Samuel A. Squirrel and Professor Wiener

By

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January, is a cold and imposing month. I set the seeds in my basement and watch the green shoots burst forth in two weeks time and then seed by seed the little plants begin to fill the flats. A small jungle of daylily seedling grasses appear and in the darkness of winter, atop the heating pad and under the sunlamps, summer returns.

1 A FRIENDLY HELLO

I am intently working on the watering and arranging of the flats, and being certain that the resident house mice do not eat the yet to be sprouted seeds. The little peanut butter traps are set and so far I have gotten rid of seven or perhaps eight. Transported to other homes more suited for my taste rather than theirs.

Suddenly I hear that "harrumph" of my old story teller, Antnee, as he settles atop one of the flats, crushing the seedling shots as he places his rotund haunches on the moist and warm seed beds. I look and shout:

"Off my seeds, you…."

He jumps across to the lab bench and looks a bit distraught and says:

"Some way to greet a friend Sir, some way indeed!"

I replied a bit upset:

"Antnee, you should know better, they are my seedlings. You have your big fat self all over them."

He looks up with that quizzical snout and says:

"Sir, my apologies Sir, but perhaps you fail, no disrespect Sir, but you fail to note that we do this all the time outside, is there something different here?"

I replied:

"Yes Antnee, here is my growing beds, and here is where I try to develop new plants, and here is mine!"

He sat there and he did what he did when he was perturbed, he rubbed his nose with his two paws, scratching each side of his dark black wet nose, and then points his right arm at me he said:

"Sir, no disrespect Sir, but perhaps you are over reacting just a bit. I have done no damage and all I am seeking is some small refuge from the cold and perhaps some conversation Sir"

At this point I knew I was in for a long talk. Perhaps, I thought, I should just get into the comfortable chair and prepare for another tale. So I put down my watering pots, moved over to my

comfortable arm chair, lifted my feet atop a lab bench and looked over at Antnee and said:

"Well my friend, I suppose you are here to tell another tale, a Squirrel Tale, no pun intended!"

I suddenly found myself laughing at the double entendre but apparently Antnee was not in a fun mood. He replied:

"Sir, no tale today, just seeking the warmth and of course Sir the good company of yourself. And how are the flowers going Sir. I see you have tried to excite your students at MIT, but alas, flowers are not for the young, they seem to follow the crowd, the pack, research things that everyone else is doing. That Sir is the advantage of age, defining your own boundaries, Sir, stretching them beyond those of youth…."

I sat up and said:

"Antnee, just where are you going with this philosophical rant, and why my MIT students, they are all out now with fresh new doctorates and seeking their careers. What is your point?"

Antnee crawled atop the wooden lab bench and laid prone upon the table with his wet black nose pointed directly at my face. He smiled and said:

"Ah Sir, there again your MIT students. Did I ever tell you about one of my distant relatives, Samuel A Squirrel, he studied and researched at MIT, like you Sir, and he was a close colleague of Professor Norbert Wiener Sir, and I believe you owe a great deal Sir to him in your first book, you do indeed Sir."

At this point I knew I was in for a tale, for somehow he wandered around to some nexus and then diving like a hawk upon a prey he got me hooked, for indeed I wondered how he was to connect with Norbert Wiener, a squirrel connection at that. Thus I said:

"Well Antnee, you have my attention, your tale sounds of interest and my work is done and so I have time. You may commence my good friend."

2 CAMBRIDGE 1938

Antnee began in his usual fashion. He said:

"Sir, Samuel A. Squirrel, well A is for Adams, Sir, his mother was a true New England Patriot, Sir, a true patriot, and well Sam, that is what he was called Sir, Sam, he was a bright young squirrel and he wandered down from the family home in Harvard Square to the Charles River front and he decided that the MIT Dome was a great place for a new home. You see Sir at the top of the Dome was the library and Sam just loved to read and he often went to hear the lectures, by just sitting on the window edges, Sir, a comfortable place, Sir, for an intelligent squirrel."

Then one day, Sam sat upon the ledge of the second floor of Building 2, where the Mathematics Department was, I believe it was the Fall of 1938 Sir, I do indeed believe that so, and he was watching an absent minded Professor talking to himself while scratching upon the black board. He watched as the Professor wrote his equations and he looked and followed. You see, Sir, Sam lived in the ceiling of the Library in the Great Dome Sir, you

know where that is Sir, indeed you do for you had been there many times yourself Sir. Well Sam came every day for several weeks as watched as the Professor drew out his argument, then went to his desk and wrote down the result, all the time holding and smoking his cigar, an awful smell Sir, a truly awful smell."

"Then one day Sir, he saw the Professor make an error in his analysis on the board, imagine that, an MIT Professor making an error, and Sam thought, should I correct him? You see Sir the window was slightly ajar, a warm October day and he could yell in and make the change. Thus Sam did just that, he said:

"Excuse me Professor, but when you tried to prove the convergence on the Fourier integral, you failed to include the full compact set."

The Professor turned around towards the door to see who said that. There was no one there. The voice it seems had come from outside. He walked to the window and all he saw was the grey squirrel, who seemed fearless and would not move. The Professor said almost to himself but out loud:

"All that is here is the squirrel, there is no one, I must be hearing things again."

Sam shouted:

"No Professor it is me, down here, the squirrel, Sam Squirrel, Samuel Adams Squirrel to be precise."

The Professor walked towards the window and looked amazed at the squirrel who now looked up towards his face, with his squirrel smile and his

whiskers bouncing as he moved. The Professor said:

"Sam Squirrel you say, and I failed to include the closed compact base, you say, well Sam, you appear to be correct, I am Professor Wiener, please come in and let's talk some more."

Antnee now showed his typical squirrel pride as he interjected:

"Now Sir, there began a true and lasting friendship, a bonding of two of God's creatures of mutual respect and interest. For you see Sir from this day forward the two were lifelong friends."

3 ONTOGENY RECAPITULATES PHYLOGENY: THE ERGODIC THEOREM (1938)

A few weeks after their first introduction, Sam was working on a particular problem on the ledge outside of Wiener's office, he enjoyed sitting there with the window slightly ajar, for the smoke from Wiener's cigar at times was a bit too much.

At which point in this tale Antnee turned to me and said:

"Sir, you see Sir, we squirrels do not partake of the, let me say Sir, the temptations of the flesh, Sir, of smoking and drinking."

I laughed and replied:

"Antnee, you know those corn cobs you have been fattening up on in the back yard."

He replied:

"Yes Sir, I do indeed, and thanks goes to Lady Sara, Sir, but what has that to do with such vices?"

I replied:

"Well my good friend, I have been noticing that the corn has been fermenting and when it does it generate corn alcohol and that my fine friend is what you are soaking in by the cob! Ha, yes, Ha!"

Antnee looked a bit askance and replied:

"Perhaps Sir you have gotten me in a conundrum, so before I reply, Sir, let me continue with the tale"

On this day Sam had been looking at a paper by Professor Birkhoff at Harvard on the Ergodic theorem. It was an old paper and Wiener was trying to improve upon it.

Sam then looked up and said to Wiener:

"Professor, have you ever heard of Haeckel's theory, Ontogeny Recapitulates Phylogeny?"

Wiener looked over at Sam and replied:

"No, frankly I never have. What is it?"

Sam replied:

"In some ways it is the Ergodic theorem of yours. The time average equals the ensemble or group average. You see Haeckel, in 1866, developed this theory that if you look at how some species develops over its lifetime, especially as an embryo, you

see traits like gills and the like, which, when fully developed, disappear."

Sam came across the desk and sat in front of Wiener. He continued:

"The other day Professor, I went out to a small pond on the edge of the Charles River, a small inlet, still water, warm, and atop the water I watched these skating spiders. You know them Professor?"

Wiener replied:

"Yes I do Sam, go on, I think I will enjoy this discussion. They are the family Gerridae which contains insects commonly known as water striders, water bugs, magic bugs, pond skaters, skaters, skimmers, water scooters, water skaters, water skeeters, water skimmers, water skippers or Jesus bugs. There are around 500 known species, commonly placed in around 60 genera. You see Sam, I was once a zoology student and I remember some of those useless facts."

Wiener laughed, as he was wont to do when he found that some fact from his deep dark past held some marginal relevance to the conversation. So Sam continued:

"Well Professor, I did two things. First I watched one spider for a long time, and they are like your Brownian motion, skating back and forth, at one instance ahead, at another sideways, like random particles, bouncing all over, almost. I decided to break the little pond into a few sectors, using twigs as markers in a two dimensional map. Then, I determined how much of the time the skating spider spent in each block. This is the time average, the average that you and Birkhoff talk

of. Namely, you take just one spider, watch it over a long time, and then try to get some average, in this case what percent of the time it is in a box on the pond."

"Then Professor, I did a second experiment. I looked at the pond with hundreds of spiders, not watching any one, just at an instant, looked at the pond, and then I counted the number of spiders in the same mental boxes, those squares I drew in my mind from the twigs in the edges of the pond. You see Professor, this is the ensemble, the group, average."

Wiener smiled, picked up his cigar, lit it and sat back and said to Sam:

"Well Sam, let me jump ahead, you found that the "time average" of the one spider equaled the "ensemble average" of the hundreds. Namely the percent of time in any box per spider was equal to the percent of spiders in a box at any time instant!"

Sam jumped up and ran towards Wiener almost jumping up to his goatee, and said:

"Precisely, the Ergodic Theorem, the paths are the same, whether you average in time or across the group! Why Professor, we can extend what Birkhoff did, we can make it stronger, and better yet, we now have reality at our hands. I am certain that will be really important, even to engineers! Why this ties together a great deal of your work, Brownian motion, the Ergodic Theorem, and a great deal more Professor."

Wiener went back to the blackboard and for hours he and Sam explored the new ramifications of this added

structure. The time went by, and as Wiener wrote on the board Sam copied on paper, hour after hour, till way past dark. Then the elements were all complete.

Wiener smiled and said:

"Well Sam we have it, we will write this up. How are the notes?"

Sam ran cross the yellow pads of notes and said:

"All done Professor, I guess it's time for dinner?"

Wiener replied:

"Yes, let's walk home."

They put the lights out, walked down the second floor of Building 2 towards the great court, Wiener waved farewell as Sam hopped up to his home atop the library. Sam thought that it was a good day's work!

I then asked Antnee:

"My good friend, how do you ever remember the stories word for word like this? And frankly why did Sam not appear as a co-author? There is a slight disconnect with reality Antnee."

Antnee looked as if I called him some disdainful epithet. He replied:

"First, Sir, with all due respect, we record these tales for posterity, and we do so with great attention to detail and fact. If you were to hear this tale say in California, or Moscow, it would be essentially the same. Now as to co-authorship, is that not evident, Sir, would you want to have to put me on the author page of some of your work?

Sir, I believe not. Besides we do not have that desire that you humans have."

I replied:

"But Antnee, you know that I have been writing these tales down, so that others can enjoy them. Why have I not given you full credit?"

He smiled and walked up to my face and replied:

"Sir, we do hope you stay out of one of those places that you humans put one another when they are perceived of, how Sir do you call it, going nuts."

I smiled and replied:

"Oh I get it Antnee, you think just because I tell these tales that people will think that I think that I talk with squirrels…."

I figured it was best to shut up at this point.

4 MEETING FEYNMAN (1938)

Antnee returned to a comfortable position and he continued his tale.

Late in the Fall, Sam had been out collecting nuts from the few oaks around the campus, just in case, as any diligent and prudent squirrel would do. As he came back towards Professor Wiener's office he saw what appeared to be a student and he was sitting in the late fall sun with some small sets of drums pounding away and making frankly a racket.

Sam felt it was not his place to complain because after all this was a

student and students pay for their tuition and thus they have certain rights. So he just climbed up the face of Building 2 and into the Professors office.

As soon as Wiener saw him, he shouted:

"Sam, what is that awful noise, and can you stop it, I cannot even think!"

Sam replied:

"It was a student Professor; I shall go down and tell him to move on. Calm down now, have a cigar!"

Wiener picked up a cigar and Sam ran back down the wall over to the student. He ran in front and started to shout and to no avail. He was desperate so he jumped atop the drums and the hands came slamming down time after time and he jumped at the anticipation of each beat. The student saw him atop his drums and just kept the beat going changing its tempo just to watch Sam dance. He was now laughing his head off, and Sam was near exhaustion!

Sam jumped off and shouted:

"Stop, you are making a racket!"

The student was laughing with great gusto, with peals of laughter, and tears coming down his cheek, until he heard Sam. Then he abruptly sat up and said:

"Whuh!"

Sam replied:

""Whuh" indeed young man, do you not know that this is an academic institution and that there are very

important faculty members doing, or should I say trying to do critical research, and you are down here acting like some buffoon."

The student turned and said matter of factly:

"And my little friend, just who are you, some MIT Professuh?"

Sam stood tall and said with pride:

"I am Samuel A. Squirrel, assistant to Professor Norbert Wiener, world renowned mathematician. And young man, just who are you."

He laughed again with tears from his eyes and said:

"I am Richard Feynman, physics student, senior that is, from New York."

At this point Sam was now hearing this sharp accent. The York came across as Yawk, and the New sounded like Nieuw. He wondered if this student was some foreigner. Or perhaps he was some import from some strange part of New York. But he continued his interrogation.

"And why do you suppose you can sit out here and make this racket, Professor Wiener is trying to think!"

Feynman laughed and said:

"Well Sam, if I can call you that, Sam you see I think by doing this."

Sam stopped for a moment and thought it would be best to engage him rather than confront him. He replied:

"And what, Mr. Feynman, are you so deep in thought about?"

"Fields, Sam, fields, and do they exist. I suppose that even as a mathematician's assistant that you may be aware somewhat of fields."

Sam replied:

"Mr Feynman, indeed I do. They are those artifacts that you physicists use to simplify your dealing with forces, which are themselves real. Fields are just that, artifacts, in a semiotic manner if you please."

Feynman sat upright now taking this little squirrel a bit more seriously. He said:

"Sam, you are exactly right, an artifact, a semiotic and hermenutic artifact. I never thought it that way."

Sam said:

"Look, Mr Feynman, I understand physics, it is almost the exact opposite of mathematics. The mathematician works with rules and step-by-step puts the puzzles together, looking at edges and colors. You physicists, the good ones, and not mathematicians, you develop a "feel" for the answer, and understanding of nature, which controls you, not the laws of mathematics, and then you have a gestalt of an answer around which you hang your mathematics. Correct?"

Feynman was now warming up to this grey fur ball. Frankly, he seemed to have answers that Feynman had been searching for again and again. The sat and spoke for a few hours, and Feynman shared with Sam many of his ideas and Sam told Feynman much

about the difference between the physicist and the mathematician.

5 COMPUTERS: ANALOG VERSUS DIGITAL (1940)

Sam had spent more time with his old friend Feynman who had then gone off to Princeton. In the process, he was becoming more interested in the field of partial differential equations and he and Wiener would discuss them at length.

In one conversation, he said:

"Professor, you know what you are doing with your Brownian motion, and the simple ways you look at things in time. Well, time has a direction, forward or even backward. However, it goes in but one way, forward. The spider on the pond has two ways, up and down and back and forth. It has another dimension to contend with, and it may go forward or backward. So Professor, I have two questions."

Wiener looked across at Sam and now after two years of working together, despite the travels that always seemed to interfere, he knew that something of merit would spew forth from Sam, Wiener said:

"OK Sam, so tell me where you are going."

Sam replied:

"Two things Professor. First we can solve the many equations in time by simulating them on one of Professor Bush's analog computing machines, but it is not as easy to do that for many dimensions, not even the water spider problem. To solve that we should have a better computing device,

and I suspect one that deals with numbers, like the digital numbers we see in some of the old techniques. Second, the Brownian motion we see in the water spider, well just look at the Charles River, look at the surface, how would we apply your analysis to that, it has no beginning or end, it does not flow in one direction all the time, the waves I mean, they are just random, random in space and time Professor, how do we handle that."

Wiener smiled and said:

"Whoa, slow down. The second question is truly a set of many very complex set of questions. The first question is however very interesting. Let me tell you how I would approach this problem."

As usual, Wiener went to the black board, Sam suspected that it was his poor vision, or perhaps that is the way he thinks, and then he began to lecture, from notes not even written, for that was his way. He said:

"Sam, you present a very interesting set of issues. You know that Vannevar Bush has been building his analog computers, devices that match the characteristics of some larger system in a smaller one. They are "like" the real thing, like what is in an equation, and then they get the results. But that means for every equation we need to solve we have to do two things."

"First find and then set up a model "like" the equations, and then change the parts each time we want to look at another possible set of assumptions. That is long and cumbersome. It is a collection of wheels, linkages, and the like. Frankly, Sam it is not elegant, between you and me Sam, Bush is a

tinkerer and not a thinker. Don't get me wrong Sam, he is a brilliant tinkerer, and at times a good thinker, but he looks at the here and now, not at what can truly be."

Sam replied:

"So true Professor, but alas as we all know, the fate of great thinkers is often to be so right, but often right so early that others do not understand and others forget that they had it right in the first place. Success is a combination of being right and being on time!"

Wiener replied:

"So thoughtful Sam, so very thoughtful. Now back to the computer model."

Wiener went to the board and began as usual, but this time with boxes and names and not equations. He started:

"Sam, first to do these equations in many dimensions we need to have a way of doing two things. First, we need to convert the values at each point into some value, which is itself a digitized version. Like what Shannon was talking about with his relays and Boolean logic. That means we use 0s and 1s. That is simple, yes, that is very simple."

"Then we need to have a way of dealing with say things in two dimensions, as we see on the oscilloscopes over in the electrical engineering folks. They scan the screen with fine lines and the screen glows if there is a signal there and its glows long enough so that when the line goes somewhere else it still glows.

Perfect. The two key elements. Can you think of anything else Sam?"

Sam replied:

"No Professor, but now we have input and output, how does it work?"

Wiener said with glee:

"Ah, good that you ask, now watch this. We need first an input method or a way to imprint the data, such as tape, running linearly and second we need a way to get the data out. Third, we need at least a summing device, a very fast one, which can do all the calculations. We can always get subtraction and multiplication and division if we have a device which adds."

Sam looks and copied some of this down in a separate picture. Wiener continued:

"Fourth, we need some formula to process the input to the output, and fifth we need a way to get rid of the data we have used up, a sweeper. Then we connect these up and we have our device."

Sam said:

"Professor, I know from some friends in the electrical engineering area that they have vacuum tube circuits which do just this for the 0 and 1 inputs, I think that will work. But how many do we need?"

Wiener did a quick calculation, and he turned a bit pale when he said:

"Sam, we may need a thousand or more if we want to get this to work. They may cost a great deal."

Sam looked at him and replied:

"Professor, that is a small part of the problem, the other is twofold. First the tubes do not last very long, you will need a team just to replace them all the time, and second, the heat will make the place an oven!"

Wiener said:

"Well Sam, we have the idea, let's write it up and see if anyone agrees."

They spent a few days on a write-up, yet they did not all the engineering details and Wiener sent it to Vannevar Bush in Washington since Bush had funding money just for this.

As Wiener had suspected, Bush turned it down in a letter in December 1940. Wiener said to Sam when he got the letter:

"Sam, I guess we expected this. We are mathematicians, not engineers; he likes and feels comfortable with engineers. Our time will come Sam, and this was a good idea, it will not die. The digital computer will eventually have its day."

Sam nodded. They both went back to their equations.

6 SPARKS SQUIRREL AND THE NROTC (1940)

The Fall of 1940 came and the War in Europe was clearly heating up. One day when Professor Wiener and Sam were working on a few interesting, problems there came a tap at the window and

Sam was overjoyed to see his cousin Sparks. He jumped over to the window, which was slightly open and shoved it up a bit so Sparks could enter. In his usual style, Wiener had been totally oblivious to the entry of a new squirrel until Sam tapped on his shoulder and said:

"Uh Professor, a moment please, here is my cousin Sparks. I think you may like to meet him."

Wiener turned about and there before he was, well a scruffy squirrel, clearly not polished like Sam, but almost swaging in his walk, like some seaman, that Wiener had seen at the docks in his many travels. Sam said:

"Professor Wiener, this is my cousin Sparks Squirrel, he lives up Massachusetts Avenue in the Harvard Yard actually. He has been working with the NROTC on the Harvard campus, Sparks is sort of an electronics buff and is also working with them on their, what do you call it Sparks, fire control systems."

Sparks perked up, not knowing who Professor Wiener was and shot out his paw and said:

"Pleased to meet you Prof, I kinda like this place, the River, water view and all, beats the poor beaten up trees in the yard up the street away, always like to see the water close, Prof, always do, reminds me that I can get to sea quickly. So what do you do here Prof, I am working on fire control with the young students, I do the ranging and aiming."

Wiener was a taken back, for he had never been spoken to in such a well "common" manner, as if he and Sparks

already shared a common bond. On second thought, they did and Wiener replied:

"Well Sparks, I was in fire control also, in the last War, I was in the Army and I worked at Aberdeen which is in Maryland, and we did all the sophisticated ranging for the new guns."

The two of them slipped into a long conversation swapping war stories, for Sparks had just come back from a Navy convoy trip across the Atlantic and avoiding German subs. Wiener was fascinated by the real life experience of one who had already been in this undeclared War.

Then Sparks hit upon a chord that resonated well with Wiener when he said;

"Prof, you know smart guys like you, well really smart guys like you, can help us with what I see to be a really tough problem. You know that if we get into battles with the Germans or even the Japs, well it will be ship against plane, and those planes go very fast and training the 20 mm or the 40 mm to hit them is a really tough job. Right now, it is like hunting hawks, you guess where they will be; you lead them with the gun, and pray. But, as any good squirrel knows, hawks are a mighty smart bird, especially on a dive, and can turn on the dime, Prof, and boy do they do that. So any thoughts?"

Wiener looked to Sam and the two of them immediately saw this as the next great step. It put all the pieces together into a single problem; they could apply all that they had been working on into a productive tool for the war effort.

They then spent a few more hours talking about the problem. Sparks was delighted to tell them all he knew for he had been trying to tell the Navy Brass but who listens to the ship's squirrel. They just kept sending him up the mast to be the lookout for subs, and he did spot a dozen in his trips and they even sank two. But, it was cold up there and in the North Atlantic, well it was often sickening, the pitch, roll and yaw, especially at the top of the mast.

Thus, Wiener wrote on the black board and Sparks jumped back and forth shouting what was to be done, and for the first time Wiener saw the interaction that is common with engineers but rarely if ever occurred with a mathematician. He was solving a real problem using the tools that he had spent a lifetime developing.

Wiener was now having new ideas at the rate of many per minute. It was the catalyst of listening to this salty squirrel, which motivated him, and they bonded as the discussion went on. Sparks was not the academic as was Sam, but Sparks had a sense of reality which was essential.

Sparks came back a few more times before he was to ship out again from the Boston Navy yard. Wiener and Sam managed to prepare a proposal, which they forwarded to the Government for the use of Wiener's theories to shooting down enemy aircraft from ships like a destroyer.

On Sparks' day of departure, Wiener and Sam went to the Navy yard to wish him well and see the ship off. It was a destroyer, they did not recall the name, and it had just been launched.

Sparks jumped to the top of the mast as the smoke came from the stack, waving all the way to Wiener and Sam as it made its way to the Atlantic, patrolling for German subs. They wished Sparks God's speed.

Wiener and Sam returned to the campus and they wrote up a short proposal as to how to track and predict the position of aircraft when attacking ships and how the guns could be used to shoot them down. They showed how much better it was than the old techniques.

Then Wiener went and spoke with Professor Caldwell, who was working with the servomechanism group, and they took the idea and ran with it.

Wiener and Sam sat in their office and smiled. Sam said:

"Well Professor, we did not get them to take the digital computer, but we got the fire control system. You know what I think did it, it was Sparks, we learned how to speak in their language and they got it. With the computer, thinking back, we did not know the language they spoke, and most likely they never heard us."

Wiener smiled as he puffed on his ever present cigar, and he replied:

"Sam, you know, you have hit upon a great idea. It's like resonance, like organ pipes and the right sound, it is a mental resonance, the mind of the listener is tuned to hear certain things and they filter out those things that do not resonate. I think there is a project there as well, Sam, I really do."

Sam smiled and said:

"Oh Professor, you have an idea a minute, let's just help through on this one, they still need us!"

Wiener puffed out the smoke and made curls across the room, am ducked and ran for the slightly open window.

7 TRIP TO BELL LABS WHIPPANY (JUNE 1941)

It was June of 1941 and Wiener had proceeded on his tracking problem with some success. He had been asked to go and meet with the Bell Labs team which was located in Whippany in New Jersey, a rural part of the state about 40 miles due west of the Statue of Liberty. Wiener agreed and decided to take his assistant Bigelow along with him.

On the sunny day he and Sam were chatting about the solution when Wiener said:

"Sam, Bigelow and I are going down to Bell Labs, want to tag along for the trip, you may find it of interest?"

Sam was surprised and happy. He knew Bigelow and yet stayed out of his way, for at times an interfering squirrel can cause a bit of a mishap. Besides Bigelow was the engineering type and Sam was, like Wiener, a thinker.

They set off on a clear and sunny June morning, from the home in Belmont, to South Station to meet Bigelow and take the train to New York. Sam stayed in Wiener's brief case, his head bobbing back and forth as they walked to the train and then to their seats. Many men were in uniforms of all sorts, and

it looked as if the War had already begun, although at this time the US was still on the sidelines. Wiener placed his briefcase next to the window and Sam stuck his head right on the glass and had great views on the ride down. Wiener and Bigelow fed Sam some packaged nuts they got on the train and these were great treats. It was the first time he had ever had a cashew.

The train neared New York Grand Central station and the three of them got off the train and into the colossal station, with its ceiling covered with paintings of the heavens in gold. Sam stretched his head out, looking at the great mass of people, the lights, the colors and smells. At this point Wiener said to the two of them:

"Boys, let's walk to the ferry to New Jersey, I want to stretch my legs."

Bigelow looked at Sam with a sense of dread since they both knew that Norbert had no sense of direction, not even south. Fortunately Bigelow had some experience in New York and Sam thought that any good squirrel would be able to find the river on an island. So outside on 42nd Street they went, and in no time at all, the noise, people, smells, sights, no creature would ever find their way out. Sam immediately saw that there was not even a single tree, how did people live here he wondered.

Then off they went, following Wiener as if he really knew anything about his trip. He walked west and then south and then west and then south. It was clear that this algorithm was not to converge. As they got closer to the west, Sam shot his head out and

jumped in front of both of them. He said:

"Stop! Professor, permit me to climb this building and see if we are in any way getting near the Hudson River. Do you agree Bigelow?"

Bigelow was a bit set back but it was clear that if they kept this up there would be no ferry to find. Wiener replied:

"if you think so Sam, I am a bit tired anyhow and feel like a cigar."

Wiener sat down, took out a cigar and started his smoking. Sam by this point did not really like cigars so he rambled atop the seven story building, then over to the west side of the roof. There in front of him was the Erie Lackawanna Ferry! He was amazed that Wiener in his random wanderings with no sense of a goal, devoid of a map, had gotten them just a block away. He scrambled down and stood before the two of them, Wiener slowly puffing on the cigar, and said:

"Professor, I really, really, do not know how you do this, but the ferry is at the end of this block and one street down. Amazing!"

Wiener slowly finished the cigar and smiled and they continued walking and leisurely boarded the Ferry for the trip across the Hudson.

They then boarded a train to Morristown, where Bigelow told the two of them was the residence of George Washington during the US Revolution. Another train ride and the sun was setting. They were to be met by some people from Bell Labs and would be staying at a local hotel. After

an hour they arrived and at the train station there were two young men in white open collar shirts and dark trousers and they had a large black Chrysler ready to take Wiener. They greeted Wiener and Bigelow:

"Professor, Dr Bigelow, we are glad to see you made this train, we were a bit concerned after so long a trip."

Wiener replied:

"I have been to China, all of Europe, and many other places in the world young man and this is truly just a short journey. Yet we would enjoy a rest before our meeting in the morning."

They drove off to the hotel and were dutifully picked up at 8:45 in the morning the next day. Another beautifully sunny June day in the country-side of New Jersey. Just down the road a short distance, say a half mile, they drove and they arrived at Bell Labs Whippany, looking like so many other military like installations of stark buildings and hundreds if not thousands of men and women walking in from a great parking lot in the front, busses unloading them from places of residence unknown. They walked to the front door, as did all others in this sea of humanity and were greeted by two slightly older men now with jackets and ties. They all signed small documents, their identity was checked, security waved them through, but now wearing badges on their coats.

Sam sat silent in Norbert's brief case since he did not have a clearance, and also most likely he was not to be allowed in any way if they knew. So snuggled down in Norbert's briefcase they went in pass the guards. Norbert

wondered if they would look afterwards but that would be a problem he would solve then.

They entered a large conference room, with boards, a complex overhead projector for some slides which none of them had seen before, and in the room must have been twenty five or more people. They were all in jackets and ties, many smoking, and there was coffee and pastries on a side board. Sam was hungry! But he stayed put.

The Executive Director of the Laboratory stood before the group and welcomed Wiener and his colleague, he did not know Bigelow's name even! But there were three, oh just two, from MIT, and almost now 30 from Bell Labs. One would guess they have nothing else to do.

Wiener was introduced and he was asked to go to the front of this crowded and soon increasingly warm room and speak. He patted Sam's head to keep it down and motioned to Bigelow to watch him.

Sam stuck his head out just a small bit so he could hear Wiener speak, and speak, and speak. There were hundreds of questions and it lasted a few hours, until poor Norbert was exhausted. Sam was now quite hot having been stuffed in the brief case and Bigelow was wondering what all the questions were about, they were talking to Professor Wiener as if he were being interrogated.

At the end of Norbert's talk they all took a break and left the room. Sam popped his head out and looked at Norbert and said:

"Professor, I think they are just getting information from you and we may very well get nothing in return. I think this is unprofessional. Also I really think that these are not some of the smartest people I have ever seen."

Wiener replied:

"I agree, I am here as if I were defending my doctoral thesis yet none of these people have read the report nor do I think they have any understanding of what is in it."

Sam replied:

"They are here for the doughnuts. Oh and while you are up, throw me one over here Professor."

Wiener grabbed another doughnut, it must have been his fifth, nervous energy, and Bigelow just sat wondering. He turned to the Wiener and Sam and said:

"We are just two, and were designing and assembling a real tracking system. They have more managers than we have students in our Department, and we have yet to see anyone who can comment intelligently."

Sam said:

"You know, I think this Bell Labs place is just a front, there may be a few smart folks, but it is also filled with hundreds of doughnut eating and outright stupid managers, sorry Professor."

Wiener smiled and as he did the crumbs bounced from his goatee to his vest, which thanks to his girth kept them from his trousers.

Sam then ran across the table to sip some water from a glass. He came back and sat before the two of them and said:

"Professor, Dr. Bigelow, look, you are telling them everything, and so far you have gotten nothing back. I thought this was to be collegial. Let's see if you can get something from them. As I understand it, they are building the tracking system and parts of the radar and the Rad Lab is using the British magnetron and they developed the electronics for the radar system. Remember, we have relatives out there depending on this all working, remember my cousin Sparks, Professor, he and the crews needed this, and they need it soon."

Wiener calmed Sam down, he gave him another doughnut. Somehow there was an endless supply of doughnuts.

The afternoon was to be the Bell Labs staff telling Wiener and Bigelow, and of course Sam, what they were doing. Yet all of them felt that the Bell Labs folks were evasive, at the least, and, if not, truly un-professional. Yet Wiener remained calm and just smoked his cigar ever so slowly. Sam was at the boiling point since they had given these people all they had worked on.

By 5PM, almost like clock-work, the meeting was called to a halt, they all shook hands, and Wiener asked to walk the mile to the hotel. Sam popped out when they had left the parking lot end ran alongside the two. He suggested that they might stretch their legs walking about the home George Washington stayed in during the Winters at Morristown. They were all game and off they men, like men with a mission. After the tour they went to

the hotel to rest before the long train ride back.

8 RETURN AND HEAVISIDE CONVERSATION

They managed to get from their hotel to Grand Central in little time. Surprisingly the way back is always easier than the journey there, at least if you are not climbing a mountain.

The three boarded a 10 AM train for Boston and they left Grand Central Station heading back.

Wiener sat back wondering what had transpired and he was truly annoyed. He sat up in the car and faced the two of them and started:

"You know, I had heard a great deal of these Bell Labs and AT&T people. I especially heard as to how they treated that brilliant man, Heaviside. You see, I know some of the people there, back at those Labs, and some are very good, kind and decent. But Heaviside. Let me tell you about him and how those demons at AT&T and Bell Labs treated him."

"When I was first asked by Bush and others to work on putting some mathematical credibility to the operational calculus that Heaviside invented I also learned a great deal about him. You see he was just a somewhat self educate electrician, he worked on transmission lines and the like and he knew some things about mathematics but not really a great deal."

"Yet he had great physical insight. His operational calculus allowed us to analyze complex dynamic systems with the simplicity of simple algebra.

Then he went on to invent amongst many things the loading coil for telephone lines, allowing long distance calls and reducing echoes. Brilliant. Yet his one weakness was he hated patents. So he just published his results! Imagine that, he just published them. Frankly that is wonderful, imaging if we mathematicians patented each theorem. Nothing would get done."

"Now here is where AT&T came in. The needed this patent for their monopoly, and having it out in the public free was not to their interest. So they paid some Columbia University Professor, a Pupin by name, to "invent" and patent this! Imagine that, they took Heaviside's work, gave it to some Professor, who had the total lack of integrity to patent it and then sell the patent to AT&T. And what do you think happened to poor Heaviside, well he died penniless in a small shack! Yes, penniless, and yet today we remember Heaviside and no one would ever think of remembering Pupin!"

Sam had never seen Wiener so intense. They all sat quiet as the train rolled on. This had been a bad trip, and Wiener rarely showed such intense emotions amongst his close colleagues. This event seemed to have brought out memories from the past and Sam wondered if they would come out again.

9 THE YELLOW PERIL (1942)

I then asked Antnee why they even went to Bell Labs and did not Wiener write a document describing his work. I said:

"Antnee, did not Wiener write his famous book, the "Yellow Peril", named because the cover was yellow and the math rather difficult. Did the Bell Labs people have that when he went there?"

Antnee replied:

"Sir, no Sir, for it was this meeting that drove the good Professor and Sam to get the document completed Sir. They did not want to have all of their ideas stolen, Wiener did not want to become another Heaviside with the Bell System."

I replied:

"But did not everyone already know what he had done, he had recognition."

Antnee replied:

"Sir, those people at Bell Labs, at AT&T, they could be quite evil Sir, they would take whatever actions they needed to claim ownership Sir, especially if they could see it maintaining their control and making money."

I said:

"Antnee, I am surprised, you sound a bit hostile towards them. I can see Wiener but my friend why you?"

Antnee was now worked up. He was going to let me have it with his pent up distrust and for reasons I truly wanted to understand. He almost stood erect, his furry belly pushed out and his gesticulating with his right paw and he said:

"Sir, you see, I have cousins, they live on the land at Murray Hill and at

Whippany. The very sites Sir. Well, those evil people, they got vicious, and Sir I mean truly vicious dogs, sent to kill, horrors at the very thought Sir, horrors, kill the family. Now any group of that sort Sir, well true evil Sir, true evil. Why Sir, we had lived on those lands for ages, well before any of their comings and goings. And look at them now, gone, disappeared, empty shells, no Bell Labs, no dogs, well Sir we survived, we prospered, and they as the evil they represented Sir, gone, good always wins Sir, truly it does."

I interjected as best I could under the circumstances and asked:

"Antnee, thanks for the tale, but the Yellow Peril, what happened there?"

He continued:

"Ah Sir, I digress, my apologies Sir, but there are times, indeed Sir there are times that even a harmless joyful squirrel and revolt, yes indeed, truly revolt!"

I stopped him because he was on a rant, there must have been a lot more bad blood between the squirrels of New Jersey and Bell Labs, but I was not in for the Encyclopedic history of squirreldom, just finish this tale, to which I was already committed. I raised my voice just a bit as I shifted in by chair, for I wanted to let Antnee know that I was not going to be his psychotherapists here. I said:

"Antnee…."

He replied:

"Oh Sir, I do get carried away a bit, well you humans have your ways also. I

believe that there is no love lost between you and those wretched Bell Labs people."

I thought for a moment and realized he had a point but I just railed a bit less than he. I replied:

"Case well taken, yet Antnee they were an example of a dinosaur of a company, slow to move, with massive heads and little brains atop. Well like dinosaurs they are now history."

Antnee replied:

"True Sir, true indeed. Now to the tale."

Wiener and Sam had returned to campus and they proceeded to put together the thoughts on the time series and estimation methods that had been developed. They had long discussions, some would deem them arguments, regarding the need to make things simple. Wiener wanted it to be mathematically correct and yet Sam kept saying that the audience was the engineer and not the mathematician.

They also struggled by having discussions regarding the applications. Wiener and Sam discussed the context and both agreed that they should look as broadly as possible.

Bigelow and Wiener would talk through the applications and the math. One time they wanted to know if they could focus on the issue of tracking aircraft. Bigelow had built the system and it was working. Yet they wanted to track targets. They had no plans so Wiener suggested tracking Sam. Wiener asked Sam:

"Sam, we need to test this on a real target, that will be you, so go out to those sycamores and we will track you."

Sam thought for a moment, looked at his sycamores in the court in front of the Great Dome, and thought he would give it a try.

For hours the three of them "played" attacking and tracking. Sam jumped and evaded the system while Bigelow, to Wiener's delight, tracked Sam.

After what seemed an eternity Sam returned huffing and puffing, and he said:

"Ah Professor, Dr Bigelow, have we not done enough?"

The two of them laughed at the site of this sweaty frizzled squirrel. The replied:

"Sam, we got you every time!"

It was events like this which punctuated their effort. It was clear that generalizing the results was better than using specific examples. They all agreed and Wiener set about the task of writing. He insisted again to provide all the details as if there were no text to refer to. In fact there was no text to refer to, he had created it all.

The most difficult task was that the estimation and prediction resulted in systems which were statistical in nature. As they had remembered in their discussions with Sam's cousin Sparks the enemy evades when it attacks and does not follow the straight line that he may be on

initially. Thus the approach Wiener used, the statistical approach too that into account.

But solving this one problem solved so many more. It was not just a solution for a fire control system on a ship, or a process control system in a chemical plant, but for signal detection and processing, for communications, and perhaps even for more. Wiener suddenly understood that he had spanned many areas of expertise with a ground changing approach, namely he could now deal with the uncertainty of nature!

10 SPARKS RETURNS AND THE END OF THE WAR (1945)

It was New Year's eve in 1945 and Wiener and Samuel were sitting in his office at MIT. Wiener looked out at the Charles, the ice had formed and the snow covered Memorial Drive. Sam was curled up on the banging radiator warm and snug. They had been discussing the results of the past year and Wiener was to go back home after he had done some small efforts in his office. The Institute was vacant, the students and faculty were gone but since the War was now over it was open and readily accessible almost anytime.

There was a scratching at the door and Wiener got up to see what it was. Samuel sensed it was another of his clan so he jumped up to see what was there. When Norbert opened the door it was instantly clear that it was his cousin Sparks, home from the War. The two of them jumped forth to grab hold of Sparks, who in turn was happy to see them as well.

Sparks looked as if he had aged greatly. He also showed signs of having been wounded which the two of them had known from letters Norbert had gotten from Lieutenant Pfeifer. They did not know how badly he had been hurt but he seemed happy to see them both.

They all sat and spoke of the War. The intensity of Sparks was gone, he seemed almost morose. He had seen a great deal of the War and its pains and he now felt them. He had lost friends, humans and of course his monkey friend, who was hit by an enemy shell at the Battle of Leyte. As Sparks spoke, as he told of the men and their gallantry, of the enemy and their intensity, Wiener was changing, he saw that this was not the game he had played with Sam in the sycamores, it was true life and death. It was at that very moment, in the midst of those very words, that Wiener became a hater of war, all war.

Sparks stayed a bit but it was clear that he just wanted to go back up to the peace and quiet of Harvard yard, eat acorns and nuts from the students. Wiener said he could come and live in the sycamores but Sparks said he needed his own family, but many thanks. The group shook hands, paws, and Sparks departed. Wiener and Sam just sat for hours that day, silent, watching the sun set in the west end of the Charles, watching lights in Boston come on, night settle in, just quiet.

11 THE SHANNON PAPER (1948)

It was mid July 1948 and the summer was not overly warm. Wiener had been travelling as was his usual way and Sam had been watching his children and grand children running about on

the sycamores in front of the Great Dome. He had managed to continue to stay current but now that the War was over there was to some degree less pressure. The Rad Lab was closed and Building 20, the old shacks, were now turned into classrooms for the returning students. Sam felt content. He was wandering in and out of Wiener's office when he saw on the desk a package from Bell Labs. He recalled the bad visit they had had there many years earlier and he decided to look through it.

To his surprise it was a preprint of a paper by Shannon on "A Mathematical Theory of Communication". It was to be published in the Bell System Technical Journal, the in-house technical organ of Bell Labs.

Sam and Professor Wiener had been working on the revision of the book on Time Series, which characterized the work they had all done during the War. The work they did related to real time continuous signals, or any real time motion, from aircraft to chemical plants to the human body.

But as soon as Sam saw the Figure 1 and then Figure 11 he knew that Shannon had taken a step forward. He had the paradigm, that example change, that single "image" or icon which would be used again and again to tell the story. It was like the images that the American Indian used about the white deer, the golden bear, the image, that lingers in the mind, like the benzene ring, that changed how chemists think. It was there in a simple block diagram and a simple chart converting 1s and 0s across a channel. This was the example!

He sat there and wondered how Wiener would take this. For Shannon had come up to see Wiener so many times and Wiener had been totally open and supportive. Also Weaver who had been the manager of Wiener's work on his tracking and prediction systems was collaborating with Shannon.

Sam was worried as to how well Wiener would take this. He was concerned that Shannon may have just used Wiener to work through the issues and then publish the work ahead of Wiener's, the perils of academia. He wondered when Wiener would return and how best to tell him.

In a couple of days Wiener had returned, and it was clear to Sam that he had not yet seen the paper. When Wiener came and sat down Sam popped through the window and said:

"Professor, so good to see you back. Good trip I hope?"

Wiener seemed quite happy to be back and he replied:

"Sam, wonderful. I had some more thoughts on the book on Time Series. How has it been here?"

Sam wandered over to his desk, and then atop the pile of papers, and took out the Shannon pre-print with his teeth and paws and dragged it in front of Wiener. He said:

"Professor, perhaps you may want to read this."

Wiener read the paper and Sam could see he was a bit concerned but like the Wiener Sam knew personally he managed to keep it in. He would keep his temper for those who deserved it

and not for Sam. Wiener read a few pages and then said:

"Sam, I see what you mean. Yes Sam we gave this young man many hours of our time, and frankly educated him a great deal. And yes Sam the book has not yet been published. Yet Sam, our focus is on the continuous signals and not these discrete ones, and secondly we differ on the entropy definition, for this was an argument Shannon and I already had, but that is a minor issue. This is communications, not what we have been doing. Yet it is so simplified. It lacks the rigor of mathematics."

Sam replied:

"But Professor, and I mean this quite respectfully, the simplicity is its elegance, and moreover the almost school boy tone is very powerful for it opens the work to be read by anyone, not just the professional. But most importantly, Professor, the simple diagrams, they tell the story, they stick in your head, like yours a the feedback loop. You see Professor he has simplified it down to basic thoughts and almost a high school level interpretation, but the conclusions are quite powerful. The idea he has about capacity, frankly Professor it is quite powerful. We should make sure they get in the book, those ideas of yours about time series."

Wiener spent the afternoon reading. Yes, he thought, it was simple, simple and elegant. It had an almost early Einstein elegance and simplicity. It was a tutorial for a large audience, a simple set of examples which seduced the reader to think this was a simple journey, this theory of communications, whereas when they got near the end, they had actually

been led across a gorge that they would never return to.

Wiener thought that Sam was correct, in focusing on the totems of the diagrams, making the problem a simple set of 1s and 0s, Shannon had expanded the audience greatly for his ideas. Wiener now knew he must do the same.

Sam said:

"Professor, there are some simple observations from Shannon. First, it is always good, if possible, to have a simple structure, example, upon which to build. Shannon had his 0s and 1s, we on the other hand deal with complex signals. Second, Shannon abstracts away the detail. He focuses on the essential. Thus the 0s and 1s are received as 0s and 1s, and there are no complex devices in between. We on the other hand have to deal with reality, and reality is all too often complex and tends to confound the simplicity of the idea. And professor, one thing I see again in Shannon, with the simple structure, as one expands on reality, with the real stuff we must deal with, having at the core a simple structure will be all important."

Wiener replied:

"A friend of mine once said, that a complicated problem is one whose structure is not understood. To some degree it is like Biology, a collection of facts, of observations, with no simple underlying principle. We must do the same, we must abstract the similar 0s and 1s, yet as a Mathematician I feel the need to show the correctness to my fellows, otherwise it will be viewed as mere manipulation. We must be

careful here Sam, we must establish what we have done very carefully."

I stopped Antnee as he went on and was curious about Wiener and Shannon. Wiener was much older and an accomplished mathematician whereas Shannon had just gotten his doctoral degree before the War and had been at Bell Labs for a few years. So I asked Antnee:

"Antnee, I hear that Wiener may have been a bit struck back by Shannon. After all, he had helped Shannon during the War on his research and he had worked on a much broader problem. Was it really the fact that Shannon had solved a simpler problem with a simpler method than Wiener that made the difference?"

Antnee replied:

"Sir, a fine question indeed, Sir. One always wonders about those things. Egos are so fragile, especially when they relate to ideas and who gets credit, and I particular in the Academy, Sir. So let me say, Shannon was so well received because his presentation was so simple, he neglected all the hard stuff, so to say, Sir, he just focused on what he believed was important at the time, the 0s and the 1s."

I replied:

"I see, Wiener was truly a brilliant man, he was a mathematician, a philosopher, a biologist if you will, and even a good linguist. Perhaps he was so smart that he had all of the dimensions in his head at once and could not focus on the simple issues."

Antnee replied:

"Yes Sir, the curse of the genius. Sir, it was felt that Shannon was very smart in his area, yet he was limited, unlike Wiener, who had broad brilliance. Yet it was that singular focus, Sir, that simplification, Sir, that allowed for the great victory of ideas."

12 THE REVISED YELLOW PERIL AND CYBERNETICS (1948)

After the Shannon paper Wiener and Sam knew that they must press hard to finish the revision of the book they had done during the war, the one on time series.

Sam had found out that Wiener had agreed to write a book on Cybernetics almost at the same time getting the revise Yellow Peril out. Wiener had told Sam early in 1948 that he had agreed to write a book on his ideas on Cybernetics and that redrafting the Yellow Peril would be simple, and he would hand it off to Sam.

Thus all through the year 1948, they finished the rewrite of Time Series and got it off to the MIT Press. Sam was tired. Then Wiener came in at 7 AM as was his wont one morning and planted the draft of Cybernetics on the desk. He looked at Sam and said:

"Read it and tell me what you think."

Same looked at Wiener and replied:

"You have done this in three months! Let me see how this differs from Time Series."

He scanned Cybernetics, and yes as Sam thought it was Wiener again, he just could not hesitate to use as many equations as possible. But Sam noted the breath as well as the depth of this

work. It was massive, just weeks after seeing the Shannon work, here Wiener had put all of his ideas on systems together in one document.

Wiener looked at Sam and said:

"I have asked Pitts and Selfridge to edit this, my eyes are failing, the cataracts you know. I guess we two are aging my friend."

Sam replied:

"Good idea Professor, I am exhausted just from Time Series. Will you permit me Professor to read this."

Wiener turned and sat in his desk chair, looked out to Sam and said:

"Be kind old friend, be kind. I poured everything into this work."

Sam said:

"Of course Professor. Let me sit in the corner here and I will be quiet."

So Sam took the draft document, neatly typed by Wiener's Secretary, and started at the beginning. Sam thought that this was unlike Shannon, there was no simplifying example, no easy entry for the engineer, it was expansive, it was a statement of a new world order, one where we could view all of nature in a new way, as a system, as a system definable by mathematical entities, and that by using those entities and what we knew about the system we could then change nature, improve it, by curing the afflicted, and creating intelligent machines. The path was described and as he read further it was clear to Sam that this was not a Shannon insight using simplicity but a

Wiener revelation using the very elements of nature.

I stopped Antnee as he spoke and was now quite intrigued:

"Antnee, you seem to be saying that Sam's interpretation was that the book Cybernetics was in many ways a response to Shannon and yet in many others almost a Magnum Opus for Wiener. Is that how you tell the tale of Sam?"

Antnee curled up against the back of my lab bench chair, the one with the soft cloth back, and he replied:

"Sir, a good observation Sir, for when one writes that Magnum Opus one often wonders what was the event that precipitated it. Often too, Sir, the Magnum Opus is a flash of brilliance, a burst of intellectual activity Sir, and it is that one singular event, Sir, that brings it forth. You know Sir, I suspect that one could do an interesting study here, yes Sir, a very interesting study. Now with the good Professor, Sir, even Sam we are told wondered if it was a culmination point, perhaps Sir, or was it that he agreed to write this over a fine diner in Paris, which may be the case Sir, or was it the, shall we call it Sir, the nudge from the Shannon paper. You have done that yourself a few times Sir, indeed I have watched you, one little nudge, and there you go."

I replied:

"Okay, Antnee, so the answer is we really don't know and most likely could not ever really know."

He replied:

"Indeed Sir, very so, indeed."

He then returned to the tale.

Thus Sam sat there all day, into the night, after Wiener had left, and read till the sun came up and Wiener returned. As Wiener came in he looked at Sam and asked:

"Sam my good friend have you been here all night?"

Same, with drooping whiskers, blood shot squirrel eyes, and yet a wet black nose said to the Professor:

"Brilliant Professor, absolutely brilliant!"

Wiener smiled and said:

"So Sam, if it is good, tell me more."

Same sat back, grabbed a cashew in his teeth, holding it with his small paws as he nibbled on it till it was totally consumed and replied:

"Sorry Professor, no food for a while makes for a shaky squirrel. Now where was I, ah yes, brilliant. It is intense, not focused at say the Bell Labs type engineer, but expansive. I feared that the equations would be imposing, yet, I was surprised that if I just ignored them then the reading was excellent. Yet, having the equations will be a foil to any saying that is nothing more than speculation."

"It truly picks up Professor when you get to feedback. Then we see the simple paradigm of the feedback loop but it is not a simplification as was that of Shannon but it was a generalization of life."

Then Sam went through chapter by chapter, and the two made a few comments and Wiener wrote them on the board since his eyes were truly failing.

Sam noted how Wiener kept asking the question of how would his peers receive this, had he been rigorous enough here and there. The document did have that schizophrenic structure of intense and proper mathematics and grand expositions of insight and evaluation as well as the ability to envision a future well beyond the then present.

I listened as Antnee recounted the conversation but again since I had read the work almost fifty years earlier I interjected my comments:

"Antnee, I can see further how Shannon and Wiener differ the more you speak. Shannon was held as some god like creature by engineers yet Wiener, in my mind, was far ahead, albeit on trails that may have required backtracking yet always in the correct direction. Yet your tale seems to let me believe that he was always questioning how he would be received by his peers, even at the latter portion of that career. Was this always a concern or was this just with Sam?"

Antnee reshuffled himself as he does when he pontificates and then replied:

"As best as I can recall from the records, for Sir we have detailed records, squirrel records, which we keep very accurately. So Sir, let me relate. First Sir it is always interesting to see how you humans are so always concerned as to how you appear, so strange at times Sir, yet you Sir do not

have as much of a problem given Sir how you appear in the garden…."

I interrupted:

"Antnee, I am gardening, not meeting with the CEO of some company! And yes Antnee, when I work, I shall we say, perspire and thus I leave to you the result…"

Antnee interjected:

"Yes Sir, Pigs and humans, the only two species with little hair and sweat…."

I stopped him:

"Antnee, stop it, back to the tale, tell me if you can!"'

Antnee looked a bit taken aback which is his way and he replied sheepishly:

"Sir, I apologize Sir, now to the tale."

Wiener spoke a few more times with Sam to fine tune certain parts and he gave the details to Pitts and Selfridge to work through and finalize the document. Then when it was ready, just a few intense days, they took the document to Wiener and he was to sign the cover letter and post it to Paris.

The week after the posting Sam was looking over what he thought was the unedited copy when he became aghast at the fact that they had sent the wrong copy! He ran down to Wiener's office screaming at his high pitch squirrel voice:

"You sent the wrong one, you sent the wrong one!"

Poor Wiener was now in a terrible spot. What should he do? Was this a disaster. They took a day to reach the publisher in Paris yet by this time the document had already been type set! It was on to the printer!

It would have to stand on its own two feet.

Antnee then became quite intense:

"Sir, poor Professor Wiener, Sir, he thought all the world would now see his errors, mere typos, but errors as they were, small ones, but as a mathematician, small means large Sir, indeed reputation shattering. There was nothing he could do! The waiting till the publication in a week or so, terrifying Sir, sheer terror indeed. All thoughts of reputational collapse Sir swam through his head, he could think of nothing else, but of errors here and errors there. Sam tried to console hi, no use Sir, no use."

Sam actually said:

"Professor, the professional world knows your capabilities Sir, and as an old friend once said to me, fear not typos, for that is what they made erasers on pencils for!"

Antnee said:

"And Sir, such a statement to the Professor did not assuage his fears Sir, not the least, indeed, not the least!"

"Well Sir, the reviews came out, they were bad Sir, many were truly cruel, they errors did resonate, and this made the Professor worry even more. Then, Sir a strange thing happened, the bad reviews from the profession

were overblown by superb reviews from the general Press, despite the math, the words, the ideas, the vision, it came through Sir, and day after day the reviews showed the Professor that his vision not only had merit, Sir, but that it was correct! He became a prophet!"

13 THE AUTOBIOGRAPHY (1951-1955)

Sam was getting old, and as one ages one seems to want to look backward and leave a memoir of what was done and why. One day in 1951 Wiener came in and Sam was laying on the window sill, quietly in the sun, resting as any old squirrel would do, his snout down and eyes closed. His whiskers shook as he snored, a squirrel snore, but a snore no less.

One day Wiener came in and said:

"Sam, I am going to write my autobiography. I want to tell the tale of all the people I have met, the wonderful things that have happened, and how it all started. It seems that there are still many young bright people who as I did find themselves developing intellectually at such a young age. Remember I got my PhD from Harvard while still seventeen. An accomplishment which took me a dozen or more years to recover from. I want to tell that tale."

Sam looked at him and said:

"Professor, beware, what may be important to you may be an annoyance to others. Perhaps you could write a novel, using that as a vehicle."

Wiener replied:

"No Sam, I really want to do this. Here, I already wrote some chapters. Let me know what you think."

Sam read through them and he was concerned. The Professor was saying things that he most likely to keep to himself. Sam thought that all individuals have bad memories but other people do not want to read about them. Sam found himself in a tight spot. He wanted the Professor to write the book, now, yet he did not want the Professor to find himself the object of scorn. What to do?

Fortunately the solution came from the publisher, who took the Professor by the hand and carefully edited it down to a readable document, and in the process Sam kept at Wiener telling him the edits were indeed better. For indeed they were.

It was a cathartic experience, writing about the past, reliving moments, and Sam would sit there like a psychoanalyst and listen, commend, and edit.

Finally it was done and Sam really thought it was good. He hoped that the readers would also.

14 TRIP TO INDIA (1953)

Antnee was now winding down for I could now tell when he was at the end of his tales. This was one more different than others and I wondered what he was trying to tell me. The people were more human, not super creatures, no emperors, queens, no classic writers or Saints. Yes there was Wiener, but there was Sparks, there was Bigelow, there were many other just regular types.

Antnee then went on:

"Sir, a sad ending Sir, but not uncommon, as all things must end, so I bring you all the way Sir. All the way, for this end tells you a great deal about the person Sir, the end tells you their character, yes indeed, their true character."

He continued:

"You see Sir, the good Professor was wont to travel, which was the case, and this time he was off to India. Sam was back in Cambridge, and he was aging as we all do so, and we are lucky to do that Sir, for the alternative is too horrible to think of, remember those dogs…"

I interjected:

"Antnee, we are finished with Bell Labs, it is finished, the dogs are gone, forget the dog Antnee, back to the tale."

He replied:

"Ah Sir, indeed, I do bemoan too much, indeed, I bemoan too much. Now to the tale."

He continued in has manner.

Then one day in 1953 when Wiener was lecturing, he returned and had a telex on his desk. It was from his office. His secretary had written that on the morning that day when she went out to give some peanut butter to Samuel, he was laying there on the corner where he always took the sun outside of Wiener's office facing the Charles. But this day he did not move, for he had died the night before. She said she wept and they had all the

students collect his remains and they had a small box made and buried him at the base of the window. They had a brief ceremony, and student after student spoke of how they had remembered Samuel, how he had been a true friend and they remembered many of his fine contributions to them, the Department and the Institute. He had lived a long and productive life.

Wiener stood frozen, for this was another death and in a way it was another road sign on his own mortality. He walked outside in the heat and humidity, one of his long walks, and he remembered Samuel, their conversations, and the fact that his contributions were never truly recognized. Yet he was remembered. Samuel could have only prospered at MIT, for at Harvard and other places his very presence would have been rejected. But at MIT they accepted many of the strangest, Wiener thought, even himself.

He stood at the edge of a tree and looked up and wept. A Hindu swami approached him and asked what was the problem that made him weep so. Wiener replied:

"Swami, I had a good friend die last night, a good friend, but a strange one. A true collaborator, one who helped me many times. But a strange friend."

The swami said:

"And what makes him so strange."

Wiener burst forth the answer, no feeling, the loss was so great, that being ever so more strange, would not bring more pain. He said:

"A squirrel, a small grey, but brilliant squirrel."

The swami was not the least bit taken aback. He looked kindly at Wiener and said:

"The circle of life always is turning, and your friend will have a better life on his next turn, and you show that he has done well this time and thus will be rewarded for his efforts. So fell grateful my sad friend for he has moved on to a much better place, and your friendship will not only survive but will prosper. Smile my friend, for life is continuing, it is something that you can take to your heart and make part of your own life as well."

Wiener smiled and looked at the swami, he had made friends with the swami at MIT but this man had hit upon the chord which he had been trying to read for many years. He thought that yes, indeed, Sam would live on.