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The Project Gutenberg eBook of Human Error, by Raymond F. Jones

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HUMAN ERROR

BY RAYMOND F. JONES

Illustrated by Paul Urban

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The government was spending a billion dollars to convince the human race that men ought to be ashamed to be men—instead of errorless, cybernetics machines. But they forgot that an errorless man is a dead man....

During its three years' existence, the first Wheel was probably the subject of more amateur astronomical observations than any other single object in the heavens. Over three hundred reports came in when a call was issued for witnesses to the accident that destroyed the space station.

It was fortunately on the night side of Earth at the time, and in a position of bright illumination by the sun. Two of the observers had movie cameras attached to their ten-inch mirrors. The film in one of these was inadequate, but the other carried a complete record of the incident from the moment of the *Griseda's* first approach, through the pilot's fumbling attempt to correct course, and the final collision.

The scene was lost for a few seconds as the wreckage drifted out of the field. The observer had been watching through a small pilot scope, however, and had wits enough to pan by hand so that he got most of the remaining fall that was visible above his horizon as the locked remnants of the Wheel and the *Griseda* began their slow, spiral course to Earth.

By the time this scene was finished, word of the disaster was already flashing to Government centers. Joe McCauley, radio operator aboard the Wheel, had been talking with Ed Harris on the *Griseda*. As a matter of routine, all their

conversation was taped, and some of this was recovered from the crash and played back at the investigation.

"—and get this," Ed was saying, "my kid had his fifth birthday just last week, and I've got him working through quadratic equations already. You've got to go some to beat that one."

"Doesn't mean a thing," said Joe. "You know how these infant brain boxes burn out. Better take him fishing and forget that stuff for a while. Hey—what the devil's going on? You got a truck driver in the control room? I just saw you out the port and it looks like you're right on top of us!"

"Jeez, I dunno. It's been like that ever since we cleared Lunaport. Sometimes I think this guy Cummins trained in a truck the way he—Hell, he's comin' up on the wrong side of the Wheel! I relayed the orders to go to the east turret. Acknowledged them himself—"

"Ed! I can see you outside the port—we're going to hit!"

The words were ripped by the shattering, grinding roar of colliding metal. Then a moment later the blast of an exploding fuel tank.

"Ed!"

"Joe—yeah, I'm here. Lights gone. Emergency power still on. Take the emergency band if you've still got a rig. I'll stand by—"

Joe switched over without comment and called Space Command Base on the emergency channel, which was always monitored. "Wheel just rammed by *Griseda*," he said. "Possible loss of orbital velocity. Extent of damage unknown."

Lieutenant James, on duty at the Base, had just returned from a three day leave and was scarcely settled in the routine of his post once more. He glanced automatically at the radar tracking screen and his face paled at the sight of the irregular figure there, slightly out of the centering circle. It was no gag.

"You're dropping," he said. "Orbital velocity must be down. Can you correct?"

"I haven't been able to contact the bridge," said Joe. "Alert all Command and have crash point computed. Stand by."

It developed that the bridge was entirely gone, along with a full thirty percent of

the station. Captain West had been spared, however, being on inspection in the other sector of the station. He came on at once as Joe McCauley managed to get the communication lines repatched.

"Emergency red!" he called. "All stations report!"

One by one, the surviving crew chiefs reported conditions in their sectors. And when they were finished, they all knew their chance of survival was microscopic. Captain West ordered: "Communicate with Base. Request plotting of crash point."

"Done, sir," Joe answered.

"Command post will be established in the radio room. Emergency steering procedure will be started on command. Man all taxi craft."

It was all on the tapes that were salvaged. Everything was done that desperate men could humanly do.



At Base, its Commander, General Oglethorpe, was in the communications and tracking room by the time Joe McCauley had established contact with Captain West.

He picked up the mike at the table. "Plug me in to the station," he commanded the Lieutenant.

He got Joe first, but the radio operator put Captain West on as soon as he arrived in the radio room. "Hello, Frank," said General Oglethorpe in a quiet voice.

"Yes, Jack—" Captain West answered. "I'm glad you're there. Does it look pretty bad?"

"Orbital velocity is down two percent. You've been falling for eight minutes."

"That's pretty bad. I've got all steering stations manned, but only thirty percent of them are still operable. We're using the taxis to give a push too. But we haven't been able to dislodge the *Griseda*. Its inertia takes almost half our available energy."

"Couldn't you get a blast from the *Griseda's* tubes to put you in orbit?"

"Adler's got a crew out there working on it. But his controls are gone, besides his fuel tanks being opened. And even if we could get their rockets operating it's doubtful we could get the right direction of thrust. Our hope is in our own rockets, and in breaking the ship away from the station."

But the closer the massed wreckage dropped toward Earth, the higher were its requirements for orbital velocity. While the crews worked at their desperate tasks General Oglethorpe sat with his eyes on the tracking scope, and the voice of his friend in his ear. He listened to Captain West's measured commands to the men in the station and to those working to free the ship. General Oglethorpe heard the repeated reports of failure to free the *Griseda*. He listened to West's orders to transfer fuel from the ship to the station as the latter's supply ran low. He watched the continued deviation of the spot on the tracking scope.

Then he turned as a lieutenant came up behind him with a sheet of calculations. "Present rate of fall indicates a crash point in the San Francisco Bay region, sir."

The General gripped the paper, his face tightening. West said, "Did I hear correctly, Jack? The San Francisco area?"

"Yes."

"We'll have to try to keep it from happening there. I'll order the rockets shut off now. We'll save enough fuel to try to do some last minute steering as we approach Earth."

"No!" General Oglethorpe cried. "Use it now! Its effect will be the same as later. Blow the chambers apart! Get back in orbit!"

"We can't make it," West said quietly. "We've gained forward velocity, but I'll bet your computers will show us better than four percent below requirements at this orbit. Spot our crash as accurately as possible on free fall from our present position. We'll save remaining fuel for last minute steering in case we're near a city."

The General was silent then as he heard the responses come back from the men who manned the rockets and who knew that with the closing of their fuel valves their own lives had also come to an end.

"We'll want testimony account for the investigation," Oglethorpe said finally. "Get the responsible officers on the circuit—but you first, Frank—"

There was a moment of silence before Captain Frank West began speaking in changed tones. "What is there to say?" he asked, finally. "You won't need to hold an investigation. I can tell you all you need to know—all you'll ever find out at least,—right now. Your decision will be the same one so many hundreds and thousands of investigating boards have made in the past: Pilot Error.

"*Human* error! That's what killed the first Wheel, and the *Griseda*. I don't know why it happened. Adler doesn't. Neither does any other man up here with us. Those who were with Cummins in the control room are dead, but they didn't know any more than we do.

"We spent a million dollars training that man, Cummins. We believed he was the best we could produce. We measured his reflexes and his intelligence and his blood composition until we thought we knew the function and capability of every molecule in his body. And then, in just one split second, he makes the decision of a moron, fumbling when he needed to be precise."

"Just what did he do?" Oglethorpe asked gently.

"Our customary approach is to the west turret. This time he had been ordered to go to the east side because of repairs on the other end of the hub. Cummins had seen and acknowledged the orders. Apparently, they slipped his mind during approach to the Wheel and he came up on the west side. Then he remembered and tried to correct his position.

"Everything must have gone wrong then. The decision was a blunder to begin with. Wrong approach, yes. But it was suicide to attempt such a detailed maneuver that close to the station. He used his side jets and slammed the *Griseda* into the Wheel at a forty-five degree angle, locking the ship in the wreckage of the rim and in the girders of the spokes."

"Was there any previous indication of instability in the pilot that you know of? We'll get a better answer on that from Adler, but we need to know if you were aware of anything."

"The answer is no! Cummins was checked out before the start of the flight just three days ago. He was all right as far as any of our means of evaluation go. As right as any man will ever be—

"Jack, listen to me. Remember when we were back at White Sands and talked of the days when there would be a Wheel up here, and ships taking off for the

Moon and for Mars?"

"I remember," said General Oglethorpe softly.

"Well, we've got a piece of that dream. But there'll never be any more, and what we've got is going to go smash unless we correct the one weakness we've never tackled properly. You'll fail again and again as long as men like Cummins can destroy twenty years' work and billions of dollars worth of engineering construction. One man's stupid, moronic error, and all of this goes to destruction, just as if it had never been.

"On the ground, a plane crashes—the board puts it down as pilot error and planes go on flying. You can't do that out here! The cost is too great. It's a sheer gamble putting this mountain of machinery and effort into the hands of men we can never be sure of. You think you know them; you do everything possible to find out about them. But you just don't *know*.

"We've solved every other technical problem that has stood in our way. Why haven't we solved this one? We've learned how to make a machine that will perform in a predictable manner, and when it fails to do so we can provide adequate feedback alarms and correctors, and we can find the cause of error.

"With a man, we can do nothing. We have to accept him, in the final analysis, on little more than faith.

"A couple of hundred men are going to die because of a human error. Give us a monument! Find out why men make errors. Produce a means of keeping them from it. Do that, and our deaths will be a small price to pay!"



These were the words of a dead man. They were heard again and again in the committee rooms and investigation chambers. They were printed and broadcast around the world, and they enabled General Oglethorpe to do the thing that became a burning crusade with him.

He would probably have failed in his effort if those words hadn't been spoken by a dying man while a shrieking, white-hot mass plunged through the atmosphere to land, finally, in the waters of the Pacific.

The wreckage missed the city of San Francisco without the necessity of guidance

by the rocket fuel so preciously hoarded by West. The *Wheel* and the *Griseda* were doomed the moment the pilot, Cummins, decided to shift the position of the ship with respect to the station.

In the anteroom of the Base Commander's office, Dr. Paul Medick rubbed the palms of his hands against his trouser legs when the secretary wasn't watching, and licked the dryness that burned the membrane of his lips.

The secretary remembered him. She probably had been the one to make out his severance papers and knew all about Oglethorpe's firing him.

Now she was no doubt wondering about the General's calling him back after that bitter occasion—just as Paul himself was wondering.

But he was pretty sure he knew. If he were right it was the opportunity of a lifetime, and he couldn't afford to muff it.

The girl turned at the sound of a buzz on the intercom. She smiled and said, "You may go in now."

"Thanks." He stood up and told his nerves to quit remembering the last time he passed through the door he was now entering. General Oglethorpe was nobody but the Base Commander, and if Paul Medick got thrown out once more he would be no worse off than he now was.

Oglethorpe looked up, a grim trace of a smile at the corners of his mouth. He shook hands and indicated a chair by the desk, resuming his own seat behind it. "You know why I called you—in spite of our past differences."

Paul hesitated. He didn't want to show his anxiety—and hopefulness—He weighed the answers that might be expected of him, and said, "It's this crash thing—and the appeal of Captain West?"

"Would there be anything else?"

"I'm flattered that you thought of me."

"There's nothing personal involved, believe me! I'd a thousand times rather have called somebody else—anybody else—but there's nobody that can do the job

you can."

"Thanks."

"Don't bother thanking me. I expect there'll still be a great deal of difference between us about the basic goals of this project. But once we start I don't want to have to fire you again."

"Just what is the nature of this project," said Paul, "its goals? Fill me in on the details."

"There are no details—beyond what you've read and heard—you're going to provide them. The objective is to find a kind of man that will keep the Frank Wests of the future from dying, as those men aboard the *Wheel* did."

"What kind of man do you expect that to be?" Paul asked.

"One who will eliminate, for all time, the damning verdict that has been handed down in tens of thousands of investigations of accident and disaster: *human error*."

"We're going to find a kind of man who can be depended on to function without error. One who can undertake a complicated task of known procedure and perform it an infinite number of times, if necessary, without a single deviation from standard."

Paul Medick regarded the General through narrowed eyes. In spite of his almost agonizing desire to possess the appointment to head up this Project he had to have a clear understanding with Oglethorpe now. He had to risk his chances, if necessary, to make himself absolutely clear.

He said, "For untold thousands of years the human race has spent its best efforts to reach the goal of perfection without achieving it. Now you propose to assemble all the money in the world, and all the brains and say: give us a perfect man! The United States Space Command demands him!"

"Exactly." General Oglethorpe's face hardened as he returned Paul's steady gaze. "No other technical problem has been able to stand before such an attack. There is no reason why this one should. And the problem *must* be solved, or we're going to have to abandon space just as we stand on the frontier, getting our first real glimpse of it."

"Your world is such a simple, uncomplicated place, General," said Paul slowly. "You want a man with two heads, four arms, and a tail? Order it! Coming up!"

"That's the way you operated when I set up your basic personnel program five years ago. It didn't work then; it won't work now."

The General's face darkened. "It *will* work. Because it has to. Men are going to the stars—because they have to. And they're going to change themselves to whatever form or shape or ability is required by that goal. They've done everything else they've ever set themselves to do—life came up out of the sea because it had courage. Men left their caves and struck out across the plains and seas, and took up the whole Earth and made it what it is—because they had courage.

"But to go to space, courage is not enough. We need a new kind of man that we've never seen before. He's a man of iron, who's forgotten he was ever flesh and blood. He's a machine, who can perform over and over the same kind of complicated procedure and never make an error. He's more reliable and enduring than the best machines we've ever made.

"I don't know where we'll find him, but he can be found, and you *will* do it, because you believe, as I do, that Man's frontier must not be closed. And because, in spite of your cynicism, you still understand the meaning of duty to your society and your race. There is no possibility of your refusal, so I have taken steps already to make your appointment official."

"You must also have prepared yourself," said Paul, "to accept me with the basic philosophy that must guide me in this matter. And my philosophy is that this Project *must* fail. It has no possibility of success. The man you seek does not exist. An errorless man would be a dead man.

"Any living man is going to make errors. That's the process of learning: make an approach, correct for error, approach again, correct once more. It's the only way there is to learn."

The General inhaled deeply and hesitated. "I know nothing about that," he said finally. "You know what I want. Even if what you say were partially true, there remains no reason why that which has been learned cannot be performed without error. I may have to put up with it, but you'll save yourself and all of us a lot of time if you don't spend three months digging up reasons why the Project can't succeed."

He stood up as if everything had been said that could possibly be said. "Let's go and have a look at your laboratory quarters."

In the hot sunlight of the Southwest desert, they walked across the yard from the administration building to a large laboratory which had been cleared to the bare floor and walls. Paul felt a sense of instability returning. But only for an instant. He'd all but insulted the General and told him he had no intention of producing the iron superman the Space Command contemplated. And still he had not been thrown out. They must want him very badly, indeed!

He had no qualms of conscience about taking the post now. General Oglethorpe had been forewarned and knew what Paul Medick's hopes and intentions were.

"You can build your staff as big as you need it," the General was saying. "This Project has crash priority over everything else. We've got the machines to go to space. The machines need the men.

"You can have anybody you want and do anything you like to them. We hope you can put them back together again in reasonable shape, but that doesn't matter too much."

Paul turned about the bare room that would serve adequately as office space. "All right," he said. "Consider Project Superman begun. Remember, I have no hope of finding a solution in an errorless human being. I'll find whatever answer there is to be found. If you have any objections to my working of those terms, say so now. I don't intend to get fired again with a Project in the middle of its course."

"You won't be. You'll find the way to give us what we need. I want you to come down to the other end of the building and meet a man who will be working closely with you."

There had been sounds of activity in the distance, and General Oglethorpe led Paul towards them. They entered a large area in which instrumental equipment was being set up. A tall, thin, dark-haired man came up as they entered.

"Dr. Nat Holt," said the General, "instrument and electronics expert. This is Dr. Medick, the country's foremost man in psychology and psychometric analysis.

"Dr. Holt will be your instrument man. He will design and build whatever special equipment your researches call for. Let me know soon what you'll need in the way of furniture and assistants."

He left them standing in the nearly bare room. Through the window they watched his stiff form march back to his own office.

Nat Holt shifted position and grinned at Paul. "I may as well tell you that the General has briefed me thoroughly on what he considered your probable reaction to the Project. I'm just curious enough to want to know if he was right."

"The General and I understand each other—I think," said Paul. "He knows I'm contemptuous of his approach to a problem of human behavior by ordering it solved. But he knows I'll take his money and spend it on the biggest, deepest investigation of human behavior via psychometrical analysis that has ever been conducted."

"It ought to be enough to buy gold fringed couches for all the analysts in the country."

Paul raised his brows. "If it's that way with you, then why are you joining me?" he asked.

"Because I have a stake in this, too! I want to see the problem solved just as much as the General does. And I think it *can* be solved. But not this way!

"There's only one way to produce men of superior abilities. The method of adequate training. Hard, brutal discipline and training of oneself. I'm going to convince Oglethorpe of it after he's seen the failure you intend to produce for him."

"That shouldn't be hard," said Paul. "It's the General's own view. The Project is simply to implement that view.

"But let's not have any misunderstanding about my intentions. I expect to give honest value in research for every dollar spent. I expect to turn up data that will go a long way toward providing better spacemen for the Command—and to give Captain West the monument he asked for!"



Alone in his hotel room that night, Paul stood at the window overlooking the desert. Beyond the distant hills a faint glow in the sky marked the location of Space Command Base. He regarded it, and considered the enormity of the thing that was being brewed for the world in that isolated outpost. Now the chance was his to prove that manhood was a quality to be proud of, that machines could be built and junked and built again, but that a man's life was unique in the universe and could never be replaced once it was crushed.

For years he'd struggled to probe the basic nature of Man and find out what divorces him from the merely mechanical. He'd known there would probably never be enough money to reach his goal. And then Oglethorpe had come, offering him all the money in the world to reach a nebulous objective that Space Command did not know was unobtainable.

Somebody was going to spend that money. With clear conscience, Paul rationalized that it might as well be him. He'd see that the country got value for what it spent, even if this was not quite what the Space Command expected.

Nat Holt was going to be a most difficult obstacle. Paul wished the General had let him pick his own technical director, but obviously the two men understood each other. In their separate fields, they were alike in their approach to human performance. Whip a man into line, make him come to heel like a reluctant hound. Beat him, shape him, twist him to the form you want him to bear.

Discipline him. That was the magic word, the answer to all things.

Paul turned from the window in revulsion, drawing the curtains on the skyglow of the Base.

Human error!

When would Man cease to indulge in this most monumental of all errors? When would he cease to regard himself and his fellows as brute creatures to be beaten into line?

He had to find the right answer before Oglethorpe and his kind found some flimsy validation for the one they had already chosen long ago.

He stood up and glanced at the clock, deciding he wanted dinner, after all. Tomorrow he'd wire Betty and the kids to get packed and be on their way. No—he'd phone tonight. She had a right to know immediately the outcome of his interview.

The dining room was almost empty. He ordered absently and clipped the speaker of his small personal radio behind his ear while waiting. He seldom used it, but here in the desert was a sense of isolation that made him seize almost compulsively upon any contact with the bright, distant world. The music was dull, and the news uninspiring. He was about to turn it off when his order arrived.

The wine was very bad; the steak, however, was good, so Paul considered it about even. His finger touched the radio switch once more. The newscaster's voice changed its tone of pounding urgency. "Repercussions of the recent crash of the world's first space station are still being heard," he said. "Murmurs of protest against construction of a new Wheel are rising in many quarters. Today they approach the proportions of a roar.

"The influential New England Times states that it is 'unqualifiedly opposed' to any restoration of the Wheel. 'In its three years' existence the structure proved beyond any question of doubt its utter lack of utility. Now its fall to Earth demonstrates the menace constituted by its presence over every city on the face of the globe.'

"Senator Elbert echoes these sentiments. 'It was utter folly in the first place to spend billions of dollars to construct this Sword of Damocles in the sky of all the world. I propose that our Government go on record denying any further intention to rebuild such a threat to the peace and well-being of nations who stand now on the threshold of understanding and friendliness which they have sought for so long.'"

Paul switched it off. He remembered the hours of world-wide tension while the Wheel was falling toward the city of San Francisco. In panic, the whole population of the Bay Area attempted evacuation, but there wasn't time. The bridges became clogged with traffic, and some hysterical drivers left their cars and jumped to the waters below.

As the wreckage neared Earth, the computers narrowed their circle of error until it was certain at last that the city would not be struck. But the damage was done. The fear remained, and now was congealing in angry determination that another Wheel would not be built.

Paul finished his meal, wondering what effect this would have on the plans to build a new Wheel—and on Project Superman. Maybe Congress would react in anger that would cut off all appropriations to the Project.

He wondered, in sudden weariness, if this would not be an unmixed blessing, after all.



The next three days were spent in telephone and telegraph communication with members of his profession as he proceeded to recruit a staff.

On Friday, Betty arrived with the kids. By the end of the following week, laboratory furniture had been installed and the first trickle of potential staff members was coming in to see what Superman was all about. Nat, too, had been busy forming his own staff and setting up basic equipment.

Paul had the feeling that they were opposing camps setting up on the same site of exploration. He tried to tell himself it was completely irrational, until Nat approached him a few days later.

"Quite a crew you're getting in here," the technician said. "You'll have to take Oglethorpe up on his offer of new buildings if you expect to find couch space for all your boys."

"That's what you're here for," Paul suggested mildly, "to do away with couches."

"Right." Nat nodded. "Anything a couch can do, a meter can do twice as efficiently."

"Sometimes both are necessary. You forget my specialty is psychometry."

"No, I'm not forgetting," said Nat. "But that's what makes it so hard for me to figure out. You're attempting to span two completely incompatible fields: science and humanities. Man behaves either as a machine or as a creature of unstable emotion. To function as one you have to suppress the other."

"Splitting Man in two has never produced an answer to anything. It has been tried even longer than couches—and with far less result."

"I'll make you a small side bet. We're going to have to work together on Superman, and coordinate all our procedures and results. But I'll bet the final answer turns up on the side of a completely mechanistic man, shorn of all other responses and motivations."

"I'll take that!" Paul said with a grim smile. "I don't know how much of an answer we'll find, but I know *that* won't be it!"

"Let's say a small celebration feed for the whole crew when Superman is completed. Nothing chintzy, either!"

They shook on it. And afterward Paul was glad the incident had occurred. It left no doubt about the direction Nat Holt would be traveling in his work.



Four weeks to the day, from the time Paul had stepped into Oglethorpe's office, he called the first meeting of his staff leaders. Invitations to the General and to Nat Holt were deliberately omitted. He wanted this first get together to be a family affair.

He felt just a little shaky in the knees as he got up before that group for the first time.

"I won't repeat what you already know," Paul said carefully. "You all know the background events that produced Project Superman.

"I am sure that each of you has also caught the two basic errors that have been assumed by the Space Command, first, that an errorless man is possible, and second, that genuine scientific discovery can be secured wholly upon command. General Oglethorpe recognizes that we consider these assumptions erroneous, but he also knows that our professional integrity demands that we pursue vigorously a course which he believes will result in success.

"We recognize, too, that we are not here to invent or produce anything that does not already exist. But, in a sense, our superiors and some of our co-workers expect us to do exactly that.

"We can agree, however, that most of Man's potential still remains to be discovered. And for us, who have hoped for a means of understanding that potential, this Project is the fulfillment of dreams. If we fail to take full advantage of it, we will win the condemnation of our profession for a century to come.

"Space Command has already concluded that a man can be stripped of his humanity and driven to an utterly mechanistic state with the robotic responses of

a machine. Let there be no mistake about it: we have been brought here to validate that conclusion.

"We will validate it by default, so to speak, unless we can produce a clean-cut analysis and demonstrations of the thing that most of us believe: that the essence of Man is more than a piece of machinery or a collection of bio-chemical reactions.

"Our science of mind and Man is on trial. If we fail, we give consent to a doctrine that will spread from space technology to all the rest of our society, and bind Man in an iron mold that will not be broken for generations. While we have been hired and will ostensibly work at the task of developing an errorless man, our basic purpose must be to validate the humanity of Man!"

He waited for their reaction. Outside, far across the open desert at the station, a rocket screamed into the air. They waited until the sound died away.

Professor Barker stood up. "There is scarcely a human being who has not by now read or heard the words of Captain West's appeal. They will be looking for the day when there will come marching from our laboratories, like a robot, the errorless man he asked for.

"Do you mean we have to fight the stated objectives of this Project? Can we not discover sufficient understanding to establish some method of training which will accomplish, in another way, the things the Space Command needs?"

"We are not fighting the Space Command's desire for more adequate men for its ships," said Paul. "We are fighting only against the false conclusions they have already formed concerning the nature of such men.

"We must solve the problem of human error. We know its purpose in the learning process. We must discover the reason for its existence in a *learned* process. We have to find out what training actually means.

"We have to ask how we know when an error has been made. It is obvious, of course, when a spaceship rams a fixed orbit station. But what of the subtler situations, where results are less dramatic, or are postponed for a long time—?"

"The primary thing to remember at this point is that our basic goal is to prevent any false confirmation of the dogma that Man is no more than a badly functioning machine, which will gain value when he has been tinkered with sufficiently so that he can slip in beside the gears and vacuum tubes and be

indistinguishable from them. And to reach this goal we must discover his true nature."

It was two weeks later that General Oglethorpe made his first visit since Superman got under way. The soldier's face seemed more deeply lined and his eyes more tired than Paul remembered seeing them before.

"You seem to have things well in hand," he said. "How soon can you give us some tangible results?"

"Results! We've just started housekeeping. In a year, maybe two, we'll have an idea where to begin a concentrated search for what you want to know."

The General shook his head slowly, his eyes remaining on Paul's face. "You aren't going to have anything like a year. You haven't got time to run down one line of research and then another. Run them all at once—a thousand of them if you want to. Why do you think you've got the budget you have!"

"Some things," said Paul, "like threading a needle—or analysing a human being—don't go much faster when a thousand men work at it than when there's only one."

"They do when there're a thousand needles to thread—or brains to pick. And that's what we're up against here. We need a volume of the kind of men we've been talking about, and we need them quick!"

"We have to find out how to get the first one."

"And you haven't got as much time now as we thought you had when Superman began. They're trying to close us up.

"We hadn't planned to build another Wheel right away, not until some refinements of design had been worked out, and we had some results from Superman.

"Now, all that's been scrapped. We've received orders from Washington that erection of a second Wheel is to begin at once, using the plans of the first one. Fabrication of structures is already under way."

"I don't understand," said Paul.

"If we don't get another one up there within a matter of weeks, this hysterical opposition among the public is liable to prevent us ever getting one there again. We have to act while we still have authority, before the crackpots persuade Congress to take it away. And by the time it's built, I want some men to put in it. Men who can be trusted to not jeopardize it the moment they put their clumsy feet aboard. I want them, Medick, and I intend to have them. That's by way of an order!"

The General rose, but Paul remained seated. "You can't get them that way, and you know it," the latter said. "We'll do all we can, as I've told you before."

"I think you'll do considerably more, now. That was quite a talk you delivered to your boys a couple of weeks ago. We will 'ostensibly work at the task of developing an errorless man', is the way I believe you put it. You're going to do a lot more than ostensibly work at it, Medick. Just how much do you think you can get away with?"

Paul remained motionless in the chair. Only his lips moved. "So you had a report on our little meeting? I hope it was complete enough to give you the rest of the things I said, that my basic purpose was not to produce human robots, but to validate the humanity of man."

Oglethorpe leaned closer, his fists resting on the top of the desk. "The humanity of man be damned! I told you before we want men who've forgotten they were ever human, men of metal and electrons. If I didn't think you were the man who could do it—probably the *only* man in the whole country—you wouldn't last here another minute. But you *can* do it, and you're going to.

"Your little lecture was enough to ruin your career in any place you try to run to, if you undermine Superman. Who do you suppose would trust you with any kind of research after that expression of intent to sabotage the Project your Government entrusted you with, and which you agreed to carry out?"

"You're finished, Medick, washed up completely in your own profession, unless you give me what I've asked for! I won't take promises any more. The only assurance you can give me from here on out is results! I want those men, and I want them damn fast!"



Professor Barker listened attentively as Paul sat across from him in the administration office and reported Oglethorpe's visit and demands.

"We're caught in a squeeze, and we've got to push both ways," Paul said. "If the Base goes down, Superman goes with it, and we've lost an opportunity that will never come again in our lifetimes. So we've got to do two things: We've got to give active support to the rebuilding of the Wheel, and we've got to develop some kind of show that will convince Oglethorpe that Superman is giving him what he wants. It will mean detouring our basic objectives, but it's necessary in order to have a project at all. I'd like you to take charge of it."

"It'll be a waste of time," Barker said slowly. "I wonder if we'll ever get back on the track."

"We'll have to gamble on it," said Paul. "I don't want you to feel I'm deliberately pushing you up a blind alley, but I think you're the best man for bringing up something we can sell Oglethorpe—while we try to do some real research on some honest goals."

"We can follow the usual lines of so-called training—brute conditioning through shock and fear and pain and discomfort. Most of the men here are already well anaesthetized in that respect. Their breakdown level is high."

"Cummins' was the highest," said Paul, "and he cracked. But work along those lines anyway. Maybe we can find a way to thicken the conditioning armor. At the same time let's push a genuine investigation into the nature of error as hard as we can. For the moment we'll forget broader objectives, until we know the Project is safe."

Barker agreed reluctantly, feeling that they would end up as mere personnel counselors before long. As soon as he left, Paul called Oglethorpe.

"I've got a suggestion," he said. "Let's not get on the defensive about this thing. Why don't you propose a Senatorial investigation of Space Command?"

"Are you crazy? Why would we want to have them come out here and pick our bones to pieces before making final burial?"

"We've got a story to tell them—remember? We've got Superman, that's going to produce for the first time in the world's history a man adequate to go into the dangers of space. And there's that little story of yours about courage. I think that would go over with them. We'd be out in front if we took the initiative in this

instead of just waiting until it rolled over us."

There was a long pause before Oglethorpe spoke again. "I wonder just what you're trying to do," he said finally. "I know you don't mean a word of what you're saying at all—"

"But I do mean it," Paul said earnestly. "I want Superman saved; you want the Wheel. It amounts to the same thing."

"You could be right. You might even be telling the truth. I'll give it some thought."



The officer in charge of the rocket crews and the take-off stand was a young engineer-soldier named Harper. Paul had met him during the first week at Base. His endorsement of Project Superman was enthusiastic.

After talking with Oglethorpe, Paul took a jeep over to the stand and located Harper. The engineer was overseeing the fueling process on a big rocket.

"Doc Medick!" Harper exclaimed. "How's your crew of head shrinkers coming along? We're just about ready for your new breed of pilots."

"What do you mean?"

"This is the nucleus ship. She's going out in orbit tonight with the first batch of supplies and instruments to get ready for the new Wheel. We're going to need your men awfully fast."

"That's what I came to talk about. Can you spare a few minutes?"

"Sure." Harper led him to the office, where the whining of fueling pumps was silenced. "What can we do for you?"

"I wanted to ask about Cummins. You knew him pretty well, didn't you?"

"Buddies. Just like that." Harper crossed his fingers.

"What went wrong, do you think? I know it's all been hashed over in the investigations, but I'd like your personal feelings about him."

Harper's face sobered and he looked away a moment. "Cummins was as good a

guy as they come," he said. "But in a pinch he was just a weak sister. That doesn't mean he didn't have a lot on the ball," Harper added defensively. "He was a better pilot than most of us ever will be, but he was just human like the rest of us."

"What do you mean, 'human'?"

"Weak, soft, failure when the going gets rough—everything we have to be on guard against every minute we're alive."

"I take it you don't think much of human beings, as such."

Harper leaned forward earnestly. "Listen, Doc, when you've been around ships as long as I have, you'll know what Captain West really meant. The weakest link in any technological development has always been the men involved with its operation. In space flight our weakness is pilots and technicians. Set a machine on course and it'll go until it breaks down—and flash you a warning before it fails. With a man, you never know when he's going to fail, and you have to be on guard against *his* breakdown every minute because he won't give any warning.

"Think what it's like to be in our shoes! We take the controls of a few hundred million dollars worth of machinery, and we know that every last man of us is booby-trapped with some weakness that can break out in a critical moment and destroy everything. We fight against it; we struggle to hold it in and act like responsible instruments. And we grow to hate ourselves because of the weak things that we are.

"Cummins was like that. He fought himself every waking hour, knowing that he had a weakness of becoming confused in a tight spot. Oh, it was nothing that even showed up on the tests, and he was the best man of any of us on the Base. But he knew it was there, just as we all know our closets bulge with skeletons that we try to keep from breaking out."

"Do you fight yourself the way Cummins did?" Paul asked.

"Sure."

"What would happen if you pulled a blunder that wrecked that ship out there on the stand?"

"I'd have had it, that's all. I'd never get within ten miles of a rocket base again as long as I lived. And there wouldn't be much worth living for—"

"It would be pretty wonderful to feel you weren't constantly on the verge of some disastrous blunder, wouldn't it?"

"It would be a rocket man's idea of heaven to handle these ships with that kind of a feeling inside him."

"We're about ready to begin running tests on Superman, and I'd like you to be the first to help us out. Can you arrange it?"

"We're tied up like a ball of string on getting the nucleus ship in orbit. I know Oglethorpe gave orders we were to jump when you called, but I'll have to check on replacements for those of us you take. What kind of test are you going to run on me?"

"I want to find out how long it takes you to make a serious error, and what happens to you when you do!"



Arrangements were made for initiating this series of tests two days later. Paul had designed them, and Nat Holt's crew had built the equipment.

But before they were started, Paul grew increasingly aware of the clamor and public agitation against the Wheel. Instead of dying out after a small spurt of anger, it was accumulating momentum in every corner of the nation.

A rabble rouser named Morgan in the middle-west had proposed a motor caravan to Space Command Base, where the participants would go on a sit-down strike until assurance was given that no Wheel would be built again. And on the heels of this came the demand by an increasing number of Senators for a full investigation of the Base.

Paul met Barker after seeing the newscast of Morgan's revivalist type appeal for a caravan of protest against the Base. "This looks like it could get to be something that would be hard to handle," Barker said. "It doesn't seem reasonable that the near-crash of the first Wheel at San Francisco could be responsible for all this commotion."

"I don't think it is," Paul answered reflectively. "The sinking of a big ocean liner doesn't produce hysterical demands that no more ships be built. The crash of an airship with a hundred people aboard is accepted for what it is, without this kind

of reaction. I think these broadcasts and write-ups of Captain West's appeal have sunk in deeper than Oglethorpe or anyone else ever intended.

"For a long time there has been building up a sense of man's inferiority to his machines. Now this incident of the Wheel and the world-wide broadcast of West's final words have triggered that inferiority into a genuine fear. They're afraid to have another Wheel up there over their heads. They're afraid that no man is capable of mastering such a piece of machinery."

Not only the public was infected with this fear, but the very men on whom the operation of the ships depended. Harper was right, Paul thought, as he reached his own office again. It must be terrible to be in their shoes, fighting constantly the conviction that they were poor miserable creatures hardly fit to polish the shining hulls of their creations!

They were trained in the best of military traditions, crushing their weaknesses by sheer force. And they had concluded their own breakdown was inevitable, in spite of their training and traditions. How could such men even hope for the stars!

But where was the flaw in it all? If the answer was not in men who were more nearly like their own machines, where was it?

They needed a year or two to even approach the problem properly, and some kind of answer was demanded within weeks!

Oglethorpe came to the laboratory the morning Harper was to begin his test runs. "We're going on a complete crash-priority basis, with round-the-clock shifts," he said. "It's been a toss-up whether to close Superman and put everything we had on the new Wheel, or leave it open in the hope of getting something out of it.

"For the time being I'm leaving it open, but remember that every hour Harper or one of his men spends here is an hour away from the job on the Wheel.

"We didn't need your suggestion about an investigation. Plenty of other people thought of it first. The Senators will be here in four or five days. You're going to talk to them. You're going to tell them what you proposed to tell them."

"Of course. And what are you going to do about Morgan's cavalcade?"

Oglethorpe spat out an exclamation. "We'll set up barricades that they'd better not cross within ten miles of Base!"

"That won't help," Paul warned. "I think you'd better let me prepare something for them, too."

"Forget them! Take care of the Senators and the Project and you'll be doing enough."

Harper arrived shortly, nervous in spite of his attempt to appear composed. But he was put at ease when they took him to the laboratory of complex testing equipment assembled by Nat Holt.

Paul indicated a seat in the middle of the mass of equipment. "As near as we've been able to make it," he said, "this simulates the landing procedure of a rocket craft. There are a hundred and thirty-five distinct actions, observations and judgements involved. A taped voice will lead you through the sequence, asking you to press buttons and make adjustments to indicate your observations and responses. When you can do all this to your satisfaction, you will turn off the tape and continue for as many cycles as you can."

"How long? A man could do that for a month, provided he didn't have to sleep."

"I think you'll be a little surprised. You will continue until your accumulation of errors becomes so great that the entire procedure collapses."

"It still looks like a kid's game to me," Harper said confidently. "Let's get started."

Carefully, they fitted the multiple electrodes of the electro-encephalograph recorder to his skull. The tape instructor was turned on, and Harper began the first cycle.

Behind the one-way glass of the observation room, Paul sat with Nat Holt and Professor Barker and two assistants, watching. The rocket engineer began jauntily, contemptuous of the simple actions required of him, impatient to have it over with and get back to his duties at the take-off stand.

The instructions coming over the speaker had some variations from the normal handling of a ship, including the items necessary to record observations and responses. Harper listened to these for a half dozen cycles. Then, confident that he could breeze through the procedure for the rest of the day if he had to, he switched off the tape and settled back to take it easy.

One by one, he watched the meters, noted their information, made the proper

adjustments, added compensations, waited for results, checked and re-checked—

"He'll go a long time," said Nat Holt confidently. "He's had top training. If it breaks down, we may find out a few things."

"Cummins had top-drawer training, too," Paul said. "His break point seemed to have no adequate antecedents. I don't think we're going to find Harper holding out very long."

After an hour, the attitude of contempt had left Harper's face, and he was proceeding with obvious boredom. He had made no error yet, but there was evident a faint trace of anxiety as he concentrated on the instruments and levers.

At two hours and a half Harper reached for a button and withdrew his hand in abrupt hesitation. Then it darted out again and pressed decisively. At three hours he was making two such hesitations every cycle.

"Not so good," Barker commented. "Not for a man who battles himself the way Harper does."

Nat Holt remained silent, watching critically the wavering dials and graphs showing the engineer's physical condition and reaction.

At four and a half hours, Harper's hand reached for a lever in the center of the board. But it didn't get more than a third of the way. In mid-air it froze, as if paralysis had suddenly struck it. Harper regarded it in seeming dumb astonishment. His face grew red, and sweat broke out upon his forehead as if from the physical exertion of trying to put his hand to the lever.

Paul grabbed a microphone and switched it on. "Touch the lever," he commanded. "Draw it toward you."

Harper looked around as if in panic, but he completed the motion. He sat staring at the panels for a full two minutes while alarm eyes went from green to yellow to red.

"Alarm red!" Paul exclaimed into the microphone. "Correct course!"

Harper turned and glared about with hate in his eyes as if to find the source of the sound. He began tearing at the wires and contacts fastened to his head and body. "To hell with the course!" he cried. "I'm getting out of here!"

He hurled the wiring harness at the panels. Then, he stood in a moment's further

paralysis and slumped finally into the chair. He put his arms and head down on the instrument desk and began sobbing deeply.

Paul put away the microphone and moved to the door. "That's the end of that," he said. "I hope our record is good. Harper might not like to go through that again."

Nat Holt was still staring through the window at the sobbing engineer. "I don't understand," he murmured. "What made him break down like that for no reason at all?"



One by one, the top engineers of the Base went through the breakdown test. Some broke down with an emotional storm as Harper had, others simply ended in a swirl of confusion that put lights flashing all over the panels. But all of them had a breaking point of some kind that could be measured in a small number of hours.

The test was a stab in the dark. It was based on an old and well-known principle that repeated tactile contact under command will break down the motor responses of the body in a matter of hours. Paul did not know whether it would actually provide a fertile lead to the problem of error or not, but it seemed the closest possible approach at present.

Nat Holt, however, was astonished at the reaction of the men. He insisted on trying it himself, determined that he would not break down no matter what happened. He lasted six hours before the panel lit up like a Christmas tree.

He subjected the resulting curves to an analyzer, and to his own he gave the most detailed attention. At the end of a full week of study on it, he called Paul with an excitement he could not suppress in his voice.

"It looks like you owe that dinner," he said. "We've got what we were looking for!"

"What are you talking about?" Paul demanded.

"We've got proof that a human being is nothing more nor less than a simple cybernetic gadget. It's a laugh—people trying to build a mechanical man all these years. That's the only kind there is!"

"You still aren't making sense."

"Come on over and see for yourself."

Puzzled and irritated, Paul left his office and went down to the analyzer laboratory. There he found Holt and his staff in a buzz of excitement.

The multiple recorder sheets were laid out on long tables, being studied intensely. Paul followed Holt to one series that was separated from the rest.

"We didn't know we had anything at first," said Holt. "The pulse was so low in amplitude that it was hard to pick out of the noise, but the analyzer showed it was consistently present under certain conditions of the subject."

"What conditions?" said Paul.

"At the exact moment of committing an error! I should say it occurs between the moment of making the decision to carry out an erroneous act and the triggering of the motor impulse that executes it."

Paul frowned. "How can you be sure it doesn't occur at any other time as well?"

"Because we've run every set of charts through the analyzer and this particular impulse comes out no other place."

"It looks very interesting," Paul said. "But why did you say you've got proof that a human being is nothing but a cybernetic gadget? I don't see what this has got to do with it."

"I didn't give you quite all the story," Holt said smugly. "I should have said that the pulse occurred every time there was an *intent* to perform an error. Sometimes that intent was not carried out."

"I don't understand."

"That pulse is nothing more nor less than a feedback pulse indicating that an action matrix has been set up which is in non-conformity with the previously chosen pattern of learning or intent. It's a feedback alarm carrying the information that an error will result if the proposed action is carried out. When the feedback is successfully returned to the action matrix a change is made until there is no feedback and a correct action is taken. When the feedback is blocked or ignored, an error results. It's as simple as that! Your complex human being is nothing but a fairly elaborate cybernetic machine operating wholly on feedback

principles. The only time he fails and breaks down is when he ceases to act like the cybernetic machine that he is!"

Holt's eyes shone triumphantly as he patted the long strips of paper on the table. Paul followed the motion of his hand and remained staring at the graphs in a kind of stunned recognition. There must be some mistake, there *had* to be. Holt's interpretation was wrong, even if the data were correct. Man, a feedback response mechanism—! If that were true a vacuum tube structure could eventually be devised to do *anything* a man could do.

"I think we'll hold off on that dinner a while yet," Paul said. "The data are interesting and, I'm sure, important—but I can hardly agree with your conclusions." Inwardly, he cursed the stiltedness he felt creeping into his voice, and his irrational resentment of Holt's continued smug grin.

"Take all the time you want," Holt said, "but when you're through you'll come up with the same answers I've got. Man is a machine and nothing else. Our only job now is to discover why the feedback sometimes fails, and to set it back on the job."

Paul took the recordings and the analyzer graphs back to his own office.

He called Barker and showed the older man what Holt had found out. "If this is true," he said, "we don't need to worry about validating Space Command's pre-chosen conclusions. It has already been done."

Dr. Barker looked puzzled and a little frightened as he sat down at the desk to examine the charts. After an hour, he looked up. "It's true," he said. "There's no escaping the fact. Look what we have here—" He pointed to a corresponding sector of the six charts he'd lined up.

"After the first feedback impulse, there was no attempt to correct," he said, "or, rather, there was a deliberate effort to suppress the feedback. This created a second, larger feedback, which, in turn resulted in increased suppression and a simultaneous enlargement of the error. The result was a hunting effect in increasingly large amplitude, like the needle of an autosyn indicator with undamped positive feedback.

"Now, here's another one with the opposite effect. In this case the hunting shows diminishing amplitude as correction of the effort results from application of the feedback pulses. One pulse is not sufficient, but they are applied in decreasing force as the intent is brought into alignment with the learned pattern. A purely mechanical response!"

Paul turned from the window through which he had been staring toward the launchers. "Then Space Command is perfectly right," he said bitterly. "We *can* give them their errorless, mechanical men—just as soon as we find ways of correcting the blockage of the feedback pulses!"

Barker leaned back in his chair and folded his hands across his moderate paunch. "I'm afraid that's right. We've been wrong all along in bucking the mechanical concept of Man. The technologists saw it long ago in a sort of intuitive way, but they couldn't prove it. Now, they can!"

"And the soul of Man is nothing but a feedback impulse!"

Barker sighed heavily. "What else, Paul?"



Morgan's Caravan appeared that evening and camped at the ten-mile limit imposed by the military police guards. They posted their signs of protest and began their picket lines. Oglethorpe sent out his sound trucks to try to scare them away, but they wouldn't scare.

Paul watched at home the broadcast of the scene, but the fate of the Base and the Wheel had almost ceased to concern him. He told Betty of the discovery Holt had made on Superman.

"It leaves nothing to account for the most valued acts of Man," he said. "It can't account for creativeness, because a cybernetic device cannot create; it can only follow a pattern. So where is the poetry, the art, the scientific invention if this is the essence of Man? It can't be, yet there's no way of getting around this thing."

"Where does the pattern come from?" asked Betty. "Isn't that the created thing which the cybernetic system tries to follow?"

Paul shook his head. "The pattern we're talking about is no more than a response to stimuli, a purely mechanical thing also. Holt claims this is all there ever is,

that what we call art, poetry, music inspiration, and intuition are nothing more than the results of badly functioning cybernetic systems. The more or less irrational results of errors in accommodating to the real world. We find pleasure in them because they tend to excuse our badly malfunctioning circuits.

"The ideal race of Man would be devoid of all this, a smoothly operating group of individuals unperturbed by emotional or artistic responses, completely capable of solving any problem in a purely cybernetic manner."

"And do you agree with it?" Betty asked.

"There's nothing else I can do! The evidence is there." He laughed shortly and moved to the window where he could see the nearby camp of Morgan's Caravan. "Human development has moved—is moving—in a completely different direction from anything I ever dreamed. Oglethorpe's iron-hard, emotionless machine-men are the only ones who'll get there. The rest of us who can't match the pace of a technological society will be shucked off as the waste part in the development of a species meant to inhabit galaxies instead of a single world."

"If I had ever wondered how you'd sound when you were completely out of your mind I'd have the answer now," said Betty.

In the morning he turned over to one of the units the task of further identifying and analyzing the feedback impulse they had discovered. In the middle of this he was called to Oglethorpe's office. The investigating Senators had arrived.

They were favorably impressed by the day-long tour that General Oglethorpe provided for them around the entire Base. But they found in Paul's announcement the strongest single factor in favor of permitting Space Command to continue with its work.

"We know now," he said, "and this is something I haven't even had time to present to General Oglethorpe—we know that a completely mechanical man is possible."

The General's eyes narrowed as Paul's flat statement continued. "We know that it is possible to have men at the helm of our ships, who are incapable of error. We have hopes of producing them within a very short time if Project Superman is allowed to continue. And when this is done, there is no technical goal we cannot reach."

This was the thing the Senators had come to find out, and they were satisfied.

"But the public has got to be reassured of this," Senator Hart said. "We need to get this mob away from your gates for one thing. The news programs keep them constantly before the public eye and the whole country is stirred up."

"We'll take care of it at once," General Oglethorpe said. "As Dr. Medick has indicated, this discovery is so new that even I had not been informed of it. Morgan's mob will go away as soon as they hear the news. And that, in turn, will reassure the entire country. We can arrange for a broadcast by Dr. Medick to the whole nation."

Paul was swept along as arrangements were made to make a statement to Morgan and his group camped outside the Base, to the press, and to the public in general.

Oglethorpe cornered him after the meeting with the Committee. "This is on the level," he said, "not something you cooked up on the spur of the moment?"

"It's on the level," said Paul. "You were right all along."

When he returned to his office an urgent message from Barker awaited him. He hurried down to the testing laboratory, where the older man greeted him in excitement and anxiety.

"It looks like we've got something by the tail and can't let go of it. Come in and have a look."

Paul followed him and found Captain Harper in an observation room, writhing on a cot in a storm of tears and emotional fury. He beat against the walls and the floor with his fists as his sobbing continued beyond control.

"What happened to him?" Paul demanded.

"We have three others in the same condition," said Barker. "We tried to determine the effect of a pure feedback impulse, and fed it back to each of them in amplified form as we found it on their charts. This is what happened. I'm afraid we may have cost them their sanity, and we don't know why."

"How could their own feedback do such a thing to them?" he asked in wonder. "What part of the chart did you take it from?"

"We used the impulse that didn't get through, the one that was blocked so that error resulted. Apparently this is the alternative to error." He nodded toward the

writhing, sobbing man. "Harper reached a point where he *had* to fail or else be subject to this psychic storm."

Paul ran his long, bony fingers through his hair. "This makes less sense than ever! If that's true, then we've got to take back what we've told Oglethorpe. His errorless man isn't possible, after all."

"I don't know." Barker shook his head thoughtfully. "Evidently the production of error is a protection against the admission of this intolerable feedback impulse. But the question remains: why is it intolerable, and why does it become so after numerous other feedback impulses have been passed?"

"Yesterday we thought we had it all wrapped up. Now it's blown open wider than ever before!"



Oglethorpe's public relations man prepared a statement to the effect that further danger from pilot error in rocket ships and the second Wheel could be considered as completely eliminated with the new training processes that would make men incapable of technical errors.

Paul knew it was as ineffectual as the average Government release, but he made no protest in his concern for Harper and the three other men. He signed the statement automatically.

He was presented the following day, however, with arrangements to give it personally to the members of Morgan's Caravan from the top of one of the sound trucks. He did protest then that any flunky on the Base could read it to the crowd as well as he. But Oglethorpe insisted he do it personally.

With official pompousness the big, olive-green truck rolled out from the Base. Paul rode beside the driver and Metcalf, the public relations man. He'd not told Oglethorpe about their latest development. If this psychic reaction to feedback proved an impenetrable barrier there'd be time enough to give Space Command the bad news. In the meantime a Wheel would be built, the public would be mollified, and Superman would continue on—to what unknown ends Paul didn't know.

The massed camp of the fanatic followers of Morgan appeared in the distance like a discarded rag on either side of the road. Then as they approached it broke into individual knots of sand-scoured, unwashed people clustered about their tents. Morgan hadn't given much thought to adequate facilities before leading them out here.

The truck rolled to a halt in the center of the camp. Morgan himself, a long, lanky figure in a dusty black suit, came at the head of a group of his people to meet them. "I hope you have the news we are waiting for," he said cordially.

"We have a statement," said Metcalf. "Dr. Medick here, who has made an important discovery that will enable all of you to return to your homes, will read it to you."

Paul could have stayed in the cab, but he preferred to climb to the platform atop the truck to get a look at the crowd Morgan had assembled. He hesitated a moment with the paper in his hands, then took up the mike and read the statement Metcalf had prepared. "The United States Space Command wishes to announce that—"

It fell utterly flat on completely non-understanding ears. Paul looked over the mass of faces and knew it had failed. Something far more than this was needed. A little feedback, he thought grimly. A little feedback of the idiocy of their present situation to correct their course and return it to normalcy.

"Five hundred years ago there might have been a crowd of people just like you," he said suddenly in low tones. "There was a harbor, and some small ships, and a man who believed he could sail them over the edge of the world. On the shore were people who thought he was a fool and a blasphemer, and a few who thought he was right—or at least hoped he was.

"Five hundred years ago was the beginning of a new freedom from the prison of a tiny, constricted world. Today, another freedom waits our successful conquest of space. And whenever a freedom has been won there have been more who jeered against it than have cheered for it. You are today making a choice—"

He talked for ten minutes, and when he was through he knew that he'd accomplished his goal. Even before the sound truck pulled out, the cars of the Caravan were breaking away from the mass and disappearing in the distance.

"Nice job," Metcalf congratulated, as if he'd been responsible for it himself.

"Just a little feedback in the right place—" murmured Paul absently.

"Feedback? What's that—new kind of propaganda technique—?"

"Yeah, you might call it that. How could a guy have been so *blind*—?" he said fiercely, more to himself than to his companions.

He hurried to the laboratory as soon as the truck got him back to Base. He rounded up Barker and Nat Holt and a dozen of his other top men. "The answer's been under our noses all the time," he said. "We've been too busy fighting each other for the sake of our own preconceived notions to have seen it!"

"What are you talking about?" Holt demanded.

"Feedback. Can't you guess what it is?"

"No."

"Are you willing to let us give you a small dose—something less than the level given Harper and his men—and then tell us what you find out about it?"

Nat Holt looked hesitant. "If you think you know what you're talking about. There's no point in my getting in a condition like Harper's."

"We'll pull you out before you get anywhere near that far."

Still dubious, he took a seat amid the mass of pulse generating equipment and electro-encephalograph recorders. A single pair of feedback terminals were fitted to his skull. The generator was set to duplicate his own feedback impulse taken from a moment of failure.

Paul switched on the circuits and advanced the controls carefully. A look of pain and regret crossed Holt's face. He cried out with a whimper. "Turn it off!"

"A second more—," Paul said. He advanced the control a hair and waited. The technologist began to cry suddenly in a low, sobbing voice.

Paul cut the switch.

For a moment Holt continued to slump in the chair, his shoulders jerking. Then he looked up, half-bewildered, half-furious. "What did you do to me?" he demanded.

"You did it to yourself," Paul reminded him. "That's your own feedback pulse

just beefed up a little, remember. How did it feel?"

"Terrible! No wonder a guy dodges that. It's enough to make him wreck a space station to avoid the full blast of it."

"What would you call it?"

"I don't know—," Holt hesitated. "Grief, maybe. Regret—anxiety. But regret, mostly, I guess."

"That's your feedback," Paul said as he removed the terminals and turned to the others. "These feedback pulses we've isolated are nothing but stabs of pure emotion."

He turned with a faint smile to Holt. "You and Harper and the rest of the iron-bowelled boys were so convinced that the pure mechanical man would be utterly devoid of all emotional responses and content! And I was so sure that a warm, responsive, emotional human being could never respond like a cold machine!

"And we were both utterly wrong. The human being does both. He operates on true cybernetic principles. But the content of his feedback control pulses is sheer emotion!

"A small error, a stab of regret. It's repeated, magnified, or diminished until the action gets back on the track that brings predicted results. Ignored, the error builds up until the whole structure goes smash.

"And we're *taught* to ignore it! It's the noble, brave and manly thing to ignore the human feelings that surge through us. Be steel, be glass, be electrons—anything but a responsive, emotional human being! That's the way to be a superman! We've tried to find the way to perfection and have fought tooth and nail against the only means of achieving it."

Barker's face was glowing with excitement and Holt seemed to be remembering something afar off. "That *was* it," he breathed softly. "I can feel it now—the way it was as I began to get jittery and make mistakes in the test procedures. I seemed to fight something within myself—something I thought was making me do it wrong. But it wasn't that, at all. I was fighting against the emotional feedback the errors were throwing at me."

"Right," said Paul. "And your iron-hard, errorless Superman is going to be the most emotionally sensitive creature you can produce."

"How did you catch on to this?" Barker asked.

"We should have seen it in Harper. He's the original iron-man. He's bottled up and fought his emotions all his life. A concentrated dose of his own feedback simply shattered the dam.

"But I didn't get it until I watched Morgan's mob reacting to the purely rational explanation Metcalf prepared to convince them they should go home. They were on a wrong tack and needed a generous amount of the right feedback to get them back where they belonged. The cold, logical approach was a dud. What does it take to move an intractable mob? Emotion—based on the projected consequences of what they're doing. A perfect feedback setup when correctly applied. And it worked."

Holt shuddered faintly and moved away from the chair he had sat in to experience his own feedback. "I'm not quite sure who owes who that dinner," he said to Paul. "But I think somebody does."

"We'll split it," Paul said. And then he was silent as they listened to the departure of another cargo ship carrying parts of the second Wheel to the thousand-mile orbit.

He smiled to himself. Ye of little faith!—he thought. Frightened about the true nature of a race that had come through three billion years of the kind of torment that Man had survived!

Man had everything that was needed to go to the stars or anywhere else he might want to go. He was safe. Man could never be turned into a robot. The basic mechanisms of his humanity were so interwoven with the structure of his being that they could never be separated.

But they hadn't come very far, Paul knew. They had opened only a small crack in a door that had been irrationally closed from the beginning of time. They had to know fully why that door had never been opened before. And beyond it might lie a thousand others just as tightly closed and closely guarded.

Yet they had reached a starting point, at last. Project Superman could get about its business of preparing men for the stars.

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