

Riding the Waves

A Life in Sound, Science, and Industry

Leo Beranek

**The MIT Press
Cambridge, Massachusetts
London, England**

© 2008 Massachusetts Institute of Technology

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

For information about special quantity discounts, please email
special_sales@mitpress.mit.edu

This book was set in Stone and Stone Sans by Graphic Composition, Inc.

Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

Beranek, Leo Leroy, 1914–

Riding the waves: a life in sound, science, and industry / Leo Beranek.

p. cm.

ISBN 978-0-262-02629-1 (hardcover: alk. paper)

1. Beranek, Leo Leroy, 1914– 2. Acoustical engineering—United States—Biography. 3. Music-halls. I. Title.

TA140.B385A3 2008

620.2092—dc22

[B]

2007013764

10 9 8 7 6 5 4 3 2 1

1 Iowa and Beyond: From Bumblebees to Ivy

It was a typical early fall day in an Iowa township: farmers were bringing produce to market, salesmen were coming in by train, and the townsfolk were making their daily trek to the post office. But, five blocks off Main Street, the Beranek home was all aflutter with excitement, worry, and anticipation. A few days earlier, our local doctor, the only one for miles around, had warned Mother that her baby would be large. The family fretted about possible complications, their anxiety deepened by the death of a neighbor woman a few weeks before following an attempted breech birth. Mother's younger sister came over to help, as did a neighbor with midwifery experience. Nobody out here went to a hospital except in the direst of emergencies; the closest facility was 15 miles away—several hours by horse and carriage over rough dirt roads. Dad was busy that day and asked to be called only if he had to be. The doctor was summoned when Mother's contractions grew faster and stronger, but he arrived too late—to find Leo Leroy Beranek, a bouncing eight-pound baby, already wrapped and raising quite a ruckus.

The date was September 15, 1914; the place Solon, Iowa, a town of about 400 inhabitants. My father, Edward, and his father had run a livery stable that went bust shortly after the arrival of Henry Ford's "Tin Lizzie," the Model T. My mother, Beatrice, had trained at Iowa's State Teacher's College and she taught in nearby elementary schools until she married Dad. In those days, everyone had a nickname. My uncle Stanley was "Strantz" and uncle Fred was "Duke"; a neighbor went by "Saint." My parents hated the other common male names, which were sure to become "Jim," "Bill," and the like, so they chose a name that had no obvious nickname, one they hoped would stick. Leo, meaning "lion," seemed short and sweet enough; to this they added my middle name, Leroy, meaning "king." My last name, Beranek, means "lamb"

in Czech. Did the confluence of “lion,” “king,” and “lamb” presage anything about my life? Without stretching things too far, I think it did.

After the failure of the livery business, Dad was forced to return to the Beranek homestead farm, three miles east of Solon, where he had been born and had lived until age 21. Immigrating from Bohemia in the mid-nineteenth century, my great-grandparents settled on this fertile piece of prairie soil in Johnson County. My grandfather, Fred B. Beranek, was born and raised on the homestead farm, which he held on to even after moving to Solon. The farm was the first of three successive farms to which we moved, like nomads, in a period of three years. Mother prompted the last two moves, and it is almost certain that the hard work involved contributed to her early death. Unaccustomed to farm life, she found it tough going—having to do without electricity, cart water from an outdoor pump, and cook on a woodstove, having to use an outdoor privy and to bathe and wash clothes in galvanized washtubs. Heavysset and strong-boned, she had learned the art of cooking, particularly German staples, from her mother. In an era without refrigeration, she had picked up the best techniques for canning fruits and vegetables and for preserving meats in crocks of lard. I remember her tending her large vegetable garden in the sweltering summer heat. But she never showed any sign of frustration and was always loving and considerate. Only now can I imagine how drained she must have felt when she collapsed into bed each night.

Dad was solid and substantial-looking, with a cheerful voice, sincere expression, and flashing, ready smile. He inspired immediate trust in those around him. He had known farming before his Solon fiasco and went back to it, without complaint, to make family ends meet. His days in the fields would start at the crack of dawn—or earlier in winter—with milking the cows and feeding the pigs, with currying and harnessing the horses to plow, sow, or reap and would not end until after dusk when he again would feed and water the farm animals and bed them down for the night.

Farm life was hard enough, but in 1918, just two years after we arrived on the homestead, it took a turn for the worse. Father's younger brother, Stanley, newly married and with no prospects for work elsewhere, moved in with us. Like Mother, Sylvia—Stanley's wife—had never lived on a farm; but unlike Mother, she had never learned how to cook or garden either. Worn out by the additional workload and responsibility, Mother insisted that Dad find another place to farm. The next March, we moved to an acreage not too far

from Tipton, at a reduced rent in exchange for the owner's sharing in our profits on produce and hogs sold.

Iowa, as the song goes, is "Where the Tall Corn Grows." And tall it should be—the great glaciers of the Ice Age dumped some of the richest loam anywhere in the continent on this state, up to 20 feet deep some places. Gently rolling, with manicured fields of corn, oats, and alfalfa, well-kept buildings and silos, the landscape exudes prosperity and efficiency in good times. Before the mid-1920s, Iowa was famous for its rainy-day mud roads. Very few were graveled and only the lone, transcontinental Lincoln highway was paved. This meant that travel by automobile between farm and town was possible only when the roads were dry; in wet weather, we turned to horse-drawn vehicles. Farmwork relied on horses—the tractor came into common use only after 1925.

School, Family, Farm Life, Friendships

My introduction to schooling on the outskirts of Tipton happened on a clear, fall-like day in September 1919. Mother dressed me in short pants—no boy wore long pants before age 14—a warm coat, and a stocking cap. With my dog, Collie, beside me, I posed for a photograph with an oversized lunch pail in one hand and a loose-leaf notebook in the other. Mother walked me to school, nearly a mile along a dirt road. Eight-foot cornstalks, laden with heavy ears, whispered to us on either side, accompanied by the sound of crickets and occasional bumblebees. As we approached an intersection, the little red schoolhouse came into view.

All twelve grades gathered in one wooden-walled, high-ceilinged room with rows of desks of various heights. The teacher's desk stood on an elevated platform, with a blackboard behind it and a pot-bellied stove to one side. I was assigned a desk and handed an illustrated reader, a slate, a pad of writing paper, pencils, and crayons, which I stowed carefully beneath my hinged desktop. I had one classmate, a girl who hardly ever spoke to me. The teacher spent a half hour with us each day, mainly working on our manual skills. At recess, the smaller boys played tag while the older ones batted a baseball around; the girls mingled to one side, skipping rope and playing hopscotch. I learned that I could outrun boys my age, and I used my speed as a defense against bullying. Later on, in high school, I would put this fleetness of foot to even better use as an all-state competitor in the 100-yard dash.

The rest of this first school year remains mostly a blank, except for the changeable weather. The daily back-and-forth trek was brightened by ground squirrels racing across the road, and the darting about of red-winged black-birds and sparrows. Rainy days were miserable: I donned boots, slicker, and a yellow rain hat that couldn't keep the wind-driven rain off my face. I trudged through snowdrifts up to my knees, slogged by fallen cornstalks (now minus their ears), and marveled at an occasional "V" of geese flying overhead. I found some small comfort in overshoes, wool socks, a heavy coat, mufflers, and woolen gloves. If a blizzard raged or the snowdrifts threatened to swallow us whole, the teacher's voice—"School called off for today!"—came across our party phone line.

My second year coincided with some dramatic changes in Iowa's school system, with the closing of most multi-grade schools and a phased transition to the modern "consolidated" school system. The school closest to our farm was in Tipton, about 10 miles distant. It was decided that I would enter first grade, counting the previous year as kindergarten.

Getting to school continued to be an adventure in itself. The roads became quagmires in spring and after each rain. Every morning about 7 AM, a school bus stopped at the end of the driveway, 200 feet or so from our farmhouse. And what a bus it was. A team of two horses pulled what looked like an oversized long box above a high, four-wheel chassis. Inside, along both sides were benches, each about 14 inches wide with an aisle between. We kids scrambled in through a narrow door at the rear. The driver sat in a separate compartment up front, under a roof with side doors; the reins used to guide his horses ran through a small opening. In the wintertime, a kerosene oil heater stood at the front end of the aisle in our compartment. Little if any ventilation got in. The windows were kept tightly shut, and I imagine it was only on account of cracks here and there that we escaped asphyxiation. The ride was just over 2 hours each way, and we generally arrived at school not long after 9 AM. As we bumped along, we passed time telling stories, "finding the button," and play-wrestling. Many of us brought cookies and thermos bottles full of warm milk. The older students tried to keep order, and I learned a little about democracy and sharing on these rides. On winter afternoons, we always arrived home after dark. Ten or more of us crammed into the bus, and we readily took on each other's colds, measles, and mumps, reducing our number by half on some winter days.

Our Tipton stay did not last long. In mid-November 1920, when Mother became pregnant, she decided that going through childbirth in a remote

farmhouse without help would be just too difficult (no one thought of going to a hospital in those days). She insisted we move back to Solon to be near her family, although her sister there, Maime, had a family of her own and could not be expected to help. A peak in demand had raised farmland prices to astronomical levels, but Dad found a farm for sale about a mile west of town; somehow, he managed to take out a mortgage and acquire machinery and farm animals. We moved in March 1921.

On entering third grade in September 1922, I found the assignments so easy that my teachers decided I should proceed straight to fourth grade, where the courses were spelling, reading, writing, arithmetic, geography, and language. Although the move was difficult both on an academic and on a social level—I was quite a bit younger than most of my classmates—I got by all right. Once in fifth grade, we were asked to think up an original story and tell it out loud. After I told mine, the class begged for more and the teacher allowed me to weave yet another yarn for their collective entertainment. At recess, the older boys played baseball or football. I tried to avoid the rib-crushing “pile-ons” where one boy would be tackled and the others would flop on top.

During a game of tag, I got a nickname that stuck with me through the remainder of my years in Solon. We had two boundary lines: one side of the two-story brick schoolhouse and the sidewalk about 30 feet in front. One boy was designated “it” and stood between the limits. The others, usually six to eight of us, would on command from “it” run from one boundary to the other, and “it” would attempt to tag someone; the first to be tagged became “it.” I came up with a bit of doggerel—“Chi-Chi Mr. Punchi, / Chi-Chi Mr. Nello, / Come catch me if you can, / I am Mr. Punchinello”—flaunting my relative swiftness, here and in other games. Soon I was called “Punch,” a nickname I did not relish, but probably deserved.

Asked to go to Grandmother Beranek’s house on the afternoon of August 27, 1921, I discovered later I had a baby brother named “Lyle Edward.” I found Mother and Lyle in bed, tended to by Aunt Maime. Mother seemed very happy, and so did Dad. I saw the baby up close and touched his hand.

I loved the farm in summertime—its smells, its bustle, its warmth. Not far from the main house were two barns and two sheds. Beyond that grew the crops, and still farther out lay a large pasture for grazing cattle. A creek flowed through the middle of the pasture. Though its bed was four feet deep, there was rarely more than six inches of water in it, except after a drenching rain-storm when the creek overflowed its banks to form a short-lived river. I loved to run barefoot in the creek, catching minnows, chasing birds that came to

bathe, and drink the clear, clean spring water that trickled from cracks in the banks. I watched with delight as the tree squirrels, ground squirrels, ground hogs, and gophers moved about in their distinctive ways—some quickly, some furtively, some deliberately, but all seeming to have a keen sense of their place in the natural world.

The plowed fields tended to dry out in the summer heat, when dust devils would form and spiral to heights of a hundred feet or more, sometimes catching me unawares. I remember wiping dust from my eyes and shaking it from my hair and clothes like some character out of the *Arabian Nights*. One summer day, a thunderstorm moved in suddenly, and before I would run home, a bolt of lightning crashed into a tree some 20 feet away, blinding and deafening me for five minutes or so. On hot days, I often went barefoot and once stepped on a rusty nail. Fearing I would come down with lockjaw, my parents rushed me into town. Doctor Nedilicky cauterized the wound with an acid-dipped Q-tip—eliciting a loud yelp from me.—He then applied a soothing flaxseed poultice held in place by a wide bandage.

The farm animals—boars, bulls, and roosters—gave me my earliest lessons in reproduction. I watched the mating rituals with much curiosity, even awe. My parents warned me not to get anywhere near the boars and bulls; a neighbor man had been knocked down and nearly killed by a boar, and stories circulated about bulls charging their owners. The purebred bull on our farm had a large ring in his nose, and when Dad moved him from one area to another, he used a six-foot pole with a hook looped through the nose ring to keep the animal obedient. One day, it dawned on me that babies came from mothers through contact with fathers, and I shared this epiphany with a neighbor boy.

Farm boys learn to tinker at an early age, and I was no exception. I often wonder how much that experience influenced my decision to become an engineer. My special interest in communications engineering almost certainly began in June 1924, when Dad came home with a Crosby one-vacuum-tube radio receiver set that ran on telephone batteries. Using headphones, three people could listen at the same time. I all but devoured the instructions for assembling the set and getting it to work, and gradually came to grasp how radio waves behaved. I installed the antenna and a ground rod, as well as insulating strips under the window to lead wires into the house. I tuned in to a host of things: national news, weather reports, music, political debates. One station—WOS in Jefferson City, Missouri—came through particularly

well. I listened every night after doing my homework. One of the most popular entertainers at the time was a jazz pianist, Harry M. Snodgrass, billed as the “King of the Ivories,” whose programs originated from the Missouri State Penitentiary, where he was incarcerated. I was glad when the governor pardoned him, but sorry when his last program aired on January 14, 1925.

Grandmother Anna Beranek was a striking woman. Tall, strongly built, and with prematurely gray hair, she was a center of attention at any gathering. Grandfather Beranek had the same hefty build as my father and sported a distinguished mustache. Widely respected, he served as mayor of Solon for many years, up to the time of his death. Grandmother always said she had married him when she found out what a good kisser he was—this in a high-school play, where they had been cast as starry-eyed lovers. I remember that cheery kitchen of hers, where she lovingly fashioned her much-admired “kolaches”—a Czech pastry usually filled with peaches, cherries, or blackberries, but sometimes with my favorite filling—poppy seeds.

Soon after we moved to Solon, Dad bought me a pony, which I named simply “Pony,” and which he fitted with a western saddle. I rode him to and from school, keeping him during the day in a barn behind Grandmother Beranek’s, not far from the schoolhouse. A neighbor boy also had a pony and a number of times, especially on Saturdays, we went riding together. I remember we once found an abandoned shed, about 5 miles away. We proceeded to kick and pound it to pieces, leaving a pile of rubble behind, mostly boards and beams. I still wonder how we escaped injury or even death when the structure collapsed around us.

Another day I was less lucky, but lucky enough, as it turned out. Pony suddenly decided to cut under a barbed wire that had been stretched over the top of a row of posts to keep horses out. The wire was just high enough to clear the horn on my saddle. I quickly ducked to one side and escaped with just a cut on my outer arm from shoulder to elbow. If I had not ducked, the wire would have slashed into my stomach and, held in place by the back of the saddle, I almost certainly would have been killed. Sometimes life is a matter of luck—or a quick reaction.

To supplement his farm income, my father learned auctioneering. He drove us over in the Model T Ford and assigned me to place number labels on animals up for auction. It was good fun. I was highly susceptible to motion sickness, however, and avoided merry-go-rounds and even swings. Every trip with Dad, I would get carsick and we would have to stop by the side of the

road. My affliction did not clear up until many years later, when I started to ride in airplanes.

Mother also found a way to help meet our staggering mortgage payments. She assembled a flock of purebred Rhode Island Red chickens, from which she collected eggs to sell to merchants in Solon and to people around the state who wanted to develop their own flocks. She advertised in the *Wallace Farmer* that she had purebred “eggs for hatching,” which she could ship by post to your doorstep—no need for a long trek over to the farm. I helped her wrap eggs in excelsior and lay them out in neat circular rows in shipping baskets. While managing her egg business, Mother continued to help milk the cows, tend her large vegetable garden, do the laundry, make beds, cook, encourage me to study each evening, and even find some time to play piano. She always worried about what would happen if Dad were to die and she were left on her own to provide for herself and two children. She took a correspondence course in bookkeeping, convinced that this would guarantee her employability if her worst fears materialized. I can remember her hunched over a table late in the evening, entering figures on lined paper and underlining sums with red ink and a ruler.

A Tragedy, Then Winds of Change

Christmas 1925 was a happy time for the Beraneks. The presents under the tree exceeded my expectations and we all—aunts and uncles included—headed over to Grandmother Beranek’s on Christmas Eve to enjoy a special dinner, featuring Iowa’s traditional oyster stew. Afterward, we attended services at the Methodist-Episcopal church, followed by midnight Mass at the Catholic church. Grandfather Beranek and his three sons were Methodist; Grandmother Beranek and my mother were Catholic. We avoided competing loyalties by acknowledging, if not always strictly observing, the core traditions of each.

Three weeks later, a hard freeze settled in, unusual even for mid-January on the prairies. Winter often held us in its grip, but never quite like this. Our old pot-bellied stove wheezed and seemed ready to give up the ghost. We huddled close for warmth as films of ice crept along the inside of the windowpanes. Mother had come down with a severe cold, and it only grew worse as we struggled to keep the elements at bay. Doctor Nedilicky had

been to the house two days before, left medicine, and asked her to stay in bed. Her sister Maime came to tend to household essentials.

Monday afternoon, January 26, Dad was taking me to town to attend to business when someone brought news that drained the blood from his face. He turned to me and said, "Let's go!" His jaw set, he said nothing as we sped home. We reached Mother's bedside just in time. She breathed her last with Dad's reassuring hands on her shoulders. I went over, kissed her forehead, and broke down in tears. The attentive priest, distraught relatives, undertakers shuffling about in hushed, respectful tones—all passed me by in a blur. Yet I didn't feel hopeless or lost. Some weeks before, Mother had taken me aside to say I should study hard, get ready for college, and make a decent life for myself. To this day, I remember where she sat and where I stood to receive this sage advice, which I took very much to heart.

Two months after Mother's death, Dad sold the farm at auction, taking a huge loss. He also sold Pony; my dog, Collie, went to live with a relative. Father, my four-year-old brother, Lyle, and I moved in with Grandparents Beranek.

All through this, I was doing quite well in school, ranked near the top of the class. But because Dad's political leanings—toward the Democratic Party—were out of synch in the heart of diehard-Republican Iowa, my classmates used to taunt me with the jingle: "Fried cats and pickled rats are good enough for the Democrats." I stayed mostly to myself, but found considerable companionship in a cousin, Arlo Bittner, who also happened to be my closest competitor academically. Arlo was the son of Grandma Beranek's sister, Blanch, who was younger than Dad, her nephew. Soon after Dad bought me a bicycle in the summer of 1926, Arlo and I were breezing around the countryside. But one night, Arlo left home and did not come back. The next day, they found him wandering aimlessly along a country road. He had suffered a mental breakdown, and could not even recognize his parents. He never recovered, even after years of treatment in a mental hospital.

I started junior high school, eighth grade, in the fall of 1926 and yearned to be more independent. I didn't bother either my grandparents or my dad about my needs, though, preferring to see what I could do on my own. When I responded to a Real Silk Company ad for salesmen in the *Saturday Evening Post*, the company assigned me—a mere novice—Solon and a nearby village for my territory. It sent me a leather-bound sales kit with samples of its

entire line of stockings and fabrics for silk lingerie and blouses. For every sale I concluded, the buyer would make a down payment and the order would be shipped COD through the mails. The down payment was my commission. Even my lady teachers bought lingerie from me, with giggles and some embarrassment. I made a modest but regular income, and remained a Real Silk salesman for two years.

Passageways to the Future

The Solon School band leader urged me to learn an instrument and join. I chose drums. Father bought me a marching drum, and the band leader taught me to play. I grew to be reasonably proficient. After a year, Dad purchased a set of trap drums from a retired professional musician, and I continued my lessons on them. I practiced after classes in the basement of the school building. Trap drums would later help me earn my way through college.

My freshman year in high school was my last in Solon. Dad married a woman from a neighboring village—Frances—and we moved to Mount Vernon, some 12 miles away, where he became co-owner, along with his cousin Gilbert, of Beranek Hardware. Keenly interested in my future, Dad came up with the idea that I should learn how radios work so that I could make some money installing and servicing sets sold in the store. He enrolled me in a radio course offered by the International Correspondence Schools. I took this quite seriously, even building my own radio set. The next year, he arranged for me to work as an unpaid apprentice to the store's serviceman, Francis Pratt, a senior in Cornell College just down the road (founded 12 years before the more famous Cornell in Ithaca, New York). Francis was an opera buff and, as we fixed radios, we played records on a wind-up phonograph. My apprenticeship completed, when Francis moved on, I was able to set up a radio repair shop of my own over Beranek Hardware. I bought a Model T Ford for \$50 and soon became known as Mount Vernon's "radioman." Meanwhile I had not forgotten Mother's insistence on a college education. Dad made it clear that, because he was still deeply in debt following the sale of the Solon farm, I must save money for college. My radio repair business was no longer just a pleasant hobby; it was now a means to an end.

Churchgoing was always a part of my early life. In Solon, I went to the Catholic church because both Mother and Grandmother Beranek were members. I enjoyed the pageantry, sometimes sang in the choir, and attended Sunday

school. In Mount Vernon, I went to the Methodist-Episcopal church, primarily because Dad and my stepmother were members. I thought of church as a way to meet other young people and to learn more about life and biblical times. I often showed up at church affairs. One evening, a pinochle contest was held in the church basement. There were 48 of us in the room, seated 4 to a table around 12 tables. A wonderful game for large groups, pinochle took two standard decks of cards, combined, for each game. When one game ended, the players moved on to different tables. The rules were complicated and I had never played before, but I got some quick instruction and a few pointers as each game progressed. Unbelievably good hands came my way all evening—beginner's luck, no doubt—and about 10 o'clock, to everybody's amazement, I ended up the winner. My prize was a large turkey, which I donated to a poor family in Mount Vernon.

Starting in my junior year of high school, and for three years thereafter, I played trap drums in a ragtag dance band. My talent—or, rather, rhythmic instinct helped along by music lessons—was spotted by Wilbur Powers, a local electrician known to all as “Polly.” He put together a dance combo, “Polly and His Parrots.” A man of 40, a little on the heavy side, he was a stupendous saxophone player. It was whispered that, though married, he was always on the make for younger women. Our somewhat mismatched band of six played weekly at dances over at the Moose Lodge in Cedar Rapids. The bass horn player, Jake, was a model of respectability, stationmaster for the Chicago North Western Railway in Mount Vernon. The banjo player, Frank, loved to regale us with stories of his trysts with local married women. The trumpeter, Bob, confined his tall tales to fishing and hunting with dramatic accounts of narrow escapes from wolves and mountain lions. The piano player, Hildred, a thin, modest woman of 30, tried to distance herself from the seamier escapades of her cohorts—and certainly offered no comfort to Polly and Frank, our resident rakes. Busy with schoolwork and radio fixing, I simply had no time for sharing racy stories. The band came to an untimely demise when the rumor surfaced that Polly had gotten a high school senior pregnant. The rumor grew larger than life, as gossip so often does in small towns, and Polly and his wife, Rae, had to leave Mount Vernon. They moved to Wilmington, Delaware, where I visited them on my first trip East.

In school, my competitive streak was starting to show. I forget why, but I signed up for a typewriting class. The girls were honing their skills for office work and there I was, the only boy, intruding on *their* territory. Though

willing to put up with me in general terms, what they couldn't abide was my being top performer. I looked forward to rattling through our weekly typing tests at breakneck speed and with high accuracy, leaving the others in my wake—helped along by a set of fingers well limbered through long hours of dance-band drumming. The outcome was as much fun as the tests—“If looks could kill,” as they say. I had never been one to worry about popularity; my goal was simply to excel in whatever I took on.

During my senior year, I applied for admission to Cornell College (Mount Vernon) and was accepted. Living at home I had managed to save about \$500. In 1931, in the wake of the Stock Market Crash of 1929, panicked runs on banks—and the resulting bank failures—were still commonplace. I recognized that we were on the verge of a deep economic depression, and I worried about the fate of my tuition money on deposit in a local bank. In mid-August, I went to the bank to withdraw \$400. The clerk called an officer, who asked me what I wanted to do with it. When I told him I was going to pay a year's tuition at Cornell College, he replied: “If you wanted it for any other purpose, I wouldn't give it to you.” I headed directly over to Cornell's financial office and put my money down—in the nick of time. The bank closed its doors permanently the very next day, and all depositors lost their savings. I never saw my remaining \$100.

Exercise in Self-Sufficiency

In the middle of my freshman year at Cornell, Dad told me that, because of dwindling business, he had sold his share in Beranek Hardware to his cousin and would move to Cedar Rapids in early March. Now I was *really* on my own—no more free room and board. I lucked out, however, in finding a cheap place to stay for the rest of the school year: Ma Miller's student rooming house, where I lodged at a discount. I applied for and received a scholarship for sophomore year, although I still had to come up with \$60 per semester for tuition.

I worked as a hired hand on a small farm for two summers, 1932 and 1933, not only to earn my keep but also to better my health and physical stamina. The farm lay to the south of Mount Vernon and my duties there fully tested the limits of my strength. To kill weeds around rows of corn, I walked from 8 AM to 5 PM behind a horse-drawn cultivator, moving slowly but deliberately over ground that the plow had just stirred up in temperatures exceeding 100

degrees on some days. Even though the noon meal meant an hour off, by evening, having rubbed all day against denim overalls, my sweaty legs developed painful chafes, which I salved from a can labeled “For man or beast.” Corn cultivation stopped about July 4, but then the oats had to be harvested. I followed behind a binder, operated by my boss, each day plunking down hundreds of bundles (sheaves), six to a shock. Next, hay had to be cut and, after drying, stacked high with a pitchfork onto a wagon and hauled to a barn for transfer into the haymow. Gardens and melon patches had to be weeded, animals watered and fed. On some days, fences had to be repaired and rings put in the noses of hogs to discourage them from rooting. In late July, we harvested melons and picked berries to take to market. Yet, a few evenings each week, I still found the energy to jump into my Model T Ford and head over to Mount Vernon to fix radios or play in the town band.

Because we helped each other out at threshing time, I got to know most of the farmers in that part of the country. Although Prohibition was in full swing, when one of our neighbors took up bootlegging, we turned a blind eye. I dated a neighbor’s daughter, who had been in high school with me, and on Sundays, often visited my grandparents in Solon. But I seldom got over to Cedar Rapids to visit Dad and my stepmother. The 20-plus miles seemed like an awfully long way in those days.

I ended the summers tanned and far stronger than I started out. Once, I even hefted a 160-pound keg of nails. I sometimes wonder how much those summers contributed to making my life as free as it has been from illness, and as active in my advancing years—with most of my joints and “marbles” still intact.

The college-owned dormitories and dining halls were way beyond my means. So, when Ma Miller offered no further discounts, I had to find another place to live. In late August, right before the start of sophomore year, I learned that three other students—seniors—had made arrangements to live in two large, unfurnished, unheated rooms over a bakery on Main Street. They invited me to join them. We needed furniture, a stove, cookware, and dishes. Freddie Katz came up with most of the furniture—four beds, four bureaus, four desks, and a half dozen chairs—on loan from his father’s secondhand furniture store in Cedar Rapids. I borrowed an oil-burning stove from Beranek Hardware. Other items came from our parents’ homes or were borrowed from friends. We each paid \$4.50 a month in rent, and put in an extra buck or two for breakfasts and evening meals. We cooked one warm course each evening

on the stove's single burner. I arranged for the bakery downstairs to pass along their one-day-old bakery goods for a dollar a week. Wilbur Smith dated a college woman who lived on campus and worked in a dormitory kitchen there. From time to time, she filched a whole roast chicken and passed it through a window to Wilbur. Leo Phearman's farm family sent eggs, smoked ham, and fresh fruit from their orchard. Freddie often brought packaged food to the table. How he acquired this we never knew, but I suspect his father helped out. On occasion, I dipped into my meager savings to bring in extra chow. I earned my noon meals by waiting tables in the Fair Deal, a restaurant just down the street.

As a sophomore, I was invited to be a member of Mort Glosser's college dance band. We played at campus dances on Saturday nights. Although my income from this and from my radio repair business took care of the year's expenses, I saw problems ahead. The repair business had fallen off—the Great Depression was deepening—and Cornell's scholarship stipend was smaller than it had been the year before. Because I could see no way to earn what I needed, and because no student in those days—in Iowa, at least—ever thought about borrowing, I resigned myself to enrolling in just one class the next year, mathematics.

The Outside World Beckons

Invited to go with the family of the local dentist, Lou Bigger, to Chicago's world fair in August 1933, I jumped at the chance. The Century of Progress opened my eyes to the world beyond Iowa. I wandered from one exhibit to another, almost in a trance. The ones I remember the most showed manufacturing, such as brand-new tires all wrapped in paper. The stunningly illuminated Electrical Building showed electricity being generated and distributed, with a fireworks display every night. "The introduction of electricity in our daily life is the greatest factor in human progress," announced General Electric, presenting a dramatic set of murals to illustrate its claim. Ford, Chrysler, and General Motors exhibited their latest cars and showed motion pictures of the assembly process. Pabst Blue Ribbon, Schlitz, Budweiser, and Old Heidelberg set up their wares in huge tents filled with tables. Each tent had a stage at one end, where a popular "big band" of the day kept visitors tapping their toes.

The best surprise was the opportunity to hear, not one, but four hour-long outdoor symphony concerts each day. The Chicago Symphony, sponsored

by Swift, performed twice a day, as did the Detroit Symphony, sponsored by Ford. I made it a point to attend a concert every day.

The foreign pavilions gave a panoramic sweep of world cultures enthralling to a sheltered Iowa youngster brought up among German-American farmers. I marveled at the Italian, Chinese, Japanese, Ukrainian, Moroccan, Belgian, and French exhibits. High in the air, the Sky Ride Car, a double-decker gondola, sailed from one end of the fairgrounds to the other across a lagoon. Because I had so little money, I lived on popcorn, hamburgers, and two beers a day. When I got home, I calculated my total expenses for four days at \$12.00. I went again the following summer.

In the fall of 1933, learning that Albert's, a dry-cleaning and laundry business in town, would house a student willing to help out, I applied and was accepted. I slept in a back room with bags of dry-cleaned clothes hanging some two feet above my bed. I was expected to start the steam boiler and sweep the floors each morning before the owners arrived.

College High Jinks

For Midwesterners, Halloween was, and probably still is, a major event. I can remember when I was living with Grandmother Beranek in Solon how high the excitement ran, how pranks would sometimes morph into vandalism, and how the townsfolk seemed resigned to this as part of an age-old custom. Main Street usually looked bombed out the morning after. Soap smears covered store windows, wheels from parked cars ended upon rooftops, and sidewalk benches were scattered everywhere. The most adventurous pranksters had absconded with outdoor privies from private homes (there was no town sewer system in 1926), lining them up in not-so-neat rows down the center of Main Street.

Things were pretty much the same in Mount Vernon, although it did have a sewer system. On Halloween in 1933, about 10 PM, I heard a knock on the front door of Albert's just as I was turning in. Six Cornell students stood in the doorway and asked me to join them in commandeering a large privy behind a home on the outskirts of town and moving it to the college dean's front porch. Dean Albion King was an officious sort, with no friends among the students. When I asked my colleagues in crime how they planned to transport the privy, they said they would simply carry it. Slipping into engineering mode, I quickly calculated the weight and reported the disappointing news: it was far too heavy to be carried. Then I got an idea. Behind

the local telephone building, not far from Albert's, was a four-wheel flatbed trailer, which the telephone company used to transport telephone poles. I proposed that we "borrow" it, which we did, and we stealthily headed out to fetch our loot.

The privy was even larger and heavier than I'd calculated, but somehow we managed to tilt it onto the trailer and push and pull it to campus. Within a few hundred yards of the dean's house, a police officer I knew stopped us. I had repaired his radio once. He asked where we thought we were going with that privy. To Dean King's front porch, I told him, knowing that King's unpopularity extended well beyond the student body. "If you put it anywhere else," the officer replied, "I will arrest you." After a struggle, we managed to stand the privy on the dean's wide, covered porch without waking anyone up—and to roll the trailer back to where we found it with no one the wiser.

The next morning, Dean King came to school fuming, exactly as we'd hoped. His suspicion fell right away on the likely perpetrators—the Deltas, a fraternity made up mostly of athletes. He grilled them, one by one, in his office. But none had been in our group, and, in the end, the dean failed to identify any of the culprits. He never suspected that I, of all people, had been willing not only to embark on such a disreputable scheme but also to make sure that it succeeded.

Radio Electronics—A Hobby Becomes a Vocation

I soon became close friends with one of my mathematics classmates, Harold Ericson, a tall, slender fellow with a pleasant manner and disposition whose father owned a telephone company in Hector, Minnesota. Harold was a ham (licensed amateur radio station operator) and knew lots about radio receivers and transmitters. He urged me to get an amateur license, too, so that I could share in the use of his transmitter. This meant I had to learn Morse code. Harold loaned me a small code-sounding machine, and I learned the dits and dahs (dots and dashes) of the Morse alphabet. When I felt confident enough to pass the test, I went by bus to a Federal Communications Commission (FCC) examination center in Des Moines. All candidates had to show they could send and receive code at not less than 10 words a minute. I squeaked by, earning the call letters "WRER," which I could use as my signature anytime I broadcast. This experience came in handy later when I went to graduate school.

At some point in the fall of 1933, the head of Cornell's speech department happened to mention how helpful it would be for his students—as a measure of their progress—to record their voices before and after their year of speech training. I later chanced on an advertisement in a radio magazine for a small recording machine, which, I found out, could produce embossed aluminum records at a cost of about 50 cents apiece. I went back to the professor and told him that I would buy the machine out of my own pocket if he would commission me to produce a 5-inch aluminum record for each student at a dollar apiece. He agreed and, in the small studio I built in one corner of a physics lab, I recorded every member of his class before and after a semester of speech training. This brought me in contact with the field of acoustics for the first time. I learned something about acoustics from a book in the college library, little realizing that it would become a major part of my professional life in the years ahead.

As the spring of 1934 approached, I found myself in financial straits once again and realized I would need to find a full-time job to accumulate some savings. In April, I applied to the fledgling Collins Radio Company in Cedar Rapids. The young president, Arthur Collins, interviewed me personally and offered me a position at 14 dollars a week, starting May 15. Arthur was the son of a wealthy real estate dealer, M. H. Collins, who had managed to avoid the worst of the bank and stock failures during the Depression. Arthur was known locally as boy inventor and radio wizard extraordinaire. Arthur's father set him up in Collins Radio, which at first manufactured only transmitters for amateurs. His breakthrough came in 1928, when he was chosen to equip Admiral Richard Byrd's expedition to the South Pole with a small transmitter that ended up performing magnificently. I became a friend of Arthur's and he invited me to his home several times to look over his amateur radio equipment and to share an evening with his family.

Now that I was leaving Mount Vernon, I decided to sell my radio repair business, which I did, to Harold Ericson for \$40. I stored my drums in Bigger's attic and headed for Cedar Rapids, where I rented a room for a dollar a week in the home of an elderly couple. I remember keeping close tabs on the clock, as we had warm water available just two hours a day.

Collins Radio was moving ahead with some fairly adventurous marketing strategies at the time, particularly with a view toward broadening its clientele for the manufacture and sale of sound systems. One possibility was that funeral homes might play recorded music during services. I was assigned to

go on sales expeditions with an old salesman, Jim Thompson, who was about 35, and had little in the way of technical know-how. My job was to demonstrate equipment, answer technical questions, and help plan the kind of system each client needed. Collins gave us an old Cadillac, a four-door sedan, to travel around in. We visited funeral homes all across Iowa, staying in low-cost motels as we roamed the countryside.

When hot weather approached, Jim always wanted to find the nearest public beach or swimming hole. He also had quite an eye for the ladies. After making several sales pitches in a town, he would take me out “cruising.” If he glimpsed a pair of presentable young women walking down the street, he would pull the Cadillac over and strike up a conversation. On one such occasion, the women joined us for dinner, and because it was a very hot day, Jim asked them where we could all go for a swim afterward. As dinner progressed and the beer and talk flowed more freely, he proposed that we invite some of their friends along and head over to the nearest pond for an evening of skinny-dipping. The perpetual charmer, Jim put together a willing group of six or so. When I declined to join in, he dropped me off at our motel—whether he was miffed with me for party pooping or happy to have the ladies all to himself, it was hard to tell. The next day, without going into specifics, he boasted about what a great time they had had. Partly as a result of such distractions, our sales expedition was unprofitable and Collins fired Jim in September.

The company asked me to stay on as an assistant in the engineering department. Three new engineers arrived at Collins at the same time—Frank Davis, Merrill Smith, and Roger Pieracci—all with master’s degrees in engineering from prominent universities. When I met them on their tour of the plant, the subject of housing came up, and the four of us decided to join forces and look for someplace to live near work. We found a very nice second-floor apartment that had two bedrooms, each with twin beds, a living room, a kitchen, and a wide hallways in a house on the nearby streetcar line—and all for \$40 a month. We shared the household chores, and my diary shows that, about once a month, my turn came to scrub the floors and vacuum the rugs.

I kept very busy outside of work, reading books that ranged from dime mysteries to engineering texts, and going out on dates. On one such date, I met Florence (Floss) Martin, a beautiful, slim woman some three years younger than I. Floss was attending business school in Cedar Rapids and lived with her aunt in a modest second-floor apartment not far from me. She and I hit it off from the start, finding plenty to talk about, and I began seeing her regularly.

We liked going to movies and kicking up our heels at Danceland, the city ballroom. By the time I returned to Cornell, Floss was my steady girlfriend, and we had even talked about getting married someday.

That fall in Cedar Rapids, I took German lessons because I had barely scraped by with a C in German at Cornell. My prospective teacher was a recent immigrant from Germany. Mr. Merner said he would teach me as long as I was willing to prepare each lesson fully and to show up at his place twice a week, promptly at 7 PM, for an hour and a half. I agreed. He began by pulling a book of German fables off his bookshelf. I studied the text so thoroughly I came to know every punctuation mark. (Quite by chance at the end of my next semester at Cornell, the professor chose to read to the class one of those very fables. To his amazement, I handed in a perfect translation.)

On New Year's Eve 1934, after working all day at Collins Radio, I rushed over to pick up Floss for a night of celebrating at Danceland. At midnight, we shouted, blew horns, and kissed, then went with my roommate Roger and his girlfriend, Bernice, to the Play-Mor Hall, where we danced to Al Morey's band until 1:20 AM. After that, we headed over to the Iowa Theater to watch the end of a movie, followed by a stop at the Montrose Hotel to enjoy yet another dance band. The evening—or morning, by this time—ended at the Butterfly Sweet Shop for coffee and cake. I dropped Floss home and fell into my own bed at 5:10 AM. My notes say: "What a grand ending to the old year. Finest year ever for me—God grant me more. What a great thing life is!"

In January, I made plans to return to Cornell. Arthur Collins appeared sorry to see me go, but I had put aside what I had aimed to—a pot of savings to help me finish up college—and along the way I had learned a lot and gotten to know some interesting people. I arranged with Harold Ericson to share in (now) his radio repair business back in Mount Vernon. Cornell awarded me a second-semester scholarship of \$112.50, which meant that I only had to find \$87.50 for tuition. Another lucky break: fellow student Richard Rhode asked me to join his popular college dance band. I played drums with them about once a week, earning \$4.00 each time.

A Momentous Encounter

At the end of the semester, I went back to Cedar Rapids to spend the summer working once again for Collins Radio. I moved into the same dollar-a-week room that I had previously occupied and, always a planner, I started

thinking about what I would do after graduation, just over a year away, when something happened that led me in a direction I never expected. On Friday evening, August 16, 1935, I drove to Mount Vernon on the Lincoln Highway, which then went from New York to San Francisco, passing through Mount Vernon along its Main Street. I spent the night on the back-porch swing of the Bigger family's home. After lunch, having passed the morning at the Cornell Library reading technical periodicals, I was strolling along Main Street when I came across a Cadillac with Massachusetts plates standing at the curb with a flat tire. Beside it was a well-dressed man looking glum. When I asked him if I could help he jumped at the offer. As I worked away with the jack and lug nuts, we engaged in a friendly exchange. I told him that I was between my junior and senior years at nearby Cornell College and how I wanted to go to graduate school, but could not afford to unless I were to obtain a scholarship. He asked me about my majors and my grades. I cheerfully answered and said that I was planning to submit scholarship requests to the University of Iowa and to the universities in the states surrounding Iowa.

At the mention of my work as a radio repairman, he perked right up. "Radio is my business," he said. He asked for my name, and after responding, I asked for his. "You are Glenn Browning?" I blurted out. "I just read one of your papers on the Browning Tuner in *Radio News* this morning in the library." Suddenly I had a new friend. He wanted to know if I had considered going to Harvard University. "No," I said, and then—before I could catch myself—"that's a rich man's school." Smiling, he informed me that Harvard had more scholarship money to offer than any of the schools I had named. He opened the door to the front seat of the car and took out a pad of paper on which he jotted down the names and addresses of two people at Harvard—one for admissions and the other for scholarships. "When you submit the paperwork," he said, "use me as one of your references." I would learn later that he had spent three years as an instructor at Harvard's engineering school before opening a successful radio manufacturing business in suburban Winchester.

That fall, I sent scholarship applications to various state universities. I also sent one to Harvard. When I wrote to Browning in February 1936, thanking him for letting me use him as a reference, he wrote back that he had already been contacted by Harvard's dean of engineering, had put in a good word for me, and wished me luck.

Letters from the state universities started arriving in March—all of them saying, in effect, that my grade record and references were satisfactory, but

that, because there were so many applicants, they could not offer me a scholarship. Then a letter came from Harvard. I opened it slowly, anticipating yet another letdown. Dated March 27, 1936, "I am very happy to tell you that you have been awarded a Gordon McKay Scholarship of four hundred dollars, covering your tuition for study in the Graduate School of Engineering at Harvard University during the academic year 1936–37." When the news got out, I could barely contain my joy. I became an instant celebrity.

Wrapping Up at Cornell

In my senior year, I bought back the radio repair business from Harold Ericson and took up residence at the Neff Funeral Home on Main Street in Mount Vernon, where, in lieu of rent, I helped undertaker William Neff pick up corpses, usually in the middle of the night. To finish up at Cornell that summer, I piled on the subjects: sociology, mathematics, philosophy, German, physics, and art.

At the beginning of the school year, I was elected to the Alpha-Theta-Alpha fraternity, with headquarters in Ma Miller's rooming house just off campus. As part of our hazing, about a dozen of us pledges were given a list of things to get done in one evening: steal some watermelons, pilfer a pig, swipe a girl's panties from a dormitory, and answer a set of tricky questions correctly. The penalty for failure was a dozen or so whacks on the rear with a large paddle—a fate we wanted to avoid at all costs. We drove over to see the farmer I had worked for who raised watermelons and who let us "steal" enough melons to treat our whole fraternity. At one of the girls' dormitories, we stood outside and yelled up our plea for a pair of panties; to our surprise, not one, but two pairs came flying through an upper window. Another farmer I had come to know during my summer stints agreed to let us "pilfer" a pig, on condition that if the animal were not returned, we would pay him \$20. With our booty in hand, we got back to the house about two hours after we started out. After correctly answering the tricky questions, we were showered with praise. But the pig got away from us and we couldn't find it in the dark, so the next day we had to fork over \$20.

To make extra money in my senior year, I added retail sales to my radio repair business, with a shop on the second floor of a building on Main Street. I convinced the RCA and Atwater Kent radio suppliers to ship me a dozen sets. My shingle over the entryway downstairs read: "Leo L. Beranek, Radios

and Service.” I found an unemployed man—about 40 years old, intelligent, nicely dressed, and clean looking—to run the sales room whenever I was doing other things, mostly schoolwork. The radios sold well and my repair business picked up, too. I also hired an electrician to help and wired some private homes.

I attended classes during the day and studied in the library in the morning and early afternoons, where I could be certain to avoid interruption. In the late afternoons, I tended to the radio business. That winter, Cornell President Herbert Burgstahler sent out a questionnaire to all students asking how many hours a week we spent on nonacademic activities. The answers were anonymous, and I reported 40 hours. In our compulsory chapel service, Burgstahler announced the results and made a special point of observing that whoever reported spending 40 hours a week outside could not be getting much out of college.

The New Year brought much change. When radio sales dropped off but the house wiring side of my business grew—because my rates were cheaper than those of the Iowa Electric Company and I benefited from subsidies under the Federal Rural Electrification Act—I decided to concentrate on wiring and stop selling radios. An advertisement I placed in the Mount Vernon paper read: “Radio Clean-Up Sale! Friday, Saturday and Monday, January 24–25–27.” And, sure enough, I pretty much cleaned out my stock that weekend.

One day every weekend, I would drive over to Cedar Rapids to see Floss. Some Sundays we went to her church, First Christian, and took part in young people’s fellowship activities there. Sometimes she would catch the bus to Mount Vernon and we would attend a college social together. We also exchanged letters weekly. Then came the day we went on a picnic with a small group of her relatives. This being the first time I’d met the greater family, I wanted to make a good impression. No such luck. Floss’s aunt asked me to drive her car. But, as I pulled out of her parking space, I pressed down too hard on the accelerator, clipping and bending the bumper of the car in front and causing the bumper on our car to fall off altogether. The usual awkward exchange of information and documents was made even more awkward because I had no license to exchange and could only stand there, looking foolish. When the aunt’s car went into the garage a few days later, fortunately, nobody asked me to help out with the repair bills.

With graduation not far off, three opportunities for wiring jobs came up at Cornell. In June, I wired the dining-hall addition to Bowman Hall and, a

month later, completed the rewiring of Rood House. My third Cornell job was the most ambitious of all. I had convinced the building committee that a central antenna system should be installed in Merner Hall, a new men's dormitory then under construction—at a fixed price of \$556.58. Later that summer, the *Cedar Rapids Gazette* announced: "Individual radio outlets [at Merner Hall] are connected with a master antenna system designed and installed by Leo Beranek of Cedar Rapids. The antenna on the roof of the hall is connected with room outlets by a continuous system of wiring in conduits." Each of my early business ventures proved excellent preparation for managing a wartime research laboratory at Harvard, four years later.

I received my bachelor's degree in the summer of 1936, just as I had hoped. I missed Phi Beta Kappa by a tenth of a point, but Cornell made up for that twenty-six years later by naming me an honorary member. Diploma in hand, I sold my radio business to a repairman in Lisbon, Iowa, for \$99 at the end of August. With a mix of excitement and nervous anticipation, I started to gear up for what was looking more and more like a risky plunge into the unknown. I had saved about \$450, which—along with my scholarship—I was hoping could be stretched to cover rail fare, room, board, and essentials for a year at Harvard. But I was already wondering, *then* what?

