

INSTANT

THE STORY OF POLAROID

Christopher Bonanos



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Princeton Architectural Press, New York

For Ellen
love without fading

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FRONTISPIECE: In 1980 Andy Warhol
posed before the 20x24-inch Polaroid camera,
a moment after he was photographed with his
(much smaller) SX-70 tucked under his arm.

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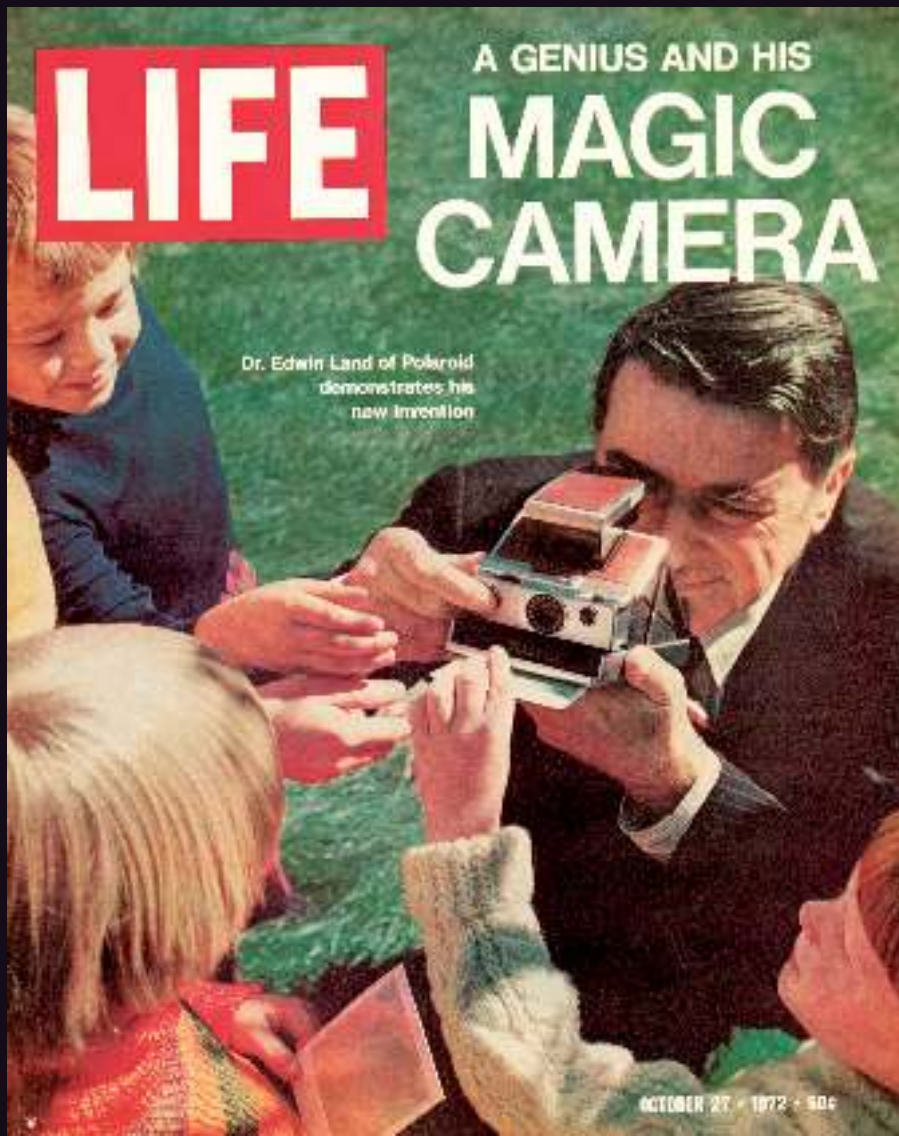
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Edwin Land makes the cover of *Life*—without showing his face.

1 Light and Vision

If you're reading this, you probably know what a Polaroid picture is. Even if you weren't, I probably wouldn't have to tell you. More than sixty years after instant photography made its debut, "Polaroid" remains one of the most recognizable coinages on Earth. As late as 2003, the hip-hop star Andre 3000 could sing "Shake it like a Polaroid picture," in Outkast's megahit "Hey Ya," and even young people did not have to ask what he meant.¹ Throughout its reign over instant photography—a field the company invented out of thin air and built into a \$2-billion-a-year business—Polaroid had no successful competitor, no real challenge to its primacy, until almost its very end.

In the 1970s, photographers were shooting a billion Polaroid photographs each year. Now the whole business has almost vanished. Right around the year 2000, picture-taking experienced a tidal change, as digital cameras swept in and all but cornered the market. Suddenly, photographic film became a specialty item, bought chiefly by artists. Any company that depended on selling or processing film had to endure some rough years of realignment. Eastman Kodak went from its late-1980s peak of 145,000 employees to fewer than 20,000, and filed for Chapter 11 protection in 2012. Polaroid, already struggling with longstanding debt and other problems, got clobbered. Between 2001 and 2009 the company declared bankruptcy twice and was sold three times; one of those buyers went to federal prison for fraud. Polaroid film was discontinued forever in 2008.

Except that it's not exactly gone. A few types of instant film are still manufactured by Fujifilm, for some older Polaroid cameras and current Fuji models. The last batches of Polaroid's own film have become highly

¹ For the record, you shouldn't shake your Polaroid pictures. They don't develop any faster when you do, and you risk cracking the image. Most people shake them anyway. See chapter 3 to find out why.

sought after, with buyers paying \$40 or \$50, or even more, for a pack of ten expired and increasingly unreliable exposures. A few enthusiasts have taken their analog-revival efforts to great lengths, trying to reinvent instant film anew. The newest owners of the Polaroid trademark have elaborate plans to meld instant photography with the digital age.

After all, digital pictures *are* instant pictures. The chief advance of Polaroid photography was that you immediately saw what you had done. If the photo was overexposed, blurry, or badly framed, you could try shooting it again, then and there. With a digital camera, you get your feedback even faster, essentially for free.

Somehow, though, digital pictures do not draw people together the way Polaroid photos did. Haul one of those old cameras out at a party, and the questions start: “Hey—can you still get film for that thing?” “Are the cameras worth money?” And, once the photos start appearing, “You know, that looks pretty good! I don’t remember Polaroids looking like that. But, you know, we had one when I was little, and....” This gee-whiz invention of the 1940s, ubiquitous in the 1970s, ostensibly obsolete today, still exerts a weird and bewitching pull.

It wasn’t just for snapshots, either. During Polaroid photography’s heyday, artists like Ansel Adams and Walker Evans sang its praises. Andy Warhol, David Hockney, and Robert Mapplethorpe all shot thousands of Polaroid pictures. Most of William Wegman’s famous photos of his dogs were taken on Polaroid film. He and many other artists, including Chuck Close and Mary Ellen Mark, were (and are) particularly fond of an immense and very special Polaroid camera that produces prints 20 inches wide and 24 inches high. Fewer than a dozen of these cameras were hand-built by Polaroid; five remain active; and one, in New York, is in use almost every day. No digital equipment comes even remotely close to doing what it does.

Children, in particular, react very strongly to instant pictures, whether they’re behind the camera or in front of it. Watching your own face slowly appear out of the green-gray mist of developing chemicals is a peculiar and captivating experience. The older Polaroid materials, those that develop in a little paper sandwich that is peeled apart after a few moments’ development, encourage a different and warm human



Park Street
New Haven
Sept. 24, 1974

Walker Evans

Walker Evans had stopped making photographs when SX 70 came along and allowed him a late career burst of creativity.



Evans used the small square format to document Americana's gags: peeling paint, or a crushed beer can in a stream.

exchange. Photographer and subject can make small talk as the picture steeps. When the print is revealed, it can be handed over as a gift or circulated around the room. There is no more social form of picture-taking.

When it introduced instant photography in the late 1940s, Polaroid the corporation followed a path that has since become familiar in Silicon Valley: Tech-genius founder has a fantastic idea and finds like-minded colleagues to develop it; they pull a ridiculous number of all-nighters to do so, with as much passion for the problem-solving as for the product; venture capital and smart marketing follows; everyone gets rich, but not for the sake of getting rich. For a while, the possibilities seem limitless. Then, sometimes, the MBAs come in and mess things up, or the creators find themselves in over their heads as businesspeople, and the story ends with an unpleasant thud.

The most obvious parallel is to Apple Computer, except that Apple's story, so far, has a much happier ending. Both companies specialized in relentless, obsessive refinement of their technologies. Both were established close to great research universities to attract talent (Polaroid was in Cambridge, Massachusetts, where it drew from Harvard and MIT; Apple has Stanford and Berkeley nearby). Both fetishized superior, elegant, covetable product design. And both companies exploded in size and wealth under an in-house visionary-godhead-inventor-genius. At Apple, that man was Steve Jobs. At Polaroid, the *genius domus* was Edwin Herbert Land.

Just as Apple stories almost all lead back to Jobs, Polaroid lore always seems to focus on Land. In his time, he was as public a figure as Jobs was. At Kodak, executives habitually referred to Polaroid as "he," as in "What's *he* doing next?" Land and his company were, for more than four decades, indivisible. When he introduced its SX-70 system in 1972—that's the photo with the wide white border that most of us think of as the classic Polaroid picture—Land appeared on the covers of both *Time* and *Life* magazines.

At Polaroid's annual shareholders' meetings, Land often got up onstage, deploying every bit of his considerable magnetism, and put the company's next big thing through its paces, sometimes backed by a slideshow to fill in the details, other times with live music between segments.



ABOVE: One of William Wegman's Weimaraners in a polite Polaroid moment with studio assistant Andrea Beeman.

OPPOSITE: Robert Mapplethorpe not only used Polaroid film; for this tableau of photos of his lover and muse Patti Smith, he also incorporated the empty film

cartridges (painted white) and one of the darkslides (reading "Don't Touch Here") that covered each new pack.



A generation later, Jobs did the same thing, in a black turtleneck and jeans. Both men were college dropouts; both became as rich as anyone could ever wish to be; and both insisted that their inventions would change the fundamental nature of human interaction.

Jobs, more than once, expressed his deep admiration for Edwin Land. In an interview in *Playboy*, he called him “a national treasure.” After Land, late in his career, was semi-coaxed into retirement by Polaroid’s board, Jobs called the decision “one of the dumbest things I’ve ever heard of.” In fact, the two men met three times when Apple was on the rise, and according to Jobs’s then-boss John Sculley, the two inventors described to each other a singular experience: Each had imagined a perfect new product, whole, already manufactured and sitting before him, and then spent years prodding executives, engineers, and factories to create it with as few compromises as possible.

During some stretches, Polaroid operated almost like a scientific think tank that happened to regularly pop out a profitable consumer product. Land was frequently criticized by Wall Street analysts, and the *Wall Street Journal* in particular, for spending a little too much on his R&D operation and too little on practical matters. That was Land’s philosophy: Do some interesting science that is all your own, and if it is, in his words, “manifestly important and nearly impossible,” it will be fulfilling, and maybe even a way to get rich. In his lifetime, Land received 535 United States patents.² No wonder everyone called this college dropout “Dr. Land”—particularly after Harvard University gave him an honorary doctorate. He advised several presidents (from Eisenhower through Nixon) on technology, and effectively created the U-2 spy plane. Richard Nixon admired his scientific prowess, once asking an aide, “How do we get more Dr. Lands?”

² Just about every biographical sketch of Land notes that this total is second only to Thomas Edison’s, and every one is wrong. As Dr. Deborah Douglas, curator of the MIT Museum, points out, the number-two patent-holder was Elihu Thomson, an early force at General Electric. In recent years, several inventors has vastly surpassed even Edison’s total.

After he quit his advisory post during the Watergate scandal, Land ended up on Nixon's "enemies list," and told a friend that he was honored to have made the cut.

He was extremely circumspect about his family life, but we know a little about his upbringing. He was born on May 7, 1909, the son of a scrap-metal dealer named Harry Land and his wife, who was called Matha, Matie, or Martha, depending on which source you read.³ As a child, Land had trouble pronouncing "Edwin," and it came out "Din," a nickname that stuck with him all his life.

Nearly every account of Land's youth conforms to the classic boy-inventor clichés. Did he once blow all the fuses in his parents' house? Of course, when he was 6 years old. Did he once disassemble a significant household object, resulting in either parental anger or parental pride? Certainly—either the family's brand-new gramophone or the mantel clock. Whatever it was, his father was not amused.

He was, it seems, introverted in person but superbly confident when it came to ideas. Accustomed as we are today to Silicon Valley style, this may imply that he was a big nerd, but that's not right. Land was neatly groomed and notably handsome, with a pleasing, New England-inflected baritone voice, and alongside his scientific passions lay knowledge of art, music, and literature. He was a cultured person, growing even more so as he got older, and his interests filtered into the ethos of Polaroid. His company took powerful pride in its relationship to fine artists, its sponsorship of public television, even its superior graphic design. He liked people who had breadth as well as depth—chemists who were also musicians, say, or photographers who understood physics. He took very good pictures, too.

As a young adult, Land grew close to Clarence Kennedy, an art-history professor at Smith College who was also a fine photographer. Their relationship not only helped refine Land's eye but also began to feed Polaroid with brainy, aesthetically inclined Smith graduates, handpicked and recommended by Kennedy. It was a clever end run around the competition for talent, because few corporations were hiring female scientists, and even fewer were looking for them in Smith's art-history department.

³ Two books are the indispensable starting point for any serious reading about Polaroid. Victor McElheny's biography of Land, *Insisting on the Impossible* (Perseus Books, 1998), is spectacularly thorough, a serious piece of scholarship that displays its author's long-term research and deep immersion in Polaroidiana. The Polaroid executive Peter Wensberg's memoir, titled *Land's Polaroid* (Houghton Mifflin, 1987), is more narrative and personal, and is long out of print. I have drawn on both, and am indebted to McElheny's book in particular, as well as to the author himself, for the sketch of Land's early life in this chapter, and for the general timeline of the Polaroid story.

Sometimes he sent the young women off for a couple of semesters' worth of science classes, manufacturing skilled chemists who could keep up when the conversation turned from Maxwell's equations to Renoir's brush strokes. In-house, people called them the Princesses.

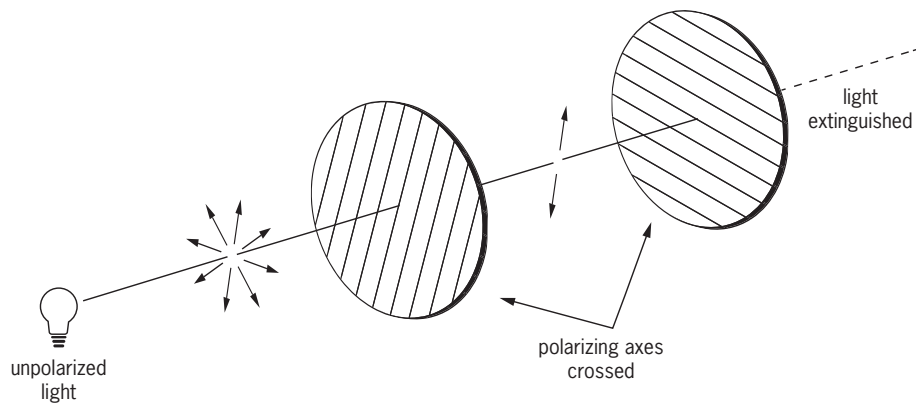
Land was also extraordinarily tenacious. One of his top research executives, Sheldon Buckler, recalls a story Land told him during a long night in the lab. As a child, Land had been forced to visit an aunt he disliked. As he sat in the backseat of his parents' car, he set his jaw and told himself, "I will never let anyone tell me what to do, ever again." You could write that off as youthful mulishness, except that it turned out to be true. Land's control over his company was nearly absolute, and he exercised it to a degree that was compelling and sometimes exhausting.

He didn't grow up in a particularly intellectual household. Land once remarked disdainfully that there were virtually no books in his childhood home. Somehow, though, he found himself a copy of the 1911 edition of *Physical Optics*, a textbook by the physicist Robert W. Wood, and obsessed over its contents the way other kids might have memorized baseball statistics—lingering on one particular chapter, about the polarization of light.

A polarizer is a unique type of filter, and its properties are best explained with an oversimplification that Land himself often used. Waves of light, as they come at you, vibrate in every plane, vertically, horizontally, and at all angles in between. Certain crystal structures can function as gratings, allowing through light that vibrates in just one plane. If you picture the beam of light as a handful of thrown straws, oriented in every direction, the polarizing filter is a picket fence. The only straws that come through are the ones that align with the slots between pickets. Sunlight is also polarized when it bounces off a flat, nonmetallic surface, like a lake or the roadway in front of you, causing glare. Adding a polarizing layer to sunglasses blocks light vibrating in that one plane, wiping out the glare and helping drivers see the road or fishermen spot trout beneath the surface of a stream. Photographers, too, use polarizing filters to even out lighting.

The real versatility appears when you put a pair of these filters together. Shine a light through that picket fence, and its waves align. Now

How Polarizers Work



Land's attempt to sell polarized headlights and windshields did not lead to a deal with Detroit, but it did create a lot of prototypes—and

lawsuits. The tag on this one carries notations from both Polaroid's corporate museum and a patent-infringement case.

put a second fence in front of the first. If the two sets of slots line up, light keeps on going through; if the slots of the second filter are turned at right angles to the first, the light is blocked. If you have the ability to pivot the second filter back and forth, you've made a finely controlled, variable valve. Whether in your laptop screen, your flat TV, or your LCD digital clock, every pixel is lightened and darkened this way.

Polarizers exist in nature too. A Nicol prism—a clear calcite crystal cut at a precise angle, then reassembled—can do the job. So can a tourmaline gem. There's also an artificially produced crystal called herapathite, named for its discoverer, William Herapath. All are very small and expensive, of extremely limited utility. If you want a big, flat polarizing filter—one large enough to make a pair of sunglasses, say—they won't work. Herapathite crystals are like tiny needles, and Herapath spent a long frustrating time trying to grow larger ones.

Land, already steeped in optics from Wood's book, had seen a Nicol prism during a scientific demonstration at summer camp. When he went off to Harvard in 1926, he was still thinking about polarizers and what they could do. A year later, he had temporarily withdrawn, frustrated by the rigidity of the classroom and his unserious classmates. He moved to New York City, where he rented a small room and turned it into a lab.

At first, he, like Herapath, tried to grow big crystals, and soon discovered that he couldn't. His innovation, one that a few people had tried before him without success, was the idea that millions of submicroscopic crystals, lined up somehow, might do the same work, and if you could coax these onto a clear sheet, you'd have your filter. Land threw himself into this problem like a man possessed. He'd gotten married during these years, to a woman named Helen Maislen. Known as Terre (pronounced "Terry"), she too had some scientific training and regularly joined him in the laboratory. In order to use specialized equipment, Land used to sneak into a locked lab at Columbia University late at night, climbing out onto the window ledge to get in.

It was in 1928 when Land, aged just 19, first broke through. His first synthetic polarizer—the world's first, a genuinely major scientific discovery—was a vial of fluid filled with tiny floating crystals aligned

with a big magnet. Soon after, he figured out how to coat a thin plastic sheet with a wet layer of microscopic crystals, then align them by stretching the sheet before the whole thing dried. It was a unique, commercializable, salable product, and Land rapidly linked up with two people to guide him in the business world: Donald Brown, a patent lawyer, and Julius Silver, a dour and effective attorney who'd been his summer-camp counselor a few years earlier. Silver, in particular, became a guiding figure throughout Land's entire life, coaching him on anything of financial or legal significance, and remaining on Polaroid's board till he was 87 years old.

Patents became a near fetish with Land. His first, for the sheet polarizer, was dated April 26, 1929, and he knew how he was going to try to commercialize it. As he recounted it in later years, he had been walking in Times Square one night, and was repeatedly blinded by oncoming cars' lights. Soon enough, he'd figured out a solution: Put polarizers with horizontal slits across each headlight, and polarizers with vertical slits over each car's windshield. For drivers so equipped, oncoming headlights would be nearly blacked out while their own would continue to illuminate the road normally. It's a pretty great idea, and nobody has offered a better solution, even eighty years later.

You may be noticing, by the way, that none of this has anything to do with instant photography. Polarizers rather than pictures would define the first two decades of Land's intellectual life, and would establish his company and career. Instant photos were an idea that came later on, a secondary business around which his company was completely re-created.

By this time, Land had returned to Harvard, falling in with his physics instructor, a recent graduate named George W. Wheelwright III. Wheelwright was an archetypal product of the old New England upper crust, freed by family wealth to explore whatever parts of life interested him. He'd worked aboard a freighter after graduation, then gone back to Harvard to teach, and was so impressed with Land that he wangled him some lab space. Within a year or so, he and Land were talking about going into business. Land had a little capital from his father, plus his polarizer patent; Wheelwright had the rest. In 1932, Land became a permanent



TOP: A consolation prize: Polaroid didn't get to cover every headlight and windshield in America, but it did market a glare-reducing visor that any driver could install.

BOTTOM: Polaroid sunglasses were the company's one early money-maker. These, called Variable Day Glasses, were adjustable. Slide the little switch along the bridge, and it darkens or lightens the lenses.

Harvard dropout, and Land-Wheelwright Laboratories was in business. A chalkboard in their little lab read EVERY NIGHT 50 PEOPLE WILL DIE FROM HIGHWAY GLARE. Land wanted to make sure everyone there understood that they were all on a mission. Manifestly important.

There were already competing polarized-headlight ideas on the market, but they lacked Land's key ingredient: the thin-sheet polarizer. He and Wheelwright aggressively pitched their system to the auto companies while working nonstop to refine and produce their new material in quantity. The staff logged overtime and nights, missing dinners and spending weekends in the lab. Land once worked eighteen days straight without going home to change his clothes, and two of those days were Christmas and New Year's.

He all but admitted that his scientific work was his first priority. "If you dream of something worth doing and then simply go to work on it," he once said, "and don't think anything of personalities, or emotional conflicts, or of money, or of family distractions; if you just think of, detail by detail, what you have to do next, it is a wonderful dream." Though by all accounts he and Terre had a fine marriage, one that lasted sixty-one years, she could certainly get frustrated at his absence and his distractedness. One of his employees recalls accompanying him, later in life, on a night when he picked her up at Logan airport quite a bit later than he'd said he would. As they arrived, Terre shouted, "You're always late, you've always been late, even when Jennifer [their daughter] graduated," and kept giving him a hard time, all the way back to their home in Cambridge. Land didn't say a word—and, after dropping her off at the house, he went back to the office.

Everyone who worked for Land seems to have a memory of the man's intense workdays, whether in these early years or decades later. The people who were close to him grew accustomed to 4 A.M. phone calls, along the lines of, "I had an idea about that problem we've been working on. Would you come in and meet me at five?" Some grew weary of it. Stan Calderwood, who ran Polaroid's marketing and sales operation for many years, got those calls regularly, until one night when his exasperated wife answered the phone and exploded at the boss.

Others found the experience invigorating. Sarah Hollis Perry, one of the Princesses, worked closely with Land for more than thirty years, nearly to the end of his life, and had a dedicated telephone line installed in her house. “When the red phone rang,” she recalls, “I’d look around to see if my children were killing themselves, and if not, I’d pick it up.” These presidential calls rarely began with small talk. “He’d say ‘Tell me something interesting.’ And you’d think and say something, and then there would be a two-minute pause—long, long times, when he was thinking—and eventually he’d come back into the conversation. You never felt the need to keep a conversation moving. He just had a tremendously confident way of talking on the telephone, knowing that you weren’t going to hang up. You had to be patient. He was demanding, very demanding, but he was so brilliant that it was remarkable.”

Land-Wheelwright needed a major contract to provide stability and cash flow, and its best hope lay with Eastman Kodak, the largest photographic company in the world. Its founder, George Eastman, had in 1888 introduced the first camera loaded with dry film, to be mailed in for processing and returned with prints and a fresh roll. The Kodak camera had turned picture-taking into a mass phenomenon. Glass negatives, the black drape over the photographer’s head, a darkroom full of fumes—all the things that made photography a specialist’s business were eliminated. Eastman’s little black box was marketed with the slogan “You push the button, we do the rest,” and the little roll of celluloid inside it built an empire, especially after the movie business began to buy billions of miles of footage. And polarizing filters, for all sorts of photographic and industrial uses, were of great interest to Kodak.

Victor McElheny’s biography of Land, *Insisting on the Impossible*, lays out the delicate and elaborate multiyear dance between Polaroid and Kodak, which I need not recap here. Suffice it to say that Kodak was a little apprehensive about the two entrepreneurs’ youth but interested enough to sign a deal. Land-Wheelwright’s staff immediately went into crash mode, coaxing batches of polarizing sheet out of the balky machinery they’d built. At the end of 1934, the first parcel went off to Eastman in Rochester, New York, and \$5,000 came back. It wasn’t their first sale—that had been to Bell Laboratories, the previous August, for \$250—but

it was the big one. Contracts followed with American Optical (to make sunglasses) and Bausch & Lomb.

Much of the outside interest in Land's company came from the headlight project. He pushed it relentlessly, urgently, insisting that he could save thousands of lives per year. He got so much press, in fact, that in 1936 a news-clipping service pitched itself to Land-Wheelwright, offering a special rate for high volume. Though he faced some technical problems (especially making a polarizer that could stand up to the heat of a headlight bulb), the real problem was corporate. General Motors, Ford, and the other automakers of the day were willing to talk to Land, but nobody wanted to take the lead. They seem to have had a vague suspicion of this outsider's idea. Also, every car on the road would've had to be equipped to make the system work, so the carmaker that went first would have no sales advantage.

How Land-Wheelwright got all that public attention was no mystery. Over and over, when faced with scientific illiteracy or lack of imagination, Land resorted to a restrained bit of showbiz. As it turned out, he was strikingly good at explaining his work to people, and powerfully persuasive. Even the simple act of rotating one polarizer over another, whereupon two nearly clear sheets gradually turn black, had (and still has) the quality of a small magic trick. When Land pitched polarizing sunglasses to American Optical, he didn't just show up with a few samples. He rented a Boston hotel room facing the sun and checked in with a bowl of goldfish, which went on the windowsill, refracting glare into the room. The AO executives arrived at the door, whereupon Land mock-apologized for the glare, saying "you probably can't even see the fish," and handed each man a filter. He closed the deal.

His physical presence helped, too. "Dr. Land's eyes were something to be experienced," recalls Nan Rudolph, a chemist who worked in his lab in the late 1950s. (She had been yet another of Clarence Kennedy's Smith College students.) "When he looked at you, it was the most piercing look you'd ever seen. I think that's what people deferred to—that analytical, intelligent, piercing gaze." Many old Polaroidians recall that look, especially the ones who were young then, people who couldn't believe that the great inventor was bringing his focus to them.

Land could write, too. As Polaroid grew, his letter to shareholders, published in the annual report, gradually became a particularly dramatic showcase for his language and his thinking. These letters—really more like personal mission statements—are thoughtful and compact, and just eccentric enough to be completely engaging. Instead of discussing earnings and growth, they laid out Land's World, inviting everyone to join.⁴ They are an astonishing departure from the baggy corporate-speak of most annual reports. He cared about words nearly as much as he did about scientific rigor: When he elevated the marketing executive Ted Voss to become a corporate officer, Land gave him a four-word job description: "Keeper of the language."

Land's first real bit of linguistic innovation appeared in 1934. As Peter Wensberg retells the story, Clarence Kennedy and Land were discussing a name for the company's first product. Kennedy, with his classical education, offered "Epibolipol," which was somehow supposed to convey "sheet polarizer" in Greek. (*Epiboly* is also a biological term involving the rapid growth of cells into a thin sheet, which is a little like the way crystals formed in Land's invention.) That unpronounceable mess was vetoed. Kennedy then fell upon the suffix "-oid," perhaps because it suggested a characteristic set of properties, as in "spheroid." It also evoked the product's celluloid base. Besides, it sounded niftily futuristic and high-tech. Combine that with "polarizer," he told Land, and you have a name.

It wasn't perfect. Until it became a household word, readers often transposed the vowels, mispronouncing it as "poyla-rode." To this day people misspell it, swapping in an *o* for the *a*. But it stuck: Polaroid!

⁴ A transcript of the 1980 annual meeting includes this revealing exchange: A shareholder asked Land about his goals when he'd been a young student. "Two things," Land replied crisply. "I wanted to become the world's greatest novelist. I wanted to become the world's greatest scientist."

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