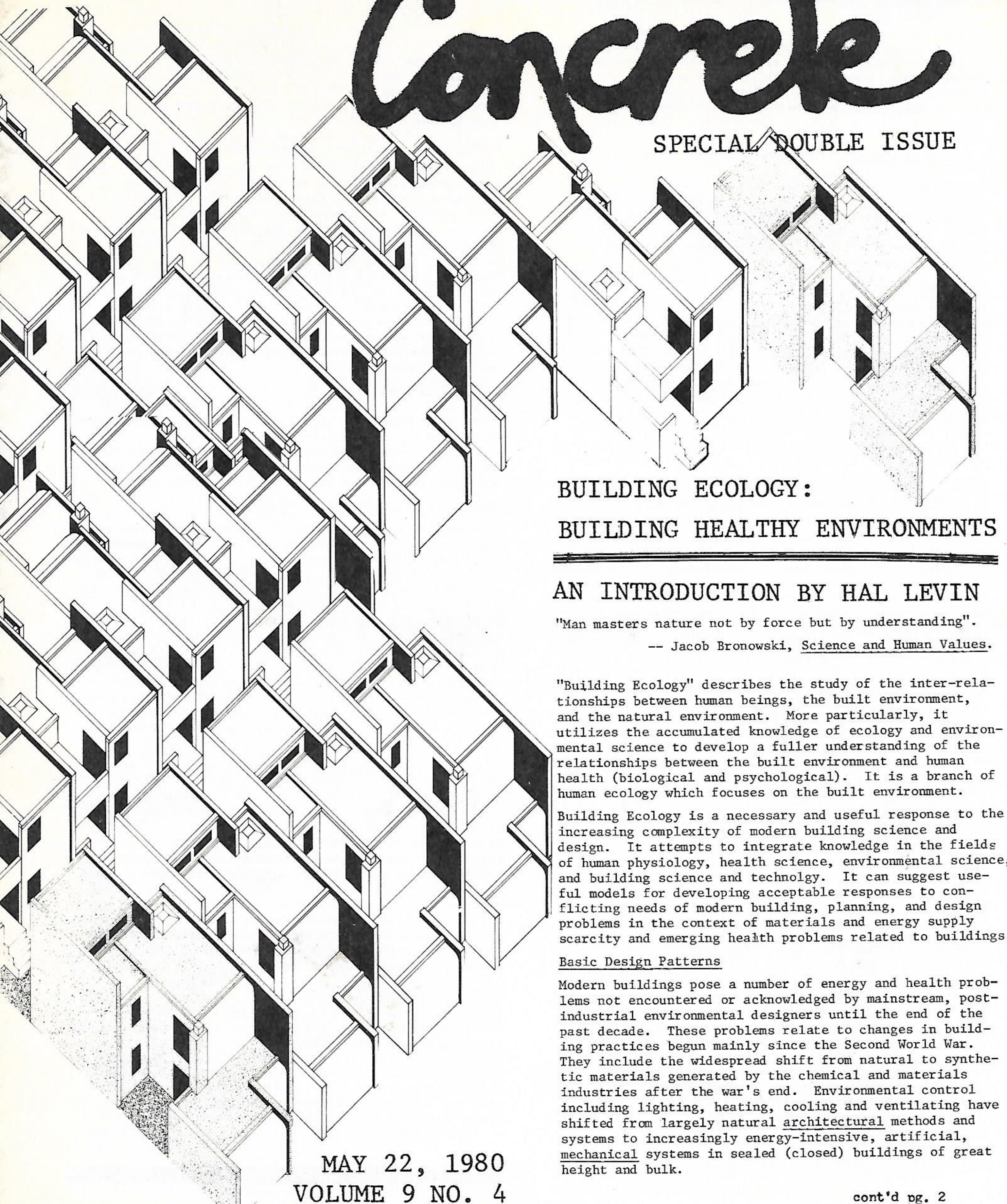
Concrete

SPECIAL DOUBLE ISSUE



BUILDING ECOLOGY: BUILDING HEALTHY ENVIRONMENTS

AN INTRODUCTION BY HAL LEVIN

"Man masters nature not by force but by understanding".

-- Jacob Bronowski, Science and Human Values.

"Building Ecology" describes the study of the inter-relationships between human beings, the built environment, and the natural environment. More particularly, it utilizes the accumulated knowledge of ecology and environmental science to develop a fuller understanding of the relationships between the built environment and human health (biological and psychological). It is a branch of human ecology which focuses on the built environment.

Building Ecology is a necessary and useful response to the increasing complexity of modern building science and design. It attempts to integrate knowledge in the fields of human physiology, health science, environmental science, and building science and technolgy. It can suggest useful models for developing acceptable responses to conflicting needs of modern building, planning, and design problems in the context of materials and energy supply scarcity and emerging health problems related to buildings.

Basic Design Patterns

Modern buildings pose a number of energy and health problems not encountered or acknowledged by mainstream, post-industrial environmental designers until the end of the past decade. These problems relate to changes in building practices begun mainly since the Second World War. They include the widespread shift from natural to synthetic materials generated by the chemical and materials industries after the war's end. Environmental control including lighting, heating, cooling and ventilating have shifted from largely natural architectural methods and systems to increasingly energy-intensive, artificial, mechanical systems in sealed (closed) buildings of great height and bulk.

cont'd pg. 2

MAY 22, 1980

VOLUME 9 NO. 4

Electromagnetic Environment

Brightly-illuminated (fluorescent) interiors have replaced incandescent and daylit spaces. Increasing use of electric equipment of all types have significantly changed the electromagnetic and electrostatic environments indoors. Many office workers, factory workers, and students spend their days in front of computer or microfilm screens; considerable concern has emerged about the impacts of these systems on their users' health and functioning.

Chemical Environment

Maintenance, fire retardant, stain repellant, and other chemicals abound -- most of them new products with considerable release to the environment. Building materials, adhesives, furnishings, and equipment also consist primarily of modern chemical products often suspected or confirmed as toxic or carcinogenic.

Occupancy Patterns

Building occupancy patterns have changed considerably during the past eight decades as occupations have shifted most workers from outdoors to indoor jobs. Modern building technolgoy, particularly fossil-fuel powered environmental control systems have encouraged development of unfriendly climates (Palm Springs, San Fernando Valley, space colonies are even 'seriously' proposed) requiring many people to spend large portions of time indoors sheltered from the elements. The result is that estimates currently suggest Americans typically spend from 70 to 90 percent of their time indoors.

Energy, Ventilation and Health

As buildings have become increasingly dependent on energy-based environmental control systems, the cost and availability of energy have become increasingly critical. The rapid decrease in cheap, readily-available energy supplies has resulted in a rush to save money/energy by tightening builidng envelopes and reducing ventilation rates. Pre-Arab oil embargo rates of 3 to 10 air changes per hour have been revised downward to 1.5 air changes per hour or less; and many serious health hazards result from increased concentrations of air pollutants. Many contaminants are generated by the buildings themselves; some are produced by the occupants; and some, like the bacteria linked to Legionnaires Disease and like cancer-producing radon gas, orginate outside. Many of these contaminants are concentrated, bred or intensified by the building itself.

From the energy crisis (and the drought in California) many of us have learned that we can get by on far less, that we had acquired careless habits of design and consumption during years of apparently abundant, cheap supplies of these and other resources. Now we are facing a squeeze on resources of all types, and we have not yet discovered the implications of adapting our buildings to new constraints.

Research conducted recently suggests that simple modification of existing approaches and technologies will often result in serious health hazards. Many of these hazards relate to substances or problems with which we have frightfully little experience. What experience we do have suggests that the interactive effects of diverse hazards and components of the built environment may have effects which are several orders of magnitude greater than the individual or even additive effects of combined hazards. At worst, we man be conducting a lethal human genetics experiment whose delayed results may not manifest for many generations.

Eco-Systems Approach

At best, we can draw from the ecologists' experience and models to develop principles and techniques of design which will produce environments capable of sustaining and supporting human life healthfully and for a long time. Many lessons are obvious, others will require deeper digging and creative translation from the ecologists' paradigms. Hopeful solutions to serious problems such as indoor air pollution can present themselves in the form of passive heating, cooling, and ventilating systems; maximum use of daylight and carefully-placed,user-controlled task lighting systems; and the use of traditional, non-energy-intensive (labor or natural materials intensive) building products, furnishings, and maintenance systems.

Traditional Design Solve Energy/Health Problems

Passive-cooling is practical in any climate in the world. Cool air tempered by the earth can be supplied to virtually any building requiring cooling. Knowledge of basic physical principles and a review of traditional cooling techniques in buildings of North Africa and the Middle East (see February 1978 "Scientific American" article on passive solar architecture in Iran) can provide designers with a simple, direct approach to ventilation and cooling without health hazards or energy and materials intensive technologies. In cold climates, the same earth-tempering techniques can provide 50 to 55 degree make-up air requiring little or no additional heat in carefully controlled, gravity-powered, simple mechanical systems.

The need for heathly as well as energy -efficient environments will stimulate development of these as well as other innovative uses of traditional building practices of indigenous cultures throughout the world. Most humble environmental designers throughout history have managed the environmental control problem skillfully and well; we can learn much from their research.

Developing a Comprehensive Approach

Above all we must attempt to develop comprehensive approaches to design, approaches which consider the long-range and widespread impacts of our designs. Large urban structures require power plants off-site, disposal of solid and liquid wastes off-site and transportation networks to carry people and materials to and from the structures. It has been convenient and traditional for the environmental designer to ignore these comprehensive concerns and assume that others would solve them. We must assume responsibility to minimize negative off-site impacts through application of resource and energy-conserving designs, coordination of specialized interests and disciplines, and a renewal of the commitment to design rather than technolgoy as a means to solve environmental problems.

At the scale of the individual building we must attempt to adopt comprehensive, thorough analyses of the interaction of the building, its users, and the environment. Contaminants filtered from building air should not be released into the neighborhood. Nor should contaminants from outside the building be brought into it and distributed by central air handling systems. Ecosystems models show us the principle of diversity which suggests maximum dispersal of air intakes to reduce the likelihood and impacts of contamination at a given point outside the building. And the impact of all the building's systems and materials on the physiology and psychology of the occupants should be a fundamental part of the designer's considerations.

Towards Sustainable Architecture

The integration of energy and health-related building problems/solutions is characteristic of building ecology. Starting with a basic understanding of physical and physiological principles, a respect for the health of the environment as fundamental to the health of our building's users, and the application of an ecosystems approach environmental design problems, we can and will create a stable and diverse building ecology, appropriate use of technology, and a sustainable architecture.