

# KANSAS STATE ENGINEERING NEWSLETTER

# IMPACT

Kansas State University - College of Engineering - Engineering Experiment Station - Division of Engineering and Industrial Extension

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## Comforting Cooperation

The research projects in the Institute for Environmental Research cover a wide range of problems, many of which are inter-disciplinary in nature, and all of which in some way involve our response to our environment. For example, a young lady from Home Economics has been dressing a copper man; an industrial engineering student has been studying the effect of environment on reaction time; and the Institute staff have been investigating the adverse affects of drafts, the effect of crowded quarters, and the relationships between activity and comfort.

### COMFORT IS A COMPLEX CONSIDERATION

Any married couple that attempts to use a single electric blanket with only one set of controls can attest to the fact that comfort is a complex sensation which differs greatly from individual to individual.

Dr. Frederick H. Rohles who is Associate Director of the Institute prepared a brief article for the Journal of Environmental Sciences (KSU Engineering Experiment Station Reprint 97 ) which outlines the complexity of the problem and describes some of the variable factors which must be considered. As a psychologist who has spent most of his professional career working in close cooperation with engineers and physiologists, Rohles has been coping with this problem for years. The variables can be divided into three broad categories, (1) the physical factors such as temperature, humidity and air movement; (2) the factors relating to the human subject, such as age, diet and health; and (3) reciprocative factors such as activity, clothing and exposure time.

### RESPONSIVE ROBOT

In order to determine the insulative value of various types of clothing, the General Electric Company developed a life-size copper manikin, a hollow copper shell in the shape of a human, fitted with internal heating elements to simulate the skin temperature of a man. It was initially developed for use by the U.S. Quartermaster Laboratory, but it is currently on loan to Kansas State. Miss Dolores Franz, a graduate student in Clothing and Textiles, utilized it in developing methodological procedures and standards for measuring heat loss.







### MONKEYS ARE SUBJECT TO DRAFT

A study in animal behavioral research promises to develop into a program to eliminate discomforts caused by the cold blasts of air issuing from auto and home air conditioners. Avoidance of electric shock has been a traditional reinforcing stimulus. Apparatus was built to test the avoidance of wind as a stimulus. Monkeys in a chilly room learned that they could stop the draft by pressing a lever. This principle is to be used to find out what levels of air velocity and temperature can be tolerated without discomfort. Human subjects will adjust air volume and temperature to establish the least uncomfortable combination.

### STUDY THE SARDINE EFFECT

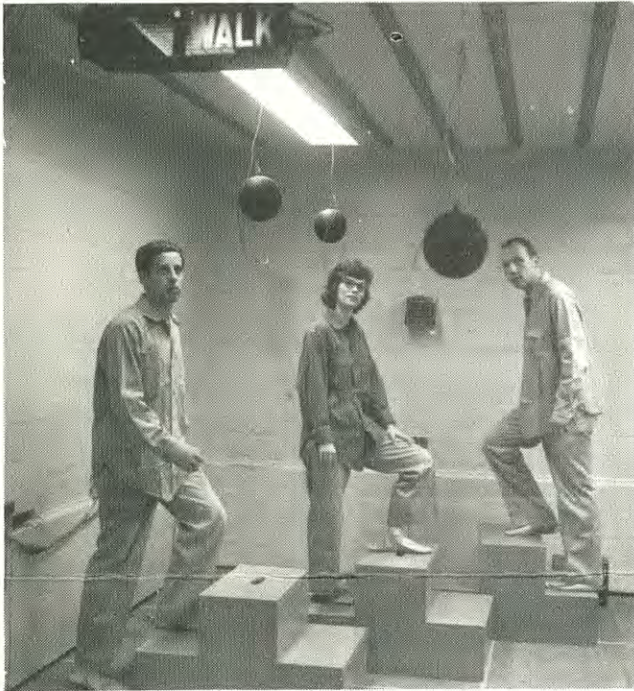
When people are crowded together in a confined space, like an elevator or an emergency shelter, the body's methods of heat regulation (convection, radiation, and evaporation) are not allowed to function normally. Discomfort may occur even if outside means are used to keep the air in the enclosure at constant temperature.

Research is being conducted in the Environmental Test Chamber, under the sponsorship of the Stanford Research Institute and the Office of Civil Defense, to determine the physiological aspects of the problem. From eight to thirty-two subjects are placed in the room at high temperature and humidity and body temperature is monitored to determine the length of time required for each individual to develop an artificial fever of two degrees. Survival in an emergency shelter may also require physical exertion. An extension of the original contract has been granted to investigate the effects of exercise in a hot, humid enclosure.

These tests also indicate that there are important psychological effects of packing - that crowding may have a strong adverse effect on temperament. Both aspects of the problem are important in the design of survival shelters, especially if they are to be used for extended periods.







#### STUDENTS TAKE IT LYING DOWN

The most comfortable temperature in an enclosure is dependent on the activities of the occupants. This has been recognized for some time, but more accurate standards are needed to guide the air conditioning industry. The American Society of Heating, Refrigerating, and Air Conditioning Engineers sponsors research in the environmental chamber which is designed to establish better design standards.

Students can earn \$1.25 an hour literally lying or sitting or walking or standing around. They pass the time studying, or playing cards and Scrabble. Three hour test periods are devoted to each of the activities or combinations of the activities. The subjects

vote at intervals on the level of comfort or discomfort. The cards and games are provided in order to keep the subjects from being bored, which might effect their interpretation of their comfort.

In addition to these responses, the oxygen consumption will be measured. This measurement can then be used as a precise criterion for defining "level of activity."

#### FINDINGS REPORTED

The first phase of the development of the new recommended comfort criteria will be presented at the ASHRAE annual meeting in January 1966. The staff of the Institute will present a paper describing the Baseline Comfort Chart in terms of dry-bulb temperature and relative humidity for men and women dressed in standardized clothing, seated and at rest, when the air movement is less than 45 fpm and the mean radiant temperature is equal to the air temperature. Correction factors which can be applied to this chart will be developed to adjust conditions for the effect of mean radiant temperatures that differ from the air temperature, different activity levels, non-standardized clothing, and air motion greater than 45 feet per minute.

Senior staff and associates of the Institute for Environmental Research are, from L to R:  
 Emil C. Fischer, Dean, Architecture and Design  
 Dr. Hilbert Jubelt, Director of Student Health  
 R. Dean Dragsdorf, Assoc. Dean, Graduate School  
 Arlin M. Feyerherm, Professor of Statistics  
 Wayne G. Springer, Project Director  
 Preston McNall, Associate Director, ERI  
 Frederick Rohles, Associate Director, ERI  
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