

He was several weeks in the hospital, refusing to see anyone until the day of his release, when I accompanied him to the Union Station. He caught a train to New York and I never saw him again. He died a few months later of a heart attack in Warsaw. At present Dr. Simpson is in correspondence with his widow in an attempt to obtain his notes on nonlateral surfaces.

Whether these notes will or will not be intelligible to American topologists (assuming we can obtain them) remains to be seen. We have made numerous experiments with folded paper, but so far have produced only commonplace bilateral and unilateral surfaces. Although it was I who helped Slapenarski fold himself, the excitement of the moment apparently erased the details from my mind.

But I shall never forget one remark the great topologist made to me the night of his accident, just before I left him at the hospital.

"It was fortunate," he said, "that both Simpson and I released our right hand before the left."

"Why?" I asked.

Slapenarski shuddered.

"We would have been inside out," he said.

WILLIAM F. ORR_____.

Euclid Alone

T¹he elevator was passing the tenth floor when Dr. Donald Lucus started from his reverie into the panic of embarrassment he always felt when he had passed his floor unknowingly. His mind shifted with reluctance from one program to another as it was drawn to the demand for a decision by the illusion of a sudden decrease in gravity that indicated the elevator would stop on the eleventh floor. He would have approximately ten seconds to decide. He could stay on this elevator, possibly all the way to the twenty-fifth floor, and get off at six on the way down, wasting a large but certain amount of his time, resulting in only a brief moment of embarrassment before unknown engineers on the top floor, who would realize his foolish mistake when he remained in the elevator, who would smile and wonder why this absentminded old fellow hadn't been retired by the Institute yet. Or he could get off now, at eleven, and wait for the next down elevator to take him to his own floor. Again, it would be apparent to the secretary at Genetics that he had gone by his floor, and he would be aware of her, sitting behind him at her desk, thinking he had been a section head much too long and ought to be replaced. As an alternative, he could resort to subterfuge and walk down the hall to knock on the door of an empty office, pretending that he had legitimate business there.

But he had neither the will nor the energy to act out such a pantomime, when his mind needed urgently to be occupied with another problem, which it had been drawn away from by this triv-

ial face-saving decision making. In the end, he decided that getting off at eleven would waste less time than any other course of action, and that was, after all, the most important consideration.

As it was, he made this decision too late to avoid another embarrassment, that of being hammered on both sides by the elevator doors as he stepped out, while the secretary of Genetics looked up and smiled. An automatic mumbled "Pardon me" crossed his lips as he pulled free of the gentle vise-grip and turned self-consciously to push the down button.

Only then could he relax and let his mind sink back to the complex but ordered patterns of proof which were its true medium. And that order had form quite as real as the world of elevator buttons and social ineptitude, of old men and young men and publishing deadlines and hiring policies. There was an intricate structure made entirely of straight lines in a plane that intersected in named points and formed identifiable triangles, all related to one another by a carefully chosen pattern of congruences, similarities, and equal sides and angles.

This structure had been built very carefully to its present state by a process of repetitive partial construction. All the way along the freeway he had occupied himself with the task of mentally rebuilding the structure which he had spent almost the whole night examining. He would begin each time at the same starting point, building one line at a time, noting each label, each equality and similarity, until the structure reached a degree of complexity, as it did each time, that exceeded his ability to assimilate new information and which became manifest in the sudden complete loss of a necessary fact. At this point the only possibility was to begin again at the foundation. Each time, he got a little farther in the proof, and while it might seem at first a most inefficient method of construction, it would eventually result, not only in a completed proof, but also, and more importantly, in a complete intuitive familiarity with that proof, both in its overall conception and in all its particulars.

It was a learning method that Dr. Lucas could remember having employed successfully for over forty years, and even his loss of mental agility resulted only in a longer amount of time spent with any one proof and not in any loss of total comprehension once the process was completed.

He had taken temporary comfortable refuge in the beauty and symmetry of this proof, which he could do now, shutting out all thought of the threat, the horror of its ultimate implications. The four cups of coffee kept him awake and uncomfortably numb to the eventual attack on his one sure foothold on reality. He stepped into the elevator and forcibly turned his thoughts from what he must do in the next few hours. For he was not certain what he must, could, or wanted to do. Too many roads were open to him, and they all seemed to lead to eventual dead ends. But that was only, as Hans used to tell him, his own lack of imagination, his lack of initiative to build his own road. So be it. As he began once more to piece together his elusive triangles, he was aware more than anything of the face of the secretary of Genetics, frozen in the last narrow inch between the closing elevator doors, smiling at an old, absent-minded man who held in his mind the cursed flame of destruction of this whole temple of reason.

If Ruth was aware of the worn, drugged look of his eyes and face when he entered the Math office, she did not betray this. She turned from her typing, pulled her glasses down on her nose, and regarded him with what she supposed was a friendly smile, as she always did. After the obligatory good-mornings, he paused, trying to force efficiency into his reflexes, confused over what were to be his instructions to her.

"Uh, Ruth," he began at length, "Ruth, would you get the Director on the line for me?"

"The Director, sir?"

She was not, in fact, asking for confirmation, only registering surprise. Dr. Lucas seldom had any contact with the Director, except at executive board meetings. When he did contact the Director, it was always through interoffice memo, and Ruth had shown her surprise at this breach of tradition before she had a chance to check herself. One telephoned subordinates and colleagues. One wrote to superiors.

"Uh, yes, Ruth, it's rather important."

Was there something else to say to Ruth? He had to call Publications, but that could wait until after he got the go-ahead from the Director.

"Oh, uh, Ruth, is the mail in yet?"

"No, sir, but there was a telegram. It's on your desk." She was

impatient to get back to her typing, impatient with his slow talk and his hesitation. But she would not return to work until he left the room. Office etiquette was her one comfort in this job.

"Oh, uh, thank you, Ruth." He turned to his office. At the door he paused a moment, as she said, in accordance with custom, "Would you like me to bring you a cup of coffee?"

He had anticipated the question, so his answer was immediate—in fact, clumsily abrupt. "No, thank you, Ruth."

As the door swung shut, the steady patter of her machine resumed. She would type one page to allow him time to take off his coat and get settled. She would sip her own lukewarm cup of coffee, which she nursed for three hours every morning, and then turn to the telephone. Her wrinkled face would show no sign of the joy she felt at hearing her own crisp, stiff voice conducting business efficiently and properly.

His hand was strangely empty as he took off his coat. He had left his briefcase in the car.

"Damn," he muttered. That meant he would have to go back for it during his lunch hour. He would definitely need to have the papers in it before he saw the Director. In fact, he had wanted to review Professor David's paper this morning and to check the mental construction he had prepared in the car. In any case, he would need the paper itself before he could run a computer check on the validity of the proof.

All these trivial irritations made it even more difficult to see through the haze of a sleepless night that he was caught up in something historic, in something frightening. He was not made for scrapping a lifetime of firmly held beliefs in a day, as Hans was. He was not made to be forced suddenly and rudely into a crucial position of responsibility. Hans could handle that sort of thing; he could not. Hans could submerge himself in madness and come up smiling, happy and sane. But for Donald Lucus madness, if it came, would be the end. He rested a hand on Hans's sculpture as he sat at the desk. In the outer office, the sound of typing stopped.

There was a thin wire human figure suspended inside a cage, which was formed by the edges of an irregular icosahedron, slightly skewed on its axis. Two edges of the polyhedron were broken, and the figure was falling, one hand stretched out vainly toward an edge, a bar of the cage. Its mouth was open.

"This," the artist had said to him years before over a game of Go, "this is you, Don. Not now. This is you at sixty-five. This is you and your twenty-faced monster and your quintic equation. I want you to save it for your old age and then tell me if I'm right."

He had clicked the cigarette holder between his teeth and grinned that diabolical smile that always dared you to guess whether he was joking or serious.

"Look at it, Don. And when you finally recognize yourself, write and let me know."

The telegram was brief and clear.

DON.

HANS DIED OF A STROKE FRIDAY. BETH ASKED ME TO LET YOU KNOW. FUNERAL WEDNESDAY AT ONE ST. PAULS, CINCINNATI. WILL NOT BE THERE AS THINK THAT WOULD BE BETTER FOR BETH. HOPE YOU CAN THOUGH. MUCH LOVE.

MARY

"Dr. Lucus, I have the Director's secretary on the line. The Director will not be in until ten this morning. His schedule is full today, but I can make an appointment for you Tuesday afternoon."

Tuesday afternoon. He set the telegram down and covered his eyes to think. Tuesday afternoon. He could make an appointment for Tuesday afternoon, and that would give him another day to relax, another day before he really had to do anything about the situation. But no, that was impossible. He couldn't put it off, and he couldn't *be* put off. Of course, he must see the Director immediately.

"Dr. Lucus?"

"Uh, yes, yes, Ruth. Uh, thank you, but I really must talk to the Director as soon as he comes in. It's . . . it's quite important. Would you leave a message for him to call me? It's very high priority, Ruth." He thought high priority sounded better than urgent, more professional. It was a term the Director would probably use.

"Yes, sir. Will that be all?" There was only a faint sign of reproach in her voice for this break with tradition.

"No, that's all, Ruth. Thank you."

But there was more. There was much more he had to do before lunch.

"Wait! Ruth? Ruth, would you get Publications on the phone? I want to speak to Jack Hudson. That's right. Thank you, Ruth."

He sat frozen behind his desk. He had to talk to Hudson and stop today's mailing, to recall any copies that had already been sent out, to hold them until someone could make a final decision. Someone. He should run a check on the computer, and a projection too. Ordering these things in his mind was a difficult task. There were too many factors to tell what to do first. The whole pattern of his schedule was torn, and he had left his damn briefcase with that damn paper in the car. Construct angle $F'G'H = \text{angle } GG'B$. Then, if AJ is dropped perpendicular to BG from A , $BJ = AJ$ and $BG = F'H$. Thus triangle ABG is congruent to . . . is congruent to . . . He rose, rushed to the blackboard, and began drawing furiously, attacking that hideous proof directly, headlong. He *must* find a fallacy. It *must* be false. He drew in three colors of chalk, erasing and redrawing segments in new proportions, stepping back across the room to view his diagram from a distance, making quick notations on the back of the piece of yellow paper on his desk, pacing the room jerkily and returning to the board to scowl, erase, and redraw. He hardly noticed it when Ruth buzzed to tell him Hudson was on the line. He strode to the desk, one eye on the board, and surprised himself by his handling of the situation.

Was the autumn number of the *Quarterly Mathematics Publications of the Federal Basic Research Institute* ready for mailing? Good, hold it until further notice. No, no serious problem. A rather important error that would have to be corrected. A paper might have to be removed. Had any copies been sent out? Five review copies had gone out earlier. Please have them recalled. As soon as possible, yes. Lucas himself would write to the *American Mathematical Monthly*. No, it wasn't a serious problem. It would be rather difficult to explain to a nonmathematician. Thank you very much for your cooperation, Mr. Hudson. Terribly sorry to cause your department all this bother. Yes, thank you. Good-bye, Mr. Hudson.

It took only a moment at the blackboard to regain his balance, to recover his position. His construction started at the bottom, spread out on both sides, and then began climbing upward, just as it had

in David's paper. Like some sort of tower. That's what Hans would call it, if he were here. A tower of matchsticks, something like that. Then he would insist that he was going to do a painting of it. And he might, in fact. It was rather attractive, quite nicely symmetric. The whole picture had a neat look of innocence about it, as if it were nothing more than a new proof of the Pythagorean theorem, for example. Hans would call it "The Tower That Demolished the Tower" or something like that and find the irony of it hilariously funny. The destruction of centuries of mathematical thought would mean nothing to him. It was a joke. A joke on Lucas, a confirmation of everything Hans had said over those interminable Tuesday-night games of Go.

As the tower neared its peak, it became increasingly obvious to Dr. Lucas that the proof was correct, that there was no fallacy. After six times through it, he could no longer tell himself he was not following it well enough, that he would see the obvious hole in the logic the next time through. David had been meticulous, he had left out no steps. His paper was densely written and quite thorough. Euclidean geometry was not Donald Lucas's field. He was not used to its methods of proof. But by now he could feel each lemma and corollary of David's theorem in his guts. He knew it was true. Only a computer confirmation remained.

He called the computer office and arranged for some time that evening, asked for three tapes to be sent to his office: first, CONPROOF2: Confirmation of the consistency of a proof in a mathematical axiom system given as a subroutine; second, EUBERT: Hilbert's axioms for Euclidean geometry, subroutine for CONPROOF2; and finally, LOBACHEVMANN: Lobachevskian and Riemannian geometries, subroutine for use with CONPROOF2.

Then he called the head of the computer division and explained that he wanted to run a social projection later in the week. The man was incredulous—and amused.

"In Math?" he asked.

"Yes," replied Lucas. "And I want the problem and the output to be considered Limited Interest."

The man paused only a second at the other end of the line, his mouth hanging open an inch from the receiver.

"I . . . I'll have to have an okay from the Director on that first, but all right, I'll see what I can keep open for you Friday night."

Lucus thanked him and hung up. His palms were covered with sweat. The use of the term "Limited Interest" had frightened him and impressed on him the seriousness of the thing he was doing. There was no classified research at the FBRI; its fundamental philosophy was one of "basic research in a free and open environment." All the work done in the building or under FBRI grants was published and widely disseminated. However, it occasionally became clear to the Institute officials that certain results could prove dangerous in one way or another if prematurely released to the public or to the scientific community at large. Therefore the code "Limited Interest" had been developed to refer to such work: unclassified, but kept strictly under wraps.

It was nine-thirty, and he had done all he could until he talked to the Director. The tower stood flat against the blackboard, a dead, crystalline, cutting blade of red and blue and orange. Outside the window, a squirrel darted along a branch and vanished down one of its countless customary routes in the maze of almost leafless branches. The Institute was built into the side of a hill, so that Dr. Lucas's office, which was on the sixth floor if seen from the front, actually appeared to be no higher than the third floor. He had a peaceful view of grass and sky, held fast by the swift, layered lattice of branches. Often he felt that he did his best thinking while he was standing here, running his eyes peacefully along the branching lines, like one of Kaufmann's illustrations in *Graphs, Dynamic Programming, and Finite Games*. But today he could not think in leisure. The soap-white walls that rose to enfold his world were too close now, and he was trapped, trapped and falling.

He did have one thing left to do, although he did not feel like seeing Ruth. It must be done, and it would give his mind something to grasp until he could talk to the Director. He had her come in, and he dictated a polite letter, a bit too long, to the editor of the *Quarterly* and asking that it be returned, so that it could be replaced by a corrected copy.

As Ruth got up to go, her steno pad pushed the yellow paper off his desk to the floor. He bent to pick it up and smoothed it on his desk, staring blankly at the calculations on the back. His watch said 10:05.

At ten-fifteen he still sat, frozen, his eyes open and filled with the erected sword shape plastered flat against the blackboard. It was

cutting deep into his retinas, but his mind was suspended in dreamless waking sleep that numbed the wound and held him in inanimate rigid repose. Solidity of metal and wood near him and touching him melted, and only the neat impersonal sword hung above, simple, clear, no longer threatening, neutral now as all things were within the asbestos web which held him.

He had to force his head down, to force his eyes to see the desk, the wrinkled yellow on white metal. To force his arm up, pull back the sleeve, and decide to act. Only then did his focus return, caught by the jittering watch, and then the office took clear familiar shape again around him. And fear returned.

"Ruth? Would you call the Director's office again and see if he's in yet?"

When the Director finally came on the line, he was curt and impatient. He didn't like to be bothered by petty problems; Lucas knew that.

"It's really quite urgent. I don't like to upset your schedule, but I'm afraid it can't wait until tomorrow, sir."

"Well, what is it in Math that you can't handle yourself, Lucas?" His voice was overamplified by the receiver, and there was no comfortable position for it. "If there are problems with funds or payroll, that shouldn't be handled through my office. I should think you would be able to take care of your own distribution of grants."

"Well, no, sir, it's a more important problem than that. It's research that I feel needs . . . uh . . . special attention. I mean there seem to be possible . . . possible dangers in publication of certain discoveries."

"In math, Lucas? You're exaggerating. What sort of research in math could produce . . . uh, dangers? I mean, you're surely getting carried away with your formulas, aren't you?"

"I'd rather not discuss it over the phone, sir. It is of rather . . . of rather Limited Interest."

"Oh?" Lucas could feel the younger man's eyebrows rising. "What sort of 'Limited Interest,' Dr. Lucas?"

"If I could make an appointment, sir . . ."

"My schedule is terribly busy, Dr. Lucas, and I don't see how I can fit in another appointment—unless you will tell me the nature of the problem."

Lucas was not ready for this, not ready to reveal to anyone else

the secret that, as far as he knew, he alone shared with Professor Paul David. He had not thought this far. He would have to tell another man the horrible thing that had been discovered, the horrible thing that had lain in wait for discovery all these centuries. His face covered with sweat, his hand sticky against the plastic receiver, he controlled his voice as much as he could and said, "A disproof of Euclid, sir. One of our fundees has produced a proof of the inconsistency of Euclid . . . that Euclid is not true, *cannot* be true . . ."

There was no reply, no sound. He didn't know if the Director was as shocked as he, or if he was incredulous, unable to believe such a thing. Did he perhaps share Hans's sense of the cosmic joke of the whole thing? Was he smiling with the chemist's triumphant smile at the defeat of the abstract theoretician? How would any man react to such knowledge? Lucus decided that the Director did not believe him, that no man could accept such a horrifying conclusion without rigid proof. Surely he himself had spent two days and sleepless nights in the attempt to shake the unshakable conclusion. Finally the voice answered. It was a short answer and made its point perfectly clear.

"Is that all? I think you should be able to clear that up by yourself, Lucus. After all, I don't know much about math, and I don't see why you have to bring it to my attention."

And that was it. He was unimpressed. It meant nothing to him.

"I think, sir, that it is very important that I explain the problem to you in more detail."

"All right, Lucus, all right. Come by at three, will you? I have an important call on the other line. Sorry, I have to hang up. At three."

The sigh of resignation in his voice had been almost theatrical. He hated to be bothered with petty departmental problems.

Dr. Lucus cradled his head in his arms on the desk, shaking uncontrollably with the release of tension, still alone in his fear and in his knowledge.

2

"Don, you're using strategy again. It's the same strategy; it's a textbook play." Hans Kaefig blew a thick puff of smoke at the stilled Go board. "Blurred your vision a little, Donnie. Come on, find a play that doesn't have a proverb to go with it."

Hans leaned back in his chair, hands behind his head, cigarette holder rising out of his bushy gray beard like a radius vector tracing minute burning circles in the air. He closed his eyes tight in a pantomime of cogitation. "What you need to do, Donnie, what you need to do is . . ."

Don smiled and fumbled with his pipe. He knew Hans could go on like this all night, fighting his own eternal battle with rational thought out loud, using Don's career as his battlefield, giving him advice, often self-contradictory, on how to break from the confines of Aristotelian logic and soar like a bird on the soul of his intellect. Or the intellect of his soul. The words varied proportionally to the amount of brandy consumed every Tuesday.

". . . what you need, Donnie, is to state a theorem without a proof—with no hope of a proof. Write a paper, Don, with ten or twenty wild, impossible theorems and lemmas and corollaries—no proofs . . . absurd theorems. I'll help you. I'll give you some ideas, you can rewrite them to sound mathematical. We'll publish them—inside a year someone will have proved half of them, done all the work, but they'll all be called Lucus's theorem or Kaefig's conjecture—and we'll have it made."

"Wouldn't work, Hans. No one would publish them without proof."

"Well, then—we'll publish it as a novel. That's it, a novel. You write the theorems, I'll write the sex. We'll call it *Propositional Calculus*, and start a rumor that it was written under drugs. We can cut the verbs out of all the sentences and make it look all Burroughs-y. That's the way to do mathematics, Don. Get out of the mainstream . . . underground math . . . subversive topology, that should be your field, luv."

"Hans, I appreciate your help with my career—"

"It's only that I pity you—I'm determined to make an artist of you, if you don't make me into a scientist first."

"Now have I tried to do that?"

"Oh, you're subtle, Donnie. You're subtle. And that's what I'm not. You can see my plan of action right away. But you—well, you just leave those books lying around open so I'll sneak a peek. You try to draw me to those dirty pictures: a truncated cube, a stellated dodecahatsit, two pyramids stuck through each other . . . it's warping my brain. I go to my studio and find my mind all hung up

in your simply connected sets and those tragic asymptotic curves—Tantalus damned to approach without reaching forever. What can I do? You have told me a doughnut is a coffee cup, and I have believed you. I used to paint the city and garbage and reality. Now all I know are points in space. I dream each night of being trapped in Königsberg, forever recrossing those bridges, while Euler stands by the river and laughs. Oh, don't deny it, Don. You are slowly turning me into what you are, enveloping me in symbolic logic and set theory. And I keep coming back and asking for more."

"And why do you come back?" asked Don, finishing off his brandy.

"Ah, you force me to say it! You are my muse, Professor Lucas. Without you my art would die. Without you, my dear friend, I would paint only the city and garbage and reality."

"Oh . . . I thought Mary was your muse."

"Mary? Of course not. A muse must be unobtainable, mysterious, the artist's opposite, the soul of what he can never be. You might as well say I am Mary's muse. After all, she did dedicate a quartet to me. Am I flattered? No. We're getting divorced this year, or next year—whenever there's time."

"You're not serious, Hans!" Don hated the terrible uncertainty. In fact, he never did know when Hans was serious about *any* subject.

"Of course I am. It was her idea. Or maybe it was mine. Anyway, we talked it over and thought it would be fun. But now you've sidetracked me. I was explaining your role in my art. Ever since I started playing Go over here, look how I've improved. Look at that sketch I did of your continuous function theorem. The critics love it. They think I'm a genius."

"It's ugly, you know. It's really ugly." As much as he liked Hans, Don had never been able really to appreciate any of his work. He found it childish, simple, and sometimes repulsive. Since Hans had begun basing his things on diagrams in Don's math books, he liked them even less. They seemed to make art lifeless and mathematics unprincipled.

"Yes, it is," agreed Hans. "Very ugly. And you see, before you inspired me I'd never been able to paint anything quite that ugly. I'd tried . . . Lord, I have as good a sense of what is offensive to the eye as any other artist, but I'd never been able to put it down

on canvas. I would walk around in the slums and look at the *dreck* in the alleys and think it was ugly. I would eat starch sandwiches at the Automat and wipe my beard with a used napkin and think that was ugly. But then when I looked into your Hocking and Young and saw that wild sphere—I knew I had found it! I knew other men had seen the true vision, and I could learn from them."

"You're crazy, Kaefig," Don intoned, shaking his head.

Hans clicked his teeth against his empty cigarette holder and drew a pack of Camels from the pocket of his Levi jacket. "You've said that ever since college, my dear professor, and it hasn't made it any less true, you smug sane bastard. Let's put away the game and get drunk. I think I've done quite enough to try to save your soul for one night."

And so it went for over seven years, from Don's thirty-eighth birthday deep into his forties, until Hans and Mary finally split up and he moved to the Midwest.

And Don never tired of his friend's harangues, because he knew there was something important there, something he should hear. And so he listened to all the nonsense and rambling, trying to sift out the bit of informational content, the little he could really learn from Hans.

Mary had been hired as conductor of the Denver Symphony, and Don had heard little from either of them since, except for sporadic Christmas cards. He had left teaching to come to the Institute at fifty-five, and there he had remained, sitting—how had Hans put it?—sitting on top of that pile of elephant tusks, lord of what little he surveyed.

A few years ago, a journalist had interviewed Dr. Lucas, because Hans had said he was the only man who could explain his sculpture *Ragtime Band*, that sprawling monstrosity that was the culmination of his fascination with the wild sphere in Hocking and Young and, according to many critics, the culmination of his career.

And now all that remained of those endless games of Go were a couple of Hans's paintings in Donald Lucas's house, the wire sculpture on his desk, and a telegram with a few hasty calculations on the back.

He worked on the program until past his usual lunchtime, carefully cross-referencing the manuals spread out on his desk. The first step had been to write out the entire proof, as well as he could

remember it, but with the diagram on the blackboard to help him. This was written in his own private notation, a hybrid of FORTRAN, mathematical symbology, and abbreviated English. The next step was to translate this into symbolic logic, using the special terms and syntax laid out by CONPROOF2 and EUBERT. Not only was it necessary to translate from one code to another; in order to avoid an impossible mass of detail, Lucus also had to augment the Hilbert axioms for Euclidean geometry with statements of all the Euclidean propositions called upon in David's proof. There was a list of these in the supplementary notes on EUBERT, and so he didn't have to worry about coding them, only that he had inserted all the necessary ones and correctly labeled them.

This was only the Euclidean part. For a while, he was afraid it would be necessary to duplicate all this work to program his Lobachevskian and Riemannian checks. But then he discovered a special tie-in in LOBACHEVMANN which would allow him to use the exact same input as was used for EUBERT and have validity checked in both non-Euclidean geometries at the same time. He was familiar enough with the use of the old CONPROOF1, but only in conjunction with such systems as TOPOSPACE and ENSN, which he used constantly in verifying topological proofs. The axiom systems for synthetic geometries had been a complete mystery to him for over thirty years, and what he had relearned in the last three days was hasty and incomplete.

So his office, normally neat to the point of sterility, took on the aspect which it had only a few days a month, those few days of feverish inspiration when he had all the business details of his position out of the way and could allow himself the luxury of creation. Directly in front of him were a programming pad, on which he was writing his final version, and a pile of scratch work. Across the upper part of the desk the three program manuals lay open; to his left was his recent reproduction of David's proof, continuous on the back of last month's budgetary output, and a stack of used scratch paper which contained calculations important enough to be saved; on his right, a well-worn FORTRAN manual on top of the three books which were almost the only customary adornment of the desk: *Webster's New Collegiate Dictionary*, Whittier's *Trilingual Mathematical Encyclopedia*, and a book of Go proverbs. The wire sculpture and desk calendar had been moved to the file cabinet to make room for all the necessary reference material.

By twelve-thirty Ruth had gone to lunch, but the programming was not nearly completed. He had to pull himself away from the pad and pencil almost violently. His hand, his whole body, and a portion of his mind were unwilling or unable to stop writing. Once the trance was broken and he was putting on his coat, it began to frighten him. Surely he worked efficiently in such a hyperactive state, but it was dangerous. He could easily push himself too far, almost unknowingly, uncaringly, if he were allowed to give himself up to the immersing impulse too often. Even as he walked through the outer office, he noticed a stiffness in his legs and neck, an ache in his back and hand, that he had been oblivious to minutes before. Returning to awareness of his body's torture, he found the temporary divorce from objectivity even more frightening, as though it had been imposed not by himself but from the outside, as though he had been driven too hard by some other being, with little or no concern for his complaints or his safety. He had been abused. And he was tired, very, very tired.

His stomach was feeling upset—from the two cups of coffee he had had with lunch, he supposed—when he returned with his briefcase and David's paper at one-fifteen. He found that once he lowered himself into the swivel chair it was necessary to sit still for several minutes to catch his breath. He knew he needed rest, but there was much more to do before he saw the Director. He tried to weigh the priorities in his mind, to reach a reasonable plan of action, but it was difficult to pin down ideas, and his thoughts were constantly intruded upon by images of congruent triangles and hyperbolic planes. Each attempt to list the tasks of the afternoon and assign time estimates to them was met with frustration, and his ears rang with the faint sound of laughing voices chattering in FORTRAN.

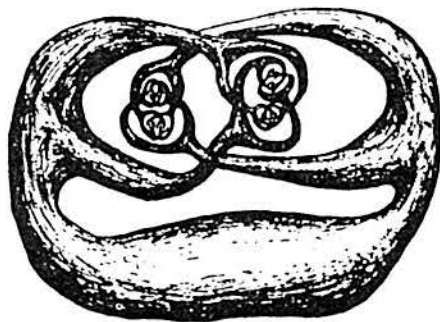
Finally he decided that the only really necessary task was to finish the programming for CONPROOF2 and have it sent to the computer division.

This took about half an hour. The work went much slower than it had in the morning. He constantly found himself looking blankly at his own notes, confusing output statements with axioms, losing his tenuous grasp on the details of David's proof.

When the whole thing was finally sent out to be punched up and compiler-checked on the A50 unit, it was ten minutes to two. He

told Ruth to call him at five to three and gratefully laid his head on his folded arms on the desk, not even bothering to darken the room.

At first sleep would not come, only sharp-edged pictures, alternately threatening and soothing: his small house, his books, Mary as she was thirty years ago, when he had thought he might marry. Unrelated images swam about in his mind: a snatch of old rock music, a lemma from the side approximation theorem, the smell of lilacs, and slowly one figure emerged from the mass and began to grow and dominate it all. At first it appeared to be only a smooth, featureless, somewhat metallic topological sphere. But this was only the bottom portion. Above, the figure split into two parts, not so much like a branching tree as like a squid with two plump arms, spread in a gentle flattened circle and coming together again—but not quite. Before the arms met, each of them split into two parts again, a thumb and an index finger, which linked together like a chain—but not quite. Before each finger reached its thumb, it was bifurcated, as was the thumb, and again the two arcs linked to form a chain—but not quite. This process continued infinitely, each step increasing the number of parts geometrically. The result was a figure simple in its construction, frighteningly complex in its final appearance.



"My God in heaven!" exclaimed Hans. "What in merciful hell is that? I never expected to find a book on demonology in your home, Donald."

Don had been at the bar pouring brandy and didn't know what Hans was referring to. By the time he got back to the table, Hans

was standing silently, biting the side of his thumb and staring fixedly at the open copy of Hocking and Young's *Topology*.

"That's Alexander's horned sphere," explained Don evenly. For a moment he too felt an uncanny horror at the picture. But it passed, and what was to Hans the image of Satan became only a wild embedding of the 2-sphere in Euclidean 3-space.

"You see," he went on, setting down the drinks, "it's topologically a sphere, but its complement is not the same as the complement of an ordinary sphere. For instance, you could link a circle around it, just like you would around a torus, and it won't come off. In fact, there are an infinite number of ways you can do it."

Hans seemed not to be listening. He did not respond when Don sat down, but continued to bite his thumb rhythmically.

"The one thing that amazes me," he said at length, "is that I have seen it—" He paused, running his fingers through his beard. "—that I have seen it . . . and I still live. What is it, Donald, and how has it found its way into your neat religious parlor?"

"I told you: it's a wild sphere. It's called Alexander's horned sphere. It's really not so extraordinary, Hans. There's a wild arc on the next page. Here's your brandy; now let's get started with the game." Don was impatient to forget the thing, for Hans to close the book and change the subject. He didn't like this reaction to a simple mathematical object, as though it were something more than it actually was.

"One could imagine Dali painting it," Hans continued, still fixing his gaze on the picture, "all ugly, bleeding lumps of flesh. That would be the obvious way. But I think I see it as a sculpture. It would have to be tremendous—say, thirty feet high—so that the branches start out fat as sequoias and end up—and end up microscopic—and never end. They should go on to the atomic level and beyond. Alexander's horned sphere. Can you see it squatting in the sun in the middle of Chicago, like some horrid, slimy crab? Yeah! Come on along, come on along. A sculpture, yes, a sculpture, that's the way I'd do it."

He slammed the book abruptly and laid it on the floor.

"Donald," he said, more in his natural voice. "Donald, if you have looked at that picture before and not felt the fear of the darkness in your veins, then all I can say is—you are hopelessly lost in your salvation. Have a Camel?"

Don shook his head, smiling, and Hans fitted a cigarette into his holder, continuing to talk between his teeth as he puffed life into it.

"Donald, the only man who is on such good terms with the devil that he can look him in the eye so casually is the satisfied theologian. You are a priest, not a prophet, and you must learn that even the bestest church what am will not protect you, your doctrinal orthodoxy will not save you, when the prophets begin to quake and wail outside the temple."

"And you are the prophet?" asked Don, egging him on.

"Hah! No, not *your* prophet. No, honey lamb, you've missed my point. Or else my analogy doesn't work out right. The prophets. Donald, I'm talking about mathematics, not art."

"Well, then I wish you wouldn't use a religious analogy. There is a fundamental difference in approach between religion and mathematics, and— No, let me finish. I know what you're going to say: that mathematics is predicated on the worship of reason. Well, that's wrong. Reason is only a tool to certain ends."

"Well, I agree, of course, Don. Reason is a tool to certain ends, and in your case those ends are basically theological. It's clear, you know, in this baroque fascination you have with the intricacies of your own proofs. You're only interested in plastering over the cracks in the temple. You've grown too dependent on it; you're afraid to worship in sunlight. Don't hide behind reason, Don. Your enemy will use the same tool. It's not reason that's against you, sweetheart; it's history."

"Anyway," Don interjected, annoyed at this turn in the conversation, "let's start playing or we'll never be done by ten."

"All right. But, Donald, I am going to do that sculpture, that Alexander's whatsit, someday. If ever I get a big commission. And you will be the only man who will understand all of its . . . all of its deeper meanings, my friend."

It was to be another fifteen years before he would get that commission and carry out his threat. It would be only twenty feet tall, not thirty, and in Cleveland, not Chicago. But it would shock, amaze, and frighten thousands of art lovers/haters, just as the original conception had shocked, amazed, and frightened Hans Kaefig.

Hans Kaefig, whose thoughts enveloped, surrounded, like rows of black disks, moving, shifting, unpredictably, while Donald Lucas's white disks coiled and struck, each move a step in a plan, each play a proverb. The patterns of black and white tessellations

became too intricate to follow, and then there was no pattern at all, only the flashing black and white and a buzzing behind them, an insistent buzzing; as seconds stretched and expanded, he groped for his thoughts, sorting out the buzzing, reached for his glasses and the button on the intercom.

"Yes, Ruth?"

"It's two fifty-five, sir."

"Thank you, Ruth. Thank you."

He sat another minute, not really awake. Then, both hands on the chair, he lifted himself to his feet and did his best to tidy his suit. The Director was twenty years his junior, and yet he felt like a truant student being sent to the principal's office to explain himself, and knowing that the principal is never disposed to hear explanations.

3

He hadn't prepared a lecture in years. He had spoken of math only with other mathematicians. He had lost the knack of translation. There were English words, phrases, similes, that could say the same thing as a few swift logical statements, but he had forgotten them. And so he did not prepare a lecture. He had no idea what he was going to say to the Director, whether to present him with a neat, clear proof or simply to shout "*Gott ist tot*," and make his point loudly and emotionally. He knew the Director was not a believer in any of the fundamental truths that were at stake. He would view a breakdown in the fabric of logic the same as a breakdown of the subway system. It was a nuisance to him, but it was certainly not his job to address himself to the problem; that was what metro engineers were paid for. That was what mathematicians were paid for. Lucas could not approach him on that level. What level he should direct his strategy toward he was not certain. He had, however, foreseen his opponent's moves well enough to expect the reception he received from the Director's private secretary.

"I'm sorry, Professor Lucas," the young man clipped, his glasses sliding down his nose in what seemed a studied parody of Ruth. "I'm sorry, but the Director is extremely busy this afternoon. I can make an appointment for Wednesday, I think . . . Of course, the Executive Board meeting is coming up next week . . ."

"That's all right, young man, I arranged to see him for a few minutes at three. I'll just slip in, and you can go back to your

datebook." He would not be stalled any longer by the technical shunting about of the organization.

The Director looked blankly up from his desk as Lucus shut the door. He mumbled something feeble about thinking it was tomorrow that they were to meet, hoping to be rid of Lucus. As it became apparent that the math head had no intention of being put off further, he graciously conceded the skirmish and turned in an overly friendly manner to the problem itself.

As they talked, he leaned back in his chair, making full use of the physical advantage of his position. He sat comfortably in his shirt-sleeves, collar open, bulky arms raised with his hands behind his head. Lucus alternately stood and sat—neither position was comfortable—in coat and tie, sweating through his shirt in the overheated office.

The Director was in his early forties, had held his position for three years. He divided his time unequally between his office, wife and children, and a girlfriend in San Jose. He drank more than Lucus had at his age, but seldom drank brandy. He was a mediocre chemist and an excellent administrator. He played golf one weekend out of two and worried that he was growing too fat. Lucus knew all this and very little else about the man. It was probable that he had studied calculus in college and forgotten a good deal of it by now, that he would be surprised to learn that an excellent mathematician might be very bad at arithmetic.

"Wait a minute," he protested before Lucus was very deep into his subject. "I thought Lobachevsky did that. I don't know much about math, but isn't that what non-Euclidean geometry is? Didn't they prove that Euclid was wrong? If it wasn't a big catastrophe then, why should it be now?"

And so he had to backtrack and try to give a ten-minute summary of the history of axiomatics. That Euclid's main contribution was not in his specific theorems, but in his method of assuming a very small number of "self-evident truths" and deriving all his results from them alone. That the question in the nineteenth century had only been over the notion of "self-evident," and then only over the fifth postulate, the so-called parallel postulate, and the exterior angle theorem. That non-Euclidean geometries had never denied the *consistency* of Euclid, but had only proposed alternative, equally consistent systems.

The Director balked at the word "consistency."

"But what's the difference between consistent and true?" he asked innocently.

"Truth has no meaning in mathematics," Lucus began. At the Director's scowl he corrected himself, for he was no logician, and these distinctions did not come quite naturally to him. "Or rather, truth is defined only relative to a given system of assumptions, you see. A statement is true in this system if it can be proved . . . I'm not sure if that's quite right . . . Well, anyway, if it necessarily follows from the assumptions. But a system of assumptions is consistent if you can't prove a contradiction from them, you see? If they could be a description of something that really exists."

"Okay, let me get this straight," said the Director, fishing a pack of Marlboros out of his pocket. "Something is *inconsistent* if you can prove a contradiction from it, right? And what your Professor David seems to have done is prove that Euclid's postulates—is that the right word?—that his axioms or postulates or whatever are inconsistent. Am I right? So that means the whole notion of Euclidean geometry is nonsense. Well, I'm no mathematician, but I don't see the problem. Luckily this Russian has given you an alternative. So if, as you say, Euclid is scrapped, you still have this hyperbolic geometry and this other one, the one like the sphere, to choose from. It's very interesting, but hardly the kind of thing that requires any sort of executive decision."

Lucus bit his lip in frustration. He had always been a bad teacher, and Hans had said that . . .

"The non-Euclidean geometries were proven consistent by Riemann and Lobachevsky—" he began.

"Yes, well, that takes care of it, doesn't it?" the younger man interrupted.

"No, it doesn't!" said Lucus, too loudly. He sat down and tried to control his voice. "Non-Euclidean geometries were proven consistent by constructing models of them *within* Euclidean space. They are *conditionally* consistent. They are consistent only if Euclid is consistent. And, in the same way, Euclid depends on them. David's proof is valid for all three."

"You mean to say that *every* system of geometry is . . . is inconsistent . . . is meaningless?"

"Yes, sir. Not just geometry. Euclid can be derived from the real

numbers. The real numbers can be derived from set theory. If Euclid is inconsistent, then the whole basis of mathematics is demolished. David's proof comprises the futility—"Donald Lucus' vision began to blur. His heart pumped blood deafeningly into his temples. There was a sharp pain in his chest. He spread his soaked and empty palms and spoke hoarsely. "—the futility of everything."

The Director was not unmoved by this display. He expected such an emotional plea on the part of a suppliant for a research grant on occasion. He was used to tearful outbursts from his girlfriend in San Jose, and he could react gently but unfeelingly in most emotional situations. But old men made him acutely uncomfortable. Emotional involvement in one's professional work puzzled and frightened him. He did not even yet understand the importance of the revelation which had been disclosed to him, but he did understand that it must be of some importance to bring this staid and dry old man to tears.

"You've checked it on the 666?" he asked.

Lucus looked away from him, embarrassed, fighting for breath, but trying not to breathe too deeply. "Not yet," he answered. "I have computer time tonight. I've made arrangements to have a social projection done this Friday, dependent on your approval."

"My approval?"

"For Limited Interest status."

"Oh." The Director rounded his lips meditatively and put his hands behind his head again. His cigarette lay in the ashtray, a long gray ash extending from the filter.

"Oh," he repeated. "Well, yes, of course. I suppose if it checks out, that you feel Something Must Be Done?"

"Yes, sir. I think there may be indications that Something Must Be Done about the problem."

And so Lucus knew that he had won the minimal confidence that he needed from the Director. The matter was to be given priority at the Executive Board meeting next week. He would have to go through the whole explanation again, many times. But it would be easier, the responsibility would no longer be entirely his. His white pieces coiled and struck across the board like a snake, squeezing the black ones out of strategic positions, reducing Hans's forces to a few holdouts near the edge. The brandy was sharp and exhilarating this evening.

4

With that trying interview over, Lucus felt a change in his mind and body. The oppressive burden was gone, and he could look forward to a great deal of time-and energy-consuming work. Responsibility was his, but it was the sort that he could be comfortable with, responsibility to get things done, to keep things moving. He spent the rest of Monday afternoon debugging the CONPROOF 2 input, which had arrived from the A50 during his absence. The work was routine, undemanding, and gently satisfying. By five-thirty it was in shape to run, and Lucus went home to dinner and eleven hours of cool and dreamless sleep.

Tuesday he worked continuously, stopping only for half an hour for lunch, fortified during the day by three cups of Ruth's dark but tasteless coffee. He had called Bibliography as soon as he got in and had his checklist headings augmented greatly. Every month articles containing certain key words or phrases in their titles or abstracts were sent to all the department heads. The controlling program was sophisticated enough to produce some very worthwhile information and very little that did not hold at least some interest for him. Now, in addition to his standard topology codes, he added a few checks in various kinds of geometry—it was, after all, likely to be his field of specialization into the foreseeable future.

David's proof had checked out perfectly in all situations, which did not surprise him at all. The program—which turned out to supply much more detailed output than he remembered from CONPROOF1—even made some suggestions on simplification of certain steps in the proof. It was indeed valid. There could be no doubt of that. He began writing up a short report on the program, which he would eventually include in his report to the Executive Board.

All day Wednesday was spent in conference with the head of the computer division, explaining in detail the results of David's proof and its connection with the rest of mathematics. They finally decided that the social projection could be done fairly easily with existing programs and data tapes, and it wouldn't be necessary to confer with Sociology—at least not until after the initial run. Lucus found himself working especially well with the man, developing an instant rapport and communicating the details of the problem much better than he had with the Director. In fact, the entire day he felt especially energetic and happy, almost euphoric, and he fi-

nally went home after seven with a genuine sense of accomplishment, disturbed only by the itching occasional thought that there was something he had meant to do but forgotten—nothing very important, but some detail that was left out, that destroyed the symmetry of the day. But this thought was eventually buried by the mass of other details, important details, enjoyable details, that competed for his time until late Wednesday evening.

Thursday and Friday were spent shuffling between two projects: the social projection and his report to the Executive Board. The Executive Board meeting, which had been scheduled to begin at two o'clock on Tuesday, was rescheduled to the morning, and all section heads were advised that some very important business might well cause it to run into most of the afternoon. The mere fact that the nature of this business was not mentioned, of course, tipped them off that it was "Limited Interest" and probably involved the sort of executive action that the Institute was theoretically not empowered to take. Actually, the Institute did stick literally to the guidelines in the Congressional bill which had authorized its founding. It served in an advisory capacity to the agencies which carried out the occasional difficult decisions which the board was sometimes forced to reach despite the seeming incompatibility of these decisions with the supposed concerns of the Institute. And if employees of the Institute were called upon to aid these other government agencies in the regrettable but necessary enforcement of decisions made in the interest of the general good, they clearly cooperated with their government as private individuals, usually in "special consultant" positions, and not as employees of the FBRI itself.

And so by adhering to the letter of its charter, the Institute managed to stretch the spirit of the charter when that spirit became a threat to more important considerations. No one on the Executive Board took this responsibility lightly. Indeed, it was the gravity, the solemnity with which they were bound to weigh questions of ethics and then exercise their own benign power in the interests of the whole of society—it was this gravity, the awesome weight of obligation and the crucial necessity of judicious application of their superior skills which secretly thrilled many of the board members and added an unequaled zest to these meetings. There had been one department head who opposed all such actions, but he had left

the Institute to return to teaching some years back. Now there was usually a broad and healthy range of opinion and discussion on questions of "interference," as it was called, Genetics holding out against exercise of such power except in the most extreme cases, Biophysics being perhaps a bit overzealous in his enthusiasm for the Institute's potential control of future events, and the rest of the departments arranging themselves variously between these two poles as befitted their individual politics, esthetics, professional ethics, temperaments, and digestive difficulties.

Mathematics, that is to say, Dr. Donald Lucas, was never entirely sure where he belonged in the spectrum, being, he knew, too easily swayed by each side of the debate in its turn, and most often casting his ballot with the majority. The issues were always too vague, uncontrollable, and, as he put it, "political," and they seemed very far from his real concerns in his work. This time, however, he had no doubt which side of the issue he would take. He would have to hold the floor himself, and he knew for certain that the Institute must take appropriate measures to head off the catastrophic events that could be instigated by David's proof.

The initial surprise of the board when they realized it was he who was going to read the report was the customary reaction he got from everybody whenever they learned that Mathematics might be involved in something important. He was the out man in the building, and he now felt a bit of pride in presenting his case, in being allowed to overshadow their scientific concerns with the problems of *his* field for an entire morning, perhaps for a whole workday.

He began by giving a precise and ordered account of David's proof, its connection with the previous history of mathematics, and the interrelation of geometry with the foundations of all modern mathematical theory.

After this, and before the presentation by Computers and Sociology of the social projection, there was a period of questions directed to Lucas, as was customary, to ensure that everyone had a clear understanding of the issue. As it was, a number of them did, but the others were often reluctant to question a speaker in another field, less for fear of exposing their own ignorance than out of professional courtesy and a desire to avoid any question which might appear as a challenge to the speaker's competence. It was usually

understood that each head considered his colleagues as the final experts in their own fields, and their private terrain must be respected, as they respected his. An attempt to gain too complete an understanding of his territory was dangerously close to a take-over of his sovereign province. So the questions were only halfhearted requests for clarification about Hilbert's axioms and the independence of the parallel postulate. Until Genetics raised a fluttering hand and asked with a Socratic smirk, "You say that the principles of Euclidean geometry can be derived from set theory, and, of course, this can be verified on the 666?"

"That's right."

"And so it all falls back on the principles of symbolic logic, and theoretically you could put the whole thing in terms of a proof in logic?"

"Yes, in fact, there is a program which can do just that with most mathematical proofs, and once I get around to it I intend—"

"Yes, yes. Well, very good. But isn't it true that your whole method of proof is based on symbolic logic?"

"Yes."

"And since you use this same method of proof in David's theorem—"

Lucus smiled. He knew what was being suggested.

"Since you use this same method of proof in David's theorem, and since you have *shown* that this method of proof is not valid—I mean, that's what you've shown by proving the inconsistency of symbolic logic itself—then you really haven't proved David's theorem at all, have you? I mean, have you?"

Naturally, most of the board members were made acutely uncomfortable by this want of tact, and especially by Genetics' toothy grin as she spread her hands and waited for an answer. She was most unpopular, and it was rumored that she was not likely to remain much longer at the Institute. These rumors, however, had been circulated for a number of years with no noticeable effect on her position or her unwillingness to initiate a change of career herself. She was fifty-five now, and if she remained at the Institute many more years she was quite likely to become the Grand Old Lady, in which case her position and power would be unchallengeable until her own gracious retirement.

But now she was a minority of one, smiling at Lucus that same

wide friendly smile that her secretary had conscientiously striven to imitate, smiling and waiting. He was not prepared for this particular question, but he had taught basic math courses long enough to be familiar with its general tactics. It was, put on the grossest level, to dismiss mathematical jargon as a lot of nonsense. But, applied more subtly, it consisted of pointing out illogicality in the nature of the mathematical approach, in the detection of ubiquitous paradoxes, all of which eventually boiled down to some variation on the Russell paradox: the serpent of mathematics was forever swallowing its own tail. But Russell had long ago found a solution in the simple expedient of multiplying the number of serpents and lining them up to swallow each other's tails, a much more plausible situation, and happily one which introduced no further problems until the level of transfinite numbers was reached, and here the mathematician was again swimming in his own medium.

"But your argument can only serve to confirm David's proof. You are arguing from a paradox, from the absurd." Lucus returned her smile, feeling around his shoulders the temporary, illusory mantle of the Grand Old Man.

"How so?" she asked.

"Well," he continued, "simply because the method of proof of David's theorem is invalid, that does not insubstantiate its result—no, wait, let me finish—at best you would have to conclude that it is proven neither true nor false. Now suppose you assume that the basis of logic is in fact *valid*. Then you are forced to accept David's theorem and the proof of the *invalidity* of your logic; you are led to a contradiction. Therefore the assumption of the validity of logic is untenable."

"But, on the other hand," she objected, "if you assume that logic is invalid, then David's proof is invalid."

"Precisely. And that is a perfectly consistent position. David's theorem does *not* say 'This sentence is false.' It says 'This sentence is unprovable,' and therefore it must be true."

"I think you're talking in circles," said Genetics.

"It's all very well for you to think that, but the fact remains that this position is sound—it can easily be verified on the 666."

The remaining questions were dutiful inquiries into the nature of the Russell paradox, and each answer was followed by a polite "Oh,

yes, I see." Lucus was calm and confident by the time Computers and Sociology began their description of the social projection.

The problem had been of quite a different nature from that of most of the projections that had been introduced to the board. Usually, a discontinuity was introduced into a percentage prediction pattern and the other initial conditions were varied within certain ranges, so that the effects of the invention of some new device or some new discovery in physical law could be ascertained, both short-and long-range effects. The discontinuity had some direct and immediate effect on material or political conditions, on arms capabilities or projected population figures or the economy. A good deal of such research had been done, it was true, with discontinuities of a religious or philosophical nature, and the sort of results obtained was quite well understood by those in the field. The Institute as a whole was seldom concerned with such results. It was the responsibility of other branches of the government to deal with the possible detrimental long-range effects of new religious or philosophical movements.

The projection for David's theorem showed remarkably unperurbed figures for a long period. Even in the mathematical world, it was predicted, little notice would be taken of it for fifteen to twenty years, notwithstanding its immediate effect on Dr. Lucus. It would be dismissed and ignored—at first. But within thirty years the disruption of the mathematical world would become violent and begin spreading into other fields. Still it would remain an academic debate. There would be much name-calling and side-taking, the introduction of heated emotions into decisions of hiring, tenure, structuring of mathematics and science departments. But still the public at large would remain entirely unaware of the issue. New schools of philosophy would arise to address themselves to the problem. Within forty years the issue would be taken up in the public press, the result being an increase in the polarization of scientists in all fields, and within fifty years, sixty at the outside, a violent antisience reaction at all levels of government, huge cut-backs in funding, reduction of departments in universities all over the country, massive shutdowns of laboratories, and even elimination of many industrial research programs. The original issue would be mostly forgotten by this time; it would be the widespread fear of being dominated by scientists, scientists pictured as

caricatures from Vincent Price movies, that would be the main concern of the public. But the effects would be disastrous for the scientific community.

There was heated discussion on this projection until one o'clock, when the board took an hour break, and then reconvened for the afternoon session. There was particular objection to the long-range nature of the projection. Many members of the board felt it was not their duty to be concerned with developments half a century in the future, and some of them were highly skeptical of the accuracy of the 666's figures for such a period, although error estimates were given for all figures, and they usually didn't get beyond 5 or 10 percent at the sixty-year level.

To many it still seemed incredible that a mathematical theorem could have such an effect, but the evidence of the 666 was hard to dispute. Only Genetics objected to the input and assumptions of the projection program itself.

"What you don't assume," she said to Lucus, again smiling with all her teeth, "is the ingenuity of the world's mathematicians. The program projects the proof of one theorem into the future, without considering what else will be proved in the future. If you scrap geometry, why shouldn't a new geometry arise? If you scrap Aristotelian logic, why shouldn't a new logic arise?"

"I assure you, madam," answered Lucus, "the proof is valid for *all* logics, for intuitionism as well as for the many-valued systems."

"And there are no other roads?" she asked cynically.

"And there are no other roads."

"Well, then, I would suppose your field is likely to come to a stagnant standstill in any case, with or without any help from Professor David."

There were shocked murmurs of censure up and down the table. Cryogenics, who had intended to question the methods of formulation of the theorem for the 666, thought better of it and folded his hands in silence.

The debate went on, but there was a marked increase of support for Lucus. By seven, when the final ballot was taken, he sat content, watching the other men and women folding their slips of paper. There was a sense of camaraderie, of common purpose, that he had never felt before with the Institute personnel. It was much like serving on the Honor Code Committee in college: the shared duty,

the secret debates, and the final pride in the satisfying justice of the verdict, a day very well spent creeping, creeping to a close.

It was the consensus of the Executive Board that Something Must Be Done, and with that most of them could entirely forget the problem in good conscience. For Lucus, however, there were more meetings with the Director and Sociology, conferences in Washington, and an eventual temporary advisory post in an agency of the executive branch.

He returned to his work at the Institute, allotting a few hours a week to his new advisory position, the few hours he used to devote to research, research which seemed to lose some of its insistent appeal now that he had other important duties. The fall *Quarterly* came out only two weeks late, minus David's article, with a brief editorial apology for the delay. Letters had to be written, editors conferred with to assure the difficulty of David's publishing his article elsewhere in the near future. Meanwhile, the foundation was laid for the discrediting of any publication he eventually managed to achieve. The strategy was all laid out by experts in Washington who had handled similar cases, and Lucus had only to implement a few of the moves which required the prestige of his position in his field. Fortunately, David was up for tenure at his university that year. When it was not granted, he had immense difficulty obtaining a position elsewhere. He was quite a meek man, and certainly not paranoid enough to accuse anyone of being involved in a conspiracy against him. He ended up turning to high school teaching, which allowed him less and less time for any serious research.

The whole problem was neatly and efficiently disposed of, and Lucus could not help admiring the simplicity of the plan of action. He had carried out his own part of the program carefully and professionally. No one could reproach him. He had represented his profession admirably.

5

"You're a creep!" said Hans, coming up behind him on his way back to the dorm after class.

"What do you mean by that?" he asked without turning, gripping his books tighter, feeling the strength in his fingers against them.

"You're a creep, Lucus, that's what!" Hans held up the morn-

ing's edition of the school paper. "Look at this, you creepy bastard! That was really a rotten thing to do."

"Look, the whole committee voted on Jonathan!" Don left the brick walk and cut across the lawn, anxious to be rid of Kaefig.

"And I know how you voted too, you creep!" Hans insisted. "And now the poor kid'll be expelled, just because he got caught cribbing on one little exam . . . and you can be smug about it. Can't you find a better way to save the honor of your precious code?"

"It wasn't one little exam, Hans, and besides—let go of me!—and besides, it wasn't just Jonathan we had to think of; it was the integrity of the whole school and the honor code. How long do you—I said let go of me!—how long do you think the faculty would let us keep the honor code if we let everybody off who broke it? Hey, get away! I've got to go to lunch!"

He dropped all his books as Hans wrestled him to the ground. It wasn't much of a match; Don was a skinny kid, and he was more worried about keeping his glasses from slipping off than in putting up a fight. He was soon on his back with Hans on top. Hans swiftly pulled off his glasses and slapped him twice, hard. He lay still, his face stinging and wet, as Hans got up.

"I had to do that, Donnie, because of the rotten thing you did to Jonathan. You understand that, don't you? I mean, we don't have to talk about it anymore. That was all I wanted to say." He held up the palm of his right hand. "You okay now?"

Don nodded. His face was hot with fear, his eyes turned upward, away from Hans.

"See you tonight for a beer?"

Don nodded. He closed his eyes and dug the fingers of one hand into the cool soil. But Hans still waited, out of his field of vision, tired and afraid; unsure, Hans waited for an answer.

"Kaefig, you're crazy!" he whispered.

He lay there, not moving, long after Hans had gone. The tree above was blurred, but he could trace the pattern of its larger branches, and the smaller ones seemed to wink in and out of existence. If he concentrated and squinted, he could follow even those, tracing the patterns over and over with his eyes and his mind. He often looked at trees, never tired of looking at trees, sliding along the limbs with his eyes, absorbing the whole of the latticework.

Every year there were new branches on the tree outside his window. Even this year, strange as it might seem, new green branches on the tree outside the window of the elephants' graveyard. To lose himself on these branches. To reach up and out with his mind. To lie prone on earth and cease to ponder on himself, the while he stared at nothing, drawn nowhere. His breath came with more difficulty these days, his hands would not close with ease and pained him when they did. Walking was an effort and all chairs too hard and wrongly proportioned. He longed to—what was the verse?—to

*seek release
From dusty bondage into luminous air.*

But he was no hero. What lay on his desk was merely dry and inevitable. The morning's mail, a cup of coffee, the laughing icosahedron. He had thumbed through the journals marked for his attention by Bibliography late in the morning. And there it was, in a Polish journal of logic, to be sure. In German, yes, but there could be no mistake: "*Die Widersprüchlichkeit der Logikgrundsätze als Folge eines geometrischen Beweises*," by Kálmán Kodály of the University of Budapest.

Of course, it had to happen; anyone should have known. He placed one hand on the icosahedron, no longer needing to look at it, and raised himself to his feet. He walked slowly to the window, knowing he would find something there, the vision of order and neutrality, of "light anatomized." It was waiting for him, soft and green and easy on his eyes. And for long minutes that morning, Donald Lucus stood at his window, tracing the lines, the beautiful lines of the tree, and wept for the death of his dear friend Hans.

MARC LAIDLAW_____.

Love Comes to the Middleman

Upon the wall, the neighborlings were arguing. Jack listened to the piping voices with increasing anger. The problems of the little people sounded all too much like his own, except smaller.

He opened his eyes and searched for the offending home among the array of tiny buildings stacked to the ceiling of his room. In most, the lights were dim or out completely; in a few, tiny shadows moved against the curtains. The smell of almond tobacco smoke drifted from half-open doorways; newspapers rustled. As a rule, the smaller citizens went to sleep early, and those who stayed up kept their voices down once he'd turned off his light.

Tonight, the Pewlins were the noisemakers:

"If you can't stay inside your budget, pretty soon we won't have a budget!"

"It's not me wasting money on drink and gambling."

"It's not you making money, either. I need my recreation."

"Recreation? You're a drunk with bad luck. It's not like you're developing a skill. You just get drunker and unluckier. And the next time—"

On his knees now, Jack rapped sharply on the door of the Pewlins' house with a fingernail. "Hey, in there. I've got a heavy day tomorrow."

At the sound of his voice, curtains stirred in the windows of other houses. The Pewlins, too embarrassed to face him, merely began to mutter.

"Told you you'd wake him. We're going to lose this house and end up in somebody's sock drawer."