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Executive Editor
Frank C. Jettner
Dept. of Astronomy
SUNY at Albany
Albany, N.Y. 12222

Editor John F. Christian
Associate Editor Jack Horkheimer
Circulation Director Ronald N. Hartman
Publicity Director H. Rich Calvird
Assistant Editors Donald Bean, Edward Hancock
Regional Editors J. Cotton, D. DeBruyn, T. Gates, R. Hitt, G. Muhl, S. Wieser, International Jeff Sparks

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In response to those who asked, the above aerial view is of the main academic podium of the State University of New York at Albany. These thoughts germinate from a small niche therein.

Our NEWSBEAT readers will note the successful international planetarium directors’ conference held consecutively in Toronto, Rochester, and Chicago this July. This meeting is especially important, for it reminds us of the hundreds of planetariums beyond the shores of North America with whom we should be regularly exchanging ideas and experiences. We have just received the official report that the conference has chosen to use The Planetarian to convey its contributions. We sincerely appreciate this confidence and the added opportunity to make this journal truly an intercontinental one. Overseas circulation has been gradually increasing, and we now have subscribers on all continents (except the Antarctic). We look forward to the possibilities afforded by this audience and have begun working on the attendant logistical problems.

Tom Gates’ report on the apparent enthusiasm of the large number of astronomy educators planning to converge on the Bay Area soon is really encouraging. The true potential of ISPE as a unifier of minds should soon manifest itself. Besides, there’s the lovely attraction of San Francisco. Come to think of it, I’m glad my paper is before that winery tour! Hmmm...

Frank C. Jettner

Letters

EDITOR: We are pleased to report many persons have sent letters or given us comments regarding the first issue of THE PLANETARIAN. Most fell in one of two categories. To the majority which were complimentary, our sincere thanks. We’re glad you liked the first issue.

A very pleasant aspect has been the number of attached inquiries from future contributors who seem encouraged by our format and potential. Editor John Christian is now finishing a pamphlet, “Information For Contributors”, which we’ll be mailing out to anyone interested soon.

The second category of letters asked, “where is it”. Although the journal’s first issue came from the printer nearly on time, many persons received it late because of the unexpected slowness of the mail and the logistics of programming the first onrush of mailing labels. A few regional associations have also been tardy in forwarding and updating their membership lists. Sorry! We aim to improve somehow!

The Committee on Manpower and Employment of the American Astronomical Society has ready for distribution copies of its pamphlet “Guidelines for Employment Opportunities in Astronomy”. Anyone desiring a copy can obtain one by writing a postcard to Mr. H. M. Gurin, Executive Officer, American Astronomical Society, 211 FitzRandolph Road, Princeton, N. J. 08540.

To indicate the scope of the Guidelines its nine sections are:

1. The Present Employment Situation in Astronomy
2. Letter from President Schwarzschild
3. The Placement Service of the American Astronomical Society
4. Applications for Positions in Major Observatories and Departments of Astronomy
5. Applications for Positions in Small Colleges, Junior Colleges, and Secondary Schools
6. Applications for Positions in Planetariums and Science Museums
7. Positions in Astronomically-Oriented Governmental Agencies.
8. Opportunities for Astronomers in Industry
9. Overseas Positions in Astronomy

Bart J. Bok
Steward Observatory
Tucson, Arizona 85721
I want to begin by telling you brief stories about three people.

Ten years or so ago, textbooks in Astronomy reported that we do not know the rotation period of Venus. When I learned Astronomy in high school and college, the rotation of Venus was a matter of mystery. It was thought that the period might be as low as a month, or it might even be a year. It wasn’t until the technique of radar astronomy was developed when we were actually able to send radar waves to Venus and observe the reflected signal, that the mystery was solved. Now the original purpose of transmitting radar waves to Venus was to find a better distance to that planet, and hence a better value for the astronomical unit. On the other hand, if Venus is rotating, the reflected radar waves should be received over a range of frequencies because the waves reflected from different parts of the planet are Doppler-shifted by different amounts. The surprising observations showed that Venus was rotating slowly, but in the opposite direction from its direction of revolution around the Sun. The earliest investigations indicated a rotation period of a little less than 250 days.

A few years later it was possible to measure the rotation period of Mercury by the same technique. Now it turns out that Mercury rotates in about 59 days. When theoretical astronomers investigated why Mercury should rotate in 59 days, they found that it could be understood in terms of the strong tidal forces the Sun exerts on Mercury, particularly when that planet is nearest the Sun.

Then they turned to Venus. How can we understand the 243-day rotation period observed for Venus? Peter Goldreich and Stanford Peale, who were both then at UCLA, found that under certain circumstances they could explain this particular rotation period of Venus also in terms of tidal effects. It turns out that Venus comes rather near the Earth at intervals which are simple multiples of 243.16 days. Thus they made a prediction that if 243.16 days should turn out to be the precise rotation period of Venus, it would be because of the Earth’s tidal effect on Venus. But this would have very strange consequences: it would require that Venus have pretty substantial lumps in it; that it deviate rather substantially from a perfect sphere. Thus it was of interest to get good observations and find out rather precisely how accurately Venus does rotate.

Among the people who were investigating the rotation of Venus was Dr. Roland Carpenter, then at the Jet Propulsion Laboratories. Carpenter, early in the investigation of radar studies of Venus, found that at certain frequencies the radar waves from Venus were reflected with extra-strong strength. He was able to identify waves of those frequencies as being reflected from certain areas “shiny” to radar waves. Now from the way the frequency of this “bump” in the reflected radar spectrum moved through the band width of the planet’s return radar signal, Carpenter could tell how Venus’ rotation carried those shiny features across its apparent disk. Thus, he could very accurately pin down the length of the planet’s day.

It turns out that the rotation period is probably just a bit under 243 days. So Venus is evidently not locked into tidal influences with the Earth. But this is the kind of investigation typical of science. Somebody makes an observation. Somebody else has a theory that might explain it, and suggests some more observations to tie it down. Then someone makes those observations and if they confirm the theory it is supported; if they fail to do so, the theory must be rejected. We probably have to reject the theory that the Earth’s tidal forces affect the rotation of Venus. This is because of the work of Roland Carpenter.

And now I shall discuss another man briefly. Since World War II, we have begun to understand, in a general way, how stars contract from interstellar matter and...
how they form and evolve, changing their structure. Deep in their interiors, stars convert hydrogen to helium. This change in chemical composition forces the whole structure of a star to change. Eventually in their evolution, as I'm sure you all know, stars are believed to become huge red giants. By that time the central parts of the stars become exceedingly hot—in the hundreds of millions of degrees. At these temperatures helium is built into still heavier elements. Many of these stars subsequently eject some of this material back into the interstellar medium.

New stars which then form from some of this ejected material must therefore have enhanced abundances of the heavy elements. In other words, stars forming today should contain more heavy elements than stars that were formed in the past. We thus reason that the sun (and its planets) must be a star of at least the second generation. If so, it means that the atoms that compose our bodies were once inside at least one star and, perhaps, many stars.

One of the most difficult parts of the theoretical study of stellar evolution is the calculation of precise models of stellar interiors. Such calculations require very accurate information on how the energy generated in a deep stellar interior filters out through the star before it is radiated into space. It is a difficult problem because the atoms of gas comprising a star are opaque to radiation; they absorb and re-emit it again and again. To understand the mechanisms for this absorption and re-emission of radiation requires a good knowledge of the quantum mechanics involved; a good knowledge of the interaction of the atoms with radiation. Formerly, the problem was one of the nastiest steps in the calculations of stellar models. Nowadays, however, almost everybody computing stellar models makes use of certain theoretical calculations of the opacity of gases like those that we find in stars. The calculations I refer to have been made by Dr. Arthur N. Cox. Thus, Cox has played a vital role in the study of the evolution of stars by providing good information on the opacity of gases in stars.

A third story I shall mention briefly concerns galaxies. We have known since 1924, after Hubble identified Cepheid variables in a few other galaxies, that our galaxy is not alone in the universe. There are, in fact, many other galaxies. Hubble himself investigated various types of them, finding that many are spiral like our own, and that others are elliptical; a small fraction of galaxies are irregular.

More recently—in the last half-dozen years—we found that Hubble's simple classification of galaxies is not quite sufficient, because many very peculiar objects have been found. These include irregular galaxies showing evidence of explosion (e.g., Messier 82); galaxies that defy classification—"peculiar" galaxies; spirals within spirals; elliptical galaxies apparently colliding or interacting with each other, sometimes with multiple nuclei; galaxies that have very bright nuclei emitting radiation in unusual amounts; and galaxies that emit enormous amounts of radio waves. A whole host of peculiar extragalactic objects have been found. It is very difficult to know how these various kinds of objects fit into the scheme of things. Among the many astronomers studying these peculiar objects is Dr. Halton C. Arp at the Hale Observatories. Arp has made an exhaustive study of peculiar galaxies. He has investigated the distribution of radio galaxies and other objects, including quasars, to search for clues as to what is going on. Some of Arp's theories are not universally accepted by astronomers today, but his observational work has been an enormous contribution to our knowledge of these interesting phenomena.

I have mentioned three men involved in three entirely different kinds of astronomical research—Carpenter, Cox, and Arp. They all have one thing in common: all three of these astronomers became interested in astronomy through planetariums. And all three served as guides at the Griffith Observatory and Planetarium in Los Angeles. They were not the only professional astronomers who were guides at the Griffith Observatory. I, and many other astronomers have worked there.

Here, I think, is an example of how early experience in planetariums can be an inspiration to young people of talent to go into the field of astronomy. Indeed, many of us helped pay our way through college by working at planetariums, which is another way they have contributed to the training of astronomers.

But this is only one kind of astronomical education—that of the future professional astronomer. Another kind, which I think is even more important, is the education of general university students that are not going to become scientists in general or astronomers in particular. (After all, there will be astronomers with or without planetariums.) Most of us in astronomy feel that it is exceedingly important that general university students should learn something about natural science, and hopefully, something about astronomy. (Some of us hope that they even buy textbooks on astronomy). About a third of the colleges and universities in the United States have courses in astronomy for the general university student.

Now today there is a kind of renaissance in the way
astronomy is taught to the general university student. Many students are becoming impatient with the methods of teaching that were appropriate twenty years ago but which today seem somehow irrelevant and impersonal. Many history majors are wondering why they should be required to learn how to compute the sidereal period of a planet, given its synodic period. Many wonder why they must use “horrible” algebra to figure out how much a man would weigh on a hypothetical planet of, say, three times the Earth’s mass and twice its radius.

Thus, many of us are searching for new and better ways of teaching more meaningful natural science, including astronomy, to the general university student. My own feeling in this respect is that we should, in designing such courses, always ask the question, “What do we expect these students to know two years, five years, or ten years after they have left the course?” Almost any intelligent student can learn (with some misery) to compute the sidereal period of a planet from its synodic period, but frankly, I suspect it is not the most important thing that he could be learning in an astronomy course.

There are, however, certain things students should get out of an introductory course: they should learn something of the spirit and the philosophy of science; how science operates; what its role is; the difference between scientific investigation and learning truth; the idea that in science we are trying to describe how nature behaves but not explain what it is. Students should, in addition, learn something about astronomy; something about the general descriptive nature of the universe in which we live and, more fundamentally, how astronomers get the information they obtain, at least in some examples.

Perhaps they should also learn enough about the beauty and simplicity of many natural laws to understand in a more abstract way the beauty of the universe itself. The same laws that tell us that a pendulum’s period of vibration near the surface of the Earth depends only on the length of the pendulum also enable us to calculate the masses of galaxies. We have observations which suggest that at least throughout our galaxy, the same natural laws of mechanics do, in fact, apply. This should be a very beautiful and exciting thing, if it is presented in an exciting way to the students.

I also think they should learn enough about astronomy to recognize certain things which are pure nonsense. For example, after having had a course in astronomy, they should be able to recognize the absurdity of the theory of Velikovsky about a comet boiling out of the atmosphere of Jupiter, later stopping the Earth’s rotation and finally becoming the planet Venus. [Indeed, my theory is that the comet came from Venus and fell into Jupiter and that is what the red spot is!] In summary, an elementary course for liberal arts students should give them some insight of what astronomy is, about how astronomers do their job, and hopefully should give the students an appreciation of the order and beauty of nature.

Now many administrators, I fear, have the misconception that the way to have an astronomy program is simply to buy a planetarium for the university campus. Let us admit that the planetarium is neither a necessary nor a sufficient item for an astronomy program. Nevertheless, with imagination and intelligent and thoughtful organization, an astronomy program for liberal arts students can be built around the planetarium as the central focusing point. Moreover, whereas the planetarium is not necessary for teaching many areas of natural science, there are certain things for which the planetarium is an almost uniquely ideal teaching aid. There is probably no better way than with a planetarium to show the general motions of the sky; the phenomenon of the daily turning of the sky and the rising and setting of the sun and
stars; the seasons; the apparent motions of the planets and how these led to our understanding of their true motions in the solar system, and of the laws of mechanics that govern them. The planetarium also can show how the sky appears from different places on the Earth, and hence the basic idea of how we can navigate at sea by observing stars, or even how we can measure the size of the Earth.

The planetarium is thus a wonderful teaching aid. Twenty-five years ago, at those universities and colleges that happened to lie close to the (then) five major planetarium installations, it was a common thing for the professor of an astronomy class to arrange a field trip for his class at the planetarium, usually for a special showing at which these phenomena and concepts could be exhibited.

The field trips were very useful, but certainly not nearly as ideal as it would be if the planetarium could be right on the campus where the instructor could use it for several weeks of his course, or perhaps, come back to it from time to time during the course. This possibility had to await the man whom I suppose we might now call the Henry Ford of the planetarium, Armand Spitz.

It was Armand Spitz who made available a planetarium at a price even colleges and universities could afford. Most educational institutions now have the ability (with sufficient arguing with the board of trustees) to obtain a planetarium installation. (Some institutions have been fortunate enough to find a generous donor who has provided a very fine planetarium, as is the case here at East Lansing.) Thus Armand Spitz has helped solve the problem of providing this very remarkable teaching aid for the use of educating general university students. This is a second way in which planetariums have been of great service in astronomical education.

In my judgment, more important still is the astronomical education of the general public. Today, professional astronomers are beginning to appreciate the fact (and I'm sorry to say that many of us didn't appreciate it some years ago) that we owe our bread and butter, directly or indirectly, to the general public—to the taxpayers. In fact, now that research contract money is harder to find, and that the Department of Defense has stopped supporting astronomical research, we are beginning to feel a funding squeeze. It is becoming nearly impossible to find funds to build telescopes, for example, at a time when the major existing telescopes such as those at Lick, at Palomar and Mt. Wilson, are not only oversubscribed, but are also flooded with city lights so that the most conspicuous spectral lines often observed are what are now called "Los Angeles lines" or "San Jose lines." We desperately need more large telescopes in good dark sites. An Air Force jet worth 50 million dollars can crash, and nobody bats an eye, but we have not yet found the few million dollars required to build a 90-inch telescope at Junipero Serra in California.

So we now realize that it is important for us to do a good public relations job. We must sell ourselves, science in general, and (from our selfish point of view) astronomy in particular, to the regents of our universities, to our legislatures and of course to the man on the street. Here is where the planetariums can and do play a vastly important role; but we still have a major job to do to show why astronomy and science are really important to the average person.
Astronomy is important, however, in many ways. For example, astronomical observations in the 16th century were ultimately responsible for the development of our modern technology, because all of Newtonian mechanics really goes back to the observations of the planets by Tycho Brahe, and their analysis by Kepler. But astronomy's contributions are not all in history. Only in the last few decades have we discovered the source of the energy of the sun and stars. Now, technicians on the Earth are learning to duplicate some of the processes by which the stars shine, not only in destructive bombs, but as a constructive source of power. Other kinds of astronomical observations led to the theory of relativity. Further, the tests for general relativity, until very recently, have all been astronomical in nature.

There are countless examples of how pure research, which apparently had no practical application whatsoever, turned out to be vital to the development of our technology—for that matter, to our way of life. Of course, it is not usually obvious what particular research being carried out today may affect our lives in, say, the next ten years. Today we are observing quasars, for example, which have a tremendous source of power that we do not yet fully understand. We are also studying pulsars which may be even more phenomenal—so much so that physicists are rushing into astronomy to get involved in the study of these peculiar objects. They do so because in pulsars lie a hope of discovering new principles of physics. How can we predict what technology in use next year, or the year after, may be based on discoveries made by means of astronomical investigations today.

So astronomy is relevant from that sense alone. It is also relevant just from the intellectual and spiritual lift that it can give us. Any knowledge of ourselves is relevant. And are not the physical laws that govern the universe and which brought us into being in a sense part of ourselves? We live in this universe, and to understand it and its workings surely can be an inspiration to people. I can imagine no better mechanism for attracting people to a place where they can begin to appreciate some of these really grand ideas than the planetarium theater. We can't force people to read a textbook on astronomy. We can't even force them to turn on the television for an astronomy program (and there are precious few of those). But many people can be attracted to a well-thought-out planetarium show.

I remember very distinctly my own early experiences at the Griffith Observatory and Planetarium. I and the other guides would assist in the planetarium demonstrations. I vividly remember the shows given by the late Dinsmore Alter, the Director of the Griffith Observatory. It was an inspiration to the public in many ways to attend those planetarium shows. They would see, following the sunset and during the "first night", the slow motion of the stars overhead. (I remember on one occasion a live cricket was loose on one of the curtains in the planetarium theater, which added realism to the effect. Unfortunately, for the rest of the presentation one of the guides had to stand at the curtain and shake it to keep the cricket quiet.) Many people don't know that the stars rise and set. Alter would point out the stars and constellations, and describe the epitaph of one famous astronomer, whose tombstone reads, "We have come to love the stars too fondly to be fearful of the night." Sometimes Alter would name the stars over and over. It was sometimes dull for us guides to hear "Dubhe, Merak, Phecda, Megrez", etc., for the eighth time during a show. But we learned these stars, and, by golly, people in the audience began to learn them too, and I think when they went outside and saw the Big Dipper, they recognized it, and perhaps some of them did lose a little of their fear of the night.

It was in the late 1940's when planetarium theaters began experimenting with space travel shows. Dinsmore Alter was very emphatic that he would not have a Buck Rogers fantasy at the Griffith Planetarium. So he designed a show that was as absolutely realistic as he could make it. Now it is a little incredulous to realize to imagine 500 people comfortably seated in chairs being transported in a rocket ship. But at least the astronomy part of the show was as authentic as Alter could make it. We would look out through a large port-shaped window in our ship at the top of the dome and see the Moon in that "porthole" growing larger and larger until presently it filled the entire window. Then we would see only a small part of the moon and finally just a crater or two in the window. Then we would "tour" over the surface, and Alter would point out the Sea of Showers as we passed over it. "There's the Alps," and "There's the Alpine Valley," he would say.

Twenty years later I remember seeing almost that exact show on television, but this time broadcast live from the Moon. I wondered to myself at that time how many of the hundreds of thousands of people who saw Alter's "Trip to the Moon" were watching that Christmas telecast from the Moon and remembered the preview of that telecast they saw at the Griffith Observatory twenty years earlier.

Far more yet can be done in the planetarium to teach modern astronomy to the general public. For example, we can look at stars of different types in the
sky not just to teach their names, Rigel and Betelgeuse, but to point out that Betelgeuse is a huge red giant star, and that Rigel is a very young blue super-giant. We can add that Betelgeuse is a star very advanced in its evolution and that in its center are, we believe, heavy elements that have been "cooked up" from hydrogen and helium by nuclear reactions. We can explain that in the future Betelgeuse will likely eject some of its matter back into space; new stars may form from that matter, and it is an exciting and dramatic thought that even our bodies are composed of atoms that must have once been inside such stars. We can point out the Orion Nebula and zoom in with a telescopic view, and say that this is a birthplace of stars. Then we can point out some star clusters (for example, the Pleiades and M13) and we can explain how each is a system of stars of about the same age. Studying those clusters thus helps us understand the way the stars evolve and hence how we can expect the sun to evolve in the next five to ten billion years. Thus our own future is, in a way, tied in with what we are seeing in the planetarium sky.

We can look at the Milky Way and show how nearly two centuries ago William Herschel, with his telescope, counted stars in different directions in the Milky Way and correctly deduced that we live in a great wheel-shaped system of stars. Then we can look at the Andromeda galaxy as it appears to the naked eye and then as it appears with a telescope. With a telescopic view, we can show M33 (the famous galaxy in Triangulum) and the individual stars in its arms and explain how Hubble was able to identify some of those stars as Cepheid variables less than 50 years ago, which provided proof that there are other galaxies far beyond the stars of our own.

Then we can point out that all we are seeing in this planetarium sky and in our real sky out-of-doors with our eyes are hot things; things that are emitting visible light, but that there is lots of other invisible radiation floating around too. Thus, with radio telescopes we find new objects—even new classes of objects, many of which cannot be seen by visible light at all. Perhaps most dramatically of all, we can detect radio radiation coming from all around us in space, the kind of radiation we would expect to be given off by a very cold body only three degrees above absolute zero; this radiation may be evidence of a primeval explosion that started the expansion of the universe ten to twenty billion years ago.

So we can begin to show people how astronomy searches for the answers to the most profound questions that man can ask. Where did we come from? When did the universe start? How did it start? How is it evolving? When will it end or will it end? What is to become of the sun and the planets? And of us? People can obtain through the medium of the planetarium a new appreciation, a new perspective of man's place in the universe. Hopefully they can carry away with them some of this inspiration when they leave the planetarium, after they watch for that one last night as the stars slowly move over their heads, until finally the sky begins to brighten a bit in the east, and until eventually the flood of sunrise colors fills the sky, with the rising sun accompanied by those final words of the demonstrator: "And now as our star, the Sun, peaks above the eastern horizon, announcing the arrival of a new day, with new hopes and new responsibilities, may I wish you all a very good morning."

(End)
“Never before was an instrument created which is so instructive as this, never before one so bewitching...”

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ROY K. MARSHALL — AN APPRECIATION

by George Lovi

With the passing of Dr. Roy K. Marshall on May 27th at the age of 64, the planetarium community lost what quite possibly was its most powerful astronomical intellect — a professionally-trained astronomer with a comprehensive grasp of most facets of the science that planetarium people are concerned with.

Like so many other disciplines, astronomy has become highly specialized, so that the astronomer whose area is galactic magnetohydrodynamics might have trouble explaining the phases of the moon to the layman. But I found Roy a fount of information when I needed it on many occasions, yet perhaps equally significant to me was the fact that he enjoyed astronomy (some astronomers don't, believe it or not). But his great talent was his facility for getting difficult ideas across.

Whether by design or accident, Roy became involved in planetarium work in 1932, giving his first planetarium lecture at the then two-year-old Adler Planetarium on August 21st of that year — on his birthday. Having just received his Ph.D., he found that, being it was the bottom of the Depression, professional astronomers were not too much in demand. But Roy was lucky to join Dr. Philip Fox at the Adler, and launch his career in astronomy/science popularization, writing, lecturing, and planetarium work. While at the Adler Planetarium, he joined Dr. Harry Crull, who also became well known in astronomical education and who, by a sad coincidence, passed on only a month earlier in Albany.

During his lifetime. Roy K. Marshall was the director of four planetaria: The Fels in Philadelphia; Morehead in Chapel Hill, N.C.; Odessa College in Odessa, Texas; and Gibbes Planetarium in Columbia, South Carolina. In addition, he taught astronomy at Wilson College in Pennsylvania in the 1930's and even became a TV personality in the late 40's and early 50's giving science Demonstrations on the Ford show. Of the several books he wrote, his Star Maps for Beginners, which he made up with Dr. I.M. Levitt thirty years ago, became the most popular.

Yet back around 1948 or '49, when I first became interested in astronomy while still in grammar school, I often dug into our family's set of The Book of Knowledge and found that many of the astronomy articles were written by a Roy K. Marshall. This whetted my appetite to get books out of the library to pursue further this topic — which my parents and teachers took a dim view of at the time.

When Roy lived in New York City in the 1960's, I got to know him personally and found it quite an experience. Aside from his astronomical knowledge, he was a fascinating conversationalist and had that characteristic professorial voice and accent: when he spoke — no matter what about — one instinctively listened. Too bad he never became a TV emcee. This addiction to talking with him caused me to run up some fearsome telephone bills after he moved out of New York; but forcing myself to hang up took about as much will power as getting out of bed on a bitter winter morning.

All those who knew Roy will appreciate why his passing was so sad.

(Editor: Mr. George Lovi is Education Consultant for Planatariums Unlimited, Viewlex Inc., Holbrook, N.Y. and Ramblings Editor for SKY AND TELESCOPE.)
The Armand N. Spitz Memorial Fund

On April 14, 1971, Armand N. Spitz succumbed to a prolonged illness at his home near Washington, D.C. He was 69 years old.

Born in Philadelphia, Spitz attended the Universities of Pennsylvania and Cincinnati and was awarded the Sc.D. from Otterbein College, Westerville, Ohio in 1956.

As Director of Education of the Franklin Institute-Fels Planetarium, Spitz became fascinated with the potential of the planetarium as an educational and motivational device. Planetariums were then all located in large cities. Determined to bring their beauty to more people, he conceived and built his first small instrument, and in 1947, founded Spitz Laboratories. Today, because of his vision, vitality, and human warmth, hundreds of planetariums located in schools, colleges, and museums throughout the world are visited by millions each year.

Throughout his life, Spitz was passionately concerned with education. He was Associate Editor of The Monthly Evening Sky Map and Popular Astronomy and authored articles and books on education, astronomy, and meteorology. In 1956, he was appointed Coordinator of Visual Satellite Observations (Operation Moonwatch) for the Smithsonian Astrophysical Observatory and served as consultant to them through 1961. He was also a consultant to the National Science Foundation.

Soon after his passing, a group of friends decided to form an ad hoc Committee for the Establishment of the Armand N. Spitz Memorial Fund. Committee members are Von Del Chamberlain (Chairman), Abrams Planetarium; Jack Spoehr, Spitz Laboratories; Mrs. Margaret K. Noble, Prince Georges County Planetarium, Crofton, Md.; Charles F. Hagar, San Francisco State College; and Jack C. Howarth (ISPE Secretary), San Antonio College. Initial contributions were solicited from the planetarium community and deposited in escrow in a Lansing, Michigan bank.

This memorial fund was established with the hope of continuing some of the work Spitz might have done had he lived longer in good health. More specifically, the fund is intended to further and improve planetarium instruction. This might be through scholarships, grants, awards, and loans. The exact uses will be determined by the Council of ISPE in communication with Mrs. Grace Spitz. The first meeting of the Council will be in San Francisco at the November meeting.

Clearly, if these worthy purposes are to be realized effectively, much money is needed. Generous contributions are invited from planetarium educators, foundations, and any other groups and individuals who are interested. As a function of ISPE, such contributions may be declared as deductible for tax purposes. Your help is needed now! In addition to your own contribution the committee also needs your comments and suggestions for possible contributors from foundations and others outside the planetarium community.

Please make your check out to the order of the Armand N. Spitz Memorial Fund and send it and your suggestions to:

Von Del Chamberlain
Abrams Planetarium
Michigan State University
East Lansing, Michigan 48823

MEET THE PLANETARIAN STAFF

Editor John F. Christian

Responsible for selecting and editing contributed articles, 39 year old John is one of the busiest on the staff. This won't surprise anyone familiar with his almost single-handed production of the GLPA Projector, begun while Asst. Director of the Longway Planetarium. He has since switched to full-time teaching astronomy and math at Genesee Community College in Flint, Mich. John has an M.Ed. from Eastern Michigan University (1963), a lovely new wife Beverly, 14 year old son "J.G.", two adorable Westlake terriers which he has bred, and deepseated desires to catch trophy-size smallmouth bass and to play par golf.
The Calgary Centennial Planetarium

by S. Wieser, Director

I want to emphasize that any institution such as ours has to find and then fit its place in the community and not vice-versa. We looked for needs within our community by listening to our audiences, and we have tried to serve them. Hopefully our community life improves because of these efforts.

One not directly involved might think a planetarium is to exclusively demonstrate the skies and its motions. It does that well, but to do that only would be an exception—not the rule. Centennial Planetarium has in addition to its Star Theatre, the "Pleiades Theatre", an Activity Centre, an outdoor museum, and the Transportation Technology and Science Museum.

What has all this to do with astronomy? But then who said astronomy was the only topic worthy of consideration by planetarium personnel? A planetarium is a multi-dimensional medium, primarily for education but not limited to astronomy education. To be sure, consideration of the skies and the universe is a major factor in the design and development of the planetarium, but this should not and does not automatically limit the overall scope and use of such facilities.

For example, we use the Star Theatre to offer a variety of astronomy programs to general audiences, a selection of curriculum-oriented topical programs to school classes, and explanations to individuals and groups requesting information.

We use the Pleiades Theatre to encourage local performing arts artists and students through awards, performances, and recitals. Science lectures are sponsored which are not otherwise supported by local educational institutions.

The Transportation Technology and Science Museum is used to display audience-participation-oriented exhibits concerning astronomy and related science and to collect and display artifacts concerning transportation technology.

The Activity Centre offers general interest and hobby courses in astronomy, related science, and transportation technology; workshop courses for amateurs in the performing arts; support to groups interested in science or technology whose artifacts can be displayed within the museum concept; and a public observatory.

The outdoor museum collects and displays vehicles portraying national achievements in transportation history.

We feel Centennial Planetarium of Calgary has made good use of its facilities and personnel to enrich the lives of its community. The planetarium, prime object of operations, was designed and built to allow for continuous growth along with the city.

(End)
"Charlie Brown" entertains in the Pleiades Theatre. A resident professional group performs under planetarium sponsorship.

A Hawker Hurricane and a North American Harvard (AT6) awaiting restoration for display.

Left, The bookstore is always an attraction for visitors.
Above, The public observatory features two 4" refractors and two 6" reflectors. A popular display, its use is limited by the availability of instructors.

The Star Theatre houses a Zeiss-Jena projector and seats 260 under a 65' dome.

A Cook transit on display. This instrument saw considerable use in the Canadian Time Service and during IGY.
Sharing the knowledge of how to turn a Quaker Oats box into a self-reversing supernova explosion is one thing, but how many times have you wanted to share a chuckle or outright guffaw with another planetarian? Let’s face it. The average person wouldn’t understand why the casual question, “What kind of botanical specimens do you have in your planetarium?” is funny. In fact this same average person would probably repeat the question. Now we’ve got it all together in THE PLANETARIAN, so let’s start sharing. Send me your little gems, and I’ll put them where we can all enjoy them — here! Send to Jane Geoghegan, 4100 W. Grace St., Richmond, Va. 23230.

Overheard:

One 3rd grader to another as they enter the chamber: “Oh, I’ve been here. We all sit down and that black ball talks.”

4th grader, as she leaves, to planetarium teacher: “Thank you for showing us the movie of the stars.”

Sobbing 1st grader, coming up to planetarium teacher during program about space travel: “I can’t go to the Moon with you. My mother won’t even let me cross the street by myself!”

In future issues I shall attempt to help the uninformed to recognize the peculiarities of a planetarian by (1) what he carries in his pockets, (2) how he tells time and the seasons, and (3) the type car he drives. If you have any ideas along these or other lines, send on the back of an outdated star calendar so we can educate the world about our wonderful profession.
PLANETARIUM PROGRAMMING FOR THE GENERAL PUBLIC

by Von Del Chamberlain, Abrams Planetarium, Michigan State University

The first part of this chapter is in the previous issue.

II. Preparing the Program

E. Selection and Preparation of Effects

Identification of desired use of planetarium equipment occurs throughout all planning phases. One often begins preparation of a program with realization that certain outstanding projections and/or audio materials will likely make it a good one. Until the program is actually prepared in detail, however, the worker is not clearly aware of all the requirements. Use of basic equipment and needed auxiliaries becomes clear as the final manuscript is prepared. Thus the manuscript should be prepared with ample time for preparation of special effects. They may be separated into those requiring: (1) preparation of artwork and photography; (2) construction of special effects projectors; (3) selection of music and other sound effects to accompany the spoken and projected program. Each requires considerable attention in public programming but can be only briefly discussed here.

Artwork and photography is often essential. Ideally the programmer should be able to plan, knowing he is not limited to slides currently in the file or obtainable from some commercial source. He will, to be sure, always face practical limitations, resolving the difference between what might be and what is actually possible within his framework of time, staff, and budget. The planning ought to be idealistic however, writing the best program possible, then adapting it to reality.

This does not mean small planetariums should not present public programs. Those with very limited staff and budget often present programs which are superior to some given under much larger domes. However, the most highly sophisticated programs result where artistic expression is not severely limited. One hopeful possibility lies in the increasing willingness of planetariums around the world to exchange their creations with each other and to get some of the most outstanding on the commercial market.

Even though most smaller planetariums don’t have an artist on their staff, they can usually obtain specially prepared artwork from interested students, members of the community, or instructional media departments serving their institution.

Special effects projections are normally required. These can vary from purely impressionistic effects, such as special lighting on the dome, designed to capture attention and establish mood, to highly realistic projections such as aurorae, clouds, snow or rain, lightning, etc. New program ideas often lead to new projection devices not currently on the market. They must be built for the specific requirements of the program.

It is true that a program can be written specifically to use existing projections, but this becomes a serious limiting factor in creative planetarium work unless a large repertoire is available.

As the program is written, an attempt is made to visually illustrate each important idea. In preparing the needed special projectors, one must begin with knowledge of the basic methods available and choose the best suited, considering limitations of budget, time, space, and other physical factors. The completed projector then becomes available for any future use. One chapter in this series will be devoted to construction of auxiliary projectors, and the
Selection of appropriate music and sound effects is one of the last tasks in completing the program. It would be wonderful if the programmer could obtain music composed especially for his program, and this has occasionally been done on a limited scale. Workers can also produce other special sound effects, and sometimes this is necessary.

Consider these two aspects of the program sound track in turn, beginning with consideration of music, then turning to other sound effects.

The music to be used in the introduction, background, transitions, and ending should set the pace and help to establish the mood appropriate to the subject matter. Often music can be selected which is directly associated with the subject of the program. Classic examples are (1) Holst's "The Planets" for a program on the solar system; (2) electronic "space" music to accentuate the void of outer space; (3) Vivaldi's "The Four Seasons"; and (4) Mozart's "The Jupiter Symphony" for a program on mythology, etc.

One's objectives often indicate preference for a live program. Most school lessons, for example, are best given live since the teacher must obtain a response from the students in order to know when to proceed. One also usually wishes to keep school lessons current and flexible both in content and duration of the lesson. There is nothing wrong, however, with recorded passages in school programs to add a polished touch.

If the program objectives do not require response and flexibility, recording might be considered. The presentation then takes on certain elements common to other media such as television and motion pictures. One still communicates with the audience, but each audience is treated alike. They may still respond, but the presentation does not depend on response.

A completely recorded program requires that equipment function reliably. Even with the best equipment one must be prepared for those rare instances when failure occurs and the program must be continued live (if it can be continued at all). It is, however, possible to write manuscripts so visual aids are used without such phrases as "...notice that...as you see here...". Thus when a visual aid does not operate, no one in the audience knows it. The capacity to describe without being limited by equipment failure is just as important in live lectures as it is with recorded ones. It never helps to point out that certain things are not going right. This only makes the audience think they are getting a...
bad performance.

The number of times a program is to be presented is important. If only a few times, recording may require too much development time to be practical. A good recording requires much time and effort before it is ever presented. On the other hand, once completed, the taped program may be presented over and over, many times a day if need be, while the creative talents of the programming staff are applied to other work.

If other reasons indicate desirability of recording the program, one must then consider the great amount of time required to prepare it. Each word must be carefully chosen and sequenced with sound and visual effects to permit pacing so that the entire program will flow properly, neither rushed nor dragging. All visuals should be completed before finalization of the manuscript to be sure words and visuals go together. Finally, the entire program should be worked through after all voice recording is finished but before music background and transitions are added. These add the final bit of luster.

Even though the programmer uses his best judgement in preparing the work, it might still turn out to be a bad job. One can get so wrapped up, the finished product is exciting to him alone. Thus the manuscript ought to be reviewed by several colleagues before it is accepted for recording. It is difficult to modify a recorded program without doing much of it over. This, of course, is one advantage of live programs; they can be modified until they receive good response from audiences repeatedly.

Sometimes it is wise to present the program live until there is no question about its quality; then put the final polish on it in the recording. Another similar procedure is to present the program live during the entire run; then if it turns out to be successful, repeat it by recording later. This program may then be reused several times over the years.

Once the recorded program is finished, it can be presented by assistant staff members. If given enough times, the time required of the professional staff to prepare it may be considerably less than that required for properly trained staff to both prepare and present it live.

Another important factor concerns the very nature of the program. Certain types could be prohibitively expensive without recording. For example, if the program required several carefully selected voices combined with other special sound effects, recording is the only practical alternative. One can, of course, avoid ever doing such a program. So choosing does place a limitation upon the creative development of both the program writer and the planetarium.

Other important questions concern how long the program can be used and how long the information presented will be current, appropriate, and accurate. This was illustrated during the dramatic moment in history when Man made his first journey to another world beyond the Earth. A recorded program on the Moon, featuring the flight of Apollo 11 would be more difficult to keep current than a live one. Recorded passages were, however, especially appropriate at that time since their use added the actual voice communications from the Moon’s surface. No program then discussing what was previously known about the Moon would be as exciting as one actually showing a simulated touchdown of Man’s first experience there while the audience listened to the actual voices of the astronauts.

Consider the difference between a public program centering on description of the current evening sky and one which treats a subject like mythology with many avenues for highly dramatic development. The first seems to lend itself to less formal treatment; the audience expects a more personalized approach and might even participate with questions and comments. Contrast this with a highly sophisticated production employing many auxiliary projections sequenced with the planetarium projector and complex sound effects. Such presentations if given live require highly skilled lecturers, both from the standpoint of showmanship and speech proficiency. If enough such personnel are available, recording may not be required, but normally highly complex programs are best recorded.

Partially recorded programs may be considered. A sequence of recorded passages brought together with short live statements can be especially effective. This provides flexibility in refining a program after the first few deliveries and adjusting it to various types of audiences. It is also useful in training new lecturers since they are required to carefully select their words to sequence ideas and practice effective use of audio-visual materials.

Some programs might be recorded with the option to give some sections live for younger audiences. The traditional Christmas program is one example which may be completely recorded for regular public programs but given live, condensed and simplified for children.

In summary, the question is not whether to ever record programs in the planetarium. The question is which programs to record, given the staff, other resources, and time and imagination of those involved.

DISCUSSION QUESTION: Consider a planetarium on a large university campus. The decision is made to develop a program to be presented to students enrolled in a humanities class. The objective is to illustrate the impact of the Copernican Revolution on current thought. It is expected that during the term 7000 students will see the program. It is necessary to have them all attend within the first 2 weeks of the course. List and discuss reasons for and against recording the program. Would you decide to record it or present it live?
IV. Completing the Program

The manuscript resulting from careful selection of subject matter, research and preparation for planetarium presentation, together with artistic work prepared as special projections and sound effects must now be brought together into a finalized form. A decision has been made on the use of recorded material. The program has been worked through in stages with effects. It is not uncommon that intense interest may yield modifications even at this final stage; in fact, some of the best ideas come in the final moments. Compromise also occurs since some materials might not be ready as expected. Final decisions are made, the sound tape produced, projections carefully scrutinized, and defects corrected. Eventually all effects are installed, outlines typed for operators and technicians, and rehearsals begun.

Finally doors are opened to the first audience, and one can evaluate the worth of his effort as judged by those for whom the effort was made. The only valid evaluation of the program is the reaction of those who witness it. They have not been involved in, nor do they often consider very extensively the amount of work required to plan and produce the show. Since it was prepared for public audiences, the effect it has upon them forms the ultimate judgement of its success.

Note that the program can be modified afterward, but this generally is unnecessary if planning has been carefully done. It is not uncommon however for the program to be improved after the first few presentations.

V. Evaluation

One should not consider the job of preparing a public program complete until he has evaluated its success. In this way he learns important items which will improve later work.

Several factors can show public response to the planetarium program. Attendance figures are one good indicator. However, competing activities, amount of advertising, extreme weather conditions, and other factors influence attendance. Spontaneous compliments and criticism may indicate public feeling about the program. News media critiques may also be helpful in determining success.

The best method of systematically evaluating and comparing programs is to develop an original evaluation instrument for use with random samples of people who attend. These can be in the form of a simple, but carefully prepared, questionnaire. The form should be brief, perhaps contained on one side of a 5" x 7" index card, and the questions should be terse and answered by a check mark. Most persons will answer such evaluation surveys in a casual manner and not be inclined to write critical essays! Some room should be left at the bottom of the form for those few who do. If this evaluation instrument is used in the same way for each change of public program, comparisons can be made which may be helpful in improving future programs and in documenting the influence of the planetarium's programs on its public.

DISCUSSION QUESTIONS: What items should be included in an evaluation instrument for public programs? What would an adequate sample consist of for meaningful evaluation? How might the questionnaires be distributed and collected? Prepare an evaluation instrument for public programs.

The next issue of THE PLANETARIAN will conclude this chapter with a sample public program which illustrates these various principles.

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Of Stars and Domes

by Mark R. Chartrand III, Amer. Mus.-Hayden Planetarium

Many people have asked how we can find our distance from the center of the Milky Way if we cannot see it. In the visual spectrum it is hidden behind obscuring nebulae; so something else must be used to point it out.

The first indication of where the center of the galaxy lay was obtained by Harlow Shapley about 50 years ago. Prior to that, it was thought we were in the center. This was a part of the so-called “Great Debate” between Shapley and H. D. Curtis, a subject for another column. What Shapley did was to study the globular clusters. They can be seen at large distances because they are out of the plane of the galaxy and thus almost free of interstellar absorption. He noted the globular clusters are distributed with spherical symmetry about a point which lay in the direction of Sagittarius and in the galactic plane. He naturally concluded that if they are gravitationally tied to the Milky Way, they should be distributed about its center of mass and not about some point off to one side. Thus we must be off to the side, and the center of distribution of the globular clusters must be the center of the Milky Way galaxy.

Today the figure for the distance to the center is taken as exactly 10 kpc for reasons of convenience. The true distance lies between 9 and 11 kpc, but exact measurement is now impossible.

There is another way to find our distance from the center, which also gives our speed of revolution about the galaxy. This is the famous method devised by J. H. Oort in the late 1920’s, still used today with better observational data. Basically it works by observing the differences in the motions of those stars closer to the center and those more distant than we are. Since the galaxy is not a rigid-body rotator (the period depending on the distance from the center), inner stars will be moving faster and outer stars slower. By careful observation of the change in these differential motions as we look in various directions, we get information on our position and speed. Both the proper motions and radial velocities of nearby stars must be used in this analysis. Thus the unglamorous field of astrometry plays a vital role in the determination of the kinematics of our galaxy.

Another attempt to determine our speed around the galactic center used the fact that, on the average, the motion of the Milky Way with respect to nearby galaxies should cancel out. Thus we observe these galaxies as a frame of reference and derive our motion from them. This isn’t easy because the galaxies are not point sources, spectral lines have widths caused by their rotation, etc. Astrometers have tried to set up a precise coordinate system using the galaxies, but it wasn’t very successful. With the advent of Very Long Baseline Interferometry in radio astronomy, however, some astronomers (or astrometers) are now beginning to set up such a system using quasars as a reference. The work should be completed by next year, but I had better get off this subject before Gerrit Verschuur accuses me of poaching on his column.

(By the way, if you have suggestions or comments on topics which might be covered in this column, please write to me at the above address, NYC 10024. I would be glad to hear from you.)

Did you observe the July 10 eclipse? If so, tell us about it! Please send in your reports, photographs, and especially ideas on ways you intend to use your observational material in future planetarium programs. Closing date is November 1, 1972. Write to: Mr. Don L. Bean, Peter Hurst Planetarium, 3225 Fourth Street, Jackson, Michigan 49203.

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Radio Astronomy Notes
Conducted by G. L. Verschuur

Pulsars — Their motion through space

One of the most interesting aspects of the study of the pulsed radio signals from pulsars has been the amount of information gathered about the regions of interstellar space between the pulsar and the Earth. For example, radio astronomers have gained valuable insight into the average density of electrons, the average magnetic field strength, and the size of clouds in interstellar space. Recently they have even been able to find out how the pulsar is moving through space.

The experiment used 2 radio telescopes, one at Jodrell Bank in England, the other at Penticton in Canada. The pulses from pulsar PSR 0329+54 were simultaneously monitored for a 24 hour period, and the signals received were computer-correlated. It is possible to calculate how the pulsar is moving with respect to the Earth in this way; since we know at any time how the Earth is moving relative to the stars, the motion of the pulsar itself through space can be found.

The experimenters concluded that PSR 0329+54 is moving at 360km/s, a very large speed for any object in interstellar space. This discovery probably helps to account for the fact that only 3 of the 60 or so pulsars now discovered appear to be associated in position with supernova remnants, although the pulsars are supposed to be the remains of the stars that collapsed after the explosion. It appears these stars can be thrown out of supernova explosions at enormous speed so that when we detect an old pulsar, it has already moved a long way from its birth place.

Searching for Supernovae by Radio

Pulsars are thought to be the remains of the stars that exploded to produce supernovae. But what about the actual explosion as it occurred? Optical astronomers have traditionally located supernovae by studying photographs of various galaxies taken at different epochs and noting whether any new objects appeared in the photographs from one year to the next. However, no supernova has yet been seen at the time it actually occurred.

Now Richard Huguenin of the University of Massachusetts is undertaking an experiment to detect radio signals from supernova explosions even as they occur. By using a radio telescope whose reception pattern covers a circle with a diameter of 60°, centered on the North Celestial Pole, he includes a very large number of galaxies in his search and expects that one or two supernovae should be occurring every day somewhere within this area. Each explosion will generate a single very strong radio pulse which should be detectable.

The detection of single rf pulses is of course very difficult because man-made interference and lightning flashes can generate them. By using two widely separated antennas in Massachusetts and West Virginia, he can eliminate most sources of man-made interference which would produce a signal at one or other of the two sites, but not at both simultaneously.

The data obtained during the experiment performed in June, 1972 is now being processed. It is always possible that Huguenin will detect radio waves which are not produced by a supernova but by some other unexpected phenomenon. A result should be available in time for our next column.

ANNOUNCEMENT

A pamphlet “Information For Contributors” to The Planetarian will soon be ready for distribution. For your free copy please write to:
Mr. John F. Christian
Division of Science & Math
Genesee Community College
1401 E. Court Street
Flint, Michigan 48503
SEEING STARS

Jerome V. DeGraff
Planetarium Instructor
Strasenburgh Planetarium
Rochester Museum and Science Center
663 East Avenue
Rochester, New York 14607

Fred Hamil
Chairman, Technical Science Division
National Technical Institute for the Deaf
Rochester Institute of Technology
1 Lomb Memorial Drive
Rochester, New York 14623

The National Technical Institute for the Deaf (NTID) in Rochester, New York, first utilized the facilities of the Strasenburgh Planetarium during the summer of 1969. At that time, a group of young deaf people from the Junior National Association of the Deaf (NAD) visited the campus at Rochester Institute of Technology. In the course of their visit they attended a performance at the Planetarium. No preliminary arrangements, such as script preview, dividing the program into sections, pre-show lectures, or captioning of the program were provided. At the end of the program, interpreters assisted in a discussion and question/answer period. The members reported that they enjoyed the experience but did not understand all of it.

To improve on this approach, the next presentation to the deaf (students at NTID), was divided in 4 segments. Interpreters outlined approximately 15 minutes of the show to follow. Suggestions as to content and explanations of what would be seen were provided. This increased the comprehension of the program but interrupted the continuity.

To preserve continuity and provide pre-show information, the third program was preceded by an hour lecture on content prior to the program. An evaluation of procedure and comprehension of the program was given to each student. The students also had complete scripts of the program to study and refer to prior to the lecture and presentation. The results of the questionnaire indicated a positive interest in the program and a desire to continue this type of experience for the deaf.

The most recent attempt at presenting the show to the deaf included the technique of captioning the verbal script.

Preliminary steps were taken to derive the final captioned script. Strasenburgh Planetarium provided copies of the script for preview and study. Study of the script included revision of the vocabulary level and the consolidation of ideas and content into a minimum number of words. The vocabulary level found in the original script required revision for more complete understanding. The length of time permitted for each caption mandated critical analysis of word choice to retain the ideas presented.

Examples of consolidating context include:

Original Script: “For the first third of the 20th century, the birth of our system of planets was thought to be the result of the tidal action of a star that passed by our sun billions of years ago.”

Revised Caption: Planet system once thought to be formed by a star that passed close to our sun.

Original Script: “There is mounting evidence to support the belief that the sun and the planets were formed about 5 billion years ago from a gigantic cloud of interstellar dust and gas.”

Revised Caption: Sun and planets now thought to be formed from a dust and gas cloud.

For the entire revised script, the length of each caption averaged 14 words. The range was from 4 to 32 words per caption. The length of each caption (number of words) was influenced by several variables. For example, when there was ample time in the program for a longer caption, we expanded the number of words. When dome activity was rapid, the caption was limited to a basic idea or context clues.

A preliminary list of the captions was developed and submitted to review by the NTID English Department. Their advice as to length of caption and vocabulary level was consistent with our work. We adhered to their suggestion of revising each caption into the present tense active voice.

The first draft of captions was presented to a review committee at the Strasenburgh Planetarium to insure that no technical aspects of the program or script had
been misinterpreted or omitted due to the revision. Upon acceptance, the program was reviewed for script timing and continuity. It was often decided that several captions could be divided for clarity and timing purposes.

The revised script in its acceptable form was submitted to Mechanical Tape Sensitive Typewriter (MTST) operators for typing on individual sheets of paper, suitable for photographing. The captions were proof read for final acceptance. 35mm Kodalith (black and white) film was used to photograph the typewritten captions, producing a high contrast negative action. Only the typed copy is projected in this form, avoiding extraneous light in the planetarium theater. The Instructional Resources Laboratory at the Rochester Institute of Technology photographed and processed each caption. The mounted slides in a Carousel slide tray and another tray of blank slides were placed on a pair of Ektagraphic projectors controlled by a dissolve unit. This dissolve unit allows the slides for one projector to be faded on as the slides of the other projector are faded off. Since one tray contains blank slides, the captions gradually appear, fade away and, after a pause, another appears. Unless the pause created by the blank slide is used, a caption is always seen among the program visuals. The blank provides for the elimination of visually distracting captions until additional information is needed. It also creates a visible break indicating new narration. The Ektagraphic projector pair are part of a peripheral projection system. The peripheral projection system is controlled entirely by a computer during the program. For these special shows, the Ektagraphic pair is operated manually from the control console. The operator activates the dissolve unit at predetermined points. Therefore, the amount of time the caption or blank is projected is controlled by the program operator. A total of 80 caption slides were used to caption this particular program (The Blue Planet).

Prior to presenting the captioned program to a deaf audience, a trial run by the planetarium staff and NTID Science staff was performed, to make final decisions on timing captions and seating the audience.

Approximately 100 deaf students, staff, and community people were invited to the first captioned program in May, 1971. Response was enthusiastic and follow-up interviews indicated a great deal of comprehension and interest in the technique. Deaf people who had the advantage of comparing the previous efforts indicated that the strategy showed vast improvement and potential.

In the preliminary stages of future program development, the aspect of script revision and captioning will be the responsibility of students at NTID. Members of the Jr. NAD have requested involvement in captioning The Last Question, a regularly scheduled program. Jr. NAD conference participants to be held in June will attend this captioned program. Students will first gain experience through captioning a previously prepared script. After this practice, the students will begin script revision and captioning for The Last Question. This adaptation of Isaac Asimov’s classic short story will add the difficult problem of captioning dialogue.

NTID students in the Business Technologies Department will be asked to participate by caption typing. Students in NTID Visual Communications Department of Photography will assist by doing the photography. This general procedure will be followed in captioning future Strasenburgh Planetarium programs.

Inasmuch as the emphasis of our efforts will be toward deaf students utilizing planetarium facilities, it is understandable that they should be involved in the planning, captioning, typing and photographing. This cooperative program increases the community utilization of the Strasenburgh Planetarium and provides an opportunity for the deaf community to participate in the cultural life of their city.

(End)

ECLIPSE SLIDES

A superb set of 20 slides of the 1972 July 10 total solar eclipse. These slides were taken under optimum conditions with a 10 cm., f/10 refractor at Tuktoyaktuk, NWT. They beautifully depict all the phenomena of the total eclipse: the diamond ring, Bailey’s beads, spectacular prominences, and the delicate structures of the outer corona. Four of these slides are enlargements of interesting details on the originals. Each slide is directly duplicated from an original by a special process carefully designed to reproduce every nuance of color and detail.

Order Set #102 .............. $19.95 ppd.

F & P
5327 Dalhurst Crescent NW
Calgary, Alberta T3A 1P6
Canada
Will Halley's Comet hit the Earth? Why is there no eclipse of the Sun by Venus? If Polaris is such a large star, why is it so dim?

The very fact that students ask these questions at all shows that distance in the universe is very much misunderstood. The planetarium and many of the other visual aids we use in teaching can make the misconceptions worse unless they are very carefully used. Solar System models have their use but if a student is left with the visual picture of Saturn at twenty of its diameters from the Sun, then perhaps we have done more harm than good.

How can we talk about a planet which is more than 3,000 million miles distant to a student who does not have a 1,000 million seconds in his life? What is a thousand million miles? A thousand million light years?

Scale models can be very effectively used to bridge the gap between visualized distance and distances we express mathematically—for which we have no conception. Tables 1 and 2 give several scales for the Solar System. They are all expressed in the FPS system. Astronomy is no place to teach the metric system. It should be taught where a student can be immersed in metric measurement long enough to learn to love it and unless this has been done earlier, use the FPS in Astronomy.

Three types of scale models have been used effectively in Milwaukee:

CLASSROOM DISTANCE SCALE—PLANETS.

Students use the largest distance scale possible on a large blackboard, a hall, a sidewalk or on an adding machine tape. (See scales 3, 4 and 5 on Tables 1 and 2.) Learners should be given planet scale size and encouraged to try to find the size of the dot for the planet before they are told to use lines for planet orbits rather than dots. Do not use pictures. Even if it is carefully explained that a different scale is involved, the concept in the learner's mind is often incorrect.

PERMANENT SCALE MODEL—PLANETS.

On a site near a high school planetarium and within the block of an elementary and a junior high school, a permanent scale model was placed in the sidewalk (See Scale 6). Permission of the city was obtained to letter the planet names and arrows pointing to the planets on the sidewalk. The planets themselves were made of finishing nails (Mars, Pluto and Mercury), stove bolts filled with epoxy (Earth and Venus), and carriage bolts (Uranus and Neptune) all of which were ground to (continued on page 58)

<table>
<thead>
<tr>
<th>TABLE 1: SCALE MODEL OF SOLAR SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale Model of Solar System</td>
</tr>
<tr>
<td>Scale 4</td>
</tr>
<tr>
<td>1 A.U. = 1 ft.</td>
</tr>
<tr>
<td>Equatorial Diameter, miles</td>
</tr>
<tr>
<td>Sun</td>
</tr>
<tr>
<td>Mercury</td>
</tr>
<tr>
<td>Venus</td>
</tr>
<tr>
<td>Earth</td>
</tr>
<tr>
<td>Mars</td>
</tr>
<tr>
<td>Jupiter</td>
</tr>
<tr>
<td>Saturn</td>
</tr>
<tr>
<td>Uranus</td>
</tr>
<tr>
<td>Neptune</td>
</tr>
<tr>
<td>Pluto</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

THE PLANETARIAN, 9/72
### TABLE 2: SCALE MODEL OF SOLAR SYSTEM

<table>
<thead>
<tr>
<th>Scale 1</th>
<th>Scale 2</th>
<th>Scale 3</th>
<th>Scale 5</th>
<th>Scale 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 A.U. =</td>
<td>$36 \times 10^6$</td>
<td>1 A.U. =</td>
<td>$10^6$ miles =</td>
</tr>
<tr>
<td></td>
<td>1 inch.</td>
<td>miles = 1 in.</td>
<td>0.4 feet.</td>
<td>3/16 inch.</td>
</tr>
<tr>
<td>Sun diameter</td>
<td>0.01</td>
<td>2/64</td>
<td>3/64</td>
<td>5/32</td>
</tr>
<tr>
<td>Mercury</td>
<td>36/8</td>
<td>1</td>
<td>1 3/4</td>
<td>6 3/4</td>
</tr>
<tr>
<td>Venus</td>
<td>67/4</td>
<td>1 2/3</td>
<td>3 1/4</td>
<td>12%</td>
</tr>
<tr>
<td>Earth</td>
<td>93</td>
<td>3 1/4</td>
<td>4 3/4</td>
<td>17%</td>
</tr>
<tr>
<td>Mars</td>
<td>142</td>
<td>1 1/2</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Jupiter</td>
<td>483</td>
<td>5 3/16</td>
<td>13 1/4</td>
<td>24</td>
</tr>
<tr>
<td>Saturn</td>
<td>886</td>
<td>9 1/2</td>
<td>24%</td>
<td>44</td>
</tr>
<tr>
<td>Uranus</td>
<td>1783</td>
<td>19</td>
<td>48</td>
<td>89</td>
</tr>
<tr>
<td>Neptune</td>
<td>2792</td>
<td>30</td>
<td>78</td>
<td>138</td>
</tr>
<tr>
<td>Pluto</td>
<td>3664</td>
<td>39 1/2</td>
<td>102</td>
<td>183</td>
</tr>
</tbody>
</table>

Scale figures are given in inches.

### TABLE 3: BRIGHT STARS

<table>
<thead>
<tr>
<th>Star</th>
<th>R.A., deg.</th>
<th>mV</th>
<th>Distance, LY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpheratz</td>
<td>2</td>
<td>2.06</td>
<td>90</td>
</tr>
<tr>
<td>Achernar*</td>
<td>13</td>
<td>.51</td>
<td>118</td>
</tr>
<tr>
<td>Polaris</td>
<td>31</td>
<td>1.99v</td>
<td>680</td>
</tr>
<tr>
<td>Algol</td>
<td>45</td>
<td>2.06v</td>
<td>105</td>
</tr>
<tr>
<td>Aldebaran</td>
<td>69</td>
<td>.86v</td>
<td>68</td>
</tr>
<tr>
<td>Rigel</td>
<td>79</td>
<td>.14v</td>
<td>900</td>
</tr>
<tr>
<td>Capella</td>
<td>79</td>
<td>.05</td>
<td>45</td>
</tr>
<tr>
<td>Betelgeuse</td>
<td>89</td>
<td>.41v</td>
<td>520</td>
</tr>
<tr>
<td>Canopus*</td>
<td>96</td>
<td>-.72</td>
<td>98</td>
</tr>
<tr>
<td>Sirius</td>
<td>100</td>
<td>-1.42</td>
<td>8.7</td>
</tr>
<tr>
<td>Adhara</td>
<td>105</td>
<td>1.48</td>
<td>680</td>
</tr>
<tr>
<td>Castor</td>
<td>113</td>
<td>1.97</td>
<td>45</td>
</tr>
<tr>
<td>Procyon</td>
<td>114</td>
<td>.37</td>
<td>11.3</td>
</tr>
<tr>
<td>Pollux</td>
<td>116</td>
<td>1.16</td>
<td>35</td>
</tr>
<tr>
<td>Regulus</td>
<td>152</td>
<td>1.36</td>
<td>84</td>
</tr>
<tr>
<td>Denebola</td>
<td>177</td>
<td>2.14</td>
<td>43</td>
</tr>
<tr>
<td>Beta Crucis*</td>
<td>192</td>
<td>1.28</td>
<td>490</td>
</tr>
<tr>
<td>Spica</td>
<td>200</td>
<td>.91v</td>
<td>220</td>
</tr>
<tr>
<td>Arcturus</td>
<td>212</td>
<td>—.06</td>
<td>36</td>
</tr>
<tr>
<td>Antares</td>
<td>245</td>
<td>.92v</td>
<td>520</td>
</tr>
<tr>
<td>Vega</td>
<td>277</td>
<td>.04</td>
<td>71</td>
</tr>
<tr>
<td>Deneb</td>
<td>308</td>
<td>1.26</td>
<td>1600</td>
</tr>
<tr>
<td>Fomalhaut</td>
<td>344</td>
<td>1.19</td>
<td>22.6</td>
</tr>
</tbody>
</table>

*Cannot be seen north of 38° North Latitude

### TABLE 4: STARS NEAR THE SUN

<table>
<thead>
<tr>
<th>Star</th>
<th>mV</th>
<th>Distance, LY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigel Kentaurus (3)</td>
<td>1, 1.5 &amp; 11.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Barnard’s</td>
<td>9.5</td>
<td>5.9</td>
</tr>
<tr>
<td>Wolf 359</td>
<td>13.5</td>
<td>7.6</td>
</tr>
<tr>
<td>Lalande 21185</td>
<td>7.5</td>
<td>8.1</td>
</tr>
<tr>
<td>Sirius (2)</td>
<td>—1.5 &amp; 7.2</td>
<td>8.7</td>
</tr>
<tr>
<td>Epsilon Eridani</td>
<td>3.7</td>
<td>10.7</td>
</tr>
<tr>
<td>61 Cygni (2)</td>
<td>5.2 &amp; 6.0</td>
<td>11.2</td>
</tr>
<tr>
<td>Procyon (2)</td>
<td>.3 &amp; 10.8</td>
<td>11.4</td>
</tr>
<tr>
<td>Gamma Ceti</td>
<td>3.5</td>
<td>11.9</td>
</tr>
<tr>
<td>Altair</td>
<td>.8</td>
<td>16.5</td>
</tr>
</tbody>
</table>

### TABLE 5: DISTANT STARS*

<table>
<thead>
<tr>
<th>Star</th>
<th>mV</th>
<th>Distance, LY x 10³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epsilon Aurigae</td>
<td>3.0v</td>
<td>3.4</td>
</tr>
<tr>
<td>Omicron² Canis Majoris</td>
<td>3.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Delta Canis Majoris</td>
<td>1.8</td>
<td>2.1</td>
</tr>
<tr>
<td>Nu Canis Majoris</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Iota¹ Scorpii</td>
<td>3.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Beta Lyrae</td>
<td>3.4v</td>
<td>1.3</td>
</tr>
</tbody>
</table>

*Data for star and planet distance are from The Observer’s Handbook – 1971.

*Cannot be seen north of 38° North Latitude

v — variable star.
proper size and imbeded with epoxy in holes drilled in the sidewalk. Saturn, Jupiter and the Sun, were painted on the sidewalk because of the problem we have with snow removal equipment. Note that about 1.5 miles of straight sidewalk is required for Scale 6 and over 7 miles for Scale 7.

On this scale learners can actually walk from Earth to Pluto (P. E. teachers please note) and really begin to grasp the size of the solar system. In this frame of reference it is much easier to think properly about space flights beyond the moon and about solar system dynamics.

MAP SCALE MODEL – STAR DISTANCE

On a scale in which 1 A.U. (astronomical unit = 93 million miles) is one inch, a light year is approximately one mile (1 mile = 6.3 x 10^4 inches and 1 light year is about 6.3 x 10^6 A.U.).

The stars were placed, using this scale, upon maps of Milwaukee County and the United States. A scale model of the solar system based on 1 A.U. = 1 inch is placed in the planetarium resource center and students can find “How many light years to my house?” or “How many light years to New York?” On this scale, learners can get some grasp of the amount of empty space in the galaxy. The scale could be expanded to a globe in a drawing of the Milky Way Galaxy.

ASTRONOMY EDUCATION RESOURCES

conducted by George Reed, West Chester State College (PA)

The Sierra Elementary Astronomy Series

The Sierra Elementary Astronomy Series was developed by Robert Duke of Sierra College (Calif.) for a target group composed of grades four to six. The series consists of three student textbooks with accompanying teacher guides and 35 mm or filmstrip visuals. The textbook units are titled Tracking the Stars, Orbiting the Sun, and Beyond the Nearby Stars. Each unit is constructed of four or five lessons of approximately 30 minutes each.

The program was designed to “emphasize concepts rather than the reiteration of facts” and to allow for “teaching styles ranging from purely didactic to purely inquisitive”. The learning objectives of the program are stated in behavioral terms which can be measured or observed.

The proper educational jargon is found in the advertising literature but unfortunately its application is not found in the manuals. The manuals do not present astronomy in what Bruner would call an “intellectually honest manner”. They present astronomy more as a “rhetoric of conclusions”. The program strongly emphasizes the classroom discussion approach but the manuals would be of little help to a classroom teacher who was unprepared in basic astronomical concepts. The explanation of the Doppler Shift as a more red or blue appearance of a star than normal could serve as a case in point.

The use of behavioral objectives in astronomy curriculum development is to be commended, but the behavioral objectives presented for the lessons are very low in Bloom’s taxonomy. The bibliography was found to be unrealistic in relation to the content of the series. The suggested extra projects in the manual were very good.

The 35 mm slides and filmstrips that comprise the essence of the series will far outweigh the inadequacies of the manual in the hands of a competent teacher. The star, stick figure, and picture outline of the constellations are excellent for teaching identification as are the slides showing the major southern constellations at two month intervals. The slides dealing with the apparent celestial sphere at different latitudes are equally impressive. Perhaps the most unusual slides in the series are those that show how the solar system would be viewed from different constellations. The Sierra Series slides are well worth consideration for use in planetarium astronomy programs.

(EDITOR: The Sierra Elementary Astronomy Series is published by Spitz Laboratories Division/McGraw-Hill, Chadds Ford, Pa. 19317.)

Authors and/or publishers desiring their work to be reviewed in this regular feature of THE PLANETARIAN should submit a sample copy to Prof. Reed, ISPE Resource Editor, at the above address. He also welcomes questions, comments, and contributions from our readers.
This is the second in a series of four articles on Motion in the Planetarium. In the last issue of THE PLANETARIAN, some methods of producing circular motion were discussed. In this issue, methods of producing linear motion are featured.

Linear or straight line motion can be used in a number of ways in the planetarium environment. In its simplest form, linear motion may be simulated by using the daily motion of the planetarium while projecting a stationary object on the dome zenith. If, however, it is necessary to move the projected image from one part of the dome to another, either mechanical and/or optical means must be employed. Motorized tilting mirrors are usually employed to produce motion of the image across the entire dome. These mirrors are placed a few inches in front of the projection lens and adjusted so that the swing of the mirror just clears the projector and at the same time places the image in the desired part of the dome.

Three different planes of rotation of the mirror may be utilized, each producing a different direction of motion. Figure 1 illustrates a 5" x 7" mirror being rotated around the minor axis of the mirror. This is the most limited of the three methods since the reflected image will not quite traverse the entire dome diameter and vignetting becomes a problem when the mirror plane approaches the optical axis plane of projection. Moreover, the motion is usually not uniform since a wheel-lever mechanism is usually used to drive the mirror. When the lever mounted eccentrically on the wheel approaches a position such that it lies along the wheel’s diameter, the mirror motion slows, finally stopping completely and then reversing direction. Finally, this method requires a large mirror surface along the major axis since at the lowest angle (c), the projected image is spread out considerably over the mirror. One advantage of this method is that the image is stable in that it does not rotate as the mirror is tilted. This could be critical for some effects.

The second method is illustrated in figure 2 and involves rotation of the mirror around its major axis. This method is especially useful when it is desired to move the image along the dome horizon and parallel to it. Like the first method it does not produce image rotation and when used in combination with method #1 can very easily produce the landing of a spacecraft on a projected landscape. This method is generally more useful than method #1 since by careful positioning of the mirror plane with aspect to the horizontal before rotation, the image can be made to move along the horizon or over the zenith or any trajectory between these extremes. Method #1 is restricted to a horizon-zenith plane.

The third method involves rotating the mirror around the optical axis of the projection lens (figure 3). This (continued on page 64)
**NEWSBEAT**

What's happening in your section of the world? Would you like to find out who's doing what and where in our profession? Then this is the part of THE PLANETARIAN that hopefully will keep you up-to-date. This section is for you, about you, and by you. If you don't keep your Regional Contributing Editor informed, the rest of our membership will be in the dark too. So please send whenever news you may have about your activities to your RCE.

**Regional Contributing Editors**

PAC, Sigfried Wieser, Calgary Centennial Planetarium, P.O. Box 2100, Calgary 2, Alberta, Canada.
PPA, Thomas Gates, Space Science Center, 12345 El Monte Rd., Los Altos Hills, Calif. 94022.
RMPA, to be announced.
SEPA, Robert J. Hitt, Chesapeake Planetarium, 300 Cedar Rd., Chesapeake, Va. 23320.
SWAP, John L. Cotton Jr., 3717 Purdue, Dallas, Texas, 75225.
International Editor, Jeff Sparks, American Museum-Hayden Planetarium, 81st St. at Central Park West, New York, N.Y. 10024.

**ISPE**

Tom Gates, coordinator for the ISPE Conference in November in the Bay Area, reports he is getting a tremendous response from planetarians who have requested further information and an intention of coming. Many contributed papers have been submitted, and the general exchange of ideas looks good. The morning sessions are generally given to facility tours and small group sessions. Most papers so far seem to be in the education and philosophy categories with fewer in the public, technical and administrative sessions. Speakers are being confirmed for several luncheons and the main banquet. Bus transportation between lodging and activities is confirmed. Some shifting of events may occur, but the tentative schedule calls for:

**Monday, Nov. 13:** Opening sessions, lunch with speakers, afternoon sessions on education, and evening tour of the Minolta Planetarium and Hospitality.

**Tuesday, Nov. 14:** Morning tour of NASA Ames Research Center, lunch with NASA speaker, afternoon sessions on technical topics, and evening regional business meetings.

**Wednesday, Nov. 15:** Morning tour of Paul Masson Winery, lunch with speaker, afternoon sessions on philosophy, and the main banquet in the evening.

**Thursday, Nov. 16:** Morning tour of Morrison Planetarium, luncheon, afternoon sessions at the Morrison Planetarium, and remainder of day free to tour San Francisco.

**Friday, Nov. 17:** Morning administrative sessions, lunch, and afternoon general session.

The registration fee will cover bus transportation, speaker fees, some clerical help, the main banquet, and some of the luncheons.

For program information and preregistration write to:
Mr. Thomas M. Gates
Space Science Center
12345 El Monte Rd.
Los Altos Hills, Calif. 94022

**SWAP**

John L. Cotton of Dallas has just taken over as new president of the Southwestern Association of Planetariums, following the resignation of Dale Johnson who has decided to leave the planetarium field. John had been vice president since the election of officers by the association this January. Following a similar shift by Tom Weldon, SWAP Editor and RCE for THE PLANETARIAN, John has also decided to temporarily take over the association's editorial duties until a "volunteer" can be found.

C. Rob Middleton of the Burke Baker Planetarium in Houston cordially invites all in the planetarium community to visit the new observational facilities there. These include a 16" Boller & Chivens Cassegrain reflector mated to a television vidicon system, and a 3.6" refractor, mounted on the roof of the Houston Museum. It is planned to direct live images of the sun, moon, planets, and stellar objects by closed circuit television into the Museum's Hall of Energy and into the planetarium chamber. On clear days the system will monitor the sun constantly in white light and in H-alpha. A video tape recorder will feed the system on cloudy days and for special programs. Rob further writes "During the past two years we have done a considerable amount of research in the telescope-television field. If you are considering a system in any way similar to ours, we would be glad to pass along any relevant information that we have gathered."

Mrs. Thomas M. Gates
Space Science Center
12345 El Monte Rd.
Los Altos Hills, Calif. 94022

THE PLANETARIAN, 9/72
GLPA

The 1972 annual meeting of the Great Lakes Planetarium Association will be held October 20 and 21 in Youngstown, Ohio. Hosts will be Warren Young of Youngstown State University and Ted Pedas of Farrell High School. The tentative agenda being assembled includes one session for contributed papers and one session for reports on the July 10th solar eclipse. Mrs. Margaret K. Noble, well-known pioneer in planetarium education, will be the Armand Spitz lecturer at the Friday evening banquet, and Dr. Edwin Bishop of Youngstown State will speak at the Saturday luncheon on "Inside Jupiter". Other speakers and information on accommodations are to be announced.

The Robert T. Longway Planetarium in Flint hosted a one-day meeting of the Michigan Planetarium Educators on June 17. The workshop was devoted to discussion and programming of material regarding Copernicus. February, 1973 will mark the 500th anniversary of the birth of this noted Polish astronomer, and many planetariums are planning commemorative programs for early next year.

Lifted from the GLPA NEWSLETTER, Spring, 1972

"Students are in unanimous agreement that "School is where you are told what to do". It strikes me as an absurdity that I should make learning simply a matter of taking orders — orders from everybody in the educational power structure but mostly from me. These orders, of course, are intended to serve the purpose of guiding students through the necessary sequential stages of intellectual development which will ultimately have them "ready" for adult life when they get there. I have been guilty of this philosophy throughout my teaching career. Only in recent years have I felt the guilt that is motivating me to write this paper now. In prostituting these stages, I have been depriving human beings of their right to determine the course of their own education. Not only was this an act of deprivation, but one of coercion as well. I was actually force-feeding my students with a type of "food" that I assumed to be best for everyone, even though I must admit I hadn't found a "food" palatable to them all. The great majority of schools today are probably best described by a depressing simile which states that schools are like large pitchers which are constantly pouring water into a lot of little pitchers — and at the end of each semester, the little pitchers pour all their water back into the large pitchers; after which all that is left is a lot of empty, wet, dirty little pitchers."

Richard Y. Joko

SEPA

At the annual business meeting of the Southeastern Planetarium Association held during the Atlanta meeting in June, special thanks went to Jim Hooks for his outstanding work as President for the preceding two years. Jack Gross assumed his duties as new President, and members elected John Burgess of the Fernbank Science Center as Vice-President and Jane Geoghegan (Jane's Corner) as Secretary-Treasurer. It was decided to hold the next annual meeting at the Miami Museum of Science with Jack Horkheimer serving as the conference organizer. (fcj musing: That should be a blast!)

Jacqueline Avent, Planetarium Curator of the Children's Museum of Nashville, Tennessee, announced that the Museum had its 20th birthday this spring. Since March, 1952 the planetarium has had 317,371 persons. Since the dome diameter is only 20' and the seating capacity is about 50, that's quite a crowd! Next year, the entire Museum will move into new quarters, including a new 40' dome for the planetarium.

John Alexander of the Bays Mt. Planetarium in Kingsport, Tennessee reports that soon they will have the first fully automated model Venus (Viewlex) planetarium in operation. Alexander would like to exchange some programs with other automated installations.

Richard Jones of the Northside High School Planetarium in Atlanta reports that the Atlanta Public Schools will soon have their third planetarium in operation. Each is equipped with a Spitz A4RPY projector and student response units at each seat. The new planetarium director, located at Harper High School, is Robert Tate.

The famed Morehead Planetarium of the University of North Carolina at Chapel Hill is sporting a new copper crown, a $60,000 observatory dome 30' in diameter to cover its new Boller & Chivens 24" telescope. Fabricated by Observa-Dome Laboratories, the dome was assembled on the ground and then placed atop the $3 million observatory annex to the Planetarium on June 14. Completion of the science education facility is scheduled for November, 1972.
The annual Fall Conference of the Middle Atlantic Planetarium Society is to be held on October 6, 7, and 8, 1972 in Chadds Ford and West Chester, Pennsylvania. Co-hosts are Michael Bennett of Spitz/McGraw-Hill and George Reed of West Chester State College.

The theme of the conference is New Dimensions in Planetarium Use, and it is being planned to have a good cross-section of papers and discussions in all aspects of planetarium usage. Tours include the Spitz Labs factory and the Fels Planetarium in Philadelphia. The highly successful and useful Gadget Fair will be repeated.

Planned seminars and paper sessions deal with new developments in planetarium use, such as new interdisciplinary programs and laboratory exercises, with new directions in museum programming, and with state of the art technical devices. More detailed information will be announced in September.

Groundbreaking has begun for a new planetarium in Herkimer, N.Y. under the direction of Don Tuttle. The facility is being financed by a number of area school districts who chose to work together in a cooperative arrangement. It will have a Minolta MS-8 projector under a 30' dome. Plans are to link the planetarium with an environmental conservation center also under construction on the same site.

The Boston Museum of Science and the Charles Hayden Planetarium are planning a combination eclipse expedition and tour of Africa, June 21 – July 8, 1973. Information about the tour may be obtained by writing to that planetarium.

**International**

Three North American cities played host to the 4th International Planetarium Directors' Conference this summer. Over 50 delegates from major planetariums throughout the world attended July 23 and 24 at Toronto's McLaughlin Planetarium with Dr. Henry King as host. They were then taken by charter bus via Niagara Falls to spend July 25 and 26 with Donald Hall and his colleagues at the Strasenburgh Planetarium in Rochester. The group then flew to Chicago for July 27 – 29 at Chicago's Adler Planetarium, hosted by Dr. Joseph Chamberlain.

All three segments were marked with a variety of tours, speakers, special planetarium programs, contributed papers, and discussion sections. Visits were made to the David Dunlap Observatory (Univ. of Toronto), the George Eastman House (the Eastman Kodak museum), the Chicago Museum of Science and Industry, Yerkes Observatory (Univ. of Chicago), and the Lindheimer Astronomical Research Center (Northwestern Univ.). The final evening was capped by attending the famed Ravinia Festival and a concert by the Chicago Symphony Orchestra.

A number of papers were presented by individuals during the weeklong event, as well as some celebrated guest speakers. Available page space here precludes our listing the entire program or the participants, but as transcripts and manuscripts become available, they will be published in The Planetarian.

At the conclusion of the convention it was decided by ballot to drop the idea of creating a permanent formal organization, named the International Planetarium Association, and instead to continue at three year intervals the international conference. It was further voted not to form a conference publication but to use the service of The Planetarian. Further details were not available at press time but will be reported in the December issue.

* * * * *

* Lifted from PAC Bulletin 72-4:

"Quite a number of our star shows carry their own distinct mark. We are using our Moog Synthesizer to produce our own sound effects and our own music. At last a twinkling star sounds like a star twinkling and not like a French Horn amorously approaching a cello on the skin of a timpani."

Sig Wieser
One of the more interesting displays was activated at the Queen Elizabeth Planetarium. Ann Curtis-Stasiuk arranged for a LEM Landing simulation on a Canadian General Electric computer. The simulation started at 1000 mph, 100 miles above the moon, and a given amount of fuel. Gary Stasiuk reports that very few of the landing attempts were successful!

A very active and enthusiastic planetarium educator is leaving Canada and returning to the United States. Dennis Gallagher has severed his relations with the Manitoba Development Corporation's "Omnitheatre". He was instrumental in finalizing plans for Winnipeg's planetarium, and his progressive leadership was its greatest initial asset. After the difficult venture into syndicated planetarium programs, his production of *The Beginning and End of the World* had promising engagements in Denver, Bradenton, and St. Louis. PAC regrets losing Dennis.

Vancouver's Dave Rodger reports a major change in administration at the MacMillan Planetarium. The city government which originally operated the museum complex has relinquished control in favor of a Vancouver Museums and Planetarium Association. After a crippling civic strike, the progress reported is both encouraging and exciting.

For anyone interested the soundtrack recording from the Omnitheatre production *The Beginning and End of the World* is now available from Golden Toad Music, 261 Montrose Street, Winnipeg, Manitoba. Write to them for details.

On May 6, the Pacific Planetarium Association held a southern section meeting at the University of Southern California (USC). Professors Gibson Reaves and John Russell were hosts. The session was entitled "The Probing Think Tank", and a roundtable discussion took place about concerns such as publicity, special effects, salaries, program, personnel standards, curriculum, social and recreational uses, and state and federal funding. Several of these topic areas are now being pursued by PPA members to report on at future meetings.

Reaves spoke about Dr. Joseph Brady's "Planet X". There is controversy over this suggestion of a tenth planet; some say not enough data has been collected, and others point out that Brady's methods are quite sound and valid, which imply the validity of the tenth planet.

Russell, a specialist in meteor showers, pointed out that the Giacobinids with a radiant point in Draco may be rather spectacular this year about October 9. The shower tends to be so periodically every 20 to 30 years.

Ron Oriti of the Griffith Observatory and Planetarium reported the activities of the Los Angeles Astronomical History Society, a group dedicated to the investigation of its namesake.

As of the deadline for the September issue, no letters or inquiries have been received, but we know that some of you are planning on sending in letters. We might share an incident that occurred at the Morrison Planetarium in San Francisco. You remember the solar eclipse of July 1963? There was a lot of discussion centered around not viewing the eclipse directly for fear of eye damage. A woman called at the planetarium and asked, "Is it true we can't view the eclipse through fogged film or dark glass?" When told this was the case, mentioning the potential eye damage, she replied, "Well then if nobody can watch it, why are they holding it?"

CONTACT! is our Question-Answer column. There are no holds barred on questions or requests for help, providing they are related to the legitimate purposes of this journal, and the Editor will send a researched reply to every letter sent him even though space may prohibit its being used in the column. So CONTACT: Mr. Thomas Gates, Space Science Center, 12345 El Monte Rd., Los Altos Hills, Calif. 94022.
Articles From Recent Issues
The Schaeberle 40-Foot Eclipse Camera of Lick Observatory
John A. Eddy, University of Colorado
The Concept of Ephemeris Time: A Case of Inadvertent Plagiarism, G. M. Clemence, Yale University
The Development of Research in Interstellar Absorption, 1900-1930, R. Berendzen and D. Seeley, Boston University
The Carnac Alignments, A. and A. S. Thom
Remarks on the Theoretical Treatment of Eclipses in Antiquity Asger Aaboe, Yale University

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PROSPECTIVE EMPLOYERS: The Executive Editor has on file several letters from well-qualified planetarium teachers seeking new employment. Please write if interested or call 518-457-3207.

The Technical Side (continued)

method has the advantage that full motion across the entire dome may be accomplished since the image on the mirror remains constant in area and no vignetting occurs. This method, however, produces image rotation which may be advantageous in some cases (a tumbling asteroid or spacecraft) but not in others.

All of the above methods require a moving mirror and stationary slide. Limited but effective linear motion may be accomplished by moving the slide along the plane and using a stationary mirror. A 35mm single slide projector equipped with a two slide carriage (Minolta Mini 35) can be used by simply motorizing the slide carriage. This can be used where only a small linear motion is required. The main advantage of this method is that the slide is moving in the focal plane making possible many effects not possible in the first three methods. For example, if one wishes to move a moving spacecraft by a window or an adjacent craft or settle a landing spacecraft behind a hill or boulder, a single mask can be placed in the focal plane of the projector and the slide of the spacecraft moved across the mask. Of course, the mask made from kodalith must “fit” the projected window, hill, boulder etc. for the spacecraft to appear to move behind the subject.

Many variations on these methods may be used and combined to produce any number of special effects. When these are in turn combined with the circular motion methods described earlier, almost unlimited motions are available to the planetarium.

(End)
Join I.S.P.E.

Membership in the International Society of Planetarium Educators is open to anyone interested in furthering its objectives. These are to disseminate planetarium and astronomically related information and to coordinate educational programs through publications and conferences.

Applicants may join by contacting the Executive Secretary or through one of the seven regional affiliated associations:

- Great Lakes Planetarium Association
- Middle Atlantic Planetarium Society
- Pacific Planetarium Association
- Planetarium Association of Canada
- Rocky Mountain Planetarium Association
- Southeastern Planetarium Association
- Southwestern Association of Planetariums

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1p 9/72
53 MORE TEACHERS

attended the 1972 Spitz/McGraw-Hill Summer Institute in Planetarium Education. Over the past 4 years, 236 planetarium instructors have taken advantage of this unique opportunity to learn the specific practical skills and methods of effective planetarium usage.

And now the Institute may be taken for graduate credit through West Chester (Pennsylvania) State College.

Write for details about our next Summer Institute, July 30 to August 17, 1973.