pushes tools against material until material gives in. Medicine pushes molecules against disease. Even our institutions push: targets, deadlines, incentives, enforcement. Two centuries of civilization, one operation, conjugated a million ways — apply force against resistance, and when the task is harder, push harder.

We are living in the exhaust of that sentence. The environmental crisis is not, at bottom, a moral failure; it is the waste stream of a civilization that knows only one operation. And the quieter crisis — the tiredness that hangs over every conversation about the future, the sense that what is on offer is only *less, slower, guiltier* — is what it feels like to live inside a vocabulary of one verb. Pushing offers a person exactly two identities: consumer of the burn, and therefore culprit of the exhaust; or spectator of a dead mechanism, and therefore irrelevant. Neither identity can love a future.

This essay tells the story of a second operation: where it came from, how it was lost, and how — in a chain of discoveries running from a lecture hall in Leiden in 1920 to the galaxy surveys of the last decade — the thing it operates *on* has been quietly rediscovered by science. The story ends with a word. I will not use the word until the reader has earned it, because the point of this essay is that you will arrive at it yourself.

## II. Five scenes from the first civilization

Begin long before industry, with five scenes. Each really happened, for thousands of years, on every inhabited continent. Watch what the people in them are *doing* — not what they believe, what they do.

**The forge.** A smith stands over iron. He does not push the cold metal into shape; no human arm can. He does something cleverer: he brings the iron to the state in which it *can* reorganize — glowing, softened — then works the pattern in, then lets it freeze. Soften, write, harden. Ask him how he knows the sword is in there and he gives the answer smiths have always given: he saw it before he began. In nearly every ancient culture the smith was a sacred figure, half feared. His craft was the clearest daily proof that form could be called out of formlessness — if you worked on the *state* of the material rather than against its resistance.

**The night dance.** In the Kalahari, when someone is ill, the community does not first treat the patient. It builds a fire, and dances, and sings, for hours — until a shared state comes over the whole group, a gathered intensity the San call a boiling energy. Only inside that state does healing begin. The dance is not decoration around the medicine. The dance *is* the medicine's first half: it conditions the entire human system — patient, healer, community — into the state in which healing can happen at all.

**The open ocean.** A Polynesian navigator lies down in the hull of his canoe, far from any land, no instrument aboard, and reads the water with his body: the interference patterns where swells from distant islands cross, the way the ocean's texture carries the map inside it. He is not overpowering the sea, and could not. He is reading the *state of a medium* — and with that reading, his people settled the largest space on Earth, centuries before the compass.

**The name.** In Egypt, a scribe cuts a name into stone and draws a protective ring around it. This is not decoration and not vanity. In Egyptian understanding the name — the *ren* — was a component of the person: as long as the name existed somewhere, the person could be restored; to erase a name was the true death. Notice the precision of the idea. The name is not a picture of the body, not a description. It is an *address* — a handle by which a whole configuration can be called.

**The vat.** A brewer, a baker, a tanner, a potter: everywhere, the same quiet method. Set the conditions — warmth, moisture, time, the right vessel — and let the material *organize itself* into bread, beer, leather, glaze. Nobody pushes a loaf into existence. You condition, and the thing emerges.

Five scenes, one grammar. None of these people is pushing. Each begins with the completed form — the sword seen, the health envisioned, the landfall known, the person named, the loaf intended — and then works not on the object but on the *state of a medium*, until the intended form is the natural outcome. Humanity ran on this operation for fifty thousand years. It was our first technology, and our best.

Then it lost its physics.

### III. The world becomes objects

The idea that undid it is one of the most productive ideas in history, so this section is not an accusation; it is an accounting.

Twenty-four centuries ago Greek thinkers proposed that reality consists, at bottom, of tiny indivisible objects moving in empty space — atoms and void. Nothing came of it for a long time. Then, in the seventeenth century, the idea found its mathematics: Newton's world of masses, forces, and laws — objects pushed and pushing, in a space that was mere emptiness, a stage. The success was overwhelming. Planets, tides, cannonballs, then steam, electricity, chemistry, industry: the object-and-force picture built the modern world, and it deserved to.

But a paradigm is not only what it explains. It is also what it *deletes*. In a world made exclusively of objects and forces, there is one thing that cannot exist: the state of a medium. And so, one by one, the practices of the first civilization became unintelligible — not disproven, simply unreadable. The smith's craft became mystique, then metallurgy-minus-the-smith. The dance became superstition; when its effects stubbornly showed up in modern trials anyway, they were filed under a word designed to mean *nuisance*: placebo. The navigator became folklore. The name became primitive belief. The whole grammar of condition-and-emerge was reclassified under a single dismissive heading, and the heading was: magic.

Even physics itself performed the deletion, in a famous drama. The nineteenth century, needing a carrier for light waves, had filled space with a substance — the luminiferous ether. In 1887, the most delicate experiment of the age tried to measure our motion through it and found nothing. In 1905 Einstein showed the theory worked perfectly without it, and the ether was banished. The verdict entered the textbooks in one line: *space is empty*. A young Scottish idea from the 1860s — Lord Kelvin's beautiful proposal that atoms might be *knots* tied in the ether, matter as pattern in a medium — went into the wastebasket with it.

By 1900, then, the deletion was complete, at every level: no medium in the world-picture, no substrate for the old operation, and a civilization equipped with exactly one verb. The twentieth century would be the century of pushing — magnificent, catastrophic pushing.

It would also, with magnificent irony, be the century in which physics itself put the medium back. That is the story most readers have never been told in one piece, so let us tell it as it happened: as a chain of discoveries, each innocent on its own, together lethal to the empty-space worldview.

## IV. The return of the medium, in nine discoveries

**1. Leiden, 1920: Einstein takes it back.** Fifteen years after banishing the ether, Einstein stood in a lecture hall in Leiden and said, carefully, that the banishment had gone too far. His own theory of gravity had turned space into something with *qualities*: it bends, it stretches, it tells matter how to move. "Space without ether is unthinkable," he told his audience — meaning not the old wind-of-ether, but this: space is not nothing. It is a physical something whose properties are the subject of physics. The stage, it turned out, was an actor.

**2. The push of nothing (1948).** The Dutch physicist Hendrik Casimir predicted something absurd-sounding: place two uncharged metal plates close together in perfect vacuum, and they will be pushed toward each other — by the vacuum itself. The "empty" space between the plates is less empty than the space outside them, and the difference presses. Half a century later the effect was measured with precision. Emptiness, it turns out, pushes. Things that push are substances.

**3. Light from shaking the void (2011).** Stranger still: theory said that if you could move a mirror fast enough, the vacuum would respond by producing *real light* — photons shaken loose from nothing. In 2011 a laboratory did exactly this, using a superconducting circuit as an effectively fast-moving mirror, and detected the light. You can, demonstrably, ring the vacuum like a bell.

**4. Heaviness comes from the medium (2012).** Then mainstream physics crossed its own Rubicon. The discovery of the Higgs particle confirmed that mass — the very heaviness of things, the property the object-worldview treated as most intrinsic — is not intrinsic at all. Particles have mass because they interact with a field that fills all of space. Remove the field, and the electron weighs nothing. In plain language: even weight is not a property of objects. It is a relationship with the medium.

**5. Kelvin's revenge (1997).** And the wastebasket gave back its treasure. Field theorists proved that stable *knots* — self-sustaining, particle-like tangles — can exist in continuous fields: Kelvin's Victorian dream, re-derived with modern mathematics, published in *Nature* under a title he would have loved. Matter as pattern in a medium stopped being a metaphor and became a class of solutions.

**6. Universes on a tabletop (1995–).** Meanwhile experimentalists learned to *make* media of the relevant kind. Cooled to near absolute zero, clouds of atoms collapse into a single collective state — a condensate — in which "particles" are ripples of the whole, sound behaves the way light behaves

in space, and researchers can watch a toy vacuum do its physics on a lab bench. One theorist showed that sound in a flowing medium reproduces the physics of black holes; a whole field — analogue gravity — now studies spacetime by studying substances. The lesson seeped in from the edges: whatever the vacuum is, it behaves like the media we can hold.

**7. Galaxies obey their surroundings (2016, 2020).** Now the telescopes. For decades, galaxies have refused to rotate as the object-picture demands; the standard patch is to posit invisible extra matter. But in 2016 a survey of over a hundred galaxies revealed something tighter and stranger: one single curve relates the gravity you *see* to the gravity you'd *expect*, across wildly different galaxies — as if the discrepancy were not random missing stuff but a *law*, switching on wherever gravitational acceleration drops below one particular, tiny threshold. And in 2020 came the finding the object-worldview simply cannot digest: a galaxy's internal behaviour depends on its *environment* — on the pull of everything around it — even when nothing about the galaxy itself changes. In object-physics, that is forbidden. In medium-physics, it is obvious: how a substance responds depends on the state it is in, and the environment sets the state. Steel under stress carries sound differently than relaxed steel; engineers use this daily to inspect bridges. The galaxies, on this reading, are telling us the same thing about space.

**8. The number of the circle.** Hidden in those galaxy measurements sits a numerical jewel, noticed at the very beginning and unexplained for forty years. The tiny threshold acceleration where the strangeness begins is related to the size and age of the entire universe — to the cosmic expansion rate — by a factor of, as nearly as we can measure,  $2\pi$ . The number of one full turn of a circle. Local dynamics, tied to the whole cosmos, through the constant of rotation. To an object-worldview this is numerology. To a medium-worldview it is a signature: closed loops — windings, knots — are the natural structures of a medium, and one closed loop carries exactly  $2\pi$  of phase. The universe's strangest number looks like the fingerprint of a knotted substance.

**9. The stiffest place (the clocks).** Last discovery, closest to home. Optical clocks — the most precise instruments our species has built — have checked whether the "constants of nature" drift, here on Earth, and found them steady to seventeen decimal places. The object-worldview reads this as: the constants are eternal. The medium-worldview reads it differently, and more interestingly: *our neighbourhood is the stiff state of the medium*. A blacksmith would recognize the situation at once — work-hardened material, so rigid that its properties seem absolute. Between the galaxies, where the environment relaxes, the same substance goes soft, and its "constants" bend: which is exactly what the telescopes of discovery 7 are seeing. One substance, two states; a stress-strain curve for space itself. My own technical work of the past years has been the assembly of precisely this picture — the vacuum as a material with a measurable response curve, stiff where we live, relaxed between the galaxies, its behaviour poised close to a tipping balance, like a spring loaded to within a sliver of release and held there by the topology of its knots. The famous "dark" ingredients of the cosmos are, in this picture, not exotic substances at all. They are the medium itself, seen in its relaxed state — and by the standard accounting, that medium makes up about ninety-five percent of everything there is.

## V. Now assemble it

Set the nine discoveries side by side and let them say their one sentence together:

*Space is not empty. It pushes, it rings, it gives things their weight, it can hold knots, it behaves like the substances on our lab benches, its response depends on its state, its state depends on the environment, its deepest number is the number of a closed loop, and where we live it is work-hardened stiff.*

In short: **reality is a medium, and matter is its pattern.** The stage was an actor all along; the objects were configurations; the void of the textbooks was a substance in its hardest state, so uniform here that we mistook its properties for eternal law.

And now recall the five scenes.

If reality is a configurable medium, then there are *two* elementary ways to create in it, not one. You can push configurations around — the operation our civilization perfected. Or you can do what the smith, the healer, the navigator, the scribe, and the brewer did: **begin with the completed form, and condition the medium until that form is the natural outcome.** Work not on the object but on the state. Not construction — emergence. Not force — configuration.

There is an old word for this second operation. It is the word the object-age used as a wastebasket for everything it could no longer read. The word is **magic** — and you can now see what it actually meant. Magic was never the violation of natural law. It was the practice of the second operation, kept alive for centuries after its substrate had been deleted from the world-picture: the operating manual preserved, the machine officially non-existent. Its practitioners could not say what they were working on, because the language for it was gone. They could only pass down the operations — the name, the rhythm, the visualization, the gathered state, the soften-write-harden of the craft — wrapped in ritual, which is what an engineering discipline looks like after its physics has been confiscated.

The physics has now been returned.

## VI. The second operation, with new tools

And here is the astonishing part: the second operation is already running again, in laboratories, under assumed names.

There is a technology in which you *write a name* — literally, a designed sequence of molecular letters — mix it into solution, warm it gently, and the intended object folds itself into existence: billions of identical, verified copies per test tube. It is called DNA origami, and it is the scribe's insight executed by chemistry: the name is an address, and the medium, properly conditioned, completes the form. There is a technology in which a field of shaped sound holds dozens of parts floating in mid-air and *assembles* them — and if you knock a piece out, the assembly heals, because the target shape is the state the field makes inevitable. That is the smith's cycle running on ultrasound. In medicine, researchers now measure what the night dance always did: collective rhythm demonstrably synchronizes the physiology of a group — heartbeats falling into step across a ritual — and the context of treatment measurably changes its outcome, the effect medicine spent a century dismissing under the name placebo. The first civilization's operations, one by one, are being rebuilt — by people who mostly do not know they are rebuilding anything.

Once you see the grammar, you can read the future in it. **Making** becomes addressing rather than extracting: objects called out of conditioned matter by their names, the Earth's crust retired as humanity's warehouse — and with it, quietly, the point of every resource war ever fought. **Moving** stops meaning burning: if how things move depends on the state of the environment — and discovery 7 says it does — then transport becomes the art of reshaping the slope of the landscape until motion is downhill, vehicles negotiating with nature instead of fighting it. **Energy** stops meaning fuel: wood, coal, and uranium were never sources, only depths of editing in the same medium, and the frontier becomes the editing operation itself — conditioning the place where the change happens rather than heating it to a hundred and fifty million degrees. **Healing** stops meaning

only chemical warfare: disease reads as degraded organization, and the physician's first act becomes what the Kalahari always made it — bring the system into the state where it *can* respond.

The impossible does not disappear because nature changes. It disappears because humanity remembers an operation.

## VII. The participant

The deepest change is not technological.

The pushing age told you what you are: a consumer of the burn, guilty of the exhaust — or a spectator of a dead machine, whose inner life moves nothing. The medium-picture issues a third identity, and it is not a consolation; it is a description. **You are a participant.** You are yourself a configuration in the very medium you act upon. Your words, your rhythms, your gathered states, the forms you begin with in your mind's eye — these are not ghosts hovering over dead matter. They are operations *in* the substrate, the same substrate the galaxies answer to. That is why every tradition guarded the name, the song, the dance, and the vision as sacred: they were the instruments of the second operation, and the first civilization knew it.

For thousands of years, civilization has organized itself around one question: *where do we find what we need?* That question belonged to the pushing world, and it is exhausted — literally. The question of the participant is different, and it is the question of the coming age:

### How should reality be organized?

The Stone Age shaped stone. The Bronze Age mastered metal. The Industrial Age pushed matter. The Information Age pushed symbols.

The next age begins with the return of the medium — and it deserves the name of the operation it restores.

Not the Age of Machines. Not the Information Age.

### The Age of Magic.

## Annotated references

*For the reader who wants to check the story. Each entry says in one or two plain sentences what the work shows and why it matters here. None of them requires mathematics to read about; several are books written for a general audience.*

### The first civilization (the five scenes)

**Katz, R. (1982). *Boiling Energy: Community Healing among the Kalahari Kung*. Harvard University Press.** — The classic first-hand study of the San healing dance: how the community raises a shared healing state through night-long rhythm and dance before any individual healing is attempted. The night-dance scene, documented.

**Konvalinka, I. et al. (2011). "Synchronized arousal between performers and related spectators in a fire-walking ritual." *PNAS* 108, 8514.** — Modern measurement of what ritual does: during a

Spanish fire-walking ceremony, the heart rhythms of participants and their relatives in the audience synchronized. Collective states are physiologically real and measurable.

**Lewis, D. (1972). *We, the Navigators: The Ancient Art of Landfinding in the Pacific*. University of Hawaii Press.** — The definitive account of Polynesian wayfinding: navigation by reading swell patterns, star paths, and the sea's texture — the state of a medium — across thousands of kilometres of open ocean.

**Assmann, J. (2005). *Death and Salvation in Ancient Egypt*. Cornell University Press.** — The authoritative treatment of Egyptian ideas of the person, including the *ren*: the name as a component of the person, whose preservation enables restoration and whose erasure is the second death.

**Griaule, M. (1948). *Dieu d'eau: entretiens avec Ogotemmêli* (English: *Conversations with Ogotemmêli*).** — Thirty-three days of instruction by a blind Dogon elder, including the teaching that the word is *woven* — speech as thread laid into a moist, carrying medium — and the account of the Nommo, the being dismembered, reassembled, and revived: pattern surviving its own dispersal.

### **The deletion (how space became empty)**

**Thomson, W. (Lord Kelvin) (1867). "On Vortex Atoms." *Proceedings of the Royal Society of Edinburgh* 6, 94.** — The Victorian proposal that atoms are knots in the ether: matter as stable pattern in a medium. Abandoned when the ether was banished; effectively rehabilitated by entry 5 of the return, below.

**Michelson, A. A. & Morley, E. W. (1887). "On the Relative Motion of the Earth and the Luminiferous Ether." *American Journal of Science* 34, 333.** — The most famous null result in physics: no measurable "ether wind." The experiment that began the deletion of the medium from the world-picture.

**Einstein, A. (1905). "Zur Elektrodynamik bewegter Körper." *Annalen der Physik* 17, 891.** — Special relativity: the paper that showed physics works without the old ether, completing the deletion — for fifteen years.

### **The return (the nine discoveries)**

**Einstein, A. (1920/1922). "Ether and the Theory of Relativity," lecture delivered at Leiden, 5 May 1920; published in *Sidelights on Relativity*.** — Einstein's own retraction of the empty-space verdict: general relativity endows space with physical qualities; "space without ether is unthinkable." Discovery 1, and the quiet turning point of the whole story.

**Casimir, H. B. G. (1948). "On the attraction between two perfectly conducting plates." *Proc. Kon. Ned. Akad. Wet.* 51, 793.** — The prediction that the vacuum pushes two metal plates together. Discovery 2: emptiness exerts force.

**Lamoreaux, S. K. (1997). "Demonstration of the Casimir force in the 0.6 to 6  $\mu\text{m}$  range." *Physical Review Letters* 78, 5.** — The precision measurement, fifty years later, confirming Casimir's push of nothing.

**Wilson, C. M. et al. (2011). "Observation of the dynamical Casimir effect in a superconducting circuit." *Nature* 479, 376.** — Shake a mirror fast enough and the vacuum emits real, detectable light. Discovery 3: the void can be rung like a bell.

**ATLAS Collaboration (2012).** "Observation of a new particle in the search for the Standard Model Higgs boson." *Physics Letters B* **716**, 1 (and CMS Collaboration, same volume, 30). — The Higgs discovery. Discovery 4: mass itself arises from interaction with a field filling all space — heaviness is a relationship with the medium, not a property of objects.

**Faddeev, L. & Niemi, A. J. (1997).** "Stable knot-like structures in classical field theory." *Nature* **387**, 58. — The proof that continuous fields can hold stable knots: Kelvin's vortex atoms reborn with modern mathematics. Discovery 5: matter-as-pattern is a class of solutions, not a metaphor.

**Anderson, M. H. et al. (1995).** "Observation of Bose–Einstein condensation in a dilute atomic vapor." *Science* **269**, 198. — The first laboratory condensate: a cloud of atoms collapsing into one collective state — a tabletop medium in which "particles" are ripples of the whole. The beginning of discovery 6.

**Unruh, W. G. (1981).** "Experimental black-hole evaporation?" *Physical Review Letters* **46**, 1351. — The founding insight of analogue gravity: sound in a flowing medium reproduces the physics of light near a black hole. Spacetime behaves like a substance; substances can teach us spacetime.

**Volovik, G. E. (2003).** *The Universe in a Helium Droplet*. Oxford University Press. — A monograph arguing in full technical depth that the vacuum behaves like a condensed-matter system — a quantum liquid — and that particles and fields are its collective modes. The medium-worldview, written from inside mainstream physics.

**Wilczek, F. (2008).** *The Lightness of Being*. Basic Books. — A Nobel laureate's popular account whose central message is exactly the turn described here: what we call empty space is a material — Wilczek calls it "the Grid" — and matter is its music. Recommended as the most accessible companion to this essay.

**Milgrom, M. (1983).** "A modification of the Newtonian dynamics as a possible alternative to the hidden mass hypothesis." *Astrophysical Journal* **270**, 365. — The paper that first identified the tiny threshold acceleration in galactic behaviour — and noted, at the outset, its uncanny relation to the cosmic expansion rate by a factor of order  $2\pi$ . Discovery 8's forty-year-old jewel.

**McGaugh, S. S., Lelli, F. & Schombert, J. M. (2016).** "Radial acceleration relation in rotationally supported galaxies." *Physical Review Letters* **117**, 201101. — Across 153 galaxies, one single curve relates observed gravity to expected gravity. Discovery 7, first half: the galactic anomaly is a law, not a scatter of missing stuff.

**Chae, K.-H. et al. (2020).** "Testing the strong equivalence principle: detection of the external field effect in rotationally supported galaxies." *Astrophysical Journal* **904**, 51. — Galaxies' internal dynamics measurably depend on their environment's gravitational pull. Discovery 7, second half: context-dependence — natural for a medium, forbidden for objects.

**Sakharov, A. D. (1967).** "Vacuum quantum fluctuations in curved space and the theory of gravitation." *Doklady* **177**, 70. — The proposal that gravity itself is not fundamental but the *elasticity of the vacuum* — the medium's stiffness against deformation. The deep hinterland of discovery 9's reading.

**The second operation, with new tools**

**Rothemund, P. W. K. (2006).** "Folding DNA to create nanoscale shapes and patterns." *Nature* **440**, 297. — DNA origami: write a molecular name, condition the medium, and the designed object folds itself into existence in billions of copies. The scribe's insight as industrial chemistry.

**Marzo, A. et al. (2015).** "Holographic acoustic elements for manipulation of levitated objects." *Nature Communications* **6**, 8661. — Shaped sound fields that hold and steer floating objects: the working principle of assembly-by-conditioned-field, the smith's cycle on ultrasound.

### **The author's technical series**

**Konstapel, J. (2026).** *The Constitutive Equation of the Vacuum Condensate; The Missing Weight and the Medium; The Vacuum as Weather (3rd ed.); The Vacuum Replicator; How the Vacuum Could Give Us All the Energy We Need. Leiden.* — The step-by-step technical assembly of the picture summarized in discovery 9: the vacuum as a material with a measurable, state-dependent response — stiff here, relaxed between the galaxies, poised near its tipping balance — with matter as its knotted pattern, and the engineering consequences drawn out. For readers who want the equations behind the story.