

ROBERT BURNHAM JR.'S 1983 TESTAMENT: AN ASTRONOMER-RECLUSE INSCRIBES HIS UNIVERSE (PART I)



Burnham, circa 1960, at the telescope Clyde Tombaugh used to find Pluto 30 years earlier
Today, June 16, 2011, would have been Robert Burnham Jr.'s 80th birthday.
Burnham was an Arizona astronomer who produced one of the most unusual, and most beloved, set of books of science, his [Burnham's Celestial Handbook: An Observer's Guide to the Universe Beyond the Solar System](#). He began putting it out as a series of loose-leaf notebooks in the mid-1960s. The full, 2,000-page, typewritten, bound three-volume set was later published in 1978 and became an instant classic among people who enjoy looking up at the night sky with small telescopes. The books are something of a small miracle, with mountains of information, inspirational reading, and pure scientific passion.

Burnham himself, however, was something of a recluse and rarely gave interviews. The only lengthy piece of writing he did about himself he produced at the height of his Handbook's popularity, in 1982, for Astronomy magazine. But among his papers was found another version of the essay nearly four times as long, dated April 1983, which the Voice is publishing today for the very first time anywhere.

At 24,000 words, the "self-interview" is so long, we were forced to publish it in two separate posts. We'll put up the second half tomorrow morning at the same time.

In 1997, [a story I did for the Phoenix New Times](#) revealed for the first time that Burnham had died in 1993. After his fascinating and illustrious career at Flagstaff's Lowell Observatory had ended in 1979, Burnham had fallen on hard times. In the last years of his life, he was living in a cheap residence hotel in downtown San Diego, selling paintings of cats in Balboa Park. I learned that he had, at one time during his later years, approached the director of Balboa Park's planetarium, but the director didn't believe that the old man in the park could have been the famous Robert Burnham Jr.

If Burnham's life ended in an unfortunate fashion, in the following essay you will meet the man at his most beguiling, a largely self-taught polymath who could be both playful and cantankerous. Nearly three decades since he put these words down, his ideas about progress, science and religion, and man's future in space still seem fresh. We hope you find his words illuminating. -- Tony Ortega, Editor, The Village Voice

An Interview with the author of *The Celestial Handbook*
By Robert Burnham, Jr.

You know, Bob, this is the first time I have ever interviewed the author of a two thousand page book.

Don't be nervous. I'm really quite harmless, if taken in moderation.

That's what your friends said. They also warned me not to get you started on Chinese poetry or we'd be here all night.

Ah, I must speak to them. Please continue.

Yes. You are the author of the largest deep-sky guidebook in existence, about one-and-a-half times the size of *War and Peace*. And probably one of the largest projects ever undertaken by a single person. I'm sure that many readers must be curious...

Right now you're probably asking yourself: What sort of creature could possibly compile and type a 2,000 page book, and stay stubbornly with such a hopeless project for many years? And remain even partly sane?

Yes. That's what I meant.

Obviously such a person must be either a warped genius or a first-rate crank. Right? And wouldn't you like to know?

They say that genius is akin to madness. Do you think that's true?

Obviously. But so is normality, whatever that means. We're all a lot crazier than we think. Though we show it in different ways. I'm a virtual hermit, for example, and never attend astronomical meetings.

Why is that?

I can't stand being crushed in the center of a seething mass of astronomers. It's like getting caught in a yak stampede in the New York subway.

Where do you get...

Such phrases? Same place Shakespeare got his. The human mind is a bottomless pool of images. You don't know what will come up until you start dredging. That's what poets do. My own brain is like the Smithsonian. Uncle Sam's attic, they call it.

I see. Tell me, did you actually start out with the deliberate intention of producing a 2,000 page book?

Good Lord, no. The whole thing started quite innocently, without malice aforethought. It's like being born, you know. At the time, you have no idea you're being shoved off a cliff.

When was this? The beginning of the book, I mean.

Oh, close to thirty years ago -- in the early 1950's. I had a small refractor then, and a copy of *Norton's Star Atlas*. After I began to get familiar with the constellation patterns, I started on a 6-inch mirror, and later on an 8-inch. And it was about that time that I began to wonder about all those objects shown on *Norton's* -- double stars and clusters and nebulae and galaxies -- for which I had no data at all. All those things with Struve numbers and Herschel designations and other esoteric symbols. Where is all the information on these objects, I wondered. There should be some sort of guidebook that would list them all, with the main facts and data.

There is Webb's *Celestial Objects*, of course. But I can't think of anything else that detailed.

No. I had a copy of Webb, but of course in the 1950's it was getting deplorably out of date. The last real revision was in 1917! Then, about 1948 or so, the Skalnate Pleso *Atlas Coeli* came out. With a great catalog. But there again it was strictly a listing of data. No detailed descriptions. Or photographs.

So you started your own?

Yes, for some years I kept adding data to the thing. It was a loose-leaf notebook, so that it could expand indefinitely. Eventually it became a series of *six* loose-leaf notebooks. I kept stuffing facts and pictures into it from any source I could get my hands on.

At this time you had no intention of publishing the thing?

Oh no. It was a compilation for my own use. Plus a record of my own observations. And that was the situation up to one damp night in October 1957, when fate sneaked up behind me with that piece of lead pipe.

I see you read P.G. Wodehouse.

Yes, old thing. I had been using the 6-inch, you see, making some rough measurements on double stars in Cetus for the book. And just before quitting I thought I'd make a quick check on Mira, the classic long-period variable.

Now my 6-inch was *the* basic telescope reduced to the ultimate essentials. No drive. No finder. No setting circles. You point it and sweep. And while doing this I came across the field of 66 Ceti. And there, a degree west of the star, was a large fuzzy nebula with a faint star-like center. Now if you check *Norton's*, you'll see that there is no bright nebula a degree west of 66 Ceti.

Had you found a comet?

A new comet. Seventh magnitude, and going southwest about 13 degrees per day. Unusually close to the Earth, obviously.

That must have been your most exciting moment in astronomy.

Up to that time, yes! The discovery was made from my home in Prescott, Arizona, so it was a simple matter to call the Lowell Observatory in Flagstaff. The gentleman who answered the call was Dr. V.M. Slipher, though I didn't know it at the time. The existence of the comet was confirmed rather quickly -- you could see it in a pair of binoculars.

I sent a telegram to Harvard the same night. A few days later the word came that the comet had been picked up independently, about twelve hours earlier, by Paul Wild in Switzerland. Still later we got a third much-delayed announcement from the Russian astronomer Latyshev. Eventually all three of us shared the honors. This was Comet 1957f. It never quite got to naked-eye brightness.

It was this discovery that led to your position on the staff at Lowell Observatory?

Eventually, yes. A few months later, when the Lowell proper motion sky survey was getting under way, I was offered employment on the project. The Lowell library was an absolute revelation, of course. And the collection plates made with the 13-inch astrograph. Here was the entire sky down to about 40° south, on huge glass plates measuring 14 x 17 inches -- nearly 3,000 of them, going to the seventeenth magnitude.

Could you put that into layman's language?

Seventeenth magnitude? Well, that's about 25,000 times too faint to be seen with the naked eye.

These were the plates used the survey you mentioned? And just what is a proper motion survey?

Well, if you compare sky photos taken years apart, you find that some of the stars have changed position slightly. These are the fairly close stars, of course.

How close?

Oh, four or five light years, on out to a hundred or so. All the stars are moving, of course, since the entire galaxy is rotating. But only a fairly nearby star will show much motion over two or three decades. So you can pick them out that way. It's sort of a census of the nearby portion of the galaxy.

And you searched the entire northern sky this way?

We started out with the intention of doing the entire northern hemisphere, at least, down to the plate limit, and recording all stars with motions more than about 0.3 seconds of arc per year. The plates were compared bit by bit in the blink-comparator, with an interval of about thirty years between the two exposures. The blink machine has a projection screen, you see, and you first see the image from one photograph, and then from the other. The images are shown alternately. Any star that has moved significantly appears as a dot jumping back and forth. It attracts your attention immediately.

And you chalk up another discovery.

Yes, it gets to be a production-line sort of thing. The older photographs had been made chiefly by Clyde Tombaugh and his associates during the Pluto search.

And you took the new photographs to match?

Yes, we took them region by region as the survey progressed. Three of us worked on the project. The final catalog for the northern hemisphere listed close to 9,000 stars, more than half of which were new discoveries. Along with these, of course, we also re-discovered all the known stars of large motion.

Including Barnard's Star?

Oh yes. That's still the largest proper motion known. It's only six light years away, of course. Yes, we used to keep that set of plates handy to demonstrate the blink technique for visitors. Barnard's Star jumped nearly three-quarters of an inch on the blink screen. Rather hard to miss.

You found no new motions to equal that?

Nowhere near it. The largest new motions were just a little under three seconds of arc per year. As a by-product of the survey, we also identified something like 1,700 faint blue stars and white dwarf suspects. These are the super-dense, degenerate stars, you know. They weigh tons to the cubic inch. We found enough to keep the astrophysicists busy for years.

And some additional comets?

Four during the Lowell survey, plus one discovery with my own 8-inch reflector. A total of six. The real goody of the collection was Comet Burnham 1959k, which showed a periodic swing in the direction of its tail. That got me a lot of humorous newspaper publicity. "Things must be pretty happy in outer space," wrote one columnist, "for, way out there, there's a comet wagging its tail! Maybe it's coquetting with the Dog Star."

Do you still hunt for new comets? With a few more you could break the record.

Oh yes, I still comet hunt. Though I don't think that another new comet would thrill me that much anymore. Not unless it was one like Ikeya-Seki, the brilliant comet of 1965.

You have other ambitions now.

I think I would like to discover a large meteorite. Especially a pallasite. To me a pallasite is one of the most fascinating objects in the world. And not a single one has been found in Arizona so far.

A pallasite? That's a type of stony-iron, isn't it?

Olivine crystals in a nickel-iron matrix. It looks like a piece of Martian peanut-brittle. I'd like to have a slab big enough to make a coffee table.

That must be a nearly unique ambition. A coffee table from outer space. And six comets. That must put you in second or third place in the U.S.?

I think so. You'll have to get the Guinness people interested in comet records for their book. Then we'll all know.

Do they have an entry for the largest astronomical handbook?

(Laughing) Not that I can remember. But I don't think there are many people around who have written a book of over 2,000 pages.

No, that should set some sort of record, I would think.

For audacity, at least. It takes a certain amount of crust to produce something that is almost certain to get you more criticism than praise.

Have you received a great deal of criticism?

To be truthful, not nearly as much as I expected. There are certain people, of course, who have been raised on the tradition of the Infallibility of the Written Word. If you publish an error, you're disgraced for life.

Anything of that size is bound to contain occasional errors.

Yes. Even if I were absolutely infallible, there would still be errors inherited from standard catalogs and reference sources. And I can tell you that these are far from rare.

Not to mention the problem of proofreading 2,000 pages of data. It leaves you goggle-eyed, with symptoms not unlike those of minimal brain dysfunction. If you have a short article, of course, you can take it to an astronomer friend and say: "Check through this, would you, when you have the time?" Try that with a ten-pound manuscript.

No thanks. Tell us, has the book won any awards of any sort?

Not yet. But it probably won't. It doesn't fall into any of the prescribed categories, you see. It isn't a Ph.D. thesis; it isn't research; it isn't a noble attempt to interpret science for the general public. . .

That's always a problem with something more or less unique. Someone should start a society in your honor and nominate you for the first award. There is a Webb Society, isn't there?

Yes, in England. They recently published several volumes in a series of observing guides.

But no Burnham Society yet?

I'm afraid not. I think it works something like getting your picture on a U.S. postage stamp, you know. You have to be dead for about fifty years first. I can hardly wait.

Yes. Tell us, when did you reach the point where you thought seriously about publishing the Handbook?

It came on gradually, like a cold in the head. Oh, it was about 1963 or so. During my first five years at Lowell the book had more than tripled in size. I was using Webb's too, of course, and I began to think: Now this is really absurd. Here's something that was first published in 1859, and over a century later it's still being offered to the modern observer as the most complete deep-sky handbook available, even though the text was last revised in 1917. Now surely this must set some sort of record in the annals of long-time lethargy.

Is there a category for that in Guinness?

(Laughing) I'm afraid not. A pity. Astronomers would win first place with no competition.

But a new edition of Webb did appear about that time, I think. In 1963 or so?

Yes, a reprint of Webb was issued, and one reviewer -- I think it was Leif Robinson -- pointed out that no real attempt had been made to update obsolete facts and interpretations, and what we really needed was a new deep-sky guidebook written for the 20th century observer.

And you answered the call.

Well, I tried to, only to find out that nobody seemed to be very interested. The unusual size of the thing was the chief objection. I estimated then that the total would run to about 1,400 pages. And that was considered completely impossible. I tried a few of the large astronomical publishers. Some thought that there really wasn't much of a demand for anything like it. Others said that there was no way to finance such a thing.

One publisher said that they would have to hire someone full time for a couple of years just to check and edit the material. That would be a requirement, they said, if they were to publish. At a cost which would make the project impossible, of course.

That must have been very discouraging.

That was the high point of the conversation. After that, things started to go downhill.

You actually tried being your own publisher for a while, didn't you?

Yes, but don't remind me of that. The memory of those days still causes me to leap forth from my pillow with a loud cry. I have this nightmare, you see, where I'm trying to publish the *Britannica* from my kitchen table...

Sorry. In a recent article on the Webb Society guidebooks, the reviewer found it surprising that so few works of the type are available in English.

It is surprising, yes, because the astronomical world offers virtually nothing in the way of support, incentive, or rewards. It was Don Marquis, I think, who said that publishing a volume

of poetry was like dropping a rose-petal down the Grand Canyon and waiting for the echo. He could have been talking about a project like mine.

While you were waiting for that echo, did you consider the academic publishers?

Of course. Academic publishers have a major problem. Their books are so immensely overpriced that only a few academic libraries can afford to buy copies. At the typical per-page rate, mine would run to something like two hundred dollars for the set. That would put it far beyond the reach of the eager amateur for whom it is intended. I couldn't afford to buy a copy myself.

The financial angle was always the reason for the rejection of the book?

Well, let me put it this way. A very large book, directed toward a fairly limited audience, is not the sort of thing that publishers are going to go wild over. It is not "economically feasible." And of course you're told that the times are hard and money is tight. And no one wants to take the risk. . .

Money is always tight, isn't it?

I have never known a time when it was loose. It seems that the times are *always* hard. The modern world has become a permanent crisis. But for some odd reason it is always the scientific, educational, and cultural activities which are ruthlessly cut back when money is tight.

Museums are in trouble. Schools and colleges are in trouble. The space program is in trouble. Symphony orchestras are in trouble. Basic research is in trouble. Yet there always seems to be plenty of money to build a new shopping center or a new chain of motels, a missile system, or a gambling casino.

I don't see anyone cutting back on the production of junk, schlock, tripe and garbage. The nation's commercial presses grind out incredible trash by the megaton. How much does the American public spend each year on third-rate movies, cheap magazines, fringe-cult pseudo-science, junk food, and astrology? Last year the money spent on tobacco in this country came to ten million dollars a *day*. If we have that much money to burn, I don't think we're exactly short of cash.

The people say it's their money, they earned it, and it's their right to spend it as they choose.

Yes, of course. And manufacturers say that they have to give the public what it wants. And of course the public vastly prefers astrology and pseudo-science over astronomy and general knowledge. We can blame the public, or the educational system, or the commercial racketeers who exploit human ignorance. But in the last analysis, the scientists themselves must shoulder much of the blame. Obviously, they have done a fearfully inadequate job of informing the public about science.

You're asking for something which is not exactly easy.

No, it isn't. Scientists get very bad press. Isaac Asimov, in one of those entertaining "My Turn" editorials in *Newsweek* once said that there is a cult of ignorance in the United States, and always has been. There is a strain of anti-intellectualism winding its way through our political and cultural life, as he put it. And science gets the blame, rather unfairly, for the misuse of technology. So anyone who shows any sign of brains, wit, or talent is denounced as an egghead.

Are you an egghead?

I think of myself simply as a human being, though the evidence is still not entirely conclusive.

You think, though, that scientists could improve their image somewhat by taking a different approach?

Well, this is going to sound like rank heresy...

Go ahead.

Let's consider just one current trend: the spectacular revival of belief in astrology. Now, very few scientists have bothered to do anything much about this at all. In the first place they don't have the funds to combat such a lucrative industry. And in the second place they think the whole thing is beneath their dignity, and really too silly to bother with.

You would disagree?

Of course it's silly. But the fact that something is silly doesn't mean that it should be ignored. Hitler was silly. The Inquisition was stupid. The great religious wars and persecutions, I would argue, were thoroughly absurd. But they were also very terrible. The beliefs themselves may be silly or harmless, but a resurgence of medieval-type thinking is no laughing matter. Do you remember that Akron, Ohio, survey?

What was that?

Shortly after the Apollo 11 moon-landing, an Akron newspaper conducted a survey of public opinion on the achievement. About 50 percent of those interviewed felt that the moon voyage wasn't really that important, scientifically or otherwise, but at least it proved that we were ahead of the Russians. About 25 percent thought the whole thing somehow blasphemous or displeasing to God. And fully 9 percent refused to believe that it actually happened. The Dark Ages have lasted a little longer than we thought.

Most scientists would probably agree with you there.

Yes, I would hope so. But when actually facing such a phenomenon as widespread public acceptance of astrology, what does a scientist actually do?

Foams at the mouth a little?

Yes, But that's about it. His sole response is to point out that there is no scientific evidence for such beliefs. Now the astrologer can afford to laugh at such feeble protests from the ivory dome, since the average American has not been raised in a culture that attaches any great importance to scientific evidence. There is no scientific evidence for most of the other things that people believe either. And besides that, the astrologer is raking in the money by the bucketful, while the astronomer is muddling by on a very modest salary, and wondering what on earth he will do if they cut off his grant.

Was that an example of Burnham's cantankerous sarcasm I was warned about?

(Laughing) Some of it. A relatively mild attack. I get much worse ones when I hear about an astrologer being awarded over two million dollars for the paperback rights to an astrology book. This happened shortly after a respected scientist assured me that no astronomical group could afford to finance such a project as the *Celestial Handbook*, and that I could either produce it myself or forget it.

You're making this up, aren't you?

Not at all. In 1978 Fawcett Books paid \$2.25 million for the paperback rights to *Linda Goodman's Love Signs*, a book of 1,186 pages that was originally published by Harper & Row at \$15 per copy. This year there is an astrology cookbook out which is really simmering on the front burner, and also a new bestseller on horoscopes for dogs, which is expected to be a howling success.

Oh Bob, that's terrible.

Yes, I thought so. I forgot to mention that there's a company that has programmed a computer to print out horoscopes, at \$20 a whack. They're grossing something like \$15,000 a month. Now I'd like to receive something like that for the *Handbook*. Or that two million, perhaps. Not in one unwieldy lump, please. Monthly checks would be fine.

We'll remember that. I get the impression that your opinion of astrologers couldn't be printed in a family newspaper.

I feel about astrology pretty much the same way as I feel about most other occult or pseudo-scientific ideas. The central thesis may be credible itself. We can't rule out the possibility that the planets do have some effect on human life. But certainly not in the way that the astrologers claim. All their rules seem completely arbitrary. They ignore the actual constellations, for example, and deal with something called the "signs of the zodiac," a totally artificial concept that man has invented. They attribute influences to the various planets without telling us how any of this was determined. Their claims are beyond the possibility of checking. Jupiter is supposed to influence financial matters, and Uranus is the governing planet of the aviation industry. Neptune rules the railroads. If these ideas are anything more than sheer make-believe, I would like to see the evidence. What sort of experiment could you possibly make to demonstrate the influence of Neptune on the railroads?

They'll probably think of something.

I don't doubt it. And if they come up with the slightest possible correlation, they'll announce that astrology has been "proved." They are claiming that astrology has been "proved" now by the finding that a "Gemini" person has a noticeably different personality from a "Scorpio" person. What they are really saying is that the average person born in June has a different type of personality structure than one born in November. Let's suppose that this could be convincingly demonstrated. Where does this leave us? What have the stars and planets to do with all this? The difference is much more likely to be due to environmental effects right here on Earth. Temperature and humidity, for example.

I think most scientists could go along with that.

Yes. But it doesn't offer much support for the claims of astrologers, does it? Now I think I can claim to be reasonably unprejudiced. For one thing, I am totally unconcerned about upholding any sort of "academic reputation." I don't care in the least what the scientific "establishment" thinks about unorthodox ideas. Scientists have been wrong in the past, and will certainly be wrong again. I hold a strictly "Sherlock Holmes" attitude about the universe; every theory must stand or fall by the weight of the evidence. I forget who it was -- Fred Hoyle, perhaps -- who said that if a theory is to be of any use, it must be vulnerable. In other words, there must be some way to check the evidence.

That's what science is all about, isn't it?

Yes, in theory. There is certainly no place for dogma or bigotry in science, or even for any sort of absolute authoritarianism. The Universe itself -- Nature, as we call it -- is the only authority. But there is a serious problem with the whole question of "evidence." All human beings are fallible, not only as observers, but as analyzers of data. We are all capable of misinterpreting the evidence, often to support a pre-conceived viewpoint. And it isn't only fringe-cult people and theologians who do this. Scientists are not immune, being human after all. Even more disturbing is the fact that we observe "evidence" which doesn't exist at all; the "canal-network" on Mars, for example.

That was a question of an optical illusion.

Yes. But how many of our other cherished beliefs are based on some illusion? Consider the world's great religious traditions. How much of this is really based on solid hard-core data? How much of this would be considered acceptable evidence in a court of law?

Probably not much. But people don't look at it that way.

No, they don't. Unquestioning belief is an important factor in many religious traditions. To a scientist this seems downright silly. But scientists themselves are often not much better. I recall hearing one psychology professor state that he could not accept the supposed laboratory evidence for ESP, no matter how good the statistical proof seemed to be. And why not? Because there was no acceptable *physical explanation* for such a phenomenon. In other words, ignore the evidence because it doesn't fit our pre-conceived view of reality. Now that attitude doesn't strike me as "scientific."

I get the impression that your personal feelings about astronomy don't exactly match the expected academic outlook.

Well, I recall the time I was asked to write an astronomical article for the hometown newspaper. I used the phrase "the intriguing mysteries of the universe." For that I was criticized by a respected professional astronomer. He said it gave the wrong impression of research. There are no mysteries in the universe, he assured me. Only data that hasn't been analyzed yet.

You wouldn't agree with that.

Such an attitude is about as far from mine as it's possible to get. I would argue that we know very little at all so far, and that virtually *everything* is still a mystery. Let me give you a quote from Thomas Edison...

Go ahead.

He said: "We don't know one millionth of one percent about anything." I could give you a few more quotes, but never mind. Let me put it in my own way. Here we are, living on a tiny satellite of one average sort of star, like billions of others. All these stars make up a huge aggregation -- a great "star-city" called the Galaxy -- like billions of others. Now, suppose you constructed a scale model of the Galaxy -- just our own Galaxy -- and you made this model so huge that it covered all of North America. How big would our Solar System be on that scale? *You could fit it into a coffee mug.*

That's pretty overwhelming.

Yes. and it makes the claims of both theologians and scientific materialists look pretty silly. A scientist may seem justified in dismissing much of the world's established religions as puerile folk-lore. But no one has shown that the viewpoint of the scientific materialists is really much better. To say that "matter" is the basic reality is to say nothing at all. "Matter" is just a word. A scientist will tell you that all material objects are composed of atoms, which are composed of electrically charged particles called protons and neutrons and electrons, and these are composed of something called "quarks." If you ask, what is an electron, actually, there is no answer, except that it is clearly not some hard little physical object like a microscopic ball-bearing. All these sub-atomic particles seem to be basically non-material. An electron is not a *thing*, it seems to be something in the nature of a tiny energy vortex. So what is matter, really?

We don't know yet.

No, we don't know yet. We don't know what electrons and protons are, and we don't know how we manage to be conscious and intelligent. So we really know almost nothing. We are just beginning to find out how to *learn*. And I would say flatly that there are mysteries all around us which are not going to be explained by any amount of analysis of factual data.

You're speaking of so-called paranormal phenomena?

No, not at all -- though possibly some of these things do deserve more serious consideration from scientists. I'm speaking of things that are part of our normal familiar world, right here in plain sight...

Give us an example.

Hamlet. The face of Abraham Lincoln. Bach's *Toccata and Fugue in D Minor*. And I would add the Grand Canyon.

You would call a great symphony a mystery?

Yes. What would you call it? A remarkable acoustic phenomenon?

Well, most scientists would say that the Grand Canyon is simply a remarkable geological phenomenon.

Yes, of course it is. In the same way that a human being is 150 pounds of animated protoplasm. The definitions are not incorrect. They are simply astonishingly incomplete. This explains much of the public apathy toward science.

The strictly scientific approach seems limited to the mechanical aspects of the world -- things that can be weighed and measured and reduced to definite principles that can be expressed either verbally or mathematically. Science, many people will say, doesn't seem able to deal with most of the things that really matter in human life.

Last year a Harvard professor said something about science reaching the point of diminishing returns. I gather you'd agree with that.

Well, setting aside the question of technical prowess for the moment, I think the average person would see it that way. Instead of making everything clearer, science is giving us a universe which becomes more and more bewildering and unintelligible. To most people the universe made more sense when the Earth was thought to be a flat disc, and a very personal deity was running the whole show from his throne up there somewhere, just a mile or two above the ground.

There are probably some people who still see it that way.

I'm sure there are. There is a flourishing Flat-Earth Society in London, and another was established in California last year. Or so I heard.

Let's go back a bit to your *Handbook*. Do you think that your somewhat unorthodox viewpoint made it difficult for you to obtain support for the project?

Undoubtedly. There are professional astronomers, it pains me to say, who see the universe solely in terms of "research." They don't recognize the existence of any such animal as the serious amateur. There are only real astronomers, they say, who are doing serious research; and then there's everybody else, but they don't matter.

When I pointed out that Webb's book was at least half a century out of date, the response was an apathetic shrug. Who cares? -- the days of Smyth and Webb are gone. Astronomy is now Big Science. Nobody ever looks at a star except to set the automatic guider for the spectrophotometer. A real astronomer may do research for years and scarcely ever see the actual night sky.

And your reply to that?

I said that if astronomy had really come to that, I would seriously suggest that all the great telescopes be locked up for a few decades so that the rest of us might have our stars back again.

You are primarily an observer.

Yes. I don't see the universe chiefly as a huge heap of raw data waiting to be fed into a computer. Collecting factual data is fine. I do it too. But the heart and core of astronomy, to me, is the direct experience of the universe. All the factual information in the world is no substitute for that.

Such a statement brands you as an amateur, some would say. And a romantic as well.

Yes, I wouldn't argue that. By professional standards, I am not much of a scientist. On the other hand, I would say flatly it is a serious error to present astronomy to the public strictly as a *science*.

Since the average man is not a scientist, and has only a limited understanding of science, his first response is to be turned off by that approach. All that kind of stuff can be left to the professor, he will say; he doesn't have to bother *his* head about it.

A century ago, Emerson lamented that a man in the street does not know a star in the sky. He could still be lamenting today. When everything becomes Big Science, what is there left for the average man? How many Americans would bother to visit Yosemite or the Grand Canyon if these things were presented to the public strictly as geological phenomena, and therefore of interest only to professional geologists? Astronomy should be presented primarily as exploration, adventure, and discovery. The scientific aspects can come later.

I see what you mean. You're what used to be called a *naturalist*, I believe.

Yes. The species is nearly extinct, I think. Thoreau and John Muir are among my heroes. It was Thoreau who said it enraged him to buy a book on frogs and find nothing in it except an analysis of bone and muscle structure. Well, I would say that it enrages me to find a book on astronomy which confines itself to strictly physical and numerical data. That's like trying to describe a great work of art and limiting the description to a chemical analysis of the pigments.

Some would say that there isn't much of an analogy there.

I know. That's where they would be wrong. I would reply that the universe cannot be comprehended through strictly scientific techniques. We are dealing with something that resembles a great symphony or great poem vastly more than it resembles a huge machine.

That's almost a religious statement.

Yes, it is.

But most of your friends describe you as strictly agnostic.

By formal standards I am agnostic. I don't subscribe to any organized creed; I have never felt the slightest need to adopt any sort of definite theology or set system of beliefs. Alan Watts has said it for me: "That would be like trying to wrap up and label the sky." I hope to see all such things eventually disappear as mankind emerges from its infancy. We don't know enough yet to say what it's all about.

We are all children. But if we cannot be wise, we can at least be honest. I accept the existence of what I call the all-pervading intelligence of the universe. The Orientals call it the *Tao*. To me, that is too obvious to need scientific proof. That's my religion -- that and the Grand Canyon. And Yosemite. And the surf coming in with the tide. And NGC-6611.

And if you had to put all this into some sort of definite statement as a reply to more conventional ideas?

I would say this: There is no ultimate truth about life or the universe which can be expressed in words. Whatever it is, it has to be experienced directly. Words are symbols, never to be confused with the thing itself. The most that any set of symbols can do is to point the way. Your task is to walk down the road, not to worship the signpost.

But do you think that most people see the universe as a mystery?

The average man probably doesn't. He has some sort of standard-brand faith which gives him all the answers. The attitude of the scientist is a little harder to understand. He seems amazingly unaware of the greatest mystery of all -- the fact that we are conscious and aware, and can feel and reflect and think. Now there are biologists who will explain that there is really no mystery here. Consciousness is explained as the result of the extremely complex electrical circuitry of the brain. Which tells me nothing at all. One might as well say that a painting by Monet is a masterpiece because of the way the pigments are arranged on the canvas.

The atoms that make up our bodies and our brains are no different from the atoms that make up a boulder or a cloud or a log of wood. But arrange them in the right way and you have a living, conscious entity. In fact, you have not only such curious and wondrous things as elephants, meadowlarks, and sequoia trees, but Beethoven, Shakespeare, Lincoln, and Einstein as well. Now surely this must tell me something about the nature of the universe. Obviously, the potential for intelligence is *there*. Which is enough to convince me that the universe is *not* a huge, meaningless aggregation of dead matter being shoved around by blind mechanical and chemical forces.

But isn't that exactly how many scientific materialists claim to see it?

Well, they claim to. But I detect a curious bit of unconscious hypocrisy here. If you think of the cosmos that way, you have no choice but to think of yourselves that way too. And I don't know any scientist who will admit that. Not even the most stubborn materialist thinks of himself as a mindless machine. Isn't it amazing, Professor Jones, that this totally dumb, blind, stupid universe has accidentally produced something so remarkably rational, thoughtful, and intelligent as yourself? A really remarkable achievement for the blind monkey at the typewriter, isn't it?

You don't believe in the blind monkey at the typewriter.

I'm afraid not. Many scientists would criticize me for hovering on the brink of anthropomorphism, but I don't quite see why a strictly materialistic outlook is supposed to be so noble either. Aside from the fact that it's really impossible as a philosophy of life. You can't build a decent society on it. People need something much more than that, obviously. And much more than just a long listing of scientific facts too.

Man is "incurably religious"?

Yes. That's beyond argument, I think.

But if you reject the blind monkey at the typewriter, what's the alternative? Aren't you giving us the old classical "argument from design" again?

Well no, I'm not. Such arguments have been repeated about a thousand times. And discredited about a thousand times. The conventional argument is the old *watch and watch-maker* analogy. The universe is so astonishingly complex and works so perfectly that it can't be explained by chance. So it must have been deliberately designed by some all-wise creator. Well, the universe doesn't really resemble a watch. And of course the universe works perfectly, because the only kind of universe that can exist at all is one that works. If it didn't work it wouldn't exist, and we wouldn't be here to be asking the questions.

That's a good point.

Yes. The conventional logic really gets us nowhere, because the same arguments would apply to the creator as well. If it makes any sense to ask who created the universe, it makes just as much sense to ask who created God. In fact, most Orientals would tell you that two questions are identical. The universe is not some sort of artifact that was "created." It does not resemble a huge piece of clockwork. Or a collection of ceramics designed by some Master-potter. Who

was it who called this the "Crack-pot model of the universe"? Human beings like to trap themselves in semantic baffle-gab. We hear it all the time. "Nature is the creation of God." Well, that's clever verbal gobbledygook. One might as well say, "The blazing of the light caused a burst of illumination." The sentence is arranged to make it seem that we are talking about several different things, so then we can argue about which of these things was the "cause" of the others. "Nature" and "creation" and "God" are three different names for the same thing: the Universe, the world, or what we call "existence."

That's the oriental view, isn't it? Most western theologians would reject that as pantheism.

Well, I don't really care what you call it. Let's not get stuck on verbal labels.

People who argue from evidence of design usually have to resort to some kind of statistical arguments, don't they?

Yes, of course. What are the *chances*, they ask, of something so complex as a protein molecule being formed through some random, mechanical process? Pretty slim, apparently. But the materialist can bounce right back with a logical counter-argument. The universe is unimaginably huge; there are trillions of experiments going on all the time; so just about *anything* that's possible is going to happen eventually, somewhere, sometime. Yes, it certainly seems remarkable that everything is just right for intelligent life to exist on this earth. But if everything *wasn't* exactly right, we wouldn't be here. We'd be somewhere else. Or something reasonably like us.

So statistical arguments don't mean much.

Not the way they're usually presented. Make a mental experiment for a minute. Imagine a square mile of land, marked off into one-inch squares, like a giant checkerboard. That would give you about four billion little squares.

I'll check your arithmetic later. OK. Four billion little squares, let's say.

Now take four billion little bingo tokens, all numbered in order. Shake them up in a big box, and hand them out one by one, at random, to be placed on the four billion squares. You'll get a certain distribution which is assumed to be totally random; token number 10,362 is on square 4,981 and so on.

OK. Now what?

Record the results. Shake up all the tokens again, and repeat the whole experiment. *What would be the chances of getting exactly the same distribution a second time? Or a third time?*

Pretty close to zero.

Yes. In fact the statistical people would tell us that you wouldn't get the same results again even after several billion years of trying. So by the usual logic, we now conclude that the original distribution must have been divinely ordained because the odds against it happening by chance are simply astronomical.

That's flawed logic, though, isn't it? Just going by the laws of chance, *any* other distribution would have been just as unlikely, too.

Exactly. That's the problem with these statistical arguments. Trillions of events are occurring all the time, so it shouldn't surprise us if any one event should seem extremely unlikely. Yes it is. But the alternate possibilities would be equally unlikely. *However...*

Now you're going to come up with something else.

Yes. Let's change the experiment just a little. Instead of the numbers on the tokens, we mark them with the letters of the alphabet. Shake up the whole mess, and put them out one by one, at random, on those four billion squares. What do we do now if we find that the whole thing now

spells out, word for word, the complete text of *King Lear*, plus Dante's *Inferno*, plus all the poems of Keats and Shelley, in order?

That's not going to happen.

Looking at it logically, no. Not even after trillions of years. But if it did?

Well, we'd say that some intelligence is acting on the whole set-up. That it couldn't be due to random chance.

Exactly. But the Universe itself *has* come up with all these things. So where does this logic lead us?

But the plays of Shakespeare weren't produced by the Universe. They were written by Shakespeare.

Yes, of course. And the poems of Shelley were composed by Shelley. But human beings did not design themselves. Shakespeare did not deliberately design his brain, nor did Beethoven consciously *plan* to build a mind that could create musical masterpieces. All of this *somehow* comes out of the Universe itself. You can say that we do it, but it is really done *through* us.

But that goes back to the argument from design, doesn't it?

No, it doesn't. I am not arguing about whether these things happened by design or by chance. However it was, these things *have happened*; the Universe *quite clearly has come up with intelligence and consciousness*. You can argue that it was by chance, but that doesn't change anything. The fact that it was possible *at all* is the important point; this fact alone must tell us something of supreme importance about the very fabric of the Universe.

OK, I see what you're driving at. But wouldn't most scientists still say that the development of intelligent life *could* be just some...unimportant by-product of the whole gigantic show...

Including the brainy scientist who is making that remark? Yes, of course. But why is it considered more *scientific* to hold such a view? Is it more logical to believe in meaningless, random chance, rather than in intelligence in the Universe? Why should it be?

Probably because the organized religions have made the whole idea so...

Cranky? Primitive? Yes. Well, that's the old "guilt-by-association" syndrome again. A lot of scientists won't touch ESP research for the same reason. They don't want to be identified with cranks. But this situation is chiefly limited to the western cultures. Consider the difference in artistic traditions, for example. Suppose an American or European collector offers to show you a "religious" picture. You know what you will see. A Madonna. A nativity scene. A crucifixion. The martyrdom of some saint, perhaps. Always a *conventionally* religious theme. Now, let a cultivated Chinese gentleman show you *his* religious picture. High peaks looming through mist. A gnarled pine tree on a windy cliff. A mountain chasm at dawn. Yes, there *may* be a hermit or a holy man somewhere in all this, but you have to really hunt for him. Where's the religion? Well, the oriental is experiencing the presence of the intelligence of the universe. In the world of nature.

You used that phrase before. But you don't think of this "intelligence of the universe" as any sort of personal deity? Einstein didn't, and I don't think that most scientists do.

No. You might as well as me to believe literally in the Easter Bunny. Or Santa Claus.

Whatever the word "God" means to me, it does not mean that. Harlow Shapley once said that the deity concept should perhaps be abandoned because of its confused meaning. No, I don't think of the universe as some sort of ultimate monarchy being ruled by a cosmic king on a throne, handing out written directives to his subordinates like a commanding general.

And I am not being irreligious when I say this. I once heard a liberal minister lament that the average American seems unable to go beyond a concept of God suitable for a six-year-old

child. I don't think he would find any reason to alter his opinion today. Religious leaders everywhere seem determined to go back to a crude, literal fundamentalism, the sort of thing that has been making standard-brand religion look silly for the last two centuries.

I imagine that you take a pretty dim view of the current swing back to old-time fundamentalism.

It can be an extremely irritating experience to talk to one of these people, because all their arguments go around and around in a closed circle, like a snake swallowing his tail. First of all, they tell us that the entire physical world is somehow corrupt or "fallen," and therefore cannot be trusted. Human reasoning is also fallible and limited, and therefore cannot be trusted. Science, which depends on human analysis of physical evidence, therefore cannot be trusted. So the whole concept of reliable knowledge hasn't got a leg to stand on. All this is summed up in that impressive phrase: "The wisdom of man is foolishness to God."

Well, you can't really argue with that, can you?

Of course not. We are all fallible human beings, so we are all capable of making errors. But this doesn't apply only to scientists and pragmatic philosophers. It applies to theologians as well. Yes of course the wisdom of man may be foolishness to God. It doesn't seem to occur to these people that all the theologies of the world may also be foolishness to God. If we can't put much trust in scientific thinking, then we can't put much trust in religious thinking either. The validity of all these things depends upon human observation, human testimony, human interpretation, human reasoning. Whatever discredits scientific thinking discredits religious thinking as well.

Religious leaders claim to have a divine revelation which cannot be questioned.

Yes. But if neither reason nor science nor evidence nor human testimony can be trusted, how can you possibly know you have a divine revelation? Since you admit you are fallible human being, how can you be sure that you would recognize a divine revelation if you saw one? That's a pretty arrogant claim to make, isn't it?

Religious authorities will say that the whole history of the last two thousand years proves the truth of their claims.

Oh sure. The Inquisition, for example? The witchcraft mania? Centuries of cruel persecutions and intolerance and bigotry? How does it happen that this divinely revealed faith has by far the worst history of any of the great religions of the world, and has everywhere been the major cause of barbarism, strife and war? The whole history of Christian Europe reads like one long nightmare. Well, let's suppose that none of these things had ever happened. Let's close our eyes and pretend that the history of religion in the western world was all perfect sweetness and light, as many simple folk fondly imagine. The validity of their claims would still depend upon human reasoning. All theological statements are human statements; all theological writings are human writings; all religious concepts were developed by human beings. Obviously. There are people who imagine that they have something more, since their whole creed depends upon that idea. And where do they go to prove this? Right back to human reasoning! You can find entire books -- hundreds of them -- devoted to proving some theological doctrine or other. Using step by step human logic.

What kind of arguments would you give one of these people who claim to have an infallible revelation?

The first response to *any* sort of claim must be: How do you know this?

They'd start quoting scripture at you.

Well, any human being can claim anything. It's up to the believer to prove his claim. Certainly all written manuscripts are the work of human beings; they were written by people, edited by people, compiled and translated by people. No book has ever fallen out of the sky with a postmark announcing "Printed in Heaven." This extreme reliance on the printed word is an irritating feature of western religion. I agree with Alan Watts when he said that worshipping a book was as much idolatry as worshipping an image of bronze or stone.

Yet you said that people really do need some sort of religious outlook, beyond what science can supply in the way of facts.

Yes, I did say that. But to me, religion has nothing to do with formal creeds or systems of belief. Religion to me is almost entirely a matter of developing or systems of belief. Religion to me is almost entirely a matter of developing what I would call "sacramental consciousness." There are people who are not at all religious in the conventional sense, but have this "cosmic awareness," so to speak, to an amazing degree. Consider some of the great Chinese poets. No one would classify Tu Fu as a religious writer. Yet Kenneth Rexroth has said that Tu Fu's response to the human situation is the only kind of religion likely to outlast this century. "Reverence for life" it has been called.

But do you think that something like that is enough for most people?

Evidently not. But if we really have to go much farther than that, we had better try to keep our heads. And please don't tell me that "faith" is the answer. If it's a question of "faith," you could believe just about anything. You could accept the religion of the ancient Egyptians or the Aztecs as readily as anything else. Faith is of no help in trying to decide between various claims. If I am not allowed to think and reason and judge, then the whole situation is really hopeless. What possible basis is there for a decision?

Most people will say that they accept the creed which seems most reasonable to them.

So we're right back to human judgment again. Attend the church of your choice. But I don't see much evidence of real choice in any of this. The geographical distribution of religions is enough to disprove that. One country is 93 percent Catholic; just across the border another country is 97 percent Protestant. Cross the ocean and you find a third country that is 98 percent Muslim. What has free choice got to do with this? Obviously the whole thing is a matter of early social conditioning. People inherit their creeds in the same way that they inherit their last names. Only a few people seriously question the traditions which surround them from their earliest years.

The established religions themselves tend to reinforce all this.

Yes of course. Is there any religion that invites doubt, skepticism, or a freely inquiring mind? The scientist is free to say to his colleagues: "Gentlemen, new findings have made it necessary to revise some of our ideas." Have you ever heard a minister make such an announcement to his flock? The average believer shows about as much independence of thought as a programmed computer.

And if you really had to make a choice between established faiths...

Oh, I'd be a Zen Buddhist probably. Or a Taoist, I suppose. Yes. They don't split the world into a material half and a spiritual half and then require you to take sides in this imaginary war. They don't fill you up with guilt, fear and shame, and then try to convince you that only *their* particular creed offers any way out of this impossible situation. They don't require you to put your brain into cold storage, or reject scientific findings that don't seem to agree with the ideas of the ancient prophets. They don't demand unquestioning acceptance of dogmas that evidently haven't the slightest chance of being true. And above all, they don't require you

to accept rigid verbal definitions of ultimate truths that are obviously beyond any verbal definition anyway. Let me give you another quote...

Go ahead.

This one is from Krishnamutri, accepted by many as one of the great spiritual teachers of our time. "I maintain that truth is a pathless land, and you cannot approach it by any path whatsoever." In other words, verbal creeds are not only useless; they become positive barriers raised up against the possibility of attainment. It is the old question of "trapping your mind in a net of words," as the Zen teacher would call it. Practically all the great religious disputes of the western world were squabbles of that sort. The great theologians were aroused to fever-heat by purely verbal disagreements over precise definitions of invented concepts. It all seems marvelously insane now.

Scientists sometimes aren't much better.

No scientist is quite as bad as that. And at least they are more *humane* about it. They don't march out to murder each other over scientific questions. A scientist who holds somewhat unorthodox ideas may find himself cold-shouldered by the establishment, but at least he isn't hauled up before an Inquisition and sentenced to death.

You spoke of something you called "sacramental consciousness" as being the real core of religion. Aren't you aware that many religious leaders have said pretty much the same thing? And that its loss is the chief source of all the anxiety of the modern world?

Yes, I know that. On this point I am in agreement with the theologians. But there is room for pretty lively disagreement about the cause of this situation, and what can be done about it. Lin Yutang wrote that the modern world has gone to pieces as a direct result of scientific materialism invading our thinking. Our human values and our moral values have disappeared, he said, and all we have left are carefully tabulated facts. Our whole conception of the nature of man has been falsified and debased; the bottom has been knocked out of the human universe --

But you don't exactly agree with that?

Well, I don't exactly disagree with what he's saying. But that's only a part of the problem. And it is a little unfair to blame science for all of this. Western-style theology has made an enormous contribution to this seething mess by dividing reality right down the middle, and then setting the two parts into conflict with each other. We are all trained to see the world as a battlefield; the mind versus the body, the spiritual versus the material, good against evil, the sacred against the secular, man against nature, the holy against the profane...In western thinking the sacred is not only set apart somehow from the physical world, but is identified solely with the supernatural. The oriental thinkers have always known that these distinctions are false. But in the western world only a few unusual personalities like Bertrand Russell have seen this. And western science has grown up in this artificially divided world, despite its rejection of the underlying philosophy.

Most of us still think of religion in terms of Sunday-school platitudes?

Well, you might say so. Yes. Our whole view of the world is centered around the notion of the good soul fighting the evils of a material world. And the odd idea that evil is something that can be stamped out by force. So the religious child in the western cultures is conditioned to think of himself as a brave soldier marching off to defend righteousness in a holy crusade. To the oriental mind all this seems amusingly futile. Evil is not something that can be fought against or stamped out, the man of Zen will tell you. Evil is the result of gross ignorance, and the really important thing is to develop wisdom. Yes of course there are real evils in the world, and yes of course we must combat them. Do we really have to argue that? If a malarial

mosquito is about to bite you, naturally you swat it. Obviously. But do you really have to develop a Man-versus-Mosquito theology as the central theme of your whole outlook on life? Why should conventional religions be so infantile as that?

What do you say to people who think that science is somehow at war with religion?

Well, it's another example of that artificial division of reality, isn't it? I've heard some really curious arguments about this question. At least once a year I can expect to read some marvelously soothing analysis of the problem in the Sunday supplement. And it always goes something like this: There is really no conflict because scientists deal with the material world, while religion deals with spiritual matters. I don't know if such a comforting platitude really fools anybody. In the first place it's impossible to divide up the world in that way. "Material" things and "spiritual" things cannot be so neatly pigeon-holed. And in the second place, science does not deal exclusively with "physical" reality, nor does religion deal exclusively with "spiritual" or "moral" questions. Scientists and theologians are asking the same basic questions: How did the universe come to be the way it is? What does it all *mean*? And why are we here? So we are all talking about the same world, but we are speaking different languages. That's why there can be a real conflict. This is particularly true in the western world, because so many religious leaders insist on interpreting metaphorical or allegorical concepts *literally*. For some odd reason they also insist on taking ancient folklore as literal historical truth. When the scientist coldly replies that there is no real evidence at all for the historical truth of such stories, *then* you have a real conflict. All this seems downright imbecilic to the hard-headed scientist, since the symbolic or allegorical content of much ancient scripture is so glaringly obvious.

Still, there are other standards of truth besides strictly scientific ones.

Of course. Historian Herbert J. Muller put it something like this: Scientific standards of truth are not the only possible standards, *but they are* the necessary standards for claims to literal, factual, historical truth. So, many of the claims of the standard-brand faiths seem clearly contrary to fact. Not only that, but they defy the principles upon which reliable knowledge rests.

The modern creationists are in this situation right now. But I don't think I'll ask your opinion of them.

No. You'd know pretty well what I'd say! Well, it's the old question of the confusion of the map with the territory, the symbol with the reality. Literal-minded people are the curse of the world. Will Durant said that a supreme and unchallengeable faith was a deadly enemy to the human mind. Rigid verbal creeds are really impossible. They close the mind to any new evidence, or to any new vision of the world.

I remember a statement something like that in your introduction to the *Handbook*.

Yes. We great writers love to quote each other. It makes us seem so learned and well read.

Yes. Your readers have probably noticed little bits of philosophy and other non-astronomical material here and there in the *Handbook*. You seem to have a strong interest in ancient cultures and world literature and art...

Yes. It may seem a curious thing, but I find that the most direct way to approach any ancient culture is through its art. It is a direct language, so to speak. Something beyond the use of words.

Your friends tell me you do a little painting yourself.

Yes. Landscapes, mostly, in a style rather resembling the works of Robert Wood. The quiet forest scene is my specialty. Winston Churchill wrote that painting was the finest diversion in the world; there is nothing else that can absorb one so completely. I can be painting at about 10

p.m. and I'll say: Just a little bit more on this corner here and I'll call it a night -- and the next time I look at the clock it's 2:30 in the morning.

And then you grab the telescope and rush outdoors...

Sometimes I do. If I'm lucky it will be raining and I can go to bed.

How would you describe your painting style?

Interpretive realism with impressionistic overtones.

Do all artists talk like that?

Only when you get them backed into a corner. A painting is not verbal communication. A work of art has to speak for itself. That's why a completely photographic realism doesn't interest me very much. It leaves nothing to the imagination. If you can see every nail-head on the barn door, it may make you admire the artist's technical skill, but it really adds very little to the thing as a work of art. The artist is giving you nothing of himself; you might as well be talking to a camera. A good painting should express far more than a direct photograph of the scene would do. Otherwise you might as well trot out that camera and settle for a good Kodachrome.

Your sympathies are with the impressionists.

Monet is just the greatest. Especially his works at Giverny. Renoir and Turner I also enjoy every much. Among modern artists, Richard Earl Thompson is at the top of my list. And Wilson Hurley and Clark Hulings. They all perform miracles with the effects of light. Which is the chief thing I look for in a painting. They make you *see*.

You feel about art the way you feel about astronomy.

The value of all these things lie in what they call expanded awareness. Heightened consciousness as the mystics call it. To take up painting can be an absolutely startling revelation. For the first time in your life you have to really look at the world. You begin to learn who to see. And you realize you've been blind for years. Astronomy should do the same for you, of course.

Some critics would call that viewpoint incurably romantic.

Perhaps. But why not? The term "romantic" is always used in a derogatory sense. Like the word "sentiment." For some odd reason we are all being conditioned to look at the world in a very business-like, unfeeling, no-nonsense way. I would argue that art is inextricably linked up with human feeling and emotion. There are artists -- and composers too -- who are trying to divorce the two. I think they're crazy. This explains much of the gap between the artist and the general public. I think it was Stravinsky who was once asked if he thought there was really a generation gap. And he replied something like this: If what I hear on the radio and see in the newspapers is any indication, there is a gap about the size of the Grand Canyon separating me from just about *everyone*.

Many scientists and artists must feel the same way. But don't you think that the achievements of the space program are helping to close that gap?

The gap between the scientist and the general public? Well, perhaps. To some extent. And the popularity of science fiction may be a good thing too.

And films like *Star Wars*?

Well is *Star Wars* evidence of widespread interest in astronomy? I would hardly say that. Such epic productions are immensely popular because they are great fun and great fantasy. True, the story is played out against an outer space background, but it's *fantasy* outer space. Real space travel is not going to be anything like that. And the public knows this...

Do you think so?

Yes. Just consider the enormous market for space toys, games, *Star Wars* novelties, posters, etc. Now try to find any comparable commercial exploitation of the Apollo astronauts and the actual moon-landing. "We don't carry that," the dealer will snort at you. "Stuff doesn't sell." On the other hand, Edgar Rice Burroughs very definitely does sell. It's the fantasy the public seems to want, not the actual reality.

The fantasy seems more exciting?

Evidently. I doubt very much that any real space traveler is ever going to find himself rescuing gorgeous bikini-clad maidens from appalling six-armed Martian horrors.

You don't think so?

Wearing a bikini on Mars, I can assure you, would be almost instantly fatal. No, I don't think that the popularity of science fantasy is much of an indication of a genuine public interest in science. Rather than having more imaginative fiction, I would prefer to see more works which attempt to raise the public understanding of real science, and of the world around us.

Is that a plug for your *Handbook*?

Well...perhaps. But you see my meaning. I would rather see more people out actually looking at the stars, than simply sitting in their armchairs, reading about the mind-boggling discoveries being made with monster telescopes and space probes. This "gee-whiz" approach is always a little irritating to me, because it reinforces the impression that astronomy is only for the technically sophisticated expert. The stars belong to us too.

[End of part I]

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