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About the Institute

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

October 15, 1969

TO: Members of the Seminar
FROM: Morris E. Garnsey, Director

As decided at the last meeting of the Seminar on October 1, we will again divide our group into three working groups for the next session on October 22.

The groups are as follows and Group A will meet in UMC room 158A; Group B in UMC room 158B; and Group C in UMC room 157B. It is suggested that we all meet promptly at 3:00 in 158A and then split up into our separate groups.

<u>Group A</u>	<u>Group B</u>	<u>Group C</u>
Robert Ayre	Kenneth Boulding	James Downton
James Corbridge	Ernest Flack	Curtis Johnson
David Hill	Eugene Haas	Paul Julian
Jack Ives	Michael McClintock	Frank Smith
Sam Johnson	David Rogers	Patrick Webber
Gilbert Hersh	Mrs. Holcomb	Walter Jessel

At the end of an hour or so we will all meet back together again for discussion.

THE ASSIGNMENT OF EACH GROUP WILL BE TO PRESENT A CHAPTER OUTLINE (WITH WHATEVER DETAIL POSSIBLE) OF A BOOK ENTITLED A THEORY OF MAN-ENVIRONMENT RELATIONSHIPS.

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

TO: Members of the Seminar
FROM: Morris E. Garnsey, Director
DATE: October 8, 1969

The following books are added to the bibliography. They have not been ordered

- Aylesworth, T. This Vital Air, This Vital Water. New York: Rand McNally and Company, 1968.
- Briggs, Peter. Water: The Vital Essence. New York: Harper and Row Publishers, 1967.
- Burns, W. Noise and Man. London: J. Murray Publishers Ltd., 1968.
- Commener, Barry. Science and Survival. Hamden, Connecticut: Compass Publishing Company, 1966.
- Dales, J. Pollution, Property and Prices. Toronto: University of Toronto Press, 1968.
- DeVos, A. and others. The Pollution Reader. Montreal: Harvest House, 1968.
- Dworsky, L., editor. Pollution. New York: Chelsea House Publishers.
- Garrigan, O. Man's Intervention in Nature. Melbourne, Australia: Hawthorne Press, 1967.
- Graham, F. Disaster by Default: Politics and Water Pollution. Philadelphia: J. B. Lippincott, 1966.
- Hoffman, R. N. Murder on the Highway. Cranbury, New Jersey: A. S. Barnes and Company, Inc., 1966.
- Hoyt, J. B. Man and the Earth. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967.
- Rodda, M. Noise and Society. Philadelphia: W. B. Saunders Company, 1967.
- Scorer, R. Air Pollution. New York: Pergamon Press, 1968.
- Smithsonian Institution. The Fitness of Man's Environment. Washington, D. C.: Smithsonian Institute Press, 1969.
- Szabad, E., editor. World Views of Population Problems. Budapest: Hungarian Academy of Sciences, 1968.
- Whitten, J. L. That We May Live. Princeton, New Jersey: D. Van Nostrand Company, 1966.

The following is copied from an article in CIVIL LIBERTIES, Number 264 - October, 1969

CLUs BACK CITIZENS' POLLUTION FIGHT RIGHTS

SoCal Sues to Halt Oil Drilling

A federal suit to stop oil drilling in the Santa Barbara Channel until opponents are given a public hearing was filed this summer by the ACLU of Southern California.

The affiliate contends area residents were deprived of personal rights without due process of law by U.S. Interior Secretary Walter J. Hickel, four oil companies, officials of the U.S. Geological Survey and officials of the Presidential Office of Science and Technology.

"The personal right is the right to live in, and enjoy, an environment free from improvident destruction or pollution; and the property right is the right to the ownership, use and enjoyment of property, free from improvident invasion or impairment," according to the complaint.

At press time, a preliminary injunction has been denied by a federal district judge, and a three-judge federal court is set to hear the case.

The CLU argues that the government is relying on secret information regarding oil contamination from the very parties who have been responsible for contamination. Last January, a blowout in a well caused massive damage as oil spilled for 10 days. In June, the government announced that approximately 50 more oilwells would be drilled in the channel, allegedly to reduce oil pressure and "thus forever prevent future spillage." Citizens have no way of knowing whether the solution is sound.....

EDITED TRANSCRIPT OF FACULTY RESEARCH SEMINAR
IN MAN-ENVIRONMENT RELATIONSHIPS

October 22, 1969

Garnsey: Everybody from the lowliest student on up has some voice in what he does and nobody has his fingers completely on what everybody does. Perhaps that's a good thing -- characteristic of a democracy. Now when we get into this field of man and his environment we're running into the "everybody-nobody" syndrome. So I think before we begin our group meetings today we'll have two reports on recent developments.

Smith: With only three days notice we received a request from a member of a consultant firm. The man's name is Jack Dahl of Peat, Marwick and Mitchell in Washington, D.C. which firm has been retained by the Ecological Society under a grant from the Science Foundation, to do a feasibility study on whether there should be a national institute for ecology. I gather they looked to Boulder for several reasons, one of which was that NCAR was held in such form by the Science Foundation as a national institute model. The ESSA Research Laboratory is almost exclusively in the physical sciences and so we didn't feel that we had much of a response to make to the several kinds of questions which Mr. Dahl's letter indicated he wanted answered. However, out of my experience with this seminar over two years, I knew very well that the Boulder community in several ways has an intense interest in such questions. So I called several of the members here and asked each of them to remark on pieces of it, to receive this visitor, Jack Dahl, and to treat of his questions. We met on a Thursday morning last week at a session with Garnsey, Rogers, Johnson, Smith, and your colleague, Mr. Esterbrook, in the Faculty Club briefly, and then I took Dahl off to look at a physical sciences data center, then to meet with one of our researchers who is working on background levels of air pollution. I introduced him to Oakleigh Thorne of the Thorne Ecological Foundation. On Thursday he was received (Dave will be telling this in part) by Bob Knecht -- I thought it would be a good idea to see the mayor of the city and I understood he was to close out his visit with Walter Roberts of NCAR.

Rogers: He came, apparently to the desires -- for the discovery of the feasibility of an institute which is unique to the extent that it is worth putting up one organization which serves for the study of ecology. And I'm not sure that his definition of ecology when he came to this place was the sort of definition that he got as a result of working here in this kind of interface. And so it was very nice to have Frank invite each of us--biological sciences, life sciences, socioeconomics, and the hard sciences--with Curt (Johnson) to widen his horizons as to what ecology really is. And I think between the three of us we had an opportunity to discover, or to point out to him so that he could discover, what an ecological institute should indeed incorporate and how it might work. Of course, I spoke to him in terms of a little broader dimension of life sciences I think, than is typically thought about in ecological fields. But we tried to point out the need for and potentialities of a center existing in the Boulder area because Boulder has in the University and other related organizations the most powerful set of environmentally-oriented facts I could possibly think of existing in such a community anywhere in the country. This is why we spent lots of our time trying to impress him with this broad gauge set of people that exist on this campus and near here. Biologically, of course, one of the things that worries me about it is whether or not the Ecological Society will take a report from a man like that who clearly is

strictly man-oriented but I'm not sure the Ecological Society is indeed man-oriented. Ecology to them is what's out there, not what's in here.

Garnsey: Well, to me one thing that's significant about the whole thing is that this whole movement has caught fire and some of us have been involved in it for five or ten years in some modest way, and all of a sudden you can hardly pick up the daily newspaper without reading some report about some kind of ecological crisis or something of the sort, and this leads me to Curt Johnson's report on what I call the "revolt of the young Turks" on our own campus.

Johnson: Well, the young Turk in this case is apparently Walt Tanttala of Physics who, in a sense, caught on a little late that something was happening. I had not known him before but he moves fast and so he called a meeting and through various contacts he dragged in a rather strange assortment of dogs and cats that he knew were somewhat interested in this area but certainly not an all-inclusive one. And the outcome of it was that we had an opportunity -- Morris described this seminar and some of the background that led to it and some of the plans that he had envisioned. I mentioned a little about something Dave Rogers and I have been thinking about in terms of the proposal; Bob Ayre told about some of things in Civil Engineering, particularly the sanitary program which already exists, and we kind of batted all this sort of stuff around for awhile but the outcome of it was that a committee was selected that includes engineering, economics, physics, law, integrated studies, and one or two others, will include a graduate student or so-- and Gil Hersh is the graduate student, and some undergraduate students perhaps to find out just what is going on and to come up with some kind of recommendations. I ended up as chairman of this committee and am not quite sure how this happened but I could hear the train coming and leaving.

But mainly I think the first thing we are going to do is to design a questionnaire which will go out to all members of the faculty and find out what's going on. There are too many important ideas, there are too many people who are anxious to do something, and with every effort of coordinating these at least getting all the ideas, the interested people, interested courses, out in front of everybody who is concerned so that we can cooperate rather than each re-inventing the wheel or fighting among ourselves. I think this will turn out to be the objective. At least this will be my intention and this is just too important and too vital to worry about little niggling points on it. So the committee will be in action very shortly. I have been in touch with most of them by phone. I have asked them to let me know their schedules so we can find meeting times and so forth and that's where it stands.

Garnsey: This seems to be the appropriate time to announce that the subject of the next meeting, on November 5th, will be the "organizational structure to do something about this." And I've assigned this topic to McClintock and Williams who started this. I think it also should be mentioned that Tanttala thought of it primarily as an undergraduate program and you certainly will agree that the sooner we get more people informed about this the better off we are, so if we have undergraduate courses it should be a major part of the program. I will be frank in saying that I don't see an undergraduate department without a graduate department to supplement it because the tradition of the University is such that the graduate department feeds the undergraduate department with T.A.'s, and research and everything else, and therefore my feeling was when I started this four years ago that we should start with graduate research and training, and faculty research, and that's why it's been deliberately

called a Faculty Research Seminar in Man-Environment Relationships and we've just neglected the poor undergraduates. But, obviously, in the end if we were sufficiently staffed and sufficiently financed we would want to go heavily into an undergraduate program. I believe Mr. Tanttila thinks we should create a new department in the University, just like the Department of Biology, or Economics, or Chemistry, called the Department of Man-Environment Relationships. I don't know Mr. Tanttila very well but I know universities after thirty years and I just think that he has bitten off a very large bite. The only way such a department could be established is if the magic fairy waved a wand and said here's five million dollars, go ahead and build your program and have a graduate - undergraduate department in it. For the simple reason -- where are you going to recruit your faculty. What departments are willing to release time and existing faculty to teach in this new department, etc. It's taken Malcolm Correll a good ten years to set up a Department of Integrated Studies and this is the kind of thing that maybe, Mr. Jessel, you recognize that business is far more advanced and flexible than universities. This is the kind of thing we just can't do whereas, let me assume that if IBM wants a new department it waves a wand and a new department appears, and it's fully staffed with highly-paid and competent people.

The challenge I put right up to Curt Johnson since he's Chairman of the committee, and to Tanttila, is all of this is very fine but how are you going to pay for it, and who is going to pay? And those to me are the two absolutely essential questions. I don't know which comes first, the hen or the egg. I mean, you know, we can draw up a beautiful proposal and take it to this foundation or that foundation and maybe the egg will hatch into a gigantic hen or rooster full of vitality. But as far as my experience with this University has been concerned, projects have been essentially individual research projects headed by a man of some reputation, who has been able to get the money from NSF or Ford, primarily because of his own reputation and the skill with which he's written up his project. And so if we just go in and ask somebody to finance an undergraduate department of man-environment relations, they're going to say there are a thousand universities in the U.S., why should we choose you? What have you got? Now, of course, we've got a great deal, I believe, at the graduate and the research level, but frankly I don't see at the moment what we've got at the undergraduate level unless we pull a lot of people out of their regular courses, etc.

Rogers: Maybe Mr. Tanttila has served as the burr under the saddle for this. And as for the results I couldn't agree with Curt more that we must discover what is going on in this place.

Garnsey: Yes. That's one thing we need to know. We come to a third report and that is what is going on and I'm going to ask Gene to tell us, from the letter I've slid back over to him, at least what's going on somewhere at some place.

Haas: It's essentially an announcement of a symposium on undergraduate studies in environmental sciences. It's triple A.S. sponsored, or at least their name is on the announcement, to be held at Hampshire College on December 27, two three-hour sessions. The letter essentially is inviting participation by faculty members, asking for names of undergraduate students and even high school students who might be bright and interested in environmental problems, indication that they are going to seek support for about 50 students, I assume that means to get them there and take care of their expenses for the day or something of this kind. They plan to have two 40-minute sessions and the rest of it, presumably, is going to be in some kind of smaller group sessions -- this is not entirely clear. Papers presented will be submitted for publication

in the journal called Environment, and all hands are welcome and if your hand isn't welcome, they would like to know what you're doing so that they can tell everybody at the symposium what you're doing.

Garnsey: And it's essentially on the undergraduate level since Hampshire College is a small college which has been struggling hard the last five to ten years to become a recognized college. Well, Curt, it's up to you to find the money and somebody to go to this.

Johnson: I will either be in touch with them, or get there or find somebody with money to get there. I might mention also that I will be in Washington in the middle of November at the Chemical Engineering meeting and among other people whom I want to meet will be this Mr. Dahl who was here before. I figure he will probably have a hundred people following up from the visits that he makes and certainly Boulder may as well be one of the places that follows up. If, toward the middle of November, certain of you have people you feel I should see if I can slip them into the schedule and they're in town, in Washington, I'll be glad to make a try at it.

Garnsey: It occurred to me that with reference to what's going on at Hampshire College that the same person could stop over at Green Bay, Wisconsin. As all of you remember the President of Green Bay campus of Wisconsin was out here and explained to us that their total curriculum is to be built around man-environment relationships. I have expressed a great skepticism about this. I teach principles of economics and there are things like, say, the quantity theory of money and I don't see how you can put the quantity theory of money into man-environment relationships, and yet I think students who take principles of economics ought to know about the quantity theory of money. And I know -- I feel sure everyone of you sitting around this table who teaches a basic course in a basic field, even involving a four-year curriculum feels that this curriculum has stood the test of time, of 25 or 50 or 100 years, and has helped with the progression of knowledge and you can't all of a sudden just turn this over and throw everything into man-environment relationships. I am really puzzled as to how they're succeeding at Green Bay, if they're succeeding at all. And I think it would be very interesting if somebody could stop there.

Now I have a final announcement. You've noticed there are several absences today and we all -- we expect absences, they're unavoidable. Jack Ives called this morning and said the he and Mr. Webber were completely tied up in negotiating a major proposal for the Arctic and Alpine Institute. And Kenneth Boulding is a person who, if you catch him on the fly at any time you are lucky, and he made a commitment for elsewhere today. But he assured me that he would be here at our next meeting, and let me repeat again what our next meeting will be. McClintock and Williams will present a proposal for an institute for man-environment relationships which I assume will include what I consider the three major areas -- the formulation of a theory, which this group is dedicated to this year; the development of a graduate program, both within and inter-disciplinary, and finally, development of undergraduate courses which also are bound to be inter-disciplinary but will lead the undergraduate to some understanding of problems of our environment. So our November 5th meeting will be a common meeting for the entire period.

I've given you a very difficult assignment for today and allowed you to divide up into small groups to work on it for the next 45 minutes anyway, and I suppose most of you recognize this as an old gambit in graduate instruction.

A student comes in and tells you he'd like to write a thesis about this or that or the other, and my invariable reply to him is to go back and set down a list of the chapter headings that you would put in your thesis. So what I want you to do in these small groups -- and I hope some of you have some ideas -- is to find out what would you put in as chapter headings in a book called "The Theory of Man-Environment Relationships"? And I hope you all brought with you my attempt as to what I think such a theory ought to include. So I suggest now that we break up into the A, B, C groups and 45 minutes from now we'll call you all back and we'll ask the reporters to put the outlines on the board.

Group separates and then reconvenes.

Garnsey: We started out with Mr. Williams, a physicist, suggesting an approach to this problem based on physical concepts and I guess you had better get up there and explain it.

Williams: We talked about breaking up the general book into three parts, the first part of which is an introduction in which it was suggested that the first chapter should perhaps be a history of man-environment relations -- Bob Ayre made this suggestion. Perhaps he would like to say a word or two about what he would like to have included in that.

Ayre: Well, I don't think it needs much elaboration. We all know that there has been profound effect on our environment historically -- if you go back thousands of years to the first major cities and the exploitation of the land in the fertile crescent in the Middle East, and so on, there are all sorts of examples. Then there's our religious background that seems to have some effect on this.

Garnsey: And there have been environments that have succeeded as far as man is concerned and environments that have failed.

Williams: Following this introductory historical chapter we thought perhaps the next chapter should be a discussion of the general approach of how the theory of the environment should be formulated. And we were thinking in terms of -- talking about the environment -- in terms of an equilibrium environment on the one hand and a non-equilibrium environment on the other hand. By equilibrium environment I think what we meant was we would consider an ideal environment, which is perhaps non-existing, in which we have more or less a stationary, steady-state environmental situation, in which you don't have any of the wild fluctuations above a normal situation. And then we divided up the rest of the book into two parts which would be one -- the first part would be the discussion of an equilibrium environment and the second part, or the third part of the book, would be a non-equilibrium environment theory. And, again, the equilibrium theory would be a discussion of an idealized environment and Eugene Haas suggested that the particular chapters in this section might be first of all, a chapter on the interaction of man with his physical environment, the second chapter might be the interaction of man with his life environment -- by life is meant non-human life -- animal life and plant life. And the third chapter might be interaction of non-human life with the physical environment. Again these would be idealized, stationary, steady-state relationships between these various segments of the environment. I believe the suggestion was also made that we might extend this first chapter to first of all to include not only man interacting with his general physical environment, but man interacting with his artifacts and man interacting with the physical environment that does not concern his own artifacts. And Bob Cohen made this suggestion and I believe he had one more.

Cohen: Well, man with man first.

Williams: -- and the interaction of man with man. The idea of starting with an equilibrium theory here is to try to decide what are the relevant parameters that characterize an ideal environment -- the relationship between, say, what parameter characterizes the relationship between man and his food supply or between man and his communication systems, and so on.

Garnsey: I can't help adding that all through here we have to talk about numbers, because if there is just a little tribe of Indians in the middle of the whole great plains it certainly is a different situation than if there is Omaha and Lincoln and the other towns across the great plains. And, of course, when we come to the great megapolis of the East coast and the West coast we run into a whole series of new problems, and these, in fact, are the problems which enforced environmental considerations upon us. The problem of the numbers. You've heard me remark before, that if an individual fisherman goes way up into a high mountain stream and catches two or three trout, which he is then going to fry over a wood fire, he disembowels them and throws the entrails into the stream and nobody cares. He doesn't care and nobody cares, because by the time these solid materials reach civilization they will have disintegrated and been purified by natural processes. But if a city of half a million people dumps untreated sewage into a river that just means that the city of half a million people 20 miles down the stream drinks water which has been treated from sewage. And this is the new factor in our society which has caused us concern. And if I drive my automobile over Independence Pass the carbon monoxide dissipates into the air and nobody cares. But if I drive my automobile along the Valley Highway along with 10,000 other automobiles, a whole miasma of carbon monoxide and other noxious gases rise to spread out, to create smog over the whole area, so that somewhere in here we have to get numbers into this in a very positive way. This is really the crux of our modern problem.

Williams: One thing that we haven't done here is to include numbers in the sense we haven't included the interaction -- or the effect of the microscopic environment upon the macroscopic, or vice-versa. We've, instead, taken a division between equilibrium and a non-equilibrium description of the system. The non-equilibrium description is an attempt at describing the real environment as it is evolving and in the first part we decided to talk about the influence of small perturbations upon the environment. What we mean by this is, consider a small sub-system of the larger environment and introduce some perturbation into the system -- such as -- it might be a new power plant. And consider the effect of this perturbation upon whatever sub-system we are interested in studying, and we ask the question, "Is the system stable or unstable with respect to the introduction of this perturbation?" If it's stable, what we mean by that is that the basic parameters that characterize the relationships between man and various aspects of his environment here do not change substantially with the introduction of this perturbation. An unstable perturbation, on the other hand, is one which would tend to aggravate the normal environmental situation or affect it in some adverse way. What we first do is consider the influence of a single perturbation at a time. The reason for doing it this way is that this is a model approach to the problem and it perhaps is tractable to some kind of solution -- it presents you with a point of view that enables you to come up with some kind of concrete answer. Of course, you never have single perturbations in any kind of real environmental situation so another thing you might do is introduce multiple perturbations into your environment

and ask not only the question, "Is the system stable or unstable with respect to these several perturbations?" but also, "What is the effect of these interactions of these many perturbations among themselves?" For example, in the air pollution problem the pollution that is due to both automobiles and factories does not add, I understand, but the total effect of both of the sources is actually greater than the sum of the individual effects of these perturbations.

So the interaction of the perturbations is a problem which I think is also worth studying. But neither of these approaches here comes really very close to a study of the real evolving environment as we know it so perhaps in a non-equilibrium theory another chapter might be devoted to the discussion of a fully-developing environment in which you might be able to say some general things based upon what has been developed previously in your discussion of perturbation theory and your equilibrium theory. I don't really know what could be included under this. There are really a lot of variables -- a lot more variables enter into that problem than enter into either of these other two problems.

Jessel: By fully-developing do you mean the actually developing environment as we now know it?

Williams: Yes. I don't know if that is an adequate -- a fair characterization.

Garnsey: I think this is a good place to stop on what might be called the approach of a physicist to this problem. I guess someday I'm going to have to be inspired to produce an outline for the approach of an economist to this problem because economists have a different set of concepts and close to those of the geographer, and we may turn out with a three-volume book.

Ayre: I don't see how fully-developing environment fits particularly, if I understand it correctly, under item three. It seems to me this is really an item four which goes into what you might call the real environment.

Williams: The real environment, though, is a non-equilibrium environment.

Garnsey: All right. Now would the second group like to report a set of chapter headings?

Smith: I'm going to ask Mr. Downton to articulate the first. The basic understanding or the perception block.

Julian: My general impression from that outline was that that was a theory of environments maybe -- what, analyzed? Let me say a little louder what I said before, that it's all very nice, except the next question is obviously what is the theory going to be about? And there's nothing up there in the first outline that said anything at all about that.

Garnsey: Well, except this, Paul, that these perturbations are introduced by man and this is man and environment. I mean, now we've got footsteps on the moon, you see.

Julian: Oh, I understand thoroughly what you are trying to do.

Garnsey: I'm not too optimistic -- well, I'm very pessimistic about my ability to write this up into something sensible for the simple reason that I think it takes a Galileo or a man of the centuries when a man knew everything, and today very few of us know very much except about very little, and this gets us into a terrible problem. And, incidentally, this gets us into all these papers on air pollution, and water pollution, and air chemistry, and cloud physics -- you could name a hundred of them -- and this is a kind of problem a person thinks he could tackle and get published. And so he does. But nobody except a few oddballs here and there are considering the question of man and his environment in the broad scope. Now we dare to do this. We may end up in June saying we have failed, God forgive us, but we tried. We may end up with something significant, I just don't know. And at this stage we're clearly still exploring what we're thinking about. All right, Frank.

Smith: Let me try to weave these together because as I confessed for our group they are nothing more than some of the things I heard said. I've tried to order them and -- in some sense it has to be just art work.

Basic understanding: The perception block. That's what the first scribbled line says. I think that, Downton, you got the notion of perception block to deal with.

Downton: Yes. Well, just let me say a couple of things in terms of what my position is, with the understanding that there will be minority reports because it is not at this point, by any stretch of the imagination, generally shared in the group. But my idea is to develop three equilibrium arrangements. The first would be a model of man which would attempt to understand man in relationship to the environment in the context of two basic dimensions -- man's needs and his uses of the environment, and I am not interested in abuses. I may presume he may perceive they are not abuses. And the second that has to do with the perceptual screening process of man as an adaptive mechanism. And so that is one part of what I perceive to be necessary. The other part is essentially Curt's idea of a population model which would, in my terms, consider two basic dimensions -- capabilities of the environment to sustain life; but that leads us to the second factor and that is the load on the system at any one particular point in time, so you could actually in both of those contexts talk about capabilities and load in your immediate period and then talk about projections and capabilities and load.

Garnsey: That also leads from the economist's point of view to the technology because the load-bearing capacity is a function of technology.

Downton: Right. So there's a lot of factors and we didn't discuss some of the more general questions. And then what I'm interested in is looking at these two equilibrium models as a total model so that you have the two models in a state of equilibrium or disequilibrium, depending on the conditions. And there was a lot of dispute on whether or not we should include man, whether or not we should only look at the population model and make concrete recommendations from that point.

Smith: Let one take responsibility for the next line which says "Where are the dangers, what are they?" This was my attempt to suggest a section of the study where you would try to do the limiting to the relevant part of the question. So often in these rooms in these days we have used examples of an environment or perception of an environmental problem which are not really so critical to the sense of emergency of our times. And so when you say "where are the dangers?" you would then have the opportunity to explain yourself, if you ~~mea~~ to work or talk about the places where man is perhaps most densely packed, the megalopolis or where it matters. It does not matter so much as you were saying a moment ago that a fisherman by himself in the mountains gets his fish and throws the entrails in the stream -- that's partly outside of our area of interest. What are they? We will probably also need to limit ourselves by saying what it is that concerns us. Perhaps we're not yet ready to deal with noise pollution, air and water pollution being so much more urgent perhaps.

Garnsey: Well, just let me say that from the very beginning, in my own thinking, and in the emphasis in the seminar we've been thinking about the physical environment because there is an entire field, broader than the compass of all of us, being studied by, I would suppose, several thousand people on the problem of man's environment in urban situations of ghettos, suburbs, mass transportation, megalopolis, and so on. And I just felt that we don't have the resources nor the particular interest to get into this except insofar as we have to recognize it in some kind of an outline. After all, there is no Helen Jacobs here, there's no Center for Urban Transportation, there's no HUD, if you like, where they have economists and other researchers who are certainly as good as we are. But there are people in Boulder who are interested in the atmospheric sciences, there are people in Boulder interested in the biological and life sciences, and so on, so we just have to limit ourselves somehow --

Smith: Let's agree then that under some title there will be a section in this book and early on it which will declare our particular interests differentiating from others being studied elsewhere, etcetera. Next "Man the Threat: Selected Activities." I invented that term also. Is it sufficient to develop a theory which is not indeed around the activities of man -- that threaten to upset the environment in some of the irreversible terms we talk about. Next I've written "Do we know what we know?" and coupled with this is the following line -- model building or information resources. There is a suspicion that we don't know how much we know, and certainly that showed up in one of our seminar sessions last year in the roundtable but my meaning in using that question here "Do we know what we know?" is to examine the promise of the likelihood that we know a lot more than we are actually confident that we know. Lots of disciplines, lots of random sources of information.

Smith: Dave (Rogers), you were remarking about using your example of the San Luis Valley data resources. There are some surprises on available data if you know where to look for it. I believe Dave used the possibility of synthesizing data about the San Luis Valley which could be a laboratory experiment, which might be gotten from very different sources -- Soil Conservation Service, school system, weather bureau, etc.

Hill: You see, the problem -- excuse me. The problem with this is that what's a different source to you is a common source to somebody else. You mentioned the Soil Conservation Service. That might be different for you, but for me it's a very common source of information. I can't help but think that maybe we'd better

and sit down and write position papers from our own respective disciplines and then look at one another, and read these. I get the feeling that for some of us we're going over real old ground. For others of us it's new ground. And if I feel that way I'm sure others do. I'm very troubled by this because right now I have a very difficult time finding out what it is we're trying to do. I had a notion at one point that we were looking for a very general theory -- a very general explanation of how man relates to his environment. From some of the comments that have been made very recently I get the notion that there are only certain parts of the environment that we're concerned about. For example, we are willing to write off urban areas because other people are studying it. Do you see what I'm having problems with, Morris?

Garnsey: Sure I do.

Hill: I could go on with my ill feelings but perhaps should stop at this point.

Garnsey: Believe me, I even lie awake with these problems, you see, because -- you know, man and his environment encompasses everything. What are you going to leave out? What fields of knowledge?

Ayre: Who says we're going to write off the urban problem.--because 75 percent of our people are urban at least by definition.

Garnsey: Which means something. All right.

Downton: Maybe your attitude about the book is wrong -- that we shouldn't be thinking about writing a book but writing a theory that, in fact, would be an outline with the kinds of factors that we would be looking at, say, as study progresses. So that it can be very general and the attitude then conveyed would not be one of what we have the capability of doing or what we will do but what should be done. And if we don't do it let someone else do it.

Rogers: I think that what I was trying to get at in our little discussion group was to evade the frightening aspects of the totality of the theory. I was sort of stimulated to think in these terms by the comments made -- at least the discussion was given in this printout that we got -- that Professor Boulding differentiated between micro and macro environments and I don't think if you start out by labeling things at the beginning -- micro, macro -- you're doing a bit of good. You're establishing definitions and you've got to screw the facts into it. This is a "bass-ackward" approach as far as I'm concerned. I proposed a small study which gives us an input from one little tiny part of the whole thing of -- I proposed that we start the thing little with a well-defined valley which doesn't have the population problems of Chicago or New York, but that micro study, if I can come back now and use some of the same words that I'm hating, built into some other micro studies which don't worry whether or not we are going to attack the urbanology stuff but these are useful to concern ourselves -- generalities that we've built up from the bottom, models that will indeed come crashing down eventually as the general theory. And this is what I was concerned about. We do have pieces of information, common to you, not common to the rest of us. It's used, indeed, by me differently than by you.

Hill: Right now I mean to think of this theory in terms of two approaches. If we look at that first outline --I think I.a. was history and history was explained as history of relationships that man has had with his environment, good and bad. Now that kind of sets the tone for one approach to this theory. Now another way of writing that history to set the tone for another approach to what we're doing is saying let's look at the history of ideas about man-environment relationships, and are we then not doing something else. I can show you a 1200 page book called Man's Role in Changing the Face of the Earth which dealt, you know, page after page with the ecological atrocities, etc., that have occurred. And then we have Fairfield Osborne and a whole _____ of literature in this field, you see. But we have very few, I think, attempts to come up with theories which get at the relationships question.

Garnsey: And while we have formally scheduled a report by McClintock and Williams next time, Professor Boulding has promised me that he will be here on the 5th. And I think we should attack him. I think we should ask him, if you'll excuse me, "What the hell do you mean by a theory of the environment? How come you proposed one? Let's have you put out a few chapter outlines of your own." He's a very brilliant man and I don't think it will phase him. In fact I think I'm likely to warn him in advance that he's likely to be attacked. So I just want to ask McClintock and Williams not to take the two full hours, you see.

Julian: He had a partial answer to that last time when a few of us asked him essentially that question, and his only answer was that it sounded like it was a good idea to do it.

Garnsey: Yeah, well, it sounds to me like it's a good idea to do it, you see, but this time I'll pin him down.

Downton: I wonder if this is really the question that's being raised here-- I'm not exactly clear on the point. Are we asking what does it mean to talk about a general theory, or are we asking what are the boundaries of a general theory? I'm interested in your specific response to that because I'm not exactly sure what your question is.

Hill: My question is what is the purpose of this theory? What is it intended to do?

Garnsey: I'll try to answer that because I was present at the very small group in the summer when Boulding was there. We had two winters of, I would say, profitable discussions of man-environment relations, some of them very narrowly defined--like four lectures on air pollution, four lectures on water pollution, a report on the activities, and work, and functions of the Air Pollution Control Center in Washington, and so on. We had that kind of thing for two years but we run out of that kind of thing, you see, we didn't think anyone wanted to come anymore to hear more speeches about more topics like this. So we said well, then, what can we do, since we still believed the subject was valid and useful, and Boulding said behind all this, air pollution control, water pollution control, solid materials control, noise control, and of course the thing that interested

Bob Ayre most was urban environments which is the field of the human ecologists of whom there are very few. Boulding said nobody has ever tried to pull this together, to ask how is it that man looks at his environment, and how does he do it?

Hill: Yeah, but you see, I don't think Boulding is right. I think Boulding is wrong. I think man has been trying to explain how he relates to his environment ever since he started thinking. And this is what I meant by looking at the history of ideas. We began with the notion that God determines everything, and then that environment determines everything, and now man determines everything. It seems to me that what we might try to do is explain how man relates to his environment.

Garnsey: Today

Hill: --human deterministic theory, not environmental deterministic theory, not a deistic deterministic theory, but a new theory.

Garnsey: I don't know a fraction of this that you do, but I know that at one stage in primitive history man thought trees were deities, and of course the sun and lightning he tried to explain to himself, and he tried to adapt to himself, and then you get the pastoral period and you begin to get ideas about how to be a good husbandman, and then you get the Bible with all kinds of quotations which you could put together if you wished on how man has looked at his environment over the centuries. There's no question about that, you see, so this is not what we mean by a theory of the environment. What I mean by the theory of environment is that in this modern age in which there are two very clear, and very sharp, and very new phenomena -- one, numbers, and two, technology -- man is manipulating his environment in ways which he never was able to manipulate it before. In the first place there weren't enough of him. In the second place, his technology was so limited that what he did had very little effect on the environment. So all of a sudden we jump from the kind of period in which these two things were true to the kind of period where we talk about the greenhouse effects, and the changing of the entire climate of the world by the manufacture of carbon dioxide. We also get to what I consider unscientific and undesirable -- we get to books like Barry Commoner's Science or Survival in which he in fact indites science for producing these changes which I just mentioned, to the quantitative effect that they are irreversible, and that we may end with a dead planet. And it seems to me that it's at this stage that we need what I would call the theory of the environment and man in the environment, and perhaps it goes back to the Bible and husbandman and all that sort of thing to some extent, but mainly it's a late 20th Century, early 2000th century concept that we're dealing with. Now maybe the only way I can beg off with Bob Ayre is to say that I know just as well as he does that 75 percent of our people live in urban communities and that the environment of the Negro child in the ghetto is far different from the environment of a college professor in Boulder, Colorado, and all I'm saying is that we can't study everything and long ago, as far as I'm concerned, I made up my mind that we would try to concentrate on the physical environment rather

rather than on the environment most broadly defined.

Ayre: I didn't mean that we should include all these social aspects --

Garnsey: Well, I had -- 35 years ago I had a graduate student friend who wrote his doctoral dissertation on the relationship between the nature of neighborhoods and population concentration and suicides, and he drew a beautiful map of the city of Chicago and he put a dot for every suicide wherever it had taken place, and he came up with the conclusion that there was a geographic relationship between suicides and physical environment. He didn't know what it was really, except, you know, it was related to poverty, drunkenness, etc., but at least he thought he had discovered something significant about why people commit suicide. They don't commit suicide out where Dave Rogers lives, but they may commit suicide down on Pearl Street -- so that in this sense there's no end to man and his environment, and that's why the environment is to a great extent is physical, and that's why physicists should be in here. It's certainly geographical in the sense that geographers know a lot about many factors which influence it. To me it's certainly economic because the question of building freeways as against metropolitan transportation systems and back in your field there are a thousand other questions involved -- economic choices of how much money is to be spent for what benefits, you see. Thus it seems to me that there are a whole group of things that you can't exclude, and this is one of the things that worries me -- in the end you can't exclude anything.

Downton: I'm for not excluding anything. It seems to me that maybe initially we have to agree that nothing is impossible and that nothing by definition that we impose can be excluded arbitrarily. I'm led to believe, for example, that we shouldn't place limits on what the environment means -- I think we can do that later. I think we should leave the door open because by limiting the environment we may, in fact, not develop a sufficiently general theory to cover all aspects of the environment.

And the other point which I have, which comes to the argument that was being made here about how man has traditionally viewed his environment -- we may want to ask why man has developed those views and what commonality can be found in those views in terms of his effort to make adaptations given his current state of knowledge. And I think both of these things should be wide open. And basically I'm troubled by the question "why are we doing what we're doing?" To me that's really anti-productive -- and I don't mean this in any personal sense -- because in any enterprise like this we start with a tremendous number of uncertainties about justifiability of what you're doing, what it's consequences will be. But I think we can only really draw those questions into the forefront and make judgments at the end of the conference -- not at the beginning. I think we've got to try to build the theory and if we fail then let's ask why. But I think we've got to begin. I'm firmly committed to the notion that we should make it as general and free as possible.

Garnsey: Let me say two things -- that once again there's always within a university an administrative organizational process by which you do this quite apart from this seminar, and that's what we're going to have reported upon next time.

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And further than this Mr. Boulding has promised to be here and Mr. Williams and Mr. McClintock are requested to confine their proposal to no more than an hour out of the two hours so everyone of us can jump on Boulding. Is that fair enough to everybody?

Hill: I don't want to be anti-productive. I am merely trying to say that if you are going to go some place it helps to read the street signs and look at the map and have some notion of where you are going.

Garnsey: I don't know if you have ever belonged to a labor union as I have for a number of years, but there is an old tradition in a labor union and that is if anybody proposes something he is promptly appointed chairman to do it. And I wonder if you wouldn't be willing to kind of get us back on the track by reading the street signs to us. I feel that as a geographer you probably have a broader perspective on this than anyone of us.

Hill: I don't think it's broader, I think it's just _____. And that's what I was trying to say earlier. I think we all have very different perspectives and it might very well be worth while to look at one another's perspectives in more depth.

Garnsey: Gilbert White will be here in the beginning of January and I consider him a man of great intelligence and as soon as we can clue him in on this I think he can give us some guidance that we may be lacking. But in the meantime, I wish you would think seriously about whether or not in November you wouldn't want to expound your ideas of what you think a Theory should be or whether we ought to have one;--especially after you have listened to Boulding on the 5th. I won't ask you for a commitment now.

EDITED TRANSCRIPT OF FACULTY RESEARCH SEMINAR
IN MAN-ENVIRONMENT RELATIONSHIPS

October 1, 1969

Mr. Garnsey introduced the two new members of the group: Dr. Robert H. Williams, research physicist with ESSA in the Aeronomy Laboratory; and Dr. Robert Cohen also in the Aeronomy Laboratory of ESSA.

Garnsey: It looks as though this is our group for today so we will follow our program and divide up into groups according to the list which you all have. Let me say that this approach to trying to get beyond vague generalities was suggested by Eugene Haas and Mr. Downton, his colleague, and I guess this is the scientific techniques of sociology and what-not. At its lowest level it's called brainstorming so Gene and Mr. Downton and I met and we decided we would break up in small groups and talk about "where do you start with the theory of man and his environment." So then following their technological advantages we set down a list of words which are supposed to stimulate some kind of reaction we can use. Now, these words may produce brilliant inspirations, or the words may be considered entirely irrelevant, you may want to come up with words of your own which are entirely different. Now before we break up, the first thing you do is that each group elects a reporter who will take some notes. I think if we spend an hour with this and then meet back together, and each reporter reports on his group we can go on from there.

(Group meets; then reconvenes)

Hersh: (reporter) We looked at the words singularly sort of forgot about them for the rest of the session. And what basically -- we decided to go around giving sort of autobiographical sketches to start as to why we were interested in the Seminar, and what caused us to join the Seminar. However, we didn't go too far in this. Dr. Ayre mentioned that the Seminar has been ongoing for a long time and that his interest basically was in trying to find working relationships between technologists or engineers and the other scientists and social scientists and to try to build these kinds of working relationships into educational patterns in the School of Engineering, in the engineering area. It then went that my interest, for example, was basically from an information approach. In other words, that information has certain commonalities and we want back into the whole problem of integrating interdisciplinary work through the integration and synthesis of information which is common to anybody's given problem. Then the curtains opened and Dr. Garnsey came in and sensing that we were giving autobiographical sketches he decided that he, too, would give us an autobiographical sketch. Dr. Garnsey's interest on first coming here from Harvard was that of international trade, and through a series of both not being interested necessarily in international trade and essentially being here at the University of Colorado which happened to be a Western state that was outlined by a bunch of surveyors who just drew boundary lines, paying no attention to natural sort of boundaries or any other sort of relationship, he became interested in the idiosyncrasy of this and began to study regional economics. Regional economics led him right into the area of water resources since economists are interested basically in scarce resources and water is a very scarce resource in the West. And from that he became interested in environmental problems because water is a very key integrating factor in environmental problems, and, of course, cuts across many interdisciplinary lines -- from politics on one

side of who owns this water right through to the technology of how best do you handle the distribution of water once the politics are out of the way. And this is basically his involvement and how he became involved in the whole man-environment concept.

I don't know that it's worth going through a great deal of history of how this group talked or the chronology. But what basically came out after a while is that -- Dr. Ives indicated -- that here in Colorado, again, we have a very peculiar situation in that above timberline, certain areas of the alpine, sort-of arctic zones, I guess, above the timberline, you have a virtual laboratory which is a very important one and close to a major institution to study many effects of land formations -- land forms as well as the entire attitudes of life that may be growing there, or climate changes on these land forms, the build up of such things as glaciers and other such concepts, and that here we have the capacity to study this and possibly -- after awhile he indicated that there are very definite integrations. For example, the watershed of Boulder is dependent to a great deal -- part of the watershed is up in the glaciers and cirques, and in some ways these were dependent upon or could be enlarged as watersheds by possible use of snowdrifts. And snowdrifts could be -- with the amount of snow there and thus the amount of water, could be increased by, in some way, controlling snow blow patterns caused by wind; and thus the availability of water in an area might be very essential to an area politically that wants that water, such as the City of Boulder. And here around this whole nucleus of problems from the city on one hand which is a cultural and political entity desiring certain resources, to an area in which these resources exist pure and simple and can be experimented with, is the entire continuum around which could be based some of the basic research of this group as well as other groups in the area of man-environment.

Dr. Hill was asked a question before this -- What is geography? Since Dr. Ayre didn't know what geography was in terms of a disciplinary science except what he had heard in high school. And, I must admit, I didn't know either. Dr. Hill drew the diagram which is behind me -- basically showing that geography, or indicating that geography is the study of the earth's surface and basically everything that's on the earth's surface. And geographers of necessity have to draw on information and processes that come from both the biophysical sciences and come from the cultural process that is studied by social scientists. And that it's possible for geographers to go up the middle as it were, studying the earth's strait -- going to the upper loop, which Dr. Ives is basically interested in, and even extending that to more of the biological-ecological problems, on the other hand more into the actual physical problems or the lower loop. And it was also indicated that geographers have long been seen as the "low men on the totem pole" basically because they conceive of their problem as possibly the definition of integration of man-environment studies or of total environment-environment studies, and man being a part of that environment. They have traced out for themselves a great task in trying to investigate this, and in making such an immense task it has very little, what might be termed "showable effect of success," and thus the colleagues say, "Oh, you're a bunch of dabblers in this and what the heck's going on?" and therefore sit at the bottom of the totem pole around an academic campus. But that possibly geography itself as explained, offers a very good integrated disciplinary form for the continuing of man-environment studies along with a lot of other disciplines.

The continued discussion was almost a three-part discussion between Dr. Garnsey, Dr. Ives and Dr. Ayre in that a lot of the information Dr. Ives was telling him about the snow, glacier, cirques, possibilities of catching snow in that area for watershed improvement, led to a discussion of how best we can integrate again the problem of man-environment. Here we had, basically, a geographer sitting with an engineer who now might be interested in catching snow, and an economist trying to find out if this is indeed the cheapest way to be found to get water out of mountains instead of building dams, which led to the problem of -- yes, and Dr. Ives mentioned there is now a Brotzman bill which has been passed for about 5.4 million dollars for the study of water resources in the West. He said that he would like to get a hold of a piece of this. In fact this is the way the conversation was ended, because, indeed, he was sitting on top of a water resource, but nobody thought of it necessarily as a water resource. They would spend their money on dams and maybe river flows, but no one would want to look at the problem of water possibly in these glaciers and experiment with these. It was brought up that possibly here we have the problem of inter-nation(?) exchange. This session produced information to members who did not know it before and possibly increased exchange would eventually get to Mr. Brotzman who might get to somebody who's holding his hands on that money to provide continued research in the area. That idea was not Dr. Ives' directly. But that information is a key factor here and the synthesis of information as well as the transfer of information is extremely essential. And, Dr. Ives pointed out further that yes, but we have to do a lot more research to further understand the mechanisms -- it's just at the point that we are now saying it might be possible but let's take a look at it further. And, indeed, information even to the scientist in his own small bailiwick in being able to use information more effectively becomes exceptionally important.

Dr. Williams spoke about his input in this and basically it's through the Colorado Clinic Environment which is interested in technologically taking a look at some of the major problems such as Rulison, nerve gas, and so forth. And it was found very often that they had to rely on other people than merely technologists and physicists to make adequate evaluations, especially in the area of the social cost loss in making these cost-benefit analyses which so often are completely forgotten.

The need for communication among the disciplines was stressed. The possibility of there being right here a laboratory, as it were, for the investigation of certain man-environment complexes was brought out very clearly. The idea that information exchange must be enhanced was also brought out; this, of course, links with the communication among disciplines. And the final note Dr. Williams spoke about: that there is hope that both the granting agencies and possibly the University itself will take a new look at interdisciplinary programs and approaches which before have been the "bad boys" of the academic community, and possibly will see that these are funded or at least are given a comfortable berth. However, Dr. Ives is very cynical as to whether this will indeed be the case. I assume there are many other cynics in the room.

Garnsey: Any questions? All right, reporter No. 2.

Holcomb: Our group consisted of Drs. Flack, McClintock, Boulding, and myself. We discussed most of the time the problems of evolving a series of man-environment relations. We didn't use the list of words either, but I think indirectly we did mention some of them. The first thing we addressed ourselves to was what are the components or the needs of the series of environment-man relationships, and some of the things were that we decided we needed to know what man reacted to, what are the constituents of the environment, what are the variables? We decided we had to somehow divide the environments up and discussed ways of doing this, such as the macro- and micro-environment. Dr. Boulding feels that it is the micro-environment which is critical and which is perhaps ignored, has been until fairly recently, because man adapts to a micro-environment rather than a macro one, he creates his own air conditioning system, his own urban climatology, and so forth.

Another means of dividing the environment would be the hydrosphere, atmosphere, lithosphere, biosphere, noosphere, and sociosphere idea, and we discussed some of these. We decided probably that the noosphere is becoming increasingly important because man is changing all the other spheres by his use of the mind. Some of the things we thought of was -- most of these are Dr. Boulding's ideas -- that perhaps we'd best in the very near future re-create extinct animals. When we've done that perhaps we can go on and create new animals. Without man, everything would revert to what it was in nature. There's no such thing today as untouched nature, nature depends on man. We might then be on the verge of a revolution in genetic creation and Dr. Boulding points out that perhaps the greatest crisis which man will face will be the genetic answer to old age, and he posed the question of what would happen if you were an assistant professor for 500 years.

Garnsey: You mean you didn't discuss euthanasia?

Holcomb: We didn't actually get on to that but -- selection, genetic selection occurs at the micro level again stressing the importance of the micro rather than the macro environment. The idea that the division between man and nature is no longer useful was brought up. In a hundred years probably there will be no species that will survive unless it is domesticated -- there will be no wild species at all. Another possibility was that of repairing genetic damage. In other words, when we change the environment by radiation can we go back and repair the damage that we caused?

Garnsey: That's a problem of irreversibility.

Holcomb: We then tried to realign ourselves to go about the thinking of requirements of man-environment theory and we wanted to know -- we need some criteria -- to know whether we are winning or losing in the environment battle, shall we say. What are the criteria that we are going to discuss an environment by? For example, does the environment have to sustain life? If so, life as we know it now or life as it will be? Does the environment have to have a nature -- have to include a nature which is not influenced by man? And we brought up the question, perhaps if we at least made man think that nature was going on on its own, that the psychological benefits would be a substitute for the actuality. Then we discussed what things we are going to describe in our theory. For example, if we want to describe the atmosphere, if we want to talk about the theory of the atmosphere, what do we need to know about it? Well, we want to know if it will sustain life; we want to know how it's evolving, and whether, in fact, it will evolve so far that it will be beyond the sustenance of life; and how we can prevent it from evolving that far?

This got us onto the problem of atmospheric history and we decided that we needed an atmospheric historian in the group. The problem of finding out what has happened in the past as regards history in the atmosphere was brought up and the fact that history is based on things which are durable and the durable things are not necessarily the significant things.

Again, we went back to the distinction between macro and micro environment and I think the whole tenor of our conversation was that we must stress the micro, and that we are doing this more, for example, in the study of air pollution. We are now looking at freeways to see if they won't change the local atmosphere rather than the atmosphere at large.

Another thing that we talked about is "what was it like before the invention of chimneys?" This is a micro atmosphere which man presumably suffered for a long time before he thought of the chimney and yet he had no physiological adaptation to this.

We want to know quantitatively how man adapts to the changing environment and also we want to know how man affects the macro environment -- what, for example, does the burning of fossil fuels do to the environment? What do pesticides do -- do they kill algae and _____ plankton on the Continental Shelf so that the oxygen supply is decreasing? Apparently there is the possibility that the oxygen supply might be reduced to zero if this goes on. So if we can find out something about past instabilities in the environment we can perhaps know something about present and future instabilities. For example, the Ice Age was a major instability and knowing something about that we might be able to predict or at least convince people that the present nature of instabilities caused by things like pesticides.

Garnsey: Thank you very much. Any questions? Although we have had micro and macro economics now for many years, I never applied this to the environment, but I think it is very important.

Julian: Well, was there any discussion of a linear distance which separates the macro from the micro environment?

Boulding: No, you can't regard the environment as homogeneous -- this is the point, it is highly structured and that on the whole it is the micro-environment which supports life and human life and they are often very different from the macro-environment -- even in the biosphere where you've got the environment under a leaf in the woods is very different from what it is ten feet up, shall we say, and that the environment in a smoke-filled room is very different from the atmosphere outside or an air conditioned car, should we say. You've got to think of the atmosphere not as a sort of grand stirred-up soup, but as something that is structured as a crystal really.

Julian: The only danger in that is -- perhaps you begin to think of the two environments as being independent of each other -- and they are not.

Boulding: No, you have to consider their interrelationships.

McClintock: You really get different information, I think from observations on different scales. For example -- a nice example exists in the field of meteorology where a network of weather stations, local observing stations, can tell you about local weather conditions and perhaps make some forecasts -- better forecasts if one has an American model into which he can put today's observations and get weather predictions for several days in advance. On the other hand, some very recent clever analyses of satellite-based pictures of cloud patterns has provided information about the overall energetics of the earth's atmosphere as it's written(?) by the sun's energy, and this on a global scale -- in the sense that maybe a half dozen simple parameters described the gross movements of the earth's atmosphere. Now this is quite different information than one obtains of course, from local observations. But it's terribly important in providing this overall model.

Garnsey: The distinction, like so many distinctions in scientific analysis, is artificial in a sense -- I mean, the one merges into another. In economics -- or in regional economics, we found it's impossible to really draw a line around a geographic area and call it a region. They are more likely zones of transference in which on one side of the zone it's pretty much different from on the other side, but within the zone the mixture is the same.

Julian: The only objection I want to make is that there was a statement which was more or less to the point that "micro" environment is more important. Now I submit that this is a value judgment on which there ought to be some discussion -- because I am not sure that I can swallow that.

Garnsey: It seems to me that in this theory -- and here we've got to begin to talk about a theory and I think micro-macro would be one division of the book. The thing that interests me so much is tolerance of the human being for the micro-environment. Now, I know some people have actually moved away from Los Angeles because they can't stand the smog. Either they can't stand it esthetically or it sets up bronchial and eye disturbances which make them physically ill, etc. And my question is, "why do all the rest of the people stay there and tolerate it"?

Julian: Or more to the point, why do so many people keep coming?

Garnsey: Yes, and there are many, many characteristics of man shaping his environment which are related to his tolerance to what might be called unacceptable environment which I think is bound to have to be a part of the theory of the environment. And I don't know that it has been investigated, and we have to know. This is where our social psychologists, that we don't have, ought to be able to make some contribution to our group.

Jessel: We addressed ourselves, primarily, to the scope of the inquiry that this group might make this next year, and needless to say, did not arrive at a consensus. And the questions that were raised you may be able to answer in terms of background. For example, what causes us to attempt to develop a theory of man-environment, and is it feasible to construct such a theory? I think there was reasonable consensus that, yes, that is feasible assuming that you construct a theory of man-environment and accept certain limitations. And then we started to discuss what these limitations might be. There may or may not have been a consensus, I am not clear, that we have a purpose in doing

this which is to affect the environment and to create or propose, rather, policies which may deal with educational systems or institutions, and that consequently in order to arrive at such a resolution in a manageable way, there would probably have to be some limitation to what we want to undertake. The sequence of things that we would want, then, is an outcome of policy based on a theory, based on a model. A policy which is based on a theory which is derived from a model. And the model would have to contain elements which are quantifiable and to the extent possible, quantified so that we can understand it..... Back to the environment first... What is it we want? We are talking about the human environment and the effect on the human race of the environment. Here we have questions for which we have no resolution. Are we talking about the human race and the survival of the human race as such? Are we talking about the survival of every member of the human race as part of this? What should be the limitations of the theory? Should the theory include how to bring about change in the environment which is acceptable to the people whom it affects? In other words, do we have to understand the human behavior and the individual perception of the environment in order to understand how to change it in his own interests? Or can we limit ourselves to the point of saying there is a policy which says the solution has to be modified to extent so-and-so so that the race can survive, but then relegate to another inquiry the question of how you bring about sufficient understanding among people to actually implement your policy.

Mr. Downton is particularly interested in making sure that the perspective of the individual be included, the reason for his behavior as a part of a capability that has to be developed to affect this behavior.

In summary, then, I think there was consensus that the work should rest on the construction of a population model. We did not discuss, but obviously it was in the air: what kind of population model this is. Is this Boulder? Or is this the United States? Or is this the globe? That within this model one would then address the various needs for the survival of the race and the effects of the individual components of the environment -- food needs, food availability, pollution effects on crops and on people, and policies on how we manage to change this should be the outcome.

I threw in one point which interests me from the point of view of political science. If you establish such policies and attempt to implement what effect does this have on increasing -- or will this increase the element of coercion in social life? And is this or is it not a part of the theory we are trying to develop?

I think that sums up the discussion but not the individual points of view which others may wish to contribute.

Garnsey: It is my feeling that it would be profitable for us to have another discussion of these same groups for another period. Do you feel you've talked yourselves out? I think at our next meeting which would be the 22nd let's meet again in these same three groups, and let's see if we can come a little closer to our goal. I think Groups B and C did a little better than Group A in this respect, but maybe Group A had more fertile ideas -- I don't know. But anyway we'll get these written reports to you in a hurry this time.

Smith: We felt that we wished that we had a better sense of how your small planning group came to the question of building a theory on man-environment?

Garnsey: I believe Ken (Boulding) is the man to answer that since he was the one who proposed it.

Boulding: I assumed if there isn't one it seemed like a good idea. I think we should be modest about this. I don't think we are aiming at a sort of a grand integrated theory of everything but, on the other hand, I think we are looking for -- well, we're hoping to learn something from each other. I mean we all have theories lying around and they may be somewhat interrelated, more interrelated than we think. I think the other thing at least that I am after, and I presume all the rest of us, is to try to identify the gaps in our knowledge, which are very severe. This, I thought, was a very interesting thing that came out in our discussion, really, is how fantastically little we know about some of even the most essential systems of the atmosphere, for instance. And that the object of the theory here in a sense is to identify interesting variables we don't know much about. In a sense to guide future proposals for research, I think.

Smith: Your adjectives, Morris, were operational and, in a phrase, reducible to mathematical expression or something -- those gave us troubles.

Garnsey: Let me comment very briefly on both of them. Economists have played around with monetary theory since the beginning of economics. And after the Keynesian revolution in the '30's and almost simultaneously with that, say the work of Wesley Mitchell in the monetary report of 1910, the Federal Reserve System was created. And we brought some order out of the chaos of the monetary system which had evolved in the United States, largely influenced by the Civil War and the big issue of bonds that the government put out in order to finance the Civil War. You can do some things with this on an operational level and without knowing much about what you're doing, but the Keynesian theory then gave us a theoretical basis for knowing what we're doing. Would you more or less agree, Ken, with this analogy?

Boulding: Well, it helps. I think the thing we are looking for here really is -- it came out in our discussion -- we're looking for a dynamic theory -- we're especially looking for all dynamic models that can get us into trouble -- especially when we're looking for things with positive feedback -- where you've got cumulative and irreversible effects, this is one thing we're certainly looking after. But, also, I think we shouldn't altogether neglect equilibrium theory -- the equilibrium of the atmosphere with the rest of the world. This is very little understood as I get it. I mean there is even the equilibrium of the atmosphere with the oceans for instance. This we certainly need to know a great deal more about. On the other hand, I think that we are looking for dynamic models here because it's these that can get us into real trouble. I always say -- I'm not interested in optimization. You see, all I'm interested in is where the cliffs are. My principle is here you are on a mesa with cliffs and optimization is not very important on a mesa. And obviously the world is a system with enormous flexibility and adaptability. The people who live in Los Angeles can live anywhere -- there may be certain irreversible processes and I think it's these at any rate that I'm especially interested in identifying.

Downton: The problem of quantification may be certain general agreement that we should have dynamic view such as environment -- but if you start with the standard that you're going to be in a sense thinking about quantification, that narrows your scope, and it was my view that we should, in a sense, open the doors to the ideas that come to us and think about quantification later. And, in fact, the theory that we develop we should expect to have limitations in the sense that some of it cannot be immediately quantifiable and that means that we simply quantify what we can and leave the rest for some future eventuality.

Garnsey: Of course, I put that into my little essay because Dave Rogers demanded that I do it. Otherwise he said he wouldn't belong to the Seminar. Gil, can you explain just in a sentence or two why Dave, or perhaps you too, feel that the mathematical or quantification aspect of the theory is so important?

Hersh: There's a great deal of difference. I think we are doing quantification mathematical aspect of theory, and I think that Dave would argue very strongly that quantification has led a lot of people down a drainpipe. The thing that he is looking for is that a certain sense of responsibility be put upon people to look very deeply into the kinds of variables; that otherwise they would consider characteristics qualitative because it's been found that these can be expressed in certain ways that you could actually discover the dynamics of these qualitative variables and how they interact. This, in fact, is one of the areas in which he works very extensively, and thus I would say that it should be -- or an attempt be made to investigate these things in a mathematical way, possibly to come up with a mathematical model ---- not necessarily, possibly to come up with a simulator but not necessarily. But quantification should be out -- I mean that isn't even in the realm of Rogers' thinking.

Garnsey: I looked at dozens of books over the summer and scores of articles and they deal with air pollution or some small aspect of air pollution like air chemistry such as our distinguished friend in the Chemistry Department here studies, you see. You deal with this little bit of man's environment, but practically nobody that I've found yet, and here I'd like to challenge our young ecologist friend -- I haven't found anybody who has put this into some unifying context, you see. I've just found people that are interested in bits and pieces of the environment, and I suppose one can go a long way for decades just with bits and pieces of the environment. But really in the end you have to develop some idea of something which can be understandable to lots of people of how man and his environment exist together.

Boulding: The only quantification I insist upon, I want to know which way is up.

McClintock: I might like to say a word if there is time to do that. It is not at all clear that at any given moment the possible quantification of the interaction of the number of variables is at all possible. Biology, for example, went along for a great deal of time in the stage of categorization. Biologists were marvelous at categorizing those things that occurred in the biological world, and it's only about the 1950's or so that the quantification in the sense that the physical scientist would insist is the proper development of the theory was able to take place. It is not clear that this theory of man-environment relationships stands at the moment at a place where strict quantification can

take place but the attempt should probably be made because, as Ken Boulding has mentioned, he would like to know which way is up. To me that means you'd like to know whether the sign is positive or negative, you'd like to know whether you're winning or losing, for example, in the air pollution battle. And it's only by the quantitative relationships of the important variables that you can arrive at the sign.

Downton: At the same time people have to see that we're losing -- you see. If you don't perceive we're losing, then quantifying doesn't make any sense except to academicians.

Julian: This is going through almost the same discussion that we went through in the other room. The thing I would like to hear is fewer "motherhood" statements and more discussion about what such a theory is supposed to be. And this is what we were primarily concerned with.

Garnsey: Let me speak for myself. Here again, I've seen all these bits and pieces -- I've seen all this literature on the environment pouring out. One group of it I forgot to mention is Barry Commoner who is a reputable scientist. He spends his time viewing with alarm what's going to happen with the environment. And he got a 4.5 million dollar grant to set up an institute because he viewed with alarm what's happening to society, you see. Well -- it's not enough to view with alarm or to disregard the whole thing and say man has been here several hundred thousand years, or a billion years, depending on what fact or theory you accept, and he'll be here for another million years or so, what are you talking about, you see. It seems to me we've reached a state where what's actually happening to man with -- given the number of men -- and what may be happening to the environment, it's time for us to try to formulate some general principles of the way man lives on earth, if you like -- that's one way to put it.

END

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EDITED TRANSCRIPT OF FACULTY RESEARCH SEMINAR
IN MAN-ENVIRONMENT RELATIONSHIPS

September 17, 1969

Introduction of Members (by Morris E. Garnsey)

First there is Dr. Robert Ayre, the head of the Civil Engineering Department. Dr. Ayre is that rare person -- a humanist and an engineer at the same time.

Then we will have Miss Jacqueline Beyer in Geography. She will come the second semester and will be teaching at Colorado Springs, but Dr. Gilbert White specifically asked that I invite her and also the Dean down there said he would arrange her schedule so that she could come on Wednesdays so we hope that in the second semester she will make some contribution to the Seminar.

The third person on the list is Kenneth Boulding, and most of you know him and can see he isn't here. I thought you would like to know that he is defending the cause even though he is abroad. Perhaps most of you saw the news story in the Boulder Camera called "CU Economics Professor Addresses Designers." There was a conference in London of scientists and engineers from 32 countries who met to "consider how a future worth living can be planned and created." And, I assume, that means the environment. Boulding, as he has twitted each of us in turn, twitted them too. He told them, "Architects have been... (article is attached).

So he is carrying the flag perhaps even in Czechoslovakia and we have to forgive him for being absent today.

I am sorry to say that Jim Corbridge of the Law School is not yet here. Most of you know him and know him as a very brilliant man with a heavy commitment in this area. He and a colleague of his have a \$100,000 grant from the Ford Foundation Division of Resources and Environment to carry on a three-year program of Resources and the Law; that is, to what extent can the law help us protect or restore or maintain our resources. Put it the other way -- is the law so framed that our environment deteriorates because the law makes us deteriorate it? He is very interested in the Seminar and I am sure he will attend although we miss him this afternoon.

In order to minimize repetition and condense the normal verbosity of discourse, the full transcript has been edited. Each member of the Seminar is welcome to expand or further edit his (her) remarks. There is a full copy of the transcript in my office. M.E.G.

Professor James Downton of Sociology has just arrived at the University of Colorado. He was nominated to this Seminar by his mentor, Professor Haas. Haas says that he is a double threat man in that he is both a political scientist and a sociologist, and so he adds another discipline to the interdisciplinary nature of our group. We welcome you to the University and to the Seminar.

Professor Ernest Flack of Civil Engineering and I jointly offer a course in Water Resources in which both the hydrology, engineering and economics of water resources are synthesized to the best of our ability. Professor Flack gets around the country a lot to all kinds of water resources conferences and brings back the heartening message that our Seminar is very well thought of throughout the country because we have really succeeded, we think, in using an interdisciplinary approach. We hope that in the course of the years the product of students will be returned a thousandfold because the engineers know some economics and the economists don't make some dumb mistakes because they don't know any engineering. So I think Professor Flack is a fine example of an interdisciplinary man interested very much in the environment primarily from the point of water and hydrology.

Eugene Haas of Sociology is now in his third year at the University of Colorado. Before that he was Director of the Disaster Research Center at the University of Ohio, and we were very fortunate to attract him to the University of Colorado just at the time that we were thinking of starting this program. I am sure you will all be interested to know that Professor Haas and Professor Ayre were nominated by the American Academy to go to Italy about 18 months ago to study the effects of the earthquakes in Sicily and the processes of rehabilitation which were taking place. There will be a report forthcoming.

Professor David Hill of Geography is a relative newcomer to this campus. We give him the accolade that Gilbert White said we ought to have him in the Seminar, by all means, because he said he would make a significant contribution.

Professor John Ives is Director of the Arctic and Alpine Institute and participated in the Seminar last year. I guess he spends about 99 percent of his time involved with the environment and man's relation to the environment which is more than I can say for myself since I have to teach courses in conventional economics. Will you excuse me, John, by saying also that you are a very bright man with quite a wide outlook on this problem.

Now comes Professor Curtis Johnson who is head of the Chemical Engineering Department at the University. All that I have said about Professor Ayre I can say about him except he didn't go to Sicily. But Ayre and Johnson have run a Seminar for Engineers which might be called the "Human Aspects of Engineering" -- something like that. They run this Seminar jointly the way Flack and I do.

The next person on the list is Dr. Samuel Johnson who is in the field of human ecology in the Medical School and he is not here today. But I would like to say that one of the strongest supporters of the idea of an interdisciplinary seminar during the last two years and a person who has been in almost constant attendance is Dr. Cobb, Head of the Department of Preventive Medicine. When we cut this down to a small working Seminar and doubled the number of meetings, he nominated one of his staff, Dr. Johnson, to become a member.

Mr. Paul Julian is the official representative of NCAR where he is a meteorologist. We managed at one time to get \$80,000 out of the state to study the variations of the flow of the Colorado River and Mr. Julian made a very substantial contribution to that study by approaching it from the mathematical point of view.

Dr. McClintock is not here today. He is a research physicist in the Physics Department and he has been extremely active in public activities dealing with air pollution and the nuclear explosion over on the Western slope. He is probably the only man in the Physics Department strongly concerned about these things and who goes outside his discipline into the public realm to discuss and talk about it.

Professor David Rogers is a biologist and director of the program in Taxonomy -- a man of very wide outlook.

Mr. Frank Smith is Program Planning Officer of ESSA and he is here sort of as an official representative of ESSA. He is also a graduate student in the University studying for a degree in Public Administration (a Ph.D.). The graduate students obviously have to work harder than anybody else, so before long we are going to call on Mr. Smith to give us a rundown on the social and economic attitudes of ESSA beginning with Bob White and going on down the line through the labs in Boulder. Frank, in terms of that assignment I hope you will have an opportunity to interview the new director and to tell him about this Seminar, and ask him his attitude toward this side of ESSA's mission. And, indeed, you might then be willing to advise us to invite him to come and speak to us.

Professor Patrick Webber in Ecology is also a new member of the faculty and is in the Arctic and Alpine Institute. Obviously in an interdisciplinary effort like this we need an ecologist and Jack Ives said Webber was the man, so we will have to find out in the next three months whether Webber is the man or not. I can't tell you very much about his background or experience. You are from Canada, are you not? What have you been doing?

Webber: I have been teaching for the past three years in York University which is a new university in Toronto. I have been teaching a course in Ecology, General Ecology, with an emphasis on problems of the environment.

Mr. Gilbert Hersh is a graduate student in Economics, but he is also a double threat man because he serves as economic officer in Professor Rogers program in Taxonomy, and in this capacity he has learned a lot

about computers -- maybe more than when he came. He is also a graduate of the University of Chicago School of Business, and since he has a foot in each of two fields he is obviously a person of interdisciplinary character whom we are glad to invite to the Seminar.

Mrs. Briaval Holcomb is a graduate student in Geography and was nominated to the Seminar as a graduate student by Professor David Hill. And Mrs. Holcomb, since you are a newcomer, perhaps you had better do what your Canadian friend did -- just tell us a little bit about yourself.

Holcomb: I am a Ph.D. candidate in Geography, but I have been here five years so I am not a newcomer to the University. I am writing my dissertation on Cultural Perception in the City.

The next to the last member on this list is Mr. Walter Jessel who is a graduate student in Political Science and is a man of middle-age. He belongs to the think tank of IBM, where they have offices in Broomfield rather than out here. He is thoroughly familiar with computer technology and also quite well-read in the field of Political Science and I thought he met all of the qualifications for eligibility for graduate students for the Seminar. He will also take the course for credit and we will get some work out of him. Unfortunately IBM sent him to New York today so he is not here.

Finally, I suppose you all know that Gilbert White has been named Director of the Institute of Behavioral Science and will take up his duties here at the University on January 1. In the second semester he will be a member of the Seminar, and of course Mr. Boulding will be a member of the Seminar as often as we can catch him between planes.

The second item on the agenda is the calendar. The old Seminar met once a month on the third Wednesday of the month, and when we decided to make this into a working seminar and double the number of meetings, we decided the first and third Wednesdays would be fine. We checked around and there didn't seem to be many conflicts. But as you know, we're now in the new calendar for the University where the first semester is over before Christmas, then we have the long Christmas break, and that changes the date of the spring semester break, and so on. In studying the calendar we decided that probably we would have to change the date of the seminar several times and I wish you would take a look at those two columns and see if you feel that the righthand column will interfere in any serious way with your first and third Wednesdays calendar.

The spring break starts the 16th so we would be having a meeting right in the middle, so we just pushed it up a week. What this means is that sometimes we will be meeting one week and then again the week right after, instead of in alternate weeks. If no one finds that the modified calendar on the righthand side of the page is going to cause him any inconvenience let's just assume that we adopt the modified calendar.

Now we begin to turn to more substantive things. We did what we could during the summer to search out some of the bibliography which exists in this field and it's a very imperfect and tentative list of publications. You are all undoubtedly aware that there is a real flood of publications coming out now in man-environment relationships. All of a sudden it's the most popular thing there is except maybe Apollo 14. And so we have bought a number of these books out of our very limited funds and put them in my office. We want you to come and borrow them and read them as part of the background. I intended to mention, and I should have put it on the list, McLuhan's Understanding Media because I think the whole problem of man-environment relationships is so wide and is going to force us to break out of our own channels of thought. It is an interesting experience to read McLuhan if you haven't read him. If you see a book on the list just call our office and see if we have it.

I repeat that many people are writing. I might add as a footnote here that we're not the only University getting into the field either. I receive several notices of programs in man-environment relationships. I might also mention in passing that those of you who were here two years ago heard the Chancellor of the University of Wisconsin at Green Bay. His is a brand new campus of 20,000 students where they are building their entire curriculum around man-environment relationships. If anyone is interested in what they are planning to do we have the material in the office.

And then finally, I think it worth mentioning that despite the very restrictive conditions of the budget in the federal government, the government is expanding its work in the environmental field very substantially and we'll have more information about programs. In fact, right now they are in the talking stages but I have been promised a pre-draft of a new program which is being organized interdepartmentally in Washington in Man Environment Relations. Gene Hass pointed out to me that the University of California through Rand is going to get a very modest grant of \$125,000 to set up a program of development in California with special reference to environmental pollution.

Next is the fourth item on the agenda; and here I hope we can begin some discussion. I realize that many times in the Seminar we spoke about the educational aspect of this and if you have the agenda in front of you I just put down a few alternatives. Perhaps we ought to organize a degree -- a Masters degree, a Ph.D., or both, in Man-Environment Relations. Somebody is going to say pretty quick that we have forgotten the undergraduate and I'm afraid we have. But our resources are limited, and I don't think the University of Colorado is in any position to duplicate Michigan or Wisconsin and set up a school of natural resources with a dean, etc. I think there are other things that we can do which are just as valuable like: (a) Let me assume that in Geography you have five fields that the Ph.D. candidate has to offer. Why don't you make one of these environmental relationships? Why don't you permit the candidate to take courses in other departments which prepare him for this field, or why don't we do this in Economics? I might say that my colleagues are so conservative and they think that Economics is so important that it's going to be a battle royal if we ever get them to drop from five fields

to four and allow environmental problems to become a part of the Ph.D. in Economics. On the other hand, this is absolutely stupid because while each of you can say that there is hardly anything more important than environmental problems in economics because it involves welfare economics, cost-benefit analysis, the choosing of alternatives, etc., these are the kinds of things economics thinks it has a kind of a monopoly on. So the geographer can come over to the economics department and get the economics department over to geography. I think during the year, as we organize these programs, we ought to discuss what we can do. For example, there must be a certain number of seminars which are already in existence which are relevant to man-environment relations. All we need to do is pull these together in a list, print a brochure, change the rules of the Graduate School and tell the students who want a field in man-environment relations here are the seminars which already exist.

The next step is to create some new seminars. Of course, it would be nice if we could hire new professors to come in and create new seminars on top of our existing program but maybe we can fit it into our existing program. Finally, we may want to create some interdisciplinary seminars comparable to the one which Flack and I run in the Water Resources field which would be primarily relevant to the environment.

Any comments?

I realize in a way I am getting the cart before the horse because I am organizing a curriculum before we know what we will talk about, but still this is a place to start.

Ives: I received notice that AAAS are running a special seminar in December in Boston. I had a letter from the Dean of the School of Natural Science at Amherst who had been notified by NSF that we had run an interdisciplinary undergraduate research participation program this summer. They asked me two things: (1) Would I like to go? (2) Would I like to nominate undergraduate students to go? The title of the Seminar was the "Prospect of Developing a Total Curriculum" in this area of man-environment relations, or environmental problems, that would run parallel in the universities to the formal disciplinary breakdown and would be an undergraduate program for the Bachelors degree.

Garnsey: I didn't know about that. It's interesting for two reasons. I have tended to think in graduate terms but I have heard people around this table express the strong feeling "why wait so late?" In the environmental field the undergraduate area is one that cannot be neglected. Let me add as a footnote that if you are planning to go to this meeting you will certainly want to look through the Green Bay curriculum to see what you think it looks like. Here is a whole university built on this theme.

Hill: Maybe one other approach that we ought to take is to draw in people who are going to become teachers -- into this interest of man-environment relations. And I think especially undergraduate education majors but also people in the graduate school, most of whom are going to become teachers. I would like to see us think very seriously about a seminar for people who are bound for teaching.

Ayre: I would like to carry this further and suggest that you have some high school teachers take part in this. Possibly right in this seminar. Curt (Johnson) and I have been around to give some talks to the high school people on the environment problem and we find considerable interest on the part of teachers and some of the students. We talked at Cherry Creek High School. They have a very open sort of relationship with the students and quite an active seminar going in one of these fields.

Garnsey: We might start a whole curriculum for the high schools. Let me say, Dave, that this is a really hard and expensive thing. It might not be too difficult to detach one teacher to give one class and to persuade Dean Romine to have enough flexibility in his curriculum to do this, but it just happens that we have on our campus beginning this year undoubtedly the country's leading authority on the teaching of economics from primary grades to high school -- Larry Senesh. He was preceded by a year or two by Irving Morrissett who also works in this field. The job of preparing materials is just phenomenal. Both of them are working with grants in the area of a million dollars from NDEA or somewhere in the federal government. This is because the argument is that lay people ought to know enough about economics to know something about the taxes they are paying, etc. You can repeat the same argument. Lay people ought to know enough about the environment to know why and how they are polluting it, why they ought to stop, etc. I don't know if there is a theory of man-environment relationships and I think if you all will do some thinking and writing, and if we can write something like a monograph on the theory of man-environment relations in the course of an academic year, we will have made a giant stride forward. As far as reorganizing our own curriculum, we can do that simultaneously and easily. For example, I could go around to every department chairman and sit and talk with him and get descriptions of his courses, etc. to see what comes out of it as far as that department's willingness to participate. We can put together what we've got. We can even make some commitments for new courses.

Downton: Perhaps I could carry this one step further and suggest that maybe one has to begin with the conception of an institute where in fact one of the primary efforts would be to gain access. I think an institute would have a more rational base for two reasons in addition to the financial one. Number one, it seems to me that if seminars are going to be developed in this area they should be working seminars; that is, not simply theoretical. There should be some effort to develop field research and I think this had to be financed. The other aspect, and since I am a political sociologist this is normal for me to be concerned about, is the function of such an institute in making change -- not just talking about it. I think if an institute is developed with both the emphasis on seminars, training, and field research, then the other emphasis should be on making recommendations to the government -- actually, if you will, performing services for government in terms of the way they can respond to these issues. That is a more grandiose view, a more challenging view, hopefully that is not beyond the scope of the academic future. I would prefer to start at that point and work backward.

Garnsey: Let me tell you what the tentative idea or plan is. Mr. White was here in July and he and Boulding and I spent an afternoon together talking about this man-environment effort. First of all (the newcomers need to know this), we have an Institute of Behavioral Science which is organized on a program basis -- that means it is organized vertically. At the top is the director and below him would be the program director, say in Cognitive Behavior and Psychology. Up to now the Institute has been in Psychology and Social Anthropology. With these four or five programs vertically organized with the director at the head, the idea is now to have a program in man-environment relations in which both Gilbert White and Kenneth Boulding and myself will be deeply involved. Of course, let's be blunt about the whole thing. We hope with those two people in the program we will first (a) be able to draft a proposal, and (b) draft a proposal which will be successful and thus fund the program. Obviously a research program would involve field research, and maybe we are quixotic, but we thought we would start by trying to write a Theory of Man-Environment Relationships. You can read a thousand articles about air pollution from one aspect or another by now, and water pollution 2,000 articles, solid waste disposal 500, and so on down the line. We don't want to concern ourselves directly with these but we want to concern ourselves with something else. I guess that leads me to the next and final part of the program. I outlined at that meeting with White and Boulding what I thought we might do if we're going to produce a theory of man-environment relationships. I shall read my statement.

(Statement read -- see attached.)

Johnson: Morris, I like your description of the three points, the adjectives that you have tacked onto the theory -- General, Operational and Dynamic. I think it sets a very good objective for us and a very concrete one in the sense that we can arrive at something -- at least we can head toward something. I was going to ask earlier whether anyone here is familiar with the project now being carried on by Kenneth Watt at the University of California at Davis. I have a portion of the report, "A Model of Society." It is eventually to be the world model -- a five to ten million dollar investment and many, many Ph.D.'s. Right now they are working on a two-year Ford Foundation grant to define the basics of the model just for the State of California. But I think we should be tied in with this group. I have a great deal of respect for what I have seen of Watt's work, but it appears to me that he is doing the kind of thinking and heading toward the kind of thing that we are interested in. This problem is big enough that you can slice it up in 60 ways and still not get in each other's way.

Garnsey: I would like to say without malice, but with some disparagement of my own colleagues in my own department, they think that what I'm doing is a good idea in a general way -- but it should be done on top of a full teaching load. And when you describe what Watt is doing, and when I listen for half an hour on the phone from Washington to the report that is just about to come out from the National Academy, I realize it would take full time just to keep up with what other people are doing. There is going to be the problem of duplication and waste if we don't somehow keep up with what other people are doing. It is the function of every one of you to know something about what somebody is doing and throw it into our pot.

Johnson: Along with that I would like to go back to your point 4(b) here because I feel that on our own campus we don't know what is going on and often when you are ready to try to get a program going and people say it's going to cost money -- that's always the first thing -- you can often completely de-wind their sails by coming up with a list of courses that are offered that are interdisciplinary and that fit right in with what we are doing. I would like to suggest that this be one of the projects -- at least I would like to know for advising my own students.

Gernsey: Let me say that this is something in which I have been sadly delinquent. During the two years in which I have been organizing the seminars and getting speakers, etc., I should have this information about our campus now. It is clear the effort will have to be made this year.

Johnson: Perhaps we could help you out with this sort of thing. I would say that Bob, Ernie and I would know within the College of Engineering the specific courses which fit.

Rogers: One of the problems, of course, is discovering whether or not the courses are worth anything for our purposes. You read the formal descriptions and then discover what they are really about. Perhaps a formulated questionnaire to the faculty using the information management system would reduce the problem of discovery of what we do know about what the campus has. And I suspect that there are lots of people that say, "Yeah, I'm doing that already." If we are clever about the method by which we query the University we can uncover these areas.

Garnsey: One thing I am worried about is when you come to ask about courses you will find Professor "X", a thoroughly honorable man, who will say he is doing this but it turns out he is doing it for two weeks out of a semester. So there is no point in putting a student in that class.

Haas: Wouldn't this also suggest that if we want that kind of information we are going to have to define what kind of information it is that we want. If we are going to poll, however we do it -- by questionnaire or directly -- we ought to have some kind of a checklist.

Garnsey: That's why I said we got the cart before the horse because I am asking about courses before we know what we want to ask about.

Hersh: The same is true of bibliographies. Very often the course may not contain information but would contain a section that we'd be interested in. Very often the professor whose expertise in the field will have a bibliography which will have much to bear on the general one if we could compile a general one. And we'd make use of professional identities of 700 faculty members as opposed to 15. The task is a large one but it might be worthwhile undertaking it.

Haas: Essentially the whole area of course offerings is related to Urban Affairs. There is a group which is interested in what we are doing in urban affairs at this university. Bob (Ayre) has been heading this thing for a while and I don't know whether the parallel is close enough or not.

Ayre: Gene (Haas) and I are on the University committee on urban affairs that was set up by Manning last February. Prior to the formal setting up of the committee there had been an ad hoc group, at least Boulding was very prominent in it. It started an inventory of University activities related to urban problems. The questionnaire which some of you may remember was sent out around Christmas (a poor time). Just how carefully these questions had been written I am not sure. There was some response. The committee was then formed and we started looking into it and realized that one of the things we had to do was try to improve this inventory. We hired a graduate student and sent out a repeat of the questionnaire. This was done in May and we got answers back before school was out. The graduate student has been working on this all summer and I have reviewed it with him and it is a good inventory. It hasn't cost a great deal to do this. I don't know how influential Mr. Boulding was in the original formulation of the inventory but certainly Miss Jones worked with him a great deal. This inventory is now being typed in final form for review by the Urban Affairs Committee and some other people, presumably Manning, etc. The first question we will have to put to ourselves is "Is this in satisfactory form and what conclusions can we start to draw from it and where does the committee go from here?" I think Gene and I started thinking about this at the same time you brought up the question of investigation in the University or inventorying of activities that relate to the area of man-environment relations. The experience that we have gone through is very similar to what you are proposing to do but in a different area.

Garnsey: Just what do we mean by man-environment relationships? In a sense everything is man-environment relationships. I wrote this sentence after much thought: "What are the essential unifying concepts of man-environment relationships from the point of view of the layman whose actual association with his own environment exhibits a multiplicity of forms?"

You and I live simultaneously in a dozen environments which overlap each other but I don't know what the unifying factor is. For example, you live in a house on a street with grass and trees, etc., far enough from the University so you have to commute. I live in a house which is close enough to walk, etc. It happens that we live in an environment which is in mountainous country and some of us go into the mountains every weekend and I go once a year. Of course, some things are more common. We all drink water from a common source, and we all breathe the same kind of polluted air although people who live near thruways probably get a higher degree of carbon monoxide in the air they breathe than people who live in remote parts of the city. Each one of those, in a sense, is an environment. Then beyond that is the environment which, in our society, makes it possible for some of us to be in Los Angeles in an hour and a

half, etc. Then there is the physical environment -- the so-called greenhouse effect which is common to all of us because it is planet-wide in its nature. I find myself kind of lost in trying to develop a theory of man in his environment. I should add that we keep acting in ways which change this environment. We build subdivisions, another ten million autos on the road, we cut down forests, etc. I will provide you with an account of what is happening to Venice. It is literally about to sink below the sea. There are several reasons for this but the main reason is that large areas of marshland along the main coast which catch the water during high water periods and store it have been filled in. The lagoon has been narrowed and now there isn't any place for the water to go except in St. Mark's Square. And it goes, up to 20 feet of it. All these people filled in this land, made lots of money, factories, houses -- here we are doing these things to our environment that we don't even know about. This is a simple case because if you displace water from one place it has to go to another. It doesn't take very much scientific knowledge to know this.

Downton: In asking the question "how can we develop some kind of unit that will bring all of these different disparate forms together?" it seems to me one of the simple-minded answers to this -- and maybe not so simple-minded -- is to attempt to understand how the individual perceives his environment; that is, not to begin with a notion of multiple environment but to begin with the notion of a perception of environments from the perspective of the individual. In this sense, in terms of the composition of the Seminar, it seems to me that we must have someone within the Seminar who is well grounded in psychology and who has some sense for personal perceptions. I think that basically, then, this is just a very tentative view, that we have to come to understand man, say in the city. In the case of my own experience in Berkeley, I persisted in telling people there was smog four years ago and the persistent answer was that it wasn't smog, it was haze; that is, it was kind of a fog. And as far as these individuals were concerned, that was not smog even though it can be read on a scientific instrument. So I am really puzzled and interested in trying to develop a theory on the basis of the individual and the way he sees his environment -- not the way we see it, as academicians, as students of man environment.

Garnsey: I think this is a very valid point. I assure you that I did not neglect it. I called Mr. Hammond immediately and asked him to give me the names of a social psychologist who might be interested. He replied that he would have to think it over.

Downton: I am interested in revolution and violence and man's relationship to others in conflict situations, and during last summer I spent some time just randomly talking to people, and what I was interested in asking them was "What kinds of things can you define as violent activities?" We use this term "violence" rather consistently and I was extremely interested in the kinds of responses that I was given, again on a random basis.

Everywhere from some conception of psychological violence when an individual plays ego games with another, to a perception even of violence inter-person as not being violence. And that interested me a great deal. Because I have a conception of violence and each of you does. And the interesting thing is that none of our conceptions is going to describe anything until we find out how different classes of people have conceptions of that term, or conceptions of anything else. So this is essentially what I think is important.

Flack: We did this project last year down in Atlanta on flood damages and it goes along with what you say. This is a natural phenomenon. The citizens who live in the flood plain, their perception of the flood damage may be quite different than the actual flood damage. Therefore man's attitude or perception of his environment may, in fact, be quite different than how he might scientifically measure that environment and how it's acting on him. This is an important part of the problem because if it's at a very low level of visibility to him, he is not going to go along with very many programs because he doesn't conceive of it as being that important to him. In theory you must recognize that there is a sharp difference there.

Garnsey: Again, from the point of view of the economist who is interested in choices, I choose to drive an automobile and take the smog rather than walk and have pure air. Put it another way, 70 or 80 million American people make this choice, which raises the question which has been discussed in the Seminar before, and that is, and I think must be related to the kind of thing you're interested in, What is the level of tolerance of acceptance in people about environmental things? In other words, just how bad does it have to get before it becomes visible, to use Ernie's (Flack) phrase? It seems to me that an answer to this question is an essential part of the theory of the environment.

Haas: I think you should illustrate a point, maybe that Jim was making or someone was making, a little bit ago. He suggested that 70 or 80 million people make this choice. Well, I think it is just as accurate to say that probably at most 60 million people do not make that choice at all. That is to say, they do not perceive that they are making the choice; they are buying a status symbol, or convenient vehicle to move around in, or something else. They have no conception at all that they are making a choice. We may look at it in that way. We can pose those potential alternatives from which they might choose had they thought about them or considered them. But as a matter of fact, I think what you're doing is contrasting what we might call the objective realities of what is going on and the subjective judgments and choices being made by people. And they're often quite different. In this case they're markedly different.

Hersh: I think that even after those alternatives are made, then they make a choice. If they will put up with the smog to have a car this should open up a whole set of questions. But very often they are not at all familiar with the objective realities.

Downton: The whole thing is the activity, say, what's the activity? -- like going to work, which means the car performs a crucial function. When is smog going to be seen as an important problem -- when they're engaged in an activity where air is necessary. So it's not just an individual's perception of the environment, but his perception of the environment in relationship to the activity he is engaged in.

Johnson: An interesting thing that ties into this, that I was going to mention while ago, is that the type of thing we're doing, I feel, is so universal, I would like to see more foreign students involved. Last spring Lou Branscomb and Mahinder Uberoi had this seminar on the population and food crisis which was quite good. As one student commented, there being about a 1:1 ratio, it was the first they had seen the right faculty to student ratio in a seminar. But I believe there was not one foreign student in this seminar, and yet it covered three schools, twelve departments, anybody from any place in the university could sign up under some legitimate number. There were no foreign students. In the United States we have the least problem so far, probably, of food and population compared to so many of the countries represented here. And yet somehow those people maybe do not perceive that they are -- they don't perceive it as a problem that maybe they should be involved in. I don't know what the answer is here, but I'd like to see our efforts somehow extended to them. When we go in to worry about these societal models of some kind, these are going to apply in many places besides the United States.

Hill (?): I have a partial suggestion for why they are not interested, or why they are not doing any thinking about these big problems. They can't afford it. One of my colleagues who was down in Chile asked somebody "Why don't you have any hippies here?" and the answer was "We can't afford hippies." They can't afford to marshall their time and resources to think about it.

Garnsey: I'd like to pick up this idea from another view. You see, so far we haven't defined the environment. I guess we can define man, but as you suggest by your example, the physical environment certainly is different in Brazil than it is in the United States. And of course it is certainly different in Appalachia than it is in Los Angeles. And that's why, again, I come back to that sentence where I talked about the multiplicity of the environments in which man lives. This can be defined in two ways. This can be defined in a -- in fact, in a crude example I used that Bob Ayre and I have lived in different environments in a sense, but it is also true that in a country with such wide geographic diversity as the United States, both urban and rural geographic diversity, people live in quite different environments. And yet there must be some kind of common factor somewhere, and I don't know what it is.

Rogers: I suspect that you could make some abstractions which perhaps lose the identity of the individual variation in the environment and yet, by this abstraction process put together those which are similar and distinguish those which are different. In other words, let us build a hierarchy of levels of environmental similarities and dissimilarities and do the same thing with man and his relationship to it. When we speak of violence, and violence has a hierarchy of events which we can certainly relate as being similar in response.

Garnsey: I guess this would be an essential part of a theory, wouldn't it?

Haas: One possibility might be to have the group next time break up into two or three or four sub-groups each of which independently spends an hour trying to lay out their conception of the major components, either of environment or man separately, or my inclination would be -- don't fiddle with that talk about the interface and see if there is some way we can come up with some general set of abstract categories which might be initially satisfying to all the people on the sub-group and then bring the groups together and see to what extent we have any commonality at all that we can put down.

Garnsey: Does this idea appeal to everybody here? If anybody wants to meet with somebody else just call my office.

Downton: May I suggest as kind of a compromise here, in terms of Gene's suggestions, that there are two basically natural groupings. Those interested in man for man, and those that are interested in man in the physical environment. And that it might be worthwhile to get these two groups together and see if, in fact, the interactionists will come up with the same set of perceptions as those that are looking at man in his interaction with the physical environment. In addition to the fact that these two groups might be able to tell us something, you would also have the reduced problem of physical space.

Holcomb: May I make a suggestion? We are talking about man-environment as two different things. I am not sure that this is a valid dichotomy because man is part of his own environment and if we separate the two we might be doing ourselves a disservice.

Garnsey: That's a very good point and it is what I was trying to say at some place in my statement. Obviously, when you get into groupings of man from primitive villages to megalopolis' why then other men are practically a dominant part of the environment. Maybe it's just a matter of convenience that we call them different. But on the other hand, I am not a tree nor a stream. I am not a pure stream nor a polluted stream, but I am a person who has a reaction to either a pure stream or a polluted stream.

Holcomb: Perhaps the stream has a reaction to you whether you pollute it or not.

Garnsey: We think of men as rational beings and a stream as a thing. Gene (Haas), what do you think of accepting the modification offered by Mr. Downton?

Haas: Well, I have a slightly different inclination -- or a couple of them. One would be to try to set up the groups so that you have a variety of perspectives. The other one would be to let people choose their own groups. I don't know that it's awfully critical as a starting point. All that I was suggesting was that I thought maybe the group process would provide some way of getting us started. Instead of having one person write on the board suggestions we all come up with. If we start with small groups, I would suggest groups of not more than four or five. Go at it for about an hour and then come with our group listings and put them up on the board and try to proceed from that point. I would like to put in a brief word of apology since I will have to be absent next time. However, it is relevant to this Seminar. As you may know, the AEC is planning for more underground nuclear detonations and one of them is going to be on Island out in the Aleutian chain. Some time during the first week in October. They may have inadvertently provided something close to an ideal field experiment for us in that we are doing a study of the tsunami warning system in some Alaskan communities and the present plan is to go into several of these communities with a series of interviews prior to the AEC shot and then wait, and if in fact it does kick off tsunamis, then be able directly to observe the warning system in process and to immediately interview persons afterward because presumably the warning will also involve recommendations for evacuation and so on. So again we see a kind of general parallel. You have scientists who want to experiment with the environment -- in this case underground shots -- which, in turn, may have implications for changing other parts of the environment. They are not sure whether it's going to produce a tsunami or not, but they have taken the precaution of working with the Palmer Observatory so that an automatic warning is going to go out for an area of about 400 miles on either side of the shot. They are going to assume that there is enough possibility of a tsunami that they will warn that area automatically. Places like Sitka, you see, where the whole total community is below 30 feet below sea level. It would only take about a 30 foot tsunami to inundate the whole area.

Garnsey: If any of you form spontaneous groupings, call us and let us know and we will try to develop a scheme of organization for our meeting two weeks from today.

Thank you all for coming. I hope you feel it worthwhile.

PROGRAM IN MAN-ENVIRONMENT RELATIONSHIPS

University of Colorado
Boulder, Colorado 80302

Morris E. Garnsey, Director
Hellem Annex 239
303-443-2211, x 6409, 6394

Dear Professor *Dave*,

For the last four years a Faculty Research Seminar in Man-Environment Relationships has been making slow but steady progress toward the design of an interdisciplinary program in this field.

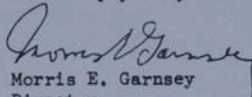
Among other things, we have published a book SOCIAL SCIENCES AND THE ENVIRONMENT, James R. Hibbs and Morris E. Garnsey (editors), University of Colorado Press, 1968, which is available to interested persons on loan. (Apply to Mrs. Schultz for a copy of the book and a report of the activities of the Program).

The gravity of the problems of man's relations to his environment has increased with extraordinary rapidity. Consequently, others than the members of the Seminar have become actively interested in this topic; and proposals for a major program in the area are being talked about. Therefore, I am convening a meeting, to which you are invited, for the purpose of discussing the possibility of creating and financing a CENTER FOR MAN-ENVIRONMENT RELATIONSHIPS AT THE UNIVERSITY OF COLORADO. This Center would, of course, work closely with ESSA and NCAR.

The proposal for a Center will be presented at the meeting by Dr. R. Michael McClintock, Research Professor of Physics and Dr. Robert H. Williams of the Aeronomy Laboratory of ESSA. The meeting will be held from 3:00 to 5:00 p.m. on Wednesday, November 5 in the University Memorial Center, room 158A.

We hope you can come, but since the number of persons who can communicate effectively is necessarily limited, we ask you for the favor of a reply. Please call Mrs. Schultz from 9:00 to 12:00 at extension 6409.

Sincerely yours,


Morris E. Garnsey
Director

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

October 15, 1969

TO: Members of the Seminar
FROM: Morris E. Garnsey, Director

As decided at the last meeting of the Seminar on October 1, we will again divide our group into three working groups for the next session on October 22.

The groups are as follows and Group A will meet in UMC room 158A; Group B in UMC room 158B; and Group C in UMC room 157B. It is suggested that we all meet promptly at 3:00 in 158A and then split up into our separate groups.

Group A

Robert Ayre
James Corbridge
David Hill
Jack Ives
Sam Johnson
Gilbert Hersh

Group B

Kenneth Boulding
Ernest Flack
Eugene Haas
Michael McClintock
David Rogers
Mrs. Holcomb

Group C

James Downton
Curtis Johnson
Paul Julian
Frank Smith
Patrick Webber
Walter Jessel

At the end of an hour or so we will all meet back together again for discussion.

THE ASSIGNMENT OF EACH GROUP WILL BE TO PRESENT A CHAPTER OUTLINE (WITH WHATEVER DETAIL POSSIBLE) OF A BOOK ENTITLED A THEORY OF MAN-ENVIRONMENT RELATIONSHIPS.

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

TO: Members of the Seminar
FROM: Morris E. Garnsey, Director
DATE: October 8, 1969

The following books are added to the bibliography. They have not been ordered

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The following is copied from an article in CIVIL LIBERTIES, Number 264 - October, 1969

CLUs BACK CITIZENS' POLLUTION FIGHT RIGHTS

SoCal Sues to Halt Oil Drilling

A federal suit to stop oil drilling in the Santa Barbara Channel until opponents are given a public hearing was filed this summer by the ACLU of Southern California.

The affiliate contends area residents were deprived of personal rights without due process of law by U.S. Interior Secretary Walter J. Hickel, four oil companies, officials of the U.S. Geological Survey and officials of the Presidential Office of Science and Technology.

"The personal right is the right to live in, and enjoy, an environment free from improvident destruction or pollution; and the property right is the right to the ownership, use and enjoyment of property, free from improvident invasion or impairment," according to the complaint.

At press time, a preliminary injunction has been denied by a federal district judge, and a three-judge federal court is set to hear the case.

The CLU argues that the government is relying on secret information regarding oil contamination from the very parties who have been responsible for contamination. Last January, a blowout in a well caused massive damage as oil spilled for 10 days. In June, the government announced that approximately 50 more oilwells would be drilled in the channel, allegedly to reduce oil pressure and "thus forever prevent future spillage." Citizens have no way of knowing whether the solution is sound.....

Personality:

An Urban Troubleshooter for 'Ma Bell'

By LEONARD SLOANE

When "Ma Bell" decided not too long ago to structure its activities involving minorities, urban affairs and educational relations as a high-level staff function, it selected a man with perfect credentials to head the department. 35 calendar years of service with the company and one hectic academic year as a member of the controversial New York City Board of Education.

And so, on Aug. 1, Walter W. Straley, a vice president of the American Telephone and Telegraph Company since 1966, was placed in charge of the new department of environmental affairs. His function, in the words of chairman H. I. Romney, is to assure that "our planning and operations be effectively related to the environment in which our service is provided and used."

Euphemisms aside, Walter Straley's role in large measure is to help A.T.&T. and its 23 operating companies do a better job of dealing with the increasing number of minority group members that have been entering their work forces in recent years. With this rise have come such costly considerations as higher turnover, more unexplained absences and greater service deterioration, which are continuing to plague both the organization and many of its customers.

"Generally speaking, the Bell System is superb in its handling of technological, logical and statistical matters," Mr. Straley asserts. "But quite like other business institutions, we sense that we are running into human problems that a generation ago would have been labeled as minor."

Mr. Straley and the 31 members of his department are now attacking problems in fields such as urban education, techniques of learning, planning for the physical environment and equal-opportunity advancement to managerial positions. But the immediate focus of their attention is on the Negroes who are being recruited and trained for entry level jobs particularly as telephone operators.

"I'd like to be of real help in the area of service standards in the central cities related to force intake and losses within six months," he says. "We'll be doing a lot of speculating about possible solutions that are putting them to death."

"You know I'd rather



The New York Times

Walter W. Straley, head of American Telephone and Telephone's new department of environmental affairs.

speculate about a lot of these areas and let the good, imaginative people in the company work with them. This is better than keeping them bottled up. If we did that, it would be five years before we'd have much to contribute."

As the 56-year-old A.T.&T. veteran does this speculating, the realities of employment trends at the corporation will be staring him in the face. While only 10 per cent of its 800,000 employees are nonwhite, the pattern of current hiring in the nation's major cities—where about 70 per cent of the 200,000 new hirings annually are made—indicates that this may be changing.

Thus, 70 per cent of the operators in New York City are now blacks and Puerto Ricans, and the percentage in Washington is even higher. In some of the central cities where nonwhite employment is high, the turnover has been so high that the companies are even having to encourage those employees

with six months or less of service.

"I don't think of this as a black-and-white problem, though," notes Mr. Straley.

"We're going to do some laboratory research in a couple of offices of the New York Telephone Company to get under way. And then we hope to make a series of interdepartmental recommendations on new approaches to recruiting, testing and pre-employment training of new employees."

His term on the Board of Education as an appointee of Mayor Lindsay during the height of the school decentralization battle and the teacher strikes in 1968-69 will undoubtedly benefit Mr. Straley while he seeks out new approaches to training his company's huge staff.

As he puts it, "the experience I had on the board was invaluable. It was practically a post-graduate course in public education."

And the school board's back ground is far from the big

city, however. He was born in Mount Pleasant, Iowa, in 1913 and first attended school in Manderson, Wyo. He later moved to Des Moines and graduated from Grinnell College in Grinnell, Iowa, in 1933.

Shortly thereafter, he became a telephone man and has been a devoted one ever since. About half of his three-and-a-half decades with Bell have been as a public relations man—he headed the parent concern's information department just before assuming his present post—with the remainder in operating posts at subsidiaries.

These jobs have ranged from his own entry-level position as a clerk in the Des Moines business office of Northwestern Bell Telephone Company in 1934 to a five-year term as president of Pacific Northwest Bell Telephone Company when it was established in Seattle in 1961. In between, he worked for A.T.&T. subsidiaries in San Francisco and San Diego.

Away from the office, Walter Straley is active in the New York Urban Coalition, in which he is a member for its educational task force. In addition, he is a member of the board of overseers of his alma mater and a director of the National Better Business Bureau.

All of these activities leave him little time for relaxation, consisting for Mr. Straley primarily of reading. "I'm a Hemingway, Faulkner, John O'Hara type," he says, although translations of the ancient Greek writers and business books are an important part of his literary diet.

"I have been so involved in the problems of communities that I have tried to become a lay behaviorist in organizational communications," he observes. "This is as close to a hobby as I have."

The reading is done either at the Manhattan apartment or the Atlantic Highlands, N. J., house where Mr. Straley and his wife, Rachel, live. Three of his five children are married, a daughter is a sophomore at the University of California at San Diego and his youngest son attends the Browning School, a private school in Manhattan.

And even though his roots are far from the sidewalks of New York, Walter Straley has become a devotee of the city. "Living in New York is great if you're involved in something," he says. "If you're not, you'll retain your sanity."

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"... the dilemma posed for the scientific community as it comes under attack simultaneously from two sides — from a political reaction and from a new kind of rebellion."

Purists and Politicians

by Don K. Price

SOMETIMES THE TONE of a headline tells you more than the news. Last summer a New York Times headline read "Pure Physicists Stay That Way: Vote to Remain Out of Politics." The story was a straightforward account of the decision by the members of the American Physical Society that it would adopt no resolutions on political issues. The flavor of the headline suggested a great deal more: that the typical newspaper readers and perhaps even a good many scientists are still inclined to think that the moral obligation of a scientist is to remain aloof from policy issues and political controversy.

Since I applauded the tactical decision of the physicists but deplored the implications of the headline, it occurred to me that this apparent contradiction was worth some further thought. Perhaps it is the crux of the apparent dilemma which the entire scientific community shares with the physicists. The dilemma is ages old — the dilemma between truth and power, or, rather, between starving in the pursuit of truth and compromising truth to gain material support. But it takes its new form in the dilemma posed for the scientific community as it now comes under attack simultaneously from two sides — from a political reaction and from a new kind of rebellion.

This attack from the two extremes makes it hard for the scientific community to continue its tradi-

tional political strategy, especially since — as sometimes happens in politics — the two extremes may in effect be allies, even though superficially in conflict.

The traditional political strategy of scientists has been to keep their sights set firmly on the advancement of basic knowledge in the conviction that their mode of thinking is in the vanguard of political and economic progress, and at the same time to persuade politicians and philanthropists to support science for its indirect payoffs in power and wealth.

This strategy was based on a belief in automatic progress that had its origins in the same way of thinking that produced economic laissez-faire. Scientific knowledge, like economic initiative, could be relied on to produce progress if government could be persuaded not to interfere, except with the necessary subsidies. But now, under attack on two fronts, scientists find this strategy harder to sustain.

On one side, the attack comes from a political reaction, which has three main purposes. Politicians want to cut down on the appropriations for research, to have more of the money spent on practical technology and less on academic theory, and to break down the degree of autonomy which the leaders of the scientific community gained a generation ago in the procedures by which research grants are distributed. On each of these points the reaction conforms to the best American pork barrel tradition.

On the other side, the rebellion is a cosmopolitan, almost worldwide, movement. One is tempted to identify it with its violent and fantastic and adolescent fringe — flower power and student insurrections. Obviously, the young are the ones who charge the cops in Chicago and barricade the buildings at Columbia or Berkeley. They have to be: my contemporaries no longer have the muscle and the wind for such exertions. Today's youth are indeed the student activists, just as today's youth are the infantry in Vietnam. But it would be as much a mistake to give the student leaders credit for the ideology of the rebellion as to give the G.I.'s credit for the war plans of the Joint Chiefs.

The ideology of the rebellion is confused; you can find in it little clarity or consistency of purpose. Its mood and temper reflect the ideas of many middle-aged intellectuals who are anything but violent revolutionaries. From the point of view of scientists, the most important theme in the rebellion is its hatred of what it sees as an impersonal technological society that dominates the individual and reduces his sense of freedom. In this complex system, science and technology, far from being considered beneficent instruments of progress, are identified as the intellectual processes that are at the roots of the blind forces of oppression.

For example, André Malraux, denying that the problem is one of conflict between the generations, says that "the most basic problem of our civilization" is that it is "a civilization of machines," and that "we, for the first time, have a knowledge of matter and a knowledge of the universe which . . . suppresses man."

Jacques Ellul, one of the heroes of alienated young Europeans, presents a more systematic indictment of scientists as "sorcerers who are totally blind to the meaning of the human adventure," whose system of thought is bringing about "a dictatorship of test tubes rather than hobnailed boots."

The theme was echoed by Erich Fromm in his support of Senator McCarthy's presidential candidacy, in a public protest against the type of society in which "technical progress becomes the source of all values" and we see as a consequence "the complete alienation and dehumanization of man."

Herbert Marcuse, who is of course the favorite

philosopher of the rebels, reduces the issue to its fundamental point: "the mathematical character of modern science determines the range and direction of its creativity, and leaves the nonquantifiable qualities of *humanitas* outside the domain of exact science . . . [which then] feels the need for redemption by coming to terms with the 'humanities.'"

In one sense, the challenge does indeed come from the humanities. The student rebels and their faculty sympathizers, at home and abroad, are found more conspicuously in the departments of humanities and in schools of theology than in the natural sciences or engineering. If the danger comes from the humanities, however, it comes not because they are politically powerful but, rather, because, as Mr. Marcuse suggests, they may have convinced scientists themselves that science is an inhumane discipline. The case for *laissez-faire* vanished when businessmen themselves became aware that unregulated initiative brought depressions and economic disaster. The potential effects of the power created by modern science and technology are so obviously dangerous to the modern world — whether in terms of the cataclysm of war or the slower but equally disastrous degradation of the environment — that it would not be surprising if even scientists should wonder whether we have been reduced to these dangers by the reductionism of their system of thought.

THE PRESSURE FROM THE REACTION. Most scientists try to avoid thinking about this basic problem very much because they are apt just now to worry more about the reaction than the rebellion. For the reaction touches sensitive budgetary nerves in anyone who is a laboratory director or a department chairman or even an aspirant to a fellowship.

I think this choice is a mistake. The reaction is a tolerable discomfort, the rebellion a fundamental challenge — and a challenge that poses problems scientists should think about critically rather than dismiss with contempt.

It is easy and misleading to blame the reaction on the Vietnam war and therefore to sympathize with the antimilitary sentiments of the rebellion. But this view overlooks the facts that two earlier wars produced more money and autonomy, not less, for science, and that the civilian agencies of government

(including those with some of the most generous and humane purposes) have been more likely than the military to insist that research funds be spent on practical problems, and that they be distributed more evenly among universities and regions.

Indeed, it seems to me that the reaction mainly uses the war as an excuse, and it is hard to see how the reaction could have been so long delayed. In slowing down the rise in appropriations, congressmen were reacting naturally to the projection of curves on the budgetary graphs that lumped basic science together with engineering development. In emphasizing application, they responded to the salesmanship of scientists who told them in congressional hearings a great deal about how science would make us healthy and wealthy, and very little about how it would make us wise. And, in their avarice on behalf of their own districts and institutions, congressmen differed only in degree from scientists themselves. In these practical ways, the reaction is in the highest tradition of the English-speaking scientific world, which has always assumed that science was justified in large part by its contribution to material welfare — the tradition of Francis Bacon, who caught cold and died while trying to learn how to refrigerate poultry, and of the Royal Society, with its initial interest in "Manufactures, Mechanick practices, Engynes, and Inventions," and of Ben Franklin's American Philosophical Society, "held at Philadelphia for promoting useful knowledge."

THE NOVELTY OF THE REBELLION. But the rebellion is a different matter. It is the first international radical political movement for two or three centuries (I am tempted to say since Francis Bacon) that does not have material progress as its purpose. Far from proposing to use science and technology to improve the material welfare of the poor, it rejects technological progress as a political goal. Far from calling on government to distribute the fruits of technology more equitably, it denounces big organization in government and business indiscriminately. For three centuries science has worked on the comfortable assumption that it could pursue fundamental truth and at the same time contribute to human welfare and humane values. Since Bacon, revolutionary leaders have accepted this assumption and considered science

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to be in the vanguard of political progress. But now the rebels say that science, by its intrinsic nature, has reduced itself to an inhumane mode of thought, and our polity to an engine of oppression, and so they conclude that humane feelings demand the overthrow of the whole system, if necessary by an irrational rebellion.

Even though many of the young rebels call themselves Marxists, the guiding spirit of the rebellion is as much in conflict with Marxism-Leninism as with Western democracy — perhaps more so, because communism believes that science can provide the basis for political values, and the New Left considers the degree of scientific influence over our political system a disaster. Communism is a system of rigorous discipline and meticulous dogma; the New Left has neither. It is more like a religious heresy, renouncing a concern for power and wealth, than like a political movement, and even its emphasis on drugs and sex is reminiscent of the antinomian rebellions of the Middle Ages.

The rebels are right when they complain of the symptoms of sickness in modern society — symptoms that afflict the Communist as well as the capitalist world. We have not learned how to make our technological skills serve the purposes of humanity, or how to free men from servitude to the purposes of technological bureaucracies. But we would do well to think twice before agreeing that these symptoms are caused by reductionism in modern science, or that they would be cured by violence in the name of brotherhood or love.

As the first step toward a diagnosis of our problem, we must admit that, as scientists, we have not been very clear in the past as to the basic relation of science to politics. When the rebels charge science with destroying freedom by subverting moral values or controlling policy decisions, we cannot dismiss the charge by repeating the old principle that political

authorities determine policies on the basis of philosophical or moral values, and that scientific knowledge only tells us how best to carry out those policies—that is, tells us the best means to those ends. This reply will no longer do. In Marxist countries official dogma holds that science determines the basic values, and in America many scientists have been hypocritical on the issue; they use the old formula as a defense for public relations, even though they realize that science has, and must have, a profound influence on values, and are inclined to believe that science could provide the answers to policy questions if politicians were not so stupid.

It is high time that we become more critical—instead of hypocritical—in facing this fundamental issue. As we do so, we should remember that the relationship of science to politics has at least three aspects. They are knowledge, institutions, and policy.

KNOWLEDGE. Let us consider knowledge first. The way people think about politics is surely influenced by what they implicitly believe about what they know and how they know it—that is, about how they acquire knowledge, and why they believe it. In traditional political systems—a few still persist in the world—issues were decided on the basis of immemorial custom, religious tradition, or the divinely sanctioned will of a ruler. Before this could change to a system in which elected assemblies could consider facts—perhaps even on the basis of scientific evidence—and then deliberately enact policies, a revolution in the nature of knowledge had to take place. That long slow revolution went along with the progress of science, and the main line of progress has of course been that of *reduction*—the change from systems of thought that were concrete but complex and disorderly, and that often confused what *is* with what ought to be, to a system of more simple and general and provable concepts.

It is clear, as Mr. Marcuse points out, that this reduction of knowledge to its abstract and quantitative bases is a calculating approach to reality that makes no allowance for humane sentiments or moral judgments. It is also clear that serious practical politicians who disapprove in theory of Mr. Marcuse may agree with him in practice, and may fear that reductionism will impair our political responsibility. For

example, leading candidates for political office have charged that the Supreme Court's weakness for sociology and statistics is eroding the moral fiber of the nation, and congressmen in committee hearings have expressed concern that the new mathematical techniques of systems analysis may dominate our strategic decisions.

But it is not at all clear to me that reductionism is a threat to political freedom or responsibility. In their practical political behavior, scientists are not quite so consistent or doctrinaire. To say that science feels the need for redemption seems to me . . . a pathetic fallacy. Science feels nothing. Scientists have feelings, and on political issues their feelings seem to me to be just as varied and moralistic as anyone else's.

On a more theoretical level, it seems to me that reductionism has not been pushing scientists generally toward a belief that science as such can solve the issues in which the average man is most interested, or can determine the nature of the political system. Although other branches of science admit their growing reliance on mathematics and physics, they seem no more likely than they were a century ago—perhaps less likely—to assume that they can solve all their problems by reducing their disciplines to atomic or subatomic bases.

The notion that scientific advance cuts down the freedom of the human spirit, and reduces the range of choice open to mankind, is an obsolete idea; on the contrary, every new grand simplification opens up a new range of complex questions for exploration. Man found it hard to change from the astronomical conception of a closed world to one of an infinite universe; the notion that scientific advance on reductionist principles will cut down our freedom, in either intellectual or political terms, seems to me the result of hanging onto an obsolete and narrowly mechanistic 19th-century conception of science.

Before we decide that the remedy for our present disorders is to put moral sentiments back into science, it may help us to remember that science is not the only mode of thought which has gone through a reductionist trend and then found that the simpler abstract concepts provided less specific guides to action than one might hope. If reduction is the change from complex and disorderly ideas that confuse what

"The free institutions' role in serving society . . . is also to serve as a source of independent criticism of those who hold power."

is with what men would like, to more simple and general (if not always provable) beliefs, the change in theology from polytheism to monotheism was reductionist, and so was the change from the Ten Commandments and the intricacies of the Talmud to the simpler commandment to love God and your neighbor as yourself. And in theology, as in science, reductionism brought a shocking denial that natural laws were in harmony with human righteousness: "for He makes His sun rise on the evil and on the good, and sends rain on the just and on the unjust."

If science can learn any lesson from theology on this point, it is that reductionism does not cause the political problem, nor can it solve it. For the simple law of love was taken, over the centuries, as the anti-nomians' justification for the abandonment of all moral laws as well as for the rigorous moralism of Calvinist Geneva and the Spanish Inquisition, for the anarchy of the hermits and the Ranters as well as for the ruthless tyranny of the Byzantine emperors.

The trouble with reductionism, as far as politics is concerned, is not that it gives *all* the answers to the important issues but that it gives hardly any. I suspect that the current attacks on science come less from those who have always feared it than from those who were frustrated when they tried to put too much faith in it. To them, it was another god that failed. Science is quite impartial in debunking idols—its proudest claim is that it is always debunking itself.

INSTITUTIONS. If we are concerned with political freedom we cannot concern ourselves only with the theory of knowledge. Reductionism in science is not the real problem. We do harm not by reducing science to its mathematical bases but only by reducing men to a concern for nothing but science. As we ponder the political status of science it may help us to recall that freedom of religion resulted less directly from the reformation of theological thought than from the competition of dissenting churches and from changes in the political system itself. That brings us to the second aspect of the relation of science to politics—institutions. And so we must face

the question whether a scientific and technological establishment, or the aggregate of scientific and technological institutions, is a threat to freedom, especially because of its intimate alliance with a bureaucracy managed on scientific principles.

At the same time that science has been reducing knowledge to fewer and simpler general concepts, society has been expanding the number and the variety of the institutions that develop and apply that knowledge. From the traditional community ruled by a priest-king, combining in one set of institutions political power and the preservation and transmission of traditional knowledge, has been evolved the complex structure of modern society. This process of *specialization* has separated from the center of political power various more or less autonomous institutions that are then permitted to operate according to their own functional requirements.

The fundamental basis for the freedom of specialized institutions is that the public recognizes that they can do their particular job better for society if they are not immediately controlled by those who hold ultimate political power. The business corporation can be more efficient, the scientific laboratory can be more innovative, if it is granted substantial autonomy. And the same principle works, within limits, within the formal structure of government itself; it is the justification not only for a nonpolitical judiciary but for a professional diplomatic or military service and for a civil service run on merit principles.

But the free institutions' role in serving society is not merely to be more efficient within their specific functions. It is also to serve as a source of independent criticism of those who hold power. It is, in short, to prevent centralization of authority. Scientific and technological competence is so necessary today for understanding the complex programs of government that scientists who are employed by institutions outside the immediate executive hierarchy have an important role to play in criticizing official policy and checking centralized power.

If they are to play that role, they must be close enough to the big issues to understand them, but they must have enough independence of action to speak without fear of damage to their status or careers. But how can they be closely enough involved

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"Scientists . . . need to adopt a strategy that is more modest in its hopes for the perfectibility of mankind and more pessimistically alert to the dangers of power."

Purists and Politicians

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without sacrificing their independence? Logically, the dilemma seems absolute. The judiciary cannot get into the fight over civil rights without being accused of usurping the power of the legislature. Churchmen cannot preach social justice without coming under political attack. And scientists cannot get involved as consultants to government, or universities accept contracts for applied research, without being accused of prostituting themselves to political power.

Obviously, an institution can be more surely free of political influence if it deals with pure science and shuns the competition for power. But absolute purity is a delusion. It is a delusion partly because every institution needs material support and cannot isolate itself from the society that supports it. Even more important, absolute purity is a delusion because it is a refusal to serve one of the essential purposes of an independent and nonpolitical institution, that of providing some independent standards of criticism of public policy.

HOW TO RESOLVE? You can resolve the dilemma in one of two ways. If your approach is doctrinaire, you can try to resolve it by forcing the competing elements together within a single institutional system. Politics and religion are obviously related, so church and state cannot be separated. Economic and political power are related, so the state must own the means of production. Political decisions must be made scientifically, so science must provide a theory of politics and a methodology for deciding public issues, and then must be controlled by the state. That way, of course, lies totalitarianism.

But if you are sensitive to the danger that any single doctrine or theory may be perverted in the interests of power, you will take a more pluralistic and more discriminating approach. You can distinguish between different types and degrees of political involvement on the part of nonpolitical institutions; even more important, you can distinguish between what it is prudent and effective for an institution to do and what that institution's members are free to do in their capacity as private citizens or as participants in other institutions. . . . A member of a church may also be a member of a political party, and need not expect both institutions to play the same roles. A professor in the university may also be a consultant to a research corporation or a government agency and a member of a scientific society. His freedom to play different roles in these different institutions — and to defend the autonomy of each institution against the others — is one of the most important safeguards of freedom in modern society.

Independent institutions are not, of course, the fundamental basis of freedom. Their independence comes from their roots in the way people think and what people believe. You will not want to let a university or scientific society function free from governmental direction if you think its work will immediately determine the major political decisions of the day.

We believe in free academic and scientific institutions not because we consider them irrelevant to practical political concerns but because we tacitly understand that their type of knowledge does not directly and clearly provide the answer to any complex political issue. Does this contradict the power of the reductionist approach that has given science

"Even pious people, unless they are simple-minded, can laugh at BOMFOG, but nobody makes fun of $E=mc^2$."

its great effectiveness in dealing with practical as well as theoretical problems? I think not. Reduction in knowledge and specialization in the definition of institutions and their roles go hand in hand. Just as the zoologist or botanist may admit the great contributions that biochemistry and biophysics have made to biology and still see that tremendous problems remain at the more complex levels of organization, to be dealt with by different modes of thought, so the politician (and his scientific adviser) may make full use of analytical science and yet be left with difficult problems of synthetic judgment in making his decision.

The type of thought that, in the style of the Marxist dialectic, rejects traditional dogma in favor of reductionist science, and then tries to make science the basis of a new dogma, is not reductionist, but only dogmatic. Reductionist knowledge provides no rationale, and no rationalization, for centralized authority. Like the specialized institutions in which it is developed, it tends to be a check on general political power, an impediment to sovereignty rather than a tool of tyranny. Reductionism and specialization have indeed biased our political system toward some of the practical abuses of power that the rebels deplore, but they have done so not by creating a centralized system. On the contrary, they have so greatly strengthened the productivity and power of specialized concentrations of economic wealth and technological competence that our general constitutional system is incapable of controlling them.

POLICY. This brings me to the third aspect of the relation of science to politics—policy, or the definition of public purpose by responsible authority.

As a complex civilization has developed its system of knowledge by *reduction*, and its institutions by *specialization*, its policy has moved over the centuries toward *generalization*. The purposes of politics have broadened from the tribe to the feudal community to the nation, and are beginning dimly to be perceived in terms of world interest; they have broken down the rigid lines of caste and class, and

are beginning to transcend differences of race. With almost as much difficulty, the general purposes of responsible politics must now try to control the specialized functions and institutions of government in the general interest.

This movement toward political concern for all men, and toward the sharing of power with them, was perhaps made possible by the other two aspects of politics—the reduction of knowledge to a more effective scientific basis and the transfer of specialized social functions away from the general system of sovereignty to institutions less concerned with power and more with material welfare. Without new techniques of communication to let men share ideas from place to place, and new techniques of production to give them enough material goods to share, the broadening of political concern would have been impossible.

I am also inclined to believe that this broadening of public purpose was encouraged by that earlier form of reductionism, the theological reductionism that slowly and partially converted religion from a complex of local superstitions to a broader and simpler faith. As far as the general evolution of public policy is concerned, the processes of reduction toward simpler and more fundamental ideas in science and in religion have had similar effects.

But I must qualify this assertion of faith with a cynical concession. Science has an intellectual advantage over religion: a reductionist science comes out with grand generalities in the form of mathematical equations that the layman reveres because he cannot understand them; a reductionist religion comes out with grand generalities in the form of platitudes that only embarrass the layman because he thinks he understands them all too well. For example, the tough-minded ghost writers for one of our leading politicians, I am told, were always annoyed at being required to put into each of his speeches a reference to what they called BOMFOG—their derisive acronym for Brotherhood of Man and Fatherhood of God.

As scientists we are apt to take pride in this distinction: even pious people, unless they are simple-minded, can laugh at BOMFOG, but nobody makes fun of $E=mc^2$. But such pride is ill-founded. If we ridicule BOMFOG, it is not because we do not believe in God or human brotherhood; indeed, the

more we believe, the more we are likely to see that such belief does not solve practical political problems, and that a politician who appeals to such abstractions for self-serving purposes is absurd. It seems obvious to us that $E = mc^2$, while it may be the fundamental equation of atomic energy, does not tell us even how to make atomic bombs, much less how to get international agreement against their use; no politician would win votes by using a basic scientific formula as an incantation.

But this is a parochial idea. We may not make a political slogan out of a scientific concept, but others do. We find it hard to imagine the political quarrels that took place in Russia over the scientific philosophy of Mach or Einstein, or to understand how Soviet scientists give credit for their discoveries to Marxist-Leninist doctrine, and Chinese scientists give credit to the thoughts of Mao. But, at least in Russia, the more sophisticated scientists react to the scientific dialectic the way we react to BOMFOG—with an appropriate mix of reverence and ridicule.

If, as Americans, we have escaped the Communist habit of muddling scientific theory with political practice, we cannot claim too much credit. We had been inoculated, so to speak, by the English-speaking historical culture against the translation of the great simple truths into practical policy. We had tried that under Puritanism—under Oliver Cromwell and John Winthrop—and had had enough. So Jefferson, as clearly as Burke, was against the Worship of Reason in the French Revolution, and T. H. Huxley opposed Comte's conversion of science into a political dogma—the dogma (which Lenin later enforced) that diversity of opinion was no more to be tolerated in politics than in chemistry.

With respect to knowledge and institutions, politics becomes more civilized as it moves in the analytical direction—toward reduction and specialization. But policy is a synthetic process: generalization requires more than analytical skills. Indeed, it demands special care with respect to analysis and specialization, not to prevent but to control and use them, and not to be misled by thinking that any one type of basic knowledge or institutional skill will solve the problems of a complex political organization. Reduction is the prescription for basic knowledge, but reductionism taken neat can poison policy.

America is not entirely free of the idea that some scientific formula will guarantee our political salvation. The president of the AAAS gets frequent letters outlining such schemes. If I were not too honest to steal such secrets from their authors, I could tell you how to provide unlimited energy without cost, and thus eliminate poverty, and how to remove all feelings of hatred and aggression, and thus guarantee universal peace. But it is typical, I think, that most of those American scientists whom their colleagues consider crackpots are interested, not in basic theory or ideology, but in gadgetry—in finding gimmicks to cure the world's ills.

PRAGMATIC REDUCTIONISM. This taste for the so-called "practical," of course, the crackpot shares with his fellow countrymen. In America, we are not dialectical materialists, only practical materialists. We do not convert our science into political faith—only our technology into business profits. We do not make our political theory into a revolutionary crusade; we only assume that technical assistance and more calories will make peasants contented, and that B-52's are cost-effective in pacifying jungle villages, and that welfare payments will remove racial hate.

The philosophers who blame such blunders on scientific reductionism—who believe that the mathematical and fundamental approach to knowledge is the basic flaw in modern politics—are themselves reducing the problem to a more abstract level than is useful. We get into political difficulties less because our method of knowing is wrong than because we put too much confidence in specialized programs and institutions and show too little concern for the processes of government that relate those specialties to general policy. It is true, of course, that many political controversies are over meaningless issues or insoluble problems, and new "technological fixes" (as Alvin Weinberg has called them) are often useful ways out. But this approach will work best if it is tried by some responsible authority who is thinking about the problem as a whole, as a part of the general political system; it can be disastrous if it is peddled to politicians by a special interest in the business or bureaucratic world that is concerned only with increasing its own profits or professional influence.

To deal with any public issue of any consequence, we need to bring science and politics together in all their aspects. We need more precise knowledge. We need more effective institutions. And we need both the will and the competence required for the synthesis of general policy. Of these three, the most difficult is the policy aspect, for generalization cannot be reduced to precise techniques, or delegated to a specialized profession or institution.

But synthesis and analysis are not incompatible processes of thought, any more than facts and values are totally separated from each other. The new techniques for the analysis of complex systems developed by mathematicians, physicists, economists, and other scientists have become the most powerful tools for the critical study of the components of policy, and hence for the development of general policies.

You cannot synthesize a sensible policy unless you have first analyzed the problem. Reductionism is not the enemy of humane political thought; it is the first practical step toward it. To take both steps is hard work, and requires the scientist to share the complexities and uncertainties that harass the politician, and to join in compromises that offend the purist in either science or morals.

From these uncertainties, the human mind is tempted to seek refuge in phony reductionism — the new rebels reducing the complexities of politics to the simplicities of moral feeling, the scientists taking shelter in the purity of research. Both these paths to purity are like *BOMFOG* — you feel obliged to respect them, but the trouble comes in putting them into effect.

THE ALLIANCE OF OPPOSITES. What is wrong with the purists, on both the moral and scientific sides, is not that their objectives are evil but that they tackle the problem at the wrong level of abstraction. In the United States we are in no danger of using science to deny political freedom, or of rejecting *BOMFOG* in favor of a theology that would support a caste system. But there is a real danger, it seems to me, that the two types of purists — the scientist and the moralist — will withdraw from public affairs and leave responsible political authority without support against the powerful combination of technological

skill and special industrial and bureaucratic interests.

For example, take the Institute for Defense Analyses. IDA is a prime target for the new rebels; to them it symbolizes the corruption of the purity of scholarly institutions by military power. IDA is also not very popular among theoretical scientists; it represents the kind of applied work with government support that does little for pure science. Yet IDA was not created in the interest of irresponsible military power. On the contrary, it was a part of the effort to give responsible civilian political authority the ability to control the competing special military interests. The constitutional authority had always been there, but without the special knowledge or the special institutional controls needed to make that power real, and hence to make possible the synthesis of the independent missions of our Army, Navy, and Air Force into a general policy.

Even before 1961, IDA was one of the tools the Secretary of Defense used as an aid in the synthesis of general policy. There was no antithesis here, in either theory or practice, between, on the one hand, reductionist knowledge and specialized staff institutions and, on the other, an effort to make general policy supreme over special technological interests.

In opposition we saw officers from the most powerful and independent segment of American bureaucracy, the career military services, supported by industrial clients who disapproved on principle of any not-for-profit corporation, rise to denounce the whiz kids in the research corporations and the Office of the Secretary of Defense. The use of mathematical and scientific techniques to deal with military policies, such as strategic plans and weapons systems, was a cold and calculating and heartless approach, they said, to what ought to be an affair of the heart — a vocation to be followed on moral rather than quantitative principles. Or as Admiral Rickover has put it, "The Greeks at Thermopylae and at Salamis would not have stood up to the Persians had they had cost effectiveness people to guide them."

Whenever a powerful special interest begins to appeal to basic moral or philosophical principles in an effort to escape subordination to general policy, we are entitled to be skeptical if not cynical. The new purists in morals and in science who join with rebellious segments of the Air Force and Navy in

attacks on IDA and the Office of the Secretary of Defense are in much the same position as the contemporary religious fundamentalists who become allies of reactionary industrialists by seeing social security, the income tax, and the regulation of business as the work of Godless communism.

A NEW STRATEGY. The idea of scientific purity — of avoiding involvement in political compromise — was once a useful notion. It helped to free science from the teleology of the earlier philosophers, and scientific institutions from the obligation to work on practical problems as practical men defined them.

This reductionist strategy, while protecting the freedom of scientific institutions, did not slow down the practical application of science in political systems that had shaken off feudal or bureaucratic constraints in an era of optimism about material progress.

But the new rebels are right in thinking that that era of optimism — that blind faith in automatic progress — has ended.

That optimism misled Western thought in two ways for a century or two after the Enlightenment.

After the French Revolution there spread eastward through Europe and Asia the optimistic notion, stemming from the Enlightenment, that science, by perfecting our philosophy and our values, will teach us how to revolutionize society and eliminate the corruptions of politics; in its Marxist form, that notion proposed to let the State itself wither away.

After the American Revolution, the pragmatic West came to a less doctrinaire but almost equally optimistic conclusion: that the advancement of science would lead to the progress of technology and industry and an increase in material prosperity, and to a withering away of governmental interference with private initiative.

The rebels are right in being pessimistic about such notions. I do not think they are even pessimistic enough. To me it seems possible that the new amount of technological power let loose in an overcrowded world may overload any system we might devise for its control; the possibility of a complete and apocalyptic end of civilization cannot be dismissed as a morbid fantasy.

And the rebels are far too romantically optimistic

in their remedy. Mere rebellion to destroy the existing order — mere purposeless violence to upset the establishment — assumes that those who gain power by violence will be nobler and more generous in purpose than those who now try to hold together the delicate web of civilized institutions.

If scientists wish to maintain the freedom of their science and, at the same time, play a rational and effective role in politics, they need to adopt a strategy that is more modest in its hopes for the perfectibility of mankind and more pessimistically alert to the dangers of power — not only power that is obviously political but the power that calls itself private as well. They should start by acknowledging in theory what in the United States we have always taken for granted as a practical matter: that reductionism in scientific knowledge; while it may provide the fundamental advances in scientific theory, does not alone provide the answers in the realm of policy, or the basis for a political ideology.

If this point is clear, no one will need to take seriously the charge that the scientific mode of thought is a fundamental threat to humane values. The threat comes not from the theoretical reductionism of science but from the very pragmatic reductionism which assumes that applications of advanced technology are automatically beneficial, or that we are always justified in granting special concentrations of technological and industrial power freedom from central political authority.

If everyone understands that science, as such, does not control policy decisions, scientists will then be free — and, in my view, will be morally obliged — to devote their synthetic as well as their analytic skills to the formulation and criticism of policies by which the nation may control technology and apply science in the public interest.

In an era which is beginning to be alert to the threats posed by modern technology to the human environment, the role of science in politics is no longer merely to destroy the irrational and superstitious beliefs which were once the foundation of oppressive authority. It is, rather, to help clarify our public values, define our policy options, and assist responsible political leaders in the guidance and control of the powerful forces which have been let loose on this troubled planet.

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

October 13, 1969

TO: Members of the Seminar
FROM: Morris E. Garnsey, Director

Enclosed, please find the transcript of the last seminar meeting on October 1, 1969

Also enclosed are two better examples of the continuous flow of material in the field. Notice particularly the article by Dr. Bentley Glass.

AAAS *Bulletin*

American Association for the Advancement of Science

September 1969

H. Bentley Glass

President, AAAS, 1969

Academic Vice-President, State University of New York
Stony Brook, New York

Letter from the President

The joint conference of the AAAS and the British Association for the Advancement of Science held in Boulder, Colorado, in April 1969 addressed itself to the general question of "Science and the Future" and more particularly to the related questions: What should be the role of the associations for the advancement of science in promoting a hopeful future in which science might aid in the solution of critical world problems? And what methods for achieving those aims might best be employed by the associations? A report by Marcel Roche of Venezuela, who was one of a number of participants in the conference who came from other than the two sponsoring countries, has provided readers of *Science* with a good overview of the spirit of the discussions which took place (*Science*, 8 August 1969). The sense of deep concern, if not pessimism, which pervaded the sessions of the conference leads me to suggest that an inversion of the title might be more appropriate. In other words, I ask my fellow scientists to think for a while of "The Future of Science."

The achievements of science in the past 150 years have been so sweeping and have so clearly transformed the world in which man must henceforth live that one might see little cause for hesitation in predicting a continuation of present trends into the future. What obviously, to a scientist, calls for pause is that the rate of growth of science, and of its applications in technology, has been occurring at an exponential rate that simply cannot be maintained in the most scientifically and industrially developed countries of the world

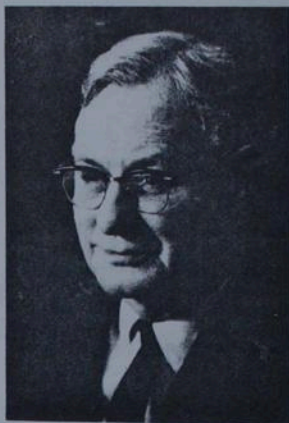
for longer than two or three more decades. Look at the past century and a half! In many parameters, growth in the century from 1820 to 1920 has been less than that in the past half century. As a consequence of the applications of scientific advances that cut the death rate without appreciably modifying the birth rate, world population has doubled in the past 50 years, whereas it less than doubled in the entire preceding century. The increasing rate leads to expectation of another doubling in the next 30 years. Life expectancy in the United States, to take another measure, was extended by 15 years in the century from 1820 to 1920, but has been extended by 17 years in the half century since 1920.

Science itself has been growing even more rapidly than world population or life expectancy. It has exhibited a doubling time, measured by the increase in the number of scientific journals or the number of publishing scientists, of about 10 years. But the inflection of the exponential curve is already here, or perhaps we have already passed it. Just a few years ago the President's Science Adviser suggested that an annual growth in the federal support of basic scientific research of 15 percent was needed to insure the growth of the national economy at the current level of 7 percent per annum. Some catching up was evidently needed in the ratio between the amount annually budgeted for basic research and the six to eight times greater amount budgeted for "development." Nevertheless, one must reckon with the fact that a 15 percent annual rate of increase represents a

doubling time of 4.7 years, and that continuation of that rate of increase for 24 years would raise the support of basic research from its present annual level of 2 billion dollars to an amount equal to the present size of the defense budget (Vietnam war included), and in 40 years to an amount greater than the present Gross National Product. Similarly, continuation of the 1940-60 rate of increase of "scientists and technologists," as defined by the U.S. Census, would under the most optimistic assumptions exhaust the entire supply of professional people in the total labor force by the year 2000.

The growth of science—"big science" as Derek de Solla Price calls it—must very soon slow down to a rate commensurate with the total growth of population and the total growth of the national economy. We are entering the phase of limiting factors, a scientific and sociological study of which will well repay the time and effort of all who are concerned with the future health of science and its relationship to the welfare of the people. At the Boulder Conference, I suggested that there are at least five major limiting factors which merit study, if we are to forecast the future development of science as a social phenomenon.

First of these is the sheer volume of scientific information that already exists without adequate codification and storage, and that is so rapidly accumulating. The total annual output of scientific reports of original research is now close to the half million mark, to judge from the admittedly imperfect



coverage of *Chemical Abstracts*, *Physical Abstracts*, *Biological Abstracts*, and other partially overlapping abstracting services. Computers have been pressed into service to provide rapid, permuted indexing. Nevertheless, we are almost as far today from the kind of scientific information service depicted by Vannevar Bush in *Endless Horizons* as we were in 1946, when he wrote the book. What is worse, I feel, is that perhaps a majority of scientists have frankly and openly abandoned the effort to cope with the flood of knowledge, even in their own specialties. They read little, especially in the foreign literatures, and depend mainly upon word-of-mouth reports from fellows of the "invisible college" to know what is going on in the liveliest centers.

The second limiting factor is closely related to the first: the ever-increasing specialization required if a scientist is to carry out successful investigations. Esoteric language and scientific jargon hamper cross communication between fields. There are increasing numbers, to use Francis Bacon's illuminating metaphor, of pioneers who dig out new ore, but a great and increasing shortage of smiths who might refine and hammer the ore into unifying theories. Mountains of ore are consequently accumulating around the mouths of the mines, until, it may seem, our future scientists will need only to refine what is already there in order to keep active.

A third limiting factor in the growth of science is the rapid rate of educational obsolescence forced upon us by the rapidity with which science and technology grow and bring about change in human society. An education in science has now about the life of an automobile. A scientist must constantly renew, extend, and reorganize his knowledge, or in approximately eight years he will be beyond hope as teacher or practitioner. Our schools and universities seem to have made little change in organization, or even in curricula, to counteract educational obsolescence in our time.

A fourth, highly critical limiting factor in the growth of science is the lack of sufficient study of the long-term, unanticipated side effects arising from the introduction of insufficiently tested technological developments. There is an inevitable negative feedback from such consequences as the explosion of the world's population, clogged transportation, smog and the pollution of our waters, and the exhaustion of certain irreplaceable resources. Technological assessment, in much broader

terms than hitherto conceived, and adapted to the special needs and circumstances of each nation and each culture, is coming to be recognized as indispensable.

Finally, one should not overlook the rapidly growing hostility toward science felt by many people, and especially by members of the younger generation, because of the partial dedication of science to military and industrial ends, because of the spoliation of the human environment, or because of the callous introduction for profit of some new drugs and chemicals insufficiently tested for their long-range effects and side effects. The magnificence of the landing of astronauts on the moon only briefly offsets this prevailing antipathy to science and technology, I fear. The support of science by society will become more and more precarious as hostility mounts.

To what then should the members of the American Association for the Advancement of Science and its sister organizations devote themselves as countervailing measures? The Boulder meeting pointed to some of these. Full-scale studies must be conducted to relate national goals, formulated in terms of human needs, to the growth of science and technology and to the allocation of resources. It will remain as true as ever that one cannot predict what great advances will come from what particular research; but the support of broad areas and fields in terms of human need and the enrichment of life will require allocations. There will never be money enough or men enough to do everything conceivable, or even everything abstractly desirable. "A full-scale study of the relation of growth in science to technological improvement, population size, and rate of population increase clearly seems needed, and the creation of an agency"—I would propose several, both public and private in each country—"to forecast as early as possible the effect of technological changes on society might be indicated. A research strategy at the national level, in both developing and developed nations, with model building and better coordination between the different areas of pure and applied science would be useful." (Since Marcel Roche here so aptly paraphrased and condensed my own remarks, I take the liberty of quoting him.)

Decisions must become based on policy rather than the conflicting pressure of special interests. Most fiscal support must "support work applicable to

human needs, according to predetermined strategies." I suspect that agreement on this score will not be unanimous. Many scientists will object, perhaps will see a threat here to the freedom of science. In my own view, the pressure of the limiting factors will very soon become inexorable.

Better public understanding of the significance and nature of science seems imperative. Can we any longer entrust this task to informal methods? What is the role of the associations in this matter? To what extent can better science education in the elementary and secondary schools provide saner attitudes toward the place of science in the life of modern man? How should the more developed industrial countries aid the advancement of science and technology in the newly developing and underdeveloped nations? These are the weighty questions we must attempt to answer. To study them more deeply and to work out methods of meeting the needs they imply will be task enough for the scientific associations in the coming decades.

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Hans Nussbaum, Business Manager, and Editor, *AAAS Bulletin*

Catherine Borrás, Assistant Editor, *Bulletin*

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

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PROGRAM OF THE SEMINAR IN THE THEORY OF MAN-ENVIRONMENT RELATIONSHIPS

September 10, 1969

Introduction

As you may know, this is the fourth year of a modest Program in Man-Environment Relationships which I have been directing. Three years ago we had a national conference on the subject and published Social Sciences and the Environment. Copies are available for those of you who do not have one. During the next two years we had a series of seminars which were rather heterogeneous in nature although all of them bearing directly on man-environment relationships. Copies of the report of the last 2 years are available.

This year we decided that we should form a small group of those most seriously interested in the subject and attempt to develop within an academic year a Theory of Man-Environment Relationships. May I reemphasize that this is a working group. It is assumed that the interest of each person is sufficient for him not only to attend the meetings regularly on the first and third Wednesday of each month from 3:00 to 5:00 p.m.; but also to study and think about the formulation of a theory throughout the year. We hope that having been invited to participate in the Seminar you are willing to approach it in this spirit.

Organization of the Seminar

The organization of the Seminar is in the hands of its members. Various alternatives have been suggested. We might split up into small groups for the next couple of months. These groups might be organized on the basis of a common scientific background or on the basis of interdisciplinary cross-fertilization. Certainly we should invite some distinguished visitors to consult with us, but it seems best to postpone such meetings until after Dr. Gilbert White's arrival in January. It must be emphasized, however, that the Seminar is primarily interdisciplinary in character. No one discipline, nor handful of disciplines, can hope to embrace the problems of total man in the total environment.

The sessions of the Seminar, however organized, will be taped and transcriptions of all sessions will be distributed to all members of the Seminar. It is hoped that these materials will assist substantially in the preparation of the book, or monograph, which is to be one of the end results of the Seminar.

Following the unanimous expressions of the faculty participants, a small number of graduate students has been invited to take part in the Seminar for credit. No doubt papers will be requested as a part of earning credit. However, we urge the graduate students to exhibit no deference to faculty members when participating in the discussions. (Some graduate students have enrolled NCD). -- So much for organization.

What is a Theory of Man-Environment Relationships?

In order to promote discussion at this first meeting I have attempted to frame at least a partial answer to the question, what is a theory of man-environment relationships?, or, in other words, what are we trying to construct? Obviously this question is the one we hope to answer during the academic year.

I wish to make three points. First, that the theory should be general; second, that it should be operational; and third, that it should be dynamic. May I define each of these briefly.

Today, the phrase "general theory" is virtually synonymous with systems analysis in the environmental field. I take this to mean that we must consider the total environment as an interrelated system which must be seen as a whole, but which can be broken down into significant units subject to correlation and reassembly.

Second, by using the phrase "operational" I mean that we must frame a theory which can be used to help solve problems and decide policy. Such a theory will necessarily have two characteristics. First, it must be possible to describe the theory mathematically as well as verbally and second, the mathematical construct must be amenable to computer operation.

Third, most obviously man's attitude toward his environment has changed over time, primarily because of the increase in his numbers and because of the effects of the knowledge explosion on the possibility of technological modification of the environment. Thus the simple theory or philosophy of the husbandman enunciated in the Judeo-Christian religion and strongly advocated by Thomas Jefferson is no longer relevant in any immediate sense to modern society. Equally, the Conservation Movement of the Theodore Roosevelt and Gifford Pinchot era is largely irrelevant today, despite the activities of the Sierra Club.

It follows that an acceptable theory of man-environment relationships must be one which is capable of embracing continuity over time while also being capable of dealing with quantum leaps in man's ability to manipulate his environment.

Having made these general and not particularly original observations, it may be useful for the purpose of opening discussion today if I raise a few questions pertinent to the Seminar. First, how can we identify the critical elements or components of the ecosystem with which we shall deal? Second, what are the essential unifying concepts of man-environment relationships from the point of view of the layman whose actual association with his own environment exhibits a multiplicity of forms, but at the same time is unified in the sense that all of man inhabits the space ship earth with its thin atmospheric envelope of life-giving properties?

Third, what are the attitudes of the scientists toward the environment; specifically how much validity is there to the mounting furor of claims that scientific discovery is being advanced without regard to the possibility of the destruction of the planet itself? And fourth, by what methods and procedures can a group of this sort attack the problems which I have described?

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS, 1969-70

Agenda for September 17, 1969

1. Introduction of Members of the Seminar
2. Discuss Calendar - explain reasons for alternate dates.
3. Description of bibliography. We have prepared an imperfect and tentative list of more recent publications dealing with Man-Environment Relationships. About 25 or 30 volumes of these will be kept in my office, Hellems Hnnex 239, and will be available freely to the members of the Seminar.
4. Academic future of the program: Organizing a degree in Man-Environment Relationships. Alternatives or steps toward this end:
 - a) Permit Ph.D., say in Geography, to substitute Environmental Relationships for one in his normal field.
 - b) Organize and designate existing seminars which are relevant to Man-Environment Relationships. Prepare brochure and catalog announcements calling attention to this opportunity.
 - c) Create new seminars in particular departments relevant to the Program.
 - d) Create new interdisciplinary seminars relevant to the Program.
5. Read Purpose of the Seminar
6. Discussion

SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS 1969-70

Participants

Professor Robert Ayre, Civil Engineering
Professor Jacqueline Beyer, Geography (Colorado Springs Center)
Professor Kenneth Boulding, Economics
Professor James Corbridge, Law
Professor James Downton, Sociology
Professor Ernest Flack, Civil Engineering
Professor Morris E. Garnsey, Economics (Director)
Professor Eugene Haas, Sociology
Professor John Ives, Arctic and Alpine Institute
Professor Curtis Johnson, Chemical Engineering
Dr. Samuel Johnson, Human Ecology, Medical School
Dr. Paul Julian, NCAR
Dr. R. Michael McClintock, Physics and Astrophysics
Professor David Rogers, Biology
Mr. Frank Smith, Program Planning Officer, ESSA
Professor Patrick Webber, Ecology, Arctic and Alpine Institute
Mr. Robert Bacon, Graduate Student, Geography
Mr. Ralph Brown, Graduate Student, Economics
Mr. Gilbert Hersh, Graduate Student, Economics
Mr. Walter Jessel, Graduate Student, Political Science

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

September 9, 1969

TO: Members of the Seminar
FROM: Morris E. Garnsey

The first meeting of the Seminar will be held on Wednesday, September 17 from 3:00 to 5:00 p.m. in UMC, room 158A. Listed below are the subsequent dates for the Seminar. The Seminar will be held in the University Memorial Center, however, specific rooms have not been set as yet for the subsequent meetings.

Organization of the Seminar will be a major topic for discussion at this first meeting and it is hoped that all the members will be able to attend.

SEMINAR DATES

September 17
October 1
October 22
November 5
November 19
December 3
December 17
February 4
February 18
March 4
March 18
April 1
April 15
May 6
May 20

Please note that October 22nd is the fourth Wednesday instead of the third Wednesday as originally planned. Also, please note that we have not scheduled any meetings for the semester break.

PROGRAM IN MAN-ENVIRONMENT RELATIONSHIPS

Proposed Seminar for 1969-70

During 1969-70 a small group of faculty and graduate students will conduct a Seminar centered upon the topic The Theory of Man-Environment Relationships.

Interest in this subject has expanded very rapidly in recent years and a number of books and articles dealing with various aspects of the subject have been discussed. So far, however, no one has attempted a general statement of The Theory of Man and His Environment. This the Seminar proposes to do; and it expects to publish its findings.

The Seminar will meet twice monthly on the first and third Wednesday from 3:00 to 5:00 p.m. during the academic year. Since this is a working Seminar regular attendance by the members is expected. The Seminar itself will work out the details for procedure. It is expected that a list of topics to be discussed will be developed and that individual members of the Seminar will give papers and reports on specific topics.

In preparation for these activities a bibliography of all recent materials relevant to the subject will be compiled and annotated as far as possible. Selection will be made of publications likely to be most useful to the Seminar.

The membership of the Seminar will not be completed until fall. However, the following persons have participated in the planning of the Seminar or have been invited to become members:

Professor Robert Ayre, Civil Engineering
Professor Jacqueline Beyers, Geography (Colorado Springs)
Professor Kenneth Boulding, Economics
Professor James Corbridge, Law
Professor James Downton, Political Science - Sociology
Professor Morris E. Garnsey, Economics (Director of the Program)
Professor Eugene Haas, Sociology
Professor John Ives, Arctic and Alpine Research
Professor Curtis Johnson, Chemical Engineering
Dr. R. Michael McClintock, Physics and Astrophysics
Professor David Rogers, Biology
Professor Patrick Webber, Ecology
A designated member from NCAR
A designated member from ESSA
Two or three qualified graduate students

REPORT ON THE UNIVERSITY PROGRAM IN MAN-ENVIRONMENT RELATIONSHIPS

June 2, 1969

The current academic year marks the third year of development of a Program in Man-Environment Relationships. The Program was launched in 1967 with a Conference on Social Sciences and the Quality of the Physical Environment held January 31, February 1 and 2, 1967, attended by a number of prominent leaders in this field. The Conference was followed by the publication of a book:

SOCIAL SCIENCES AND THE ENVIRONMENT

edited by Morris E. Garnsey and

James R. Hibbs,

University of Colorado Press, 1968

During the academic year 1967-68 a Faculty Research Seminar in Man-Environment Relationships was organized. This Seminar met monthly drawing its membership of about 45, from interested faculty members and staff of the National Center for Atmospheric Research and the Research Laboratories of the Environmental Science Services Administration. Various aspects of man-environment relations were explored by such speakers as Kenneth Boulding, Willard Libby and Edward W. Weidner, Chancellor of the University of Wisconsin-Green Bay.

In 1968-69 the Seminar concentrated primarily on two topics: Weather Modification and Air Pollution in the Denver Metropolitan Area. A copy of the program of the Seminar for this year is attached. A new feature of the Seminar this year has been the addition of graduate students to its membership.

The Man-Environment Program at the University of Colorado received a great impetus by the appointment in March of Dr. Gilbert White as Director of the Institute for Behavioral Science and Professor of Geography, effective January 1, 1970. Dr. White together with Professors Boulding and Garnsey will constitute a steering committee to develop the Program. It is expected that within a year or two a number of interdisciplinary seminars in man-environment relationships will be offered and that it will be possible for masters and doctoral candidates in several fields to include a sound background in man-environment relationships as a regular part of the graduate program. It is also contemplated that undergraduate courses will be offered.

Finally, the immediate program for next year is described in the attached document.

/s/ Morris E. Garnsey
Director

FACULTY RESEARCH SEMINAR IN MAN-ENVIRONMENT RELATIONSHIPS

Programs 1968-69

October 23, 1968:

- Dr. Helmut Weickmann, Director, Atmospheric and Chemistry Laboratory, ESSA -
"Technical Aspects of Weather Modification - The Great Lakes Experiment."
- Dr. Joachim P. Kuettner, Director, Office of Advanced Research Projects, ESSA -
"Man-Environment Experiments in Weather Modification."
- Dr. Eugene Haas, Professor of Sociology, University of Colorado - "Social
Aspects of Weather Modification."

November 13, 1968:

- Dr. Archie Kahan, Chief, Office of Atmospheric Water Resources, Bureau of
Reclamation, Denver Federal Center - "Project Skywater: The Bureau of
Reclamation's Atmospheric Water Resources Research Program"

December 11, 1968:

- Dr. Perri Stinson, Professor of Environmental Engineering, University of Denver -
"Optimization Problems in Weather Modification Research."
- Dr. Lewis Grant, Department of Atmospheric Science, Colorado State University -
"Weather Modification Projects at Colorado State University."

January 8, 1969:

- Professor Kenneth Boulding, Professor of Economics, University of Colorado -
"General Systems in Social and Physical Sciences - with Special Appli-
cation to Weather Modification."

February 12, 1969:

- Mr. Loren Crow, Consulting Meteorologist, Denver - "Meteorology of Air Pollution
in the Denver Airshed."
- Professor Paul Urone, Professor of Chemistry, University of Colorado - "The
Chemistry of Air Pollution."

March 12, 1969:

- Dr. Roger S. Mitchell, Director, Webb-Waring Institute for Medical Research,
University of Colorado Medical Center - "Medical and Health Aspects of
Air Pollution."

Professor Gary Widman, University of Denver Law School - "Legal Aspects of Air Pollution."

Professor Jay Crowe, Professor of Sociology, Denver Center - "Social Aspects of Air Pollution."

April 9, 1969:

Mr. Leonard Dobler, Chief of Engineering, Air Pollution Control Division, Denver Building Department, City and County of Denver and

Mr. Charles Martinez, Chief of Inspection, Air Pollution Control Division, Denver Building Department, City and County of Denver - "Problems of Administration and Enforcement."

Dr. Edward W. Walbridge, Department of Astro-Geophysics, University of Colorado - "Minimal Air Pollution City."

May 14, 1969:

Dr. Thomas W. Bilhorn, Director, Division of Facilities, NCAR - "Designs and Decision for Environmental Quality: An Environmental Engineer's View of Here and There and the Odds on Getting Anywhere."

Panel: Professor Robert Ayre, Chairman, Civil Engineering, University of Colorado

Dr. Thomas Flynn, Chief, Office of Program Development and Evaluation, ESSA

Professor Eugene Haas, Professor of Sociology, University of Colorado

Professor Curtis Johnson, Chairman, Department of Chemical Engineering University of Colorado.