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The Road to
Science Fiction

Volume 2: From Wells to Heinlein

Edited by James Gunn



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To Robert A. Heinlein, Isaac Asimov,
A. E. van Vogt, Theodore Sturgeon,
and all the other writers
who created the golden age

diverse and often tragic possibilities that confront us, but also that we may familiarize ourselves with the certainty that many of our most cherished ideals would seem puerile to more developed minds. To romance of the far future, then, is to attempt to see the human race in its cosmic setting, and to mould our hearts to entertain new values.

But if such imaginative construction of possible futures is to be at all potent, our imagination must be strictly disciplined.

He was writing not fantasy but "imaginative construction of possible futures," what others called science fiction. "The merely fantastic has only minor power," he wrote, and "we must select with a purpose. . . . We must achieve neither mere history, nor mere fiction, but myth." *Last and First Men* was a major contribution to the myth of the future that "Doc" Smith, Ed Hamilton, and others already had begun to shape, and to which writers yet to roll paper into typewriter, notably Robert Heinlein and Isaac Asimov, would work into a kind of consensus future history.

From Last and First Men

BY OLAF STAPLEDON

Chapter XIII HUMANITY ON VENUS

I. TAKING ROOT AGAIN

Man's sojourn on Venus lasted somewhat longer than his whole career on the Earth. From the days of Pithecanthropus to the final evacuation of his native planet he passed, as we have seen, through a bewildering diversity of form and circumstance. On Venus, though the human type was somewhat more constant biologically, it was scarcely less variegated in culture.

To give an account of this period, even on the minute scale that has been adopted hitherto, would entail another volume. I can only sketch its bare outline. The sapling, humanity, transplanted into foreign soil, withers at first almost to the root, slowly readjusts itself, grows into strength and a certain permanence of form, burgeons, season by season, with leaf and flower of many successive civilizations and cultures, sleeps winter by winter, through many ages of reduced vitality, but at length (to force the metaphor), avoids this recurrent defeat by attaining an evergreen constitution and a continuous efflorescence. Then once more, through the whim of Fate, it is plucked up by the roots and cast upon another world.

The first human settlers on Venus knew well that life would be a sorry business. They had done their best to alter the planet to suit human nature, but they could not make Venus into another Earth. The land surface was minute. The climate was almost unendurable. The extreme difference of temperature between the protracted day and night produced incredible storms, rain like a thousand contiguous waterfalls, terrifying electrical disturbances, and fogs in which a man could not see his own feet. To make matters worse, the oxygen supply was as yet barely enough to render the air breathable. Worse still, the liberated hydrogen was not always successfully ejected from the atmosphere. It would sometimes mingle with the air to form an explosive mixture, and sooner or later there would occur a vast

atmospheric flash. Recurrent disasters of this sort destroyed the architecture and the human inhabitants of many islands, and further reduced the oxygen supply. In time, however, the increasing vegetation made it possible to put an end to the dangerous process of electrolysis.

Meanwhile, these atmospheric explosions crippled the race so seriously that it was unable to cope with a more mysterious trouble which beset it some time after the migration. A new and inexplicable decay of the digestive organs, which first occurred as a rare disease, threatened within a few centuries to destroy mankind. The physical effects of this plague were scarcely more disastrous than the psychological effects of the complete failure to master it; for, what with the mystery of the moon's vagaries and the deep-seated, unreasoning, sense of guilt produced by the extermination of the Venerians, man's self-confidence was already seriously shaken, and his highly organized mentality began to show symptoms of derangement. The new plague was, indeed, finally traced to something in the Venerian water, and was supposed to be due to certain molecular groupings, formerly rare, but subsequently fostered by the presence of terrestrial organic matter in the ocean. No cure was discovered.

And now another plague seized upon the enfeebled race. Human tissues had never perfectly assimilated the Martian units which were the means of "telepathic" communication. The universal ill-health now favoured a kind of "cancer" of the nervous system, which was due to the ungoverned proliferation of these units. The harrowing results of this disease may be left unmentioned. Century by century it increased; and even those who did not actually contract the sickness lived in constant terror of madness.

These troubles were aggravated by the devastating heat. The hope that, as the generations passed, human nature would adapt itself even to the more sultry regions, seemed to be unfounded. Far otherwise, within a thousand years the once-populous arctic and antarctic islands were almost deserted. Out of each hundred of the great pylons, scarcely more than two were inhabited, and these only by a few plague-stricken and broken-spirited human relics. These alone were left to turn their telescopes upon the earth and watch the unexpectedly delayed bombardment of their native world by the fragments of the moon.

Population decreased still further. Each brief generation was slightly less well developed than its parents. Intelligence declined. Education became superficial and restricted. Contact with the past was no longer possible. Art lost its significance, and philosophy its dominion over the minds of men. Even applied science began to be too difficult. Unskilled control of the sub-atomic sources of power led to a number of disasters, which finally gave rise to a superstition that all "tampering with nature" was wicked, and

all the ancient wisdom a snare of Man's Enemy. Books, instruments, all the treasures of human culture, were therefore burnt. Only the perdurable buildings resisted destruction. Of the incomparable world order of the Fifth Men nothing was left but a few island tribes cut off from one another by the ocean, and from the rest of space-time by the depths of their own ignorance.

After many thousands of years human nature did begin to adapt itself to the climate and to the poisoned water without which life was impossible. At the same time a new variety of the fifth species now began to appear, in which the Martian units were not included. Thus at last the race regained a certain mental stability, at the expense of its faculty of "telepathy," which man was not to regain until almost the last phase of his career. Meanwhile, though he had recovered somewhat from the effects of an alien world, the glory that had been was no more. Let us therefore hurry through the ages that passed before noteworthy events again occurred.

In early days on Venus men had gathered their foodstuff from the great floating islands of vegetable matter which had been artificially produced before the migration. But as the oceans became populous with modifications of the terrestrial fauna, the human tribes turned more and more to fishing. Under the influence of its marine environment, one branch of the species assumed such an aquatic habit that in time it actually began to develop biological adaptations for marine life. It is perhaps surprising that man was still capable of spontaneous variation; but the fifth human species was artificial, and had always been prone to epidemics of mutation. After some millions of years of variation and selection there appeared a very successful species of seal-like sub-men. The whole body was moulded to stream-lines. The lung capacity was greatly developed. The spine had elongated, and increased in flexibility. The legs were shrunken, grown together, and flattened into a horizontal rudder. The arms also were diminutive and fin-like, though they still retained the manipulative forefinger and thumb. The head had shrunk into the body and looked forward in the direction of swimming. Strong carnivorous teeth, emphatic gregariousness, and a new, almost human, cunning in the chase, combined to make these seal-men lords of the ocean. And so they remained for many million years, until a more human race, annoyed at their piscatorial success, harpooned them out of existence.

For another branch of the degenerated fifth species had retained a more terrestrial habit and the ancient human form. Sadly reduced in stature and in brain, these abject beings were so unlike the original invaders that they are rightly considered a new species, and may therefore be called the Sixth Men. Age after age they gained a precarious livelihood by grubbing roots

upon the forest-clad islands, trapping the innumerable birds, and catching fish in the tidal inlets with ground bait. Not infrequently they devoured, or were devoured by, their seal-like relatives. So restricted and constant was the environment of these human remnants, that they remained biologically and culturally stagnant for some millions of years.

At length, however, geological events afforded man's nature once more the opportunity of change. A mighty warping of the planet's crust produced an island almost as large as Australia. In time this was peopled, and from the clash of tribes a new and versatile race emerged. Once more there was methodical tillage, craftsmanship, complex social organization, and adventure in the realm of thought.

During the next two hundred million years all the main phases of man's life on earth were many times repeated on Venus with characteristic differences. Theocratic empires; free and intellectualistic island cities; insecure overlordship of feudal archipelagos; rivalries of high priest and emperor; religious feuds over the interpretation of sacred scriptures; recurrent fluctuations of thought from naïve animism, through polytheism, conflicting monotheisms, and all the desperate "isms" by which mind seeks to blur the severe outline of truth; recurrent fashions of comfort-seeking fantasy and cold intelligence; social disorders through the misuse of volcanic or wind power in industry; business empires and pseudo-communistic empires—all these forms flitted over the changing substance of mankind again and again, as in an enduring hearth fire there appear and vanish the infinitely diverse forms of flame and smoke. But all the while the brief spirits, in whose massed configurations these forms inhered, were intent chiefly on the primitive needs of food, shelter, companionship, crowd-lust, love-making, the two-edged relationship of parent and child, the exercise of muscle and intelligence in facile sport. Very seldom, only in rare moments of clarity, only after ages of misapprehension, did a few of them, here and there, now and again, begin to have the deeper insight into the world's nature and man's. And no sooner had this precious insight begun to propagate itself, than it would be blotted out by some small or great disaster, by epidemic disease, by the spontaneous disruption of society, by an access of racial imbecility, by a prolonged bombardment of meteorites, or by the mere cowardice and vertigo that dared not look down the precipice of fact.

2. THE FLYING MEN

We need not dwell upon these multitudinous reiterations of culture, but must glance for a moment at the last phase of this sixth human species, so that we may pass on to the artificial species which it produced.

Throughout their career the Sixth Men had often been fascinated by the idea of flight. The bird was again and again their most sacred symbol. Their monotheism was apt to be worship not of a god-man, but of a god-bird, conceived now as the divine sea-eagle, winged with power, now as the giant swift, winged with mercy, now as a disembodied spirit of air, and once as the bird-god that became man to endow the human race with flight, physical and spiritual.

It was inevitable that flight should obsess man on Venus, for the planet afforded but a cramping home for groundlings; and the riotous efflorescence of avian species shamed man's pedestrian habit. When in due course the Sixth Men attained knowledge and power comparable to that of the First Men at their height, they invented flying-machines of various types. Many times, indeed, mechanical flight was rediscovered and lost again with the downfall of civilization. But at its best it was regarded only as a makeshift. And when at length, with the advance of the biological sciences, the Sixth Men were in a position to influence the human organism itself, they determined to produce a true flying man. Many civilizations strove vainly for this result, sometimes half-heartedly, sometimes with religious earnestness. Finally the most enduring and brilliant of all the civilizations of the Sixth Men actually attained the goal.

The Seventh Men were pigmies, scarcely heavier than the largest of terrestrial flying birds. Through and through they were organized for flight. A leathery membrane spread from the foot to the tip of the immensely elongated and strengthened "middle" finger. The three "outer" fingers, equally elongated, served as ribs to the membrane; while the index and thumb remained free for manipulation. The body assumed the stream-lines of a bird, and was covered with a deep quilt of feathery wool. This, and the silken down of the flight-membranes, varied greatly from individual to individual in colouring and texture. On the ground the Seventh Men walked much as other human beings, for the flight-membranes were folded close to the legs and body, and hung from the arms like exaggerated sleeves. In flight the legs were held extended as a flattened tail, with the feet locked together by the big toes. The breastbone was greatly developed as a keel, and as a base for the muscles of flight. The other bones were hollow, for lightness, and their internal surfaces were utilized as supplementary lungs. For, like the birds, these flying men had to maintain a high rate of oxidation. A state which others would regard as fever was normal to them.

Their brains were given ample tracts for the organization of prowess in flight. In fact, it was found possible to equip the species with a system of reflexes for aerial balance, and a true, though artificial, instinctive aptitude for flight, and interest in flight. Compared with their makers their brain volume

was of necessity small, but their whole neural system was very carefully organized. Also it matured rapidly, and was extremely facile in the acquirement of new modes of activity. This was very desirable; for the individual's natural life period was but fifty years, and in most cases it was deliberately cut short by some impossible feat at about forty, or whenever the symptoms of old age began to be felt.

Of all human species these bat-like Flying Men, the Seventh Men, were probably the most care-free. Gifted with harmonious physique and gay temperament, they came into a social heritage well adapted to their nature. There was no occasion for them, as there had often been for some others, to regard the world as fundamentally hostile to life, or themselves as essentially deformed. Of quick intelligence in respect of daily personal affairs and social organization, they were untroubled by the insatiable lust of understanding. Not that they were an unintellectual race, for they soon formulated a beautifully systematic account of experience. They dearly perceived, however, that the perfect sphere of their thought was but a bubble adrift in chaos. Yet it was an elegant bubble. And the system was true, in its own gay and frankly insincere manner, true as significant metaphor, not literally true. What more, it was asked, could be expected of human intellect? Adolescents were encouraged to study the ancient problems of philosophy, for no reason but to convince themselves of the futility of probing beyond the limits of the orthodox system. "Prick the bubble of thought at any point," it was said, "and you shatter the whole of it. And since thought is one of the necessities of human life, it must be preserved."

Natural science was taken over from the earlier species with half-contemptuous gratitude, as a necessary means of sane adjustment to the environment. Its practical applications were valued as the ground of the social order; but as the millennia advanced, and society approached that remarkable perfection and stability which was to endure for many million years, scientific inventiveness became less and less needful, and science itself was relegated to the infant schools. History also was given in outline during childhood, and subsequently ignored.

This curiously sincere intellectual insincerity was due to the fact that the Seventh Men were chiefly concerned with matters other than abstract thought. It is difficult to give to members of the first human species an inkling of the great preoccupation of these Flying Men. To say that it was flight would be true, yet far less than the truth. To say that they sought to live dangerously and vividly, to crowd as much experience as possible into each moment, would again be a caricature of the truth. On the physical plane indeed "the universe of flight" with all the variety of peril and skill

afforded by a tempestuous atmosphere, was every individual's chief medium of self-expression. Yet it was not flight itself, but the spiritual aspect of flight, which obsessed the species.

In the air and on the ground the Seventh Men were different beings. Whenever they exercised themselves in flight they suffered a remarkable change of spirit. Much of their time had to be spent on the ground, since most of the work upon which civilization rested was impossible in the air. Moreover, life in the air was life at high pressure, and necessitated quells of recuperation on the ground. In their pedestrian phase the Seventh Men were sober folk, mildly bored, yet in the main cheerful, humorously impatient of the drabness and irk of pedestrian affairs, but ever supported by memory and anticipation of the vivid life of the air. Often they were tired, after the strain of that other life, but seldom were they despondent or lazy. Indeed, in the routine of agriculture and industry they were industrious as the wingless ants. Yet they worked in a strange mood of attentive absent-mindedness; for their hearts were ever in the air. So long as they could have frequent periods of aviation, they remained bland even on the ground. But if for any reason such as illness they were confined to the ground for a long period, they pined, developed acute melancholia, and died. Their makers had so contrived them that with the onset of any very great pain or misery their hearts should stop. Thus they were to avoid all serious distress. But, in fact, this merciful device worked only on the ground. In the air they assumed a very different and more heroic nature, which their makers had not foreseen, though indeed it was a natural consequence of their design.

In the air the flying man's heart beat more powerfully. His temperature rose. His sensation became more vivid and more discriminate, his intelligence more agile and penetrating. He experienced a more intense pleasure or pain in all that happened to him. It would not be true to say that he became more emotional; rather the reverse, if by emotionality is meant enslavement to the emotions. For the most remarkable feature of the aerial phase was that this enhanced power of appreciation was dispassionate. So long as the individual was in the air, whether in lonely struggle with the storm, or in the ceremonial ballet with sky-darkening hosts of his fellows; whether in the ecstatic love dance with a sexual partner, or in solitary and meditative circlings far above the world; whether his enterprise was fortunate, or he found himself dismembered by the hurricane, and crashing to death; always the gay and the tragic fortunes of his own person were regarded equally with detached aesthetic delight. Even when his dearest companion was mutilated or destroyed by some aerial disaster, he exulted; though also he would give his own life in the hope of effecting a rescue.

But very soon after he had returned to the ground he would be overwhelmed with grief, would strive vainly to recapture the lost vision, and would perhaps die of heart failure.

Even when, as happened occasionally in the wild climate of Venus, a whole aerial population was destroyed by some world-wide atmospheric tumult, the few broken survivors, so long as they could remain in the air, exulted. And actually while at length they sank exhausted toward the ground, toward certain disillusionment and death, they laughed inwardly. Yet an hour after they had alighted, their constitution would be changed, their vision lost. They would remember only the horror of the disaster, and the memory would kill them.

No wonder the Seventh Men grudged every moment that was passed on the ground. While they were in the air, of course, the prospect of a pedestrian interlude, or indeed of endless pedestrianism, though in a manner repugnant, would be accepted with unswerving gaiety; but while they were on the ground, they grudged bitterly to be there. Early in the career of the species the proportion of aerial to terrestrial hours was increased by a biological invention. A minute foodplant was produced which spent the winter rooted in the ground, and the summer adrift in the sunlit upper air, engaged solely in photosynthesis. Henceforth the populations of the Flying Men were able to browse upon the bright pastures of the sky, like swallows. As the ages passed, material civilization became more and more simplified. Needs which could not be satisfied without terrestrial labour tended to be outgrown. Manufactured articles became increasingly rare. Books were no longer written or read. In the main, indeed, they were no longer necessary; but to some extent their place was taken by verbal tradition and discussion, in the upper air. Of the arts, music, spoken lyric and epic verse, and the supreme art of winged dance, were constantly practiced. The rest vanished. Many of the sciences inevitably faded into tradition; yet the true scientific spirit was preserved in a very exact meteorology, a sufficient biology, and a human psychology surpassed only by the second and fifth species at their height. None of these sciences, however, was taken very seriously, save in its practical applications. For instance, psychology explained the ecstasy of flight very neatly as a febrile and "irrational" beatitude. But no one was disconcerted by this theory; for every one, while on the wing, felt it to be merely an amusing half-truth.

The social order of the Seventh Men was in essence neither utilitarian, nor humanistic, nor religious, but aesthetic. Every act and every institution were to be justified as contributing to the perfect form of the community. Even social prosperity was conceived as merely the medium in which

beauty should be embodied, the beauty, namely, of vivid individual lives harmoniously related. Yet not only for the individual, but even for the race itself (so the wise insisted), death on the wing was more excellent than prolonged life on the ground. Better, far better, would be racial suicide than a future of pedestrianism. Yet though both the individual and the race were conceived as instrumental to objective beauty, there was nothing religious, in any ordinary sense, in this conviction. The Seventh Men were completely without interest in the universal and the unseen. The beauty which they sought to create was ephemeral and very largely sensuous. And they were well content that it should be so. Personal immortality, said a dying sage, would be as tedious as an endless song. Equally so with the race. The lovely flame, of which we all are members, must die, he said, must die; for without death she would fall short of beauty.

For close on a hundred million terrestrial years this aerial society endured with little change. On many of the islands throughout this period stood even yet a number of the ancient pylons, though repaired almost beyond recognition. In these nests the men and women of the seventh species slept through the long Venerian nights, crowded like roosting swallows. By day the same great towers were sparsely peopled with those who were serving their turn in industry, while in the fields and on the sea others laboured. But most were in the air. Many would be skimming the ocean, to plunge, gannetlike, for fish. Many, circling over land or sea, would now and again swoop like hawks upon the wild-fowl which formed the chief meat of the species. Others, forty or fifty thousand feet above the waves, where even the plentiful atmosphere of Venus was scarcely capable of supporting them, would be soaring, circling, sweeping, for pure joy of flight. Others, in the calm and sunshine of high altitudes, would be hanging effortless upon some steady up-current of air for meditation and the rapture of mere percipience. Not a few love-intoxicated pairs would be entwining their courses in aerial patterns, in spires, cascades, and true love-knots of flight, presently to embrace and drop ten thousand feet in bodily union. Some would be driving hither and thither through the green mists of vegetable particles, gathering the manna in their open mouths. Companies, circling together, would be discussing matters social or aesthetic; others would be singing together, or listening to recitative epic verse. Thousands, gathering in the sky like migratory birds, would perform massed convolutions, reminiscent of the vast mechanical aerial choreography of the First World State, but more vital and expressive, as a bird's flight is more vital than the flight of any machine. And all the while there would be some, solitary or in companies, who, either in the pursuit of fish and wildfowl, or out of pure devilment, pitted their

strength and skill against the hurricane, often tragically, but never without zest, and laughter of the spirit.

It may seem to some incredible that the culture of the Seventh Men should have lasted so long. Surely it must either have decayed through mere monotony and stagnation or have advanced into richer experience. But no. Generation succeeded generation, and each was too short-lived to outlast its young delight and discover boredom. Moreover, so perfect was the adjustment of these beings to their world, that even if they had lived for centuries they would have felt no need of change. Flight provided them with intense physical exhilaration, and with the physical basis of a genuine and ecstatic, though limited, spiritual experience. In this their supreme attainment they rejoiced not only in the diversity of flight itself, but also in the perceived beauties of their variegated world, and most of all, perhaps, in the thousand lyric and epic ventures of human intercourse in an aerial community.

The end of this seemingly everlasting elysium was nevertheless involved in the very nature of the species. In the first place, as the ages lengthened into aeons, the generations preserved less and less of the ancient scientific lore. For it became insignificant to them. The aerial community had no need for it. This loss of mere information did not matter so long as their condition remained unaltered; but in due course biological changes began to undermine them. The species had always been prone to a certain biological instability. A proportion of infants, varying with circumstances, had always been misshapen; and the deformity had generally been such as to make flight impossible. The normal infant was able to fly early in its second year. If some accident prevented it from doing so, it invariably fell into a decline and died before its third year was passed. But many of the deformed types, being the result of a partial reversion to the pedestrian nature, were able to live on indefinitely without flight. According to a merciful custom these cripples had always to be destroyed. But at length, owing to the gradual exhaustion of a certain marine salt essential to the high-strung nature of the Seventh Men, infants were more often deformed than true to type. The world population declined so seriously that the organized aerial life of the community could no longer be carried on according to the time-honoured aesthetic principles. No one knew how to check this racial decay, but many felt that with greater biological knowledge it might be avoided. A disastrous policy was now adopted. It was decided to spare a carefully selected proportion of the deformed infants, those namely which, though doomed to pedestrianism, were likely to develop high intelligence. Thus it was hoped to raise a specialized group of persons whose work should be biological research untrammelled by the intoxication of flight.

The brilliant cripples that resulted from this policy looked at existence from a new angle. Deprived of the supreme experience for which their fellows lived, envious of a bliss which they knew only by report, yet contemptuous of the naïve mentality which cared for nothing (it seemed) but physical exercise, love-making, the beauty of nature, and the elegances of society, these flightless intelligences sought satisfaction almost wholly in the life of research and scientific control. At the best, however, they were a tortured and resentful race. For their natures were fashioned for the aerial life which they could not lead. Although they received from the winged folk just treatment and a certain compassionate respect, they writhed under this kindness, locked their hearts against all the orthodox values, and sought out new ideals. Within a few centuries they had rehabilitated the life of intellect, and, with the power that knowledge gives, they had made themselves masters of the world. The amiable fliers were surprised, perplexed, even pained; and yet withal amused. Even when it became evident that the pedestrians were determined to create a new world order in which there would be no place for the beauties of natural flight, the fliers were only distressed while they were on the ground.

The islands were becoming crowded with machinery and flightless industrialists. In the air itself the winged folk found themselves outstripped by the base but effective instruments of mechanical flight. Wings became a laughing stock, and the life of natural flight was condemned as a barren luxury. It was ordained that in future every flier must serve the pedestrian world-order, or starve. And as the cultivation of wind-borne plants had been abandoned, and fishing and fowling rights were strictly controlled this law was no empty form. At first it was impossible for the fliers to work on the ground for long hours, day after day, without incurring serious ill-health and an early death. But the pedestrian physiologists invented a drug which preserved the poor wage-slaves in something like physical health, and actually prolonged their life. No drug, however, could restore their spirit, for their normal aerial habit was reduced to a few tired hours of recreation once a week. Meanwhile, breeding experiments were undertaken to produce a wholly wingless large-brained type. And finally a law was enacted by which all winged infants must be either mutilated or destroyed. At this point the fliers made an heroic but ineffectual bid for power. They attacked the pedestrian population from the air. In reply the enemy rode them down in his great aeroplanes and blew them to pieces with high explosive.

The fighting squadrons of the natural fliers were finally driven to the ground in a remote and barren island. Thither the whole flying population, a mere remnant of its former strength, fled out of every civilized archipelago

in search of freedom: the whole population—save the sick, who committed suicide, and all infants that could not yet fly. These were stifled by their mothers or next-of-kin, in obedience to a decree of the leaders. About a million men, women and children, some of whom were scarcely old enough for the prolonged flight, now gathered on the rocks, regardless that there was not food in the neighbourhood for a great company.

Their leaders, conferring together, saw clearly that the day of Flying Man was done, and that it would be more fitting for a high-souled race to die at once than to drag on in subjection to contemptuous masters. They therefore ordered the population to take part in an act of racial suicide that should at least make death a noble gesture of freedom. The people received the message while they were resting on the stony moorland. A wail of sorrow broke from them. It was checked by the speaker, who bade them strive to see, even on the ground, the beauty of the thing that was to be done. They could not see it; but they knew that if they had the strength to take wing again they would see it clearly, almost as soon as their tired muscles bore them aloft. There was no time for waste, for many were already faint with hunger, and anxious lest they should fail to see. At the appointed signal the whole population rose into the air with a deep roar of wings. Sorrow was left behind. Even the children, when their mothers explained what was to be done, accepted their fate with zest; though, had they learned of it on the ground, they would have been terror-stricken. The company now flew steadily West, forming themselves into a double file many miles long. The cone of a volcano appeared over the horizon, and rose as they approached. The leaders pressed on towards its muddy smoke plume; and unflinchingly, couple by couple, the whole multitude darted into its fiery breath and vanished. So ended the career of Flying Men.

3. A MINOR ASTRONOMICAL EVENT

The flightless yet still half avian race that now possessed the planet settled down to construct a society based on industry and science. After many vicissitudes of fortune and of aim, they produced a new human species, the Eighth Men. These long-headed and substantial folk were designed to be strictly pedestrian, physically and mentally. Apt for manipulation, calculation and invention, they very soon turned Venus into an engineer's paradise. With power drawn from the planet's central heat, their huge electric ships bored steadily through the perennial monsoons and hurricanes, which also their aircraft treated with contempt. Islands were joined by tunnels and by

millepede bridges. Every inch of land served some industrial or agricultural end. So successfully did the generations amass wealth that their rival races and rival castes were able to indulge, every few centuries, in vast revelries of mutual slaughter and material destruction without, as a rule, impoverishing their descendants. And so insensitive had man become that these orgies shamed him not at all. Indeed, only by ardours of physical violence could this most philistine species wrench itself for a while out of its complacency. Strife which to nobler beings would have been a grave spiritual disaster, was for these a tonic, almost a religious exercise. These cathartic paroxysms, it should be observed, were but the rare and brief crises which automatically punctuated ages of stolid peace. At no time did they threaten the existence of the species; seldom did they even destroy its civilization.

It was after a lengthy period of peace and scientific advancement that the Eighth Men made a startling astronomical discovery. Ever since the First Men had learned that in the life of every star there comes a critical moment when the great orb collapses, shrinking to a minute, dense grain with feeble radiation, man had periodically suspected that the sun was about to undergo this change, and become a typical "White Dwarf." The Eighth Men detected sure signs of the catastrophe, and predicted its date. Twenty thousand years they gave themselves before the change should begin. In another fifty thousand years, they guessed, Venus would probably be frozen and uninhabitable. The only hope was to migrate to Mercury during the great change, when that planet was already ceasing to be intolerably hot. It was necessary then to give Mercury an atmosphere, and to breed a new species which should be capable of adapting itself finally to a world of extreme cold.

This desperate operation was already on foot when a new astronomical discovery rendered it futile. Astronomers detected, some distance from the solar system, a volume of nonluminous gas. Calculation showed that this object and the sun were approaching one another at a tangent, and that they would collide. Further calculation revealed the probable results of this event. The sun would flare up and expand prodigiously. Life would be quite impossible on any of the planets save, just possibly, Uranus, and more probably Neptune. The three planets beyond Neptune would escape roasting, but were unsuitable for other reasons. The two outermost would remain glacial, and, moreover, lay beyond the range of the imperfect etherships of the Eighth Men. The innermost was practically a bald globe of iron, devoid not merely of atmosphere and water, but also of the normal covering of rock. Neptune alone might be able to support life; but how could even Neptune be populated? Not only was its atmosphere very unsuitable, and its gravitational pull such as to make man's body an intolerable burden, but

also up to the time of the collision it would remain excessively cold. Not till after the collision could it support any kind of life known to man.

How these difficulties were overcome I have no time to tell, though the story of man's attack upon his final home is well worthy of recording. Nor can I tell in detail of the conflict of policy which now occurred. Some, realizing that the Eighth Men themselves could never live on Neptune, advocated an orgy of pleasure-living till the end. But at length the race excelled itself in an almost unanimous resolve to devote its remaining centuries to the production of a human being capable of carrying the torch of mentality into a new world.

Ether-vessels were able to reach that remote world and set up chemical changes for the improvement of the atmosphere. It was also possible, by means of the lately rediscovered process of automatic annihilation of matter, to produce a constant supply of energy for the warming of an area where life might hope to survive until the sun should be rejuvenated.

When at last the time for migration was approaching, a specially designed vegetation was shipped to Neptune and established in the warm area to fit it for man's use. Animals, it was decided, would be unnecessary. Subsequently a specially designed human species, the Ninth Men, was transported to man's new home. The giant Eighth Men could not themselves inhabit Neptune. The trouble was not merely that they could scarcely support their own weight, let alone walk, but that the atmospheric pressure on Neptune was unendurable. For the great planet bore a gaseous envelope thousands of miles deep. The solid globe was scarcely more than the yolk of a huge egg. The mass of the air itself combined with the mass of the solid to produce a gravitational pressure greater than that upon the Venerian ocean floor. The Eighth Men, therefore, dared not emerge from their ether-ships to tread the surface of the planet save for brief spells in steel diving suits. For them there was nothing else to do but to return to the archipelagos of Venus, and make the best of life until the end. They were not spared for long. A few centuries after the settlement of Neptune had been completed by transferring thither all the most precious material relics of humanity, the great planet itself narrowly missed collision with the dark stranger from space. Uranus and Jupiter were at the time well out of its track. Not so Saturn, which, a few years after Neptune's escape, was engulfed with all its rings and satellites. The sudden incandescence which resulted from this minor collision was but a prelude. The huge foreigner rushed on. Like a finger poked into a spider's web, it tangled up the planetary orbits. Having devoured its way through the asteroids, it missed Mars, caught Earth and Venus in its blazing hair, and leapt at the sun. Henceforth, the centre of the solar system was a star nearly as wide as the old orbit of Mercury, and the system was transformed.

Ford's in His Flivver

By 1932 the world had passed through one disillusioning crisis and was deep in another. World War I had shattered carefully nurtured notions of progress in human affairs, had virtually destroyed a generation of European men, and had created the Communist Revolution and a persistent mood of cynicism.

Progress, nevertheless, was evident to the discerning. Population (it had not yet begun to seem a liability) was expanding in the Western world as public-health measures and better nutrition began to reduce the death rate and lengthen the life span: in the United States between 1900 and 1960 it increased from 47.3 years to 69.7. The U.S. gross national product increased over the same period from \$17 billion to \$500 billion.

A significant part of the improvement in productivity came through invention, particularly in agriculture, where new machinery, hybrid grains, and chemical fertilizers brought further efficiencies to a process that had already reduced the labor of producing an acre of wheat from sixty-one hours to three hours. Meanwhile energy became cheap and plentiful with the discovery of oil and processes for fractionating it, and the increasing application of electricity to all sorts of tasks; steel-making was improved; transportation by ship, train, truck, and eventually airplane got produce and the abundance flowing out of new factories to the markets of the world; radio and the telephone improved and speeded communication. . . .

During this period factories became efficient means of producing goods for mass consumption. The process began in 1798 when Eli Whitney invented a means for mass-producing guns through interchangeable parts; it culminated in 1916 with Henry Ford's invention of the production line. Instead of workers taking parts to a chassis, Ford moved the chassis past a series of workers who performed a single task, thus enabling him to replace skilled mechanics with unskilled laborers. It also enabled him to reduce the price of his "tin lizzie" from \$850 to \$360, in spite of the fact that in 1914 he had reduced the work day from nine hours to eight and more than doubled the wages of his workers. His innovations brought the automobile into