

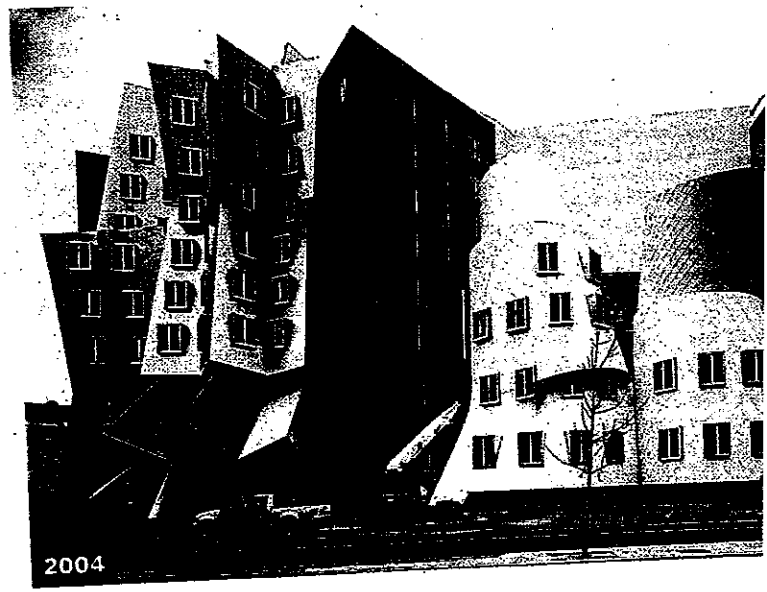
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~~(SECRET)~~ BRAD HOWLAND SHORT
STORIES

TO BE DEDICATED TO
JERRY LETVIN
- Brad Howland

pp 2



Building for Science

We're looking at two views of the same site at MIT, on Vassar Street in Cambridge. It's hard to say which of the buildings is more remarkable. The old one didn't have a name. It was called Building 20. The new one is flush with names. It's the Ray and Maria Stata Center for Computer, Information and Intelligence Sciences, and parts of it are named after high-tech donors Bill Gates and Alexander Dreyfoos.

Building 20 was one of those "temporary" structures that never go away. It was built on a crash schedule during World War II, and its purpose was to develop radar for use in the war. It was an enormous, sprawling structure of heavy timber framing and asbestos siding. The Cambridge Building Department gave permission for it to exist only "for the duration of the war and six months thereafter."

But Building 20 lived for 55 years and became a legend. When its fate was finally sealed, scientists at the Massachusetts Institute of Technology held a wake in its honor. They called it the "Magical Incubator," because so much significant research came out of it.

Building 20's greatness was its absence of architecture. In a building so lacking in character, it was impossible to establish academic or social hierarchies. Everyone was equal, and science was democratic, creative, and freewheeling. You could perform improbable experiments or bang holes in walls or roofs to connect up new equipment, because nobody cared what happened to Building 20. The result, say scientists, was the most productive building of its size in American history.

The Stata Center, which opens early next month, is the opposite. It tries to do with architecture what Building 20 did by not having any. The architect is the world's currently most famous, Frank Gehry, whose Walt Disney Concert Hall in Los Angeles opened last fall to general acclaim. At Stata, Gehry's playful shapes create a partylike atmosphere. And his architectural swoops and collisions make for a building that will always look as if it's still under construction. The building is a metaphor for the cutting-edge innovation that will occur, it is hoped, in its labs, offices, and classrooms.

Indoors, Stata is conceived as a mixing chamber. Students, faculty, and researchers in different fields will bump into one another in broad rambling corridors and open terraces. There are public facilities such as a cafe, fitness center, dance studio, and day-care center. Philosophy and linguistics will share the building with hard sciences. The hope is to break down the isolation of one discipline from another. At Stata, social interaction — not, in the past, an MIT priority — will be relied upon to spark scientific ideas. **EG**

OUT WITH THE OLD The plain Building 20 (left) at MIT was famous for what happened inside.

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ORIG SET 15 Dec '13

Oct 25, th '13

OUTLINE

- A. Introduction and History of Bldg 20 at MIT
- B. Representative Stories
- C. Cambridge and Boston
- D. Rogues and Geniuses
- E. Jerry Lettvin's Group ~~Successes~~ IN BLDG 20
- F B. Jerry Lettvin, Personal
- G. Patents and Inventions
- H. Concluding items.

TITLE of Book Building 20 Short Stories.

BUILDING 20 SHORT STORIES
A Introduction
EA

- A. Introduction
2. History of Bldg 20, Radiation Laboratory during WW II, RLE and Mit Lincoln Lab.
3. Key Accomplishments of MIT Alumni During WW II

BUILDING 20 SHORT STORIES
by Bradrowd Howland

INTRODUCTION

Many members of the U.S. scientific community have heard the remarkable history of MIT 's Building 20, a temporsry WW II ~~building~~ building, built in 1943 for wartime radar research. With highest possible priorities, it was hurridly constructed of huge wooden beams, and sheathed with pressed asbesdos board, known then as transite. Due to a tragic fire in Boston in 1942, it was fully equipped with sprinklers, ~~and~~. Its most remarkable phase was after the war ended, two ~~years~~ years later, when its huge extra floor space contributed to a number of imoportant functions, and it ~~eventually~~ soon became the intellectual center of MIT.

To help occupy this space, two large laboratories, the model train club, two large machine shops, etc. occupied only a ~~small~~ fraction. The MIT model train club, belonging to the students, and open 24 hours, exhibited the largest HO gage model train array in the Boston area, also there was MIT's Linguistics ~~department~~ department, a smaller mini-college called Concourse, etc.

I was fortunate to have been hired, after dropping out of the Harvard physics gra program, in 1950, and had a laboratory connection for the next 37 years, till 1987. During much of this time, I was a member of Prof. Jerry Lettvin's group, from which most of these storjes orignated. Jerry was said to have the most creative mind at MIT-- he was there from 1951 until its demolition in 1995.

In 1990, Jerry, my mentor, said "since the building is made of asbesdos, which is a deadly poison, and therefore cannot be dismantled, they shold put a plastic dome over it, and declare it a National Monument!"

One would think that, with at least twenty years to plan\$ its replacement, that they would have donw an exceptionally fine job of ~~planning~~ planning ~~the~~ the repladement of what was obviously their most important building. Instead, they erected an archictual monstrosity, without a right angle evident in its structure,

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and, far worse, they left out space for the Model Train club, which served as a magnet for the students. It has been said that trains are now unpopular, but a trip to any large book store ~~which~~ which displays many regularly published train history magazines will show otherwise. Noam Chomsky, now resides exactly eight stories above his former office, with Morris Halle, in the old building. A curious fact, which shows how liberally FDR spent money on ^{War radar} research is little-known: a still larger, similarly constructed building, #26 was demolished in ~~1944~~ years after the war.

The following stories involved ~~negligible~~ negligible creativity, since I merely related, as accurately as possible, some of the most bizarre events, particularly in Jerry Lattvin's group, which took place. Certain names were, of necessity altered. It was also my intention to show how work at MIT ^{in the Fiftys} interacted with the local neighborhood, ~~centered~~ centered about ~~the~~ the Subway stop at Kendall Square, ~~Cambridge~~ Cambridge was then a thriving suburb of about a hundred thousand residents;; it has altered completely since.

The chief character in this book is Professor Jerome Y. Lattvin, phusician, neurologist, psychiatrist, circuit hacker, and a veteran, as a Doctor, of General Patton's conquest of Germany.

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history

INTRODUCTION AND HISTORY OF BUILDING 20

Many members of the U. S. Scientific community have heard of the remarkable history of MIT's Building 20.. This was a temporary building, built in 1943 during WW II to augment the space for the Radiation Laboratory, which developed radar. ~~It was built, with top priority, of massive wooden beams; the walls were made of pressed asbesdos board, ealled transite. It was thoroughly wired for AC, 110 volts DC, and 400 cycles AC, used for aircraft electronics.~~ It was built, with top priority, of massive wooden beams; the walls were made of pressed asbesdos board, ealled transite. It was thoroughly wired for AC, 110 volts DC, and 400 cycles AC, used for aircraft ~~electronics.~~ A still larger building, # 26, next door was demolished after the war. Building## 20's huge floor space inluded three levels and five wings. It was, however, ~~only~~ after the war that Bldg. 20's importance became evident, and only/ ~~the intellectual~~ the intellectual center of the Institute.

With such an enormous floor space, the student - run Model Train Club was ~~alloted~~ alloted five bays, sufficient to house the largest HO gauge rail configuration in the Boston area. This exhibit was open\$ to the public, as well as former MIT graduates, years after earning their degrees.

The principal laboratories in Building 20 in 1950, ~~Jerome~~ were the Research Laboratory of Electronics, headed by ~~Jerome~~ Wiesner, and the Nuclear Science Laboratory, headed by/ ~~Jerrold Zacharias~~ Jerrold Zacharias. I was hired, by good fortu to work at RLE on speech recognition, after dropping out from the Harvard Physics Department. I was able to ~~maintain~~ maintain laboratory access until 1987, roughly two third the life of the building. I had, at best two bays, including a darkroom, a small machine shop, and \$ fourteen locked cabinets to store equipment. For much of this interval, I also had a paying job at MIT's Lincoln Laboratory, twelve miles away in Lexington.

My mentor, and later thesis adviser, ~~was Prof.~~ was Prof. Jerome Y. Lettvin, ~~to whom this book is dedicated,~~ to whom this book is dedicated, He was ~~hired~~ hired to do neurophysiology research in 1951, and was still employed when the building was finally scrapped in ~~1998~~ 1998, fifty-five years after it was built! Jerry had said: "Since it is made of asbesdos, it

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it cannot be demolished, ~~so they should put a plastic dome over it and~~
declare it a national monument. ^{stories}

The ~~story~~ ^{stories} to follow will give, I hope, some measure of the important ^{all}
~~functions~~ of building 20, so I will not try to list them here. But
one would think, that with at least twenty years to contemplate the design

~~of its replacement~~ of its ~~replacement~~ replacement, that they would have done an excep-
tionally fine job in planning its replacement. ~~new~~ But the omission, in the ^{all} eight-story monstrosity, ~~of its~~
(which contains ^{few} right angles in its structure) of the model train club, and
its track layout, ~~the~~ -- the social center for fifty ^{some} years, was inexcusable!

My good fortune was to join Jerry Lettvin's group -- ^{his} being ^{his} the most creative
and brightest mind I have met. His ~~biography~~ ^{auto-} biography has been ~~printed~~ ^{board-} printed elsewhere,
it suffice it to say that he was a neurologist, ~~psychiatrist~~ ^a psychiatrist, neurophy-
siologist, circuit designer, and was a member of both the biology and electrical
engineering departments. He would ~~jokingly~~ ⁱ jokingly boast "I am a double professor,
with a ~~licence~~ ^{license} to kill!" -- reminiscent of James Bond, and when asked about his
~~licence~~ ^{license} to kill, he would reply: "my medical degree." He was also ^a ^{UL S. Army} veteran
member of General Patton's drive thru Europe. At Jerry's "festshrift", at age
65, the largest lecture hall at MIT ~~was~~ ¹⁰⁻²⁵⁰, was half filled with his
students, many of whom were professors at universities throughout the country.

In writing these stories, I cannot claim any ^{creativity;} ~~accuracy~~ I have just
~~reported~~ ^{and to} as accurately as I could, the events that happened to me, ~~and to~~
Jerry Lettvin's group ^{related events} ~~persons'~~ located in Bldg 20, and other ^{names} elsewhere. Some
have ~~been~~ ^{changed} been changed ~~for~~ ^{obvious} for obvious reasons.

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In writing these stories, I cannot claim any ^{creativity;} ~~creativity;~~ I have just reported ^{and to} ~~as~~ as accurately as I could, the events that happened to me, ~~our~~ ^{our group,} ~~related~~ ^{persons'} events located in Bldg 20, and other ~~elsewhere~~ ^{elsewhere}. Some ~~names~~ ^{names} have ~~been~~ been changed ~~for~~ ^{for} obvious reasons.

PP10

A FEW KEY TECHNICAL ACCOMPLISHMENTS OF MIT ALUMNI IN WW II

There have been many books written about the origon of the key technical ideas which led to the atomic bomb. The names of Hahn, Strassman, Lisa Meitner, are well known. However, less well understood is the fact that it was radar that won the war-- the atomic bomb only ended it.

The part played by key MIT graduates ^{in World War II} are less well known, than those of the atomic bomb. However, I would like to suggest that the kwy person, ~~responsible for the development~~ ^{development} of the atomic bomb was not Oppenheimer, Szilard, ~~or other physicists.~~ ^{Bethe,} Rather, it was General Leslie Groves, an MIT graduate in civil engineering.

A second General, whose technical brilliance had great effect ^{on the war} was General Doolittle, ~~a~~ a graduate of the MIT aviation department, one of the few such in the USA at that time. It was his recognition that two-engined, Mitchell B-25 long range bombers could take off from the short decks of ~~aircraft~~ aircraft carriers, by having the ship steam directly into the wind, ~~on a day~~ on a day when there was significant ocean breeze. Together with the height of the deck, which could be traded for speed, these four factors enabled what was seemingly impossible. The raid is known to have done negligible damage, particularly since they were forbidden to bomb the Emperor's palace, but the effect on the later battle of Midway was significant, because of ships which couldn't ~~participate,~~ participate, so as to protect the home island.

World war II was an extremely technical war, and the contributions, ~~is~~ not only to radar, but to long range precision radio navigation, LORAN, was of immense importance to the convey battles in the Atlantic. This was Alvarez's idea. Interestingly, it turned out that in the early tests of LORAN, most of the ~~supposed~~ ^{supposed} errors were those of conventional astronomical observation with sextants, as then ~~practiced~~ ^{practiced} in the navy!

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Now, as to Radar: It is well known that the first effective use of radar by the allies was in the "Battle of Britain", using frequencies in the two hundred megacycle range, of 1.5 meter wavelengths, instigated by Watson-Watts (later Sir). But the key invention that enabled the jump from meter to centimeter wavelengths was made by two engineers at Birmingham University; their names are John Randall and Henry Boot. This, the cavity magnetron, was a gigantic breakthrough, and put the Allies years ahead of German radar.

This tube, which was surrounded by the poles of a high strength permanent magnet, involved the manufacture of a high-precision copper anode, with six or eight narrow and deep holes, with precision slots leading to a larger central hole.

The British with difficulty built a dozen prototypes, six of which transported to the US, in the hopes that we could find a method for mass producing them. The problem was solved by a brilliant inventor, then at Raytheon, who had been a protoge of Vannivar Bush, at MIT. He had previously invented the circular bimetallic disc, which is used to this day in most every refrigerator in the world. This structure involved brazing together, with a thin sheet of gold, two metallic discs with dissimilar thermal expansion coefficients.

So you can see how, this inventor, whose name is unknown to me, solved the problem: He started with large, four inch diameter beryllium copper thin-sheet discs. He then had a tool and die machinist make a die with four large outer guide holes, and in the center the complex exact cross-section of the magnetron, holes and slots. (That's what tool and die makers are capable of.) Then, with one thousandth inch gold foil as solder, between each of the stack of discs, with precision aligning threaded rods, he was able to heat the assembly in an oven, and weld it into a vacuum tight entity. The outer guiding holes, etc. were then machined off, leaving the desired ultra-precision anode assembly. His was a critical contribution to the War Effort; the Germans later recognized that they were years behind our effort. The US also produced a quarter million radar sets, and trained many thousands of operators.

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B REPRESENTATIVE BUILDING 20 STORIES

1. The Seventy-Five Dollar Fine
2. The Decor of Building 20
3. Married to the Model Train Club
4. "The Phantom Has a Point "
5. The Red Diner, Nearby On Main Street
6. ~~\$~~ Mike's Car Garage Next To the Red Diner
7. A Terrible Winter Morning in 1961.
8. ~~\$~~ The Scream in the Middle of the Night.
9. "That Damned Bat Must Have Radar"
10. The Pirated ~~\$\$\$\$\$\$\$\$\$\$\$\$~~ Twelve Inch Klipsch Horn Speaker
11. The Wall of Books in Building 20
12. The Giant Snow Storm in 1961.
13. "You Don't Measure Anything, Do You?"
14. "Why Is There Something Wrong With Every Piece Of Equipment in This Laboratory

MPB

DATE
JULY 1975
NUMBER
Story #1

The Seventy-Five Dollar Fine

As was often the case on a winter night in Cambridge, a severe snowstorm alert had been declared. My little, seventy-five horsepower Saab 96 front-wheel drive car was parked safely in the large, three story garage adjacent to Building 20. ~~#####~~ Shortly after 8:00 PM, one of the janitors came to my lab and said, "Brad, there is a student in tears in the front lobby, perhaps you can do something." It was fortunate that he noticed this, because ~~the~~ story was this: The student had a large Volvo 260, a rear wheel drive car, ~~a~~ considerably heavier car than mine, and his battery was dead ~~after~~ after numerous attempts to start a very cold engine. Still worse, because Vassar Street was a major truck route, there was a \$75 dollar fine for parking during a declared snow emergency. A nearby sign so indicated. Remember that these were 1967 dollars.

I didn't look forward to what had to be tried, so I rather selfishly made him put his set of chains (I didn't have any) on the front wheels of my little car, a bone and finger job in the cold, and then I attached an excellent nylon rope to the bumpers of both cars. There was, fortunately, little traffic, and we prearranged a signal that when I honked, he would let out his clutch. We went down Main Street towards the traffic circle at Kendall Square.

After two honks and attempts to start, both cars came to a halt—and we had used a good part of the traffic-free road before being committed to crossing the bridge to Boston. Just then, I had an inspiration—I knew he was a physicist, not an engineer, so we stopped to confer, ~~and~~ I asked him, "Which gear are you using?" His answer: "Low gear, the first of four." So, I ordered him to use fourth gear, in which the car would more easily start the engine, rather than first gear. Later, he was to shift to third, and I also told him to run the lights on dim, so I could see if the generator was working.

Low and behold, it worked! By the time we were back to the garage, he was driving on his own, and the battery was nicely charging. So we parked both cars safely out of the snow and ran his engine for a few more minutes. In any event, the \$75 fine was no longer a problem. Of course, we had to switch back the chains, but this wasn't so much of a problem.

After all this work, of which he did at least 90 percent, I was feeling pretty good, and said, "Come to my lab nearby, and we will celebrate with some Cherry Kiafa wine. Since it was illegal to keep alcohol on campus, I kept it locked in a cabinet. As was then the fashion, we each partly filled a 250mm chemical beaker and sipped the warming fluid.

During our recovery, my new friend said, "This wasn't the worst thing that has happened to me today. This morning, I went to visit my fiancée ~~and~~ and found her in bed with my best friend."

So, I learned that day an important lesson—it is the accumulation of troubles that can push one over the edge, not the severity of the worst ~~one~~. One can handle only a certain amount of bad news at one time.

There is a follow up: Twice, when I was standing on a corner in North Cambridge, where I lived, waiting for a bus to Harvard Square, he drove by, slammed on ~~his~~ brakes, and gave me a ride to MIT. The second and last time—I was very grateful for each time—he said, "I'm getting married next Sunday," and when I looked at him quizzically, he added, "But not to the same girl."

Story *61

The Décor of Building 20

As Told By Noam Chomsky

As is well known, Building 20 was hastily erected in early 1943 with the highest possible priority in lumber, wiring, and plumbing. ~~#####~~ ^{for} nasty assembly and fireproofing, it was made of pressed asbestos board. The earlier tragic Coconut Grove fire in downtown Boston, which killed hundreds, certainly had a part. Building 20 was fully sprinkled, and the only fire ever, years later, put itself out, ~~ty~~ ^{ty} sprinkler.

The wiring was for 110/230 volts, three phase, with the wires on the ceiling on huge insulators—there were four huge transformers feeding the building with both 110 volts DC, and AC, also three phase, 400 cycles. The ~~###~~ ^{###/100 cycles} was for aircraft electrical tests, and 110 volts DC, for magnets. It was crude, but it was ideally suited for radar and similar advanced wartime research. The transformers were filled with dangerous PCB fluids, which were non-flammable, and being toxic, were largely responsible for the ultimate replacement of the building.

Building 20, of course, was not originally air-conditioned, except to cool several copper-shielded Faraday cages.³ After the war, air-conditioning was added, if it was the room of a senior official like a dean. One very hot day, Noam Chomsky and Morris Halle, linguists who shared an office on the third floor, put in a request for an air conditioner.

The reply came back from some unknown official: "Yqur request was denied, because the installation would not accord with the décor of Building 20! This made Noam and Morris so mad that they went down to the Marshall Field store and, with their own money, bought the largest such machine that would fit in the window and installed it themselves with the help of a friendly electrician.

So much for the décor of Building 20.

³ The Faraday cage protected electronic equipment from being damaged by lightning or electromagnetic radiation by enclosing it within conducting material or a mesh of such material.

Married to the Model Train Club

There isn't space here to describe the full importance of the MIT model train club to ~~the~~ MIT. ~~#####~~ But, for many decades later, it was ~~still~~ located on the second floor of Building 20 and was open to visitors from everywhere 24 hours a day. In at least five bays, there was a huge HO gauge layout of the greatest possible complexity.² The model trains were supplied by the members, who owned them personally.

But if you went there on an ordinary day, there was very little train action—the boys there were more concerned with relay and, later, PDP-8 computer control of the trains. The club clientele seemed to me to be a homogeneous group of very bright but lonely boys who were also interested in the photography of full size trains. This perhaps substituted for their apparent lack of interest in girls, who were ~~#####~~ rarely present. But ~~these boys~~ ^{they} were extremely knowledgeable about the U.S. railway system. One day a question about the Pennsylvania RR came up: "What was the steepest grade on the Penn RR from New York City to Pittsburg?" Answer: at the mouth of the tunnel under the Hudson River, just entering New Jersey.

Another fact was that, over the years, the club members, after graduation from MIT, i.e.; the former members, would still bring their trains to run at the club. One day, I met a very attractive MIT coed, a PhD in arts, and I ventured to ask her, "What's it like to be married to the MIT train club?" Answer: "It's normal for my family, for my father is the chief of passenger locomotives for the New York Central RR." So the love of trains is a family affair in more ways than one.

² The typical scale of model railroad trains.

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Story *47

"The Phantom Has A Point"

As told by Steve Burns

A friend at Building 20, who was larger and far stronger than most of us—you will see why this is important—had a habit of taking action when the coke machine failed to give him the drink he had paid for (I had the same problems with the coffee machine). So, when the coke machine didn't work, he swiveled it, all 500 or so pounds of it, so that it faced the wall, and taped a note to it, saying "THIS MACHINE ESCHEWS QUARTERS." He signed, "The Phantom."

Later that day, when the little man from the Coke company was trying to turn the machine around so it could function, my friend appeared, and together they restored the alignment of the ~~coke~~ machine. The little man read the note and said "this phantom can't even spell — he said that the machine ESS-CHEWS quarters. What does that mean?" My friend explained how the word is pronounced, and ~~explained~~ that it means that the machine spits out quarters, without providing a coke. So they inserted a quarter, and the machine, which was now plugged in, spit it out. The little man said, "The phantom has a point."

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Story *36 (also listed as #107)

The Red Diner Nearby on Main Street

When I first arrived at Building 20, my friends there advised me not to eat at the Red Diner, which was across Main Street, by far the closest eatery. But since it was open 24 hours, it was convenient ~~and~~ I didn't find the food there to be that bad. Thus, when the MIT cafeterias were closed, I would often eat there. I especially liked their beef stew; it was real food!

Their main server was a rather unkempt man in his fifties, obviously a graduate of the school of hard knocks. One day as he was serving, I was flanked by two Cambridge policemen who were talking about the benefits of twenty or thirty year sentences for offenders. Then, my server said, "I was in jail once, for six months." This was a bit of shock, until he explained further. "It was AWFUL! I was given six months for failure to pay alimony. Much as I hate the old bitch, she gets the first check at the end of the month, after payday." So much for a twenty-year sentence—one fortieth of that time made a lasting impression on this poor man.

One day, as was my habit, I ordered from him the beef stew, and then out of habit poured a bit of cream into it—it made it taste better and turned it white. The new mixture looked strange, but it usually tasted great, but not today. So I called my friend and said that the beef stew tasted bad. He took one look at the strange milky white mixture and grabbed it away, saying, "Order anything on the menu, and it is paid for." He must have thought that rat poison or drain cleaner had gotten into my stew.

This incident was one that was too complex to explain^{so} I just ordered a cheeseburger and let it go.

When it was after midnight, I would go for a bite at the Red Diner, with a book, and then wait till the janitor came by and unlocked the front door of Building 20, which was locked from midnight until 6:00 AM but checked every hour on the hour.

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(5)

12/27/65

MIKE'S

~~MIKE AND HIS BROTHER'S~~ CAR GARAGE NEXT TO THE RED DINER
1947

In the early fiftys I bought an old Plymouth ~~1947~~ car, from which I
in the course of fixing it's many problems
learned a great deal, ~~at Mike's garage.~~ I remember,
soon after I bought it, I showed it off to a/couple at the lab-- he was an
aviation# student, and ~~he~~ ^{they} asked me why I had bought it. I said "I had
\$900 dollars to spare, and I ~~needed~~ ^{needed} a little cheering up." His wife, ~~instantly~~
replied:" The next time you have \$900 to spare, and need a little cheering
up, come see me instead!" I was so innocent then that I didn't know if she
~~meant it,~~ but since her husband was famous as a crack ~~shot~~ ^{brought up} with
a revolver, I never ~~mentioned~~ ^{mentioned} the matter/again.

In any event, with both my car and Jerry's mother-in-law's car ~~which~~
needing ~~many~~ ^{considerable} t and
~~several~~ frequent ~~repairs,~~ Jerry and I spent time at the garage. It happened
that Mike, who was really smart, ~~had~~ ^{poverty} due to ~~his~~ ^{had} dropped out of
medical school/ ~~part way,~~ ^{and became instead a} car mechanic. He would delight
Jerry, by analyzing ~~the~~ Mrs. Brady's car's ailments in medical terms. He
would say" The carburator is the heart, liver and lungs of ~~the~~ ^{the} engine." ~~###~~

Mike was an extremely honest and friendly mechanic, and he withheld his scorn
of my car
one terrible day, when I accidentally drove one wheel/into his grease pit.
It took ~~three men~~ ^{several two-by-sixes, and three strong men} to get it out, and I was lucky that the fall
didn't drive the pistons thru the head of the ~~engine.~~ ^{engine.}

I finally sold the Plymouth, after ~~he~~ ^{Mike} had rebuilt the engine totally, and I
let him drive my ^{new} little Swedish/ ^{four} cylinder Saab 96, compact car. He took
it for an extremely energetic spin, and announced that it needed an extra ~~one~~
hundred pounds in the trunk. So he wasn't biased against foreign cars. In any
event, what I learned ^{from Mike and his brother} about auto mechanics was of far greater value than the
cost of all the repairs to my old Plymouth.

6/19/19

One day, Jerry and I were listening to Mike explain how his automatic electronic wheel balancer, used after tire change, worked. Mike showed us how, after determining angle and magnitude of the unbalance, one should place two equal weights, exactly sixty degrees on each side of the unbalance location.

Jerry and I ~~argued~~ argued that one such weight, placed ~~between~~ between would suffice. The instructions for the machine, ~~allowed~~ allowed them to sell two weights, where one would suffice. But after a half hour of argument, we couldn't convince either Mike or his Brother that our method would work. Years later, I realized that all we needed to do was to remove the two weights, and reinstall one of them, and show that the wheel was still in balance. However, Jerry and I did have fun and we learned about cars, ~~learn~~ learn alot from Mike, but we were able to teach him little.

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Story *23

A Terrible Winter Morning in 1963 1961

A friend named Walter Pitts, having studied almost everything else known, turned to organic chemistry in his late thirties. His most important discovery was that of electroluminescence—a solution of luminol which, when excited by an anodic platinum electrode (nothing else would stand this treatment) would emit a weak blue light. ~~##~~ ^{The idea} occurred to me ~~##~~ that using a much weaker portion of hydrogen peroxide, the ingredient that reacted with the luminol ^{it} could be utilized to permit fluid flow visualization. When I showed this to Jerry Lettvin, he invited many professors, from aviation, fluid mechanics, etc., and they were all crowded in a very small room with huge bottles of chlorosulphonic acid on the ^{top} shelves. It was a wonder that no one got killed that day. One of those attending was the head of hydrodynamics at MIT, ~~##~~ ^{from} a building directly across Vassar St. from Building 20.

I stupidly agreed to a demonstration to his class, at 11:00 AM, but the night before, I realized that it would be impossible to lug all that apparatus across the street and set up the demonstration, so I took a large set of excellent pictures, showing the patterns of flow on stalled ~~and a~~ ^{*} ~~and~~ working airfoils ~~##~~ ^{made of} platinum plate and mounted them on cardboard for passing around the class. The critical information was more easily seen this way than by an actual demonstration, since the blue light was so weak.

In the morning, I loaded these pictures in my car, but because it had snowed, there was insufficient traction to get out of my parking place, and since there was a car immediately behind, I couldn't coast backwards. So I had to call a cab and just made it to the classroom.

No sooner had I begun my lecture, with the aid of an old fashioned blackboard, when the professor, who was also head of the department, interrupted me, saying, "You said that you would give the demonstration, and now you only have pictures to show the class." I was, of course taken aback, and I could have taken my pictures back and walked out, but I absorbed his abuse and finished the lecture with an invitation to come see "the real thing" if they wanted. No one did. ~~##~~

Fortunately, the talk had been announced in some official publication, and a brilliant student of biology at Harvard, Steve Vogel, befriended me and offered my pictures and me a ride home in his car. He also offered to help me get my car out of its trap.

We had attached a strong towrope to the bumpers and were well on the way to pulling my car out into the plowed street when an old woman yelled from a window, "Don't you ever park here, etc., etc." It was, by the way, perfectly legal to park in any such legal space. So I stupidly yelled back, "Mind your own business, or you'll be sorry." The next thing I knew, a tall man came out of the house, showed me his Cambridge police identification and said "I just heard you threaten my wife."

I may have dissolved in tears, I don't remember, but this was the low point of the day, even considering the Hydrodynamics professor's remark. In any event, he realized that we were just trying to get the car out from in front of his house, and so the matter was settled without my arrest. I am still grateful to Steve for his help that day. Nothing important came out of the flow visualization method, although it was written up in publications and was the subject of several bachelor's theses, a master's and a doctoral thesis at the MIT Fluid Mechanics (NOT the Hydrodynamics ~~##~~ Department), ~~Department.~~

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Story *64

THE SCREAM IN THE MIDDLE OF THE NIGHT

~~The Scream in the Night~~

For many years, the MIT campus police had their office in Building 20 on the second floor, directly over my laboratory in wing C. One night, I was actually locked in my laboratory, reading a scary mystery story, when I heard a blood curdling woman's scream. The effect, particularly since my door was locked, was terrifying, especially after 11 PM, during the night shift of the janitors.

I am proud to say, I responded almost instantly, and I got up there in less than 30 seconds. Already on the scene were ~~###~~ all the nearby janitors—and together we found the situation evidently under control. A young woman, clothed, in only a raincoat, was leisurely talking to two uniformed MIT officers. ~~My~~^{Our} presence was obviously superfluous.

We later found out what happened through the grapevine: The young woman lived nearby and had had a fight with her husband. So she set out, stark naked, for a run across the MIT campus, where she was apprehended by the MIT police, and a raincoat was thrown over her, to preserve order and decency. During her interrogation, the policeman had evidently asked a touchy question, and that accounted for the scream!

But the lesson is this: if you are a female, under threat, a scream is your best defense. The ability to gather a group of male defenders is unequalled by any other means. The only thing that might be better would be a pair of Rottweilers. I once encountered an armed gasoline attendant in Harvard Square late at night, and, since this upset me, I complained the next evening to a different attendant. He said, that this was stupid. The best protection in that position wasn't a gun, it was a dog, since even if you are shot, the dog will finish the fight, and the malefactors know this.



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Story #19

That Damned Bat Must Have Radar!

The total length of all the corridors in five wings and three stories of Building 20 was at least half a mile. One winter night, a bat became trapped in the building and, with seemingly inexhaustible energy, flew continuously through most all of the hallways on all three floors. There was evidently no place where it could hang upside down. The bat would take about fifteen minutes to make a complete circuit~~##~~ of the building.

The greatest danger to the bat was the janitors, who were terrified by strange animals such as bats and tarantulas, and one of them would take a vicious swing with his old fashioned broom every time the poor, harmless bat swept by, at perhaps twenty miles per hour. Having failed at his last attempt to dispatch the bat, the janitor was heard to say, "That damned bat must have radar!"

Eventually, someone opened a door to the cold, and the bat escaped.

Footnote/[#]Bats don't, of course, broadcast microwave pulses, but, since they are very nearly blind and fly in totally black caves, they rely on SONAR, the sonic equivalent of radar. Sonar is, of course, used by the Navy for submarine location. Bats operate at ultrasonic frequencies, so their pulses are inaudible to humans.

(Howard, do you think this footnote is necessary?.)

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THE ~~PIRATED~~ TWELVE INCH KLIPSCH HORN SPEAKERS

My first year at RLE, 1950, there was an expert carpenter ~~#####~~ who manufactured erzast Klipsch Horns; He had ~~#####~~ taken one apart, and made patterns for all the thirty or forty wooden parts which, when fitted together and very complex made ~~##~~ a relatively compact/exponential horn for frequencies below ~~##~~ 400 cycles. The higher frequencies were handled by a commercially available tweeter, but ~~in fact~~ the latter was ~~#####~~ unnecessary if one had a sufficiently expensive difference that ~~#####~~ conventional/speaker. The ~~catch~~ was, for practical reasons, he scaled ~~##~~ his product to fit a ~~twelve~~ inch, Jim Lansing speaker.

The carpenter ~~#####~~ would ~~#####~~ use a giant band saw to cut ten ~~#####~~ sets of parts at a time, and ~~the~~ complete set/sold for only \$35.

I bought a set from a student at the Harvard Business school, and ~~##~~ soon realized that I would have no place to assemble it, so I called in my Uncle, who was an audio entheusiast. ~~#####~~ Unlike ~~#####~~ I my uncle/had no knowledge of woodworking, ~~##~~ so ~~##~~ we moved the entire collection of unlabelled parts, with no instruction, ~~##~~ to his basement shop, in his house in Lexington.

Despite the lack of instructions, ~~##~~ together we ~~##~~ somehow managed to assemble ~~##~~ it, ~~##~~ by ~~##~~ glueing with Lepage's ~~##~~ wood glue, ~~##~~ This ~~##~~ was made from horse remenants, and took overnight to dry. ~~##~~ The construction took at least ~~##~~ twelve round trips ~~##~~ with ~~##~~ and from to Cambridge-- 12 milse each way, But we did it!

My uncle's wife, who opposed all his efforts to do anything interesting, fortunately didn't visit his basement, and had no idea how much a Jom Lansing ~~##~~ twelve inch speaker cost, \$250 in ~~##~~ 1952 ~~##~~ currency ~~##~~, which I certainly couldn't have afforded ~~##~~ one, ~~##~~ it was ~~##~~ nor did I have any space to fit the speaker, ~~##~~ the size of a ~~##~~ refrigerator.

So I got my investment of \$35 back, much praise for figuring out how to do the critical assembly, and my uncle enjoyed its monophonic performance for

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decades after.
~~Another forty five years~~ His wife, who didn't understand finances, was unaware of the cost of the turntable, ~~the MacIntosh amplifier, etc.~~ And my part in this was ~~eventually~~ forgiven. There was another bond between me and my uncle-- he enjoyed Playboy Magazine, then a sensational advance in ^{female} photograph, and I would bring him a set of seven or eight of these, ^{magazines,} hidden between copies of Aviation Week. ~~magazines~~ He would later thank me, in front of her, for the excellent "chassis" of the planes, etc.

There is a ~~see~~ ^{pastscript} to this story-- my uncle died, ^{thirty years later,} and ^{his wife} ~~his wife~~ after him a week ~~week~~ ^{in 1984}, and my mother was one of the Chosen Seven relatives, who were to share ^{their} household ~~effects.~~ I and a friend drove my mother there, and were repeatedly bawled out for being present, when we ~~we~~, except for my mother were not of the ^{Chosen Seven.} One of them asked another, "What is that huge old speaker-- ~~it looks like~~ it looks like junk to me!" And, thank the Lord, I said exactly nothing! I could have told them of its worth, then at then at least several thousand dollars, Klipsch being long since dead ~~and~~ the speaker out of production. But I kept quiet, and hopefully the speaker rests in a landfill, ^{somewhere,} rather than with those greedy relatives

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Story *14

The Wall of Books in Building 20

Marvin Minsky was quite famous as the head of the "AI," or Artificial Intelligence Laboratory, which occupied its own nine-story, new building in Tech Square, along with Polaroid's Headquarters, which was directed by Edwin Land. One day, Marvin had in tow a bevy of *Time* magazine photographers with all their equipment. It was about 1975, and, ~~they were shooting~~ with 35 mm lenses, ~~and~~ flash and photoflood lights, using Kodachrome film, ~~and~~ constantly, only to sort out the best pictures later. For an onlooking amateur photographer, the expense of the enterprise was dazzling.

But the most remarkable aspect of the event was this: Why did they come to Jerry Lettvin's large office, with the huge table, etc., to take the pictures? The answer was quite amusing. Marvin, perhaps because of his Harvard education, wanted to be photographed with a background of a wall of books, and nowhere in all the vast space of the nine-story Artificial Intelligence building—where each professor had his own VAX computer, ~~each~~ the size of a washing machine, purring away on the ninth floor—was there a wall of books! Thus, it was impossible to photograph ~~there~~ so eminent a scholar as Marvin undoubtedly was. The alternative, as *Esquire* magazine was wont to do, was to give the subject a glass of bourbon to hold, but this would not have conveyed the desired high intellectual level. for him

Jerry, on the other hand, in return for a favor, had managed to have built a giant bookcase—perhaps seven feet high by ten or twelve feet wide—and it was filled with books on every subject from neuroanatomy to astrophysics. Periodically, useless books, like the latter, were dumped in the corridors and more added to the collection.

So that is why Marvin Minsky borrowed Jerry's "wall of books." Thirty years later, it ~~may be~~ is doubtful as to ~~whether the books still exist~~, but they proved very useful in 1975.
whether the books still exist,

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NOT SENT TO OR LISTED

SEVEN pp 1

THE GIANT SNOWSTORM OF NINETEEN SEVENTY-EIGHT

One evening in the winter of 1978, there was forecast a major snowstorm. as

I remember going for supper at Walker Memorial, when it was snowing, and I

walked back to Building ~~20~~ ²⁰, the rate of snowfall had increased massively--

perhaps ^{by} /ten times. Fortunately, I was able to spend the night on my couch in

the lab, but ^{by} /the next ^{morning}, the "Northeaster"-- the worst sort of blizzard, had deposited

thirty inches everywhere. The radios proclaimed special ^{city and state} /rules for the occasion:

No vehicles, except for snowplows and rescue vehicles were allowed to drive

anywhere, for the next ten days. It was extremely ^{fortunate} /that a major fire

didn't consume Cambridge, since ^{the city was mostly wood buildings, and} /not even fire trucks could have moved. The police

were ~~deployed~~ /^{deployed} at critical "squares," i. e. Harvard, Central, Brattle,

~~etc.~~ ^{bottle necks} /etc, which were ~~critical~~ ^{critical} to any intercity travel.

The storm hit on a Friday, on Monday noon a dedicated physicist, ^{Prof.} /Ray Weiss,

arrived at the lab with a Volkswagen filled with groceries, milk, blankets, etc.

He ^{police} /was cursing and swearing at the ~~forces~~ ^{forces} of all the ~~cities~~ ^{cities} between

Watertown, where he lived, and MIT. "They made me drive thru Belmont, and

Somerville," was his complaint. ^{For Ray,} ~~Ray~~ a dedicated physicist, the greatest

blizzard in ninety years was a non-event, compared to his losing time at his

laboratory, and he was outraged that Harvard Square was ^{bleckaded} ~~bleckaded~~ to

He ^{was} ~~was~~ lucky to have avoided the substantial, \$100 fine for such behavior

I was able to buy some food at shops in Central square, though the trip ^{on foot} ~~on foot~~

at night was extremely hazardous, since Polaroid had hired huge dump trucks, which

cruised the narrow ^{also} /plowed lanes WITHOUT LIGHTS, where the pedestrians were to be

found.

The food situation gradually eased, though for five days, it was forbidden

for anyone but MIT students ^{and critical workers} ~~to~~ to eat at the two cafeterias at MIT.

And it ^{only} ~~was~~ /was four days before the ~~doorway~~ ^{doorway} to my nearby apartment building was cleared.

~~the city of Cambridge~~ You would think, with the challenge

of this record snowstorm, that ~~would~~ ^{would} have done an especially good job in

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cleaning up the mess. Not so: after five days, they had cleared ^{only} one lane on
 Vassar street, a major two-way truck route. There was little to say in favor
 of the administration of Cambridge ^{then.} ~~#####~~

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"YOU DON'T MEASURE ANYTHING, DO YOU"

The Physical Sciences Study Committee, PSSC for short, was begun by Prof. Jerrald A Zacharias, head of the Nuclear Sciences Lab, ~~also~~ also located in Building 20. It was started after the Russian ~~Sputnik crisis~~ Sputnik crisis means satellite in Russian-- when the ~~US~~ Government poured huge sums of money to attempt to ~~bring~~ bring the US back to the frontiers of science. I was then in charge of our ~~group's~~ ^{group's} MIT group's ~~new~~ electrochemiluminescent method for visualizing fluid flow, and I was invited to ~~develop~~ ^{film} the ~~new~~ method, based on ^{the} chemistry of Walter Pitts, ~~for~~ for a film, one of a series being made to help high school schools ~~learn~~ learn science.

I arrived one morning in Watertown, at ~~the~~ at a former movie theatre, which ~~had been~~ ^{was had been} by PSSC ~~had been~~ purchased/for use as a studio for the films. I brought all my apparatus, both electrical and chemical, and a large circular glass bowl, holding a quart of ~~liquid~~ liquid or ~~more~~, which was ~~rotated~~ rotated to provide the fluid motion. Varying the angle ^{flat} of attack of a ~~platinum plate~~ platinum plate/electrode would enable one to visualize both smooth steady lift, that is a sidewise force on the plate, or a much brighter glow due to turbulent motion when the airfoil was stalled. ~~This was very crude~~ ^{airfoil by} ~~by wind tunnel standards~~, but it sufficed for the pictures.

The studio was equipped with a genuine ^{twenty-five thousand dollar} Mitchell movie camera, operated by a Hollywood photographer, with ~~his~~ ^{an} assistant. ~~The~~ The photographer never touched the film-- he gave ~~orders~~ orders to his assistant, who did all the work. I never saw the results, which I suspect were underexposed, but we did do a full scale test with various lenses, etc. The difficulty was the low brightness of the blue glow, and the very short exposure time, at 24 frames per second.

So, for this ~~critical demonstration~~ ^{critical demonstration} I did my very best to prepare the solution, which contained 10 cc of 3% hydrogen peroxide, ~~also~~ also potassium hydroxide, tiny amounts of luminol, etc. I measured each out with a scale and graduated cylinders, as accurately as I could.

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The Master Photographer, who, in the course of filming ~~many such~~ science instruction films had evidently learned alot, said to me: "You don't ~~measure~~ measure anything, do you?" I should later have told this story to Zacharias ~~himself~~, but I avoided important ~~persons~~ ^{people} in those days. It was, of course a fact that the Chief Photographer had developed ~~higher~~ ^{making} ~~many such~~ standards of measurement than I had, in the course of ~~science~~ ^{making many such} /~~science~~ /science films.