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THE MARVELOUS MRS. STANLEY AND THE AMAZING DR. YOUTZ

Dr. Richard Youtz, a man who valued reason and logic and who trusted the cautious plodding of the scientific method, was surprised. Yes, this was what he had come here looking for, but he realized that he had not truly expected to find it. The woman, a housewife with a shy expression, had successfully identified the different colored cards he had brought, using not her eyes, but her hands. Blindfolded. Sitting there at the kitchen table, in the home she and her husband had built themselves, on the ten acres where they lived with their four sons, near the edge of Flint, Michigan, she had reached her hands through the armholes of the black box and rubbed them over the different colored cards. She'd been able to tell the different colors apart.

It was early spring of 1963, still cold in Michigan, while the two sat at the Stanley family's kitchen table and ran the experiments, Dr. Youtz with his long thin face and droopy eyelids beneath neatly side-parted hair, Mrs. Stanley with her sloped shoulders, smooth round cheeks and curled bouffant hairdo. There were three pieces of cardboard, one red and two blue, all covered with squares of thin material that eliminated any texture cues. And Mrs. Patricia Stanley had concentrated hard and separated out the one red card. That was nothing, really. The chance of randomly guessing the unmatching card was one in three. But she had done it five times in a row. Dr. Youtz knew the laws of probability. The chance of getting it right five times in a row was $1/3^5$, or one in 243.

The investigation that brought Dr. Youtz to Mrs. Stanley's kitchen table had begun at Columbia University, in the faculty lunchroom. With its cacophony of clattering silverware and chatter, the odors of coffee and reheated casseroles, the flavors of sandwiches pulled from crumpled brown paper bags and the crunch of not-too-ripe apples, a lunchroom is a suitable place to begin a query into the senses. Dr. Youtz, the Chairman of the Barnard Psychology Department, had been following a story in the news. In the January 25, 1963 edition of *Time*, he had read about a young woman in the mountains of Russia who could "see" with her fingertips. Rosa Kuleshova, the article claimed, could read text from books and newspapers and describe the contents of photographs by touching them, while blindfolded. The results were clear enough; she could even place a finger over the eyepiece of a machine that generated different colored light and identify the colors correctly. Nobody understood how she did it. Kuleshova was epileptic, and although her brainwave

patterns changed when she used her "finger-sight," scientists had not found a concrete link between her special ability and her epilepsy. Perhaps there was another explanation, the article posited: several members of her family were blind, and she had learned to read both Braille and print, making no great distinction between the two ways of reading. Perhaps this was why "her senses of touch and sight had become practically interchangeable." She could even feel colors: smooth white, coarse red, wavy blue.

Youtz told the story to his colleagues. He probably would have relayed the story with a blend of fascination and skepticism—but perhaps also with laughter. He was a man of science, not a person to be taken in by the antics of some neurologist in the Ural Mountains as reported in the popular press. But Youtz had also read some other accounts—more cautious, more scientific—translated from Soviet scientific journals. Perhaps, the writers of those papers supposed, Kuleshova's skin had some special sensitivity to light.

When Youtz repeated the stories to a group of colleagues, it probably sounded to them like it does to us: like magic. But then the senses—just the five commonplace ones that never show up in news magazines—are all a bit magical. Even as Dr. Youtz told Rosa's story, professors were chewing on sandwiches, molecules passing along the surfaces of their tongues, hitting the raised edges of the taste buds and entering the spindle-shaped chemical receptors inside the buds' pores, the cells that carry the chemical messages into the receptor sites below the tongue's surface. At the receptor sites the chemicals from lunch changed the cells' membranes, affecting the ways that ions crossed between them to neighboring nerve cells, activating a chain of chemical messages that travel into the brain. In fractions of seconds, cellular messages traverse the tiny fibrous cords of nerve that pass through the brainstem and connect to the thalamus and finally arrive at the frontal cortex, which recognizes turkey on rye or grilled cheese and tomato.

What, really, was Dr. Youtz doing when he told his colleagues the story of Kuleshova's finger-sight? Just sending commands from brain to throat and mouth, via chemical emissaries, tightening and loosening some fibers in his throat while passing air over them, pushing the air through his mouth while shaping the tongue and aperture in a particular way so that the vibrations in the air would be detectable to his friends across the table, making sure to move the air just so. The sound waves reached across the table and into the lunchmates' ears, through narrow canals into shell-shaped chambers. The pressure from those waves vibrated three tiny bones in those chambers, and the movement triggered electrical signals and caused the auditory

nerves to release a chemical that would ferry information into the brain, which translated the waves back into words. And just like that, the tales of Soviet science and magical finger-sight would have leapt from his mind to theirs. Our bodies do all sorts of sorcery; maybe finger-sight sounded really possible.

If anyone could lend credibility to the far-fetched tale, it was Dr. Youtz. He was both worldly—having taught in China, studied in Berlin, done research for the Air Force in Korea, witnessed the detonation of two atom bombs in the New Mexico desert—and down-to-earth, the son of a South Dakota pastor and schoolteacher, who had worked as a farmhand in rural Massachusetts and as a door-to-door salesman in Iowa. Youtz was also well-credentialed; before coming to New York he had double-majored in psychology and education, earned his PhD in Psychology at Yale and worked in the Psychology Department at Harvard. And then Marion Gillim, an economics professor, spoke up.

Gillim remembered that when she was a senior in high school in Owensboro, Kentucky, in 1939, her teacher had the class do a series of experiments with the tactile senses. They had handled and described various objects while blindfolded. Gillim remembered that one of her classmates, Patricia Ainsworth, had been able to not only describe the objects she handled, but also—after rubbing them for about 30 seconds to a minute—identify their colors, even correctly identifying the stripes of a multi-colored scarf. Intrigued, Youtz urged Gillim to find out how he might contact the woman who could see with her fingers. That spring, Marion Gillim tracked down her old classmate and Youtz wrote a letter to see if Patricia Ainsworth—now Patricia Stanley—still had the skill that her high school science teacher had uncovered 24 years earlier.

Mrs. Stanley wasn't sure if she still had her "finger-sight." She had ignored the skill after that day in class; she thought it a "rarity" but paid it no mind. But when her husband administered a preliminary test she found that she could still tell different colors apart with her fingertips. She agreed to let Youtz investigate her ability, saying that she hoped her participation could lead to some medical advance to help the blind. On April 2nd Youtz traveled from New York to Michigan and arrived at the Stanley family's door, lightproof box and colored cards in hand.

The experimental box and set of stimuli were specifically designed to test dermo-optical perception, which would become known as "DOP" in the scientific press and as "finger-sight" in less scholarly circles. During testing, Youtz blindfolded Mrs. Stanley and stuffed Kleenex around the blindfold's edges to ensure she could not see out. She would place her hands into the lightproof box, which, at 30" wide, 20" deep, and 15" high, took

up a good portion of her kitchen table. The 1/2"-thick plywood was painted matte black inside and out. Two armholes had been cut in the front panel, and fitted with thick velveteen sleeves that reached inside the box. When she inserted her arms into the sleeves, Mrs. Stanley put her hands through the elasticized wrist openings that were designed to let her handle the objects without letting any light into the box. Youtz would place a set of cards into the box through the door in back, careful not to let her see them before or after the experiment. During each trial he put three cards inside the box—two were the same color and one was different—and asked her to separate the cards by color and identify the names of the colors if she could. He repeated the test five times with each set of cards, shuffling the stimulus cards after each test and then moving on to other color pairs.

That April, Mrs. Stanley consistently separated the cards successfully, often correctly separating the colors five times out of five and correctly naming the colors on the second or third test. She was successful in discriminating two-color combinations of red, yellow, green, blue, purple, black, and white, with the exception of white-yellow pairs, which gave her trouble.

Youtz's experimental box had a light bulb inside it, which was sometimes on, and sometimes not. Mrs. Stanley's results did not vary significantly when she was handling the cards in complete darkness versus when the box was lit. But other variables did change her results. Mrs. Stanley could not discriminate between or identify the colored cards when the cards were covered with 1/2"-inch picture glass, or when her fingertip temperature fell below 75 degrees, or when both hands and stimuli were submerged and she tried to use her "finger-sight" underwater.

How was Mrs. Stanley identifying the colors? In the lighted box, Youtz supposed the phenomenon could be due to the skin's sensitivity to light. When we see things, it is because reflected light passes through the transparent corneas that sit in front of our eyes, onto our retinas at the back. The focused light creates an image on the retina, and then passes into the photoreceptors behind the eye, which absorb photons, change shape, and trigger a cascade of enzymes and neurotransmitters that send the visual information to our brains via the optic nerve. Skin sensitivity to light occurs in many organisms, though the skin is several thousand times less sensitive to light than are human eyes. So light and photoreceptors are necessary—but not necessarily whole eyes.

But this could not explain Mrs. Stanley's ability to differentiate colors in the lightproof box when the light was off. Youtz suspected that temperature was key to tactile color discrimination. Human hands generate heat, and darker colors absorb more heat than do lighter ones. Perhaps Mrs. Stanley was detecting a temperature difference when she rubbed the cards in her hand.

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Youtz returned to Barnard. That spring, while continuing to teach, he read the literature on dermo-optical perception. Plenty had been reported in the Russian press about Rosa Kuleshova and the progress that was being made in those studies. The Russian scientists had found two more subjects with similar abilities: nine-year-old Lena Bliznova and 37-year-old Nina Kulagina. Youtz got a grant to have the Russian literature translated and to fund further studies of his own. According to the USSR's Academy of Sciences, doctors had been successfully working with the women; with training, their finger-sight was growing stronger. Researchers gave bold, hopeful statements to the press about teaching blind people to see with their hands in the future. A calmer, more scholarly account of skin sensitivity to light was published in *Biological Review* that year; it focused on the skin of aquatic and amphibious animals.

Youtz scoured it, annotated it, and summarized it, absorbing information about dermal light reactions and photoreceptor cells. The human eye is sensitive to electromagnetic radiation of certain wavelengths: about 0.3 to 0.7 microns. When electromagnetic radiation exists at these wavelengths, it is light; when it exists at wavelengths of one or two microns, it is infrared radiation—heat—which of course we sense with our skin rather than our eyes. Perhaps, Youtz supposed, in some people the skin's sensitivity to electromagnetic radiation extended below 0.7, into the sensory territory traditionally held by the eye. Perhaps Mrs. Stanley's skin sensitivity extended to 0.5, or to even to 0.3.

That summer Youtz returned to the kitchen table at the house on the outskirts of Flint to continue working with Mrs. Stanley. It was hot that summer, and muggy. The experiments made Mrs. Stanley tired; she said the concentration exhausted her.

Our senses seem automatic, and for the most part they are. With an unobstructed view, the human eye can see a grapefruit 1,250 feet away, but focusing on that grapefruit, watching it carefully and trying to notice details about it when it is hovering at the border of the visible and the nonvisible—about to topple out of the realm where the eye has power—would certainly be tiring. In any event, the tests that summer were successful; Stanley continued to correctly identify the colors of Youtz's cards using only her sense of touch. Youtz returned to New York for the fall semester determined to learn more.

Just as the semester was starting, Youtz presented his findings for the first time. At the meeting of the Psychonomic Society, held in late August at Bryn Mawr, Youtz presented a paper titled "Aphotic Digital Color Sensing: A Case Under

Study." He was more careful in his language than the *Time* reporters had been, certainly more cynical than the Russian scientists seemed to be. He described the experiments in detail but offered no single hypothesis, no promises of teaching others to develop the skill. Even so, a wave of publicity followed the paper. That year, while Youtz ran similar tests on 133 students from his Introduction to Psychology class, science reporters buzzed. "Sixth Sense is Hinted" ran in the *New York Times*, "Sees with Fingers" in *Newsweek*. "One is inclined to be skeptical," Youtz is quoted in one article, though the journalist apparently did not share this inclination. "Patricia Ainsworth Stanley is a typical American suburban housewife—almost," the story reads. "She can 'see' with her fingers in the pitch dark."

Youtz was always more careful with his wording, but "aphotic digital color sensing" and "dermo-optical perception" do not capture the imagination the way that "finger-sight" does. He was insistent that differentiating colors is not the same as vision. We talk about *vision* as though it is one monolithic ability, but it is more properly thought of as an amalgam of senses: depth perception, motion detection, discerning color or pattern or distance. Youtz continued to emphasize the limitations of his study as he did the conference rounds that year, presenting his progress reports to the major psychological associations.

All the while he continued running tests on the Barnard students. Eight students agreed to further work with Youtz to try and develop their dermo-optical perception. After 20-30 hours of practice with red, white, and blue stimuli, one student was particularly good at telling red stimuli from blue, another blue from white, another at differentiating all three consistently; the rest had correct results attributable to chance. The ones who successfully discriminated colors often remarked that they were not sure how they could tell the cards apart, and that perhaps it was due to temperature. The experiments led him to conclude—tentatively—in his remarks to the Eastern Psychological Association in Washington, D.C., that dermo-optical perception was "a real phenomenon," and that it was "most likely an extension or variation of the temperature sense in the skin."

When Youtz returned to Flint that winter to test Mrs. Stanley again, she was not able to reproduce the results of the previous summer. He speculated that this was due to the cold temperature: perhaps the decreased blood flow to the fingertips dulled the sensation in whatever heat- or light-sensing receptors Mrs. Stanley was using. One day they raised the temperature in the room to over 80 degrees, and Mrs. Stanley's results were once again above the level of chance, but overall the January 1964 trials were unsuccessful. The results were noted

in one paper; others continued to report of the marvel of Mrs. Stanley's finger-sight.

The press attention culminated in a long piece in the *New York Times* that March, entitled "We Have More Than 5 Senses." The reporter referenced the newly discovered "fingertip seeing" indicated by the "Barnard-Russian discoveries," which he lumped in with other new or latent senses such as echolocation (dolphins use this, but he was talking about humans). After reading the story Youtz wrote a letter to the editor to clarify some of the finer points of his research, but he was already beginning to look silly.

Following the *Times* article, Martin Gardner, a famous science writer and mathematician (as science writers and mathematicians go), wrote a letter to the paper saying the piece was "marred by a premature, uncritical acceptance of recent findings by the Russians and by Richard P. Youtz." As he went on to point out, "Dozens of similar cases have been reported during the past century. In every case, careful follow-up tests disclosed that subjects were obtaining information by methods well known to conjurors and mentalists, but not to psychologists." Youtz, he claimed, was being taken in by magic tricks.

The press coverage went on; despite Gardner's letter several more articles appeared in the next year. Meanwhile, during 1965 and 1966, Youtz continued to present his findings at conferences despite the fact that when he retested Mrs. Stanley on two more occasions, her results never again surpassed the level of correct responses that could be explained by chance.

In 1966 Gardner published a four-page piece, complete with footnotes, in *Science*, expanding on his earlier letter to the *Times*. In "Dermo-optical Perception: A Peek Down the Nose," Gardner listed many claims of eyeless sight and explained what magicians' tricks the subject had used or could have used in each case. The most common way to see while blindfolded is the "nose peek," in which the blindfolded person can sniffle, wrinkle her nose or furrow her brow and create a small opening where the blindfold crosses the bridge of the nose; this is what Gardner suspected Kuleshova and Stanley had been up to. "Youtz's first round of tests," he wrote, "were so poorly designed to eliminate visual clues that they cannot be taken seriously." Gardner had a long-running column in *Scientific American* and had written a book in which he criticized pseudoscience and called for skepticism in scientific inquiry. Being criticized by Gardner put Youtz's notions in the same boat as creationism and telekinesis, which Gardner had famously attacked—a fair place for finger-sight but perhaps too harsh an assessment of dermo-optical perception. Youtz fought back, the men's disagreement playing out in the venue where it had started: in the op-ed pages. In letters to the editors of both *Science* and the *Times* he carefully laid out his

temperature-sensing hypothesis and described in detail the controls under which he had performed the experiments.

But letters to editors could not resurrect Youtz's theories, no matter how fierce the wording or how methodical the experimental technique they described. He no longer had successful experimental results to report. His grants expired, the Barnard experiments never really took off, and Patricia Stanley never again repeated the results she had achieved on that first breathtaking visit in April of 1963 or during those muggy hours of summer experimentation. In 1968 Youtz published his final paper on the topic, an account of the entire experience in *Psychology Today*, a magazine straddling the worlds of academic and popular psychology. He opened the essay with a quote from Jonathan Swift's *Gulliver's Travels*:

> *There was a man born blind, who had several apprentices in his own condition; their employment was to mix colors for painters, which their master taught them to distinguish by feeling and smelling: it was indeed my misfortune to find them at that time not very perfect in their lessons; and the professor himself happened to be generally mistaken.*

Hoping to avoid being seen as just another mistaken professor, Youtz wrote, "Most people would agree with Swift that the idea of telling colors by touch is absurd… it is simultaneously regarded as impossible and magical. Yet discriminating between colors by touch may turn out to be neither." He went on to describe his initial fascination with the Russian experiments, his meeting with Mrs. Stanley and the subsequent experiments, his hypotheses about light receptors in the skin or an extension of the skin's normal thermoception.

But as usual, when it came to this particular study, Youtz had a hard time successfully navigating around the rigid skepticism of his colleagues and the press's tendency toward simplification. When the article came out, the paragraph describing sensitivity to reflected light included a sentence reading, "As is well known by anyone who has walked from an asphalt parking lot into a sandy beach in the summer sun, dark colors absorb more light as well as more heat than light colors." In his copy of the magazine, Youtz circled the sentence in black ballpoint and crankily wrote in the margin in curly schoolteacher cursive, "Nonsense introduced by editorial rewriting." (Dark colors absorb more visible radiation, light, which is then converted into infrared radiation, heat. So asphalt does *absorb* more light than sand does, but it *radiates* more heat. An important distinction, at least for someone writing about

temperature sensitivity.) No letter to the editor followed—at least not one that was published.

As Youtz's finger-sight investigations wound down, the team of Russian scientists continued to study Rosa Kuleshova, Lena Bliznova and Nina Kulagina. In August of 1970 scientists determined that the women had been peeping all along. A group of five scientists who had not been involved in the previous tests devised a set of four experiments, each with a different way of eliminating visual sight. In two of the experiments, subjects would be blindfolded, but in such a way that it would be possible for them to catch glimpses of the stimuli if they tried. In the other two trials, the vision-elimination methods were airtight. As Gardner predicted, when the subjects were able to cheat, they seemed to exhibit "cutaneous sight" (the term used in Kuleshova's case was different from Youtz's because it encompassed more than the ability to perceive color), and when cheating was impossible, their correct responses fell well within the limits of probability. The team determined that the subjects "could have used ordinary sight and hearing to obtain information" all along. It had been simply a matter of sneaking a peak down the nose, opening an eyelid and letting photons hit corneas and letting corneas signals retinas, which simply transformed light waves into spikes of ions crossing membranes up into the brain. Nothing more magical than that.

By the end of the '60s, Dr. Youtz's work with Mrs. Stanley was completely over—he continued teaching at Barnard, taking on research projects, serving as the Chair of the Psychology Department and then as a student advisor. In his later years he returned to the study of "finger-sight," in a way, a type of finger-sight whose miraculousness we tend not to notice: he worked with blind students to optimize Braille.

As for Mrs. Stanley, she never confessed to cheating, but nor could she replicate her first results. It would be satisfying if we could understand now what Youtz could not, if somewhere in his notes and marginalia were the hidden clues, something that could place Patricia Stanley in one camp or another: illusionist charlatan, biological miracle. There are no such clues. To fill this vacuum of certainty, one wants to think of the whole thing as a coincidence, a fluke incident where the laws of probability were broken, nothing more.

Ultimately, it matters very little whether Mrs. Stanley's finger-sight was the real thing or a fluke (though I do hate to imagine it as an extended deception). This much is certain: our bodies send our brains information about the world in ways beyond sight, hearing, touch, taste, and smell. There is proprioception, for example, the sense through which we know

where all our body parts are in space (the reason you can close your eyes, wave your right hand around and touch your left hand to it without any input from your eyes), and equilibrioception, which, by sensing the levels of dense fluid in the inner ear, gives us feelings of balance and acceleration. Will finger-sight someday be added to that list? Will it become a known sensory anomaly like color blindness, or a suspected one like tetrachromacy†? Maybe it was nothing at all, and the story ends in a kitchen in Michigan. The housewife and the investigator at that kitchen table were asking questions they were never able to answer, but they were also in touch with some certainties: that the body is mysterious, that science is ongoing, that time and discovery change the way we understand the worlds around and within us. Science has a reputation as the opposite of magic, but if Mrs. Stanley is evidence of nothing else, she is concrete proof that looking closely at the natural world can make it seem more marvelous, not less.

† Most people are trichromats, meaning they have three kinds of cones in their eyes for recognizing color. Red/green color blindness occurs when people have only two cones, making them dichromats. Recently researchers have been investigating the possibility that some people have four cones, enabling them to see thousands of colors that the rest of us can't detect. A 2012 article in *Discover* magazine notes: "It's possible these so-called tetrachromats see a hundred million colors, with each familiar hue fracturing into a hundred more subtle shades for which there are no names, no paint swatches. And because perceiving color is a personal experience, they would have no way of knowing they see far beyond what we consider the limits of human vision."