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Georgia On My Mind  
by Charles Sheffield  
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I first tangled with digital computers late in 1958. That may sound like the dark ages, but we considered ourselves infinitely more advanced than our predecessors of a decade earlier, when programming was done mostly by sticking plugs into plug-boards and a card-sequenced programmable calculator was held to be the height of sophistication.

Even so, 1958 was still early enough that the argument between analog and digital computers had not yet been settled, decisively, in favor of the digital. And the first computer that I programmed was, by anyone's standards, a brute.

It was called DEUCE, which stood for Digital Electronic Universal Computing Engine, and it was, reasonably enough to card players, the next thing after the ACE (for Automatic Computing Engine), developed by the National Physical Laboratory at Teddington. Unlike ACE, DEUCE was a commercial machine; and some idea of its possible shortcomings is provided by one of the designers' comments about ACE itself: "If we had known that it was going to be developed commercially, we would have finished it."

DEUCE was big enough to walk inside. The engineers would do that, tapping at suspect vacuum tubes with a screwdriver when the whole beast was proving balky. Which was often. Machine errors were as common a cause of trouble as programming errors; and programming errors were dreadfully frequent, because we were working at a level so close to basic machine logic that it is hard to imagine it today.

I was about to say that the computer had no compilers or assemblers, but that is not strictly true. There was a floating-point compiler known as ALPHACODE, but it ran a thousand times slower than a machine code program and no one with any self-respect ever used it. We programmed in absolute, to make the best possible use of the machine's 402 words of high-speed (mercury delay line) memory, and its 8,192 words of back-up (rotating drum) memory. Anything needing more than that had to use punched cards as intermediate storage, with the programmer standing by to shovel them from the output hopper back into the input hopper.

When I add that binary-to-decimal conversion routines were usually avoided because they wasted space, that all instructions were defined in binary, that programmers therefore had to be very familiar with the binary representation of numbers, that we did our own card punching with hand (not electric) punches, and that the machine itself, for some reason that still remains obscure to me, worked with binary numbers whose most significant digit was on the `_right_`, rather than on the left -- so that 13, for example, became

1011, rather than the usual 1101 -- well, by this time the general flavor of DEUCE programming ought to be coming through.

Now, I mention these things not because they are interesting (to the few) or because they are dull (to the many) but to make the point that anyone programming DEUCE in those far-off days was an individual not to be taken lightly. We at least thought so, though I suspect that to higher management we were all hare-brained children who did incomprehensible things, many of them in the middle of the night (when de-bug time was more easily to be had).

A few years later more computers became available, the diaspora inevitably took place, and we all went off to other interesting places. Some found their way to university professorships, some into commerce, and many to foreign parts. But we did tend to keep in touch, because those early days had generated a special feeling.

One of the most interesting characters was Bill Rigley. He was a tall, dashing, wavy-haired fellow who wore English tweeds and spoke with the open "a" sound that to most Americans indicates a Boston origin. But Bill was a New Zealander, who had seen at first hand things like the Great Barrier Reef, that the rest of us had barely heard of. He didn't talk much about his home and family, but he must have pined for them, because after a few years in Europe and America he went back to take a faculty position in the Department of Mathematics (and later the Computer Science Department, when one was finally created) at the University of Auckland.

Auckland is on the north island, a bit less remote than the bleaker south island, but a long way from the East Coast of the United States, where I had put down my own roots. Even so, Bill and I kept in close contact, because our scientific interests were very similar. We saw each other every few years in Stanford, or London, or wherever else our paths intersected, and we knew each other at the deep level where few people touch. It was Bill who helped me to mourn when my wife, Eileen, died, and I in turn knew (but never talked about) the dark secret that had scarred Bill's own life. No matter how long we had been separated, our conversations when we met picked up as though they had never left off.

Bill's interests were encyclopedic, and he had a special fondness for scientific history. So it was no surprise that when he went back to New Zealand he would wander around there, examining its contribution to world science. What was a surprise to me was a letter from him a few months ago, stating that in a farm-house near Dunedin, towards the south end of the south island, he had come across some bits and pieces of Charles Babbage's Analytical Engine.

Even back in the late 1950's, we had known all about Babbage. There was at the time only one decent book about digital computers, Bowden's "Faster Than Thought," but its first chapter talked all about that eccentric but formidable Englishman, with his hatred of street musicians and his low opinion of the Royal Society (existing only to hold dinners, he said, at which they gave each other medals). Despite these odd views, Babbage was still our patron saint. For starting in 1834 and continuing for the rest of his life, he tried -- unsuccessfully -- to build the world's first programmable digital computer. He understood the principles perfectly well, but he was thwarted because he had to work with mechanical parts. Can you imagine a computer built of cogs and toothed cylinders and gears and springs and levers?

Babbage could. And he might have triumphed even over the inadequacy of the available technology, but for one fatal problem: he kept thinking of improvements. As soon as a design was half assembled, he would want to tear it apart and start using the bits to build something better. At the time of Babbage's death in 1871, his wonderful Analytical Engine was still a dream. The bits and pieces were carted off to London's Kensington Science Museum, where they remain today.

Given our early exposure to Babbage, my reaction to Bill Rigley's letter was pure skepticism. It was understandable that Bill would want to find evidence of parts of the Analytical Engine somewhere on his home

stamping-ground; but his claim to have done so was surely self-delusion.

I wrote back, suggesting this in as tactful a way as I could; and received in prompt reply not recantation, but the most extraordinary package of documents I had ever seen in my life (I should say, to that point; there were stranger to come).

The first was a letter from Bill, explaining in his usual blunt way that the machinery he had found had survived on the south island of New Zealand because "we don't chuck good stuff away, the way you lot do." He also pointed out, through dozens of examples, that in the nineteenth century there was much more contact between Britain and its antipodes than I had ever dreamed. A visit to Australia and New Zealand was common among educated persons, a kind of expanded version of the European Grand Tour. Charles Darwin was of course a visitor, on the Beagle, but so also were scores of less well-known scientists, world travelers, and gentlemen of the leisured class. Two of Charles Babbage's own sons were there in the 1850's.

The second item in the package was a batch of photographs of the machinery that Bill had found. It looked to me like what it was, a bunch of toothed cylinders and gears and wheels. They certainly resembled parts of the Analytical Engine, or the earlier Difference Machine, although I could not see how they might fit together.

Neither the letter nor the photographs were persuasive. Rather the opposite. I started to write in my mind the letter that said as much, but I hesitated for one reason: many historians of science know a lot more history than science, and few are trained computer specialists. But Bill was the other way round, the computer expert who happened to be fascinated by scientific history. It would be awfully hard to fool him -- unless he chose to fool himself.

So I had another difficult letter to write. But I was spared the trouble, for what I could not dismiss or misunderstand was the third item in the package. It was a copy of a programming manual, hand-written, for the Babbage Analytical Engine. It was dated July 7, 1854. Bill said that he had the original in his possession. He also told me that I was the only person who knew of his discovery, and he asked me to keep it to myself.

And here, to explain my astonishment, I have to dip again into computer history. Not merely to the late 1950's, where we started, but all the way to 1840. In that year an Italian mathematician, Luigi Federico Menabrea, heard Babbage talk in Turin about the new machine that he was building. After more explanations by letter from Babbage, Menabrea wrote a paper on the Analytical Engine, in French, which was published in 1842. And late that year Ada Lovelace (Lord Byron's daughter; Lady Augusta Ada Byron Lovelace, to give her complete name) translated Menabrea's memoir, and added her own lengthy notes. Those notes formed the world's first software manual; Ada Lovelace described how to program the Analytical Engine, including the tricky techniques of recursion, looping, and branching.

So, twelve years before 1854, a programming manual for the Analytical Engine existed; and one could argue that what Bill had found in New Zealand was no more than a copy of the one written in 1842 by Ada Lovelace.

But there were problems. The document that Bill sent me went far beyond the 1842 notes. It tackled the difficult topics of indirect addressing, re-locatable programs and subroutines, and it offered a new language for programming the Analytical Engine -- what amounted to a primitive assembler.

Ada Lovelace just might have entertained such advanced ideas, and written such a manual. It is possible that she had the talent, although all signs of her own mathematical notebooks have been lost. But she died in 1852, and there was no evidence in any of her surviving works that she ever blazed the astonishing trail defined in the document that I received from Bill. Furthermore, the manual bore on its first page the author's initials, L.D. Ada Lovelace for her published work had used her own initials, A.A.L.

I read the manual, over and over, particularly the final section. It contained a sample program, for the computation of the volume of an irregular

solid by numerical integration -- and it included a page of output, the printed results of the program.

At that point I recognized only three possibilities. First, that someone in the past few years had carefully planted a deliberate forgery down near Dunedin, and led Bill Rigley to "discover" it. Second, that Bill himself was involved in attempting an elaborate hoax, for reasons I could not fathom.

I had problems with both those explanations. Bill was perhaps the most cautious, thorough, and conservative researcher that I had ever met. He was painstaking to a fault, and he did not fool easily. He was also the last man in the world to think that devising a hoax could be in any way amusing.

Which left the third possibility. Someone in New Zealand had built a version of the Analytical Engine, made it work, and taken it well beyond the place where Charles Babbage had left off.

I call that the third possibility, but it seemed at the time much more like the third impossibility. No wonder that Bill had asked for secrecy. He didn't want to become the laughing-stock of the computer historians.

Nor did I. I took a step that was unusual in my relationship with Bill: I picked up the phone and called him in New Zealand.

"Well, what do you think?" he said, as soon as he recognized my voice on the line.

"I'm afraid to think at all. How much checking have you done?"

"I sent paper samples to five places, one in Japan, two in Europe and two in the United States. The dates they assign to the paper and the ink range from 1840 to 1875, with 1850 as the average. The machinery that I found had been protected by wrapping in sacking soaked in linseed oil. Dates for that ranged from 1830 to 1880." There was a pause at the other end of the line. "There's more. Things I didn't have until two weeks ago."

"Tell me."

"I'd rather not. Not like this." There was another, longer silence.

"You are coming out, aren't you?"

"Why do you think I'm on the telephone? Where should I fly to?"

"Christchurch. South Island. We'll be going farther south, past Dunedin. Bring warm clothes. It's winter here."

"I know. I'll call as soon as I have my arrival time."

And that was the beginning.

\* \* \* \*

The wavy mop of fair hair had turned to grey, and Bill Rigley now favored a pepper-and-salt beard which with his weather-beaten face turned him into an approximation of the Ancient Mariner. But nothing else had changed, except perhaps for the strange tension in his eyes.

We didn't shake hands when he met me at Christchurch airport, or exchange one word of conventional greeting. Bill just said, as soon as we were within speaking range, "If this wasn't happening to me, I'd insist it couldn't happen to anybody," and led me to his car.

Bill was South Island born, so the long drive from Christchurch to Dunedin was home territory to him. I, in that odd but pleasant daze that comes after long air travel -- after you de-plane, and before the jet-lag hits you -- stared out at the scenery from what I thought of as the driver's seat (they still drive on the left, like the British).

We were crossing the flat Canterbury Plains, on a straight road across a level and empty expanse of muddy fields. It was almost three months after harvest -- wheat or barley, from the look of the stubble -- and there was nothing much to see until at Timaru we came to the coast road, with dull grey sea to the left and empty brown coastal plain on the right. I had visited South Island once before, but that had been a lightning trip, little more than a tour of Christchurch. Now for the first time I began to appreciate Bill's grumbling about "overcrowded" Auckland on the north island. We saw cars and people, but in terms of what I was used to it was a thin sprinkle of both. It was late afternoon, and as we drove farther south it became colder and began to rain. The sea faded from view behind a curtain of fog and drizzle.

We had been chatting about nothing from the time we climbed into the car. It was talk designed to avoid talking, and we both knew it. But at last Bill, after a few seconds in which the only sounds were the engine and the whump-whump-whump of windshield wipers, said: "I'm glad to have you here. There's been times in the past few weeks when I've seriously wondered if I was going off my head. What I want to do is this. Tomorrow morning, after you've had a good sleep, I'm going to show you everything, just as I found it. Most of it just where I found it. And then I want you to tell me what you think is going on."

I nodded. "What's the population of New Zealand?"

Without turning my head, I saw Bill's quick glance. "Total? Four million, tops."

"And what was it in 1850?"

"That's a hell of a good question. I don't know if anyone can really tell you. I'd say, a couple of hundred thousand. But the vast majority of those were native Maori. I know where you're going, and I agree totally. There's no way that anyone could have built a version of the Analytical Engine in New Zealand in the middle of the last century. The manufacturing industry just didn't exist here. The final assembly could be done, but the sub-units would have to be built and shipped in big chunks from Europe."

"From Babbage?"

"Absolutely not. He was still alive in 1854. He didn't die until 1871, and if he had learned that a version of the Analytical Engine was being built anywhere, he'd have talked about it non-stop all over Europe."

"But if it wasn't Babbage --"

"Then who was it? I know. Be patient for a few more hours. Don't try to think it through until you've rested, and had a chance to see the whole thing for yourself."

He was right. I had been traveling non-stop around the clock, and my brain was going on strike. I pulled my overcoat collar up around my ears, and sagged lower in my seat. In the past few days I had absorbed as much information about Babbage and the Analytical Engine as my head could handle. Now I needed to let it sort itself out, along with what Bill was going to show me. Then we would see if I could come up with a more plausible explanation for what he had found.

As I drifted into half-consciousness, I flashed on to the biggest puzzle of all. Until that moment I had been telling myself, subconsciously, that Bill was just plain wrong. It was my way of avoiding the logical consequences of his being right. But suppose he were right. Then the biggest puzzle was not the appearance of an Analytical Engine, with its advanced programming tools, in New Zealand. It was the disappearance of those things, from the face of the Earth.

Where the devil had they gone?

\* \* \* \*

Our destination was a farmhouse about fifteen miles south of Dunedin. I didn't see much of it when we arrived, because it was raining and pitch-black and I was three-quarters asleep. If I had any thoughts at all as I was shown to a small, narrow room and collapsed into bed, it was that in the morning, bright and early, Bill would show me everything and my perplexity would end.

It didn't work out that way. For one thing, I overslept and felt terrible when I got up. I had forgotten what a long, sleepless journey can do to your system. For the past five years I had done less and less traveling, and I was getting soft. For another thing, the rain had changed to sleet during the night and was driving down in freezing gusts. The wind was blowing briskly from the east, in off the sea. Bill and I sat at the battered wooden table in the farm kitchen, while Mrs. Trevelyan pushed bacon, eggs, homemade sausage, bread and hot sweet tea into me until I showed signs of life. She was a spry, red-cheeked lady in her middle sixties, and if she was surprised that Bill had finally brought someone else with him to explore Little House, she hid it well.

"Well, then," she said, when I was stuffed. "If you're stepping up the hill you'll be needing a mac. Jim put the one on when he went out, but we have plenty of spares."

Jim Trevelyan was apparently off somewhere tending the farm animals, and had been since dawn. Bill grinned sadistically at the look on my face. "You don't want a little rain to stop work, do you?"

I wanted to go back to bed. But I hadn't come ten thousand miles to lie around. The "step up the hill" to Little House turned out to be about half a mile, through squelching mud covered with a thin layer of sour turf.

"How did you ever find this place?" I asked Bill.

"By asking and looking. I've been into a thousand like this before, and found nothing."

We were approaching a solidly-built square house made out of mortared limestone blocks. It had a weathered look, but the slate roof and chimney were intact. To me it did not seem much smaller than the main farmhouse.

"It's not called 'Little House' because it's small," Bill explained. "It's Little House because that's where the little ones are supposed to live when they first marry. You're seeing a twentieth century tragedy here. Jim and Annie Trevelyan are fourth generation farmers. They have five children. Every one went off to college, and not a one has come back to live in Little House and wait their turn to run the farm. Jim and Annie hang on at Big House, waiting and hoping."

As we went inside, the heavy wooden door was snug-fitting and moved easily on oiled hinges.

"Jim Trevelyan keeps the place up, and I think they're glad to have me here to give it a lived-in feel," said Bill. "I suspect that they both think I'm mad as a hatter, but they never say a word. Hold tight to this, while I get myself organized."

He had been carrying a square box lantern. When he passed it to me I was astonished by the weight -- and he had carried it for half a mile.

"Batteries, mostly," Bill explained. "Little House has oil lamps, but of course there's no electricity. After a year or two wandering around out-of-the-way places I decided there was no point in driving two hundred miles to look at something if you can't see it when you get there. I can recharge this from the car if we have to."

As Bill closed the door the sound of the wind dropped to nothing. We went through a wash-house to a kitchen furnished with solid wooden chairs, table, and dresser. The room was freezing cold, and I looked longingly at the scuttle of coal and the dry kindling standing by the fireplace.

"Go ahead," said Bill, "while I sort us out here. Keep your coat on, though -- you can sit and toast yourself later."

He lit two big oil lamps that stood on the table, while I placed layers of rolled paper, sticks, and small pieces of coal in the grate. It was thirty years since I had built a coal fire, but it's not much of an art. In a couple of minutes I could stand up, keep one eye on the fire to make sure it was catching properly, and take a much better look at the room. There were no rugs, but over by the door leading through to the bedrooms was a long strip of coconut matting. Bill rolled it back, to reveal a square wooden trapdoor. He slipped his belt through the iron ring and lifted, grunting with effort until the trap finally came free and turned upward on brass hinges.

"Storage space," he said. "Now we'll need the lantern. Turn it on, and pass it down to me."

He lowered himself into the darkness, but not far. His chest and head still showed when he was standing on the lower surface. I switched on the electric lantern and handed it down to Bill.

"Just a second," I said. I went across to the fireplace, added half a dozen larger lumps of coal, then hurried back to the trapdoor. Bill had already disappeared when I lowered myself into the opening.

The storage space was no more than waist high, with a hard dirt floor. I followed the lantern light, to where a wooden section at the far end was

raised a few inches off the ground on thick beams. On that raised floor stood three big tea-chests. The lantern threw a steady, powerful light on them.

"I told you you'd see just what I saw," said Bill. "These have all been out and examined, of course, but everything is very much the way it was when I found it. All right, hardware first."

He carefully lifted the lid off the right-hand tea-chest. It was half full of old sacks. Bill lifted one, unfolded it, and handed me the contents. I was holding a solid metal cylinder, lightly oiled and apparently made of brass. The digits from 0 through 9 ran around its upper part, and at the lower end was a cog wheel of slightly greater size.

I examined it carefully, taking my time. "It could be," I said. "It's certainly the way the pictures look."

I didn't need to tell him which pictures. He knew that I had thought of little but Charles Babbage and his Analytical Engines for the past few weeks, just as he had.

"I don't think it was made in England," said Bill. "I've been all over it with a lens, and I can't see a manufacturer's mark. My guess is that it was made in France."

"Any particular reason?"

"The numerals. Same style as some of the best French clock-makers -- see, I've been working, too." He took the cylinder and wrapped it again, with infinite care, in the oiled sacking.

I stared all around us, from the dirt floor to the dusty rafters. "This isn't the best place for valuable property."

"It's done all right for a hundred and forty years. I don't think you can say as much of most other places." There was something else, that Bill did not need to say. This was a perfect place for valuable property -- so long as no one thought that it had any value.

"There's nowhere near enough pieces here to make an Analytical Engine, of course," he went on. "These must have just been spares. I've taken a few of them to Auckland. I don't have the original of the programming manual here, either. That's back in Auckland, too, locked up in a safe at the university. I brought a copy, if we need it."

"So did I." We grinned at each other. Underneath my calm I was almost too excited to speak, and I could tell that he felt the same. "Any clue as to who 'L.D.' might be, on the title page?"

"Not a glimmer." The lid was back on the first tea-chest and Bill was removing the cover of the second. "But I've got another L.D. mystery for you. That's next."

He was wearing thin gloves and opening, very carefully, a folder of stained cardboard, tied with a ribbon like a legal brief. When it was untied he laid it on the lid of the third chest.

"I'd rather you didn't touch this at all," he said. "It may be pretty fragile. Let me know whenever you want to see the next sheet. And here's a lens."

They were drawings. One to a sheet, Indian ink on fine white paper, and done with a fine-nibbed pen. And they had nothing whatsoever to do with Charles Babbage, programming manuals, or Analytical Engines. What they did have, so small that first I had to peer, then use the lens, was a tiny, neat 'L.D.' at the upper right-hand corner of each sheet.

They were drawings of animals, the sort of multi-legged, random animals that you find scuttling around in tidal pools, or hidden away in rotting tree bark. Or rather, as I realized when I examined them more closely, the sheets in the folder were drawings of one animal, seen from top, bottom, and all sides.

"Well?" said Bill expectantly.

But I was back to my examination of the tiny artist's mark. "It's not the same, is it. That's a different 'L.D.' from the software manual."

"You're a lot sharper than I am," said Bill. "I had to look fifty times before I saw that. But I agree completely, the 'L' is different, and so is the

'D'. What about the animal?"

"I've never seen anything like it. Beautiful drawings, but I'm no zoologist. You ought to photograph these, and take them to your biology department."

"I did. You don't know Ray Weddle, but he's a top man. He says they have to be just drawings, made up things, because there's nothing like them, and there never has been." He was carefully re-tying the folder, and placing it back in the chest. "I've got photographs of these with me, too, but I wanted you to see the originals, exactly as I first saw them. We'll come back to these, but meanwhile: next exhibit."

He was into the third tea-chest, removing more wrapped pieces of machinery, then a thick layer of straw. And now his hands were trembling. I hated to think how Bill must have sweated and agonized over this, before telling anyone. The urge to publish such a discovery had to be overwhelming; but the fear of being derided as part of the scientific lunatic fringe had to be just as strong.

If what he had produced so far was complex and mystifying, what came next was almost laughably simple -- if it were genuine. Bill was lifting, with a good deal of effort, a bar, about six inches by two inches by three. It gleamed hypnotically in the light of the lantern.

"It is, you know," he said, in answer to my shocked expression.

"Twenty-four carat gold, solid. There are thirteen more of them."

"But the Trevelyans, and the people who farmed here before that -- "

"Never bothered to look. These were stowed at the bottom of a chest, underneath bits of the Analytical Engine and old sacks. I guess nobody ever got past the top layer until I came along." He smiled at me. "Tempted? If I were twenty years younger, I'd take the money and run."

"How much?"

"What's gold worth these days, U.S. currency?"

"God knows. Maybe three hundred and fifty dollars an ounce?"

"You're the calculating boy wonder, not me. So you do the arithmetic. Fourteen bars, each one weighs twenty-five pounds -- I'm using avoirdupois, not troy, even though it's gold."

"One point nine-six million. Say two million dollars, in round numbers. How long has it been here?"

"Who knows? But since it was under the parts of the Analytical Engine, I'd say it's been there as long as the rest."

"And who owns it?"

"If you asked the government, I bet they'd say that they do. If you ask me, it's whoever found it. Me. And now maybe me and thee." He grinned, diabolical in the lantern light. "Ready for the next exhibit?"

I wasn't. "For somebody to bring a fortune in gold here, and just leave it..."

Underneath his raincoat, Bill was wearing an old sports jacket and jeans. He owned, to my knowledge, three suits, none less than ten years old. His vices were beer, travel to museums, and about four cigars a year. I could not see him as the Two Million Dollar Man, and I didn't believe he could see himself that way. His next words confirmed it.

"So far as I'm concerned," he said, "this all belongs to the Trevelyans. But I'll have to explain to them that gold may be the least valuable thing here." He was back into the second tea-chest, the one that held the drawings, and his hands were trembling again.

"These are what I really wanted you to see," he went on, in a husky voice. "I've not had the chance to have them dated yet, but my bet is that they're all genuine. You can touch them, but be gentle."

He was holding three slim volumes, as large as accounting ledgers. Each one was about twenty inches by ten, and bound in a shiny black material like thin, sandpapery leather. I took the top one when he held it out, and opened it.

I saw neat tables of numbers, column after column of them. They were

definitely not the product of any Analytical Engine, because they were hand-written and had occasional crossings-out and corrections.

I flipped on through the pages. Numbers. Nothing else, no notes, no signature. Dates on each page. They were all in October, 1855. The handwriting was that of the programming manual.

The second book had no dates at all. It was a series of exquisitely detailed machine drawings, with elaborately interlocking cogs and gears. There was writing, in the form of terse explanatory notes and dimensions, but it was in an unfamiliar hand.

"I'll save you the effort," said Bill as I reached for the lens. "These are definitely not by L.D. They are exact copies of some of Babbage's own plans for his calculating engines. I'll show you other reproductions if you like, back in Auckland, but you'll notice that these aren't photographs. I don't know what copying process was used. My bet is that all these things were placed here at the same time -- whenever that was."

I wouldn't take Bill's word for it. After all, I had come to New Zealand to provide an independent check on his ideas. But five minutes were enough to make me agree, for the moment, with what he was saying.

"I'd like to take this and the other books up to the kitchen," I said, as I handed the second ledger back to him. "I want to have a really good look at them."

"Of course." Bill nodded. "That's exactly what I expected. I told the Trevelyans that we might be here in Little House for up to a week. We can cook for ourselves, or Annie says she'd be more than happy to expect us at mealtimes. I think she likes the company."

I wasn't so sure of that. I'm not an elitist, but my own guess was that the conversation between Bill and me in the next few days was likely to be incomprehensible to Annie Trevelyan or almost anyone else.

I held out my hand for the third book. This was all handwritten, without a single drawing. It appeared to be a series of letters, running on one after the other, with the ledger turned sideways to provide a writing area ten inches across and twenty deep. There were no paragraphs within the letters. The writing was beautiful and uniform, by a different hand than had penned the numerical tables of the first book, and an exact half inch space separated the end of one letter from the beginning of the next.

The first was dated 12th October, 1850. It began: "My dear J.G., The native people continue to be as friendly and as kind in nature as one could wish, though they, alas, cling to their paganism. As our ability to understand them increases, we learn that their dispersion is far wider than we at first suspected. I formerly mentioned the northern islands, ranging from Taheete to Raratonga. However, it appears that there has been a southern spread of the Maori people also, to lands far from here. I wonder if they may extend their settlements all the way to the great Southern Continent, explored by James Cook and more recently by Captain Ross. I am myself contemplating a journey to a more southerly island, with native assistance. Truly, a whole life's work is awaiting us. We both feel that, despite the absence of well-loved friends such as yourself, Europe and finance is "a world well lost." Louisa has recovered completely from the ailment that so worried me two years ago, and I must believe that the main reason for that improvement is a strengthening of spirit. She has begun her scientific work again, more productively, I believe, than ever before. My own efforts in the biological sciences prove ever more fascinating. When you write again tell us, I beg you, not of the transitory social or political events of London, but of the progress of science. It is in this area that L. and I are most starved of new knowledge. With affection, and with the assurance that we think of you and talk of you constantly, L.D.\_

The next letter was dated 14 December, 1850. Two months after the first. Was that time enough for a letter to reach England, and a reply to return? The initials at the end were again L.D.

I turned to the back of the volume. The final twenty pages or so were blank, and in the last few entries the beautiful regular handwriting had

degenerated to a more hasty scribble. The latest date that I saw was October, 1855.

Bill was watching me intently. "Just the one book of letters?" I said. He nodded. "But it doesn't mean they stopped. Only that we don't have them."

"If they didn't stop, why leave the last pages blank? Let's go back upstairs. With the books."

I wanted to read every letter, and examine every page. But if I tried to do it in the chilly crawl space beneath the kitchen, I would have pneumonia before I finished. Already I was beginning to shiver.

"First impressions?" asked Bill, as he set the three ledgers carefully on the table and went back to close the trapdoor and replace the coconut matting. "I know you haven't had a chance to read, but I can't wait to hear what you're thinking."

I pulled a couple of the chairs over close to the fireplace. The coal fire was blazing, and the chill was already off the air in the room.

"There are two L.D.'s," I said. "Husband and wife?"

"Agreed. Or maybe brother and sister."

"One of them -- the woman -- wrote the programming manual for the Analytical Engine. The other one, the man -- if it is a man, and we can't be sure of that -- did the animal drawings, and he wrote letters. He kept fair copies of what he sent off to Europe, in that third ledger. No sign of the replies, I suppose?"

"You've now seen everything that I've seen." Bill leaned forward and held chilled hands out to the fire. "I knew there were two, from the letters. But I didn't make the division of labor right away, the way you did. I bet you're right, though. Anything else?"

"Give me a chance. I need to read." I took the third book, the one of letters, from the table and returned with it to the fireside. "But they sound like missionaries."

"Missionaries, and scientists. The old nineteenth century mixture." Bill watched me reading for two minutes, then his urge to be up and doing something -- or interrupt me with more questions -- took over. His desire to talk was burning him up, while at the same time he didn't want to stop me from working.

"I'm going back to Big House," he said abruptly. "Shall I tell Annie we'll be there for a late lunch?"

I thought of the old farmhouse, generation after generation of life and children. Now there were just the two old folks, and the empty future. I nodded. "If I try to talk about this to them, make me stop."

"I will. If I can. And if I don't start doing it myself." He buttoned his raincoat, and paused in the doorway. "About the gold. I considered telling Jim and Annie when I first found it, because I'm sure that legally they have the best claim to it. But I'd hate their kids to come hurrying home for all the wrong reasons. I'd appreciate your advice on timing. I hate to play God."

"So you want me to. Tell me one thing. What reason could there be for somebody to come down here to South Island in the 1850's, in secret, and never tell a soul what they were doing? That's what we are assuming."

"I'm tempted to say, maybe they found pieces of an Analytical Engine, one that had been left untouched here for a century and a half. But that gets a shade too recursive for my taste. And they did say what they were doing. Read the letters."

And then he was gone, and I was sitting alone in front of the warm fire. I stewed comfortably in wet pants and shoes, and read. Soon the words and the heat carried me away a hundred and forty years into the past, working my way systematically through the book's entries.

Most of the letters concerned religious or business matters, and went to friends in England, France, and Ireland. Each person was identified only by initials. It became obvious that the female L. D. had kept up her own active correspondence, not recorded in this ledger, and casual references to the

spending of large sums of money made Bill's discovery of the gold bars much less surprising. The L.D.'s, whoever they were, had great wealth in Europe. They had not traveled to New Zealand because of financial problems back home.

But not all the correspondence was of mundane matters back in England. Scattered in among the normal chat to friends were the surprises, as sudden and as unpredictable as lightning from a clear sky. The first of them was a short note, dated January, 1851:

\_Dear J.G., L. has heard via A.v.H. that C.B. now despairs of completing his grand design. In his own words, 'There is no chance of the machine ever being executed during my own life and I am even doubtful of how to dispose of the drawings after its termination.' This is a great tragedy, and L. is beside herself at the possible loss. Can we do anything about this? If it should happen to be no more than a matter of money...\_

And then, more than two years later, in April, 1853:

\_Dear J.G., Many thanks for the shipped materials, but apparently there was rough weather on the journey, and inadequate packing, and three of the cylinders arrived with one or more broken teeth. I am enclosing identification for these items. It is possible that repair can be done here, although our few skilled workmen are a far cry from the machinists of Bologna or Paris. However, you would do me a great favor if you could determine whether this shipment was in fact insured, as we requested. Yours etc. L.D.\_

Cylinders, with toothed gear wheels. It was the first hint of the Analytical Engine, but certainly not the last. I could deduce, from other letters to J.G., that three or four earlier shipments had been made to New Zealand in 1852, although apparently these had all survived the journey in good condition.

In the interests of brevity, L.D. in copying the letters had made numerous abbreviations; w. did service for both 'which' and 'with', 'for' was shortened to f. and so on. Most of the time it did not hinder comprehension at all, and reconstruction of the original was easy; but I cursed when people were reduced to initials. It was impossible to expand those back to discover their identity. A.v.H. was probably the great world traveler and writer, Alexander von Humboldt, whose fingerprint appears all across the natural science of Europe in the first half of the last century; and C.B. ought surely to be Charles Babbage. But who the devil was J.G.? Was it a man, or could it be a woman?

About a third of the way through the book, I learned that this was not just copies of letters sent to Europe. It probably began that way, but at some point L.D. started to use it also as a private diary. So by February, 1854, after a gap of almost four months, I came across this entry:

\_22 February. Home at last, and thanks be to God that L. did not accompany me, for the seas to the south are more fierce than I ever dreamed, although the natives on the crew make nothing of them. They laugh in the teeth of the gale, and leap from ship to dingy with impunity, in the highest sea. However, the prospect of a similar voyage during the winter months would deter the boldest soul, and defies my own imagination.\_

\_L. has made the most remarkable progress in her researches since my departure. She now believes that the design of the great engine is susceptible of considerable improvement, and that it could become capable of much more variation and power than even A.L. suspected. The latter, dear lady, struggles to escape the grasp of her tyrannical mother, but scarce seems destined to succeed. At her request, L. keeps her silence, and allows no word of her own efforts to be fed back to England. Were this work to become known, however, I feel sure that many throughout Europe would be astounded by such an effort -- so ambitious, so noble, and carried through, in its entirety, by a woman!\_

So the news of Ada Lovelace's tragic death, in 1852, had apparently not been received in New Zealand. I wondered, and read on:

\_Meanwhile, what of the success of my own efforts? It has been modest at best. We sailed to the island, named Rormaurma by the natives, which my charts show as Macwherry or Macquarie. It is a great spear of land, fifteen

miles long but very narrow, and abundantly supplied with penguins and other seabirds. However, of the 'cold-loving people' that the natives had described to me, if I have interpreted their language correctly, there was no sign, nor did we find any of the artifacts, which the natives insist these people are able to make for speech and for motion across the water. It is important that the reason for their veneration of these supposedly 'superior men' be understood fully by me, before the way of our Lord can be explained to and accepted by the natives.\_

On my first time through the book I skimmed the second half of the letter. I was more interested in the "remarkable progress" that L.D. was reporting. It was only later that I went back and pondered that last paragraph for a long time.

The letters offered an irregular and infuriating series of snapshots of the work that Louisa was performing. Apparently she was busy with other things, too, and could only squeeze in research when conscience permitted. But by early 1855, L.D. was able to write, in a letter to the same unknown correspondent:

\_Dear J.G., It is finished, and it is working! And truth to tell, no one is more surprised than I. I imagine you now, shaking your head when you read those words, and I cannot deny what you told me, long ago, that our clever dear is the brains of the family -- a thesis I will never again attempt to dispute.\_

\_It is finished, and it is working! I was reading that first sentence again, with a shiver in my spine, when the door opened. I looked up in annoyance. Then I realized that the room was chilly, the fire was almost out, and when I glanced at my watch it was almost three o'clock,

It was Bill. "Done reading?" he asked, with an urgency that made me sure he would not like my answer.

"I've got about ten pages to go on the letters. But I haven't even glanced at the tables and the drawings." I stood up, stiffly, and used the tongs to add half a dozen pieces of coal to the fire. "If you want to talk now, I'm game."

The internal struggle was obvious on his face, but after a few seconds he shook his head. "No. It might point you down the same mental path that I took, without either of us trying to do that. We both know how natural it is for us to prompt one another. I'll wait. Let's go on down to Big House. Annie told me to come and get you, and by the time we get there she'll have tea on the table."

My stomach growled at the thought. "What about these?"

"Leave them just where they are. You can pick up where you left off, and everything's safe enough here." But I noticed that after Bill said that, he carefully pulled the fire-guard around the fender, so there was no possibility of stray sparks.

The weather outside had cleared, and the walk down the hill was just what I needed. We were at latitude 46 degrees south, it was close to the middle of winter, and already the sun was sloping down to the hills in the west. The wind still blew, hard and cold. If I took a beeline south, there was no land between me and the 'great Southern Continent' that L.D. had written about. Head east or west, and I would find only open water until I came to Chile and Argentina. No wonder the winds blew so strongly. They had an unbroken run around half the world to pick up speed.

Mrs. Trevelyan's 'tea' was a farmer's tea, the main cooked meal of the day. Jim Trevelyan was already sitting, knife and fork in hand, when we arrived. He was a man in his early seventies, but thin, wiry, and alert. His only real sign of age was his deafness, which he handled by leaning forward with his hand cupped around his right ear, while he stared with an intense expression at any speaker.

The main course was squab pie, a thick crusted delicacy made with mutton, onions, apples and cloves. I found it absolutely delicious, and delighted Annie Trevelyan by eating three helpings. Jim Trevelyan served us a

home-made dark beer. He said little, but nodded his approval when Bill and I did as well with the drink as with the food.

After the third tankard I was drifting off into a pleasant dream state. I didn't feel like talking, and fortunately I didn't need to. I did my part by imitating Jim Trevelyan, listening to Annie as she told us about Big House and about her family, and nodding at the right places.

When the plates were cleared away she dragged out an old suitcase, full of photographs. She knew every person, and how each was related to each, across four generations. About halfway through the pile she stopped and glanced up self-consciously at me and Bill. "I must be boring you."

"Not a bit," I said. She wasn't, because her enthusiasm for the past was so great. In her own way she was as much a historian as Bill or me.

"Go on, please," added Bill. "It's really very interesting."

"All right." She blushed. "I get carried away, you know. But it's so good to have youngsters in the house again."

Bill caught my eye. Youngsters? Us? His grizzled beard, and my receding hairline. But Annie was moving on, backwards into the past. We went all the way to the time of the first Trevelyan, and the building of Big House itself. At the very bottom of the case sat two framed pictures.

"And now you've got me," Annie said, laughing. "I don't know a thing about these two, though they're probably the oldest thing here."

She passed them across the table for our inspection, giving one to each of us. Mine was a painting, not a photograph. It was of a plump man with a full beard and clear grey eyes. He held a churchwarden pipe in one hand, and he patted the head of a dog with the other. There was no hint as to who he might be.

Bill had taken the other, and was still staring at it. I held out my hand. Finally, after a long pause, he passed it across.

It was another painting. The man was in half-profile, as though torn between looking at the painter and the woman. He was dark-haired, and wore a long, drooping moustache. She stood by his side, a bouquet of flowers in her hands and her chin slightly lifted in what could have been an expression of resolution or defiance. Her eyes gazed straight out of the picture, into me and through my heart. Across the bottom, just above the frame, were four words in black ink: "Luke and Louisa Derwent."

I could not speak. It was Bill who broke the silence. "How do you come to have these two, if they're not family?"

His voice was gruff and wavering, but Annie did not seem to notice.

"Didn't I ever tell you? The first Trevelyan built Big House, but there were others here before that. They lived in Little House -- it was built first, years and years back, I'm not sure when. These pictures have to be from that family, near as I can tell."

Bill turned to glance at me. His mouth was hanging half-open, but at last he managed to close it and say, "Did you -- I mean, are there other things? Things here, I mean, things that used to be in Little House."

Annie shook her head. "There used to be, but Grandad, Jim's dad, one day not long after we were married he did a big clear out. He didn't bother with the things you've been finding, because none of us ever used the crawl space under the kitchen. And I saved those two, because I like pictures. But everything else went."

She must have seen Bill and me subside in our chairs, because she shook her head and said, "Now then, I've been talking my fool head off, and never given you any afters. It's apple pie and cheese."

As she rose from her place and went to the pantry, and Jim Trevelyan followed her out of the kitchen, Bill turned to me.

"Can you believe it, I never thought to ask? I mean, I did ask Jim Trevelyan about things that used to be in Little House, and he said his father threw everything out but what's there now. But I left it at that. I never asked Annie."

"No harm done. We know now, don't we? Luke Derwent, he's the artist."

And Louisa, she's the mathematician and engineer."

"And the `_programmer_` -- a century before computer programming was supposed to exist." Bill stopped. We were not supposed to be discussing this until I had examined the rest of the materials. But we were saved from more talk by the return of Jim Trevelyan. He was holding a huge book, the size of a small suitcase, with a black embossed cover and brass-bound corners.

"I told you Dad chucked everything," he said. "And he did, near enough, threw it out or burned it. But he were a religious man, and he knew better than to destroy a Bible." He dropped it on the table, with a thump that shook the solid wood. "This come from Little House. If you want to take a look at it, even take it on back there with you, you're very welcome."

I pulled the book across to me and unhooked the thick metal clasp that held it shut. I knew, from the way that some of the pages did not lie fully closed at their edges, that there must be inserts. The room went silent, as I nervously leafed through to find them.

The disappointment that followed left me as hollow as though I had eaten nothing all day. There were inserts, sure enough: dried wildflowers, gathered long, long ago, and pressed between the pages of the Bible. I examined every one, and riffled through the rest of the book to make sure nothing else lay between the pages. At last I took a deep breath and pushed the Bible away from me.

Bill reached out and pulled it in front of him. "There's one other possibility," he said. "If their family happened to be anything like mine..."

He turned to the very last page of the Bible. The flyleaf was of thick, yellowed paper. On it, in faded multi-colored inks, a careful hand had traced the Derwent family tree.

Apple pie and cheese were forgotten, while Bill and I, with the willing assistance of Jim and Annie Trevelyan, examined every name of the generations shown, and made a more readable copy as we went.

At the time it finally seemed like more disappointment. Not one of us recognized a single name, except for those of Luke and Louisa Derwent, and those we already knew. The one fact added by the family tree was that they were half-brother and sister, with a common father. There were no dates, and Luke and Louisa were the last generation shown.

Bill and I admitted that we were at a dead end. Annie served a belated dessert, and after it the two of us wrapped the two pictures in waterproof covers (though it was not raining) and headed back up the hill to Little House, promising Annie that we would certainly be back for breakfast.

We were walking in silence, until halfway up the hill Bill said suddenly, "I'm sorry. I saw it, too, the resemblance to Eileen. I knew it would hit you. But I couldn't do anything about it."

"It was the expression, more than anything," I said. "That tilt to the chin, and the look in her eyes. But it was just coincidence, they're not really alike. That sort of thing is bound to happen."

"Hard on you, though."

"I'm fine."

"Great." Bill's voice showed his relief. "I wasn't going to say anything, but I had to be sure you were all right."

"I'm fine."

Fine, except that no more than a month ago a well-meaning friend of many years had asked me, "Do you think of Eileen as the love of your life?"

And my heart had dropped through a hole in the middle of my chest, and lodged like a cold rock in the pit of my belly.

When we reached Little House I pleaded residual travel fatigue and went straight to bed. With so much of Jim Trevelyan's powerful home-brew inside me, my sleep should have been deep and dreamless. But the dead, once roused, do not lie still so easy. Images of Eileen and the happy past rose before me, to mingle and merge with the Derwent picture. Even in sleep, I felt a terrible sadness. And the old impotence came back, telling me that I been unable to change in any way the only event in my life that really mattered.

\* \* \* \*

With my head still half a world away in a different time zone, I woke long before dawn. The fire, well damped by Bill before he went to bed, was still glowing under the ash, and a handful of firewood and more coal was all it needed to bring it back to full life.

Bill was still asleep when I turned on the two oil lamps, pulled the three books within easy reach, and settled down to read. I was determined to be in a position to talk to him by the time we went down to Big House for breakfast, but it was harder than I expected. Yesterday I had been overtired, now I had to go back and re-read some of the letters before I was ready to press on.

I had been in the spring of 1855, with some sort of Analytical Engine finished and working. But now, when I was desperate to hear more details, Luke Derwent frustrated me. He vanished for four months from the ledger, and returned at last not to report on Louisa's doings, but brimming over with wonder at his own doings.

\_21 September, 1855. Glory to Almighty God, and let me pray that I never again have doubts. L. And I have wondered, so many times, about our decision to come here. We have never regretted it, but we have asked if it was done for selfish reasons. Now, at last, it is clear that we are fulfilling a higher purpose.\_

\_Yesterday I returned from my latest journey to Macquarie Island. They were there! The 'cold-loving people,' just as my native friends assured me. In truth, they find the weather of the island too warm in all but the southern winter months of May to August, and were almost ready to depart again when our ship made landfall. For they are migrant visitors, and spend the bulk of the year in a more remote location.\_

\_The natives term them 'people,' and I must do the same, for although they do not hold the remotest outward aspect of humans, they are without doubt intelligent. They are able to speak to the natives, with the aid of a box that they carry from place to place. They possess amazing tools, able to fabricate the necessities of life with great speed. According to my native translators, although they have their more permanent base elsewhere in this hemisphere, they come originally from 'far, far off.' This to the Maori natives means from far across the seas, although I am less sure of this conclusion. And they have wonderful powers in medical matters. The Maori natives swear that one of their own number, so close to death from gangrenous wounds that death was no more than a day away, was brought to full recovery within hours. Another woman was held, frozen but alive, for a whole winter, until she could be treated and restored to health by the wonderful medical treatment brought from their permanent home by the 'cold-loving people' (for whom in truth it is now incumbent upon me to find a better name). I should add that they are friendly, and readily humored me in my desire to make detailed drawings of their form. They asked me through my Maori interpreter to speak English, and assured me that upon my next visit they would be able to talk to me in my own language.\_

\_All this is fascinating. But it pales to nothing beside the one central question: Do these beings possess immortal souls? We are in no position to make a final decision on such a matter, but L. and I agree that in our actions we must assume that the answer is yes. For if we are in a position to bring to Christ even one of these beings who would otherwise have died unblessed, then it is our clear duty to do so.\_

It was a digression from the whole subject of the Analytical Engine, one so odd that I sat and stared at the page for a long time. And the next entry, with its great outburst of emotion, seemed to take me even farther afield.

\_Dear J.G., I have the worst news in the world. How can I tell you this -- L.'s old disease is returned, and, alas, much worse than before. She said nothing to me, but yesterday I discovered bright blood on her handkerchief, and such evidence she could not deny. At my insistence she has visited a physician, and the prognosis is desperate indeed. She is amazingly calm about

the future, but I cannot remain so sanguine. Pray for her, my dear friend, as I pray constantly.\_

The letter was dated 25 September, just a few days after his return from his travels. Immediately following, as though Luke could not contain his thoughts, the diary ran on:

\_Louisa insists what I cannot believe: that her disease is no more than God's just punishment, paid for the sin of both of us. Her calm and courage are beyond belief. She is delighted that I remain well, and she seems resigned to the prospect of her death, as I can never be resigned. But what can I do? What? I cannot sit idly, and watch her slow decline. Except that it will not be slow. Six months, no more.\_

His travels among the colony of the 'cold-loving people' were forgotten. The Analytical Engine was of no interest to him. But that brief diary entry told me a great deal. I pulled out the picture of Luke and Louisa Derwent, and was staring at it when Bill emerged rumple-haired from the bedroom.

This time, I was the one desperate to talk. "I know! I know why they came all the way to New Zealand."

He stared, at me and at the picture I was holding. "How can you?"

"We ought to have seen it last night. Remember the family tree in the Bible? It showed they're half-brother and half-sister. And this." I held the painting out towards him.

He rubbed his eyes, and peered at it. "I saw. What about it?"

"Bill, it's a wedding picture. See the bouquet, and the ring on her finger? They couldn't possibly have married back in England, the scandal would have been too great. But here, where nobody knew them, they could make a fresh start and live as man and wife."

He was glancing across to the open ledger, and nodding. "Damn it, you're right. It explains everything. Their sin, he said. You got to that?"

"I was just there."

"Then you're almost at the end. Read the last few pages, then let's head down to Big House for breakfast. We can talk on the way."

He turned and disappeared back into the bedroom. I riffled through the ledger. As he said, I was close to the place where the entries gave way to blank pages.

There was just one more letter, to the same far-off friend. It was dated 6 October, 1855, and it was calm, even clinical.

\_Dear J.G., L. and I will in a few days be embarking upon a long journey to a distant island, where dwell a certain pagan native people; these are the Heteromorphs (to employ L.'s preferred term for them, since they are very different in appearance from other men, although apparently sharing our rational powers). To these beings we greatly wish to carry the blessings of Our Lord, Jesus Christ. It will be a dangerous voyage. Therefore, if you hear nothing from us within four years, please dispose of our estate according to my earlier instructions. I hope that this is not my last letter to you; however, should that prove to be the case, be assured that we talk of you constantly, and you are always in our thoughts. In the shared love of our Savior, L.D.\_

It was followed by the scribbled personal notes.

\_I may be able to deceive Louisa, and the world, but I do not deceive myself. God forgive me, when I confess that the conversion of the Heteromorphs is not my main goal. For while the message of Christ might wait until they return to their winter base on Macquarie Island, other matters cannot wait. My poor Louisa. Six months, at most. Already she is weakening, and the hectic blush sits on her cheek. Next May would be too late. I must take Louisa now, and pray that the Maori report of powerful Heteromorph medical skills is not mere fable.\_

\_We will carry with us the word of Christ. Louisa is filled with confidence that this is enough for every purpose, while I, rank apostate, am possessed by doubts. Suppose that they remain, rejecting divine truth, a

nation of traders? I know exactly what I want from them. But what do I have to offer in return?\_

\_Perhaps this is truly a miracle of God's bounty. For I can provide what no man has ever seen before, a marvel for this and every age: Louisa's great Engine, which, in insensate mechanic operation, appears to mimic the thought of rational, breathing beings. This, surely, must be of inestimable value and interest, to any beings, no matter how advanced.\_

Then came a final entry, the writing of a man in frantic haste.

\_Louisa has at last completed the transformations of the information that I received from the Heteromorphs. We finally have the precise destination, and leave tomorrow on the morning tide. We are amply provisioned, and our native crew is ready and far more confident than I. Like Rabelais, "Je m'en vais chercher un grand peut-etre." God grant that I find it. \_

\_I go to seek a "great perhaps."\_ I shivered, stood up and went through to the bedroom, where Bill was pulling on a sweater.

"The Analytical Engine. They took it with them when they left."

"I agree." His expression was a strange blend of satisfaction and frustration. "But now tell me this. \_Where did they go\_?"

"I can't answer that."

"We have to. Take a look at this." Bill headed past me to the kitchen, his arms still halfway into the sleeves. He picked up the folder of drawings that we had brought from the crawl space. "You've hardly glanced at these, but I've spent as much time on them as on the letters. Here."

He passed me a pen-and-ink drawing that showed one of the creatures seen from the front. There was an abundance of spindly legs -- I counted fourteen, plus four thin, whiskery antennae -- and what I took to be two pairs of eyes on delicate protruding eyestalks.

Those were the obvious features. What took the closer second look were the little pouches on each side of the body, not part of the animal and apparently strapped in position. Held in four of the legs was a straight object with numbers marked along its length.

"That's a scale bar," said Bill, when I touched a finger to it. "If it's accurate, and I've no reason to think Luke Derwent would have drawn it wrong, his 'Heteromorphs' were about three feet tall."

"And those side pouches are for tools."

"Tools, food, communications equipment -- they could be anything. See, now, why I told you I thought for the past couple of weeks I was going mad? To have this hanging in front of me, and have no idea how to handle it."

"That place he mentioned. Macquarie Island?"

"Real enough. About seven hundred miles south and west of here. But I can promise you, there's nothing there relating to this. It's too small, and it's been visited too often. Anything like the Heteromorphs would have been reported, over and over. And it's not where Derwent said he was going. He was heading somewhere else, to their more permanent base. Wherever that was." Bill's eyes were gleaming, and his mouth was quivering. He had been living with this for too long, and now he was walking the edge. "What are we going to \_do\_?"

"We're heading down to Big House, so Annie can feed us. And we're going to talk this through." I took his arm. "Come on."

The cold morning air cut into us as soon as we stepped outside the door. As I had hoped, it braced Bill and brought him down.

"Maybe we've gone as far as we can go," he said, in a quieter voice. "Maybe we ought to go public with everything, and just tell the world what we've found."

"We could. But it wouldn't work."

"Why not?"

"Because when you get right down to it, we haven't found anything\_. Bill, if it hadn't been you who sent me that letter and package of stuff, do you know what I would have said?"

"Yeah. Here's another damned kook."

"Or a fraud. I realized something else when I was reading those letters. If Jim and Annie Trevelyan had found everything in the crawl space, and shipped it to Christchurch, it would have been plausible. You can tell in a minute they know nothing about Babbage, or computers, or programming. But if you wanted two people who could have engineered a big fat hoax, you'd have to go a long way to find someone better qualified than the two of us. People would say, ah, they're computer nuts, and they're science history nuts, and they planned a fake to fool everybody."

"But we didn't!"

"Who knows that, Bill, other than me and you? We have nothing to show. What do we do, stand up and say, oh, yes, there really was an Analytical Engine, but it was taken away to show to these aliens? And unfortunately we don't know where they are, either."

Bill sighed. "Right on. We'd be better off saying it was stolen by fairies."

We had reached Big House. When we went inside, Annie Trevelyan took one look at our faces and said, "Ay, you've had bad news then." And as we sat down at the table and she began to serve hot cakes and sausage, "Well, no matter what it is, remember this: you are both young, and you've got your health. Whatever it is, it's not the end of the world."

It only seemed like it. But I think we both realized that Annie Trevelyan was smarter than both of us.

"I'll say it again," said Bill, after a moment or two. "What do we do now?"

"We have breakfast, and then we go back to Little House, and we go over everything, together. Maybe we're missing something."

"Yeah. So far, it's a month of my life." But Bill was starting to dig in to a pile of beef sausage, and that was a good sign. He and I are both normally what Annie called "good eaters," and others, less kind, would call gluttons.

She fed us until we refused another morsel of food, then ushered us out. "Go and get on with it," she said cheerfully. "You'll sort it out. I know you will."

It was good to have the confidence of at least one person in the world. Stuffed with food, we trudged back up the hill. I felt good, and optimistic. But I think that was because the materials were so new to me. Bill must have stared at them already until his eyes popped out.

Up at Little House once more, the real work started. We went over the letters and diary again, page by page, date by date, phrase by phrase. Nothing new there, although now that we had seen it once, we could see the evidence again and again of the brother-sister/husband-wife ambivalence.

The drawings came next. The Heteromorphs were so alien in appearance that we were often guessing as to the function of organs or the small objects that on close inspection appeared to be slung around their bodies or held in one of the numerous claws, but at the end of our analysis we had seen nothing to change our opinions, or add to our knowledge.

We were left with one more item: the ledger of tables of numbers, written in the hand of Louisa Derwent. Bill opened it at random and we stared at the page in silence.

"It's dated October, 1855, like all the others," I said at last, "That's when they left."

"Right. And Luke wrote 'Louisa has completed the necessary calculations.'" Bill was scowling down at a list of numbers, accusing it of failing to reveal to us its secrets. "Necessary for what?"

I leaned over his shoulder. There were twenty-odd entries in the table, each a two or three digit number. "Nothing obvious. But it's reasonable to assume that this has something to do with the journey, because of the date. What else would Louisa have been working on in the last few weeks?"

"It doesn't look anything like a navigation guide. But it could be intermediate results. Worksheets." Bill went back to the first page of the

ledger, and the first table. "These could be distances to places they would reach on the way."

"They could. Or they could be times, or weights, or angles, or a hundred other things. Even if they are distances, we have no idea what units they are in. They could be miles, or nautical miles, or kilometers, or anything."

It sounds as though I was offering destructive criticism, but Bill knew better. Each of us had to play devil's advocate, cross-checking the other every step of the way, if we were to avoid sloppy thinking and unwarranted assumptions.

"I'll accept all that," he said calmly. "We may have to try and abandon a dozen hypotheses before we're done. But let's start making them, and see where they lead. There's one main assumption, though, that we'll have to make: these tables were somehow used by Luke and Louisa Derwent, to decide how to reach the Heteromorphs. Let's take it from there, and let's not lose sight of the only goal we have: we want to find the location of the Heteromorph base."

He didn't need to spell out to me the implications. If we could find the base, maybe the Analytical Engine would still be there. And I didn't need to spell out to him the other, overwhelming probability: chances were, the Derwents had perished on the journey, and their long-dead bodies lay somewhere on the ocean floor.

We began to work on the tables, proposing and rejecting interpretations for each one. The work was tedious, time-consuming, and full of blind alleys, but we did not consider giving up. From our point of view, progress of sorts was being made as long as we could think of and test new working assumptions. Real failure came only if we ran out of ideas.

We stopped for just two things: sleep, and meals at Big House. I think it was the walk up and down the hill, and the hours spent with Jim and Annie Trevelyan, that kept us relatively sane and balanced.

Five days fled by. We did not have a solution; the information in the ledger was not enough for that. But we finally, about noon on the sixth day, had a problem.

A mathematical problem. We had managed, with a frighteningly long list of assumptions and a great deal of work, to reduce our thoughts and calculations to a very unpleasant-looking nonlinear optimization. If it possessed a global maximum, and could be solved for that maximum, it might yield, at least in principle, the location on Earth whose probability of being a destination for the Derwents was maximized.

Lots of 'ifs.' But worse than that, having come this far neither Bill nor I could see a systematic approach to finding a solution. Trial-and-error, even with the fastest computer, would take the rest of our lives. We had been hoping that modern computing skills and vastly increased raw computational power could somehow compensate for all the extra information that Louisa Derwent had available to her and we were lacking. So far, the contest wasn't even close.

We finally admitted that, and sat in the kitchen staring at each other.

"Where's the nearest phone?" I asked.

"Dunedin, probably. Why?"

"We've gone as far as we can alone. Now we need expert help."

"I hate to agree with you." Bill stood up. "But I have to. We're out of our depth. We need the best numerical analyst we can find."

"That's who I'm going to call."

"But what will you tell him? What do we tell anyone?"

"Bits and pieces. As little as I can get away with." I was pulling on my coat, and picking up the results of our labors. "For the moment, they'll have to trust us."

"They'll have to be as crazy as we are," he said.

The good news was that the people we needed tended to be just that. Bill followed me out.

\* \* \* \*

We didn't stop at Dunedin. We went all the way to Christchurch, where Bill could hitch a free ride on the university phone system.

We found a quiet room, and I called Stanford's computer science department. I had an old extension, but I reached the man I wanted after a couple of hops -- I was a little surprised at that, because as a peripatetic and sociable bachelor he was as often as not in some other continent.

"Where are you?" Gene said, as soon as he knew who was on the line.

That may sound like an odd opening for a conversation with someone you have not spoken to for a year, but usually when one of us called the other, it meant that we were within dinner-eating distance. Then we would have a meal together, discuss life, death, and mathematics, and go our separate ways oddly comforted.

"I'm in Christchurch. Christchurch, New Zealand."

"Right." There was a barely perceptible pause at the other end of the line, then he said, "Well, you've got my attention. Are you all right?"

"I'm fine. But I need an algorithm."

I sketched out the nature of the problem, and after I was finished he said, "It sounds a bit like an under-determined version of the Traveling Salesman problem, where you have incomplete information about the nodes."

"That's pretty much what we decided. We know a number of distances, and we know that some of the locations and the end-point have to be on land. Also, the land boundaries place other constraints on the paths that can be taken. Trouble is, we've no idea how to solve the whole thing."

"This is really great," Gene said -- and meant it. I could almost hear him rubbing his hands at the prospect of a neat new problem. "The way you describe it, it's definitely non-polynomial unless you can provide more information. I don't know how to solve it, either, but I do have ideas. You have to give me all the details."

"I was planning to. This was just to get you started thinking. I'll be on a midnight flight out of here, and I'll land at San Francisco about eight in the morning, your time. I can be at your place by eleven-thirty. I'll have the written details."

"That urgent?"

"It feels that way. Maybe you can talk me out of it over dinner."

After I rang off, Bill Rigley gave me a worried shake of his head. "Are you sure you know what you're doing? You'll have to tell him quite a bit."

"Less than you think. Gene will help, I promise." I had just realized what I was doing. I was cashing intellectual chips that I had been collecting for a quarter of a century.

"Come on," I said. "Let's go over everything one more time. Then I have to get out of here."

\* \* \* \*

The final division of labor had been an easy one to perform. Bill had to go back to Little House, and make absolutely sure that we had not missed one scrap of information that might help us. I must head for the United States, and try to crack our computational problem. Bill's preliminary estimate, of 2,000 hours on a Cray-YMP, was not encouraging.

I arrived in San Francisco one hour behind schedule, jet-lagged to the gills. But I made up for lost time on the way to Palo Alto, and was sitting in the living-room of Gene's house on Constanza by midday.

True to form, he had not waited for my arrival. He had already been in touch with half a dozen people scattered around the United States and Canada, to see if there was anything new and exciting in the problem area we were working. I gave him a restricted version of the story of Louisa Derwent and the vanished Analytical Engine, omitting all suggestion of aliens, and then showed him my copy of our analyses and the raw data from which we had drawn it. While he started work on that, I borrowed his telephone and wearily tackled the next phase.

Gene would give us an algorithm, I was sure of that, and it would be

the best that today's numerical analysis could provide. But even with that best, I was convinced that we would face a most formidable computational problem.

I did not wait to learn just how formidable. Assuming that Bill and I were right, there would be other certainties. We would need a digital data base of the whole world, or at least the southern hemisphere, with the land/sea boundaries defined. This time my phone call gave a less satisfactory answer. The Defense Mapping Agency might have what I needed, but it was almost certainly not generally available. My friend (with a guarantee of anonymity) promised to do some digging, and either finagle me a loaner data set or point me to the best commercial sources.

I had one more call to make, to Marvin Minsky at the MIT Media Lab. I looked at the clock as I dialed. One forty-five. On the East Coast it was approaching quitting time for the day. Personally, I felt long past quitting time.

I was lucky again. He came to the phone sounding slightly surprised. We knew each other, but not all that well -- not the way that I knew Bill, or Gene.

"Do you still have a good working relationship with Thinking Machines Corporation?" I asked.

"Yes." If a declarative word can also be a question, that was it.

"And Danny Hillis is still Chief Scientist, right?"

"He is."

"Good. Do you remember in Pasadena a few years ago you introduced us?"

"At the Voyager Neptune fly-by. I remember it very well." Now his voice sounded more and more puzzled. No wonder. I was tired beyond belief, and struggling to stop my thoughts spinning off into non-sequiturs.

"I think I'm going to need a couple of hundred hours of time," I said, "on the fastest Connection Machine there is."

"You're talking to the wrong person."

"I may need some high priority access." I continued as though I had not heard him. "Do you have a few minutes while I tell you why I need it?"

"It's your nickel." Now the voice sounded a little bit skeptical, but I could tell he was intrigued.

"This has to be done in person. Maybe tomorrow morning?"

"Friday? Hold on a moment."

"Anywhere you like," I said, while a muttered conversation took place at the other end of the line. "It won't take long. Did you say tomorrow is Friday?"

I seemed to have lost a day somewhere. But that didn't matter. By tomorrow afternoon I would be ready and able to sleep for the whole weekend.

\* \* \* \*

Everything had been rushing along, faster and faster, towards an inevitable conclusion. And at that point, just where Bill and I wanted the speed to be at a maximum, events slowed to a crawl.

In retrospect, the change of pace was only in our minds. By any normal standards, progress was spectacularly fast.

For example, Gene produced an algorithm in less than a week. He still wanted to do final polishing, especially to make it optimal for parallel processing, but there was no point in waiting before programming began. Bill had by this time flown in from New Zealand, and we were both up in Massachusetts. In ten days we had a working program and the geographic data base was on-line.

Our first Connection Machine run was performed that same evening. It was a success, if by "success" you mean by that it did not bomb. But it failed to produce a well-defined maximum of any kind.

So then the tedious time began. The input parameters that we judged to be uncertain had to be run over their full permitted ranges, in every possible variation. Naturally, we had set up the program to perform that parametric variation automatically, and to proceed to the next case whenever the form of

solution was not satisfactory. And just as naturally, we could hardly bear to leave the computer. We wanted to see the results of each run, to be there when -- or if -- the result we wanted finally popped out.

For four whole days, nothing emerged that was even encouraging. Any computed maxima were hopelessly broad and unacceptably poorly-defined. We went on haunting the machine room, disappearing only for naps and hurried meals. It resembled the time of our youth, when hands-on program debugging was the only sort known. In the late night hours I felt a strange confluence of computer generations. Here we were, working as we had worked many years ago, but now we were employing today's most advanced machine in a strange quest for its own earliest ancestor.

We must have been a terrible nuisance to the operators, as we brooded over input and fretted over output, but no one said an unkind word. They must have sensed, from vague rumors, or from the more direct evidence of our behavior, that something very important to us was involved in these computations. They encouraged us to eat and rest; and it seemed almost inevitable that when at last the result that Bill and I had been waiting for so long emerged from the electronic blizzard of activity within the Connection Machine, neither of us would be there to see it.

The call came at eight-thirty in the morning. We had left an hour earlier, and were eating a weary breakfast in the Royal Sonesta motel, not far from the installation.

"I have something I think you should see," said the hesitant voice of the shift operator. He had watched us sit dejected over a thousand outputs, and he was reluctant now to raise our hopes. "One of the runs shows a sharp peak. Really narrow and tight."

They had deduced what we were looking for. "We're on our way," said Bill. Breakfast was left half-eaten -- a rare event for either of us -- and in the car neither of us could think of anything to say.

The run results were everything that the operator had suggested. The two-dimensional probability density function was a set of beautiful concentric ellipses, surrounding a single land location. We could have checked coordinates with the geographic data base, but we were in too much of a hurry. Bill had lugged a Times Atlas with him all the way from Auckland, and parked it in the computer room. Now he riffled through it, seeking the latitude and longitude defined by the run output.

"My God!" he said after a few seconds. "It's South Georgia."

After my first bizarre reaction -- South Georgia! How could the Derwents have undertaken a journey to so preposterous a destination, in the southeastern United States? -- I saw where Bill's finger lay.

South Georgia Island. I had hardly heard of it, but it was a lonely smear of land in the far south of the Atlantic Ocean.

Bill, of course, knew a good deal about the place. I have noticed this odd fact before, people who live south of the equator seem to know far more about the geography of their hemisphere than we do about ours. Bill's explanation, that there is a lot less southern land to know about, is true but not completely convincing.

It did not matter, however, because within forty-eight hours I too knew almost all there was to know about South Georgia. It was not very much. The Holy Grail that Bill and I had been seeking so hard was a desolate island, about a hundred miles long and twenty miles wide. The highest mountains were substantial, rising almost to ten thousand feet, and their fall to the sea was a dreadful chaos of rocks and glaciers. It would not be fair to say that the interior held nothing of interest, because no one had never bothered to explore it.

South Georgia had enjoyed its brief moment of glory at the end of the last century, when it had been a base for Antarctic whalers, and even then only the coastal area had been inhabited. In 1916, Shackleton and a handful of his men made a desperate and successful crossing of the island's mountains, to obtain help for the rest of his stranded trans-Antarctic expedition. The next

interior crossing was not until 1955, by a British survey team.

That is the end of South Georgia history. Whaling was the only industry. With its decline, the towns of Husvik and Grytviken dwindled and died. The island returned to its former role, as an outpost beyond civilization.

None of these facts was the reason, though, for Bill Rigley's shocked "My God!" when his finger came to rest on South Georgia. He was amazed by the location. The island lies in the Atlantic ocean, at 54 degrees south. It is six thousand miles away from New Zealand, or from the Heteromorph winter outpost on Macquarie Island.

And those are no ordinary six thousand miles, of mild winds and easy trade routes.

"Look at the choice Derwent had to make," said Bill. "Either he went west, south of Africa and the Cape of Good Hope. That's the long way, nine or ten thousand miles, and all the way against the prevailing winds. Or he could sail east. That way would be shorter, maybe six thousand miles, and mostly with the winds. But he would have to go across the South Pacific, and then through the Drake Passage between Cape Horn and the Antarctic Peninsula." His words meant more to me after I had done some reading. The southern seas of the Roaring Forties cause no shivers today, but a hundred years ago they were a legend to all sailing men, a region of cruel storms, monstrous waves, and deadly winds. They were worst of all in the Drake Passage, but that wild easterly route had been Luke Derwent's choice. It was quicker, and he was a man for whom time was running out.

While I did my reading, Bill was making travel plans.

Were we going to South Georgia? Of course we were, although any rational process in my brain told me, more strongly than ever, that we would find nothing there. Luke and Louisa Derwent never reached the island. They had died, as so many others had died, in attempting that terrible southern passage below Cape Horn.

There was surely nothing to be found. We knew that. But still we drained our savings, and Bill completed our travel plans. We would fly to Buenos Aires, then on to the Falkland Islands. After that came the final eight hundred miles to South Georgia, by boat, carrying the tiny two-person survey aircraft whose final assembly must be done on the island itself.

Already we knew the terrain of South Georgia as well as anyone had ever known it. I had ordered a couple of SPOT satellite images of the island, good cloud-free pictures with ten meter resolution. I went over them again and again, marking anomalies that we wanted to investigate.

Bill did the same. But at that point, oddly enough, our individual agendas diverged. His objective was the Analytical Engine, which had dominated his life for the past few months. He had written out, in full, the sequence of events that led to his discoveries in New Zealand, and to our activities afterwards. He described the location and nature of all the materials at Little House. He sent copies of everything, dated, signed, and sealed, to the library of his own university, to the British Museum, to the Library of Congress, and to the Reed Collection of rare books and manuscripts in the Dunedin Public Library. The discovery of the Analytical Engine -- or of any part of it -- somewhere on South Georgia Island would validate and render undeniable everything in the written record.

And I? I wanted to find evidence of Louisa Derwent's Analytical Engine, and even more so of the Heteromorphs. But beyond that, my thoughts turned again and again to Luke Derwent, in his search for the "great perhaps."

He had told Louisa that their journey was undertaken to bring Christianity to the cold-loving people; but I knew better. Deep in his heart he had another, more selfish motive. He cared less about the conversion of the Heteromorphs than about access to their great medical powers. Why else would he carry with him, for trading purposes, Louisa's wondrous construct, the "marvel for this and every age" -- a clanking mechanical computer, to beings who possessed machines small and powerful enough to serve as portable language

translators.

I understood Luke Derwent completely, in those final days before he sailed east. The love of his life was dying, and he was desperate. Would he, for a chance to save her, have risked death on the wild southern ocean? Would he have sacrificed himself, his whole crew, and his own immortal soul, for the one-in-a-thousand chance of restoring her to health? Would anyone take such a risk?

I can answer that. Anyone would take the risk, and count himself blessed by the gods to be given the opportunity.

I want to find the Analytical Engine on South Georgia, and I want to find the Heteromorphs. But more than either of those, I want to find evidence that Luke Derwent succeeded, in his final, reckless gamble. I want him to have beaten the odds. I want to find Louisa Derwent, frozen but alive in the still glaciers of the island, awaiting her resurrection and restoration to health.

I have a chance to test the kindness of reality. For in just two days, Bill and I fly south and seek our evidence, our own "great perhaps". Then I will know.

But now, at the last moment, when we are all prepared, events have taken a more complex turn. And I am not sure if what is happening will help us, or hinder us.

Back in Christchurch, Bill had worried about what I would tell people when we looked for help in the States. I told him that I would say as little as we could get away with, and I kept my word. No one was given more than a small part of the whole story, and the main groups involved were separated by the width of the continent.

But we were dealing with some of the world's smartest people. And today, physical distance means nothing. People talk constantly across the computer nets. Somewhere, in the swirling depths of GENie, or across the invisible web of an Ethernet, a critical connection was made. And then the inevitable crosstalk began.

Bill learned of this almost by accident, discussing with a travel agent the flights to Buenos Aires. Since then I have followed it systematically.

We are not the only people heading for South Georgia Island. I know of at least three other groups, and I will bet that there are more.

Half the MIT Artificial Intelligence lab seems to be flying south. So is a substantial fraction of the Stanford Computer Science Department, with additions from Lawrence Berkeley and Lawrence Livermore. And from southern California, predictably, comes an active group centered on Los Angeles. Niven, Pournelle, Forward, Benford and Brin cannot be reached. A number of JPL staff members are mysteriously missing. Certain other scientists and writers from all over the country do not return telephone calls.

What are they all doing? It is not difficult to guess. We are talking about individuals with endless curiosity, and lots of disposable income. Knowing their style, I would not be surprised if the Queen Mary were refurbished in her home at Long Beach, and headed south.

Except that they, like everyone else, will be in a hurry, and go by air. No one wants to miss the party. These are the people, remember, who did not hesitate to fly to Pasadena for the Voyager close flybys of the outer planets, or to Hawaii and Mexico to see a total solar eclipse. Can you imagine them missing a chance to be in on the discovery of the century, of any century? Not only to observe it, but maybe to become part of the discovery process itself. They will converge on South Georgia in their dozens -- their scores -- their hundreds, with their powerful laptop computers and GPS terminals and their private planes and advanced sensing equipment.

Logic must tell them, as it tells me, that we will find absolutely nothing. Luke and Louisa Derwent are a century dead, deep beneath the icy waters of the Drake Passage. With them, if the machine ever existed, lie the rusting remnants of Louisa's Analytical Engine. The Heteromorphs, if they were ever on South Georgia Island, are long gone.

I know all that. So does Bill. But win or lose, Bill and I are going. So are all the others.

And win or lose, I know one other thing. After we, and our converging, energetic, curious, ingenious, sympathetic horde, are finished, South Georgia will never be the same.

\* \* \* \*

This is for Garry Tee -- who is a professor of Computer Science at the University of Auckland;

-- who is a mathematician, computer specialist and historian of science;

-- who discovered parts of Babbage's Difference Machine in Dunedin, New Zealand;

-- who programmed the DEUCE computer in the late 1950's, and has been a colleague and friend since that time;

-- who is no more Bill Rigley than I am the narrator of this story.

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