

TRACK 9 28:28

Unknown Speaker presenting Erica Erdman's presentation at APA tribute to Sperry in California.

Speaker 1: [INAUDIBLE 00:00:01] that psychology could be the study of behavior only, strongly influenced the content and methodology of psychological science. The study of consciousness and intersection were banned from psychology. Under Lashley, Sperry investigated the adaptive capacity of the visual system in newts, a type of salamander, by rotating the eyeball of these animals 180 degrees. After surgery, when small pieces of meat were moved back and forth in the water above the animals, they tilted their heads downwards and began to move towards the bottom of the aquarium, not the top. Again, not adaptive relearning occurred. Such experiments suggested to Sperry that a form of chemical selectivity in nerve growth was occurring. He proposed that nerve cells acquire and retain identification tags that are chemical in nature by which they can be recognized and distinguished from each other. And if they find their proper targets by specific chemical cues, which respond to complementary ones in the target. The idea that individual cells have characteristics specifying their development, and that cells with the retina could be chemically different, was totally new and heretical. Sperry's ideas, according to neurobiologist David Hubel, had a profound effect on the entire experimental field of neurodevelopment. In psychology, various experiments brought into question the extent of the influence of the environment in learning. These studies consistently showed that whenever central fibers were disconnected and transplanted, or just scrambled, regrowth always led to orderly, functional recovery, independent of learning. This research supported the news of ecologists and a contest of instincts formally rejected returned to a place in understanding human behavior.

After a stint at the Yerkes Primate Laboratory in Florida, Sperry returned to the University of Chicago as assistant professor in 1946. There, and later at Caltech, he and his students Nancy Miner and Ronald Meyers conducted a series of experiments to investigate Lashley's notion that the cerebral cortex functioned as a diffuse electrical field. Sperry made grids on the cortex of his experimental cats, sliced through the gray matter, and tested the cats' discrimination ability. In a similar experiment, the investigators inserted mica plates into the cats' cortex. Neither the slices, which would cut any neural connections traversing with the cortex, nor the mica plates, which would stop electrical impulses from passing, had any effect on the cats' behavior. They could still resolve a triangle and discriminate the target shape from highly similar ones. These experiments disprove the theory that self-conduction currents in the cortex were responsible for perception of a Gestalt pattern. As Hamburger said in preparatory remarks when Sperry was awarded the Gerard Prize for outstanding contributions to neuroscience, "I know of nobody else who has disposed of cherished ideas of both his doctoral and his post-doctoral sponsors, both at the time the acknowledged leaders in their field."

At Chicago, Sperry decided to investigate the function of the corpus callosum. All of his work to this point had emphasized the importance of connections, and here was the largest bundle in the brain with no apparent function. The neurologist McCullough had stated that the only demonstrable function of the callosum was to facilitate the spread of epileptic seizures. Lashley had once remarked jokingly to Sperry, "The corpus callosum is perhaps the mechanical structure which held the two hemispheres together so they wouldn't sag." Sperry thought that perhaps there was something at a higher level. A different [INAUDIBLE 00:04:02] was applied and decided to investigate.

Now, the problem in studying the callosum was to cut the optic chiasm. Sperry had learned stereo microscope surgery to pick up tiny eyes, and had also been using it to implant electrical field distorters to test the field theory. He applied this now to the callosum problem. At that time, surgeon's eyeballs, whatever was being cut, it was unheard of to work through a microscope. Sperry decided, however, to use this technique for cutting the optic chiasm. He and Ron Meyers proceeded with cutting the chiasm and the corpus callosum of the cats. Based on Lashley's work with cats, they built a box in which the cats could be trained to go through one or another door with food. They used this box to train the cats with one eye included, and then investigated what the cats knew when they switched to the other eye. Training did not transfer. The cats were completely unaware of what they had been taught. As neurosurgeon Joe Bogen said later, "The behavior of those cats was the most dramatic thing I have ever seen."

With this research, Meyers and Sperry showed that the callosum had a very specific function and vision. This was the beginning of the split brain work. Sperry moved from the University of Chicago to Caltech, along with Miner and Meyers of the split brain test. Other students came. Some, like Ted [INAUDIBLE 00:05:28] and John [INAUDIBLE 00:05:29] and Giovanni Berlucchi worked with cats. Others, like Mitchell Glickstein, Richard [INAUDIBLE 00:05:37], Chuck Hamilton, and his coworker Betty [INAUDIBLE 00:05:39] worked with monkeys. In 1960, a human patient subsequently known as WJ arrived at the emergency room of White Memorial Hospital, where he was seen by Dr. Bogen. It became apparent that the patient had medically intractable seizures with multiple seizure [INAUDIBLE 00:05:59]. After extensive unsuccessful treatment at that hospital and six more week of unsuccessful treatment at NIH, this patient, at Bogen's suggestion, agreed to undergo a commissurotomy. This was the beginning of the modern human split brain study.

When Michael Gazzaniga arrived as a beginning graduate student in September of 1961, Sperry suggested that he make a study of WJ, the principal part of his thesis work. This work continued over in ensuing years, eventually including other patients, because the surgery on WJ in February 1962 proved to be so successful in controlling the epilepsy. Sperry, Gazzaniga, and Bogen conducted psychological experiments with a patient, in which information presented to one hemisphere, visually or [INAUDIBLE 00:06:52], was not identified by the other. These experiments demonstrated the independence of the two preceding hemispheres with two distinct modes of central process. The research shows that consciousness was not a global, non-specific pervasive phenomenon that could be localized in each hemisphere. Other researchers—including Trevarthen, Levy, Nebes, Tang, Eran Zaidel and Dahlia Zaidel, Gordon, Johnson, Kozlowski, Ellenberg, Franco, [INAUDIBLE 00:07:24], Cronin-Golomb, [INAUDIBLE 00:07:26], and Henninger—greatly extended these findings, as did the dozens of scholars from other institutions that studied these patients.

Left-brain/right-brain studies in normal subjects with perceptual techniques developed in laboratories across the country, across the world, an entirely new way of thinking about the human mind arose. The experimental commissurotomy work catapulted consciousness back into the domain of psychology. Although demonstrating the function of the callosum was sufficiently important to result in a Nobel Prize, Sperry himself believed that his most important contribution was his theoretical work on consciousness. He had long been considering the mind-brain relation and first wrote on it in 1952. The split brain work prompted a new approach. It was clear that each hemisphere had its own conscious mind, but in the normal brain, consciousness appeared unified. This led Sperry to posit that consciousness was a larger whole that spanned both hemispheres through the callosum. The same site suggested the idea of emergent properties that act back down upon the structures from which they arise. This led Sperry to a new bidirectional solution to the mind-body problem, in which not only did material influences give rise to mental phenomena, but new, emerging mental phenomena impacted and causally influenced the material brain from which they came. Sperry recognized that the emergent approach had important ramifications. Organisms were not merely clusters of atoms. Macroproperties had causal force as well. Not only genes were selected in evolution, but the individual as a whole, even societies, were selected. Preferences were comprised of hardwired and acquired characteristics. Thus, for explaining behavior, it was important to understand not only the facts, but also a person's values. This new view of a causal role in consciousness led Sperry to believe that human values are the most powerful force on Earth.

Methodologically, Sperry was a behaviorist, believing only in those phenomena that could be reliably observed and validly measured. However, he was also a mentalist, believing in the reality of mind. The mentalist view of consciousness has now replaced the behaviorist view, as evidenced in the cognitive revolution, and psychology has switched from disregarding consciousness to returning it to the central place. The timing and continuing influence of Sperry's theory suggest that it played an instrumental role in the cognitive revolution. It appears that he brought consciousness back into the domain of psychology without sacrificing the rigorous objectivity and methodology of rational science. Sperry, and others such as [INAUDIBLE 00:10:18], George Miller, and [INAUDIBLE 00:10:19], reintroduced mental events into psychology. It is unlikely that they will be omitted again.

One of the important problems in the study of consciousness was that of fusion. How does information from many areas of the brain become synthesized to give rise to a unified experience? The split brain shows that the fusion problem is greater than simply the integration of information from various sensory modalities. How does neural activity create meaning or transcend the sense of self? [INAUDIBLE 00:10:52] psychologist

and specialist in the history of consciousness says, "Sperry's work suggests that consciousness is more than a neural network. The patients have revealed two independent senses of meaning and awareness. Simply connecting by exciting or inhibiting does not generate meaning. The split brain data will not allow us to gloss over this creative function. These subjects are an integral part of the study of consciousness and cannot be ignored. If one reviews the current work of people who worked with the split brain subject in Dr. Sperry's lab, one is struck by the high number who are investigating some aspect of consciousness. Clearly, the split brain work generated the conviction that it was possible and important to study consciousness scientifically."

What direction will psychology go? Sperry would like the causal role of consciousness to direct our actions. He exhorts us to adopt values consistent with preserving the planet, mainly limiting population growth. What can we do to realize his vision? Although we may desire to do what is good, we often do not do so. People often seem unable to limit themselves for the greater good. Motivations out of our awareness generate behavior that's inconsistent with our expressed values. The split brain model of dual consciousness may help us better understand these motivations, and in doing so, assist us in bringing our values more closely into line with our actions. Regardless of the extent to which consciousness and the intact brain is dual or unified, the entitative process whereby unity takes place and greater entities emerge will continue to challenge scientists in general and psychologists in particular.

[Applause]

I now have the privilege to present Erica Erdman's presentation. Erica is the former library research assistant of Dr. Sperry. She's now retired. She lives in Rockport, Nova Scotia. She and her husband, Carl, came down for six months every year for the Canadian government so that she could retain her medical insurance up here, six months in Canada. So, they would drive down, or Erica would fly, and she would work very diligently for Roger collecting the various pieces of research in the library, and working with him in developing his theory of consciousness, and arguing it about it with him as well. So, without further ado, let me present Erica.

Erica believes she may be the only person, or at least the first one, who was attracted to work with Dr. Sperry not because of his outstanding achievements in science but because of his refusal to let his achievements dominate and limit his worldview. Her first encounter with Sperry's visionary thinking occurred through reading, *Bridging science and values*, 1979. In that article, he expressed with convincing power the belief that in a sound and healthy world, facts cannot be pursued at the expense of values, and values cannot be pursued at the expense of facts. He or she read from the pen of a neuroscientist, an outstanding neuroscientist, that values, not electrical-chemical activity or synaptic transitions or action potentials, but values determine our actions and decisions. Of course, Sperry knows very well that all this physical sparkling inside our brain cases is essential, and he would never dream of neglecting its importance. But he also knows that we could not function unless all this fire is first translated in subjective experience, and that it is our own special, subjective experience that allows us to think, and that makes life worthwhile and meaningful.

When he first expressed them in the mid-'60s, these views seemed heretical. In 1979, when Erica read them, they were halfway into acceptance, and now in the '90s, they're taken for granted. Even an authority in neuroscience such as Gerald Edelman now maintains that consciousness is efficacious. But it was not Sperry's mind-brain theory that carried her away. It was the extension of his quest from how we think to what we think, and to the way in which our thinking affects the quality of human life on Earth, and the long-range prospects of our biosphere. In Sperry's view, that step was natural. Within the brain, we cast conceptually in a hierarchical continuum from the brain's subnuclear particle, on up through the atoms, molecules, and brain cells, to the level of neurocircuit systems without consciousness. And finally, the cerebral processes with consciousness. Objective facts and subjective values become parts of the same universe of discourse. The scientific image of man regained much of the freedom, dignity, and other humanistic attributes of which it long has been deprived.

In other passages, the image of our creators reinstated closer to reality and described as being of awe-inspiring grandeur. All of this, she felt, was written from her heart. Of course, she dreamed of assisting Dr. Sperry with his work, and she was elated when he dream came true. Not that everything went smoothly.

"On the contrary," Erica explained, "to say that I helped Dr. Sperry would be a euphemism. In fact, I managed to make his life more difficult by just agreeing with many of his most cherished convictions." Their greatest bone of contention was competition. Sperry felt that evolution knows best, that our brains, our thoughts, and our spirituality were the result of a struggle for survival in nature, and that we would still be crawling around like earthworms or sly moles were it not for competition.

Erica was appalled by the waste of genius she discovered in a scientific paper she had to read in the library during her position as Sperry's library research assistant. How much highly valuable time was misused to diminish the impact of an opponent's contributions. Nor was she convinced that evolution's creation and subsequent elimination of 99% of all species in existence would display wisdom of a superior kind, a wisdom we oft copy. She would draw pictures of an evolutionary tree with all branches clipped off due to extinction, and only a feeble route making it up to the top. And Sperry would draw innumerable shoots and off-springs on the surviving route, supplying nature with a wonderful variety of life he loves so much.

Needless to say, after nine years of these debates and discussions, each of them was more than ever convinced of their respective position's validity. Nevertheless, for Erica, the time was immensely fruitful. She conducted independently a research project in search of values for human survival, and as a result, published *Humankind Advancing*, dedicated to the promotion of more far-sighted responsible attitudes. She also published *Beyond a World Divided*, a book on Sperry's thought and philosophy for the general public, written together with the science writer David [INAUDIBLE 00:18:32]. This book concentrates on Sperry's courage, on his advance again and again after each victory into new and unexplored territory, attacked by his critics and overcoming all obstacles, drawn forward by his encompassing vision. For Erica, too, it was his vision that overpowered all disagreement, and that was the reason for her staying on until she was convinced she could be of no more use to him. He never asked her to leave.

The following is based on *Beyond a World Divided*, the book on Sperry's vision and courage. After documenting the fury and the fight between science and religion, by hope dissolved and mutual incomprehension, our hero is introduced. Roger Sperry looks at human problems from a larger perspective, one that brings into focus not only all of mankind but all of life, and beyond that, all of creation. From this vantage point, he sees humanity as a small but extraordinary fragment of reality, endowed with the gift of mind, probably the most amazing product of evolution. But wasting that gift, indeed, on the verge of destroying it, Sperry sees warring worldviews, defending facts against ideals or ideals against facts, as part of a larger whole as incomplete fractions of the same reality. That reality is ruthlessly eliminating all unrealistic expectations—that is, expectations that fail to take account of nature's laws—while, at the same time, condemning to sub-human conditions those without any expectations, ideals, or values. In Sperry's view, unrealistic expectations are created not only believing certain supernatural powers, but also by unwarranted confidence in the ability of materialistic, reductionist science to compensate for the loss of such beliefs.

Earlier in his life, Sperry was drawn by the lure of the mind-brain problem, first toward the investigation of brain development, a work on which he himself tends to look back as more radical and more basic than the latest left brain research, and in which he invented the experimental paradigms that people have used for the last 30 years.

Having succeeded, however, he reacted to his victory in an unexpected way. While eager researchers crowded into the field he had opened, he preferred the challenge and the loneliness of asking new questions and being the first in a new area. This new field is split-brain research, the work for which he received the Nobel Prize, had an immense impact globally, not only in the world of science, but also among the general population. And even all this glory failed to keep him permanently within the boundaries of his chosen domain. At the height of his success, Sperry reacted in a fashion intensely typical of his character. He stepped forward beyond all his previous work to accept the challenge of a far greater, more difficult, and more important task. He even went so far as to call all his previous efforts relatively minor in their implications compared to his present concern with consciousness, ethics, and values. Transcending traditional boundaries of science, he advanced into philosophy.

Crucial to Sperry's philosophy are the concepts of the emergence [INAUDIBLE 00:22:00] causation, the appearance of new phenomena and laws through first-time constellations of atoms and molecules in the

universe, and the causal effect of these phenomena and laws on all previous, as well as subsequent, evolution. These causal effects disappear, and with them any adequate representation of reality with the dissection of entities into parts. Contemplating ethics, Sperry turned to the wonders of nature as pole star. For him, the forward thrust of evolution was an awe-inspiring phenomenon, but it was wrong to destroy and degrade, and right to enhance and revere. He often corrected her when she spoke of human survival, and maintained that survival alone can occur under degrading conditions – what we have to aim for is quality survival.

How can quality survival be achieved? A new, more encompassing vision is needed to attract humankind away from shortsighted, solely money-oriented interpretations of success to true advance, advance that liberates hidden and largely unknown potentials within the human brain. Concerned and farsighted thinkers agree that if we continue to equate success with immediate material gain, we are in danger of creating a small, irresponsible, and unconcerned upper class, taking advantage of the vast majority of human beings who live in abject misery, and whose proliferation would be encouraged because it will increase the market. That mass, of course, would be kept gullible, uncritical, and in such desperation that they will sell everything they have, even their health and their moral

Alarm about this development leads to a counter reaction that infuses ethical values enshrined in ancient traditions with new life. Ethnic coherence is defended to the extreme; even super ethnic values such as Catholicism are guarded with new tenacity. Contraception still in 1993 was declared a sin by Pope John Paul II in perhaps the most important document of his papacy. Both magnets—the one of money and its counterpart, the one of guidelines adverse to science—are pulling humanity back to conditions of the Middle Ages – or worse. In the face of these powerful dominators of human decision-making, a new magnet of an encompassing vision so beautifully described by Sperry and so well reinforced by his integration of science and values provides a beacon of hope for our future that can hardly be overrated. In the eyes of science, to put it simply, man's creator becomes the vast interwoven fabric of all evolving nature, a tremendously complex concept that includes all the [INAUDIBLE 00:24:48] and emergent forces of cosmic causation that control everything from high energy subnuclear particles to galaxies, not forgetting the causal properties that govern brains and behavior at individual and social levels.

For all these, science has gradually become our accepted authority, offering a cosmic scheme that renders most others simplistic in comparison and which grows and evolves as science advances. This emphasis on constant enrichment of our view of reality, on constant increase of our understanding of nature, including human nature, and on the need for a constant reevaluation of our guidelines is, Erica believes, the most mature and promising attitude to which we could aspire. Only now she sees clearly why she feels so uncomfortable with an overemphasis on competition. Competition, whether in nature or culture, leads to advantages only within the present situation. Competitive advantages, when the situation changes, turn into disadvantages. Human beings who are able of foresight—or at least a glimmer of foresight—have the right and the duty to transcend the limitations of nonhuman nature.

A new definition of the highest good is suggested as a goal for our species to strive for – the capacity of fore...the capability of foresight and insight. Long-range foresight is a prerequisite for quality survival of our planet. The new goal would not contradict Sperry's demand to revere and enhance the forward thrust of evolution, but would help to focus and direct it. If that new idea could be substituted for the present money god that destroys our species and our Earth, reasons for a counter reaction would be absent, our efforts to regulate population growth would be much more successful, and we would look forward toward the future with renewed hope. Though diverging somewhat from the definition given by Sperry, the above suggestion is fully in line with his thinking, nor is incompatible with the tribute to him. On the contrary, it highlights one of his qualities, which though occasionally mentioned, has not yet been sufficiently appreciated. The ability to provide an atmosphere that encourages in his coworkers critical thinking, self-reliance, and creativity. Erica's firmly believed—firmly convinced—that if the grand vision Sperry described would become the pole for our new mental compass, the recognition of his work and his impact will grow with each century to come. Thank you.

[Applause]

Speaker 3: If you're interested in the journal, Polly has several copies. Of course, I'll have several more.

- Speaker 1: This is the copy, the January issue that's attributed to Roger Sperry. So, if you would like a copy...
- Speaker 3: Okay. Our next presentation this morning is by [INAUDIBLE 00:27:43] from Monash University in Australia, and the title of his presentation is "Brain-Body Connection [INAUDIBLE 00:27:52] for Science, Humanity, and Health Care".
- Speaker 4: Well, I already told you that I was never a student of Sperry's—