

Erich Harth, November 16, 1919 ---

Erich Harth arrived at the bus station in Syracuse, NY on a cold, snowy day in December, 1940. He was met at the station by the secretary to the President of the Syracuse Peace Council, Norman Jayhill Whitney. Whitney was a minister as well as a faculty member in the English Department of Syracuse University and was known as someone who would help settle refugees from Europe. He took Erich to lunch and then introduced him to the manager of the Syracuse Hotel who hired him as a bus boy. Whitney then arranged for Erich to stay at the YMCA until he could find other quarters. In January Erich enrolled in Syracuse University. He was granted two years of advance placement for his graduation from the gymnasium in Vienna. Originally, he wanted to study philosophy, but when he enrolled for a physics course, William Fredrickson, head of the Physics Department, told him to major in physics as “that is where the action is”. Erich did so, received his BS in 1943, and began graduate school as, in spite of the war effort, physics students were deferred from the draft. In anticipation of the Normandy invasion, the deferments were canceled in the spring of 1944. Other graduate students got jobs at Oak Ridge, but, as an enemy alien, Erich could not. So, Erich was drafted and left for basic training at Camp Blanding in Florida, thus beginning his second tour of military service.

After basic training at Camp Blanding in Florida, Erich volunteered for the paratroopers. He had four weeks of training at Fort Benning and then shipped out of Fort Ord to the Pacific theater in July 1944. He arrived in Leyte and from there was sent to Negros in the Philippines to join the 503rd parachute infantry regimental combat team. There he trained as a machine gunner, but after two weeks, he volunteered to become a medic in response to a call from the battalion surgeon, Captain Pierce. After the war ended, the Japanese on Negros surrendered and a couple of months later the 503rd regimental combat team was shipped to Japan where medic Harth served in an aid station until he was sent back to the United States for discharge.

So, in September, 1946, Erich Harth once again arrives in Syracuse to pursue his education.

But, his journey this far was hardly simple or direct.

Erich was born in Vienna, Austria on November 16, 1919. His mother Sophie Harth had come from Germany to be a nurse in an Austrian hospital during World War I. There she met a Jewish physician, Captain Martin Nassau. They had a strong relationship, but marriage was not possible because of the religious difference. As a result, Erich was brought up by his mother who did not marry, but worked as a nurse in a large hospital in Vienna. His father resumed his career as a physician in Vienna. Although he married, and had a family, he remained aware of Sophie Harth and her son Erich. When he was 14 or 15, Erich met his father, but no particular relationship developed.

At the age of 5, Erich began the usual Viennese education: 4 years of grade school followed by 8 years of middle school and gymnasium. In the latter he had 7 years of Latin, 5 years of Greek as well as calculus, science, and literature. Over these 8 years, his classmates formed a tight group and who did things together. There were bicycle trips to neighboring countries, there were mountain climbing and skiing trips – some with a teacher. The relationship was so strong that to this day Erich remembers the names of the boys in the class.

Upon graduating from the gymnasium in 1937, Erich was crazy about flying. So at the age of 17, he joined the army and became an air cadet. When Hitler announced the Anschluss, Austria became part of Germany. As a result, the Austrian army was issued German uniforms and their officers were replaced by German officers. They were retrained and carried out mock battles meant to illustrate the superiority of the German troops – to the point of winning battles in which the German troops would have been mowed down by Austrian machine guns. Prior to Hitler's arrival in Graz, there was a Stern March in which the Nazi supporters in Austria were to converge on Graz in a star like formation from all directions. Erich was lined up with the troops that stopped the demonstrators. When Hitler came to visit Graz, the troops, then all in German uniforms and under German command, lined up to protect and honor him – alternately facing the roadway with blanks in the gun and facing the crowd with one round in the gun. Initially, Erich was lined up facing the crowd and with a live round in his gun. When an officer noticed that in the lineup had two neighbors with blanks, Erich, among others, was turned around to face the motorcade with Hitler arriving. One imagines that history could have been changed by one of those turned around using his live round.

By rights, being half Jewish, Erich should have remained in the army and completed his training. However, by mistake, he was discharged by his commanding officer in August, 1938. He was not unhappy and Sophie Harth immediately said, “you’ve got to get out.” And in this way, his journey begins. His mother was German and she had a job as a nurse, so she could stay undisturbed. There were Protestant and Jewish organizations to help people leave Nazi occupied countries to find safer locations. So with the help of a Dutch organization, Guildermeister, Erich left for Portugal in September, 1938. On the way, he tried to enlist on the side of the loyalists in the Spanish Civil War. Fortunately, he was unable to do so and he ended up in Lisbon.

In Lisbon, Erich was helped by the Jewish community. In order to remain in Portugal, one needed to show that one had a certain amount of money. The head of the Jewish community was a physician who had treated the Chief of Police and they had become friends. When a group of refugees wanted permission to stay in Portugal, the physician arranged for them to pool their funds to reach the necessary amount. In turn, each used the same pool to get permission to remain in Portugal for a year. Erich was partially supported by the Jewish community which also ran a soup kitchen. He was able to earn a little money by giving lessons in English. He rented a room on rua d’Alegria, Street of Joy. His mother became concerned about the “Joy” and arranged to visit him in Lisbon. However, permanent residence in Portugal was not possible. Where was he to go?

A student friend from Budapest was also in Lisbon. Together they learned that one could get a student visa to go to Brazil for a year. They were granted visas as students to study Portuguese in Brazil. With the support of an international agency, Erich left for Brazil on a British ship in the latter part of August, 1939. In Lisbon, Erich had met the attorney general in Vienna who had prosecuted the assassins of Engelbert Dollfuss, the Chancellor of Austria preceding Schussnig. Although he was not Jewish, he was a refugee. However, he had a connection with an engineer in Rio de Janeiro. Erich arrived in Rio in September, 1939 just as the war in Europe erupted. He

contacted the engineer and was hired to do translations and to write up patents in English. Here again, Erich was also able to earn some money as a teacher of English. However, in the warm climate, he suffered with malaria through the winter of '39-'40.

The Viennese prosecutor also had a connection with Raimar von Bulow, a Danish plantation owner on a large island, Illia Bella (Santo Sebastian). In December 1939, Erich went to work on the island. He was picked up late at night by canoe. When they arrived at the plantation, von Bulow started reading to him. Erich suddenly realized that it was his horoscope. He had fallen in with a cell of mystics who tried to convert him. After quite a struggle, they gave up. The work was hard. They had to build roads, attend to coconut palms, and take care of cattle. The palms were diseased. As an attempted cure, they injected Prussian green powder into the trees. It did not do much good. Von Bulow had Erich and Leonya Kipnis, a Russian coworker, travel up the Amazon River to another plantation where the palms were not diseased. The trip was interesting, but they did not learn very much.

In the meantime, Erich's father had left Vienna in 1939 and arrived penniless in New York. Somehow he had learned Erich's address and he asked an acquaintance to vouch that Erich would not be a burden on the United States. On the basis of such an affidavit, one was put on a quota to await a visa to enter the US. In September, when Erich went to San Paulo to renew his Portuguese visa, he was told that the American Consulate had a visa for him. So, in the fall of 1940, Erich left the island. Von Bulow lent him \$180 for his passage and he left for New York. His father met him at the boat and made arrangements for help from the Hebrew Immigrant Aid Society (HIAS). This support gave Erich some breathing space as his father was struggling and had yet to take his medical examinations so he could open a practice. Erich learned of an organization that helped refugee students. He was told that there were better opportunities in upstate New York. In particular, they had a connection with the Syracuse Peace Council. They made the connection for Erich, gave him bus fare and sent him on his way.

In December 1940, Erich arrived in Syracuse, he then entered Syracuse University for the spring term 1941, began his study of physics, was drafted into the US Army in July 1944, served abroad, and in September 1946 he resumed his graduate study at Syracuse University. In the meantime, his father had worked in a prison hospital until he got his MD. Then he got a position as an anesthesiologist in a New Jersey hospital. In 1947, Erich brought his mother to Syracuse. She was happy to leave Vienna to be with her son. While here, she worked as a nurse at Memorial Hospital. After Erich got his PhD, she retired and returned to Vienna where she was supported by Social Security and an Austrian pension.

As soon as the war ended, William Fredrickson began to build a PhD program at Syracuse University. By the fall of 1946, he had hired Arnold Siegert, Nathan Ginsberg, Herbert Berry, Henry Levinstein, and Charles Bachman, respectively in theoretical physics, spectroscopy, atomic physics, solid state physics, and electronics, to supplement the teaching staff that was present during the war. Erich studied quantum mechanics with Siegert, but the following year Siegert left for Northwestern University. However, that year Johanna Brunnings, Melvin Lax, and Peter Bergmann were hired in quantum theory, nuclear theory, and gravitation respectively, and John Trischka and Kurt Sitte as experimentalists studying atomic beams and cosmic rays.

Cosmic ray research appealed to Erich as it required doing experiments at high altitudes and that meant mountains. He asked Kurt Sitte to be his advisor, but Kurt put him off until he could learn some cosmic ray physics. His research program began in the summer of 1948 along with two other students Irving Kofsky and Harold Kasnitz. He built a cloud chamber and in the summer of 1949 the three of them were off to Mt Evans in Colorado to make measurements. That first year, their equipment was moved along with that of a group from Cornell. The following year they had their own red truck. On Mt Evans they had two bases. The main laboratory and living space was at 10,000 feet and a small laboratory was at 14,000 feet. The cloud chamber, set up at the lower lab, was triggered to respond to penetrating showers. Particle counters were set up at the higher lab. They were looking for K-ons and Λ hyperons as well as V particles that represent a neutral particle decaying into two charged particles. This was frontier physics at the time. At the end of the summer of 1950, a student Plofker, who came up to visit the group on Mt Evans, offered to drive the truck back to Syracuse. He detoured and had an accident in the South. He claimed that he got lost, but Fredrickson had him leave the department. But the data were taken, analyzed, and written up in the following year. Erich received his PhD in June, 1951.

As a graduate student, there was also time for sports and a social life. Erich enjoyed skiing and mountain climbing. Two summers in Mt Evans allowed for climbing time and the Adirondack Mountains are nearby. He and other students in the physics department made use of them. Several physics students were attracted to young women in the Romance Languages Department. In particular, in 1948 Erich met and started courting Dorothy Feldman who was studying for a PhD in Spanish literature. They married in February, 1951 and their first child, Peter, was born in October.

In the fall of 1951, Erich left for Washington, DC to work at the Naval Research Laboratory. There he worked with a small group studying nuclear physics with a small 20 MeV betatron. Then, Marty Block, a professor at Duke University appeared. Marty was called up as a Naval Reserve officer. He knew Ralph Shutt who had built a diffusion chamber at Brookhaven and they had a lot of data that needed to be analyzed. Marty enlisted Erich to help with the analysis. This grew into a team relationship which also exposed some emulsions to the Cosmotron at Brookhaven.

As the McCarthy period heated up, Erich's Q clearance was held up because of his relationship with Kurt Sitte. Kurt had been held at Buchenwald for six years and had been a member of left wing parties in Czechoslovakia before the war. Therefore, he was under suspicion by the State Department. When he left the country in 1953 to participate in cosmic ray experiments in Brazil, his passport was lifted and he could not return. Erich was questioned by a Navy security team about his relationship with Kurt and then denied the clearance.

Marty suggested that Erich go to Duke as a Postdoc so they could continue to work together. There Erich continued to analyze data from Brookhaven and also took charge of Marty's students doing fast time of flight studies. In 1954 C N Yang and T D Lee published a paper suggesting that it would be interesting to see K^- events in He to determine the $K^- - \Lambda$ relative parity. They decided to build a He bubble chamber to do the experiment. Duke had a strong low temperature group under Henry Fairbank. With Fairbank's help, Erich built a small model He bubble chamber. However, when tested, because of the low index of refraction, tracks were not

visible unless viewed at a small angle. Erich then built a baffle that enabled them to see the tracks. At that point, they submitted a proposal to NSF asking for \$65,000 to build a big He bubble chamber containing 4 liters of liquid He. The bubble chamber was designed and built with the help of Fairbank and Jack Leitner, a fresh PhD from Columbia, who was hired for the project. About this time, Giancarlo Moneti and Romano Bizzari at Frascati were also planning to build a He bubble chamber. Giorgio Salvini in Rome knew Erich from his cosmic ray work and was aware that he was part of a group that had built a small helium bubble chamber. He contacted Erich who wrote to Giancarlo a long letter describing their work. This letter gave the Italian group some guidance for building their bubble chamber and some collaboration resulted.

At this point, in the spring of 1957, Erich received an offer from Syracuse University and in the fall Erich together with Dorothy and Peter returned to Syracuse. A year later, Jack Leitner joined Erich at Syracuse and they continued their work on the He bubble chamber. On returning to Syracuse, Dorothy was able to work closely with her advisor and was able to complete her dissertation and receive her PhD in 1958. Their second son, Rick, was born shortly afterward. Her dissertation was on the work of an Ecuadorian poet, Carrera-Andrada. After getting her PhD in 1968, she taught at Onondaga Community College. She became chairperson of Modern Languages and head of the Women's Study Program. She became interested in the Chicano movement in the US. In particular, she studied the farm labor movement under César Chavez. She collected material from farm workers near the Mexican-American border. *Voices of Aztlan*, a book on Chicano literature was published in 19xx. Dorothy retired from OCC in 19xx and since has taken care of their home and large plants in and outside the house.

The bubble chamber was first taken to Brookhaven for testing. However, there was a good K^- beam at the Bevatron in Berkeley and the cloud chamber was sent there for exposure. There the bubble chamber was exposed to the K^- beam from the Bevatron under the auspices of a consortium of research groups from Syracuse, Duke, Johns Hopkins, and Oak Ridge. Coincidentally, Nahmin Horwitz was working on the beam when Jack Leitner visited for the run and that led to Nahmin coming to Syracuse in 1959. Scanners were hired to examine the thousands of pictures from the experiment. In particular, they were looking for hyperfragments – a particle in which a proton or neutron was replaced by a hyperon, a heavier than proton particle. They found the first hyperfragment, H^4 consisting of a proton, 2 neutrons, and a Λ and also hyperhelium with one neutron replaced by a Λ .

In the early '60s, at a meeting on high energy physics in Italy, Erich met Bruno Vitale, an Italian physicist, who told him about the work of Frank Rosenblatt, a psychologist at Cornell, who had invented the *perceptron*, a computer algorithm that simulated the processing of stimuli through a succession of layers of neuron-like elements. When he returned to Syracuse, Erich started reading about the brain and about neural networks. He continued to analyze the data that came from the experiment at Berkeley, but soon devoted all of his efforts to the study of the brain.

Erich started with computer simulations of the dynamics of randomly connected populations of neurons, with the assumption that such local groups, rather than single neurons, represent responses to particular stimuli. These studies revealed a hysteresis that could be the basis of memory. The interactions between different such populations, he called *netlets*, led to a simple model of various types of conditioned reflexes and other interactions between different stimuli.

These connectivities were represented initially by a 100x100 matrix of positive (for excitatory) and negative (for inhibitory) elements representing strengths of the synaptic interconnections. Later much larger populations of neurons were considered. His reporting of this work at a conference of Automata Theory in Italy 1965 and a series of papers in the *Biophysical Journal* and the *Journal of Theoretical Biology* was his professional introduction to the field.

He then turned his attention to vision, aided by a number of graduate students. The visual pathway leads from the retina to the LGN (lateral geniculate nucleus) in the thalamus, and from there to a succession of higher areas in the cortex, labeled V_1, V_2, \dots . Eventually visual information arrives at the highest centers, the prefrontal cortex. But fibers lead not only *up* the visual pathway, but strong bundles form return paths between all these centers. Thus, the LGN receives much more input from *above* than it does from the retina. The human brain is said to talk mostly to itself.

The presence of these loops suggested to Erich that an optimization or hill-climbing algorithm may be operating, in which responses at higher cortical levels act as *cost functions* that could enhance, repress, or otherwise modify the incoming signals. He developed a particular optimization algorithm, called *Alopex*, which seemed particularly suitable for neural implementation. Together with a student, Litsa Tzanakou, who continued this work as chair of the Department of Bioengineering at Rutgers University, the method was successfully applied to the study of receptive fields of neurons in the frog visual system. Here, using *Alopex*, the scalar response of a neuron is used to modify an initially random input pattern to converge on a pattern that maximally stimulates that neuron. The receptive field is thus obtained automatically, without the standard trial-and-error procedure.

Erich thought that hill-climbing also plays a role in human thought processes. He used the term *sketchpad model* to compare creative thinking to an artist's use of a sketchpad on which he creates, observes, and modifies his work. Thus, higher, and often *scalar responses*, control from above, the evolution of complex neural programs near the sensory input levels.

The problem of *consciousness*, and how a physical system like the human brain, can be the source of subjective sensations and feelings, has occupied Erich's thoughts, as it has those of most contemporary neuroscientists. No longer is consciousness waved away as a pseudo-problem, but it remains largely unsolved. Erich has also been concerned with what physicists call *locality*: Where in the brain is the information that tells us what the billions of neurons are doing at this time? Each neuron does its thing in isolation, as it were, knowing only what impulses impinge on its membrane at this moment. There is no general *knower* in the brain. In neuroscience this is known as the *binding problem*.

Is the brain more than a fancy computer? Erich pointed out that, unlike most systems studied by physicists, the dynamics of living tissue involves the interaction of matter over scales of many orders of magnitude, from molecular to macroscopic. This is particularly true of brain tissue. By contrast, a steam engine can be understood by considering only its macroscopic structure and interactions. The brain is also unique as regards the role of *time*. There is no unique propagation velocity in the brain, and we find it difficult to define the meaning of simultaneity of firing of two neurons in different locations, except for the measurements by an external observer. Also, present brain activity (hard to define), depends not only on past events, but is sensitive to the future, anticipated or actual, as in the case of a

well-known phenomenon called *retrograde masking*, in which the sensation of a stimulus can be extinguished by a later stimulus. Erich concludes that the frequent assertion that *the brain computes*, cannot begin to do justice to what goes on in the brain.

Erich's research and thinking about the brain is summarized in two books: *Windows on the Mind* (1982, Morrow, NY) and the *Creative Loop* (1993, Addison Wesley, Reading, MA). In both he presents some physiology of the brain. In *Windows*, he describes some early experiments and his own attempts with model networks. In the latter book, he stresses the importance of stimuli moving from reception areas to higher areas in the brain and then looping back. In the process, novelty is often created, hence the *creative loop*, which is another way of referring to the *sketchpad model* of thought processes.

His third book, *The Dawn of a Millenium*, (1990, Little Brown, Boston, MA) looked forward to the millennium year of 2000. Here he contemplates the problems humanity faces in the 21st century. He sees 'humans with Stone Age bodies and Stone Age brains' facing problems for which they are totally unprepared. 'What happens', he asks, 'when a species that retains ancient territorial and tribal aggressions, also owns nuclear-tipped ICBMs?' Couple this with a world that seems hopelessly overpopulated, finite in its resources and increasingly polluted, the outlook appears bleak except for what has been called the *Promethean Gene*, our ability to reason into the future and make decisions on observation and thought rather than on ancient instincts.

In all of this work, Erich was aided greatly by the collaborative efforts of his many graduate students, some twelve of whom completed doctoral dissertations for PhD degrees under his guidance.

Today, Erich is mostly at home with Dorothy. He continues to think about these problems, but instead of skiing and flying, he paints. No doubt, he uses his mental sketchpad to plan his images and designs.