The International Society for Ecological Psychology

Volume 2 Number 1 NEWSLETTER May 1985

Contrary to the evidence in front of your nose, this Newsletter was not intended as another vehicle for spreading publication lag. So much for good intentions.

## BINGHAMTON 84

The events (händelse) of the 1984 Annual Meeting of the ISEP occurred as advertised.

The Society's leisure class first met at the Singer - Link plant in Binghamton for the Friday morning (Oct. 26) tour arranged by Dean Owen. Salient features were:

Machine Ecology

1. Simulation of flight is a technology in its own right. Designing and building aircraft to fly have precious little to do with designing and building simulators.

2. Building one simulator costs hundreds of thousands, often millions, of dollars and many months. The magnitude of the task is so great that 11 is a very large number of civilian simulators for a major plant to be building at one time. Taken together, the complexity and expense explain why building simulators and planes are separate industries. Simulators are not casual byproducts of aircraft production.

3. There are two competing criteria for the quality of a simulation --

A. the "feel" of a simulator to an experienced pilot, and

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B. objective data on simulator response characteristics under specified conditions. Without always being very precise, the customer wants the simulator to be as realistic as possible so that training on it will in fact be training. The manufacturer must sell the simulator and cannot risk the customer's refusing to purchase it because a pilot doesn't like the "feel". Consequently purchase agreements now include a specification of objective characteristics the manufacturer agrees to match -- no matter what a testing pilot may conclude.

Corporate jets are becoming bigger business than airlines.

Social Ecology

1. Engineers (the males) are barely old enough to shave. One forgets that Bachelors Degrees are marketable in some disciplines.

2. Link is a surname.

Orienting Ecology

1. One can get lost in Binghamton.

Note that the most thought provoking aspects of the tour concerned the problem of simulation itself. The visual displays we thought we might see were not included on the tour. Since so many topics in psychology depend on simulation arguments we look forward to contributions in these pages from people who wrestle with such concrete problems. Jane Conway's talk on Saturday extended our appreciation of simulation problems by describing the particular case of simulating the control of very slow changes such as occur in steering large ships like oil tankers.

In nearby Ithaca, New York, Eleanor Gibson and her students had prepared the Cornell Infant Labs for our inspection in the afternoon. It is amusing to realize that the category "psychological equipment" has been extended to include waterbeds and skating rooms -- under the same roof as original Hipp chronoscopes and Titchener's pickled brain.

The James J. Gibson Memorial Lecture, given by Dick Neisser, completed the Friday agenda. The Homecoming (Neisser's and Cornell's) audience was treated to a glimpse of his recent work on categorizing, extensions of his own work and some of Jimmy Gibson's ideas to topics most often associated with the research of Rosch and Keil in recent years.

Saturday, back in Binghamton, was filled with talks, a lunch discussion, business, and Posters.

Election

At the ISEP business meeting, Carol Fowler, John Kennedy, and Ed Reed were elected to the Board of Directors, Fowler and Reed for two years, and Kennedy for one. Board members and their years for reelection or replacement are listed here.

| October 1985 | October 1986 |
|---|---|
| Margaret Hagen | Carol Fowler |
| Robert Hoffman | Eleanor J. Gibson |
| Mari Riess Jones | James J. Jenkins |
| John M. Kennedy | Joseph Lappin |
| Nathan Knobler | Ulric Neisser |
| William Mace | Edward S. Reed |
| Robert E. Shaw | Sverker Runeson |
| Scott Kelso | |

Poster Session Research

Since the schedule of posters was not sent around in advance, here is a list of those presented:

Becklen, R. & Stoffregen, T. Effects of cross-modal specification, redundancy and practice in a dual attention task.

Carello, C. & Turvey, M. T. An ecological perspective on baseball's "illusions".

Gibson, E. J. & The Infant Lab of Cornell University. Surface continuity as a factor in the affordance of traversability.

Gibson, E. J. & Stoffregen, T. Peripheral optical flow in standing, young walkers.

Hettinger, L. J. Increasing sensitivity to descent information.

Kay, B. Rhythmic wrist movements modelled as coupled nonlinear oscillators.

Owen, D. Higher order variables specifying self motion: Some success and some problems.

Pallos, I. Are there spirals in the twisted cord illusion?

Rosenblum, L. Coordinating rhythmic movement: Von Holst revisited.

Todd, J. T. Perception of structure from motion without projective correspondence.

Whang, S. & Warren, W. H. Visual control of walking through apertures.

Wolpert, L. & Owen, D. Flow interferes with descent detection.

Sampler of Talks

The morning session on symbols and language included presentations by Howard Pattee and Carol Fowler, abstracts of which are presented here.

Phonological Realism

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According to a "mentalist" theory of phonology, the phonological constituents of words are mental constructs that neither appear in the talker's articulations, nor (therefore) are specified in the acoustic speech signal that serves as stimulation for the listener. As Hockett's well-known "Easter-egg" analogy is meant to reveal, in this type of theory, phonological segments have properties that prevent their nondestructive realization in a vocal tract; therefore, necessarily, perception of the segments must be reconstructive and indirect.

A theory of phonological realism would take a quite different view. According to such a theory, to the extent that phonological segments are constituents of words and more generally are part of a language user's "linguistic competence", they have no properties that cannot be articulated -- indeed, they are articulatory in nature -- and they can be fully specified by an acoustic speech signal.

There are apparent barriers to a theory of phonological realism in descriptions of essential properties of phonological segments provided in the linguistics literature. In particular, the segments are characterized as discrete, static and context free, whereas in articulation they are said to be merged together, dynamic and context sensitive. The first two properties can be eliminated as barriers. The supposed static nature of phonological segments does not work in linguistic theory, and the idea that segments are discrete can be replaced by one that they are overlapping but separate in articulation and therefore are separable by listeners. The third barrier, that phonological segments are context - free in the mind, but context - sensitive in the vocal tract, may also only be apparent. Articulatory invariants corresponding to phonological segments have not been found to be sure; nor, however, have they been eliminated as possible.

If these barriers can be eliminated to the view that phonological segments can be uttered, then a major barrier is also eliminated to a theory that they are directly perceived from an acoustic speech signal.

Symbol System Origins:
Some Evolutionary Models

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Theories of biological evolution depend fundamentally on the genotype-phenotype distinction. Genes function as strings of discrete units that constrain the physical dynamics of the phenotype. Evolution is the primeval case of a symbol-matter relation. Our aim is to simulate this relation, that is, to make a working model of an evolving system. The problem is that theories of symbol strings, i.e., logic, mathematics, computation, language, have nothing to do with physics,while theories of physics have nothing to do with symbol strings. In cognitive theories this problem is reflected in the two extreme approaches to modelling the brain, the information processors who reject physics as irrelevant and treat symbol strings as the essence of cognition, and the ecological psychologists who regard symbol strings as irrelevant and treat physical interaction as the essence of cognition.

To relate symbols and matter in a model requires asking questions about the physics of symbols. Why are strings so effective in constraining the morphology and dynamics of material systems? How do physical systems generate symbols, e.g., measurements? Strings have special physical properties that bear on these questions. The unique, intrinsic sequencing of strings allows ordered physical access without a scanning rule. Each element of a string is also physically accessible at any time, i.e., they have no inside or outside. Strings are a novel state of matter (1 - dimensional crystals) that allow folding. Folding generates entirely new physical constraints; that is, folding results in natural implications or emergent behavior that is not possible in a formal string system without embedding it in a complex simulation of the physical world. At present we do not know how simple a model of the physical world can be, and still produce significant evolutionary behavior in string-controlled systems.

## Ecological Psychology and Nuclear Exterminism

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James Gibson (1979) proposed that the starting point for ecological psychology is the mutuality of active, perceiving organisms and the meaningful environment. To emphasize that an animal's environment is real and not a phenomenal construction, Gibson wrote, "The organism depends on the environment for its life, but the environment does not depend on the organism for its existence," (p. 129). Yet today it appears that the environment does depend on some animals for existence, for our species can destroy the intricate fabric of the entire ecosystem in a matter of minutes. We sense that there is a deep contradiction in our field, when the fruits of our research are applied to designing the extermination of the very ecological systems that we have dedicated our lives to understanding. The contradiction is greater since we think ecological psychologists are particularly well situated to challenge such

## 1985 ANNUAL MEETING

Saturday, October 19

Trinity College
Hartford, Connecticut

The program will focus on theoretical/ philosophical issues in the morning and theoretical/ physical issues in the afternoon. A poster session for research will again be held.

PLAN YOUR POSTERS!

## Members Speak Out

The Saturday meeting was punctuated by a lunch period discussion of professional responsibility led by Bill Warren and Ed Reed. A short version of their position paper is reprinted here. Robert Shaw contributed a lengthy reply that was also available at the meeting. The longer version of Warren & Reed may be obtained from Bill Warren. I have copies of Shaw's paper.

anti-ecological"exterminist" trends. The remarkable adaptive, self-preserving integrity of living systems that is the basic phenomenon of our field should not only lure us to research, but must also be adopted as an ecological imperative to guide our political actions.

What has brought modern scientists to the point where they can collaborate in their own self - annihilation? A dominant attribute of science since the sixteenth century has been its objectification of nature and the natural world. This world view has had three corollaries of immediate concern to us here: the self - proclaimed role of the scientist as a neutral, disinterested observer; the belief that human beings are endowed with special rational powers (language, intelligence, consciousness) that separate us from the rest of the natural world; and the ideology of mechanism, which treats nature as an inert device with independently manipulable parts, subject to prediction and control. Each of these tenets has served to legitimize the human exploitation and domination of nature, up to the ultimate domination represented by nuclear weapons. We believe that the rejection of this posture is congenial to -- indeed, is implicit in -- ecological psychology. We are in a position to challenge the hubris of our species' belief that it is above nature and can manipulate nature with impunity. We must recognize our place as animals within the ecological web: What befalls the ecosystem befalls us along with it.

It is not hard to see why one would oppose nuclear war and the destruction of the ecosystem. What is difficult is to see how this threat intersects our own research, and what to do about it. Over one third of all scientific and technical personnel in the U.S. work under military contract, and the Defense Department's R&D budget for weaponry alone is 15 times the entire budget of NSF. The growth of a vast military, industrial, political, high-tech R&D, and security apparatus has come to so dominate our social priorities and values that the social historian E.P. Thompson has christened our mode of life "exterminism." Our proposal is that this military - industrial - research establishment is a threat to survival so abhorrent in its proportions that we are forced to adopt a stance of noncooperation.

How is it possible for a supposedly advanced society to commit its major material, intellectual, and moral resources to an economic sink -- at best useless, at worst suicidal -- all in the spiritual service of Thanatos? The only rationale we are given for this seeming death - wish is deterrence. But under scrutiny, reality runs counter to deterrence logic. First and foremost, it is the U.S., not the Soviet Union, that has upped the nuclear stakes by initiating each new generation of weaponry. Second, escalation under deterrence logic has not led toward an improved defense or greater security, but greater instability, by promoting high accuracy, short flight times, "launch on warning" strategies, and serious entertainment of the delusions of a completely preemptive first strike, a "limited" theatre nuclear war, and a blanket "star wars" defense. Thus, deterrence logic has led paradoxically to its own negation -- a heightened risk of nuclear war -- and in the process legitimized expanded weapons production. The basic facts remain that the arms race is in the short - term interest of the U.S. war - based economy, whereas Soviet economic pressures are against such wasteful production; that the U.S. has been leading the arms race, while a threatened Soviet Union has been trying to keep up.

We find it untenable to participate in servicing such a system. Military research neither serves our nation's defense, nor helps to maintain a stable balance of deterrence, but contributes to a profit-making enterprise that contaminates our moral life and makes the whole world less secure. Defense - funded "non-military" research serves the related functions of lending the war-production system legitimacy and making intellectuals beholden to military interests. By participating in the weapons complex of military grants, channeled "basic" research, applied research and

development, training, and so on, scientists collaborate in the bilateral march toward annihilation. More subtly, they promote the exterminist trend within society itself, the infiltration and acceptance of military priorities, and a mode of life predicated on death -- not just our own, but that of the ecosystem.

What are the implications of this exterminist context for those of us in ecological psychology? The research environment created by exterminist funding priorities, corporate interests, technological trendiness, and the political climate may color our work on ecological problems in ways we are only beginning to be aware of. Among other things, this context influences what research problems are found to be interesting, "hot," even scientifically valid. Typically, this has been accompanied by a move away from natural human situations and toward artificial, alienated ones, with the human subject treated as an input-output component in a larger device -- the objectification of nature as machine extended to ourselves. Crudely, the extent of exterminist influence in ecological research is reflected by the extent to which our task situations approximate the cockpit of a fighter aircraft. Why is it better, for example, to present computerized luminous dots on a CRT with an on-line joy stick, than to create simple situations in which people can act on the perceived affordances of real objects and events?

There is, of course, no clean line dividing "ecological" research from "exterminist" research -- but that does not mean that there is no specific difference. Broadly speaking, it is the difference between working on projects whose most immediate potential is to contribute to human well-being, and those whose most immediate potential is to degrade or place at risk human life or the natural environment. The sorry state of science under exterminism is that any progress toward a deeper understanding of the way natural systems operate can, with enough work and enough resources, be turned against those systems, ever more efficiently and totally. But we do have a choice: between research with direct military applications and that related to human well-being, between approaching the military with open arms and resisting the expropriation of our work, between collaborating with the exterminist system and working to change it.

For our part, we have decided not to apply for grant money from military agencies, not to use military research facilities such as labs or the ARPA net, not to attend military - sponsored conferences or accept military travel money. In research, we propose to concentrate on the ordinary activities of organisms, trying to integrate formal laboratory research with more naturalistic studies, while going out of our way to bury possible military implications. We also anticipate having to choose not to work on some problems because of their direct applications. These choices have consequences. Our laboratories may be under - funded, our research may not proceed as quickly, and the parade of Big Science may pass us by. But by these forms of active noncooperation we attempt to disentangle ourselves from the exterminist context as much as possible -- short of quitting research -- to resist its influence, withhold legitimation, and maintain our independence.

More positively, we hope to promote conceptual work on the relations between ecological science and the present social crisis. As a group, we can help preserve our sanity, work to reverse the trend toward militarizing science, lobby for increases in non-military funding, and organize scientists to publicly oppose destructive applications of research and the nuclear threat itself. With their dedication to living systems and their habit of systemic analysis, ecological scientists are in a unique position to move from disinterested observers to active advocates for the life of the ecosystem.

AROUND ACADEME

## Seeing Cognitive Science Through Ecologic-Colored Glasses

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Everybody's a Cognitive Scientist these days, even though no two people may agree on what it means to be one. At UCSD, we have a program in Cognitive Science that has held weekly seminars for several years now. We are indeed an interdisciplinary group, it being more the rule than the exception for Psychology, Anthropology, Music, Communications, Linguistics, and Sociology all to be represented at any given meeting of the seminar.

During the Fall quarter of 1984, the main task undertaken by the Cognitive Science seminar was to read and discuss P.N. Johnson-Laird's 500-page book, Mental Models. The book is a hodge-podge of topics that have interested mainstream cognitive psychologists over the last 15 years, including logic, language, and imagery, among others. Whereas it was often noted in the seminar that Johnson-Laird was very clever and a persuasive arguer, the overall conception of the book was negative; a number of the participants would agree (at least privately) that the book might have been better entitled Mental Muddles.

From an ecological point of view, the heart of Johnson-Laird's incoherence occurs in a section beginning on page 399 called "How do mental models represent the external world?" It seems clear that Johnson Laird used his writing of this section as a way of working through the problem; it is equally evident that, by the end of the section, he has not made any appreciable headway. There is just no way Johnson-Laird can get the environment into his theory; although he is formal about the way he represents what is going on in the organism, he has reserved no formal place for the environment as a source for his "mental models".

Another thing Johnson-Laird attempts to do, and fails, in this revealing section of the book, is to specify those conditions under which an internal representation is needed, and what counts as evidence for the operation of an internal representation. Z. Pylyshyn also grapples with this problem to no clear conclusion in his most recent book. It is certainly a credit to Johnson-Laird and Pylyshyn that they attempt to confront an issue that most cognitive psychologists have ignored, sidestepped, or assumed obvious. But to me it borders on scandalous that a notion which is so central to current "cognitive" thinking as internal representation is so poorly developed, i.e., we don't know how to specify when one is needed and we don't know what counts as evidence that one exists.

During the Winter quarter, the seminar tackled materials by Putnam ("The meaning of meaning"), Dretske (Knowledge and the Flow of Information, and Barwise and Perry Situations and Attitudes. I believe these readings constitute a kind of middle ground between what most of present-day Cognitive Science is about and the concerns of ecological psychologists. Can a more ecological approach be incorporated into Cognitive Science without the latter coming apart at the seams? Stay tuned for later reports.

ISEP NEWS & Weather
Jean Paul D'Arpa

From around the corner and around the world, ecological topics make news. However, even the scrupulous news hound may experience some difficulty in identifying the good news, the bad news, and the ecologically valid news. To assist you in the quest, our crack team of reporters and stringers brings you News & Weather of ecological psychology. The particular orientation of topics, the slant of the stories (or, is it tilt?), varies from one installment to the next, but the general perspective is the familiar one.

KOESTLER'S REVENGE -- Remember Beyond Reductionism? One of its editors, Arthur Koestler, was an imaginative if unorthodox intellect, and a friend of psychology. It seems only natural, then, that after his death (by suicide) a portion of his estate should be used for endowing a chair in psychological research, and Koestler's trustees have identified the University of Edinburgh as the beneficiary. But this isn't any ordinary psychology job. If you are thinking of applying, you will have a distinct advantage if you are telepathic, if you can levitate objects, if you possess acute powers of precognition, or if you can change yourself into a bat or a wolf. At the very least, you should sleep in a coffin, cast no reflection in a mirror, bend keys psychokinetically, and do a couple of card tricks. You see, the Koestler Memorial Chair is only fit for the girth of a parapsychologist, and according to Prince Charles, Chancellor of the University, such an appointment will "advance our knowledge in a field that has been given scant attention." The ultimate decision will be made by Koestler himself from the true world beyond this one, who will participate in meetings of the senior faculty via Ouija board.

FRONTIERS OF ARTIFICIAL INTELLIGENCE -- Just when you thought it was safe to crank up the ole ROM's, PROM's, and 6800's (or 8088's) again, comes this dreadful item from an issue of the Morbidity and Mortality Weekly this spring. It seems that a die - casting machine killed a machinist (H. sapiens) who got too close to it. This marks the beginning of an era, we may suppose, for it is the first recorded instance of a death caused by a microprocessor controlled factory drone, though the official language is much more ominous: The incident is classified as a robot - related death. Is this the clarion call, in which one form of intelligence (superior, heroic, dispassionate, computational) does battle to the death with its inventors (irrational, skeptical, loyal, and intuitive)? Probably not, although such a fantasy is consistent with such luddite technofears of the last two hundred years. We of the ISEP know that, in truth, the "robot" is no more capable of malevolence than is a washing machine or a toaster. But, beware!! The next time your local nerds start chanting about the beliefs of computers and the necessity of considering them to be "beings", they will surely try to get huge grants to study this growing menace in the factories, in the businesses, and, yes, in the laboratories of the world.

DRUG NEWS I -- One index of human ecology produced each year by the Food and Drug Administration is the report entitled "Drug Utilization in the United States." The most recent information contained in the report extends through 1983 (where were you two years ago?), and shows some changes relative to our prior steady state. In this survey of prescription pharmaceuticals, the big finding is that tranquilizers and sedatives are losing their popularity, and that the aging of the population is reflected in the increased use of cardiovascular and arthritis medications. Top five prescriptions for 1983 are cardiovascular drug Lanoxin at #5, Valium at #4 (having slipped from #1), the Tylenol - Codeine goofball at #3 (climbing from #6), and at #2 and #1, two hypertension preparations,

Inderal and Dyazide. Of course, there is one simple problem in interpreting these data. Either we are aging faster than we are calming down, or . . . well, you teach the courses in experimental design and evaluation. You figure out the problems.

DRUG NEWS II -- Did you hear the one about Leishmania? This is an intestinal parasite that causes human visceral leishmaniasis, also known as Kala-azar and Dumdum fever. You don't want to know the symptoms, so just play it safe by staying out of the regions where this parasite is mainly found (India, China, Russia, Africa, the Mediterranean basin, and Central and South America). Well (here's the joke), Science this spring carried a report about these little bugs that was rather extraordinary. For reasons best known to a biophysicist, these protozoans were given anti-depressant medication -- and, they ruptured their membranes . . . laughing? Who can say what thoughts occur to a depressed protozoan.

TOYS ARE WE -- Have you been wondering what little items to get for the youngsters to permit them to learn about the world by playing with things that represent affordances scaled to their half - pint size? If so, you will welcome the news about G.I. Joe's adversary. What is G.I. Joe, you ask? Well, to make a long story short, he is a warrior Barbie doll who comes with a complete arsenal of special forces tools instead of a wardrobe, jacuzzi and cosmetology salon. The motivation for the G.I. Joe toy must be to create or to enhance fierceness in children who play with it. Now, just as Barbie doll has Ken doll for companionship (Ken is a graduate of Andover and is a freshman at USC) G.I. Joe has Zartan the Enemy. What is Zartan, you ask? Schizophrenic, that's what, according to Zartan's manufacturer, Hasbro. Imagine the salutary effect this will have on play therapy sessions! When several mental health groups requested that Hasbro change the identity of the Zartan toy, naturally Hasbro agreed to comply, but only in the next press run. So, check the stores near you. It may not be too late to get your offspring an authentic schizophrenic toy.

MISPERCEPTION OF THE MONTH -- ISEP member P.E.R. reports that someone he knows told him that a Necker cube looked three dimensional!

## OTHER PEOPLE'S MEETINGS

### Report From International Congress

The September, 1984 International Congress of Psychology in Acapulco, Mexico, included a number of symposia on perception and action and quite a bit of discussion of ecological psychology. A symposium on "Gestalt Psychology and Information Processing" included papers by Gunnar Johansson and Sten-Sture Bergstrom of Sweden, Emanuel Leeuwenberg of Holland, Klaus Landwehr of West Germany, and Robert Hoffman and Joseph Perczel of the U.S., among others. A symposium on "Sensory Substitution" included a paper by Gunnar Jansson of Sweden and the symposium "Motor Learning and Action Systems" was chaired by David Lee of Edinburgh and included discussions of ecological ideas by George Stelmach and Karl Newell of the U.S.

At these symposia, and at less formal gatherings, a number of issues were discussed, such as: (1) The issue of stages in perception. (2) The issue of the perception of information versus perception via information. (3) The role of Gestalt laws of form in a psychology of perception. (4) The issue of dynamics versus statics (which is basic to perception and on which should a theory of perception be based?). (5) The issue of stimuli versus configurations.

There were spirited debates on the role of motion in visual perception, including some insightful comments by Stephen Palmer of Berkeley, and spirited debates about Gestalt notions. There were also a number of frank discussions about the need for research programs in the ecological psychology of perception and action--that is, ecological psychology as a research strategy. Some raised the concern that ecological psychologists spend more time theorizing than conducting research, and that when they do research they care not about "control" groups. There was a sentiment that it is now time for ecological psychology to "put its money where its mouth is."

Overall, there was general agreement that ecological psychology offers a number of imortant ideas and challenges, and that it also faces many problems--such as "explaining" the Gestalt laws and integrating "coding theory" approaches to form perception.

Proceedings of the Congress will be published by North-Holland in the Spring of 1985.

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LETTERS

This letter is written to express my delight at being a member of a group that cares enough to circulate and discuss papers such as the one Warren and Reed wrote on exterminism. Whether or not one agrees with everything they say, there are warheads pointed at us all and it is important for us to grapple with this problem in whichever way we feel is best. The ecological view, with its focus on naturally occurring integrated systems, can provide us with guidelines to replace the separatist and divisive views that fuel the cold war. We have a singular opportunity to use our expertise to further scientific and social policies that are calibrated to human scale and human needs.

Scientific progress has always involved problems. But most of us still survive the effects of past scientific and social policymakers well-intentioned but serious errors (DES -- designed to prevent miscarriages now causing cancer; asbestos -- mined to contain fires now killing workers; the green revolution -- designed to improve poor economies now replacing millions of agricultural workers with machines and leaving them homeless and starving). In today's nuclear climate, good intentions, scientific expertise, and margins for error are not enough. Recall Einstein's regrets about the fruits of his knowledge. He once recommended the nuclear project to Roosevelt and then relentlessly tried to retract that recommendation. He wrote to all the heads of state around the world urging them not to drop the bomb. Recall also Oppenheimer saying that he knew the questionable moral implications of creating the bomb, but he could not resist the intellectual challenge.

The situation we are in today has no precedents. We cannot appeal to the criteria we have used in the past. We do, however, have substantial evidence about the effects of nuclear incidents on our health and well being. The primary issue is survival, both our own, our children's, and their children to come. My concern is that the issue of nuclear threat, and what we may inadvertently be doing to exacerbate that threat, can be obscured by extraneous factors. We may lose sight of the danger in pursuing our alternate concerns. I hope, however, that no matter what each person believes about nuclear armament, the role of scientists, or the possibilities for remediation, she or he would try to keep the issue of nuclear threat clear and do whatever can be done, in whatever way, to help avert it.

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BOOK REVIEWS

The Consequences of Body Size - A Review of Three Recent Books

T. A. McMahon and J. T. Bonner, (1983), On Size And Life, Scientific American Library (Distributed by W. H. Freeman, NY).

R. H. Peters, (1983), The Ecological Implications Of Body Size. Cambridge, U.K.: Cambridge University Press.

W. H. Calder, III, (1984), Size, Function, and Life History, Cambridge, MA: Harvard University Press.

These three new books all discuss the consequences of body size for factors such as metabolic rate, bone proportions, energetic costs of locomotion, as well as population and territory size. The relations turn out, nearly invariably, to be allometric. That is, they are power functions and thus linear on log-log plots. This work surely has important implications for ecological psychology; The affordances of a surface for support or as a falling-off place, the energy costs of different rates and modes of locomotion are all related to body size.

McMahon & Bonner have written the least technical and broadest of the three. They cover plants, microrganisms and human artifacts such as boats and bridges as well as animals. They give a clear introduction to the basis mathematics, do fairly full derivations, and give emphasis to the physical principles underlying the allometric relations. McMahon's principle of elastic similarity is discussed in detail, showing why we should expect the common finding that diameters of supporting members are in proportion to the 3/2 power of their lengths.

The concept of dimensionless numbers is nicely presented. The authors include an explanation of how the numbers are derived and illustrations of their value in gaining insight into various phenomena. Two examples, the Reynolds and Froude numbers, are illustrated in variety of situations. Their roles in terrestrial locomotion, bird flight and in scaling problems in testing reduced-size models of boats are discussed.

The book is written in a clear, engaging style, and is well illustrated. This is popular science at its best.

The other two books are aimed at the specialist, giving surveys of the current state of research on allometric relationships found in animal structure and function. Peters' book is the driest of the three, aiming at providing a summary of empirical relations. Following

Hume, he is dubious about the value of causal explanations. Long appendixes give summaries of hundreds of studies, including the type and number of subjects used, values of parameters in regression equations, etc. Peters gives a great number of examples of how one can manipulate the equations to extract their various implications.

Calder covers much the same ground, but shows a greater concern for the underlying causal factors. He also attempts to find implications of the results for the theories of evolution and sociobiology. In one section, he discusses the relation of body size to the pitch of animal vocalizations and the animal's territory size. Small animals necessarily produce high pitched sounds, which, due to internal friction as sounds move through air, attenuate more rapidly than lower frequencies. Small animals also tend to hear higher frequencies well and to have territory sizes linearly related to body size. Thus, all these factors are tied to body size in a way appropriate for effective communication.

Even if you don't feel the need to integrate this work into your own research, the material has a good deal of intrinsic interest. The ideas of physiological time (the total number of heartbeats in a lifetime seems nearly invariant over species), bacteria living in a world dominated by viscous forces, and how the Lilliputians should calculate Gulliver's food allotment are fun to play with.

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