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Lighting Issues in the 1980's

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Lighting Issues in the 1980's

Summary and Proceedings of a Lighting Roundtable
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ABSTRACT

The Lighting Roundtable described in this report was conducted to foster an open discussion of the goals, issues, and responsibilities of the lighting community. It was not a problem-solving session, but rather a time to examine the long-term aspirations and objectives of lighting and the barriers that may stand in the way of achieving them. Eight major issues were addressed by nine panelists and a number of invited auditors. The issues are as follows: 1. The Public Image of the Lighting Community; 2. U.S. Role in the Worldwide Lighting Community; 3. Factors Affecting Human Activities in the Built Environment; 4. Effect of Lighting on Environmental Quality; 5. Effects of Barriers; 6. Establishment of Illuminance Levels; 7. Integration of Subsystems; and 8. Professional Development and Lighting Education.

The present publication consists of two parts: (1) A summary of the proceedings and (2) a complete transcript.

Key Words: Biological effects of lighting; energy conservation; illumination levels; lighting; lighting design; lighting education; lighting research; post-occupancy evaluation; power budget; task lighting; visual performance.

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Introduction

The IES/NBS Lighting Rountable grew out of a February 1979 discussion between Drs. Richard N. Wright and Francis T. Ventre of the Center for Building Technology, National Bureau of Standards, and Will Fisher and Frank Coda of the Illuminating Engineering Society. The Roundtable was "to foster an open discussion of the goals, issues, and responsibilities of the lighting community. It was not to be a problem-solving session, but rather a time to examine the long-term aspirations and objectives of lighting and the barriers that may stand in the way of achieving them."

The Roundtable was planned by a steering committee consisting of Dr. Joseph Murdoch, Chairman, and Carl Long, Howard Brandston, Der Scutt, and Dr. Arthur Rubin. Frank Coda served as liaison between the committee and IES. As a means of facilitating a broad-ranging discussion, the steering committee asked Roundtable participants to address eight major issues:

1. The Public Image of the Lighting Community
2. U.S. Role in the Worldwide Lighting Community
3. Factors Affecting Human Activities in the Built Environment
4. Effect of Lighting on Environmental Quality
5. Effects of Barriers
6. Establishment of Illuminance Levels
7. Integration of Subsystems
8. Professional Development and Lighting Education

The panelist and auditors were selected with the intent of surfacing the broadest possible range of viewpoints while facilitating open debate among participants.

Each of the nine panelists was asked to prepare written statements on three or four of the issues, prior to the Roundtable. Each issue was considered in the following way. The prepared statements were read in turn by the panelists. A discussion of the issue among all panelists then followed. At the conclusion of the discussion, the panelists responded to comments and questions submitted by the auditors. The Roundtable readers, Charles Amick and Mel Unglert, screened and ordered the auditors' questions. Finally, as time permitted, the auditors had the opportunity to question the panelists directly. George Cornish, a past-president of IES, directly moderated the entire Roundtable preceedings.

The present publication consists of two parts: (1) A summary of the proceedings and (2) a complete transcript.

The summary is organized to highlight the major topics as discussed at the Roundtable. That discussion inevitably reflected the dynamism of the group of knowledge participants. Consequently, the format of the summaries differs somewhat from the original eight-issue format. The summary presented here is the editor's best effort at balanced reporting and for which he takes full responsibility. The reader may judge the editor's success at objectivity by consulting the complete transcript that follows the summary.

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PART 1

ROUNDTABLE SUMMARY

Purposes of Lighting

What functions does lighting serve? Views ranged from the aesthetic to the pragmatic.

Several speakers stressed the human content of lighting design. "What we are lighting is going to be lived in, sat on, looked at, talked into, activated, operated, or, in some way, used by people individually or en masse," said Louis Erhardt, adding that "if lighting, which intervenes between the product and the people, becomes a point of friction, then the lighting designer has failed."

On the other hand, the lighting designer has succeeded if people are made happier, safer, and more comfortable or more efficient.

Other speakers took a more analytic view, pointing out that lighting was a function of physics, physiology and psychology. Lighting was what made a space "legible"--by allowing the observer to determine the size, shape and location of objects beyond arm's length.

Neil DeKoker stressed the importance of lighting in the working environment, pointing out that an effective and safe working environment may attract workers and keep them on the payroll longer.

Ernest Wotton identified two types of lighting: one type illuminates the form of the space itself; the other he called "overlighting", which, in his words, "addresses itself to meeting the requirements for the working space."

In lighting, human and commercial objectives tend to coincide, according to Michael Frye, Stephen Squillace and other speakers. "To what extent one would change (a design) so that aesthetics became pleasuring and comfortable, I don't think we know," said Frye, "but I'm not sure that there is a trade-off."

Finally, some touched upon the relationship between lighting and quality of life. "Would the quality of life also change lighting?" asked Russell Atkinson. Frye agreed this was the big question when facing aesthetics. "This issue is about what do people want, and their philosophy is changing substantially--the correct answers today may not be correct tomorrow," he said.

Lighting Design Criteria

To achieve the purposes of lighting, we need an orderly approach to develop the necessary information and to provide it in an appropriate form to lighting designers. An early step is development of criteria to be met by lighting, and criteria levels which are valid and measurable. These criteria, which must respond to such realities of modern day society as resource and energy conservation, fall into one or more of the following classes:

- Performance (task and visual)
- Non performance (aesthetic)
- Energy conservation.

Pressing issues such as "how much light ought a human being to have," "how much space ought a worker to have," and "how much heat and how much natural light?" must be considered.

"These are hard issues for a society which has built its strength on the basis of waste. Unless we deal with that issue, we are not going to get to the bottom of it," noted Saul Goldin, who added that we do not even know the proper questions to ask.

George Clark and Alan Lewis proposed additional factors when developing appropriate criteria for illumination quality: Comfort/discomfort (in terms of direct glare evaluation, for example); and aesthetic, psychological aspects (because every space has a psychological impact).

Visual (Performance)

The most basic criterion for proper lighting is the one which deals with how we see. "What," asked Myron Kahn, "is the process involved in the utilization of luminous energy, electromagnetic radiation, or whatever you want to call light? What does it do to things to make them visible?"

Nobody has the answer today, Alan Lewis pointed out.

He felt there was no one who could claim even to understand the transduction process. Contrasts, for example, are important under some conditions but quite unimportant under others.

"It is an extremely complicated process," said Lewis, "because you must know a great deal about the underlying mechanisms."

Lighting intensity must be seen in the context of other attributes of the visual system, whereas too often in the past, the only variable to be optimized had been lighting intensity. Said Donald Ross: "It has been repeatedly demonstrated that the demands placed on the electric lighting subsystem are very minimal if proper attention is given to improving other portions of the visual system, such as glare, contrast, color, size, and viewing angles of objects of interest."

Nonperformance (Aesthetic)

The need to perform research on aesthetic criteria was discussed. Lewis noted that most of the panelists felt the topic involved mainly the use of aesthetic or nonperformance criteria in determining the human activities in the built environment. Several of them had advocated markedly increased research in the area. He suggested that, in the uncontrolled past, people did what suited them; this in itself, is data on what people preferred.

Squillace objected that it was very hard to quantify reactions to change, in human factors-type parameters, especially when trying to predict the effect in a new building.

"The quality of lighting must be part of the luminance level considerations," Lewis urged. This meant such things as freedom from veiling reflections, concern for color harmony, and comfort criteria must be considered.

Private industry, various levels of government and the IES have each developed illumination criteria, based on their own priorities.

Daylight

Daylight received only modest treatment, but provoked controversy. Daylighting input will be a valuable contribution to energy budgeting, said Robert Smith, adding there was a desperate need for information on the topic.

In answer to a question from W. C. Burkhardt, Smith responded there was a need for IES to approve easy-to-use approximations for inserting daylighting into the ASHRAE 90-75 standard. The architect is the basic person making the decisions about daylighting and its translation into a building design, he added, and he needs simplified information because, in Smith's words, "at the conceptual stage he doesn't have time for large computations." He also called for a daylighting design handbook of acceptable practice.

On the other hand, Kahn cautioned against overestimating the value of daylighting: "Its quality varies too widely and it in itself can diminish the value of interior lighting quality because of the brightness differences," he said.

Rita Harrold agreed, but felt it was a factor one must look at in creating an energy budget.

Energy Conservation

Several speakers raised the issue of trade-offs between energy conservation, performance and aesthetics.

General Motor's plants seek to supply about 50 footcandles on working areas, according to Neil DeKoker. If any tasks need more light, it comes from supplementary local lighting. "We use efficient light sources and luminaires and use nonuniform lighting wherever it is practical," he added, such as having more light on assembly lines than in other areas.

"How many watts per square foot can you spare for aesthetics?" asked Atkinson.

Squillace felt no one was qualified to answer this, but pointed out that lighting for aesthetics cost watts and money--all at the expense of other wattages in case of an upper limit.

"There are many ways to create pleasant atmospheres, and those that use extra energy ought to be looked at as being less desirable ways," said Ross, adding that a little creativity might be substituted for using more energy.

Several roundtable participants said that energy-saving design was compatible with aesthetics without necessarily increasing the load. An example given was the highlighting of merchandising areas and lowering the ambient levels, resulting in improved aesthetics and reduced energy consumption.

Lewis warned against designing lighting systems solely on the basis of measured performance; this would be inappropriate even if performance could be accurately measured. Personal preference and regard for aesthetics are worth a good deal," he added, "even though, at the moment, they cannot be measured in conventional monetary units." Finally, Frye cautioned against energy conservation decisions made at the expense of lighting quality.

Regulation and Lighting Design

A role for government with respect to lighting design provoked conflicting viewpoints.

The rationale for the role of government was summarized by John Cuttica: "It is the intent of the Department of Energy not to restrict the light designer or any other designer. What they are really looking at in the standards area is to come up with a building energy budget and then leave creativity to the artistic ability of architects or designers of lighting to stay within that budget. Put a budget on the building and leave it to the architect and the lighting engineer to determine how much will go towards lighting and to do it in an efficient manner."

Energy codes would help to enforce that concept or at least make people aware of it, Ross felt.

At the other end of the spectrum, DeKoker said he would prefer to see no mandatory codes or standards regarding lighting or other energy use, figuring these could end up inhibiting energy-efficient design.

Morgan Christensen agreed, adding "there were really only two motivators--greed and patriotism.

"Every dollar that we (at General Electric) can save, in maintenance or in operating costs, in terms of profit dollars, is the equivalent of $16 worth of products that we don't have to make and sell. That is where greed and patriotism come together," he said.

The linkage between dollar savings and energy savings was not universally supported. Among factors mentioned by those skeptical of this approach were:

- lack of responsiveness by many industries and designers to date;
- absence of dollar savings (e.g., speculative buildings); and
- need for energy saving to "stand on its own."

Harrold saw in regulations some more positive effects, such as the production of advanced technology, more efficient system components, better space utilization and more responsible value judgments by the lighting designer in lighting recommendations and solutions. But she noted confusion as to the limit of the law, the voluntary versus mandatory aspects of meeting regulations, and the understanding and interpretation of some aspects of each state's code. She called for some uniform system recommended from the federal level, so as to avoid a tangle of code variations.

Until we know more about the effects of lighting on human performance, standards governing levels should be only as rigid as needed to prevent abuses that will be detrimental to the public safety, Lewis urged.

While DeKoker estimated that lighting consumed only 3.6% of electrical energy consumed by General Motors, Ross commented that all savings were important. Ross further noted the need to modify building practices as a means of conserving energy.

Several speakers stressed the systems view of energy conservation.

Harrold felt we must move away from prescriptive standards, which deal only with sub-component performance, and begin to analyze the total performance of a building. She indicated that: "Such effective interaction of subsystems for lighting should result in optimizing the operation not only of individual luminaires, or groups of lighting components in one area, but through the balance of electric lighting with daylighting and HVAC systems, the reduction of peak demand for that facility. This activity is increasingly being done by total building performance computer programs."

Harrold cautioned that: "We can't totally rely on the machine. There is a lot of human input that still needs to be evaluated."

Legislation dealing with lighting was discussed in some detail. In particular, questions were raised as to the usefulness of power budgets (watts per square foot) and the ASHRAE 90-75 lighting standards.

Watts Per Square Foot

Ross favored the watts per square foot criteria as an interim measure for lighting and as a possible first step towards energy conservation. He saw the goal of most code enforcing agencies as consolidated development of all energy uses for buildings--including lighting energy. Such a code would permit so many BTU per square foot per year, for all uses. This total could be made up of components, part lighting, part air-conditioning, selected for that building, location and function. The total would be the only amount controlled. The owner or designer would be free to mix energy uses any way he saw fit, so long as he stayed within that budget.

Harrold and Smith expressed misgivings about Ross' approach.

Said Harrold: "Watts per square foot budget estimations imply that all commercial buildings and office spaces are designed in exactly the same way and all industrial spaces have exactly the same kind of design problems."

Smith said he had the greatest fear of proliferating watts per square foot lighting codes. "The procedure permits a macro approach and eliminates the need for a specific analysis of the lighting requirements of the facility," he added. Quality lighting designs are more apt to occur when there are qualified, energy conscious lighting designers, Smith felt.

"The watts per square foot approach further dilutes the early need for collecting information d making decisions that affect the quality of the lighting design," he concluded.

Ross feared the process by which recommendations of illumination levels by the IES have become minimum standards in many building codes.

ASHRAE 90-75

State governments endorse ASHRAE 90-75 Standards (on lighting) without realizing that they do not relate to visual requirements, commented Kahn.

On the other hand, Clark liked the fact that 90-75 did not attempt to determine lighting design. He called it an energy standard and not a lighting standard.

IES and Legislation

Smith urged greater representation for IES as a resource in lighting legislation activities.

But what control, if any, was exercised by IES on the use of its findings for legislative purposes, asked Howard Brandston. "What are we doing to safeguard against promulgation of standards that are based on questionable research?" he added.

Squillace doubted if anything was being done.

The answer, according to Lewis, is to have IES committees evaluate research and try to determine its usefulness. It's the interpretation of research for use in practice that is the problem, not the research itself.

Lewis' comments point to the need to define IES' responsibilities and those of the lighting profession in the design of illuminated environments.

The Lighting Community's Image

The lighting community was discussed from national and international viewpoints--with the main emphasis on activities within the United States.

National Lighting Community

Many participants were worried that the mass media had portrayed IES rather negatively since the start of the energy crisis. Other criticized IES for what they perceived as narrow interests by participants in its activities.

Yet Harrold maintained that all committees strove for balance in representing various areas of interests.

"Many of our severest critics are within the Society," Lewis noted. "Anybody who has sat in on any of the recent technical committee meetings has been perhaps overwhelmed at the lack of accord. There are indeed substantial disagreements even within the Society, but I think that is very healthy."

Clark felt IES was still the principal organization concerned about the best lighting, not the least amount of lighting we can get away with, or the best way to reduce the energy content.

Ross summarized a number of issues regarding past activities of IES: For one, he was concerned that a lot of past IES actions, still prevalent today, came to be standards due to poor interpretation of research and not enough critical discussion before they were accepted.

Another Ross concern was that one should not try to predict a relationship between lighting and performance, as IES has been prone to do.

One of the roundtable's auditors said he noted a gradual awareness and recognition in IES of the need for generating a greater body of knowledge about the more subtle effects of lighting.

In response to a question about the need to encourage broader membership involvement in IES activities, Clark noted a difficulty in prior years in getting participation: "We do not have the funding to pay for people to attend our technical committee meetings," he concluded.

International Lighting Activities

Funding also has hampered participation in international lighting activities, according to Squillace; the U.S. government has played no part, except domestically, and then only recently, due mainly to the energy crisis.

Clark pointed to the dominance of the European countries in CIE activities, since out of the thirty countries in CIE, some eighteen are European.

Nevertheless, Frye and others noted the pre-eminence of the United States in the international lighting community. This dominance added to its responsibility, he pointed out.

Lighting Design Today

Lighting design was examined from the standpoint of the education and other qualifications needed by practitioners.

Education and Professional Needs

Several panelists and auditors indicated that lighting design, with few exceptions, is not at the present time a viable, full-time profession.

"It seems ironic," noted Smith, "that in 1977 there were 1,399,000 academic degrees awarded, but not one toward the discipline of illumination engineer."

Harrold pointed to the uneven quality of education available to people who want to be lighting designers. "Many people graduating from certain lighting courses today are not really qualified to be a part of the growing industry," she charged.

Lighting design is often not a full-time activity. "Perhaps 5 percent of our architectural income is related to lighting and 15 percent to consulting engineers," said Clark. That made it difficult to hire a full-time lighting person. "Eighty percent of the lighting in square footage in the United States is designed by technicians and draftsmen," Clark went on. He urged formal lighting training for architects, engineers and other designers of the built environment, as well as multidisciplinary studies (e.g. social sciences) for people trained as lighting designers.

Ross labeled educational programs conducted by IES for professional design staffs as "among the best."

Smith outlined several needs for improved academic programs in lighting. "The credibility and vitality of an academic program are measured largely on its ability to attract research activities," he said, pointing out that for an educational program to prosper it must attract research funding or direct grants. With outside funding, the faculty can take part in professional activities and the schools acquire test equipment and demonstration packages.

"For the lighting community to attain a high level of respectability, there must be appropriate degree programs," Smith urged.

Squillace called for upgrading the status of the illuminating engineering profession. To attain this, illumination must be given discipline status in the schools. Moreover, the professional should be educated properly, examined by peers and given state, federal and even international registration," according to Squillace.

The issue of exactly how to confer status upon qualified designers was controversial. Smith said we are not yet at a point where we should be seeking registration for lighting engineers. But somebody ought to be certifying lighting designers, he added, calling upon IES to take a leadership role.

Brandston, noting that IES was a technical, not a professional society, wondered whether it was a technical society's place to certify its members as being qualified to do a professional design function.

What is needed is some identification of illuminating engineering as a discipline, a specialty, or a field of endeavor worthy of credentialing, said Lewis, adding that this task was up to the lighting profession itself.

Smith invited those with feelings about credentialing to send their comments to IES.

Finally, Frye provided perspective on the value of credentialing, pointing out that engineering and lighting were discovered in England and that many of the guild systems were similar to the credentialing under discussion. "These guilds were highly successful," said Frye. "They kept the standard that the people wanted to keep. They maintained a level of craftsmanship."

Lighting and the Design Process

The relationship of lighting design to the building design process received considerable attention.

Lighting effectiveness depends on the relationship of many factors in an internal space, said Frye, so simply specifying light levels will not always produce the same result in different circumstances. So lighting should be considered and integrated with other factors at the outset, rather than tacked on later, he concluded.

"We seem to wait too long, until ground has been broken and plans have been drawn. Lighting has been an afterthought in design projects," agreed Harrold.

A major criterion considered by builders is how to obtain an appropriate return on investment, raising the issue of "first costs" vs. "long-term costs."

"Are market forces as likely to conserve energy in small homes, apartments, condominiums, office buildings and rental commercial space," asked Richard Wright, "as they are in major industries like General Motors, which are owner/users of the space?"

Many buildings are put up by people who are not going to occupy them and pay the utility bills, DeKoker pointed out. "Then it becomes a matter of put it up the cheapest way they can. They don't always take a look at first cost vs. energy conservation," he added.

Christensen examined long-term costs in terms of employee salaries. He looks at changing lighting in terms of how it will affect his company. "I look at people because they are the ones affected by lighting . . . Thirty-eight percent of our company's sales dollar goes to people," according to Christensen.

Clark pointed out that: "Perhaps the most neglected aspect of building design has been a careful determination of the human activity which the building is intended to house."

Francis Ventre was concerned about the integration of subsystems: "The architectural profession was the original integrator of subsystems but evolution of subsystems specialists has outrun integrating methods."

Robert Clear and Samuel Berman stated the interaction of lighting with other factors such as room temperature, noise level, and psychological factors such as motivation, enthusiasm and anger is still not understood.

Control Systems and Energy Conservation

One auditor pointed to a major energy usage problem. He said the public's view of the lighting industry is gained by looking at large buildings lighted after hours, yet the lighting industry has no control over this. It's the building owners themselves who have the control.

James Jewell said the way one saves energy in lighting systems is by turning them off, adding: "We may debate levels endlessly, but conservation in lighting comes from the control in lighting systems."

GM had saved energy by such simple means as lowering temperatures and turning off lighting, and by more sophisticated measures such as production process changes, heat recovery applications and installation of computerized facility monitoring and control systems, according to DeKoker.

Design and Computers

The cost of programmable calculators and smart terminals has come down to the point of making possible system analysis that had been previously considered too laborious. "The end results should be higher quality lighting designs that are also sensitive to other systems," Professor Smith pointed out.

Programs and input data must be available to the designer in a readily usable format. Smith fears a 'black box' syndrome, however. Designers should not accept computer designs without understanding the algorithms that were used to produce those designs, he feels, or an unhealthy situation may develop both for design professionals and the manufacturers.

Lighting and the User

The point was made repeatedly that the interaction of people and buildings must be better understood if lighting design is to respond to user requirements. This topic was approached in terms of the development of criteria, the evaluation of lighting designs and the role of control systems for energy efficient lighting designs.

User Role in Criteria Development

Squillace called for more dialog between lighting designer and client in the development of criteria.

He urged designers to ask such questions as: "What is the activity to be performed in the space? What tasks are you going to perform? If you know the tasks, can we work to determine how the various tasks are responsive to light? What are the various other spaces that you have dealt with? Are the people happy in them?"

Biological Responses to Light

Frye gave a broad overview of biological research findings, pointing out that electromagnetic radiation, including light, had important biological effects. Vision is the most obvious biological response, he said, but there are additional, nonvisual responses. "It is now established that light does influence both autonomic and endocrine function . . . [this] certainly demands our attention."

In commenting on Frye's paper on the biological effects of lighting, Dr. Lewis noted that animals are markedly affected but man seems to adapt to the nonvisual effects much more readily. He also reminded listeners that many of these studies have been questioned as to whether they are scientifically valid.

Clark broke down what he saw as concerns over photobiological research activities into three categories:

- The potential harm as related to the photobiological aspects of lighting.
- The prophylactic impact (such as the fluoridation of water).
- The therapeutic impact, with individual producers (manufacturers?) dealing with groups of knowledgeable medical people, after which they build the light sources.

GSA as a Lighting User

How a major building user employs design criteria was discussed by Norman Bott of GSA.

"One of the most important concerns of the application engineer in the Federal construction establishment has been in the area of illuminance levels," he said, adding that GSA's standard design practice has always been to provide conservative illuminance levels in the office portions of its buildings.

As energy problems became more evident, GSA began to question its practice of uniformly illuminating every square foot of office space to the recommended illuminance level for the most difficult seeing task.

The concept of nonuniform task-oriented lighting using relocatable luminaires fits very well into GSA's program to improve the environment in its office facilities, said Bott. GSA's open office concept consists of a floor-ceiling sandwich containing illumination, air conditioning, telephone, background sound and power distribution systems.

GSA also retained illuminating and acoustical consultants to recommend techniques, standards and tests that would make sure these approaches resulted in satisfactory office environments.

As a result, the illuminance level was set at 50 footcandles on the task, with 30 footcandles in the intervening area.

Post Occupancy Evaluation (POE)

General agreement existed that lighting designs are seldom evaluated and that they should be. Clark summarized these feelings in the following way: "Each year the American Institute of Architects give its awards for beautiful buildings. Would it not be better if we waited at least a year and then found out how the building works for whatever it was intended to be used for? We have erected a lot of buildings but we do not analyze them. We are off to the next building and then to the next. We do not really sit down and study and evaluate what we are doing."

Lighting Information

A theme running through the proceedings was the need for better lighting information for the consumer and the designer. The information was categorized into state-of-the-art knowledge and new information (research findings). Clark noted that many documents are produced without a particular audience in mind . . . with the result that they are not readily usable by anyone.

Consumer

The discussion dealt with the demand for information, its proper source, form and its recipients.

Consumer research in England, France, and Germany disclosed that the biggest issue was knowing how to use lighting, according to Frye.

Harrold pointed to the demanding, sophisticated and knowledgeable caliber of these consumer audiences.

As to who supplies the information, DeKoker felt manufacturers of lighting equipment should provide it if the public is interested in it. If they succeed, they might sell their product better. "It is a marketing, not an IES type of responsibility," he said.

Designer

When supplying information to designers, a plea for simplicity was countered with a desire for sophistication.

A newcomer to the lighting industry needs to have it explained in the simplest terms, said Frye.

In contrast Professor Smith called for sophisticated information, adding that industry standards should be developed for comprehensive and accurate presentation of illumination-related product concepts. "Our posture in the marketplace should be one of sophistication and accuracy," he said.

He urged publication of a daylighting design handbook of acceptable practice. It should include needed algorithms for calculator and computer programs.

Information

The most controversial topic discussed at the roundtable centered on the type and form of information needed by lighting designers.

Lighting Levels

"There should not be such a thing as 'illumination levels,'" Squillace felt. "Instead, it should be experimental data, properly reported, so that qualified professionals can interpret and use the data to achieve certain solutions to their clients' needs. Illumination level is only a tool. The amount of flux per unit area impinging on a surface is only useful to gain other knowledge of that surface, such as its luminance, luminance gradient, the interaction between surfaces, and other factors of this type."

No single number or range of numbers can satisfy all situations, Squillace said, and added that the qualified designer can design for any situation.

Lewis supported Squillace's view by saying that energy and cost-effective lighting design cannot be done through simplistic formulas applied to generalized spaces. Luminance levels should be established only for specific spaces with known uses, he said. "Lighting for spaces which have unknown uses should be at a minimum level until such time as the use is determined," he concluded.

Clark, Harrold and Smith disagreed, claiming that many lighting designers lacked the training and experience to design without guidelines.

Smith urged IES and the lighting industry as a whole to offer guidance, in part by establishing a guide for illuminance levels. Otherwise "lighting quality would diminish to even a poorer point than what it is now," he said.

In response to a query from W. M. Waldbauer as to interim illumination levels, Ross said that for the office work, the U.S. Government subscribed to the 50, 30, 10 ruling with permission to raise those levels where it was proven that it would serve some purpose. "I think that is probably adequate," he added.

What the RQQ Committee of IES will do, according to Lewis, is use the judgment of a large number of people to come up with numbers "in a range that everybody won't think will be too bad. That will be the interim, I believe," he felt.

Equivalent Sphere Illumination (ESI)

The usefulness of ESI as a research and design tool was seriously questioned.

"Since ESI is known to vary by a factor of two or more for representative tasks at the same station, isn't it a difficult metric to use and establish as a guideline for a lighting enivronment?" asked one auditor.

ESI was supposed to be a model that would predict performance based upon its value, Ross said, but claimed it doesn't do that. He said he had studied experimental results and found there was no correlation. Therefore, he felt the complexity of calculating ESI was unjustified.

Visual Information

"Is there enough relevant visual information for lighting design?" was a question that arose at the roundtable. Lewis felt a wealth of data was being generated every day, but the illuminating engineering community was ignoring it because it was not done by illuminating engineers. "I think that is one of our problems," he said.

Prestigious papers on color theory and visual perception have not appeared in the Journal or the Handbook because, from Squillace's experience, the committees have not involved themselves in those areas.

On the other hand, IES committees have spent considerable time and effort developing and publishing illumination levels.

Biological Information

Frye called for a textbook in the biological area that would cover state-of-the-art research and point out ways to a better understanding.

Pointing to the Future

The discussion of the needs of the lighting community varied, covering issues ranging from IES membership to research activities.

As to future directions for IES activities, Ross urged "a forthright and clear explanation of uncertainties in past practices and goals for the future, with interim consensus recommendations."

Broader Representation Within IES

Harrold called for broader participation in IES by those concerned with lighting. "We should try to work with other organizations and other people who have some bearing on what it is that we do," she added. She pointed to good lines of communication with people in various agencies, such as the Department of Energy.

International Activities

Squillace proposed an ambitious program to intensify national and international lighting research. Consulting engineers, educators, owners and legislators should participate, he said, and outlined a plan under which the user industry, the manufacturing and supply industry and the government should seek these objectives:

- Sponsor and fund, together and separately, research on indoor lighting;
- Report the findings of such research worldwide;
- The U.S. should spearhead an international IERI;
- International meetings should be sponsored by the U.S., or else international "chairs" of illumination education should be established in several countries.

Research Needs

Research needs were expressed both from the user standpoint and from thie perspectives of the research and design communities.

Areas suggested by Bott of GSA included accurate selection of task locations; a study of what constitutes reasonable surface reflectance; how best to utilize luminaire distribution; and the basic principles of task visibility.

Through the years, GSA has funded general studies on various lighting systems; on the application of high pressure sodium luminaires to offices; hand calculation techniques for ESI design; task-lit systems furniture; and systems designs based strictly on performance criteria, Bott stated.

Many of these areas have been studied by others with differing results, he pointed out, and called for work to provide a wider base of knowledge on which the building owner and his engineer can base decisions.

Other research issues arose earlier in this paper. They ranged from basic issues (e.g. how we see) to pragmatic application needs (e.g. responding to an energy budget).

Harrold said the designer needed to have better ways of predicting with reasonable certainty what the end result of a lighting design is going to be. That wasn't the same thing as "being able to go to a space, to adjust it, make changes and do things so that it finally comes out right," she cautioned.

Squillace made the same point with respect to nonperformance research.

Research Goals

What designers need to give lighting its deserved importance in environmental design, according to Frye, is a research approach which looks more deeply at the human response to lighting, rather than stressing the physical assessment of lighting as a mere flux of energy.

Light Source Characteristics

"We need a full definition of 'full spectrum of light sources,'" said Clark. Right now, he said, the industry does not know what the accepted definition is of a full spectrum.

Methodological Research

One type of research to receive attention concerned methodology--how to perform appropriate research. This issue arose with respect to several areas:

- Multidimensional Scaling

  The technique will be accepted for others to use, hoped Clark, but first it has to be found both useful and valid, otherwise "there is no use in collecting all of that data," he added.

- Multivariate (Sensory) Studies

  Frye felt more research was needed in this area, adding that one of the major problems was to make an objective experiment with clearly isolated variables.

- Biological Research

  A broad discussion on the biological effects of lighting--positive and negative--led to a consensus that they are not well understood, even though their potential is great. Clark cited ultraviolet lights as an example of this need. Available data are sparse and often contradictory, he said.

° Productivity

How do you measure productivity in lighting? asked Frye.

DeKoker agreed that techniques for measuring productivity were needed, and suggested the National Bureau of Standards could best answer that question. (This requires extensive research - editor.) Bott also pointed to the need for "more and varied performance studies."

° Post Occupancy Evaluation

Probably 99 percent of designed lighting is not post-evaluated (POE), declared Squillace, and called for a scientific procedure to perform POE's. Clark noted that a major requirement is a better understanding of the human response to the built environment.

° Energy Audit

Analytic tools to perform energy audits were needed, Squillace pointed out.

° Long-Term Effects

Clark and Lewis both called for a better understanding of the long-term effects of lighting on human performance.

LIGHTING ISSUES IN THE 1980s -

SUMMARY AND PROCEEDINGS OF AN ILLUMINATION

ROUNDTABLE SPONSORED BY

THE ILLUMINATING ENGINEERING SOCIETY

OF

NORTH AMERICA

AND

THE NATIONAL BUREAU OF STANDARDS

EDITED BY: ARTHUR RUBIN

June 14 and 15, 1979

New York Sheraton Center
New York, New York

PART 2

TRANSCRIPT OF PROCEEDINGS

1.0 OPENING STATEMENTS

1.1 Dr. Murdoch (Chairman, Steering Committee): I would like to welcome you all to this IES/NBS Roundtable. I am Joe Murdoch of the University of New Hampshire.

I have been serving as Chairman of the Steering Committee which has been putting this conference together. I might mention that the origin of this conference is a very informal discussion which was held back in February between Dick Wright and Francis Ventre of the National Bureau of Standards, and Bill Fisher and Frank Coda of IES which suggested that such a conference would indeed be very useful at this time for the lighting community.

Subsequently, the Steering Committee was appointed. As you can see from the program, the purpose of this meeting is to foster an open discussion of goals and issues and responsibilities of the lighting community, and I would be remiss if I did not point out one of the early things that the Steering Committee decided and that was that this conference is not a problem-solving session but a problem-identification session.

The Steering Committee defined eight issues to be addressed over the next two days. It selected panelists to prepare written statements on these very issues. You see these folks in front of you now.

It further suggested a group of auditors which we hope are broadly representative of the lighting community who will have the opportunity to prepare questions in writing for consideration by the panel.

I should point out that two publications will result from this conference. The first, NBS is planning to have a full report of the conference published; and secondly, it is the intention of IES to have an issue of LD & A (Lighting Design and Application) dedicated to this conference, at least, a portion of an issue of LD & A.

I would like to introduce the various people who are participating in the conference today beginning with the Steering Committee, and without embarrassing any of them, I wish they would either rise or put their hands up when I call their names.

These people have been a great deal of help to me in putting this together.

First, there is Howard Brandston of Lighting Design in New York; Carl Long of Carl J. Long & Associates in Pittsburgh; Art Rubin of the National Bureau of Standards in Washington; Der Scutt of Poor, Swanke, Hayden and Connell in New York; and another member of the Steering Committee who has been working with us throughout and has been a great help, Frank Coda, the executive vice president of IES, in New York.

One of the things that the Steering Committee decided was that we wanted to have a couple of readers to take the questions from the auditors, to put them together in some meaningful order, and present them to the panelists. In that vein, we persuaded Charley Amick and Mel Unglert. Charley is from Daybright and Mel is from Westinghouse.

Now, I would like to introduce the panelists even though you can see their names.

There is Norman Bott of the General Services Administration in Washington; George Clark of Sylvania in Massachusetts; Neil DeKoker of General Motors in Detroit; Michael Frye from Rotaflex in London, England. By the way, Mike, we are pleased that you could make the trip over.

Next is Rita Harrold of Westinghouse in Bloomfield, New Jersey; Alan Lewis, who is not here yet, who is from the State University of New York, College of

Optometry; then Don Ross of Ross and Baruzzini of St. Louis; Bob Smith of the University of Illinois in the architecture department; and Steve Squillace of Smith, Hinchman and Grylls Associates of Detroit.

There are two other things that I need to do before I sit down. The first of these is to give the two gentlemen, who are serving as the co-sponsors, if you will, of this conference, and they are Bill Fisher, president of IES, and Dick Wright, who is the Director of the Center of Building Technology, an opportunity to say a few words of welcome themselves.

I would like to start first of all by introducing Bill Fisher.

1.2 Mr. Fisher (President IES): Thank you Joe. Good morning ladies and gentlemen. It is my pleasure to welcome you all here on behalf of the Illuminating Engineering Society of North America.

I am pleased to find that we do have a representation here from all of the major countries in North America who are members of the IES. We are certainly pleased to be a co-sponsor with the Center of Building Technology of NBS at this roundtable on lighting.

We see this meeting as evidence of the continuing interest and even heightened interest in the lighting subject, shared by the Government, by users of lighting, by those who design and specify lighting, and in short, by the whole lighting community.

Whether our interests stem from lighting in our commercial and industrial working environments, or from lighting as a factor in our life styles, such as at home, or at the disco, or at other nighttime recreation, or whether it stems from the higher present-day cost of lighting, or the energy used by lighting, I think it is good to see the interest in this subject and have the opportunity to discuss some of the issues relating to lighting's future.

Speaking of that energy issue, which is a subject I have been keenly interested in for some time, I hope that everyone present understands that this nation will not save any oil by reducing lighting energy. I feel that I must mention this because there is such a widespread misconception on this subject. Without reservation, all of the members of the lighting community that I know of encourage users to use just as little lighting as possible to accomplish their visual objectives.

However, the fact is that in 34 states, around the United States, oil usage has increased whenever lighting energy is reduced because of the loss of the heating effect of lighting in buildings, and this considers also the load that lighting puts on cooling systems. With less lighting heat, the thermostat turns the furnace on more frequently, hence more oil is used then where oil is the heating source.

I hope that everybody agrees that this nation's most serious energy problem, by far, is oil.

It is true there are 16 states where oil can be saved as lighting energy is reduced. It is those states where, unfortunately, a fair amount of oil is used in generating electric energy. Most of the states do not.

As I said, the net effect of all 50 states is a washout as far as oil usage is concerned. I just wanted everybody to be aware of that fact, and with this in mind I think our discussions will be more objective on the subject of lighting.

We have tried to bring a broad background of interest and experiences to both the panel and the auditors to make sure that all points of view are represented here.

I think the Steering Committee has succeeded fairly well in this objective although not quite to the extent that we had hoped for originally. It was not possible to get commitments from everybody who was invited. We had hoped to have a representation from ASHRAE, for example, from NCSBCS (National Conference of States on Building Codes and Standards), from AIA, the ASID, BOMA and so on.

While I am sure everybody here, both the panelists and the auditors, will be addressing the issues objectively, because of individual backgrounds and experience, there will be specific viewpoints presented by each panelist. I think that is very good.

However, the outlook of any one speaker may be somewhat similar to one of the other half dozen or so blind men who were asked to give their personal description of an elephant they were congregated around, after feeling some particular part of the elephant's anatomy. You will remember the various descriptions that were given.

So, I urge everyone to give the greatest attention to all of the viewpoints that will be expressed here today and tomorrow, colored by the background of the various speakers. By keeping our ears and our minds tuned objectively to all of the viewpoints expressed, even those which may not be popular with our own personal views, I think we should wind up with a better description of the elephant and a better description of the issues which must be faced squarely by the lighting community in the future.

Thank you.

Dr. Murdoch: Thank you, Bill. Next, I would like to introduce Dick Wright from the Center of Building Technology.

1.3 Dr. Wright (Director of CBT, NBS): Ladies and gentlemen, we from the National Bureau of Standards greatly appreciate the opportunity to work with the Illuminating Engineering Society of North America in this effort to identify the principal issues that face the lighting community, those issues that it needs to address in order to serve our society's needs for a better built environment.

Let me take a moment or two to tell you why the National Bureau of Standards, and the Center for Building Technology, is co-sponsoring this activity.

We are an interdisciplinary building research laboratory consisting of engineers, architects, physical and social scientists. Our major product is the technical studies that provide the bases for performance criteria for buildings. We seek to provide measurement technology to determine objectively how well a building serves the needs of the public for usefulness, safety, and economy.

I should note that although the name of my organization is the National Bureau of Standards, we do not promulgate any standards nor do we have any regulatory authority, but rather we serve as a research resource for organizations both private and public that do have these responsibilities.

We have had very successful experiences throughout the years in using roundtables to clearly identify and illuminate the issues in important areas of building performance.

For instance, it was in 1972 that we co-sponsored a roundtable with the General Services Administration on energy use in buildings.

One product of that roundtable is the Manchester, New Hampshire demonstration office building. Another product was the pioneering effort of the General Services Administration to use an energy budget as a target in the design of its buildings. Another following activity was our assisting the National Conference of States for Building Codes and Standards by drafting a document to serve as

a basis for energy conservation standards for buildings. This document was then processed by the American Society of Heating, Refrigerating, and Air Conditioning Engineers, to become ASHRAE 90-75.

We see a roundtable like this not as a problem solving effort, but as a problem clarifying effort. We would look forward to a number of follow-up activities that with address some of the major societal needs for improvement in lighting practices.

We are here because it is apparent to us that there are substantial disagreements on the technical bases for lighting standards. There are disagreements that some of our staff have perspectives on. We do not suggest that we have the only legitimate views, but feel that our views, and others should be aired.

Bill Fisher has mentioned the energy crisis as an important motive for this roundtable. But, there are clearly many important qualities of lighting that will be discussed here during the next two days. We do not want to take one narrow societal view concerned with lighting. We want to make sure that we have all important concerns in mind.

It seems to me that the lighting community has a much lower level of non-proprietary research than the importance of lighting to the public would seem to justify. I hope that this will be one of the issues illuminated during our discussions.

To what extent are there problems that can be resolved simply by making appropriate use of the established lighting practices? It appears that people may not be using the tools that are really readily available to them.

To what extent are there problems because practices have not adapted themselves to the growing body of knowledge where there appear to be gaps between what is conventionally used as good practice and what is known to be a better basis for practice?

What areas are there in which research is very badly needed to deal with problems that are clearly identified in practice, but for which there is no objective, verified knowledge to improve the practices?

So, I look forward to some very stimulating discussions in the next two days, discussions that will help us see much more clearly just where the problems lie.

Thank you very much.

Dr. Murdoch: Thank you, Dick.

When the Steering Committee met first, we decided that the toughest job at this whole conference was going to be the job of being the moderator.

We are very fortunate, we feel, in having been able to persuade George Cornish, the past president of the IES and Commissioner of Planning and Transportation for the City of Calgary, Alberta, to assume that role.

I want now then to turn the proceedings over to George Cornish and allow him the opportunity to establish the ground rules, but before I do that, I would say that the Steering Committee is completely behind George in turning this over to him and saying, "George, you are the boss. Put on a good show."

So, with that, I present to you George Cornish.

1.4 Mr. Cornish: I would like to also extend a welcome to you ladies and gentlemen this morning here and to echo the comments of the past two speakers. I trust that we shall all have a very fruitful two days.

2.0 "GROUND RULES" FOR ROUNDTABLE

Getting on to the format and rules--which will be followed--and I use the word "followed", I trust, advisedly, because from time to time we may stray slightly from the rules to put a little more spirit in the proceedings in order to allow a little more free-ranging debate.

There are to be discussed between now and tomorrow afternoon a total of eight issues. This suggests that it is going to require, particularly from the panel, a full cooperation if we are to keep on schedule.

We will try to keep on schedule, and if we deviate, we will have to pick up on the next issue. The procedure that will be followed is that on each particular issue the panelists who have been chosen to speak on such issue, of which there shall be between three and five, on any particular issue, will be allotted five minutes and I will be quite strict on that five minutes.

They will read their statement and expand thereon in any manner that they see fit. At the conclusion of the statements, there will be an opportunity for a period of some twenty minutes for the panelists, for the entire panel to debate the issue.

During that twenty minutes, and for the first ten of it only, the IES staff that is here today will be circulating in the audience to collect any questions that the auditors wish to have considered by the panel in the third portion of the discussion. That is for the first ten minutes of the debate while it is ensuing.

At this time, I would ask that you try to keep your questions short and devote it and direct it towards the issue that is under consideration.

We have, as it was explained by Dr. Murdoch, two readers whose responsibility it will be, in the second ten minutes, to review those particular questions, to sort them, to file them in order, and indeed to select those questions, if there are too many of them, and in some cases to combine them. It will be their choice and their choice solely as to the number of questions coming forward and in whatever order.

At the end of the second ten minutes, of the twenty minutes of debate, the readers will then read the questions which they believe have most appropriately been posed by the auditors. The panel will be asked then to direct their answers to those questions. When you are posing questions, indicate if you have any particular panelist in mind to comment on that particular question.

Because it is impossible to determine how many questions there will be, I will have the readers give me some indication at the start, to determine how much time will be spent on any particular question.

Following the written question period, there will be the opportunity for ten to fifteen minutes of verbal questioning by the auditors from the floor of the panelists. Please keep your questions short and succinct and directed to the issue under debate.

Generally, speaking, if there are a number of questions from the floor, as I do anticipate there will be, I may have to cut it off when the time has elapsed. I will be trying to keep the allotted time period for each question to two minutes.

If I might, for a moment, address myself to the panelists. Lady and gentlemen, during the debate, I would ask you to keep your comment short because time will be of the essence.

Again, please direct your comments in an objective nature to the particular issue that is under discussion at that point in time.

There will be no introduction of personalities and that goes for the audience as well. There will be no introduction of commercialism either.

With those few comments, I believe I have covered all of the points that the Steering Committee and I discussed last evening. Accordingly, with three minutes to spare, we are to proceed with the first issue.

3.0 ISSUE NO. 1. "THE PUBLIC IMAGE OF THE LIGHTING COMMUNITY"

The first issue this morning will be "the public image of the lighting community." There will be panelists who will be addressing themselves specifically to this particular issue and they are Mr. George Clark, Mr. Michael Frye, and Ms. Rita Harrold and Mr. Robert Smith.

3.1 WRITTEN STATEMENTS BY PANELISTS

3.1.1 Mr. Frye: I wish to say thank you for making me most welcome, so far, anyway.

When preparing for this roundtable, I was conscious of the honor that I would be one of the few--I did say non-American, but perhaps I had better say non-North American, in attendance.

I must say that I am very impressed that such a roundtable has been set up at all, especially where it is the intention to reveal and identify the issues, the goals and responsibilities of the lighting community, and because of this, I am conscious that some of my remarks may be regarded as critical and coming from an outsider to boot. I am an outsider who has spent four years at one of your universities and who is a great admiror of the progressiveness of your society.

Thus, I felt that I must contribute honestly and constructively in order to be worthy of the high aspirations of this roundtable.

If the schedule will permit it, I think I am allowed to insert a small story, a story of an English judge wherein the counsel for the prosecution got up and made a fantastic case and said at the end to the judge, "What do you think? There is no doubt about it. The case has been totally proven, don't you agree?" The judge said, "You are absolutely right. You are absolutely right." The counsel for the defense got up, and who also did a fantastic performance, and said, "Your see, my lord, there is no doubt about it. The case is totally proven for the defense. Don't you agree?" The judge replied, "Yes, you are absolutely right. You are absolutely right." Then, the clerk of the court, he then got up and he said to the judge, "But, my lord, they both cannot be right. They both cannot be right." The judge said, "You are absolutely right. You are absolutely right."

Much of what I shall say in this section comes from the findings of consumer research and the remainder comes from discussion with the members of the community whose work involves them with lighting in general. More research needs to be done in this area, but here is an outline of how the lighting community is is seen:

The lighting community's image is most noticeable by its absence. Where it does exist, it is as follows: The lighting community provides a service to society. It is seen, but not heard. Lighting is there, the industry is taken for granted. Historically, its role has rarely been questioned, but questions are beginning to emerge. The most obvious, in the wake of the oil crisis, is energy conservation which may favour new or different lighting policies. Less obvious is the issue referred to later on, of the effect of lighting on health and the environment. Both these have a direct bearing on lighting technology and both are receiving more attention in America than elsewhere. Although the health issue is best described as controversial in America, in Europe it is barely recognized at all. Whilst conflict has arisen in the USA between industry and the proponents of the health issue, the fact that this has not happened in Europe gives the lighting industry there an ideal opportunity to react in a responsible and positive manner.

Where the lighting community has an image, it is generally indifferent. Criticisms range from dissatisfaction with existing lighting programmes, in particular, the mass use of the fluorescent lamp, to the lack of information

available on the subject of how to use lighting correctly. With the advent of more functional lighting in commercial buildings, the consumer can see the impressive effect that lighting can have. The desire has now been irreversibly established to transfer this application of lighting and its effect to the home.

In examining in more detail the public image of the lighting community, it is useful to explore the changes and past trends. One is forced to look more closely at what has evolved.

Lighting has been seen as a decorative item, as an aspect of furnishing which does not command much attention or thought in its own right. The value put on lighting was a reflection of this attitude - people have found it acceptable to pay $1,000 for a chair, but not for a light.

Lighting was left very late in the process of building construction and to a large extent a lighting fitting manufacturer was asked to provide the lighting of a new building, or a renovation of the lighting, quickly and rapidly at the last moment. Historically, this shows up its relatively low weighting in the mind of the architect, designer, builder or home owner. No real change began until the mid 1960's when functional lighting began to emerge.

The user prefers functional lighting to be inconspicuous, unobtrusive, but fulfilling what is expected of it in showing up or emphasizing the colour, texture, shape and form of the space or object in question. It creates a mood. The important contribution of the introduction of the dimmer switch to the mood of the room must not be ignored. Its advent enabled the consumer to change the effects of lighting in the home, even by using those light fittings already installed. The more economical lighting in factories resulted in the introduction of more functional lighting in commercial areas, i.e., hotels, offices, shopes, museums, and the like. As a result, lighting now receives more attention earlier in the planning for new buildings and refurbishing old ones because of pressures by the architects, lighting consultants, designers and manufacturers, though the low priority afforded by the end-user to this aspect of the building makes it extremely difficult to achieve. Issues such as lighting levels versus the quality of lighting and task lighting and energy conservation in lighting have received more attention in the media.

Thus people are becoming more interested and aware of lighting because they are becoming more and more exposed to these issues and because public and commercial buildings now show how lighting can be used. For the specifier to be able to interest the public with an improved approach to lighting in buildings, they both need to be aware and concerned with its importance and effects. Historically, the public was not aware of the issues, but the scene is now set. The public now has a strong desire to learn and understand about the use of lighting. The introduction of the dimmer switch, as referred to above, stimulated the consumer's desire to experiment more with lighting, but when consumers attempted to emulate the lighting effects found in commercial and public buildings, in the domestic environment, they were faced with a collection of fittings unsuitable for small locations. Hence, their demand for smaller, more discretely designed fittings with limited or non-visible flex led to products suitable for every room in the house, and most important, fittings that were easy to install. In this period, the image of the lighting community has been tarnished by the lack of suitable products and appropriate supporting material and information as described above.

The fact is that light, like water, air and foot, is a necessity. It is a basic requirement of man. Without any one of these we would die. This reality should be compared with the image of light and lighting that the public has which is that lighting is only of limited and marginal use in its purely visual and decorative function. Though the seeds of this appreciation have begun to evolve, it will be sometime before a basic understanding is achieved throughout the community.

However, the stage is now set for lighting to be integrated at the onset into a building project based on the knowledge that it is a fundamental environmental requirement.

Support is needed to assist industry in fulfilling what is primarily an educational requirement (something that industry can only afford to do in a limited way) and to improve both industry's and the public's appreciation of the importance of lighting, not just for its visual requirements in use by the public, but to also identify that it is an essential need of man. It would be reasonable to suggest, even at this early stage in the proceedings, that the subject of lighting and light should receive more attention and time at universities and at other educational establishments for students generally and particularly for students in architecture and design. It may be interesting to note that in my company we give frequent lectures to the profession and its students and this is something that we have been doing for more than a decade. To date, we have never been able to satisfy demand.

This ever-growing desire for education on the use of lighting needs to be satisfied. We should be aiming at providing a deeper and more responsible understanding of the essence of lighting and what the industry is trying to achieve.

Mr. Cornish: The second panelist who will be addressing this issue is Rita Harrold.

Ms. Harrold: I feel as though I am on trial here this morning with Charley Amick and Mel Unglert who are sitting before me as judge and jury, and over to my right is a court reporter taking notes. I am wondering at this time when the sentence and how the sentence will fall.

The problem that I think I am facing, and you, George, you made mention of the lack of light on the podium, we talk an awful lot in the lighting industry of poor contrast and good contrast, and as I unfortunately had the pleasure of typing up my own notes at home on my own typewriter, I apparently have poor contrast on colored paper. However, I will do my best to decipher what I wrote.

3.1.2 If we take the discussion topic at face value there is probably little or nothing to be said. The general public probably knows nothing about the existence of a lighting community much less has an impression from which to develop an image. I am assuming therefore that the public in question here is a specific section of the population, namely those who are in some way professionally involved.

In the past the lighting community has received some "bad press" on a variety of issues--lighting levels, complexity of some of our recommended procedures, erroneous assumptions that lighting was the sole conspicuous consumer of energy at the outset of the energy crisis. With the removal of lamps from many commercial installations and the turning off of lights, gloom literally stood a good chance of pervading.

We seem to have weathered that crisis and in the '80s the view from here is much more optimistic. Public education, response to our critics, and enlarging the scope of our own area of influence to talk to other disciplines have drawn attention to the importance of lighting to the total environment from a quality as well as quantity aspect and have helped to position lighting relative to other design considerations.

The lighting community is not viewed today as a totally engineering oriented group, and in recent years we have seen much emphasis placed on the design aspects of the profession, with concern for lighting demonstrated by architects, interior designers, space planners and others. IES has recently created a new position on its Board of Directors for a vice president of design and application and this should publicly demonstrate the Society's commitment to including that area of interest in its voting structure.

Those are the prepared comments that I made, but if I do have a couple of seconds to pick up some matters that Michael Frye indicated, I would like to go on, if I may.

Mr. Cornish: Please do, Rita.

Ms. Harrold: Perhaps unlike the British community, I do not think that we have any lack of availability of equipment in this country. There has always been a lot of light sources and illuminators from which the designers can choose.

As far as the general public not understanding what the lighting community is all about, the problem is one of perhaps directing an image towards them that is indicative of the kinds of services that are available from designers and architects to the general consuming public. I do not think that we have gotten down to the level of the homemaker, for example, and I would wholeheartedly agree with some of the comments that have been made that we have not encouraged people to prepare their lighting design early enough in the game.

We seem to wait too long until ground has been broken and plans have been drawn, and lighting has unfortunately been very much the afterthought in the design projects labeling it as a necessity rather than a functioning part of the total design of that space.

Prof. Smith: I first want to recognize my appreciation and grand feeling of being a participant in this program.

3.1.3 Significant factors impacting the image of the lighting community as perceived by the professionals, bureaucrats and consumers who are not directly involved in the activities of the community.

As I prepared to write this paper, an incident came to mind that occurred during the 1978 IES Technical Conference. I was riding an elevator with a young man of college age who was attending a conference on solar energy. He scrutinized my conference name tag and responded, "Illuminating Engineering Society; what do you guys do besides screw in light bulbs?" This incident supports my own feeling that the lighting industry is, in fact, devoid of an image. This paper examines several contributors to this undesirable situation.

Absence of Degree Programs

In the U.S. Department of Labor's Dictionary of Occupational Titles, the "Illuminating Engineer" is listed along with a brief description that indicates the practice of this professional occupation requires "synthesizing", which is the highest level of cognitive achievement, "speaking-signaling", and "precision working." This is an appropriate description for a profession that is responsible for developing the illuminating systems that allow our population to extend their productive and social activities far beyond that possible in the pre-electric light era. Also, this is a profession that impacts the use of over 5% of the nation's energy consumption. Thus, it seems quite ironic that in 1977 there were 1,399,000 academic degrees awarded, but not one for the discipline of illuminating engineer. (It is true that Pennsylvania State University and the University of Colorado at Boulder do offer options in illumination as a part of the architectural engineering curriculum.)

It is folly for the lighting community to expect to have a strong positive image when illumination is not among the thousands of disciplines that are recognized by our education system. I propose that it is of the highest importance that financial support be established to develop and maintain academic programs in at least five universities including one doctoral program.

Absence of Research Programs

It is a "chicken and egg" type of discussion as to whether the absence of research programs is due to the absence of academic degree programs or vice versa, but it is a fact that the Research Center Directory, a listing of research-interested institutions, does not list illumination as a research topic. Several schools indicate that they have an interest in illumination research but only as one of several interests. Of course it is also true that there is ongoing research on subjects closely associated with illumination, but research activities must accompany academic degree programs if the programs are to have vitality and credibility.

I propose that the industry and the Government pursue a policy of encouraging academic programs in illumination studies by giving the committed institutions first opportunity to participate in illumination research.

Simplism

There is, in my opinion, a basic responsibility for the knowledgeable to be able to explain the complex in understandable straightforward language. It is also a responsibility that the highest degree of integrity be maintained throughout that explanation. When a complex concept or a product is described, the description must not take on a simplistic diluted posture if that concept or product is to be accurately perceived. To illustrate my point, it is only necessary to compare the labeling of an incandescent lamp with another commonly purchase item.

Without meaning any disparagement to pork and beans, I ask you to peruse the label that was taken from a can (exhibit 1) and then note the label from a "soft white bulb" (exhibit 2). The purchaser of the pork and beans is given accurate information on the nutritional value, the ingredients, heating directions and suggested uses plus instructions on how to store and an address and invitation to write for additional information. It should also be noted that the calorie content is listed, but without emphasis. As we examine the labeling of the incandescent lamp, we notice first that it is called a bulb; the power rating is emphasized (need I note that power and light have an abstract relationship); and one has to wonder exactly what is an "Avg. hour" and an "Avg. Lumen." Also, what is the significance of being "soft white?"

I would expect a consensus of agreement from this audience that the incandescent lamp has a higher complexity quotient than the pea bean, but the consumer would not arrive at that same decision by reading the accompanying labels.

This simplism is a degradation to the image of the product and the industry; how can we convince the public that lamp lumens, lamp life, luminance, efficacy, talbots and candelas are important values when we don't use the terms ourselves?

Industry standards should be developed that set forth a criteria for comprehensive and accurate presentation of illumination-related concepts on products. Our posture in the marketplace should be one of sophistication and accuracy. (It should be understood that the simplism is not confined to lamp labeling but has, in my opinion, permeated the industry.)

Mr. Clark: It has been interesting to listen to the other three. I had sat here originally thinking where I was going to wind up. I said, that if I had come in last, that everything pretty much sure would have been said. It is interesting, however, with the title "Public Image of the Lighting Community," the variety of interpretations that this has taken. That remark, by the way, was a communication that the panel got. I am not saying that critically, but what I am saying is that is what each of us was looking at as the explanation of what this was about.

I happen to take a more narrow approach. I addressed this subject matter in terms of the lighting community and not lighting or its products. I addressed it in terms of the public in its broadest sense of the word. So, in that context, let me proceed.

3.1.4 The IESNA represents the largest organized segment of the lighting community. Since this organization has never really addressed itself to the general public, its image is largely that developed by the general news media. Because this same media understandably does not attempt to treat technical subjects on a technical basis, it has been especially susceptible to a few articulate critics of the Society and to their description of the Society and its activities and recommendations. Their views (often more emotional than factual) have been repeatedly publicized, meeting the test of being newsworthy, while those of the IES have been considered lacking in news value and therefore remain unpublished.

It is interesting that the result has been a sort of "Johnny Two-note" approach:

(1) Lighting levels are "too high" because of the IESNA

(2) The IESNA is made up largely of "black hats" and therefore not to be trusted.

Note that this omits any reference to the many other areas of the Society's work and assumes that all those in the lighting community who stand to benefit commercially from products and services (in other words, most) are lacking in technical and professional integrity.

The media itself has been very difficult to deal with as some of us can personally attest. As naive recipients of occasional media attention we've found ourselves misquoted, quoted out of context, and frequently used to provide token balance in reporting. Furthermore, proof statements by critics are not required and cross-examination is not available. Fair or not, however, one would have to say that the public image of the IES is at least tarnished.

The Society's reputation in the public view would not be too significant were it not for the fact that the great majority of today's regulators (and tomorrow's regulators to come) have gained their knowledge of lighting through the news media. Their frame of reference thus created makes it more difficult to get an open-minded hearing for the Society's views.

While there is no financially practical way in which the image of the IES can be turned around in the media, we should resist any temptation to paint it all black. Many organizations have image problems these days not the least of which is government. The Society has fundamental technical integrity and continues to be the best and sometimes the only consumer advocate for lighting.

Mr. Cornish: When I made my opening announcements, I neglected to mention that the questions from the auditors should be put on the three-inch by five-inch cards which the staff will distribute to you and be made available.

All of the questions that you submit should be signed so that we can verify that they have been submitted by an auditor.

The staff incidentally from IES who will make these cards available to you are Howard Haynes, Mr. Shankar, David Reyes-Guerra, Larry Pistassi, Chuck Beardsley and Linda Madden. Those are the people who will be circulating amongst you to distribute the cards and will be picking them up.

At this time, I would like to open the discussion to the panelists.

3.2 PANEL DISCUSSION - ISSUE NO. 1

Ms. Harrold: I have a question of George Clark. George, I agree with your comments. However, I am asking for a little more clarification.

You indicated that the public image has been tarnished, and then in your closing statement, you said that we (IES) represented the best and the only consumer avenue of information or advocate.

Do you see us progressing in the future to improve that public image, and by what means can we get the word across that we are the best advocate?

Mr. Clark: With respect to the public image as I have suggested I do not see any practical way of improving it. We probably will have continuing difficulty in getting understanding for our consumer advocate role.

I am not suggesting that we have not faced some very legitimate questions, but the fact is the questioning has come from a frame of reference that is related to the energy situation and a desire to reduce energy requirements - including the energy used by lighting. That is the prime if not only goal of many of those by whom we have been questioned.

The goal of trying to provide the best lighting possible for the user public, whether it is commercial, industrial or residential, provides a different frame of reference for addressing the issue. It is in this context that I believe the Society is still the principal organization that is concerned about lighting for the benefit of the consumer. The need to reduce the energy used by lighting ultimately has to stand in conflict with the need for lighting. While there are lots of issues involved, the IES is uniquely qualified to contribute to the resolution of the conflict. The IES is in a unique position to represent the consumer interest.

Mr. Cornish: Are there any further comments from the panelists or any further debate?

Mr. Frye: There was a slight misunderstanding in my statement. I was not trying to deal with the lighting community in what it actually performs and what products are available. There is a very difficult issue in dealing with images until they are actually perceived.

I am surprised that you do not find in North America that the image of the lighting community, certainly in Europe, anyway, is regarded detrimentally by the fact that generally information is not available which may not be the lighting community's fault. There are those subjects of how to use lighting, how to fix it, and such as where you can buy one, but you cannot create the effect that we thought necessary, which is the perception problem which is quite a major issue.

Mr. DeKoker: George, I get the impression that we are trying to take a technical society and make them a salesman and marketer. It seems to me that manufacturers of lighting equipment, who are trying to impress and sell their particular product over their competitors to the public and users, should be the ones to provide the information if the public is interested in it.

If they provide the information better than anybody else, then they might sell their product better. It seems to me to be a manufacturer sales marketing type of responsibility rather than an IES type of responsibility.

Mr. Smith: I agree with you. I think the IES needs to establish the standards. I talked to some of my friends working for one of the various companies about what I was going to say about the can of pork and beans.

They said that the public only understands watts and power when they buy a lamp.

As long as that condition exists, then I do not see or think of any one of the companies taking leadership and saying that we are going to establish a whole new labeling procedure.

I would like to see the IES step forward and stipulate by saying what we believe is the proper labeling procedure.

Mr. Bott: I was just going to say that in almost 30 years of GSA you get to learn what a tarnished image is.

These things come and go, and you just have to persevere because eventually things do get cleared up and are straightened out. You find that you are still there and some of the other people are not. I just want to say that you just have to roll with the punches a little bit.

Mr. Cornish: Mr. Clark?

Mr. Clark: I wish to make some comments relating to some of the more recent discussions.

If we are talking again about the general public, the cost of communication is outrageous. There are amongst the auditors people like John Cuttica of the Department of Energy and others who are experiencing this problem right now in relation to the need of conveying certain information to a broad public in terms of light sources and saving of energy.

It is extremely expensive to educate two hundred million or even one hundred million people if those are indeed the ones you wish to educate.

We are faced with the fact that for any given item about which we wish to educate the consumer public, that is the household user, the communication involves a tremendous amount of funds. It is a exceedingly difficult proposition to undertake - particularly if we have changed from our present system to the metric (SI).

Indeed one of the immediate problems facing us is how we get into the metric system. It seems to be going OK in the industrial world to some extent and in the commercial world, but when we get to the general public we have a real problem. I agree, Bob, with your comments, yes I agree with your concerns but I guess I disagree with IES being a media to achieve it.

The most we have ever spent in IES on public relations was for a period of two years at $6,000 per year - a ridiculously low figure for this kind of activity. By the way, this was before the energy issues were involved. The Society had to reluctantly come to the conclusion that would not afford even this "drop in the bucket." In the end it was almost wasted money. Our intentions were good but anyone involved in this kind of area realizes that $6,000 does not go very far.

Mr. Squillace: I want to comment on one of the remarks made by Neil DeKoker and as well as on some the remarks made by Bob Smith. Bob mentioned the pork and beans label, the fact that the public, I believe he implied, and he can correct me if I am wrong, is more or less educated to what it says on the pork and beans label. Let's examine that a little bit. It says it contains beans, bacon, monosodium glutamate, hydrogenated olive oil, coconut oil--maybe! It says right on the label! It says it may or may not contain! It goes on reciting chemicals that I am sure the general public at large is completely unaware of. I do not say all of the public, I say most of the public. Now, if you take a look at the advertisement for the 100-watt light bulb it says that its average life in hours is of such and such and its average lumens is such and such output. Sure, the public may not know what a lumen is, but on the other hand, I don't think it knows what monosodium glutamate is in most cases, or anything else for that matter. What I am saying is that I don't think that we have any different a

problem in the lighting industry than what they have in the food industry, or in any other industry. Take the automobile. I dare say the public at large has not got the slightest idea of what a cam is, or what a shaft is.

I say to you that there comes a point when you have to stop. How much can you educate anybody, whether you are a manufacturer, or in any other part of the industry? You can only go so far. Once you get the horse to the water, if he does not dip his head in the water, then he is not going to drink. The public has a duty for its own health, or for its own well-being. It cannot sit there in the sun all day long and be spoon-fed with simplistic solutions to problems. For crying out loud, let's stop doing it!

In terms of Neil DeKoker's remarks, about marketing, he is right, the IES cannot as a body market the things that we have here. However, one of the steps that it has taken, and I should say should do more of, is to market itself. Both the IES here, and all of the societies abroad, in terms of what I have seen in Europe, they too have not marketed themselves.

Funds have to be raised and I understand that they are difficult to get. It is indeed difficult to do anything in the way of getting funds these days for anyone or for anything, but we just have to do it. We have to let the people know who we are, whether it be done by television, or broadcasting, or the giving out of our minutes to the public, or whether it is done by the news media, the newspapers--well, speaking of the newspapers, they have a great time in publishing some of our adversaries' comments or critics' comments, but I do find little, very little discussion in favor of the IES.

Most of the information supporting the IES position is not accepted by the news media. They are being unfair, and somewhat harshly discriminatory. So, while we do not market perhaps the actual product itself, we certainly have to market--well, I don't say the IES, but I want to say the lighting industry somehow. I want you to know that it is not just the IES that does it alone. It should be done by a lot of people.

Mr. Cornish: Thank you, Steve. Once we turn you on, we are sure to have an interesting debate.

Ms. Harrold: Steve has said it all so eloquently that I really do not have that much to add.

The manufacturers, I believe, have a pipeline directly to the consumer, and maybe therefore a greater opportunity to quote whatever word that we want right in front of them. But I have bad news for all of you, gentlemen, who may not go to the supermarket and get hung up on the labels for the pork and beans and for the light bulbs. Most women, at least from what I observed, do not read labels. They are simply whisking around with their carts and grabbing item after item. They do not have time these days. And, apart from that, why would I need to read the pork and beans label. I know how to cook beans and pork. I always have.

Prof. Smith: I have two comments. One is directed to George Clark. I was wondering if the IES should establish standards, and if not, who would and who should.

The other is simply another observation that arises from my own teaching experience. As I tried to impress to the architectural students that they should apply lighting with some type of skill, I showed them how to calculate using R-40s but they say that you can never get the data. I have difficulty getting the data myself.

How can we be so sophisticated about the science of illumination if the data is not available? And, essentially, the data is not available to the general public. Yes, you can get it by writing in, I realize that, but I am talking about sophistication in the marketplace.

Mr. Clark: I would like to comment on both of those questions. First, the matter of IES setting standards. My perception of IES, and I'm not speaking as an official of the organization at this time, but having been associated with it for two or three years, is that we do not set product standards. That is not our goal and aim in life.

It is our function to try to get lighting standards, measurement standards, nomenclature standards and various other matters of this nature. This is quite distinct from product.

ANSI is a product oriented organization. When we have light source, lighting equipment, ballast or whatever, ANSI is the source for the standard for the product itself.

We also have NEMA, the National Electrical Manufacturing Association, which sets some standards, but mainly when it gets to a product standard, it is handled through ANSI.

So, in that sense, I would find it difficult to feel that the role of the Society, at this time, should involve things such as labeling.

Incidentally, as perhaps some of you are aware, we already have a Federal regulation relating to labeling for light bulbs. This sometimes makes it difficult to get all the required information on the label and still get any light out of it.

So, there are some things that are already prescribed for the benefit of the consumer. This is not a total void. Nonetheless perhaps there is an avenue for further discussion. In terms of data, Bob, I share your feeling. Perhaps this comes from my own background which covers thirty years in lighting - about 50% involved with lighting fixtures and about 50% with lamps. I think we could do a better job.

When we get to discussing barriers, I think I can explain one reason why this does not happen. In one sense it is a "chicken and the egg" situation. The great proliferation of detail that some people desire is of little interest to others.

Again I am not talking about IES as such, but as a total lighting community we will perhaps improve the quality and quantity of our information output in those areas where we do so little today.

Mr. Cornish: Seeing there is no further debate from the panelists, and also inasmuch as our readers have the questions ready to start the third portion of this debate, I will call on the readers.

Just as a side comment, I might say on the question of product labeling, while I am not supposed to comment, in your country you have to contend with one language, but in mine, you have to find enough room to put it on in two languages.

3.3 WRITTEN QUESTIONS/COMMENTS BY AUDITORS

3.3.1 Mr. Florence: *"Is there any thought about an industry-wide public relations organization for the education of the public via the press?"*

Mr. Clark: About two and a half years old is the National Lighting Bureau. The genesis of that organization was the feeling that in fact we were not spending enough time explaining lighting versus lighting products. There was the feeling that the individual manufacturers were doing their own thing, telling about their new products and why their products were better than other people's products. In the process, over the years, very little was said about lighting and what lighting in fact can do and what it cannot do which is equally important, by the way.

So, the National Lighting Bureau was put together to provide this public relations opportunity. It has been struggling a bit. We had a problem, in the beginning, in that the public relations agency that we employed decided to go out of business after about three or four months and we had to go back and sign another one. This necessitated beginning again the education process that you have between any group and its public relations organization. However, it is functioning at this time with a budget that is somewhere between $60,000 to $70,000.

Again, when you talk to people in the public relations field, they will tell you that this is not very much money. This is what is being used at this time to try to do more by way of explaining lighting and the benefits that it can produce for people.

Mr. DeKoker: There might be an opportunity. The International Energy Agency of which the United States is a member, announced last November that the month of October of 1979 would be the International Energy Conservation month. All of the major countries, or at least most of them, have committed themselves to this program with special emphasis areas and programs to increase the public awareness of the total energy situation, the need for energy conservation, and what it can or cannot achieve and so forth.

Possibly, the IES can take advantage of this opportunity also to issue a special publication, or some sort of an advertisement, or whatever, or the member companies can, to increase the awareness of lighting in its relationship to energy in order to improve the public awareness at this opportune time. So, we have a specific date to shoot for which will give us the opportunity and challenge to work towards that.

3.3.2 Mr. Kahn: *"Can it be denied that only the visual effects of lighting relate to 'energy savings,' and that until the engineers are informed and educated to these relationships, design cannot accurately take them into consideration?"*

Mr. Clark: Can you try that again?

Mr. Amick: Maybe Myron can in one sentence clarify this?

Mr. Cornish: Mr. Kahn, could you try to clarify it?

Mr. Kahn: Take it in two parts.

Mr. Amick: *"Do you agree that for too many years the IES stressed the quantity of light, footcandle factors, rather than its visual effectiveness and only in recent years has the IES applied itself to the quality aspects, ESI, visual performances, et cetera, that ESI is a complicated system; and although basic laws of physics have been available to guide lighting education, instead emphasis has been on engineering and design rather than a better understanding of the visual functions of lighting and its relationships to the needs of the eye brain system?"*

Mr. Clark: To some extent I would agree with Myron but then I would have to look back and recall that in 1957 I presented a paper at the IES Annual meeting which had to do with the visual environment. We have had some others in the years since. In August 1961 we had an issue of Illuminating Engineering devoted to the luminous environment.

I remember as I came into the lighting field originally there was considerable concern about direct glare and veiling reflections. We sometimes think that veiling reflections came along only as an issue with ESI. They have been a design consideration for many years. Of necessity they were handled in a qualitative way since we did not have the quantitative know-how to do otherwise.

We had a rather pragmatic way of trying to cope with a problem--indirect or luminous indirect luminaires. We knew that louvre shielding was not appropriate. It was only when we got to the ESI concept that we began to feel we could apply numbers to this factor. It is inaccurate and unfair to suggest that it was not previously a design concern. Perhaps we were not as knowledgeable as we should have been or could have been and perhaps there were some people that were not concerned, but IES itself recognized the problem.

With respect to direct glare, we are on our third direct glare evaluation system. The first of these goes back a long way. I suspect we will be talking about this when we get to the environmental issue.

In terms of the aesthetic and psychological aspects, as Myron well knows, I have taken issue with the Society in years past. I am pleased to see that in the last 10 or 12 years there has been a good deal of additional activity that has taken place. I think we are developing a greater concern for the visual environment and not solely on an intuitive basis.

So while it is true that we can always do better, we do not need to feel that we have totally neglected other concerns such as illuminance and direct glare. Unfortunately, the image that we are talking about here gets down to the most simplistic aspect, which is footcandles. So, in that sense, you are right in that, unfair as it may be, we suffer from that in terms of our image.

3.3.3 Mr. Goldin: *"We are not a consensus group. Criticism from Ralph Nader and the New York Times is partially right in that it is only recently that we are trying for a balance and it is quite expensive to participate."*

Mr. Clark: Saul raises a good point. Being foolhardy, I'm ready to comment on it. Seriously, he raises a point that is a problem. It is a significant barrier and it is in that area that I would have expected it to be raised. But all of the subsequent subjects have some bearing on the image part of it. That perhaps is one of the difficulties we are experiencing in this first roundtable session. We have had difficulty over the years in getting certain kinds of participation, since as a Society we do not have the funding to pay for people to attend our technical committee meetings. The meetings are open and we encourage attendance but unless a person can get there and pay his own way, there is no way this can be done.

For many years the American Institute of Architects paid the expenses of people attending their committee sessions. Obviously this has been a problem in the politics of establishing eligibility for funding. A few years ago in dealing with their hierarchy, I learned that they were thinking of dropping this policy. Whether or not they have, I have lost track. It does then become a question of who is to decide who gets paid and who doesn't. That's a nice little political problem for any type of organization.

I have been concerned by the fact that we have not been able to get many of the consultants or architects we would like to have participating - particularly from the smaller organizations. They have people who could contrbute and yet can just not afford to go to meetings.

We have corresponding members for our committees but that is less satisfactory for both sides compared to having somebody who is actually able to participate in the discussions. As Saul well remembers this matter came up in my tour as the incoming IES President.

I have to admit that I have not found an answer myself and I don't think the Society has at this time either.

3.3.4 Mr. Fisher: *"There seems to be pessimism about improving the image of the IES. Should we not try to maintain communication with the critics? Get them working within the Society?"*

Mr. Squillace: Of course, we should keep the communication lines open. All of the critics, be they Ralph Nader, Bill Lam or Dick Stein, or any of the other prominent names appearing in the press. Whoever they are, the lines of communications should be kept open, yes. The question is how to know which is the real important one. Again, I repeat, that is a two-sided coin. Bill Lam was invited to be here today and he isn't. Sorry about the name again, but he isn't. Darn it! I wonder why? That is all.

Dr. Lewis: I should think this comment should not be let go without saying that of course many of our severest critics are within the Society. Anybody who has sat in on any of the recent technical committee meetings has been perhaps overwhelmed at the lack of accord by the people sitting around the table. There are indeed substantial disagreements even within the Society, but I think that is very healthy. I think too that indeed there are people outside of the Society who are also critics, but that at least certainly within the Society everybody is not all on one line. There is substantial criticism that is ongoing at all times.

Ms. Harrold: Yes, I think there is another group and not just the critics. I think that group includes anybody who is at all involved in activities that may be at the periphery of the field of illumination. We should try to work with other organizations and other people who have some bearing on what it is that we do.

I would not want to emphasize the word "critics" because I think that is what we have been doing in the last couple of minutes. There is a whole range of people that could be very helpful to us. The Government agencies is one example and the IES management committee has discussed that very issue this week. Fortunately we do have some good lines of communication with people in various agencies such as the Department of Energy, naming one example.

Mr. Clark: I may have left Bill with a feeling towards the end of my statement that it was a bit pessimistic. First of all I would like to say that I personally have spent long hours over several years with some of our most severest critics trying to listen to their ideas and to convey ours.

After a very honest attempt, I happen to have been defeated by someone who disagrees with me - not because of the fact that he disagrees with my ideas but rather because we cannot somehow have a discussion and agree that our differences of opinion are honest ones.

I prefer to make no further comment on this except to say that there has been a very strong effort made in this particular regard.

My particular comment was related to the public image in the broadest sense. I am pessimistic in making any significant changes in the foreseeable future. It would take a number of years of getting repeated favorable publicity - which is almost impossible to get in the news media. I would be inclined to come back to what I thought was a very cogent comment by Norm Bott. It is just something which has happened and we must go on doing the best we know how hoping that over a period of time the negative image which has been created by some of this material will pass.

Mr. Frye: I think perhaps we have been spending an awful lot of time talking about different parts of the elephant. I am certainly conscious that the issue, or at least one of the issues here, is the information, and not just about the product itself, but how to use information.

I think we have gotten off the topic of what the image is of the lighting community by the general public. They feel there is a lack of information available to them where and when they want it. It is not necessarily directed at the

product, but how to use it. I think this is something that we have to direct our attention to. It will be an expensive exercise in the education of people, but it has to be put into perspective. In my view, this is the key issue of how to use lighting and not necessarily which individual products you would select from 15 different items that are exactly the same thing. The question lies in how you actually use it.

Mr. Cornish: Thank you. Mel will have the next question.

Mr. Unglert: This is to the general panel by Francis Ventre.

The question, as I would interpret it, it reads:

3.3.5 Dr. Ventre: *"It seems likely that consumers, building owners and managers, legislators and regulators need to be informed to some degree. Where should emphasis by placed and what should the different messages be?"*

Mr. Cornish: That is a general question to the panelists? Where should the emphasis on this education approach be placed? Would someone like to kick off on that question?

Mr. Clark: Sorry. It seems I am not as bashful as some others.

One of the things I think, and have long thought, as some of the people at IES will recall, is that IES itself does have an opportunity to work somewhat in the direction that Bob Smith has suggested. Had we not been hit with the energy situation when I assumed my presidency, maybe we would have gotten it off the ground because I felt so strongly about it.

We have a tendency to produce a lighting recommendation publication whether it be for schools or offices, or whatever without a specific audience in mind. They are developed generally with the idea that a consensus is reached on what the specific lighting under consideration ought to be and then someone tries to describe it in appropriately technical terms. As a consequence it often winds up being a document which is not readily usable by many of the people we would like to reach with it. This does not necessarily detract from it as the reference document.

It has been my suggestion that our recommendations continue to be developed much as they are now, but then with the help of less technically oriented people subdocuments would be produced that are addressed to particular audiences.

In the case of school lighting, for example, it might be a simple two to four-page folder with abstracts and statements for the basic document addressed to contractors. Another might be produced for school boards having in mind their concerns. This is just one illustration.

In the case of industrial lighting, for example, there might be a similar kind of document produced for the plant engineers.

Mr. DeKoker: I think one of the things that we have to communicate to our legislators, and to the general public, is that although lighting is highly visible energy, as an energy consumer, it really represents a small amount of the total energy used in the country.

I think the real increase in interest in lighting standards are the booklets that have come out, like the FEA's lighting and thermal operations. They were developed because lighting is a highly visible energy consumer and therefore ought to be given our first attention. It is still getting a lot of attention.

I really believe that out of 215 million people in this country, 214.5 million really do not want to know how to design lighting systems and get into a lot of detail.

They are very comfortable with the fact and the knowledge that, if they need an expert in the area of lighting design to do a complex job--whether it be for a major industrial complex or for a residence--that they can call on somebody who has that knowledge and that it is readily available and can be purchased.

I think that we are trying to address people who really don't want to know all the details about lighting design. They have no interest. We do have to address misinformation about the amount of energy that is used for lighting. For example, people will look at a big neon sign, or something like that, and say that it is kind of bright. Is it really necessary?

Perhaps, if they were to realize that the lighting in the lobby of a building may only represent 0.1 percent of the total energy used in the building, then they may not be so worried about it. I think that is probably the issue that we have to really address more than anything.

Prof. Smith: I am not sure how far Francis Ventre wanted to go back in identifying the issue. Of course, I have my own prejudice, but I believe it lies in the field of education. That is where we really have to start.

I live in a small town in the prairie. I know it is not New York City, but without making a survey I would be very confident in making the statement that there is not a single practicing engineer in the City of Champaign-Urbana that has ever taken a course in lighting design or a course in visual perception.

That is not to say that there is any great magic about what the academic can lend. I am not saying that you cannot be a good designer in not knowing those things, but I do believe that it is the essence of this, because you said there were a half million that knew something about lighting.

Mr. DeKoker: I said there may be a half million that might be interested.

Prof. Smith: When I look at people who are doing the lighting design, in the small towns in the Midwest, they certainly do not fit in your half million. I am not sure they are interested but they are doing the jobs. I believe that the void in the educational system is one of the main contributors to this lack of interest in lighting.

Mr. Frye: I am surprised that you actually think there are these few hundred people interested in how to use lighting. We did some consumer research in England, France, and Germany. Certainly there we found the biggest issue, when we did this consumer research, which may be the case or not the case in America, was knowing how to use lighting, to learn more about it, which comes out of something like 80 percent of the people that we interviewed by an independent organization. Secondly, I go along very strongly with this education problem as to how you get it across. Despite what people say or may indicate, it is not that easy to get it across. It is a very expensive exercise getting information from a lighting manufacturer to whoever the user is.

It is all right when you have a hundred thousand dollars of installation, but when you get down to a ten or a twenty-dollar sale in the room, I think it is a very fundamental issue to be directed towards the high school, the lighting engineers, or the engineers who are doing the designing.

Dr. Ross: I have been reluctant to talk on the subject. I am not really too qualified to speak on the public image of the lighting community. I will be going only on my personal point of view. I should also say that it should be tempered with the fact that I very sincerely believe that whatever bad press might be attributable to past actions has been corrected because I think there is a strong breath of fresh air that is moving in our direction which I personally feel is worthwhile for IES and the lighting community itself.

So, with that caveat, I would like to take a little bit of issue with what Neil DeKoker has said concerning lighting energy being insignificant. I think if we look to any place where there will be energy savings, coming in all small amounts, there is not one target that one can shove aside. What we are going to finally have to do is to take each of these little elements and work on them, and on optimizing each item. For instance, as bad as the lighting is in this room, I would hate to see it out of here altogether.

So, with that expression, I think lighting is as important as any other, and perhaps some people thought that there might have been some excesses that were easier to get at compared to some other fields. At least, I think we have made some strides in that direction.

As far as the public is concerned, and by public, I guess I would have to limit my comment to those people who use lighting, who are concerned about it, not necessarily the designers, but perhaps the building owners or operators. I think when they come into contact with lighting is when they install some and they are given some recommendations, the only thing, up to a few years ago, that they had to go by was something called the lighting level. They wanted seventy footcandles, or one hundred footcandles or one hundred fifty footcandle, and somebody would recommend one hundred fifty footcandles, but when the price came in at a dollar and a half a square foot, they say, "That is too much. What can I get for seventy footcandles or fifty footcandles."

Lo and behold, once they got the fifty footcandles they would say, "What the heck is this one hundred fifty footcandles all about? Why did you recommend one hundred fifty footcandles?"

There was a credibility gap, especially when the lighting standards came out and stated the minimum footcandles on a task at any time. By gosh, that is pretty powerful. Perhaps it was excusable in those kinds of reommendations. But, then, somehow OSHA came along and suddenly these recommendations became the law and people were compelled to use them and that is when I think they rebelled. I think these things have started a compounded problem and have perhaps led to something of a credibility gap.

3.3.6 Dr. Berman: *"Research in lighting would be more appropriate if you include research in vision. Would you comment on a number of universities and research establishments involved in vision research, and if you cannot remember them, Bob, I will be glad to give you a hand."*

Mr. Amick: I suppose you know Ohio State University that some of you mentioned, Pennsylvania State University, Kansas State University.

Prof. Smith: I think North Carolina is in there also? Is there not one southern school?

Mr. Amick: The University of Virginia. There is some work that is being done at Georgia Tech and at the University of Colorado. This is essentially the list, Dr. Berman.

There are other research establishments such as the Franklin Institute that are doing research in vision.

Dr. Lewis: Yes. I think your comments are very appropriate. I think you are showing exactly what the problem is because you are only counting institutions who do research supported by the Illuminating Engineering Society, and in fact, there are thousands in universities that do research.

What you are doing is saying, "Who is doing vision research where we are testing the effect of luminance level or that of glare or something on vision, where in

fact there is a wealth of data being generated daily that the illuminating engineering community more or less unfortunately ignores because it is not done by illuminating engineers.

I think that is one of our problems. We have to look at the tremendous amount of data that is available, and when we include that, your list will go from seven up into the thousands.

Mr. Cornish: Those are two viewpoints.

Prof. Smith: It is not my intent to exclude those notable institutions doing research on vision, but to point out that there is more to illumination than vision research and there is a vast field where there is no research being completed.

Mr. Unglert: There are two questions I have that are very much akin to each other. I will read them both. One of them happened to be directed to Mr. Smith, but I think they are general.

3.3.7 Dr. Atkinson: *"Would a clearer or a more complete message on incandescent lamp packages enhance the public image of the lighting community, and what format would you suggest?"*

3.3.8 Mr. Cuttica: *"What type of information should appear on lamp labels to better educate the public and what specific means should be used to educate the public community?"*

Prof. Smith: I think that all of the information that is usable to the person who is designing or employing that particular product should be available at the time of purchase.

I did not particularly mean to stamp it all over the label, but certainly the packaging or the pamphlets should be available in order to give all of the information that is appropriate for applying that piece of product.

Mr. Cornish: Any other comments?

Well, that is the end of the actual formal questions.

We will now take about a ten-minute period, at which time, the members of the audience who are auditors will have an opportunity to direct their own questions to the panel or make a comment.

I would ask you to keep it short and brief and to the point.

3.4 ORAL QUESTIONS/COMMENTS BY AUDITORS

3.4.1 Mr. Jewell: The Illuminating Engineering Society in this and in any other country is a very small part of the lighting community as such. However, in the United Kingdom, the Illuminating Engineering Society has recently become part of a larger community of building sciences. I wonder if Mr. Frye would like to comment on whether or not that integration and interrelationship has yet had long enough time to demonstrate that there is a greater degree of professional intercourse now.

Mr. Frye: Well, the first answer to that question is that I am not altogether sure. I think it is too early to say, but the early consensus of opinion appears to be that it is a shame to be absorbed in that way because it has been ranked with things that are traditional, and such like, which I think is an unfortunate change.

I actually spoke with John Collins, the past president of the English IES, who I think was doing a pretty good job with the funds that they have available. I

think it was a terrible shame because it came about mostly from political pressure from the British Government. The first round of impressions is that it is a bad thing. So, I cannot really say what will be said later on.

3.4.2 Mr. Wotton: First, I would like to make a comment. Although I live in Canada, I teach at a school in the United States, and perhaps I could indicate how lighting is considered at the school which I believe is one of the largest universities in the United States in that the architect gets three hours of one term, and the engineers designing lighting systems get no lighting input at all.

I have listened with great interest, sir, to the comments that Professor Smith made about the need for further education, but I should be interested to have your views on where these graduates, and so on, are going to get work once they have received their education.

I understand that one of the schools in the United States which used to give a graduate degree in lighting, in some form or another, no longer gives that degree because the call for this qualification is no longer there. It seems to me that we have, in some way or another, to generate a desire for better education among those people who are going to be eventually employed, that is, the graduates of these schools.

On the question of the education of the public, could Mr. Frye comment on some British experience in educating the public with respect to the trade association. I understand that the organizations that were there are no longer there, and I wonder whether they fell out of use because in fact they were not able to do the sort of job that the people who were paying the money were expecting from these organizations.

Prof. Smith: I will address your question in much detail on the last subject of the conference when I shall be talking about education.

But, just as a brief statement, the endeavors that the universities perform are directly in relationship to the amount of money that is available. By example, the University of Illinois, I do know that some of the graduates are still here. It is one, if not the leading school of illumination engineering in the country, however the research money dried up and so the program dried up. So, I think those two have to tie together.

Mr. Frye: I do not think I can answer your question, sir, because I do not know the background before the advent of the Illuminating Engineering Society. So, I'd rather not comment. I am sorry.

Voice: It seems to me that part of the general public view of the lighting industry is gained by looking at large buildings that are lighted after hours, and it just occurred to me that the lighting industry has no control over them. The people who have control over those buildings that are burning a lot of energy, when it is not really required, are the building owners themselves.

I do not know who to address this question to, but with respect to the National Lighting Bureau which has been set up for public relations, has there been any campaign launched specifically as it pertains to building owners to point out what they can do to save energy and save their own image at the same time?

Mr. Cornish: Mr. DeKoker has been quite involved in that activity. He might be able to answer.

Mr. DeKoker: As a company that has over three hundred million square feet of manufacturing and office floor space worldwide, and I guess that is a pretty good amount to talk about. One of the important programs that we had in initiating our conservation program is of course educating people and management and employees to turn off all equipment including lighting when it is not needed, at such time as, for instance, during luncheon breaks, between shifts, at the

end of the shifts, and so on. In fact, the janitorial services were realigned in some cases, to be performed during normal operating hours so that we could turn off the lights at the end of shifts.

Another practice put into effect was only turning on equipment in those areas of the buildings where people were actually working. Then, to turn off equipment in that space when the work had been completed and employees moved to other areas. By example, some spaces were lit or equipment operated for eight hours when the need justified one hour. There has been quite an effort in that area. So, there has been quite an increase in energy awareness in the past few years.

3.4.4 Mr. Kahn: My question is directed to Professor Smith and Mr. DeKoker. You indicated there are many other important lighting studies taking place at various universities around the country, in addition, to vision; addressing yourself to the building industry's problem, concerned with excessive rates, paying for electricity and the exorbitant amount of lighting it takes to illuminate nonresidential buildings, do you believe you could very well impress a building owner by talking about all of these other, invisible areas of importance to lighting, other than vision? They light buildings for visual performance, for vision, and if you can't sell them in using lighting for that purpose, I don't know what other research you would have in mind that might affect that.

Now, Mr. DeKoker made the comment that he didn't think that the amount of lighting energy being used in the country was of great significance. Well, if the figures we've got are correct, and I presume they are, the $3-1/2 to $5 billion in lighting energy waste in nonresidential buildings may not be important, then of course Mr. DeKoker would be right.

When a spokesman for the Illuminating Engineering Society addresses this group by starting off to say that there is no oil to be saved in the United States by conservation of energy in lighting, as Mr. Fisher did, what are we to use as our foundation?

Personally, I know that this isn't a fact: that there is a great deal of oil to be saved in the United States by practical and intelligent use of lighting, and I don't think that the public relations of the Society or the industry is going to be improved, until the industry and the Society addresses itself to the problem of visual performance, which results from lighting, and which is the only real measure than can relate to energy conservation.

Prof. Smith: Either I misunderstood you or you misunderstood me. I said that there were areas of research other than in the illumination area. I think that there are some very important facets to illumination besides--well, the exact term has slipped my mind--visual performance?

Mr. Kahn: Vision.

Prof. Smith: Please, do not misread me. I am not trying to discount it. There is a lot more to it. Perhaps, we in the State of Illinois still fight Indians and ride horses, but most of the people are not to the point in the engineering profession in the Midwest region that they can address themselves in a sophisticated manner with respect to the subject of vision.

We have to first be able to understand what a candela is, and what lumens are, and a few more terms dealing with light. I am not knocking the profession, but what I am trying to knock is the educational system which would permit the professions to develop in such fashion.

3.4.5 Voice: The question has to do with the air conditioning and the heating people who are reducing their heating bills by reducing their heating levels, but letting the temperature float higher in times of stress in terms of energy consumption.

Yet, these two professions are literally responsible for helping the people in times of severe weather.

My question basically relates to the fact that you feel that the lighting society is somehow being denigrated by being grouped in with these two organizations, and that somehow lighting is more important than heating and air conditioning. I would have rather felt honored to be grouped in with something that is so basic.

Mr. Frye: Basically, I was not expressing my own view. I have yet to see whether I really think that the IES, in its incorporation with CIBS in England is a good or bad thing. I was only reporting to somebody's question with respect to what the typical view in England among the lighting community was. That was a bad thing. I did not necessarily subscribe to that view.

3.4.6 Dr. Berman: I would like to address myself to the panel with a particular question on the public's image. In talking to public interest groups about various professional organizations that influence lighting levels, in their building environments, one perceives the feeling that the Illuminating Engineering Society, in its membership, is dominated by people from the lamp industry, and from the electric power industry.

If the IES believes that they should improve their public image, would the panel like to comment on how they would include in its membership, a wider range of interests that might reflect some of the desires of the Society, especially as they reflect on consumer interests?

Ms. Harrold: I would say, just from my personal experience in working on various technical committees, all committees certainly strive for some kind of balance and in fact it is a mandate from the Board of Directors that we must have a balance in representation from various areas of interests.

I would like to speak to a specific example. We had a meeting of the energy management committee last week, and one of the committee members, out of his own curiosity, looked around the room and came up with a grand total of members present enunciating what areas of interest they represented.

Out of eighteen people, only two were in the producer-manufacturer category, and we were heavy in the consulting and user end.

So, I think on committees you should find that there be a balance. If you look at the Society in general, and I say it is heavily weighted in terms of technical group membership, then I would say that all of you should go out there and find new members. Someone should go out and get them and their interest groups to become members.

Mr. Cornish: I think that we will now close off the discussions on this topic.

So, let us take a fifteen-minute break.

4.0 ISSUE NO. 2. "U.S. ROLE IN THE WORLD-WIDE LIGHTING COMMUNITY"

4.1 WRITTEN STATEMENTS BY PANELISTS

4.1.1 Mr. Squillace: Except for a very limited number of individuals, the U. S. industry (in general) has not been represented in the lighting community meetings.

The user industry (users of lighting) has done very little to promote the understanding of lighting art and science in our own country, let alone sponsoring people to attend the meetings around the world concerning the subject. The lighting manufacturer, on the other hand, has sponsored some activity abroad. In my opinion, it (the lighting industry) has not extended itself far enough to really understand in depth the meaning of some of the decisions which have been made both overseas and at home. As far as I know, the U. S. Government has not participated abroad at all on the subject of indoor lighting, and domestically, only recently (inspired mainly by the energy crisis).

It is, therefore, imperative, in my belief, that the user industry, the manufacturing and supplying industry, and the government attempt to accomplish four major objectives:

1. Sponsor and fund, together and separately, research on indoor lighting.

2. Report the results of such research not only within the confines of our own borders, but all over the world.

3. Invite other countries here to our shores and sponsor some groups ot the world-wide lighting meetings and symposia.

4. The same parties should jointly sponsor a couple of dozen or so chairs throughout the world at leading universities to teach the art and science of illumination.

Though the education item is mentioned last here, the order is not meant to detract from its importance. It is just as important as research.

While I have been discussing the role of the U.S. in the world-wide lighting community, it is not untoward to form an alliance with whatever countries are willing to cooperate on the four objectives mentioned above.

It is not to be considered that it is unhealthy or insane to consider, if you will, a "United Nations" of lighting research, professional registration, etc. Such a group could also serve as administrators of proper education at various world-wide universities, as well as administrate CEU for re-registration of professionals.

4.1.2 Mr. Clark: On an organizational basis the United States is represented by the U. S. National Committee of the Commission Internationale de l'Eclairage (CIE). We are one of thirty (30) countries in that body. At the present time the U. S. has the chairmanship of five (5) technical committees out of a total of twenty-nine (29). The CIE President of the past four years is from the United States. The USNC has eleven (11) constituent organizations including of course the IES of North America. So much for statistics.

The IESNA is itself international in that its membership comes from Canada and Mexico as well as the U. S. The Illuminating Engineering Research Institute has an international outreach through the frequent research symposia which it has arranged in Europe.

It is evident from the foregoing that the U. S. lighting community has had an active role in the organized aspects of world-wide lighting. The North American contributions to lighting practice elsewhere in the world have been many. In the

field of color, for example, the Color Rendering Index and the basic work in colorimetry had U. S. origins. Shielding of luminaires in work spaces and the development of air-handling luminaires are other examples. The U. S. has been the prime-mover in getting international attention for the field of photobiology. The concept of visual performance is one which is getting more application attention internationally. The U. S. through CIE has been a strong influence in the studies of vision -- photopic, mesopic, and scotopic. We are also making new and important contributions to the study of visual environment.

The U. S. role in the lighting community of world, however, is not simply to press for adoption of our own contributions. We have no monopoly on ideas and knowledge. Our participation must also have the purpose of learning from others around the world. I believe it does.

4.1.3 Mr. Frye: I would like to preface my remarks with the following qualifications. This was not a subject that I chose to speak on. My own involvement with lighting community only really began in 1976, having come from the mechanical engineering industry, and my knowledge of the lighting community, particularly in the USA, is accordingly limited and wholly coloured by a European perspective.

The world-wide lighting community is fundamentally dependent on new and better light sources. I know only too well as a lighting fitting manufacturer that the major constraint on developing new fittings is the availability of new light sources. Specifiers, (be they architects, lighting consultants or designers), are fundamentally constrained in what they can do by the fittings that the lighting manufacturer provides. So, in short, the public depends on the specifiers, specifiers depend on the lighting fitting manufacturers and the lighting fitting manufacturers are dependent on the light source manufacturers. With a few exceptions the light source manufacturers are most advanced in the USA and many of the European light source manufacturers have American parent companies controlling them. Where they are not directly controlled or owned by U. S. light source manufacturers, they probably have agreements with U. S. light source manufacturers. Thus the light source manufacturers dominate the world-wide lighting community, and the U. S. dominates the light source manufacturers. With this position comes huge responsibility, and the role of the USA must clearly be to provide more and improved light sources, to influence better lighting practice, and to directly or indirectly influence light source manufacturers outside the USA. In short, the role of the USA is to lead the world by providing what is needed and by example.

In addition, not only do American light sources and fittings influence the work market, but American building forms are widely exported. The USA tends to lead the world in living and working patterns. In part, this is because America is very potent commercially and because it is an aspect of the American cultural tradition to explore the applications of technology in everyday living without the kind of restraint that often occurs in older cultures. As a result, the rest of the world tends to look to America as a workshop where new ideas and applications are conceived and developed. For example, task lighting which first emerged as a concept around 1973 in America has not yet been fully explored as a working principle. Although in Europe it has been applied to a limited extent, the predominant attitude is one of waiting to see what America will ultimately make of the idea. In this respect, Europe generally imitates and follows American leads, waiting for America to work out the problems.

In my view, it is essential at this stage to gain a perspective on lighting's current importance relative to other aspects of buildings. Lighting equipment probably accounts for less than 10% of the capital cost of a building and in many cases for less than 5%. In addition, the use of energy in lighting is surprisingly low in that it accounts for less than 15% of energy consumption in most buildings and the best average available for a European building is estimated at less than 8%. Against this, we find that more than 80% of all the sensory stimuli in man are optical and, perhaps even more surprising, it has been reported that over 25% of the entire human energy budget is normally required for visual

processes alone. It appears that we in the twentieth century ascribe less importance to lighting than did our Maker. Though this in itself is not a reason for putting more lighting into buildings, it does indicate the importance of lighting to man and warns us that it is an area which may need more attention.

Later on in the day, I will be talking about the effect of lighting on environmental quality and more detailed attention will be given to the effects of artificial lighting and the areas where it may be potentially harmful or in need of improvement. Considerable research needs to be done in this area to substantiate existing findings to isolate the most harmful areas and to identify suitable remedial action.

Suffice to say at this stage that we need to take a better perspective on energy and lighting. Though various governments have directed considerable funds towards promoting energy saving even with lighting, the benefits in terms of savings are tiny and the costs in terms of increasing potentially harmful effects are likely to be substantial. If we could achieve a 25% saving in energy consumption on lighting in buildings (which I hasten to add would be a substantial achievement for a whole country or economy), then the net saving on the total energy consumption bill for buildings would be 25% of 8%, i.e., less than 2%. To achieve this saving, lower quality lighting in environmental terms would have to be used with the risk of unquantifiable damage. Such an approach must be a bad trade-off in human terms and incidentally in commercial terms as well. The full implication and effects of such an approach need to be fully researched before any further action in that direction is taken. My own view is that an overwhelming case exists for improving the quality of lighting and we are fortunate in this case in that the human and commercial objectives coincide. It is clearly advantageous from the human or social point of view to have better quality lighting and it is also in the interests of the entire lighting community including light source and light fitting manufacturers, architects, lighting consultants, designers and the like for a higher expenditure in total and proportionately to go into the lighting of buildings. In addition, it can be argued that it is also in the interests of government and the economies of the world.

Perhaps the best opportunity for energy savings with respect to the lighting industry would be more constructively directed towards using better materials from an energy consumption point of view, i.e., in fittings, light sources and other hardware.

In the past, the USA has done a substantial job in supporting the development and pioneering needed for the world-wide lighting community. I would not want to leave you with the impression that I am criticising what has been achieved so far, and I am particularly impressed with the range of light sources that are available in the USA compared to Europe. As an example, I believe that there are several hundred types of PAR lamps available in the USA whereas there are less than ten types available in Europe, though I accept that, in this respect, having a lower voltage for your electricity distribution network is a big advantage.

Perhaps one exception to this is the application of tungsten halogen, i.e., quartz iodine lighting for general use. Because mains voltages are usually higher in Europe than in North America, it has been worthwhile to develop lighting fittings which step down mains voltage to run small quartz iodine sources at low voltage (12V or 6V). In this area, Europe has been taking a limited lead, but one again American has a potential advantage even in this field since compact tungsten halogen sources can be run direct from American mains voltage and it has been easier to develop low wattage (150W) sources of this kind in America than in Europe. This year, the first mains voltage 150W tungsten halogen source was announced by a German manufacturer but there is still no firm date for its commercial availability and even the 300W mains voltage tungsten halogen source took two years to develop and still suffers from poor light distribution.

Recently, the East European countries, particularly Czechoslovakia and Poland, have begun to export extremely competitively priced basic light sources as the GLS incandescent lamp and have, as a result, forced many European manufacturers to concentrate to a greater extent on sources which were previously considered either too sophisticated or to have only limited market appeal. Many West European manufacturers are now promoting decorative incandescent lamps of various kinds particularly lamps with new or more interesting shapes and (to a lesser extent) lamps of various colours. This commercial invasion from Eastern Europe has probably been another factor in the move towards developing low voltage quartz iodine/tungsten halogen sources and fixtures. It is not improbable that in the near future these same East European countries will launch a major export drive with similarly competitively priced fluorescent tubes which could be expected to have an even greater impact on the existing market shares enjoyed by the major American and European light source manufacturers. We must, in particular, ensure that the quality and life of these fittings are at least as good as the current American and European equivalents.

We are now at a crucial stage in the development of industry and the evolution of mankind; the USA, bearing in mind its dominant position in this industry, has a huge opportunity and a vital role to play.

The business community is in the best position to influence the public at large, governments, economies, world trade and the like. Energy, or should I say the lack of it, has built up into a dramatic issue as have other raw material shortages. Though I do not wish to get into the great energy debate, the implications as far as the lighting community is concerned, are important. Please bear in mind that my comments here are limited accordingly. If economic history repeats itself, it will not be the lack of energy and the lack of raw materials that will determine the future prospects for the world economy, but the attitude and inventiveness of man; solutions may include considerable realignment and adjustment by man to more reasonable attitudes towards the use of energy and other scarce resources, i.e., away from learned wants to an approach based on essential needs. There is no doubt in my mind that solutions to the various energy and raw material problems will come, what is at issue is how long it will take and who will do it. Who will take the risks which are even more substantial in terms of new technologies than in the 40's? The environment for risk taking is that much more difficult now. The second world war did provide an opportunity for exploring new technologies, processes and materials. These were subsequently introduced and were a fundamental ingredient in the economic boom of that post-war period. The USA must support new processes, new technologies, new materials, new systems and new approaches, particularly where directed towards the lighting community. However, in the process of introducing these new ideas, we must not repeat the pitfalls of the past. Each item must be carefully tested and the USA can set an example and not allow the public at large to be the guinea-pig.

In the meantime, we need to apply our attention to "restoring the balance" where we have disturbed it. There is little gain if all we have done in saving energy in lighting or in developing new technologies including new light sources because of lack of full and thorough research into non-visual side-effects is to run the risk of contributing, however minutely, to damaging the environment. Though individual items of research as we will see later on, are not in themselves conclusive, cumulatively they identify the need to carry out more research in this areas. It would be a shame if for the sake of a dime, i.e., relatively inexpensive research before commercial exploitation, we inadvertently contributed to the greater need in society for hospitals, prisons, delinquent centers, mental institutions, cancer wards and the like.

Topics Which May be of Relevance and Which are Under Consideration

Other opportunities for the USA taking a leading role include:

- The implications of "the new physics" on our understanding of light and its influence on biological systems including ideas such as The Theory of Dissipative Structures (New York Times, 29 May 1979).

- Encouraging improved communications between various research areas, in particular lighting and medicine, including cancer, psychology, therapy, delinquency, crime. This should include light and colour therapy.

- Researching into controllers using Microprocessors to measure and control levels of various wavelengths of light in a totally controlled environment and other applications.

4.2 PANEL DISCUSSION

Mr. Cornish: Now, in the same format as utilized for the first session, during the next ten minutes, the staff will circulate for the questions of the auditors, and in the meantime, the panel will debate this matter.

Mr. Squillace: I would like to comment on the statement made by George Clark concerning the CIE and the involvement of the United States, and so on, in that area.

Certainly, there are some thirty odd countries who are represented with the United States being one of them.

As I see this, those countries have been dominated by the manufacturers. They have been the most active in that area including the United States.

There has been very little participation by the consulting engineers' side, and/or even the educational side to some extent. What I look for, hopefully in the future, is that if they can only structure this properly, then you will have more participation by the practitioner, the lighting designer, or whatever name you want to ascribe to it. Then go ahead to label the users and the designers in our area.

For example, in all of the meetings that I have attended for CIE, both here and abroad, I do not think I have met any building owner, or any legislator, on either side of the fence. There are people here who have attended a lot more meetings than I have and they may have met some. But, I think that they have been more conspicuous by their absence rather than conspicuous by their presence. They need to be involved.

My friend Saul Goldin tells me that I have not paid attention to Pablo Cahaega who has been quoted to say that those who are gifted should pass on their knowledge and gifts to others who are not so gifted.

I believe that those who are so gifted, if there really is any such people, because I think everybody is gifted, should look to their own resources and come up with some of their own meat grinding and eating processes.

There is no way that you are going to get into the fray unless you start chopping at the beef and partaking in the prize. There has been some involvement by the United States, but I do not think it has been anywhere near enough. We have defined ways to fund people to get there and do the things that need to be done.

Mr. Clark: First of all there is no quarrel with that. It would be nice to have more people and a better audience both domestically and internationally. It would be great to know how to do it.

That is not an issue in my comment here. When we talk about participation, for example, at the CIE level it is true that we generally do not have building owners as members. We do have one on the U. S. National Committee who is going to Kyoto for the meeting in August.

Another important area is government. We have a large number of government people who are involved. With apologies to Steve if I make the wrong assumption but I believe he thinks primarily of lighting for buildings. There is a lot more in the field of lighting, at least as far as what I am addressing it at the moment.

Many of us, myself included, have an immediate tendency to think of lighting in terms of buildings. But of course we have, for example, the issues of various types of measurements. We have the international aspects of photometry, radiometry, and we have a study group on global radiation. Users are often involved on these committees. The U. S. in fact has the chairmanship of the theater, TV, and studio lighting study group. Who is the chairman? He is a man from the Columbia Broadcasting System, yes, a user. So I do think we have users involved, recognizing the limitations which Steve has so very well pointed out. My approach has been to make this group aware of what we are doing as opposed to what could be done.

One comment I cannot resist making while I have the floor before George quite properly shuts me off. It relates to Noel Florence's comment, and also the one that Michael Frye made. It has to do with turning off lights.

I know that John Cuttica has gone through this three or four times. In the follow-up of Public Law 94-163, the energy bill of 1975, each state was to put in place some lighting code or more accurately some lighting energy code. As matters now stand we do not have even one that addresses energy. They are all expressed in terms of power.

This means every code would allow buildings to have their lights burning 24 hours a day. That is a shame - a real shame.

All of the pressures are directed to take away from the benefit side of lighting not the waste. Naturally some of us are undoubtedly biased towards the benefits of lighting but the argument is generally related only to degree.

On the other side, the waste where nobody is going to argue has not been addressed. I mean the operation of lighting when and where it is not needed. I believe that is too bad and am doing my small bit as John well knows in again trying to get across the idea of energy versus power. This is because there seems to be another opportunity coming with respect to the states programs for existing buildings. I believe that the public image of lighting waste relates more to use when not needed than to quantify and this is what I tried to tell the Massachusetts State Building Code Commission when they adopted their code. That is also what I told John Anderson and his people at DoE the other day.

The public perception of waste of light cannot be expressed in footcandles. The eye does not measure footcandles. The wonder why those buildings are burning their lights at night. During the oil embarge years this was a matter of great public interest. Some of the useage about which they complain might have been very legitimate but they have no way of knowing that and in many cases they were in fact not appropriate. So they are all lumped together in the public perception. They see lights on when they don't think they ought to be. There are lights on in many places when and where they shouldn't be.

Dr. Ross: I was going to comment on something that Michael Frye said. I suspect it is fair game although it might not be right on the U.S. worldwide subject. Michael, you did say at the outset of your prepared opening remarks that because you were under pressure you would miss a few things.

Perhaps I have misunderstood something that is out of context because of that, so I would like to review a few matters.

You had a somewhat impassioned plea for us not to decrease, I assume, the lighting levels. It could be a lot of things. I don't think that you would argue that we ought not to try to conserve as much energy as we could, but certainly not reduce those levels of lighting or visual processes that are created thereby below where they were causing trouble. We don't know where that is.

You yourself have said that we need to perform the experiments. We are still operating somewhat in the dark, as it were, even though we are in the light, and perhaps in too much light.

There are good estimates, that we are wasting twenty or thirty percent of our energy. Perhaps you can look to this room. We could cut the lighting energy down by one-third with the same amount of light, or with the same amount of energy, increase the lighting to something useful.

This is the kind of thing that takes place all over. We have recessed incandescent cans up in a little hole and put in one hundred watts and we get probably effectively one watt out. That is completely wasteful. That is the kind of situation that we must go after first because there is so much of it.

I would agree with the fact that we could be talking about energy, but time is just as important. The United States has illumination levels that are substantially higher compared to the rest of the world and perhaps we should come down to where they are. Perhaps that would not damage the environment too much.

Mr. Frye: I did say first of all that I was talking from the European perspective. I was not saying that the illumination levels were right or wrong, but what I am saying, is that before you tamper again with what is going on, I believe that you should check out what it means and what it does.

Before you either change the levels of lighting or put different types of light sources in, which apparently show huge reductions in energy cost, I say to you to watch out for the other side effects which you have not tested out. You should check these matters out absolutely fully and not just in terms of the amount of energy that you use, but in lots of other ways as to their effects before you tamper again.

I am in total agreement that if you could not light the back of the room and the rest of the room, that this is a good thing to do, but what I am still questioning has to do with what you should actually use up here, but don't reduce it and change it until you have done the test.

Certainly, when you don't need it, then turn it off and don't use it. The way you are spending your time, that is another matter.

Prof. Smith: I would like to speak on one question. Now I do add that I am not all that acquainted with the worldwide situation, but I went to two libraries, one in the engineering building here, and at our own library at the University of Illinois, which is the third largest university library in the country, and I think one of them had one publication dealing with the CIE, but our own university library had no publications of the CIE. What is the program for disseminating those publications, and how could it be improved?

Mr. Cornish: I would like to try to bring us back to the topic, if I could, which is the United States role in the worldwide lighting community.

I think this is an important topic from the point of view that indeed as a Canadian, with the interrelationships that go on between ourselves in the CNC and the USNC, it is important that we recognize that we sometimes have differing

opinions, but we still end up using the same products between ourselves. That may be opening up a can of worms, but is there anyone who would like to speak on that?

Would the president of the USNC like to comment on that?

Mr. Clark: Maybe we have not done enough in terms of publicity, but as each publication comes out we do put notices in a great variety of publications such as the trade and professional magazines, including LD&A. I was going to indicate a few recent publications but they just don't come to mind at this moment. They do come out sporadically as you might expect.

Bob, you can rest assured that you are going to get a list of them sometime soon. Yes, lists are available.

The publications can be purchased either from the Canadian National Committee in Ottawa through the National Research Council or they can be purchased in the United States from the U. S. National Committee, the Secretariat of which is at the National Bureau of Standards. Dr. Jack Tech is Secretary of the USNC and located at the Bureau. He has a supply.

We can always get more from the Central Bureau of CIE in Paris if we do run out of them. Publicity for the USNC and the CIE publications is one of my problems, by the way. I have not done an especially good job in solving this area of public relations. The releases which we now get out from time-to-time are usually very brief statements of the title and content of a publication and where it is available.

I would like to comment on one other thing that is international in response to what Michael Frye said.

I'm not being totally facetious, when I say that I think that the United States light source industry would be interested in the thought that its role is to lead the world. While it would perhaps like to think it does lead I suspect we might get some argument from one or two European producers of light sources as to whether or not we are the leader. Obviously each company leads in its own way because it is always trying to produce new light sources and trying to get a bigger share of the market. Of course we have a larger indoor market to begin with in this country. That may give us some special advantage in certain cases. In the broadest general lighting types I suspect it does not. I must say I found Michael's comment on light source leadership interesting.

Mr. Frye: There are a number of European light manufacturers who have done a lot. I do think in terms of the products available in both European and American markets, the opportunities are available in terms of the light sources in the United States which I believe are very much substantially higher.

I do not want to be critical, but I do say that I think that this is an area that in America you are doing a great job because I think you do lead. This is a lead that other people can follow. We tend, in Europe, to more or less follow your lead in the environment in building forms.

Although you may not always dominate, the fact still is that you do tend to lead, and we tend to look over our shoulders from time to time noticing what you are doing. So, your role is very substantial in that regard.

Mr. Squillace: I would like to attest to the fact of what Michael Frye made in his statement about the United States, I guess, leading in the area of research, at least sometimes, I do say not always, but I do think that what he said has a lot to do with what happened back in the 1940's when we established the IERI.

Regardless of the problems arise even internally between IERI and the IES and other groups, I think that this has been good for us in the way of research. My comments about the United Nations still hold. I would like to hear from the panel and the auditors when we get their questions, when we reach those sessions.

I believe that the United States can play a great role in spearheading an international group that could have its own IERI somehow. It could have its genesis hopefully right now, not only in research, but also in education. I do not want to leave out education. We do not have enough education in this country, and it appears this is also the case in many European countries. There could be a lot more. In other parts of the world, there is even less than what we already have here in the United States and in Europe. I am sure that some of the underdeveloped countries could use help in that area.

So, the CIE, for example, could be that "United Nations group" if it could only structure itself a little bit differently. Continuing with education, and the registration of professionals in that area, I also believe that should be done. I will talk more about that when we have our education session.

The United States' role should be spearheading that, I believe. Certainly at least we should try to. I think we could also spearhead the funding and we will talk about that in some of the other sessions.

Dr. Ross: I just want to return the compliment to Mr. Frye. I have found that in all of the publications that are available to us, that the British IES handbook is perhaps one of the best, and I might hasten to add, the one that I refer to more frequently than do I of any of the other reference books in the designing output.

Mr. Frye: I agree.

Mr. Cornish: Well, lady and gentlemen of the panel, I think that has rather adequately debated that subject to this point. It would be interesting to see what our auditors have raised in the way of questions. I will turn the microphone over to the readers and they can give us some of the questions.

Mr. Unglert: It is interesting that some of the auditors sort of got off the track or the primary question as well. Here too, we will debate those questions that are not completely relevant, put them to the end, if we have more time.

4.3 WRITTEN QUESTIONS/COMMENTS BY AUDITORS

4.3.1 Dr. Atkinson: *1. Does the United States lighting community get as much out of CIE as it contributes?*

2. What do you see as the value of participation in CIE?

Mr. Clark: I guess I would have to say yes to the first question. It should be understood that I happen to be a strong believer that nobody has a monopoly on good ideas.

The situation with CIE is not unusual perhaps with international organizations. First of all it is not trying to be a super-IES. While we have our United States National Committee, we are not trying to duplicate what IES does per se.

We lean heavily on IESNA and its people in the development of things for international consideration but there are subjects to which the IES does not address itself.

There is a particular mechanism for international lighting activity. The key organization of the CIE is its Action Committee, which meets periodically. We have had a U. S. member in the past and there currently is a Canadian member who is in fact chairman at the present time. We do have a North American involvement. The Action Committee then works to determine with the individual technical committees their scope of activity. They have a scope and they have a work program. As you might expect, some committees will go through a period of several years in which they are extremely active because they have a particular subject to be handled. As other times they might be quite inactive.

One example of the difficulty sometimes experienced is that of the colorimetry committee trying to get agreement on uniform color spaces and color difference equations. After several years of effort it finally got resolved in what might be considered a political kind of way so that the work might be put into practice while there continues on an effort to solve the matter at a technical level.

We could not get a total consensus internationally or indeed in the United States. While we perhaps finally did in the United States achieve it partially, there was a strong dissenting view. The CIE publication is now out offering two choices of color difference equations, the selection from which by the user will be made on the basis of the type of application involved. This whole process demonstrates one kind of situation.

As many of you know there is another committee, that on visual performance, which has produced the famous CIE 19 after twelve or fifteen years of work. This work is coming to a conclusion presumably at the Kyoto meeting in August. This has been a very active group and fortunately we have had U. S. representation from someone who could travel. He also has been the international chairman.

There are some committees that have done nothing, at times absolutely zero. I can tell you as president of the USNC this is a bit of a problem in getting someone to serve on a committee who simply ends up sitting there waiting for something to happen.

This can be done because there doesn't happen to be anything deserving of international concern in the minds of the people who are involved and whether we would agree or not, by the international community. On the other hand, when issues do rise where it would be useful to have some kind of international agreement, the same committees can become very active.

One of the most active CIE areas falls within the category of materials. One is the committee on the photometric characteristics of materials - a very difficult area in which to reach consensus on standardization. The color rendering

committee is another active one. All in all I think we do get a great deal back for what we give to this international organization. As a final example we have what is now called TC 3.5, Lighting and the Environment.

Another example is the CIE committee TC 3.5, Lighting and the Environment, which is today a combination of the previous TC 3.1.1.3 and study group A. This effort has a long history. There are many here who are aware of this such as Ernie Wotton, Howard Brandston and Charlie Amick. John Flynn is the present international chairman of TC 3.5.

Most of the early activity for this committee came from the European community even though there were a small group of us in this country who were very interested. But it has taken a long time to get any great level of general interest. I have to say that in the earliest stages of this activity the work was generated primarily through the international group, through other countries in CIE. In fact, CIE had had a committee long before there was an IESNA committee corresponding to it. Only now are we beginning to perhaps contribute as much, if not more, from the United States as we have been receiving.

Mr. Amick: Steve, there are three questions that are addressed to you and I believe are related. Would you like to have all three at one time?

Mr. Squillace: Might as well.

Mr. Amick: The first question comes from Noel Florence.

4.3.2 Mr. Florence: *1. Do you feel that we in America are paying enough attention to overseas ideas and research?*

4.3.3 Dr. Wright: *2. Are there any instances of world lighting practices being put in advance of those in the United States or in the IES of North America?*

4.3.4 Mr. Waldbauer: *3. How would you propose that funding be made available for world-wide research and information distribution?*

Mr. Squillace: The first one was from Noel Florence? Fine. It deals with paying enough attention to going overseas?

I think my comments addressed themselves to that. I do not think that we are now, as a whole, paying enough attention. There perhaps are a few people, but from my own limited experience, they are mainly manufacturers and some utilities, and not a lot of those.

Certainly, the practitioner, as I see him, in the everyday world, whether involved in buildings or in other areas of lighting, George, they have not done much.

On Alan's side, maybe it is a different story. When it deals with opthamologists and optometrists who may be doing a lot more in the engineering aspects of buildings and related industries to buildings.

I do not see us paying much attention to what is going on overseas because even domestically our research is not what I would like to see it, let alone what is happening overseas.

Mr. Amick: Question number two had to do with lighting practice. Are there other countries ahead of us in some areas?

Mr. Squillace: I don't know what the answer to that is. All I can say is that right now I do not see anything where the other countries are ahead of us. I think there are many countries that are concurrent with us though.

Mr. Amick: Perhaps in roadway?

Mr. Squillace: Yes, maybe in roadway. Certainly in the area of paper reflectors, there has been a lot of work that has been done overseas. The supply and demand centers that we call now for lighting.

Mr. Amick: How are we going to pay worldwide research and information distribution?

Mr. Squillace: As far as I'm concerned, the payment will be coming at least in this kind of a manner. So far, I have promoted, or have tried to promote in this country, the idea of the community, as a whole, and that involves the building owner, the government, the practitioner himself, in all its phases, the architects, the engineers and others, the contractors, suppliers and manufacturers, the utilities, of going right to them, if you will, and asking them to provide a fund. I called it a one-time donation.

Well now, perhaps sometime, when you say to people it is only a one-time approach, they might very well think you are going to be coming after them again in a little while. No, I say it is one-time or perhaps occurring every twenty or thirty years, or whatever it may be.

This trust fund could be established producing many millions of dollars. The community could live off the interest of that alone. They would need further funding only when the need would arise such as, for example, due to inflation.

If they can live off that interest, then I think we have enough money to do the kind of job that we need to do, to at least approach it, and the international community can do the same.

I am not sure whether we need to duplicate those, but I have not given it that much thought. Off the top of my head, I say that we should have a trust fund nationally as well as internationally. That is the way I would do it.

In order to go after this trust fund, indeed it addresses itself to a great deal of money. For example, in our own country, in a broad sense, there are probably 100,000 individuals and companies who could be approached. Out of this 100,000, perhaps only five percent would respond favorably. This five percent is equal to 5,000. If each one of those 5,000 were to be generous enough to donate $5,000, this generates $25 million.

Twenty-five million dollars at roughly ten percent interest computes to at least two and a half million dollars a year.

Compared to the pittance that we have been throwing in as an IERI group, that would be a tremendous amount of money. It is a lot more than what we are giving now.

This would spearhead a lot of good work and bring a lot of it to conclusion. You see, we seem to lose a lot of it in starting an experiment and then having the funds drying up. We are not able to finish the experiment and so we leave it there incomplete. However, in order that it not be left like that, somebody then comes along and passes judgment or makes an interpretation or an extrapolation that is incorrect, and hence we apply the results of research incorrectly.

Mr. Unglert: The next one has to do with vision research, and I have two questions that are sort of related.

The first one is directed to Alan Lewis.

4.3.5 Dr. Wright: *1. Is vision research better coupled to lighting practice here or in Europe?*

The second one is directed I guess to George Clark.

4.3.6 Dr. Berman: *2. What efforts in lighting and vision research are going on in the Soviet Union, and if there are, where are the translations?*

Dr. Lewis: I have to plead ignorance.

I am not really familiar with lighting practice either in this country or in Europe.

I do not know to what degree they make use of what are referred to as basic visual data.

In reading the European publications, like Lighting, Research and Technology, which is a superb journal, it seems to contain more basic resaerch, and for instance, they have an abstract service, and that kind of thing, which I find to be extremely useful.

Beyond that, I really could not comment. I suspect it is used in about the same amount. I think people use what is available, but the problem is the interpreting of the basic research to somebody who can put it into practice.

Unfortunately, we do not have many people, on either side of the Pacific Ocean or of the Atlantic Ocean, who are well-versed in those areas. We will be talking about that in the education session that will come along later.

Mr. Clark: I have to plead somewhat ignorant, too, on the Russian situation in this particular area. They were our allies in Barcelona in 1971 when we got the photobiology activity. They have been very much concerned and active in that area in terms of interradiation of humans, little kids with ultraviolet, and so forth. In terms of this particular area, I am really not sure. We do have the problem with translation as well.

The CIE has three official languages--French, English and German.

Our Russian friends unfortunately very often tend to ignore that fact and they do not, as often as we would like, provide their material and input translated in one of those languages. I think they simply come along and say: "Here it is. It is yours."

So, the translation problem has been to some extent difficult. I am not qualified at the moment to talk on that, particularly on the visual performance element of their lighting design.

Mr. Squillace: The question is how others are using the research, and particularly abroad. From the practitioner's standpoint, at least from those that I have been able to talk to, I would guess it is at the same standpoint as in the United States.

The United States engineers and practitioners are not making use of the results of research. Only a very limited number of people are using them, and I find the same thing true in Europe and in other locations.

Mr. Cornish: The next question please--and I think it is going to have to be the last one because we will follow with a debate off the floor.

Mr. Amick: George, there are three questions dealing with export areas. The first question is for Rita Harrold.

4.3.7 *1. What percentage of United States-made lamps are exported?*

Ms. Harrold: I have no idea. So I will have to defer that question to George Clark.

Mr. Clark: I don't carry that figure in my head either.

Mr. Amick: The next question is from Bill Erhardt.

4.3.8 Mr. Erhardt: *2. What percentage of the lamps used in the United States are imported?*

Mr. Clark: That is confused by the fact that you take it absolutely literally. I have the situation where a manufacturer actually ships a lamp from here to there, and you also have the fact that in some locations manufacturers have plants. United States manufacturers, that is, plant locations in countries, in other countries, where they produce certain varieties or types.

I have an idea that that figure is available through the Bureau of Census, but I do not have a handle on it right now.

4.3.9 Dr. Ventre: *3. Is the export of U.S. lighting products, or of professional services associated with lighting, a significant fraction of total sales and services of United States firms?*

Dr. Ross: I cannot speak for products, but as to services, I think it is a negligible part.

Mr. Amick: The second part of the question:

3(a). Is any country a net exporter of lighting products and services?

Dr. Ross: That might be true of some European countries that do a lot of exporting.

Mr. Frye: You have got the different standards on the electrical network. We are on 220-240 and you are on 120. So, that really eliminates a lot of transatlantic importing and exporting. There is a considerable amount relative to what is there, particularly in the Middle East, in terms of architecture and that part of it, but not very much in terms of quality because light sources are not available.

Most attempts to do this have been very unsatisfactory. And as far as Europe is concerned, the strongest countries who are exporting are basically Holland, and in a limited way the United Kingdom, but in a major way a large amount comes from Western Germany.

Mr. Amick: Yes, Mr. Frye, and I have a question: Because your country recently went to the metric system, there is a question from the same auditor which is:

4.3.10 Dr. Ventre: *Does United States metrication bring opportunities or hazards to international marketing? Will the United States providers of products and services be helped or be hurt by going to the metric system?*

Mr. Frye: Is this question really relevant? I don't want to answer it.

Mr. Cornish: We have some questions now from the audience.

4.4 ORAL QUESTIONS/COMMENTS BY AUDITORS

Mr. Crouch: Mr. Chairman, we have had two research projects in England, at the University College of London and at City University.

Dr. Hopkinson, whose name was mentioned earlier, has said he would like to carry out a project at City University in relation to age. We have had one here at Kansas State University which seems to indicate that 60-year olds are more sensitive to discomfort glare, and can stand only one-fifth the luminance of the luminaires that 10-year olds can stand.

Dr. Hopkinson wants to have research done in order to conform this and to amplify the relationships.

We have nine projects that are going but we have not enough money to support it in England at this point. Can England possibly join with us in supporting this joint project?

Mr. Cornish: Can you speak for England, Mr. Frye?

Mr. Frye: I will respond with the usual qualifications. The subject is actually touched on in the report that I will refer to later on written by Barry Tibbs from the Health and Research Council relating to different ages.

It is one area that deserves a lot of attention. It is getting the funding, particularly in Europe, to areas that are not related to sources. I was thinking of what Steve Squillace was saying about the $5,000 input from individuals accumulating to $2.5 million. I would like to say that I would be very happy to have a few of those dollars and to get some percentage interest in the United Kingdom.

Mr. Kahn: Mr. Frye, my question relates to the issue of the U.S. role in the worldwide lighting community. I would like to ask you, do you agree that even in England the world lighting influence, as it is directed to industry and the public, really stems from the combined promotion and education by the lamp and

fixture manufacturers, as well as the utilities and the support of trade groups, and that in England, just as in the U.S.A., in this era of energy conservation, the real problem is that primarily in the U. S., only IES has the organizational capacity for leadership in establishment of lighting standards and in the education of the public for energy efficiency? It is only in the hands of the IES in the United States, and this is probably the most formidable organization in the world. Now, in the United States, we also have a chance for strong government support and interest from people such as NBS and others; this remains the single greatest hope for leadership in lighting. However, we must be credible in terms of our leadership.

Mr. Frye: I think I agree with practically everything that you have said, Mr. Kahn, and that is the fundamental reason why I am here.

Mr. Cahaega: I am speaking for 100 percent of the Latin American countries who would rely on the HID lamps produced by American lamp manufacturers and a little bit produced by the European manufacturers.

All of the technology that comes through us, such as in the area of lighting designers, is through American branches that are in the Latin American countries. So, we would rely 100 percent on the American technology in that area. That is all. Thank you.

Mr. Cornish: Thank you. We have time for one more question and I will get to you just in a minute.

Voice: I don't know where I can help this learned panel with the statistics, and all of the information that it needs, but it is my own feeling, from my small observations made on a visit to a place called Paris, that they do eagerly import American reflector lamps, especially the small ones, that they use in huge quantities in their gas lanterns and export in huge quantities those photochromatic light sources that begin to cover our land like a plague, like a virtual pus from the east to the west.

Mr. Cornish: If I can only turn it over to the reader for a final comment, because I understand that we will have to close the session off very shortly.

Mr. Amick: Some of the questions are of more specialized interest. It appears, even though we have tried to work these into the later sessions, we may very well not get to them.

Could we not suggest to the audience that they may take advantage of the luncheon and coffee breaks to contact the specific panelists?

Mr. Cornish: I think that is an excellent suggestion. I hope that the members of the audience will try to contact those panelists over the lunch hour.

(Whereupon, at 12:30 p.m., a luncheon recess was taken.)

AFTERNOON SESSION

1:40 p.m.

Mr. Cornish: I have a couple of announcements to make. First of all, there will be a set of papers distributed tomorrow, just before lunch, which are the written prepared statements of the panelists who are each speaking on the issues.

Because of the exigencies of time, and for those who may have had to limit their spoken word, the full statements will be distributed as I said.

Secondly, because we are short on time the readers will be taking all questions, and I do emphasize this, that are pertinent to the subject under discussion each time, and those that are left over that are not addressed as part of the discussion by the panel, these will be given to the Court Reporter who is with us and they will be included in the material that makes up the official account of this meeting.*

I know this will not get the answers today, but at least it will get the questions raised.

Finally, if I might mention to the speakers, the panelists, and to the audience, I can appreciate the problems of wandering because the subjects are so interrelated, but anything that you can do to keep on track with the subject at hand will help us with our time constraints.

The participants are George Clark, Don Ross and Neil DeKoker and Mr. Michael Frye and Alan Lewis in that order, please.

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* These questions were later asked during the open question periods.

5.0 ISSUE NO. 3. "FACTORS AFFECTING HUMAN ACTIVITIES IN THE BUILT ENVIRONMENT"

5.1 WRITTEN STATEMENTS BY PANELISTS

5.1.1 Mr. Clark: In a paper which I authored in 1957 I suggested that lighting is based on the 3P's - Physics, Physiology, and Psychology. Not each science individually but all three together. Viewed from my perspective this idea has only been reinforced and broadened in the years since.

Lighting is an all-important factor in the built environment--interior especially. It provides the legibility of space so necessary for the successful and efficient functioning of humans in the buildings we create for work or recreation.

Legibility can be for orientation or mood--or both. Lighting is the essential communication medium for any physical elements of the environment which are beyond arm's length. It helps determine their pereived size, shape and location with respect to the observer. The physionomic quality of the space is also conveyed by lighting as it reveals the esthetic and psychological design.

Lighting then has the power to support the design intent, modify it, or negate it. It needs to be considered as part of the total design if it is to be positively effective.

Perhaps the most neglected aspect of building design in the past has been a careful determination of the human activity which the building is intended to house. Buildings have too often been designed for the structure itself. Without a really careful analysis of what people are expected to do in the spaces created the results are almost certain to be less than they could and should be.

While I have a special respect for the creative design talent of many of our design professionals, I believe they along with the rest of us could benefit from more research relating to the human response to the built environment. Personal judgment can often be too superficial and sometimes misleading since the designer is normally called upon to design for others -- usually groups of people whom he will never meet. This I believe is the basic argument for population studies which provide important input to the creative designer.

Certainly lighting is not the only important factor affecting human activities in the built environment, but just as certainly it is one which has a strong influence on an individual's perception of the space--visually and psychologically. This in turn can affect his or her activity--positively or negatively.

5.1.2 Dr. Ross: It appears that there is a good and developing understanding of the factors related to lighting and how it affects human activities in the built environment. These relate to emotional factors (such as ambience, appearance, and color rendering); operational factors (such as performance, safety, fatigue, discomfort, transient phenomenon); maintainability (such as resistance to wear, adaptability, and mean-time-to-failure); and costs including first-costs and operating-costs.

The relative low cost, ease of application, and versatility of electric lighting has caused it to be most ubiquitous. That some practices have been carried to excess should be no surprise in a world where the same could be said about much human activity.

In the light of present concerns about energy and, perhaps, excess consumer demand stimulation, there are practices which should be modified to be more conservative. Practices to be modified should involve all lighting design (both artistic and functional) that could be changed to require less energy input and less physical material input to a given system and still provide for the desirable human response.

In this regard, it is imperative that one optimize the entire human visual system and not only the electric illumination subsystem.

5.1.3 Mr. DeKoker: I recognize that we in industry have a great many responsibilities in the operation of our businesses. Perhaps the most fundamental of these is to make a profit. Without profits there would be no jobs nor would we have the money to meet our growing social goals.

We're greatly concerned with the quality of the working environment at General Motors since payroll is one of the biggest single corporate expenses; and morale, attitudes, productivity, safety, motivation of employees can all have a decisive effect on what we get for our payroll dollars.

We see lighting as one of many factors affecting human activity in our plant and office facilities. We want to provide an effective and safe working environment for employees. We think this will attract more workers to us and keep them on our payrolls longer. Employee turnover is always a problem and training new employees is costly. We think the lighting of our facilities can contribute to an attractive environment that can help reduce employee turnover -- and boost productivity.

Lighting does contribute to productivity and good workmanship. While the speed of our production lines is fixed and thereby lighting won't necessarily affect the number of cars being turned out each day, lighting does affect the quality of installation of automobile components all along the assembly line and helps to reduce mistakes and rework. We think such mistakes are kept to a very low level in our facilities and lighting helps to achieve this type of performance.

Lighting is responsible for 3.6% of the total energy used at General Motors facilities (see attachment A). This compares with the energy used for heating, ventilating and air conditioning which represents 27.6% of total energy use and is the largest single category of energy use in GM. The HVAC investment in energy is necessary so people can work in a clean and comfortable environment. Yet, it's almost eight times the energy used for lighting.

Our lighting objective in GM plants is to supply about 50 footcandles on working areas. If any tasks need more light, it's provided with supplementary local lighting. We try not to waste energy, including lighting energy, so we use efficient light sources and luminaires and use non-uniform lighting wherever it's practical -- more light on assembly lines than in surrounding areas, for example. We also use more than 50,000 high pressure sodium lamps at GM plants to reduce our lighting energy use and costs. The recently completed 2.7 million square feet GMAD-Oklahoma City assembly plant, for example, utilizes over 7,600 high pressure sodium lamps.

We're also aware that if we cut back on lighting, we'd have to add more heat in our plants in the winter, so only a part of the lighting energy reduction would be saved, net. There might also be some savings in air conditioning, too, but most of our plants aren't air conditioned and the potential risks of lowering the lighting in terms of safety, mistakes, etc., aren't worth taking the chance.

In summary, we at General Motors are trying to use lighting energy effectively and efficiently because it makes an important contribution to the quality of our working environment for all employees.

1977
TOTAL ENERGY CONSUMED
BY PROCESS IN GM

PROCESS GROUPING	CONSUMPTION (TRILLION BTU)	PERCENT
HVAC	61.9	27.6
Metals Casting	38.3	17.1
Liquid Heating	21.9	9.8
Furnaces	18.5	8.3
Ovens	17.3	7.7
Paint Systems	11.8	5.3
Steam Generation Losses	11.2	5.0
Lighting	8.1	3.6
Compressed Air	7.3	3.3
Metals Machining	6.1	2.7
Assembly & Material Handling	3.4	1.5
Plastic, Rubber & Urethane	3.3	1.5
Metals Forming & Shearing	3.0	1.3
Product Testing	2.7	1.2
Soldering & Welding	2.4	1.1
Forging & Forming	1.4	0.6
Domestic Hot Water	1.3	0.6
Waste Disposal Facilities	0.7	0.3
Freeze Prevention & Snow Melting	0.2	0.1
Other	3.2	1.4
TOTAL	224.0	100

5.1.4 Mr. Frye: In the last ten years, a fair amount of work has been done in the United Kingdom, particularly by J. A. Lynes at Pilkingtons, on the directional characteristics of lighting in interior spaces. As a result, the British IES code now includes recommendations on the way in which directionality could be quantified, using the concepts of scalar illuminance, illumination vector and vector/scalar ratio. This work on the directional character of lighting followed studies of the natural flow of lighting from windows in buildings. Flat, even lighting, such as that produced by fluorescent lamps, is monotonous and even boring. It has been shown that if the artificial lighting in a building has a directional component, then this is clearly preferred.

Equally, in America in recent years, there have been studies of the reaction to different lighting modes. Here though, there has been some attempt to derive what has been called a subjective lexicon of such reactions in an attempt to transcend the inevitable limitations of a purely quantitative system when it is applied to a complex human situation. Measurement is fine if it is capable of accommodating the real responses of the occupiers of a given space. Happily, the purely functionalist school of lighting which held that high lux levels were directly proportional to increased efficiency no longer holds sway. In many cases, follow-up studies have shown that at least part of the response to new lighting installations was a response to the change itself. The effect of lighting depends on a complex inter-relationship of many factors and characteristics in an internal space and the way it is used and perceived so that simply specifying light levels will not always produce the same result in different circumstances. What is needed is an appreciation that lighting is properly part of the environmental space, to be considered from the outset rather than tacked on later and that not only technical expertise is necessary, but also a sensitivity to architecture and design and a good memory and the ability to learn from practical situations. Perhaps above all, a liking for the subtleties of lighting and a feeling for the intangible essence of lighting as it fills and affects a space and illuminates shapes and surfaces. Indeed, much of the research which is currently being done does echo this need to consider lighting

as a more widely based discipline rather than purely as a science. What is needed, if one wishes to express it in scientific terms, is more research into the effects of lighting, on the perception of space and how the perceived image affects the psychology and perhaps even the physiology of the viewer. In addition, we need to consider more carefully the external world where shadow, colour, movement and density of light are all constantly changing. It is these factors which influence our perception of objects, space and textures.

Unfortunately, in Britain, where the British IES has recently been absorbed into the CIBS, The Chartered Institute of Building Services, there is generally a failure to recognize that the lighting profession needs clear-cut recognition and definition in its own terms rather than being seen as a fringe activity in terms of building and architecture equivalent to heating and ventilating engineering. Again, the least appreciated aspect of lighting is that while satisfying various technical criteria, the application and the choice of those criteria is very much an art depending on experience and sensitivity. Sadly, there are very few opportunities to learn about lighting design. One or two courses are available in England, but they are only really scratching the surface. Phillips have provided a lighting demonstration facility in which various lighting design effects can be compared and there are a couple of books only which are available in Europe, but in general, facilities for lighting design education are virtually non-existent. As a result, my company has had to undertake constant education of the lighting specifier, the designer, the architect and commercial customers about the principles of lighting design in order to guide them in their choice of lighting fittings. But, often there is not enough time to go beyond general statements about appearance, lighting effects and some technical information.

Lighting need not merely be a hit and miss affair--specifiers can and want to incorporate new and original ideas, but they lack the means to do so. We must provide them with the appropriate products and necessary information. What they need to enable them to give lighting its deserved importance in environmental design is a research approach which looks much more deeply at the human response to lighting rather than concentrating on the physical assessment of lighting as a mere flux of energy. Lighting does not exist without space, but nothing exists without lighting.

Dr. Lewis: This is my first attempt to discuss the position paper today. When first asked to do this, I was sort of taken aback a bit because it reminded me of the statement that the definition of a cultured person is one who can listen to a William Tell Overture, but at the same time not think of the Lone Ranger. I feel pretty much the same way because when I hear of "ballast," I think of that portion of the bottom of the boat that keeps it from tipping over. That is my relative expertise in some of these areas, however, I will attempt to make my comments.

5.1.5 The built environment has allowed mankind to function in places he would otherwise avoid, at times he would otherwise be asleep, and for durations he would otherwise resist. Because of the increased comfort and efficiency which is obtained through a controlled environment, he spends substantially more time indoors than did his ancestors (or his parents for that matter). For most of us, this shift has occurred within our own lifetime and we have had little experience with the long term physiological and psychological effects of increased indoor living.

Empirically, it would appear that the benefits to be derived from the progessive move indoors far outweigh any negative factors. We do know that the move to a more controlled climate has increase productivity significantly and, as the shift to domed stadiums and enclosed tennis courts has indicated we even prefer many leisure activities in an indoor setting. There are, however, some possible negative factors. The Russian literature seems to indicate some detrimental effects from lack of exposure to ultraviolet radiation in factory workers (or at least in increase in performance when UV is provided artificially on the job); although this finding has not been replicated elsewhere.

There have also been reports that fluorescent lighting in schools may aggrevate "hyperactive" children. These reports have been more or less discounted on the basis of the poor controls in the original studies and by a lack of replication in later investigations.

Physiological deficiencies have been noted in person who must continuously live indoors, such as the chronically ill, but these effects have been linked to inadequate UV exposure and can be countered by artificial lighting with UV components. There is no evidence for similar effects among the normally mobile population who can get out-of-doors even occasionally.

There has been occasional concern expressed for the effects on biorhythms of abnormal light-dark cycles that are possible because of our indoor living. Although some birds and animals can be markedly affected by such effects, man seems to be able to adapt quickly to such changes without harmful consequences.

It would seem then that there are few serious problems attending our increased time indoors and that the built environment has, if anything, increased the scope and depth of human activities. Lighting has made such living possible and it remains for us to use it effectively to enhance our lives, productively and aesthetically.

5.2 PANEL DISCUSSION

Mr. Cornish: We will now proceed with the second portion of the topic.

Dr. Lewis: Well, seeing that there is no one else, perhaps I can just say something that may be a little controversial, but perhaps I will be doing nothing more than raising a straw horse. Let me see what happens.

Obviously, most of the panelists felt that the topic involved primarily the use of aesthetic or non-performance criteria in determining the human activities in the built environments. Several of them advocated markedly increased research in the area. One of the things that always bothered me about this is that obviously one of simplest ways of doing this research is, of course, by giving people the opportunity to do anything and see what they can do, which is indeed, I thought, the state of affairs for the last 100 years.

Perhaps the other panelists might wish to comment on why this is not suitable research, or what you see coming out of perhaps other kinds of research, which would be more formal in its analysis.

Are we going to get any new information from it?

Mr. Squillace: I will comment on that. If I understand you correctly, we have done research in this area in the last 100 years but it has been done in a certain way by having people doing certain things and then trying to evaluate their reaction or performance whenever one changes various parameters in certain ways.

I guess the biggest fault that I find with that, if there is a fault, is that it is very hard to quantify reactions to change in human factors-type parameters. How do you use that as a predictor on the new building that you are to remold or or build?

After it is built, you can then decide that you did this wrong or that you did that right. To get predictions before building so that you can come close to the mark is where I find the difficulty. The experiments have to be changed to the extent that you can get somehow quantifiable factors that will let us predict what people's performance and reactions will be in the building, but we do this (before the building is constructed) during the design and concept stages.

Dr. Lewis: I guess I am still confused Steve, because it seems to me, in the type of thing you are talking about measuring here, what you are doing is measuring the effect on performance of changes in aesthetics, and that is really not what I am thinking.

What I am thinking is the aesthetic sense for its own value. I know that George talked about this for some time. We have got to emphasize the effects of lighting on performance. Certainly that is very important. The fact that you enjoy the space is important too even though they absolutely have no effect on performance.

Mr. Squillace: If I go into a space, and do an experiment, and the space has gold walls, black floors, black ceilings, and whatever else you can imagine, and then I say get some sort of survey out of people as to how they feel aesthetically about it, when I move to design, then how do I predict what will happen?

I don't think that I can say by just taking the same space and rebuilding it that I am going to get the same reaction. How do you quantify that and forget about performance?

If, out of 100 people, ten of them say that they do like it but 90 of them say that they do not like it, to what degree do I change it?

Dr. Lewis: I am not sure you do. That is my point. We have done that experiment for 200 years. People have been allowed to build anything they have felt comfortable with. You have seen the result. Conformity has not been one of the things that we have come up with.

In fact, what we have shown is that aesthetics is something that is probably very individual and cannot be quantified, and I think that is good. So, I am not sure why, having done the body of information that we might have had had we analyzed all of these buildings.

Secondly, it has to be more than just making surveys. Unless you know what you are going to do with a survey when you get it, what's the point? That is why multi-dimensional scaling and some of these other things are going into the picture in order to get a handle on what you are going to do with the information when you get it.

Mr. Clark: I was interested a few years back when the AIA Journal carried an article by a psychologist who said what I have been trying in my own small way to say for a great many years. In effect he said each year the American Institute of Architects gives its award for some recently completed beautiful buildings. Would it not be better if we waited at least a year and then found out how the building works for its intended use? What I am trying to say, Alan, is that it is my own feeling that we have erected a lot of buildings but that we do not often analyze them. We are off to design the next building and then to the next. We really do not sit down and study and evaluate what we are doing. We have a great mass of opportunity, I agree.

Related to this is some of the history of CIE committee TC 3.5. Some ten or twelve years ago it embarked on a program in which the British were particularly enamored of the idea of making appraisal surveys of lighting installations. They took lighting experts, six or seven of them, to visit various installations. With a prepared check list these were rated in a variety of ways by the experts.

The French then took the form and added more questions and they too got quite excited about the idea. Both were trying to persuade us in the United States to participate.

Meanwhile the questionnaire kept getting longer and longer with additional and different ideas being included. When we arrived at Barcelona in 1971 there was a stack of surveys which had been completed. What to do with them? Back now to

Steve's point. I have the survey but what does it tell me? The problem that we have had and the reason for the kind of work John Flynn's work is doing together with other work is to try to analyze those elements in which we have a concern as separate from the others. We want to try to determine if possible those which are a complement or a detriment to the total. One reason why we do not have the body of information that we might have had had we been able to analyze all these buildings is that we did not have a generally acceptable metric.

It has to be more than just making surveys. Unless you know what you are going to do with the material when you complete it what's the point? That is why we are interested in multi-dimensional scaling and some of the other techniques now being studied. These give us an opportunity to handle the information when we get it.

Mr. Frye: I would like to answer in a slightly different form. In the more enlightened days of the British empire, which some of you may remember, the Minister of Health, hearing of an epidemic in one of the far-off colonial countries, sent a telegram saying: "Shall we send more doctors?" He got the reply from somebody in the area: "If you get rid of the damn curse that is causing it, we won't need your doctors."

Mr. Cornish: Is there anything else that any of our panelists would care to contribute to this subject? It is an area where we can certainly get some lively debate.

Mr. Bott: One of the jewels in our crown, if we have any, is that we have done a number of demonstration buildings. We normally do surveys after the fact, but part of the problem is as to how the questions are asked and how they are phrased and who makes the survey.

I remember one in particular where the team was sent out and a fella comes back and he is reporting on our magnificent project where he makes reference to the neon tubing. I said, "What neon tubes?" He said, "You know, those all over the ceiling." So, I threw his survey material in the trash.

Prof. Smith: All of us view these questions, and I think the people who wrote them did that intentionally of course, within our own biases.

I had looked forward to the discussion here of listening in and trying to solve some of my own problems.

Basically, of course, that is one of the classroom environments where I would like to, if possible, have maximum performance from my students. I am sure this fits into other categories, but let me restrict myself to the classroom atmosphere where I feel most comfortable.

Of course, I would like the lighting system to be a contributor to that improved human activity. I would hope the students would not go to sleep. That is a function of lighting because in fact I read some research at one point where a darkened ceiling will tend to keep your students awake better than would a lighted ceiling. They apparently lean back, they don't like it, and so they look forward.

I make jest of it because I think there is a big need for research in this area. How can we perform, if you wish to call teaching performance, or how can we design facilities unless we understand what impacts the human activities in this space.

I read John Flynn's research with great interest. I feel that this fits my needs and I try to accommodate what I can with his work.

I guess I am a little frustrated at this point in that I am not sure I understand what is going on around me. Have I addressed the wrong issue with my interpretation of the question?

Mr. Cornish: Certainly not, from my point of view, I don't think so at all.

Prof. Smith: There seems to be disagreement, or else I have not read enough literature, as to whether there is a need for more information. I believe there is certainly a need for more information.

Mr. Cornish: What I would like to see here is the panel getting involved in a debate.

Is there a need for more information or is there not a need? That is really what I expect would come out of this.

Mr. Frye: Yes, I wholeheartedly agree. I think more research is needed in this area and I feel that one of the major problems is again this issue of making an objective experiment where you have clearly isolated variables when you have a lot of other things affecting it. Such as, you have shadow change, or something as simple as having coffee in the morning. All of these things affect your perception of the space. It is very difficult to do. I think this is where people give opinions to such an enlightened group very carefully because everything, you know, seems to affect the space about which we are talking. This is the problem because more research is needed, and possibly the way in which to carry that out is to research what happens actually in the outside world and then relate it to the inside world.

The trouble is that you have perhaps 30 to 50 different variables that are all working at the same time and you are trying to isolate them. It is so incredibly difficult.

Mr. Clark: I just want to reemphasize that in my opening statement I did call for research.

One example of ongoing activity is John Flynn's work which has been supported by a number of us. One of the things we see coming out of that and which has been completed most recently is the opportunity to expand on what John has done by using the research technique. The lack of such a technique is what has made it difficult to even design effective research. Hopefully it is at least one answer to the thing that Michael has talked about in terms of trying to sort out all the variables.

We have looked at multi-dimensional scaling as one type of opportunity, restricted in my view, but nonetheless available to be expanded beyond just the present work. Simply having people appraise an interior environment, for example, and then asking them "how do you like it?" is not productive. Perhaps we can get a better handle on the matter by some of the new techniques.

Our hope has been that the technique would be proven out by John's work and would get acceptance as a technique for others to use. This is an approach where the investigators need not know all of the gory details of the technique other than its application and could then submit the data which they collected to a location which had the processing qualifications. This might permit us to build a very sizeable data bank which would then provide the opportunity for statistically significant population studies - something we badly need in several areas of lighting.

Some of us were concerned that without a reasonable consensus ahead of time the technique might be discredited after considerable time and expense had been expended to collect data. This, of course, would be most unfortunate.

So far we think that we are on fairly solid ground within fairly limited use of the technique. I am enthusiastic about the possibility of getting research or perhaps more properly investigations done at a relatively low cost. One can foresee situations where graduate schools, for example, might welcome projects for their students using the multi-dimensional scaling as the metric.

Another area where I will take a moment to comment, and of which John Kaufman is especially well aware, is my twenty odd years of hope that we would start designing dynamic installations which might help Bob Smith with his clients. I think that it is a sound idea but it's an idea which needs to be investigated beyond the sort of editorial paper which I was able to produce in 1957.

Basically we design lighting so that when we turn on the switch it remains constant until we turn it off. This is a relatively unnatural kind of lighting for the human environment. Maybe there is merit in having lighting which changes with time in our designed spaces.

I have been promoting this idea for twenty years without much success but I am taking this opportunity to raise the point again in case some person in this audience is interested enough to pursue it further. Hardware is not the problem. Benefits versus cost is.

Ms. Harrold: Maybe this is one reason why I did not select this issue because I guess, like Bob Smith, I am having trouble coming to grips with what is said on paper versus what we are discussing.

I see it as two sides to the issue. One is the human activities as stated in this position statement, and the other, which I think some of the panelists have perhaps channeled their thoughts to, is in the area of human response. We have two different issues on the same table.

I agree with George Clark in that sense that I think what we need is some research. I am wondering what we would do then if they collected a data bank of ideas? I think there is a great deal of prescriptive information that needs to be addressed in working with a client on a one-to-one basis, which is the kind of thing we tend to do in residential design where we have the opportunity to work with the client to begin to qualify what the needs are for that particular individual. You do not always have that opportunity in industrial and commercial facilities. As Steve Squillace said, you don't know what the end use is going to be. In fact, we make statements in some of our procedures saying that we are going to design based on the expected intended use of that building. That leaves a lot of latitude in somebody's design terms and does not really begin to address some of the issues in trying to provide for human activities but at the same time we may not know what they will be.

If it is a question of looking to human response, maybe there are predictable kinds of things where people are going to respond to certain light distribution patterns in a particular way. So, it depends on whether you are addressing the activities or you are addressing human response.

Mr. Squillace: Perhaps this may be helpful, but I do not know if there is still some confusion. I think, in your statement you really have a pretty good grip on it.

We, at our office, when confronting a client, often have a dilemma that develops because of the kinds of questions that we ask clients concerning the lighting criteria. We ask what criteria should be used to base our lighting on. Immediately they respond with 70 footcandles. We then come back with no, no, no, that is not it at all.

What is the activity to be performed in the space? Do you know what you are going to do in the space? What are the tasks that you are going to perform? If

you know the tasks, can we work to determine how the various tasks are responsive to light? What are the various other spaces that you have dealt with? Are the people happy in them?

Can you imagine a client like General Motors, a mammoth operation, giving you an answer to that? They don't even have the foggiest idea how to answer it.

The reason, like George said, is that they have never stopped to evaluate, and see what has been done. I am not blaming the client alone in this, perhaps the professional is more to blame than the client. Until we go to that data bank and arrive at the prescription that Rita has mentioned, we cannot fill out that prescription. It just cannot be done.

Hugo Blaisdell started to gather a data bank and John Flynn has continued the work, perhaps not exactly how Hugo did it, but somewhat like that, in this country. Dr. Hawkes in England (which is the first time I ran across it in Europe) used a similar approach. Others now are carrying it on. A lot more data are needed.

In the classroom, for example, how many times have I stood before a board of education and said, "How are you going to use the room?" Nobody knows. Whether you approach the teacher, or even the kids, the point is that I think the criteria have to be established first. You have to write down the criteria before you write down the specifications.

Prof. Smith: Steve, I certainly agree with you wholeheartedly. I also agree with George, though--his comment about the dynamic designs. If we can only get some of those incorporated we would be ahead.

As far as waiting until all of the research is completed, before we do anything, that bothers me a little bit. I have always followed the philosophy that I would rather catch hell doing something wrong instead of catching hell for not doing anything at all. Let's do something even if all of the data is not in yet.

5.3 WRITTEN QUESTIONS/COMMENTS BY AUDITORS

Mr. Cornish: Turning it over to the readers, let us proceed to that portion on this subject.

Mr. Unglert: The first question, it seems to me, is sort of a position statement, but we will take it for what it is worth.

5.3.1 Mr. Erhardt: Paraphrasing a few sentences from Henry Dreyfus, *"What we are lighting is going to be lived in, sat on, looked at, talked into, activated, operated, or in some way, used by people individually or en masse. If lighting, which intervenes between the product and the people, becomes a point of friction, then the lighting designer has failed. If on the other hand, people are made safer, more comfortable, and more eager to perform or efficient, or just plain happier, the designer has succeeded. Illumination is lighting design, which is the practice of controlling the mediating effects of the light interposed between the scene and the viewer."*

That was addressed to Bob Smith and Michael Frye. Are there any comments, gentlemen?

Mr. Smith: I wonder if Louis Erhardt is writing with the head of a pin? How the hell does he get all that down in that 3 by 5 inch card? I have no comment. Sorry Louis.

Mr. Frye: I don't think there is any comment.

Mr. Amick: This one is addressed to Neil DeKoker and Michael Frye. There are really three questions that are sort of tied in together. The first:

5.3.2 Mr. Florence: *1. Would you comment on the relationship between visibility and total performance or productivity?*

2. Would you speak about how you make your productivity?

5.3.3 Dr. Beck: *How about evaluating lighting performance post occupancy?*

Mr. Amick: In other words, I feel Dr. Beck is asking, after a building is occupied, how do you evaluate the lighting performance? Neil, do you want to take the first part of it, the relationship between visibility and post performance/productivity?

Mr. DeKoker: I cannot relate to any specific hard numbers, but I could pull out the file that illustrates the past research that has taken place not only at Emerson, and at General Motors, but at other places where the lighting levels have been changed and productivity, quality and so forth, measured.

There has been research in this area as recently as last year in one GM division in Ohio, but I do not have that data available.

Mr. Amick: But, you found that productivity went up?

Mr. DeKoker: Well, let me first of all talk a little more about the first issue, please.

Lighting productivity, the quality of lighting, and the amount of lighting in the work environment, people have some very strong feelings about this. In one of our central foundry plants, we performed what we call assistance visits to see how our plants are doing on energy conservation performance. This particular plant had quite a high lighting level throughout the aisles, the corners, under equipment, and everywhere. We were concerned about it because it was a little more than normal and it is an area where we could conserve a bit of energy.

However, because the plant is a foundry, and is very energy intensive, their lighting energy was less than two percent of the total energy used in that facility. Management, from the plant manager on down quoted a number of reasons for their use of light. They said, "Have you ever seen a foundry so clean? Do you see any dust? Do you see any garbage? Do you see anything in any corner, or under equipment? What do you think of our employee morale?"

It covered everything; lighting, we think, is one of the most important things that we can do in our environment in order to keep our employees happy. It helps to keep a clean environment which also spawns other side benefits.

You do not have to go in that plant and measure or prove anything to him because he is not going to turn around and then reduce the lighting level. They do a tremendous job in turning it off when nobody is there at the end of the shifts and apparently the benefits that they get out of lighting far exceed the costs.

How you measure productivity, the second question, I think, the National Bureau of Standards can better answer that. However, primarily, it is the amount of output in units of production or in dollars of value added (depending on which terminology you want to use on a national basis) per direct productive labor hour input. The product output is related to labor input.

Mr. Amick: Mr. Frye, do you want to comment on these first two?

Mr. Frye: I will take the first one. How do you measure productivity in lighting? That is very difficult. There is a total bag, if you will, of various factors that are isolated here. I think you may have to do some fairly subjective comparisons in terms of aesthetics and establish the criteria for the comparison, but obviously, you have succeeded if the people are happy when you are using resources by turning people's times better. That is the issue.

Now, how you actually go about it, I don't know. I think you just have to make up your mind and study one or two things and then try to bring up a total picture.

Mr. Amick: Steve, what about the post-occupancy evaluation?

Mr. Squillace: I am not sure that I am really qualified to talk about post-occupancy evaluation except to say that I wish I knew more about it. However, how do you measure productivity as opposed to the post-occupancy situation? Is that the question?

Mr. Amick: I guess you can expect a medical man to use that kind of a term. Excuse me, Dr. Beck, no disrespect intended.

Dr. Beck: As doctors, we use post-operative evaluation by following up on our patients to see how they have done. Does a lighting person in design go back to see whether he has been successful or not?

Mr. Amick: Thank you for clarifying the question, Dr. Beck.

Mr. Squillace: As far as I can tell, from my travels around the country, probably 99 percent of the lighting that is designed is not post-evaluated, however, there is that one percent that does look at the situation to see if they have succeeded.

Recently, for example, I went down to some office space, more particularly, weaving space, that belongs to one of our clients. I particularly wanted to see this space because this was a laboratory area. Even though weaving space that was manufacturing cloth from fibers was done on an experimental basis in nature. These were new techniques, not techniques previously established. When we asked for the criteria, nobody knew how to attack the problem except to say that we would use the example from one of their old plants. They simply said, "Do it like this."

We decided not to "do it like this." We decided that because we wouldn't have learned very much. So, we went in afterwards, Dr. Beck, and we talked to the actual workers, and lo and behold, I, never having worked a loom or a weaving machine before, there I was looking at the heddles and the reads, but not only that, also trying to thread them along with the workers who were there helping me and showing me how the equipment operated.

We looked at the vertical lines and I had my photometer there and we measured what was impinging on the cloth and on the heddle itself and we tried to evaluate how these people felt about it. Fifty percent of them liked the solution that we gave but fifty percent did not, as you might well guess. So, the question was, "Why don't you like it?" So, we went on and on and on.

We finally said to them that maybe we should wait six months and see if the problem rested with the fact of moving from the old space to the new space. You see, the problem was that fifty percent of the workers said it was not good. The owner then came back and said, "Gee whiz, fifty percent of my people don't like it. You made a mistake! You got to pay for new lighting!"

I then replied, "I would be very happy to if you could only tell me what lighting is really needed, both in terms of quality and quantity."

He stepped back and said, "What do I do? Do I double it?"

Our advice to the client was to leave the lighting alone and wait for time to pass to see how the employees would react after becoming accustomed to the new surroundings. In addition, we advised that a study of the task be initiated in order to determine if we could do something about the need for lighting. The study has not been started as yet.

Six months later, we went back and we said, "How about it fellows?" Well, you know what? On the first occasion that we visited the plant the floor was painted just a plain red. I suggested a gray and so apparently they painted it gray. Perhaps I should not have done it and I should have waited the six months, but they went ahead and painted it anyway before the six months had lapsed and it appears that everybody was happy.

I cannot say that painting of the floor with light gray did it all by itself. Perhaps, I think, there is a combination of both here, but after six months living and working in the space, the onus of moving from their former place of employment to a new one had worn off and the change to the new spaces was no longer disagreeable. Those are the kinds of things we are doing.

That is not scientific by any means, it is only a gathering of the right kind of data. We have got to structure this in order to be capable of doing a lot better job.

For the same client, with respect to the lab and office spaces, the same thing happened. When you move people from a space that has lots of windows, a place that was like being at home -- for example, with pots of coffee boiling -- to a new office without daylight or the other homelike amenities, there is likely to be a negative reaction to the change, especially immediately after the move has taken place.

The architects did not take cognizance, if you will, of the fact that they are moving from a place with considerable natural light in a space to one without any natural daylight. Not only that, but for me, the colors that were selected in the new space left a little bit to be desired.

To look at a pumpkin colored wall in a space where I look at litmus paper, and at chemistry tubes all day long, that is not really to everybody's liking. There were complaints. Again, we waited six months, then came back, and almost all the complaints were gone. I might say that there weren't all that many complaints voiced. There are all kinds of reasons for that and so we ended up explaining this to the owner.

Right now, the owner is contemplating giving us a contract whereby we can look at various tasks in spaces of this type and change system parameters one at a time to see if we can isolate those parameters which have significant effects on visibility and comfort. The customer/client happens to be one who is enlightened and wants to get along with it. They may have fun with it. I sure hope so.

Prof. Smith: The question about the research and existing facilities. Back when I worked for a living, I was in the maintenance department of the University of Illinois.

We were constantly trying to evaluate older buildings. One thing that we did come across quite accidentally, by the way, was that there were some of our rest room facilities on campus that had a tendency to have a greater odor level than did others.

So, working as a person who is very cognizant of these, and trying to solve the problem we found out that those rest rooms happened to be the ones that were less well illuminated. We raised the illumination in some of these areas and we found out that the custodians then cleaned them up.

So, we arrived at the decision, and I do bring this up, because if we are going to do the research in existing facilities, then I think we have to identify what kind of results arise out of this. I have no idea as to whether I should have raised the illumination by five footcandles, or raised it by 25 footcandles, or just what. However, I do know that raising the illumination gave rise to a

cleaner environment. I don't think that we can ever expect research to quantify exactly how much it is that one has to raise illumination in order to bring down odor.

5.3.5 Mr. Kahn: *My question relates specifically to the use of eyes in perceiving visual tasks, etc. How many members of the panel can describe simply how things such as visual tasks utilize illumination to make themselves visible? Understanding this relatively simple phenomenon is necessary to the exercising of design judgment on the quantity and quality of light; and thus, it affects the amount of light and energy actually required.*

Mr. Frye: I would like to consider the previous one. I remember where we had complaints with installation of lighting, and when we lit them, we found that they lost their color. The second one was with meat which turned brown, and so we had to change it for those people who wanted to eat meat. The third one was when we installed lighting in tents, the clients complained that there was no electricity.

Mr. Cornish: Is there someone who would like to address Mr. Kahn's question?

Mr. Unglert: Does anyone know how to measure how much light is required to do it? I would assume it is how much lighting do you want to --

Mr. Kahn: It is really very simple. The question is: How many of the members of the panel can describe how things, such as visual tasks, utilize illumination to become visible? In other words, we sit in a room with the lights off and you think everything disappears. It's all there, but you can't see it. Now, what this questions refers to is, what is the process involved in the utilization of luminous energy, electromagnetic radiation, or whatever you want to call light? What does it do to things to make them visible? A simple question. If you can't understand it, how can you recommend lighting?

Dr. Ross: I am sure Mr. Kahn wants me to say that we perceive something by contrast differences, or contrast itself, or by luminance or brightness changes. I suspect, for a large measure, that is one of the important cues. This is the relative brightness between different portions of the task.

At what level, or at what deterioration in contrast where their performance dropped off, is a matter of substantial amount of debate and research. It is just now, I think, taking place in a way that we can all agree that the results would be meaningful.

In the past, I think many of these kinds of experiments were performed when we were not aware of the many variables that affected the results that we were getting. Therefore, the results were somewhat contradictory and subject to question.

It is this development of contrast, in the difference in brightness of the portions of the task, that permits us to see. That not only pertains to black and white, but certainly to color and how that different energy and different portions of the spectrum affect the eye.

If those things can improve that and enhance it, then that certainly increases visibility. At what level do you set those at, again, they are important. How far you have to go along these lines, where you are to stop, where you have to decrease or increase the levels, I don't know, because there seem to be some optimum levels both for increasing and decreasing which are dependent on the task.

That is what it is all about, the research that is going on now.

Dr. Lewis: I think the answer to your question is nobody.

Anybody who thinks they can explain simply and clearly the relationship between the luminous environment and what is seen is kidding himself.

It is an extremely complicated process. I do not know of any, including the most knowledgeable people in vision in the world, who can claim to even understand the transduction process. In fact, contrasts, while they are important under certain conditions, are completely unimportant under other conditions.

For instance, there is no border seen binocularly, yet you see an object there just as nice as can be. I am not saying that is applicable to lighting, because that is a very special case, but it is not simple. It is an extremely complicated process because you must know a great deal about the underlying mechanisms.

Mr. Frye: Can I give a simple answer? Light is being thrown onto something and it is being reflected and it is being received as a number of messages to the brain and then disbursed throughout the body.

It is a simple process. It is energy going from here (indicating) and reflected and coming back, or direct, it is a mixture of all of those things, and all of the other things that are going on in the body that determines how you perceive the light and the contrast and everything else.

So, there are a number of things that are stimulating optically, visually and this sort of thing. You have the ear, the stomach, through the drugs, everything that is going on in the body affects your perception of what is coming in apparently only visually.

Mr. Cornish: The next question?

Mr. Amick: I have three questions that deal with matters of aesthetics and environment. The first one is addressed to George Clark from Robert Laughlin.

5.3.6 Mr. Laughlin: *Is it not a waste of time and energy to talk about aesthetics? For example, how do you judge art? How and who can judge art and/or aesthetics?*

Mr. Clark: A theory of my own, and I'm not sure how much support I have for it, which has developed after a good deal of discussion on the subject with people I feel to be knowledgeable, is that aesthetics is a subheading of the psychological effects. Furthermore it is a nonstatic situation. Our aesthetic tastes change over time. Part of this is manifested in what we call trends and part in changes in our own individual "frame of reference." Our frame of reference is a key factor. I happen to believe it is a very important concept insofar as lighting is concerned. One aspect of this, incidentally, in answer to that past question, is a tenet of the general semanticists. It holds that none of us see objects - we only see the image of objects. I think that this is a powerful idea - especially for lighting people. If you can couple that concept with the image of the object which the designers establish within their own frame of reference one has an element that is involved in aesthetics. This doesn't mean that we are going to set precise rules.

I think there can be guidelines and general directions to follow with population factors involved. Further we need to keep in mind the fact that people in most spaces are not there looking at it as work of art - they are in the spaces performing some activity.

Peripheral vision seems to be a very significant factor as it carries messages to the brain in very large numbers. Are these good or bad messages? I feel we are still lacking good metrics for determining the subconscious impact of our design spaces.

Many of you could agree that there have been situations where on an aesthetic basis the judgment made as one looks at a room is to see it as very beautiful. On the other hand, if you had to work there for eight hours a day, three hundred

days a year you might not be able to stand it. These are the areas I think about involving aesthetic factors where we can be helpful with research input.

Eventually it gets back to the intuitive, creative designer but with added information which cannot really be part of the designer's intuition - for example, population variation.

In general the artist does not design for the general population. He creates something which satisfies him whether anybody else likes it or not. Too bad if you don't. If it turns out that some people do, fine. I don't believe spaces should be designed that way. Some may be successful but the uncertainty is too great.

This goes back to Steve's point where we are talking about predicting ahead of time. Most designers cannot plan on the luxury of being able to go in after the fact and make adjustments.

5.3.7 Dr. Atkinson: *Please discuss the trade-offs between performance and aesthetics.*

Let me read the first one and perhaps we can tackle them both at once.

5.3.8 Mr. Brandston: *If this visual component for the task is such a small factor, is not the environment a far more important factor and shouldn't lighting's function, after visibility, really be to reinforce the environment?*

Do you want to tackle both of those?

Prof. Smith: I felt comfortable on the first one. I should have waived the second one to someone else.

Yes, I felt comfortable with the first one because aesthetics is strictly a performance definition, and so whatever I said could not be wrong.

You threw that second one in there and so that is where I got a little worried. Would you reread the first one again?

Mr. Amick: Please discuss the trade-offs between performance and aesthetics.

Prof. Smith: I would hate to ever think that they could be separated or differentiated against. To design a space totally without aesthetics as a consideration I cannot believe would maximize or optimize performance. I cannot separate the two in that way at all.

Mr. Amick: Are you saying, if engineers design a building, they will tear it down?

Prof. Smith: With a PE behind my name, I just --

Mr. Amick: Well, how about Howard Brandston's question?

Prof. Smith: I believe the engineers, even though they may not always want to admit it, indeed are sensitive to the total environment and not just the work task.

I just do not believe that any of the lighting designers are sensitive at all and separate aesthetics totally with function. I cannot believe that it can be done.

Mr. Amick: Howard says: Should lighting's function be to enforce environment? What do you think, Steve?

Mr. Squillace: Certainly that should be one of its functions, to enhance the environment, and the pleasantness if you will, of being in the environment.

I do not think that we know to what extent today the visibility level, or the actual visual phenomenon, is a percentage of the total appreciation of the environment.

If one could say (as an example to make a point) that the total appreciation of a space is represented by a figure, such as 100%, then I could not say that vision is 10%, 5% or 50% of the appreciation, as the science stands now. I don't think that we know, but when we do lighting, I don't think that we can separate aesthetics from performance, because if we do, performance is going to fall.

There are indeed not only subsystems of the environment, but the senses perceive them together in total and therefore, the design, while predicting and conceiving them separately, must finally bring them together to operate as a whole. The sensation and feeling must be together and not separated.

For example, Russ, the General Services Administration will remember this, because one of their buildings was involved with pure number criteria, namely 60 ESI on the task, and a 70% VCP.

They were going to mock up a 30 by 30 space and put in some lighting. The specifications called for the giving of the number of ESI on the task. Unfortunately, I think the specification was not all-inclusive enough and so they got exactly that from the contractor with almost no ambient light at all.

Then, to boot, the mock-up was such that it did not enhance the ambient light at all, and so everybody agreed that it was very, very bad, even though they had the ESI level on the task.

Performance in this environment would have gone to pot regardless of the fact that there was 60 ESI on the task.

To what extent would one change that so that aesthetics became pleasing and comfortable and therefore, produced good performance? I don't think we know. If we can have a trade-off, fine, but I'm not sure that there is a trade-off. I don't think that we know.

There is certainly a lot of research that has to be done.

Mr. Cornish: Ladies and gentlemen, we have now reached the point where I have to to shut off this topic or we will otherwise be getting behind.

The next topic is that of the effects of lighting on environmental quality. I would suggest to you that a good deal of what we have been discussing for the last little while has really been that subject as well as the factors of affecting human activities. It is for that reason I let the conversation be extended because they seemed to have been combined one into the other.

I would suggest there be a reasonable time frame on this topic, which is the effects of lighting on environmental quality. At the end of that we will cut down on the number of the questions from the readers and we'll try to provide a little more time for questions from the audience. Would that be acceptable?

Seeing as I hear no one objecting, and if I did, I would have my hearing aid turned off, we will proceed to issue number four.

6.0 ISSUE NO. 4. "EFFECT OF LIGHTING ON ENVIRONMENTAL QUALITY"

6.1 WRITTEN STATEMENTS BY PANELISTS

6.1.1 Mr. DeKoker: When one considers this subject, there are at least two options on environment that come to mind: one is the working environment to which lighting contributes a great deal of quality as my discussion on Issue 3 points out; another is the effect of lighting and its energy requirements on the earth and its atmosphere.

Lighting as an energy user consumes electricity coming mostly from coal, hydro and nuclear sources. Oil and gas account for only about 30% of electricity production. Even less of these fuels will be used to generate electricity in the future.

Despite industry's successful conservation efforts, I believe we will continue to need increasing quantities of electricity in the immediate as well as long-term future, to substitute for oil and gas where practical and economical and to increase goods production and employment. This means that electric energy from coal and nuclear will need to be increased over the next few decades. Of course, the safety of nuclear plants must be assured while realizing there is no such thing as totally riskless society. In any human undertaking, we must balance risk versus potential gain.

If we insist on trying to achieve absolutes -- as we often seem to in our zeal to protect the environment and the consumer -- safety and security will eventually cost more than we, or any nation, can afford. The 18th Century English author Samuel Johnson wrote, "Nothing will ever be accomplished if all possible objections must first be overcome." That observation couldn't be more appropriate to America's need to increase energy production. At some point the arguments must be ended, a decision made, and action taken.

I also personally believe that nuclear power must be one of the alternatives that we use in the future. Certainly, its potential benefit is too great to abandon summarily. Three Mile Island can help make the development of nuclear power safer -- just as our response to the fatal fire aboard Apollo I ultimately contributed to a successful moon-landing program.

Both accidents occurred as this country was trying out new technology. Just as the nuclear accident has, the death of three astronauts shook the nation. In the aftermath, many questioned whether the project should proceed.

In the case of Apollo, the fire prompted a searching reassessment of the project. Basic designs were tested, redesigned and retested, new standards of quality were imposed, tougher test procedures specified, higher reliability rates for components established, both flight and ground crews received more effective training, emergency procedures were rewritten, tested, rewritten and retested again. The risks weren't eliminated, but they were minimized. Finally, Apollo went ahead to become one of our greatest technical achievements.

As much as I personally admire the Apollo program, I believe nuclear power is far more important to our future today than the moon-landing program was in the late 1960's. We should use the Three Mile Island accident the way we did the Apollo I fire: learn from it -- and then do everything possible to minimize the risks of a similar accident occurring again.

To the extent that we can use daylight in our building facilities, we can save some energy for lighting and reduce environmental effects as far as the earth and its atmosphere are concerned. But daylight isn't dependable every day through the year, and many of our GM plants are operated two and three shifts. Therefore, we need electric lighting for a substantial amount of time out of each 24 hours. But, we also have to evaluate windows and skylights in terms of heat los in winter and heat gain in summer since this increases heat flow and energy use.

There is an increasing trend toward replacing window sash with insulated siding to conserve energy. This, of course, eliminates the daylighting option and makes adequate lighting an absolute necessity for manufacturing.

Lighting can do double duty in building interiors by supplying useful building heat when outside air temperature gets below 65°F or 60°F. This takes some load off the conventional heating system, normally supplied by gas or oil.

I would like to look forward to a day when solar energy can begin to function economically and on a wide scale -- though my personal opinion is that it will be at least a couple of decades before it makes much of a contribution to our energy requirements. Nor am I very optimistic about direct conversion of solar energy to electric energy, unless there is some major breakthrough in technology that is unforeseen at present. Even the DoE projects that solar energy will at best represent only 5 quads or less than 5% of U. S. energy consumption by the turn of the century.

6.1.2 Mr. Fryc: Much of what I am about to say in this section is considered controversial. Many of the effects of light to which I shall refer have been investigated and there is prima-facie evidence to support the broad conclusions. But, I must stress that it is essential that further detailed and controlled scientific experiments be carried out to fully substantiate and develop the findings.

It is now well known that electromagnetic radiation, including light, has important biological effects. In the case of light, vision is the most obvious biological response, but there are additional nonvisual responses to light. The best known of these are the result of light falling on the skin surface, including suntanning and the associated formation of vitamin D3 in the skin. Phototherapy, simply the deliberate exposure of large skin areas to light, is now used in the treatment of a variety of illness ranging from jaundice in newborn babies to skin diseases such as psoriasis and herpes.

When the eyes see light, the information is not only sent to the visual centres of the brain, but in mammals a small number of nerve fibres are diverted from the optic nerve along the inferior optic accessory tract through the midbrain and down the spinal cord. The information about light seen by the eye is relayed to the sympathetic nerve system from the spinal cord, and returns to the head to affect the rate of secretion of the pineal body, a small gland which, among other recently discovered functions, modifies the output of the master endocrine control gland, the pituitary. Light, thus, has an immediate influence on the entire hormone balance and in turn is able to affect chemical activity throughout the body including some of its most vital functions - reproduction, metabolism and growth, and response to emergency. It is widely recognized that there is a psychological response to colour - different colours evoke different moods and feelings. But, it is now clear that there is also a physiological response to colour, not only colour reflected from objects but also the balance of wavelengths in illuminating light. A wide variety of such colour responses have been reported in animals and birds - changes of blood pressure and cholesterol levels, alteration in muscle tone, sexual activity, and even rates of tooth decay and tumour growth. These effects also occur in man: there are striking immediate differences in general muscle strength - including that of the heart muscle - under different coloured lights, and an influence of mental judgments, co-ordination and metabolism has been reported. For example, time, size and weight tend to be overestimated in red light and underestimated in blue light.

Even more surprising than these responses to strongly coloured or monochromatic light are the results of exposure to what is generally thought of as "white" light, such as most kinds of ordinary broadband artificial light sources. Here, even marginal disparities in the relative intensities of different wavelengths, particularly between the red and blue ends of the spectrum, produce an extraordinary range of abnormal biological responses. For example, the ratio of sexes produced by breeding animals is affected by the colour difference between alternative types of white fluorescent tube. Clearcut cellular responses to

artificial light sources have been observed with time-lapse photography, including the interruption of protoplasmic streaming and mitosis. (Protoplasm is the semi-fluid part of the cell which in many cases should show a regular pattern of circulation, and mitosis is the cell division which results in ordinary growth).

The total lifetime of cancer-prone mice is radically altered by the kind of lighting they are exposed to. C_3H mice live nearly twice as long in daylight under an air curtain or quartz glass as they do under ordinary fluorescent lamps. Similarly, human cancer patients have been shown to benefit from maximum exposure to "raw" unfiltered daylight. It seems reasonable that light should be able to influence the rate of cancer development, since the pineal gland is known to be able to inhibit the growth of neoplasm and tumour in some way, and in view of the response of the pineal to light, it may be that pineal function is impaired under less than the full natural spectrum of light.

Radiation from the sun reaches a peak in the visible band and the atmosphere acts as a selective filter permitting only certain wavelengths to reach the earth's surface. The resulting daylight spectrum is substantially even across the visible range, rising steeply beyond the deep violet at 400 nanometres. By 290 nm there is effectively a complete cutoff in the ultraviolet. But between 290 nm and 400 nm there is a significant amount of ultraviolet energy, which has very considerable biological benefits if, and only if, it is present in this natural small proportion together with a relatively more intense spread of visible light. It is this band of near-ultraviolet which is responsible for suntanning of the skin and the formation of vitamin D3, and it now appears that the eyes also mediate responses to near-ultraviolet. The iris reflex of the human eye has been shown to respond to the presence of near-ultraviolet in visible light by closing more, and simply by putting ordinary window glass or clear spectacles in front of the eye results in the the loss of muscle strength. There are now a number of reports about the general health benefits of additional near-ultraviolet and these need to be carefully distinguished from the generally harmful effects of ultraviolet shorter than 290 nm. For example, the radiation from some of the older type of so-called sun lamps and from the detrimental effects of near-ultraviolet on its own or at high relative intensity to accompanying visible light. In this respect, the newer solarium tubes are an improvement, but they have not yet been fully tested in this context.

These findings about the advantages of balanced wavelengths of visible light plus near-ultraviolet have led to the concept of "full spectrum" lighting. Photobiologists have tended to look at the positive effects of various wavelengths in isolation, but it now seems that the relative lack of other wavelengths is equally important because it means that part of the complete natural response is missing. In other words, living systems expect to be illuminated with the full spectrum of natural daylight and have evolved to make vital use of this particular balance of wavelengths, which we alter at some risk.

Certain fluorescent tubes are now available which give an approximation to the daylight spectrum including the near-ultraviolet and it has been reported to improve the health of zoo animals, improve calcium metabolism in elderly men, improve academic performance and reduce tooth decay in Florida schoolchildren, improve performance and health in Russian factories and schools, and, used with clear near-ultraviolet transmitting glazing, result in a 25% increase in efficiency for a business in Florida.

It is too early yet to give a detailed account of the mechanisms underlying these responses, but the autonomic nervous system and the pattern of hormone secretion are certainly capable of mediating many of the observed effects and at the same time it is now established that light does influence both autonomic and endocrine function.

All this has important implications for the design of artificial light sources. The ideal so-called "full spectrum" light would be an incandescent source between 5,000 and 6,000 degrees Kelvin, but ironically it is not practical to run

ordinary incandescent sources at such high temperatures - standard tungsten filament lamps run at about 2,500 K. Low voltage tungsten halogen lamps are better than this, but still only run at about 3,000 K. It is easier to use various kinds of gas discharge lamp to mimic higher colour temperatures. In the case of fluorescent lamps this is comparatively easy to do, but the majority of tubes sold have considerably lower effective colour temperatures to make them compatible with incandescent lamps. Some other discharge lamps can give a more satisfactory full spectrum output, such as the xenon arc lamp and the metal halide mercury lamp, while others, such as the sodium vapour lamp, both high and low pressure, are very poor indeed in this respect.

In the case of fluorescent lamps, there seems to be a number of biologically undesirable side effects resulting from the current fixture design. The use of alternating current mains electricity results in rapidly flickering light and low but biologically active levels of radio frequency radiation. In addition, there is a very low-level radiation from the ends of the tube which can be stopped with lead foil. Biological responses have been reported ranging from the onset of epilepsy and migraine attributed to the flicker, to the abnormal growth responses in plants, loss of muscular strength in adults and hyperactivity in school children in response to the non-light radiation. The N.I.H. has even reported that the reduction of muscle strength can also be detected in the heart. These side effects could be eliminated from fluorescent lamp fixtures with very careful redesign which would very considerably improve the health aspect of these lamps. We are all aware that a significant number of people find these lamps difficult to work under and in view of this new knowledge we should all recognize that there is a need to eliminate these effects from commercial luminaires.

However surprising the list of reported responses to light may be, it is clear that light plays an organizing or determining role in the body which we have only recently begun to uncover.

Naturally, much of the more controversial material presented here needs further corroboration and analysis. But, there seems little reason to doubt that light is capable of producing the effects described.

It is hard to overestimate the potential significance of these findings. That there should be such widespread systemic responses to what have previously been considered marginal and insignificant spectral shifts certainly demands our attention. But using artificial light on the vast scale that we do, we are already deploying these photobiological stressors throughout society. Indeed, the distortion of the total radiation background becomes an issue when the side effects of existing lighting technology are also taken into account, and it is important to appreciate that as yet there is no evidence that the body has any protection at the systemic level against unnatural spectral balance in environmental lighting, perhaps because such conditions are not encountered in nature.

It is in fact our responsibility to investigate the issues raised in this paper.

In the United Kingdom, The Light and Health Research Council has been formed as a nonprofit charitable organization to do just this. Barry Tibbs has compiled a full review of the existing research in this area and has written a paper with a full bibliography, entitled "Light and Man's Health". What surprised me about this document was the sheer volume of information in an area where I thought very little work had already been done. The report runs to some forty pages and includes nearly 150 detailed references. This report is available to anyone at this meeting who wants it. The Light and Health Research Council is already planning a variety of experiments and as a point of interest this includes an investigation of the effects of fluorescent lamps in school classrooms and on physical exercise and concentration.

The immediate and longer term aims of the Council cover the following areas:

There is an obvious need to restore the balance. Investigation is needed into the best way of doing this. This will involve advising and influencing various groups of people. Specifiers should be urged to make the greatest possible use of natural light which will involve using near-UV transmitting glazing whenever possible. It is probable that there will be a need to add near-UV to existing light sources in an attempt to achieve what has been termed "full spectrum lighting". Here though, effort should be concentrated on areas where people spend most of their time rather than areas where people only stay for short periods.

In view of everything I have said, we obviously all need to spend more time outside walking, dare I say, jogging down to the store rather than driving.

In conclusion, I would like to emphasize that everything I have said here needs to be confirmed by further research to isolate and quantify the various harmful factors.

6.1.3 Dr. Lewis: Positive Effects

There is no doubt in my mind that the innovative and judicious use of lighting to compliment the architecture of buildings, landscapes, and art has been especially positive in creating a more pleasant environment in which to work and to live. Although the effect of "pleasantness" on human behavior has proven to be somewhat difficult to quantify, only the most hardened skeptic would argue that people don't perform better in surroundings that they perceive to be more satisfying. We must not fall into the trap of designing lighting systems solely on the basis of measured performance; to do so would be inappropriate even if we could effectively measure total performance. Personal preference and regard for asthestics are worth a good deal even though, at the moment, they cannot be easily measured in conventional units such as dollars. It is especially fortuitous that exciting and asthetically pleasing lighting and light-enhanced effects can be obtained without a major sacrifice in energy and that an attractive environment can also be visually efficient.

Negative Effects

To my mind, one of the most unpleasant side-effects of modern lighting is the problem of light trespass - especially that which illuminates the night sky. Aside from the problems of the astronomer which are often invoked in this issue, there is the immense aesthetic value in being able to view the stars at night, an occurrence no longer possible near our larger cities. One only needs to view the sky from 50 miles at sea to be impressed with how few of the stars we can see from the land, even with minimal pollution.

I believe that the night should be dark and, if outdoor lighting cannot be better controlled, I would support action to drastically reduce its use. I believe that we have grossly overlighted our cities and highways (the glow from New York City can be seen 60 miles away at sea level) and that the reduction in environmental quality has been out of proportion to any gain in safety and visiblity.

Mr. Clark: One of the things that this discussion has already brought to your attention is one that has bothered me in my early days of beginning to call an architect, because whenever the word environment was brought up, I thought of the interior environment, the built environment and the architect saw the environment in which the building was going to be located.

So, I am going to be talking about the built environment and not the environment that the architect understands, that is, where the building is going to be placed.

6.1.4 In a talk which I have given for many years entitled "Light and Architecture" I make reference to color, form, and texture as tools of the designer. I then project a couple of slides showing attractive interiors using all three. Next I

show a slide which illustrates what these spaces would look like without light. The slide is an opaque blank! Hoping I've made a powerful point I then proceed to discuss the impact of lighting on color, form, and texture - to enhance, distort, or degrade - in fact to exist.

Unfortunately, too little of the attention on lighting as a tool for environmental design has been devoted to work spaces. This is where I believe we have the greatest challenge. This is where many people spend a large part of their life. In this situation we need to design for both the visual environment and the visual task - both - togther. They need to be complementary.

Unfortunately designers in the past have approached the design from one viewpoint or the other depending on their personal background. I was privileged to chair for several years a joint IES/AIA committee on the Luminous Environment. This experience helped highlight the problem. Environmental quality should not be considered an abstraction but should relate to the activity in the space.

Comfort/discomfort is a parameter of environmental quality which IES has addressed for many years - we're on our third system of direct glare evaluation, for example. The aesthetic and psychological aspects help determine the environmental quality as well (every space has a psychological impact - intended or not). In this field we have more limited knowledge and have tended to rely on intuitive design. Statistically this has appeared to work fairly well but that may only be because we rarely evaluate the performance of our buildings by any rigorous methodology. Superficial appraisals can be very misleading. In any event I'm convinced we can do better.

The environment we're discussing is for humans - lighting is for people. In this context there is a new concern for environmental quality which designers will likely be facing in the not too distant future - the photobiological effects. In 1970 the IERI and IES sponsored what was probably the first seminar in this field. (It led to the formation of the American Society for Photobiology). In the past few years some of my colleagues and I, anticipating the designers' needs, have presented a couple of IES papers relating to the matter of control of ultraviolet in lighting design for the built environment. This a field of great complexity but one which will be getting more attention in the years ahead.

6.2 PANEL DISCUSSION

Mr. Cornish: We will now open the discussion to debate among the panelists, while the questions are being drafted to be given to the readers from the audience.

It is quite obvious that some panelists have taken one tack and other panelists have taken another. It will be interesting to find out from the Steering Committee what was their original intention, but I won't bother with that at this time. That might even be the third alternative. It really seems to me that we are dealing with two issues. We have two approaches to this topic.

Mr. Bott: I might say that I have only seen a few studies on this subject. There was, in regard to the ultraviolet, a statement in one of them which said fifteen minutes in the sunlight would make up for eight hours of exposure to these fluorescent lamps.

It seems to me, that alternative presents a much cheaper way to solve the problem.

In spite of what you might think of the availability of government expenditures for any purpose, we must have more definite proof than we have at the present time to justify using these lamps.

Mr. Cornish: Thank you. Perhaps we can reduce the workday by fifteen minutes for all government employees.

Dr. Lewis: It is important to keep in mind, when looking at the studies, there is an awful temptation to combine the work that has been done on animals and on man; the responses are very, very different.

This is not to say that there are not very small, or long-term effects which have been so far immeasurable, but not many of the conclusive effects of short wavelength radiation on such things as muscle tone, where these kinds of things have been done with animals, and to my knowledge at least the effects have not been particularly well documented on man with such things as biorhythms, et cetera.

There is no doubt that animals are markedly affected. Man does not seem to be. He seems to adapt very quickly to these kinds of things. We should also keep in mind that many of these studies have been subject to some controversy in terms of their scientific validity. Many studies, especially on the effects of hyperactivity on children, on the effects of human performance that the Russians have done, have not been subjected to particularly careful scientific scrutiny. The results have yet to be replicated to the satisfaction of many reputable scientists in this country and in Western Europe.

I am not saying that it is for us to say they are wrong, but we had better be careful before we jump in with both feet. There are a lot of questions to be answered here.

Mr. Cornish: Thank you, Alan. I think Mr. Frye wants to say something.

Mr. Frye: I was not trying to say that all of this that I quoted was 100 percent correct. All that I have stated is that these things have been reported, and that the report has 150 references of which perhaps 5 might be questionable in the way that you suggest.

You need to add this together with all of the accumulated data available. There is a need for us to do something about it, to investigate it properly. I don't think anybody can argue with that statement.

Having said that, I think we should be directing our attention to see whether or not these effects are real. We have to actually test it out.

Dr. Lewis: I agree with that. The reason I make the point is that the press does indeed get ahold of these kinds of things and pulls them out. It is important that we be aware that this is something that is in the investigatory stage.

Mr. Frye: I thought I had qualified it at the beginning, I thought I had qualified it at the end, and I sure am convinced I qualified it everywhere else in between.

If I have not made my point, I will make it again.

Mr. Cornish: Mr. Frye, I think the point is that the press would indeed miss all of the qualifications.

Mr. Clark: I just wanted to make sure that everyone is aware that we have not ignored this matter. As a follow-up of the 1970 meeting on photobiology which I mentioned earlier, the Illuminating Engineering Research Institute, even with its limited funds, has been involved in some photobiological research. First of these was related to potential thermal damage to the retina from high intensity light sources. Later a research project under Dr. Pitts at Houston University was established. This is an attempt to relate "real life" light sources to previous research which has been done on a wavelength by wavelength basis.

We currently have two research programs under consideration which I hope and expect will go forward in the next fiscal year of IERI. First of these is one in which the long term effect of radiation in the blue end of the visual spectrum will be investigated. The other is to study the beneficial effects of vitamin D production by ultraviolet irradiation of the skin.

Again there are so many directions in which to allocate our researches - so much to be done. It is difficult to know how to assign priorities. The fact is that we are doing some things in these areas with our lighting community funds.

Mr. Frye: If I might make one quick comment. I feel that perhaps one of the things that is needed is for somebody to produce a textbook rather like Samuelson's book on economics to cover all of the potential approaches. It is putting this thing together which is the problem.

There are lots of little pockets of research and information but nothing is coordinated on a worldwide basis. That is why I go along with Mr. Squillace's recommendation to go on an international basis to find out which issues are real, which are not, which are important and which are not important.

Mr. Clark: If you will arrive at Kyoto, Japan sometime between August 16th, I think it is and the days that follow, you will hear, I am sure, of just such an activity relating to this whole area that we have.

As a matter of fact, the chairmanship of that particular committee happens to have a U.S. secretariat at that moment. One of our people from the United States is the chairman of TC-17 which is the one on photobiology. So, there is some action going on at the international level.

Dr. Ross: There is a second important effect that is related to lighting on environmental quality. It relates to the concerns expressed in the country concerning additional power-generating plants. It turns out that for every dollar spent on lighting equipment that is on during the periods of peak demand, which typically is between the hours of 2 and 4:00 in the afternoon (when the air conditioning systems are on during the summertime for example) -then for every lighting that is on during this period of time, and for every dollar spent for that lighting, approximately one more dollar has to be spent for a power plant someplace to provide the electricity.

So anything that can be done to decrease the wattage of lighting that is on during those periods of peak demand will directly decrease the requirements for power plants, and hence decrease the need or the concerns about the siting of power plants and the pollution that might be associated with them.

Mr. Squillace: I would like to move away from the photobiological effects and move to the others so that we can get the whole picture.

As Mr. Frye has said, we need to collect all of this information by making a concerted effort, in this country, at least, to formulate data as far as indoor and outdoor design activities are concerned. One of the items that we have concerned ourselves with has been the phenomena of Visual Comfort Probability.

The VCP (Visual Comfort Probability) experiments have only really concerned themselves with recessed luminaires. We have not yet attempted to experiment with all of the rest of the myriad of lighting systems and subsystems that we can use and do use to see how they may or may not affect human comfort. We do the very dangerous thing of extrapolating to other systems using the recessed luminaire techniques. I believe it's wrong to do such extrapolation, and therefore, we have encouraged some more research to come about, and it's starting.

These activities, however, will take some years before we know where the research will lead us.

Therefore, my plea again is for an international research board, call it United Nations of lighting research. It cannot rest with the CIE alone.

Further, let me stress another point. All factions of the industry must involve themselves in at least reading and trying to understand the results of research. This means the practitioner, the manufacturer -- by that, I do not mean the

president or the sustaining member or whoever, but I mean the fellow who has to design the fixture--he has got to get involved. It is the man who makes the decisions on the reflectors, the size and the shape, the kind of thing that you are giving to the public, as well the fellow uses it. It is not only who buys it, but who uses it in design. They have to be involved somehow, and learn the meaning of the research results, as well as contributing where they can.

Prof. Smith: I have a little trouble with Mr. Ross' statement concerning, if I have quoted him correctly, that the dollar of light essentially means the dollar invested in the power plant at peak demand.

I have trouble in the sense that if I remember my statistics correct, there is something around 3 to 8 percent of our energy that is being consumed by lighting, and yet we are blaming all of that peak demand on the lighting system. Why are we doing that?

There seems to be something that is happening all the time. I would say a dollar of light means 3.8 cents of additional power plant and the rest of that energy means the rest of it because that is our proportional share of the total energy used.

Why do we blame the light for the whole dollar plant investment?

Mr. Cornish: That deserves a rebuttal.

Prof. Smith: Yes, please.

Dr. Ross: There is a misunderstanding between energy and power. As Jim Jewell would say, not to mention any names, I am speaking of peak demand, that for every watt that gets turned on during that particular time that the peak demand is occurring, there has to be a generator capacity put on the line regardless of how long it is used even if it is for an hour.

Therefore, any watt added, such as if a housewife were to put on an iron, you have 1,000 watts required--it requires 1,000 watts of generating capacity at the generating plant. That is what I am referring to, not the energy but the power.

Mr. Amick: Isn't just lighting any power?

Dr. Ross: Right, any power turned on.

Mr. Unglert: I think it depends on the considerations of environmental effects.

6.3 WRITTEN QUESTIONS/COMMENTS BY AUDITORS

6.3.1 Drs. Berman and Clear: *Does anyone on the panel have a feeling for how lighting interacts with other factors that affect performance, room temperature, noise level, psychological factors, motivation, enthusiasm, anger, internal relationships, cosmetics?*

Mr. DeKoker: We do not know how, but it definitely all relates. The people who fall asleep in here after lunch, it is not because of the low lighting level which would induce sleep, but the fact that it is about 60 degrees in here.

If the relationship of energy consumption that I have for our company of 27 percent of HVAC, and about 3.6 percent for lighting holds true, we would raise the temperature here by quadrupling the lighting level quantity- and quality-wise and turn up the thermostat about six degrees and we would still be saving energy and stay awake also.

Prof. Smith: I thought it was because we were so dynamic.

Mr. DeKoker: It is you who are dynamic.

Mr. Clark: At the end of my prepared statement I briefly made mention of thermal and sonic areas. In the acoustical area we do have some information and we have been adding to our knowledge. If we go back twenty or twenty-five years the room acoustics criteria of the time made it clear that lighting was taking up space which would otherwise be occupied by sound absorbing material.

We now know more than we once did but the architects knowledge of acoustics was very limited. One of the problems which was misunderstood related to sound transmission. It was difficult trying to get an understanding of the difference between sound isolation and sound transmission and the fact that you could put all of the acoustical material you wished into an area but if it was of a type that was transparent to sound it was going to be effective only in the room in which it was installed. It was not going to take care of sound transmission from one room to another.

We now have criteria for recessed lighting equipment which have been developed for the General Services Administration which treat some aspects of this in terms of a metric called speech privacy potential (SPP).

Perhaps there are more things that we should know in their relationship of the acoustical environment of a space to the lighting. I am not speaking of ballast noise and amplification by the lighting fixtures. There is the relationship to acoustical spacing which sometimes must be considered.

Dr. Lewis: I think also there is a quantifiable relationship in terms of if you measure the effect of lighting in terms of performance output, the minute that you stress the system, through other modalities, such as sound, temperature, anything of the like, which is causing a change in the amount of, say, time, you pay attention to one or the other, which causes a drop in the performance; you may then have to compensate for that drop in performance.

If you are measuring visual performance by artifically raising the level, so that you can perform at a higher level visually, for instance, to increase the contrast, to increase the background, assuming that it will increase performance; you can offset one against the other and this is an indirect effect.

You are affecting lighting but you can compensate for it by changing the lighting system. That is something that you could quantify.

Mr. Amick: There are five questions dealing with the biological effects and so forth. Most of them are addressed to Mr. Michael Frye. Let me try to do it this way.

Mr. Frye, could you give a one-sentence answer to each of these five questions?

Please try to restrict your answers to ten or fifteen words.

6.3.2 Dr. Atkinson: *"Many of your records have been proven to be completely erroneous. How much liability or credibility do you place on such things as the hyperactivity response, the admission of soft X-ray fluorescent lamps, the biological efficiency of the full spectrum lens? On a scale of one to ten, how much importance do you place on each?"*

Mr. Frye: They run individually low, but cumulatively high.

Mr. Amick: Question number two.

6.3.3 *"For example, radio frequency might be a biological effect from lighting systems, then by using more pure lamps, you would be using less RF and maybe people would be better off. But, do you think there are any changes of anything associated with that kind of thing?"*

Mr. Frye: I don't understand the question.

Mr. Amick: On to the next one.

6.3.4 *"Does Mr. Frye have any feeling on the trade-off between the biological insults from poor lighting and the environmental insults from increased power generation to produce full spectrum lamps?"*

Mr. Frye: It is probably less than two percent of the energy cost of the building which is probably a saving of the energy needed. By lighting the corridor less the area where the people are sitting more, by turning off some lights, and by other factors, and there would be no energy increase.

6.3.5 Mr. Amick: *How accurate and efficient can a broadband full spectrum lamp be made and how expensive is it? I guess these two gentlemen are asking you how much should these things cost.*

Mr. Frye: I do not know the answer to the question.

Mr. Clark: My answer is to use a question to answer the question. I keep reminding our light sources committee that we need a consensus definition of "full spectrum" light sources. As far as I know - someone correct me if I am wrong - we do not have one. Once we get it we can carry on from there. Just now we do not have an accepted definition of a full spectrum light source and it is difficult to make sensible evaluations without it.

6.3.6 Mr. Fisher: *"Lighting engineers may need to be allied to MD's, medical doctors, if they expect to avoid malpractice suits related to the biological health of the people in internal environments. Would it be better not to attribute better medical benefits to lighting until more definite research on humans is available?"*

Mr. Clark: In my own mind I have established three categories with respect to our photobiological concerns and the research activities to investigate them.

One is the potential harm relating to the photobiological aspects of lighting. Second is the prophylactic possibilities, the generally beneficial results - much in the category of fluoridation of water. The third is the therapeutic use of light sources. In general this latter area has been handled on a more or less one-to-one basis by individual producers dealing with groups of medical people interested in specific treatments. The producers have generally provided light sources and occasionally some funding.

Personally I think that is an appropriate way to handle it. As lighting people we do not need to get into it in any broader fashion. Treatment should be under the direction of a medical person and not a lighting person once the treatment methodology has been established.

In the case of potential harm there are some areas which we are looking at and yes, to a lesser degree, those that might be long-term benefits. There are some limitations but probably no greater on one side than the other. We need to establish priorities recognizing there is difficulty in doing so. My ultimate concern is the bottom line involved in designing spaces for people. As I showed before the designer is going to have a difficult time weighting how much harm he can accept versus how much benefit he should provide. This is the same kind of problem which is presented in any kind of design situation except in this case it is in the field of photobiology.

6.3.7 Mr. Hattenberg: *"How does the spectrum distribution of natural light vary with time of day and year to rain, normal atmospheric changes, and atmospheric pollution?"*

Mr. Frye: Obviously it varies a lot. In the previous section, I referred to the constant change in various items, the constant change in the natural outside world.

I think that is an issue that needs to be studied. I think this has been misunderstood around this roundtable, but I do not believe that all of these studies and experiments are 100 percent correct. What I did say is that they are altogether providing a great deal of evidence which needs to be investigated including what goes on in the natural outside world. I think it is our responsibility to check it out with respect to all of the issues.

Mr. Cornish: We will have about 15 or 20 minutes for questions from the audience and we can try to cover the two subjects that have been dealt with, which in all honesty, appear to be three.

6.4 ORAL QUESTIONS/COMMENTS BY AUDITORS

Mr. Scutt: I would like to share with you the incredible experience that happened two nights ago.

A gentleman by the name of Mr. Terse made a very exciting talk on the work of Mr. Alvarat which is part of the exhibition that opened this week in New York. He spent a full year in Finland where he photographed some old buildings at two times of the year.

Once during the winter and once during the summer. He photographed them with the same film and the same exposure at the same time of day. The photographs are the most incredible set of photographs that I have ever seen that answer Mr. Frye's comment in that as the winter light which he referred to as lemon light filled the interiors of these marvelous buildings and then you look at the summer light, it was a completely different set of characteristics.

The shape of the space was perceived differently and then in the wintertime the electricity, the whole interior environment became a completely different kind of space. I would love to get this published somehow. I wish there was more scientific data relating to this marvelous set of photographs.

The fact that the dawn to dusk cycle varies at different times of the year absolutely affects the interior environment of architecture. It is a fascinating thing.

Dr. Beck: I am just a little bit concerned about some of the things I have heard about. I say that because they place this lighting under the heading of medical devices which are now covered by a whole body of law and put them under the jurisdiction of the Food and Drug Administration, including the invention and uses of devices.

I would like to suggest that you give some consideration to this when you consider this because a whole body of law is coming into being at the present time concerning medical devices.

Mr. Cornish: Is there anyone on the panel who wishes to comment or address themselves to that comment?

Mr. Clark: Amen.

Voice: If you have ever travelled to the interiors of the developing countries in the world and you ask those people what is the most useful thing they can have from electricity, they say, "lighting".

Stand back and look at the progress and see what the organization has done. I think what I have seen here today in these last few sessions besides this awareness and the gradual increase in the body of knowledge, that is provided by it.

Mr. DeKoker: Consider how essential lighting is accepted to be and has demonstrated to be, coupled with the tremendous knowledge that we already have on how to apply lighting and the limits in terms of equipment available.

Now, if you have an eight by twelve room and you need two lighting fixtures, no matter how much you calculate and to what degree you go into it with all of this available knowledge, if you bring all of these variables in and find out we need 1.72 fixtures, you are still going to put in two of them.

It seems to me that the increased interest in energy and lighting has been due to the energy situation. Lighting uses a small percentage of the total energy in this country. We have enough knowledge already to do a heck of a lot. It is certainly evident that we ought to avoid simplistic standards like watts per square foot and stuff like that, that are being seriously considered.

Mr. Squillace: In our practice, I think it is important that we put it into perspective. When questions are asked, and they are asked by some of our clients, what is our opinion of the photobiological effect of artificial light sources - how do we consider them. I say that we don't.

If you need experienced advice to help the client, then call in your consulting medical physician. We should not, as lighting designers, say that we can advise our clients on this subject. We can only show the state-of-the-art to the client and help him measure the gains and losses. Further, the experiments must go on, so that we can continue to better understand and better apply our devices.

Mr. Crouch: Mr. Chairman, it is awfully good to have Mr. Frye with us from another country so you can always ask such people questions.

I want to note the fact that in the previous subject that we considered this afternoon, we are indebted to Dr. Douglas Carroll of the Bell Telephone Laboratories for the development of multi-dimensional psychological scaling and semantic differential scaling techniques. Professor Flynn, from Penn State University, and his associates, have now developed these techniques into a lighting tool. We now have a manual of how to assess the subjective feeling of an interior.

One of our other researchers was inspired to utilize Professor Flynn's technique in connection with his study of visual performance. Dr. Smith, from Ohio State, applied Prof. Flynn's technique to observers who were working on productivity and error studies of simulated office tasks.

As will be stated in our new Annual Report, he has found with the observers working in the simulated office cubicle under randomized levels of illumination that the curves of people's subjective feelings rise and bend over with levels of illumination in very similar manner as the productivity curves.

In the meantime, Mr. Flynn is adopting the Smith techniques of randomizing and counterbalancing the visual performance effects in relation to various changes in the environment that will affect the subjective feeling of that environment. We will be having an interesting interplay between aesthetic and subjective effects and actual performance of people working under these different effects.

I would like to, of course, direct my question to Mr. Frye.

Are there parallel things like this abroad? We want to know if there are parallel studies in other nations.

Further, in reference to the later discussion of biological effects, we are just entering the field, as George Clark has indicated, and we want to know if there is some parallel work going on in the rest of the world.

You gave us a very comprehensive presentation, and I thought you might be able to give us that information.

Mr. Frye: As far as I know, there is very little. There is an experiment being set up, as I mentioned in my report, at Leeds University to try and isolate the variables and effect of lighting on school children. I would be very pleased to hear about any particular piece of research, or any process, being done at the moment.

Hopefully, the Leeds experiment will provide some of the weighting that should be given to the various variables. In Russia there has been quite a lot of work in this area.

Usually, there are problems in translation - but they usually do specify that certain wavelengths of light are mandatory in certain buildings, as part of a minimum dosage for the users.

They are obviously satisfied that there is a benefit because they are very energy conscious, and would not waste energy. There are a number of other minor studies, too.

Mr. Wotton: May I share something that occurred to me fairly recently?

I had to go to do some work in a large office building belonging to the Canadian Government. It this large office building, there was a large drawing office which had rather interestingly become renovated.

So I said the chief draftsman, "what sort of lamps do you have in here?" He said, "we have brand X. They do marvelous things for us. I was wearing a red tie and I thought if they were using a brand X, my red tie wouldn't have gone brown. Later in the day, I saw the man whose job it was to put lamps in the particular offices. I said, 'tell me, have you got brand X in this place?' He said, 'oh, no. I have brand Y. Brand X cost me $6 and change. Brand Y looks the same and it cost a dollar and they don't notice any difference.'"

This effect, gentlemen, is known, I am told by my psychologist friends, as the placebo effect. It is a phrase which I tend to trot out because I think it sounds rather professional.

The next point I would like to make is that our panel here did not address itself to the positive need of two forms of lighting in a space.

There seems to be the need for one form of lighting, the form of space itself. The form of lighting that we have in here.

Secondly, there is the need for overlighting which addresses itself to meeting the working space, the requirements for the working space.

The tradition has sort of grown up that we have or that we use one form of lighting to meet these two requirements. I suggest that the present need to conserve energy is making it very clear that we may have to separate these two lighting requirements -- one for the space and one for the world. I was sorry that your panel, sir, did not address itself to this.

One third point addresses to Mr. Smith, who said that he felt that black ceilings in lecture rooms might be a good thing. As I understand it, and I speak as a lecturer, having had my audiences go to sleep on me, the situation is something like this.

It occurs primarily in rooms with indirect lighting sir, and you are sitting there listening to the lecturer, you gaze at the ceiling and your eye is drawn to the ceiling. The eyeball then revolves in this socket into the position which

it takes when you are asleep and this sends a message to the brain that you ready to go to sleep and your audience, sir, and mine, does just that.

Mr. Kahn: It is a great pleasure to follow Mr. Wotton. I noted this meeting was billed as, "An open discussion of the goals, issues, and responsibilities of the lighting community." As a member of "the suffering auditors," we are not given the opportunity to properly reply. I have a number of questions and a number of comments to relate to a half dozen people, and I am going to talk very quickly so that I can cover each one.

Now, you were asked a question by me, Mr. Lewis, and you replied that you didn't think that anybody could evaluate how light produces visibility or visual contrast of materials. Well, I'm sure that George understands this, and other people, and I'm sure you could, too, if you had familiarity with polarized light. If you had seen the general environment under several sets of circumstances, one with vertically plane polarized light, and one with horizontal, and a third with conventional light, your eyes would tell you the difference.

The difference is based on the absorbing capability of materials. You see, if materials can properly absorb the colors of the spectrum of the light source, then the materials' colors come back in the form of the proper color, reradiated back to the eye. The visual detail, color and contrast are the things we see.

I was just looking for that simple explanation of the degree to which light is functional, and this based on the degree to which light can be properly absorbed into the materials. This was the question I asked the panel. Mr. DeKoker made a comment about some $68 million worth of lamps. Is that the figure that General Motors buys each year? Was that the figure?

Mr. DeKoker: That's the energy costs we are using.

Mr. Kahn: Oh, I see. In any event, I don't know how many lamps you use a year, but I venture to say that if you can cut that level of lamps by about 33%, and you could see just as well, that would be of considerable interest to your Financial Vice President at General Motors. I think if you can examine the visual effects of light and the factual aspects of lighting--from real-life situations--you might change your opinion on how much money you can save, and therefore the value of decreasing light levels, rather than considering increasing or ignoring this--even if this comment risks the possibility of losing General Motors as a client.

Now, Mr. Squillace, you know, you amaze me, Steve. About fifteen years ago, you were a champion of the quality aspects of lighting. I remember in Detroit when I made a talk, you agreed with me.

Today you throw questions back into the Doctor's lap, and say you don't want to cope with it, and then you start talking about handling building clients. You seem to ignore the fact that the Illuminating Engineering Society for many years supported lighting recommendations which are of prime importance to the designers and engineering profession. They tell people how much light to design to; and they do it in terms of ESI now. You say you don't recommend, you are more or less trying to help people understand why they're using light and for what purposes. You can readily use the illuminating engineering practice of recommending, and this is actually what you are doing. It's just that you are denying you are doing it. You are recommending how much light people should use and why and how long and so on.

But I've noticed in the past dozen years, there has been a complete change in you; there seems to be an apparent avoidance of facing the subject of polarization. I've never heard of you talking about polarization and vision for years. And, yet, we know in classroom lighting, or wherever vision is important, polarization plays a role which is significant in most visual circumstances--the degree to which we can reduce specular reflections, reflective glare or veiling

reflections. All are fundamental to the degree to which we can improve vision, and this is directly related to energy consumption, and it seems to me that any knowledgeable engineer such as you would seek to utilize all of these available technical tools, backed up by the most extensive research Ohio State University ever did on any lighting subject, which was the comparison of polarized vs. unpolarized lighting, 84 pages published in the IES Journal.

Now, George, I met you in 1957, and it's been a long time. It's now 1979, and you're still calling for more research. I think its high time that we draw a line on some of the research and try to apply what we now practically know to help us in primary areas: (1) Reduce consumption of lighting energy; (2) Improve vision from lighting, with the technology at hand. I think if we did that, and you know how to do it, and I know how to do it, we could provide basic tools which the Illuminating Engineering Society could use to gain more respect and recognition on the world scene.

Mr. Cornish: I think Mr. Kahn, we will say that you have had more than your share of the time with your questions.

Thank you.

Are there any questions?

I would like to recognize this gentleman here followed by Mr. Fisher.

Voice: It seemed to me that lighting for environmental quality must include some lighting or consideration of lighting that purely brings joy to the eye. It is an art form, and as such, it is difficult, it seems to me, to teach. It requires a lot of experimentation to see how and what effects turn out.

The kind of experimentation that one does to get proper theater lighting is doing a lot of theater lighting. My question is that in this kind of lighting design, what or how are we teaching this today?

How could we teach it? Do the schools which are teaching lighting today, and there is a lot of technical knowledge that has to be gained, do the students there have an opportunity for pure experimentation with light to gain some idea of the poetry of light?

Prof. Smith: I will address it briefly.

Again, on my last presentation on education, I did a little survey. Lighting education as it exists today primarily exists in the architectural schools. It primarily is a very limited type of experience. I believe I am almost a typical school and I devote 60 classroom contact hours to lighting.

We are tickled to death just to say that art is indeed an important part of lighting and that science is also an important part and the two are inseparable in good lighting design.

We just don't have time to develop any kind of real feeling for art. I tell my students, I can teach a science, but the art can only be learned. It must be practiced.

Mr. Fisher: Just a quick comment regarding a combination of environmental factors that might affect performance of human beings. ASHRAE has outlined a study to relate color and lighting to the perceived temperature of an environment and thermal comfort.

That certainly has some energy complications.

ASHRAE has asked IES if we would like to be involved and certainly we want to be involved in something of this sort. We don't have the money, but we hope that we can be a party to the research anyhow. If anybody knows where we can find the money, we would appreciate your comments.

Mr. Cornish: We have now come to the end of this session on the time basis.

Mr. Cornish: The last subject for this afternoon is the effects of barriers.

There is going to be a very interesting topic because we saw what the panelists or how the panelists managed how to interpret in several ways the previous topics.

This one I can at least interpret in two ways myself without any difficulty. I think it will be very interesting to see how the panel treats this particular issue.

The panelists that will be making statements are Rita Harrold, Don Ross, Robert Smith and Neil DeKoker, and in that order.

) ISSUE NO. 5. "EFFECT OF BARRIERS"

7.1 WRITTEN STATEMENTS BY PANELISTS

Ms. Harrold: Certainly it will be interesting. I wish we could have an instant replay of this sometime and get the people who make these statements to make the full comments.

Bob and I have had some conversation during the last week off and on and had difficulty in even interpreting what somebody else thought they wanted us to say. Maybe that is the way to approach something.

The Mideast oil embargo of 1973-74 served as a painful indicator of the importance of energy to our national economy and highlighted its vulnerability to foreign supplies. Since that time, the United States' energy picture has entered a phase that has been characterized as the "transitional storm" -- basically a technical, social and economic interface between feeble energy systems as designed during the inexpensive fossil fuel age and current/future energy costs and sources.

We are all very much aware of the initial impact of the energy crunch on lighting systems, and our attempt as an industry since then has been to put lighting in perspective with other building systems and energy users.

At the beginning of the crisis we were faced with "voluntary" compliance by the then Federal Energy Office. FEO became FEA and began the enforcement process -- 50/30/10 and all that. State and local activity has increased and shows all indications of continuing the stepped-up legislative process with federal funds available to produce audit procedures, energy management documents etc. While practicing professionals, consulting engineers, designers, electrical contractors may be cognizant of the existing and pending state codes to establish limits to the building's energy consumption, and are designing buildings to those limits, the enforcement process is slow to take effect. Its full impact is yet to come, and will probably surface within the next year or two.

The existing building owner may be aware of legislation for compliance with a given standard, but confusion exists as to the limit of the law, the voluntary versus mandatory aspects of meeting those regulations and the understanding and interpretation of some aspects of each state's code.

More to the point, as many major industrial and commercial users state, is the economic burden or impact of audits, surveys and resulting building modifications. Another cause of complaint or confusion is the diversity of regulations and the lack of uniformity of code requirements from state to state for lighting. A major retailer or industrial user with facilities in several states faces a real problem of compliance complexity. An energy manager for such a firm must be well aware of all the regulations in areas in which his company operates. Similarly, consulting engineering firms, lighting designers and other professionals with clients in several locations must be increasingly knowledgeable about various state codes. Until and unless some uniform system emerges as a recommended procedure from the federal level, promulgated to the states, we will continue to face a tangle of code variations.

But whether the climate of acceptance regarding compliance is favorable or unfavorable, the effect of energy legislation in the private sector is positive, in that questions are being asked and both legislators and users are in a state of "preparation" for future enforcement. Some states with legislation in place have workshop/training programs not only for inspectors to understand the code, but also for building owners on what is involved to comply with the regulations.

Growing fuel costs will be a further limitation on energy consumption and will increase the sensitivity to operating costs. As more energy efficient space is made available in new and renovated buildings, competition for tenants will be

an incentive to modify building systems. Rather than seeing energy restrictio as a negative, a barrier to future lighting developments, perhaps we might rat find some more positive effects. Future trends should produce advanced technology, more efficient system components, better space utilization, more responsible value judgments by the designer in lighting recommendations and solutions.

7.1.2 Dr. Ross: If there are barriers then I suspect that we are talking about barriers to change or to development.

One should look to see the vested interests and determine how to propose changes that might be received or countered.

The interests of the lighting community are found to reside largely in the following groups: lamp manufacturers, fixture manufacturers, ballast manufacturers, device and component manufacturers, distribution network, installation and maintenance contractors, lighting designers, professional societies, user groups, and electric utilities. In all of the above, the concentration is by far the greatest for lamp manufacturing, with only four major producers; while no single entity in all the rest of the categories controls even 5% of the market in their respective groups, except for fluorescent ballasts.

Profitability varies, with lamp manufacturers reported to show significantly higher profitability than fixture and device manufacturers, for example.

If there are barriers to change, one should look to the vested interests to determine how the proposed changes might be received or countered.

It appears that much of the research in the electric lighting industry has been sponsored in the past by lamp manufacturers and the electric utilities. Under conditions of too many avenues of required research and too little time, personnel, and funds, there has been a strong tendency for those research projects to be funded that were of interest to the sponsors.

The Illuminating Engineering Research Institute was originally set up to be independent of these influences, but unfortunately, I believe, has been unable to maintain those standards.

Research into methods for optimizing visual performance related to lighting should be sponsored in a manner similar to those of ASHRAE, NBS, or the National Science Foundation, for examples, to achieve a better balance in research effort.

A second barrier appears to stem from a fear expressed within the Illuminating Engineering Society that changes from past recommended practices related to lighting design would somehow discredit the Society, even though such practices are now recognized as being based on models of human performance that can not be experimentally verified. In my estimation, nothing is farther from the truth. A forthright and clear explanation of uncertainties in past practices and goals for the future with interim consensus recommendations is desperately needed.

Mr. Cornish: The next speaker is Robert Smith.

Prof. Smith: Having trouble with the Committee's statements, I took the liberty of defining my own question.

I feel comfortable that way because like all pieces of art, it is in the eyes of the perceiver.

I identify the barriers as being those artificial impediments to the desirable objective as imposed by people and conditions having a peripheral or remote position to the lighting community.

In other words, it is those things which the heart of the lighting community cannot control.

1.3 Prof. Smith: The artificial impediments to desirable objectives as imposed by people and conditions having a peripheral or remote position to the lighting community.

Bureaucratic Apathy

From my point of observation, there appears a tendency by some bureaucrats to ignore the significance of illumination. In two instances of major importance that I am aware of, procedures were developed and distributed that have major implications to the lighting industry but failed to address the lighting issue comprehensively.

An organization was funded to develop an energy code with accompanying training materials. A document published and distributed by that organization extrapolated from a parent IES document, but abbreviated and did not codify the document. In addition, the training manual provided an example using an incorrect procedure. The results of this were that many states either adopted the code document and tended to ignore the lighting portion, or they adopted an IES standard which was not written in code language. In another case, a major endeavor was funded to develop a computer simulation program for use in supporting the energy codifications. This program, which has national implications, has a documentation which is 700 pages long, but only one page is devoted to the subject of lighting. The procedure set forth by this document to input the lighting energy into the building is not adequate nor does it encourage the development of energy conscious lighting systems.

> It would be desirable that due to the specialized nature of the lighting industry, that whenever projects were awarded that implicated the lighting industry, authorities from that industry be involved in the project.

Watts Per Square Foot Codes

Of all the movements now in progress that affect the lighting industry, I have the greatest fear of the effects of the proliferation of the watts per square foot lighting codes. Although I seriously question the propriety of the procedure, my deepest concern is that the procedure permits a macro approach and eliminates the need for a specific analysis of the lighting requirements of the facility. Quality lighting designs are more apt to occur when qualified, energy conscious, lighting designers become seriously involved throughout the design procedures. The watts per square foot approach further dilutes the early need for collecting information and making decisions that affect the quality of the lighting design.

> I suggest that a serious appraisal be made of the overall implications of the watts per square foot lighting codes.

7.1.4 Mr. DeKoker: On the subject of barriers, I would prefer to see no mandatory codes or standards regarding lighting, or any other energy use. This kind of attitude has been continually expressed by professionals in building design and by industry for many years. We feel such codes and standards could in fact inhibit energy-efficient design. Furthermore, free market forces have historically proven to be the best means of balancing supply and demand.

Industry has done an outstanding job in energy conservation. In fact, U. S. industry consumed only 0.9% more energy in 1978 than in 1972. This is a major accomplishment when noting that industrial output increased by 21.2% based on the Federal Reserve Board's Index of Quantity Output. In addition, industry employment increased by more than 1.7 million people or 7.2% in this period. In terms of energy efficiency, industry has reduced its energy consumption per unit of output by 16.8% in 1978 compared to 1972.

In General Motors, the energy consumption in our North American Operations was reduced by almost 7 trillion Btu or 2.9% last year compared to 1972. Again, this is a remarkable achievement when considering that these operations produced over 1.5 million more vehicles, an increase of 24.7%, have added over 20 million square feet of modern manufacturing facilities, and have increased employment by some 71,000 people. Last year, we used 8.5 million Btu less energy to build each vehicle than in 1972, for an improvement in energy efficiency of 22.2%.

We believe that market forces can continue to be relied on to obtain even further improvements in energy conservation. Shown here is GM's energy bill for the U. S. and Canadian operations. Even though GM used less energy last year than in 1972, our energy bill has nearly tripled from $321 million in 1972 to over $925 million in 1978. However, without conservation, this energy bill would have been over $1.1 billion. This amounts to an energy savings of over $180 million in 1978 alone. We believe that the deregulation of energy prices and the reliance on free market forces will result in improved energy efficiency by all consuming sectors while at the same time, stimulating increased supplies of existing as well as new sources of energy.

GM has achieved these energy savings through a very wide range of energy conservation measures from the simple -- such as lowering temperatures and turning off lighting -- to the sophisticated -- such as complex process changes, heat recovery applications and the installation of computerized facility monitoring and control systems. Of course, light is an important part of our conservation program but it must be kept in perspective with what this can achieve. We could turn off every light in GM and we would save only 3.6% of the energy we use. This is misleading, of course, because without light, we would have to totally shut down and that would be disastrous to put it mildly.

I believe the foregoing serves as excellent evidence that we don't need mandatory regulations for lighting or anything else to cut energy usage. In fact, mandatory codes and standards might well reduce energy conservation efforts and inhibit initiative. The State of Massachusetts' simplistic lighting standards in watts per square foot, for example, have resulted in engineering man-hours to complete surveys and develop compliance plans. These man-hours could have been much more effectively utilized in areas where we use a great deal more energy and, therefore, achieve greater energy savings.

7.2 PANEL DISCUSSION

Mr. Cornish: I would ask the auditors now to start thinking about their questions and submit them to the readers. I would ask the panel to enter into debate on this particular subject.

I would think the differing approaches between what Don Ross has said and what Neil DeKoker has said would certainly give us food for debate for at least the time that has been allotted for this subject.

Mr. Squillace: The first question is of a general nature and then one specifically to Don and next to Neil DeKoker.

Gentlemen, the general question, I would have interpreted in addition to the codes and regulations that the panelists have talked about, there is also another thing.

What about partitions and/or objects in space? How do they detract, if you will, from visibility? I think we should address that. Certainly it would involve some increase in energy to get the same visibility that you would have in an open space.

The above is therefore a barrier and I wonder how we would treat that one.

Secondly, for Neil, I agree with you that perhaps the private sector should be left to its own devices to come up with some of the energy savings. But I wonder whether the same attack and vigor of attack would be attendant in the private sector if it didn't have out in front of it the spectre of regulation.

As I see the problem right now, there has really been no effective regulation by the government or from anyone else for that matter. They have been fumbling and bumbling along for that matter. But the spectre is there, and therefore a monitoring device.

I wonder if the individuals in general -- I don't speak generally of General Motors, but of the individuals in general--would have really mounted an attack on this problem of energy unless somebody had said, "Look out. We are going to do such and such."

Don, you mentioned ASHRAE and the way it conducts its experiments. I am not a member of ASHRAE and I don't pretend to know how they do things, except that I get the feeling from my colleagues in the mechanical department in our office, that there really isn't much difference between who is doing research in ASHRAE than there is in any other organizations like IEEE or IES or any other.

Trane, Carrier, York and all of these good people who sell equipment are doing one hell of a lot of research. As a matter of fact, I don't see any of the private consulting firms doing very much in the mechanical area, at least not to my knowledge.

Perhaps you can help me on that subject.

Dr. Ross: I don't know where to begin.

I almost feel like Myron Kahn. I should make a whole list and take everybody on one at a time.

Specifically, I had reference to ASHRAE's procedure. They issue requests for proposals (RFP's) just as the Federal Government does. They develop a scope of work and desired results and suggested procedure.

They circulate these RFP's and allow different institutions to respond, and in that way get the benefit of other people's ideas. That was the specific procedure that I had in mind.

Mr. Squillace: I am glad you clarified that. That is only in the last few years, a couple of years ago?

Dr. Ross: I guess that is true.

Mr. Cornish: Steve had two questions for you, did he not?

Mr. Squillace: No. Neil is the sponsor for the regulations.

Dr. Ross: As long as I have the microphone, may I continue for just a little bit.

We had four panelists here. Three of them discussed codes, which I didn't discuss at all, although I certainly have a strong feeling about them.

Rita discussed the confusion that exists in the field today because of the plethora of different codes that each state is coming up with on its own. I think the Federal Government requested that, but gave them very minimal guidance. One would hope that we do get a uniform code across the country, particularly because as the country gets smaller, as far as communication is concerned, I think it would be very helpful if there were some uniformity among the states as to what kinds of codes they want and how we should endeavor to comply with them.

I don't want to waste time arguing about the watts per square foot codes. They are just power codes. What we are really all talking about is an energy code. At least that is the ultimate desire.

The watts per square foot criterion is certainly an interim step to get there and I suppose that one would need to develop that kind of concept before developing the energy code. It certainly is the energy that we are looking to save.

The ultimate goal, as I understand it, on the part of most code enforcing agencies is to think of consolidated development of all energy uses for buildings - to include lighting energy. The code would allow or permit so many Btu per square foot per year, for all uses. This might very well be made up of components, part of it being lighting and part of it being air-conditioning, but selected for that building and for that location and for that function. Once these elements are decided and the budget in kilowatt hours per square foot per year is developed, it is the total of all of these things. Then that total would be the only amount that is controlled and the owner or designer would be free to mix his energy uses any way he saw fit to optimize the uses of that building, but staying within that budget. That to me seems to be a desirable approach.

I think anything else in the meanwhile is probably only an interim standard and should be considered as such.

Mr. DeKoker: Steve, in response, would individuals be doing this? It is like saying to my teenage son to come home on time and do this and that. If he didn't, he would get a beating. I would like to think that individuals would be a little more mature than my 11- or 13-year-old son may be.

Mr. Squillace: I don't think that you can make that assumption.

Mr. DeKoker: I think we can.

In GM, we have monthly reports of energy usage, energy consumption of and costs from all plants for all of the energy sources that we use, including water and all utilities dating back to July of 1929. The reason is that we have always been interested in controlling energy costs. Back then energy was a larger percentage of the cost of doing business than it is today, or compared to the 1960's at least.

I have minutes of meetings dated back to 1956, where we had all of our divisional plant engineers discuss the subject of utilities conservation. In other words, industry has always been concerned about controlling operating costs, include utilities. That is why industry is a relatively efficient user of energy.

At GM we initiated a "lead plant" program in 1971 to evaluate what we could achieve with a formalized conservation program in a plant.

The first year's results of that program were presented at our corporate plant engineers conference in 1972, and at that meeting, the Chairman of the Board of GM asked every plant to initiate a formal program to obtain energy savings.

This was motivated not because of prices at the time, but because of our recognition that energy was becoming a serious problem in the U.S. because of government control energy prices and all of the other factors, we did not provide incentives for the producing industries to increase domestic energy supplies.

That is why we took those actions and that I think is being very responsive. We have been fighting those issues before the Federal Power Commission since 1969 and '70, when we were fighting strongly for decontrol of energy prices and the use of end-use curtailment criteria when energy is in short supply.

I would say that we were responsive long before any kind of a threat or some kind of a standard.

Ms. Harrold: Picking up on something that Bob Smith I think first alluded to, I would like to make an additional comment.

We are talking about the single number watts/ft^2 solutions that have been offered by various states without going into naming which ones they are.

There are some obvious limitations with those estimations. They imply that all commercial buildings and office spaces are designed in exactly the same way and all industrial spaces have exactly the same kind of design problems.

We in the IES tried to look at a broader approach and tried to develop something a little different than a single number, watts per square foot. I don't think there is anything wrong with an attempt to find a simple solution; we need a sounder base.

When you look at the work that GM did, it is simply a horrendous task. Even with the computer facilities and the analysis available, there is still all that work left that one must do in order to conduct an audit to determine what is installed in an existing facility.

I agree with what you said in terms of our need for an energy budget.

We have addressed the load limit, the connected power aspect of lighting. We have spent a great deal of time and effort on arriving at the best solution, based on how to establish a limit for power at this stage. Our need for an energy budget is something that is coming down the road.

Secondly, I would like to say that I am very lucky. I am sure you realize that Bob is a super-personality and knowledgeable fellow. He sits on the IES Energy Management Committee, which is to develop an energy procedure. It is to look at all of the variables in order to come up with an energy standard for lighting.

Prof. Smith: I have several comments to make.

First of all, as Rita indicated, I certainly agree with Don in saying that our ultimate goal must out of necessity be to bring about an energy lighting code or an energy lighting standard, if you will.

To arrive at that point, though, I think it is a serious mistake to take the one number, watts per square foot, as the first step.

Dealing with building code officials and practitioners in the field, I believe we need to make strides in the direction of educating these people as to the intricacies of lighting.

The code officials have never had to deal with lighting before. Their requirement is in the National Electrical Code and NFP101 is very minimal, strictly addressing safety.

Now we are asking an industry to start getting involved in the lighting terms, and when we give them this simplistic tool of taking the gross area and multiplying by a single number, we are going to greatly inhibit the final goal that we want to achieve.

That is my feeling. Watts per square foot is just not conducive to comprehensive thinking about the problem.

Secondly, I am opposed to a macro-type of standard approach for energy. I believe that lighting in its unique nature needs to be addressed as a separate element before it can be incorporated into the total system.

When I look at the computer program, which I referred to earlier, I see that lighting is 1/700th of the total and in fact is even less than that, when you look at the simplistic nature of that one page. I say that if that computer program is put into the design process, there is no reason for anybody to make any studies of what is going into that design because there is nothing in that computerized analysis that requires any lighting engineering or even any thought.

So, I believe that we need to pull it out and take a close look at it from the energy standpoint and then put it back into the total system to make sure that we have studied it as a process.

Next, Neil, I have a couple of points to make.

I first of all would like to say that I do not like to see financial criteria being used as a way of evaluating energy savings. I would much rather see them referred to as incentives for saving energy.

There are many times where cost is not a good measure of energy conservation techniques. I find that a problem. Take a speculative builder. What are the incentives for the speculative builder to incorporate good energy use techniques? There aren't any. The only thing he is looking at is his first dollar. It is not energy use. If we can't regulate those people we will never achieve on a large scale the energy conservation.

Mr. DeKoker: May I respond to that?

If you are going to use an example of the speculative builder, and we need to address that area, then let's address it. I believe that 85 percent are doing a good job.

In regard to the REF factor, I think that it is rather subjective and I think that those kinds of things are being considered because we weren't controlling artificial distortions in the marketplace.

That is what we want to get back to by getting rid of artificial prices and arbitrary standards.

Mr. Frye: The way watts per square foot is set up, it is frightening. The macro-approach is a little bit better. But what concerns me is the so-called new codes. What is good today can very well turn out bad tomorrow. Legislation can be the very barrier for tomorrow. As we have seen with a lot of industries, we better utilize government sources towards the education that we have been talking about.

Mr. Clark: Nobody has so far restated a barrier about which we talked previously. That is the barrier of the lack of formal training for architects and engineers and other designers of the built environment.

I believe it to be a most serious barrier and that it will continue to be for many years. We can develop all manner of search, design practices, equipment, and so forth but if you can't get it through the system then it doesn't do very much good. The IESNA people here have heard me say this for a long time. It was the message of my tour of North America in 1973 as the then incoming president.

One of the statements I find useful is that perhaps 5% of an architectural firm's income is related to lighting and 15% of a consulting engineering firm's. These are obviously generalized estimates but they have been pretty much confirmed by lots of contacts with lots of design professionals.

Obviously that makes it difficult to have a full-time lighting person. They of necessity are going to be part-time lighting designers. I make the statement

that 80% of the lighting in square footage in the United States is designed by technicians and draftsmen. The only quarrel that I get from my design consulting friends is that it is probably closer to 85%.

There then is a real barrier. I think we will probably talk about that more tomorrow so I will comment further at this time.

The other statement that I would like to make reference to is that of Don Ross. First of all I think that nearly everybody can agree with it. In a way it is a paraphrase of one of the best statements at our IES conferences that I have heard. It was authored by Noel Florence, who reminded us that everybody has an accent.

Anyway, the point is that I believe we can show a great many research activities in which would be difficult to find a full consensus amongst the so-called vested interests as to what was best. Having served on industry trade organization committees, I know that trying to get full agreement on almost anything is difficult.

I agree with you the one area we keep referring to is really illuminance recommendations. This also has to be taken in the context of practicality.

A number of years ago I heard one very vocal critic of the lighting community suggest in an open meeting that the reason lighting fixtures were shielded was to increase the number of lamps required to do the lighting. In his mind it has nothing to do with glare. He felt it was OK to use bare light sources.

I think that this unfortunately complicates what is not necessarily an easy communication to begin with. I would like to make a plea for moderation and the elimination of assigned motives. Just because one may be a "black hat" doesn't mean that he or she cannot have objectivity.

There is indeed a great deal of research that is needed. I agree this is a limitation in the way that Don has indicated. It would be nice if it were not so and I am not quarrelling with some of his basic ideas. I would suggest that there is a lot of research going on but, as George Cornish suggested a few years ago, it would be difficult to find a "vested interest" that has been less supportive than the lighting industry.

Dr. Ross: I would like to first echo Sam Berman's comments.

It is appropriate at the time to say that 99.99 percent of the things that the IES does are really fine work. I don't like a few of them, but there is no sense in all of us sitting at this table agreeing with one another.

The other thought that you mentioned earlier is the cost of attending and participating in meetings.

It is certainly a very strong barrier and one that we ought to direct our attention as was earlier mentioned by Steve.

Finally, I must say that apparently I am the only person at the table who favors very strongly the watts per square foot criteria as an interm measure for lighting and perhaps as a first step towards energy conservation.

I think that we all know enough about lighting systems and how to design them so that we can with a little bit of effort, develop those kinds of systems that can be accommodated by the watts per square foot measure leaving room for exceptions. We can then specify that unit rather than going through a rather laborious calculation which is going to end up with the same number within plus or minus 10 percent. I guess that is the point that I am trying to make. I am defending the logic of the watts per square foot criterion.

Ms. Harrold: Thank you. Correction. I guess I don't believe, with a misunderstanding, Don, I think what we are saying is yes, watts per square foot, but we are not saying a single number of watts per square foot that says all office buildings need three watts per square foot or .5 or whatever the magic number is.

It is a precalculated system, if you will. It is taking the base procedure and doing the calculations for the end users so there is a table with a range of unit densities from which to choose depending on what the task activity is in that space.

But it is watts per square foot, and it has a more scientific base, if you will, than at 2.5 for every office building in a merchandising space or whatever.

A little more detail.

Dr. Ross: I still subscribe to the fact that we had a number of people who disagreed with it about being penalized to go to a more laborious one. Give one that people can live with and shoot for and accept for code purposes.

7.3 WRITTEN QUESTION/COMMENTS BY AUDITORS

7.3.1 Mr. Waldbauer: *It has been my experience that dollars and cents have been the motivating factor for energy reduction rather than the spectra of government regulation.*

In other words, if the owners desire to hold down on operating costs, that may do as much or more than the regulations is what I think Walt is saying.

7.3.2 Mr. Kahn: *Who is responsible for the ASHRAE 90-75 Standards (on lighting) recommended by the Department of Energy? State governments endorse it without realization that it does not relate to visual requirements nor consider maximum lighting energy savings potential; nor is it a guide to visual needs from lighting. Footcandles or watts per square foot--these do not convert to viable codes that relate to visual performance, and thus they cannot permit maximum lighting energy savings potential, and the IES can help correct this misuse of recommendations.*

Mr. Clark: I would just like to restate to you Myron's statement that I gave you on energy uses and news.

Some of us are pleased that it does not attempt to determine lighting design. It is an energy standard and not a lighting standard. That may not be what you would like -- yes, it is a power standard, I agree. It is an attempt to think about the energy for lighting rather than lighting itself.

Some of us feel that we are not yet to the point where we ought to have legislated lighting design. There is adequate power available hopefully in order to have good lighting and you can have poor lighting with the same power. That gets back to the process that we talked about.

It doesn't rule out good lighting. It doesn't ensure good lighting, either. It wasn't intended to.

7.3.3 Dr. Wright: *Are market forces as likely to conserve energy in small homes, apartments, condominiums, office buildings and rental commercial space as they are in major industries like GM, who are owner/users of the space?*

Mr. DeKoker: Probably in the rental type facilities, there might not be the incentive for the person who is renting if the utility bill is part of his rental fee. It wouldn't have the same incentive. You might as well be comfortable and enjoy yourself and open a window if it gets too warm. But if the utility bill is made separate, where the individual pays it, then the incentive is there.

In President Carter's address to the nation on April 5th he indicated that the residential sector had done a good job conserving and that over half of the home owners in the nation had insulated their homes.

If we were to make statements like that, we would have to prove everything.

The point is that they are saying that they are conserving energy. 5 to 10 percent improvement in the residential area, which means this sector is responding to market forces.

Mr. Unglert: Here is a second one that says:

7.3.4 Mr. Hattenberg: *Can a supply and demand of the free market effectively practice sufficient energy conservation to ensure adequate energy sources for future generations?*

Mr. DeKoker: Very much so. I think, just looking at the definition of proven and probable reserves and so forth; these reserves are based on current economics and technology.

We have used up a very small percentage of the oil in this country. We have used a large percentage of currently proven oil reserves, based on current prices and technology.

But when you look at the fact that the price of energy has gone up a lot, this is creating a lot of new potential for additional oil discoveries and advanced technology. With President Carter's plan to phase out price control of oil and gas, I think you will see quite a turnabout in the oil picture.

In addition, the same thing is true about natural gas. So you will see an improvement in the future.

7.3.5 Dr. Berman: *Who would believe a meeting of the IES took place all day at a level of three footcandles?*

7.3.6 Mr. Scott: *Watts per square foot nomenclature has been with us for sometime. I have seen little evidence that interior designers and architects are using this rule of thumb.*

In fact, they can't do the arithmetic.

Mr. Amick: George Clark, you ought to listen to this.

I disagree with Clark that 85 percent of lighting design is being done by managers.

7.3.7 *There is a responsible design being done today using sensitivity to accommodate task in ambient requirements. How then can the lighting designers be taught the responsibility of respecting the energy concern without using the watts per square foot factor?*

Mr. Clark: In my comment remember I said square footage. That is one of the difficulties. We have some highly competent designers. Unless the building industry and the design industry has made tremendous shifts in terms of the amount of square footage being done during the las few years, however, it means that while the competent designers are doing lots of work there are thousands and thousands of square feet being done by very small consulting engineering and architectural firms. It is in this context that my statement was made. I cannot defend 80% specifically. I am only relating that in making that statement my design professional friends tell me that if anything, I am underestimating the situation.

If you will look at what has happened in the past in terms of work spaces lighting with inverted tee-grid ceilings, one might ask what's so great about designing in this situation. One can only put the fixtures in certain locations. We just have to tell the draftsman how they are to be spaced and then he can do the whole floor or the 10 floors and we have taken care of that design problem. Meanwhile, the more sophisticated designers can concentrate their efforts and concerns on some of the more specialized areas.

As I say I have no absolute data. I was only relating to what I think is still the strong barrier, whether it is 80% or only 50%. It is still a barrier in trying to get our procedures and concepts used in everyday lighting design.

Perhaps there have been many changes since then, but during my travels several years ago I made a point of asking how many architects and consulting engineers concerned themselves about glare in offices to the extent that they were specifying VCP's or even knew what VCP's are. In schools we have a specialized kind of situation where this rating system has been used because of the special characteristic of schoolhouse construction programs. I am talking of a broad cross-section of people such as you get if you travel the country and talk to lots of architects and engineers. This is where the generalized idea comes from. On this basis I am inclined to think that my 80% figure is still pretty good.

Prof. Smith: Yes, I wish to relate to some of the comments that George has made insofar as education.

The point that I was trying to make under the watts per square foot, and again I define that as the one number without any deviation from the activities of the spaces within the facility that we are talking about.

It is the educational process that I am italicing about. If we can't get a sophistication into the education, getting this 85 percent of the people who are doing the lighting design, we are not going to get energy conscious lighting designs. That is my biggest opposition to the office buildings that, they are good for 3 watts per square foot, and I give that to the draftsman and he multiplies the gross area and then that is the answer.

It is the great number of the professionals who are not specializing in lighting who need to have the code. You can't say that you are not lighting specialists so then we won't codify you. So you have to get the document out.

7.3.8 Dr. Berman and
Dr. Clear: *How do you get energy efficiency when faced with a barrier of life cycle costs versus first costs?*

Dr. Ross: How do you get energy efficiency when faced with a barrier of life cycle costs? I think that is how one would get it.

Mr. Cornish: Very good answer, that would have been mine.

Mr. DeKoker: There is plenty of incentive out there with the energy prices going up at the rate they are. There are still plenty of things to do from a retrofit standpoint. When you are building a new building, obviously the life cycle cost is the way you look at things from the point of considering fairly energy efficient designs. In fact, every new GM building is designed to far exceed the minimum standards of ASHRAE 1975.

Dr. Clear: *The question was misunderstood.*

How do you sell the concept of considering life cycle costs rather than first costs?

Dr. Ross: I think the energy codes will certainly go a long way towards enforcing that concept or at least making people aware of it. It will help. We have been privileged to work with several states in developing their energy codes, in trying to find out from a group of merchants, for example, what might be appropriate in terms of energy standards for their occupations so that the standards won't cripple them, or rather not hurt them.

We found a great deal of support for the concept of code lighting limitation because one of the big problems is that a man has a shoe store, for example, and he has lighted his show window and interior space to 30 footcandles and highlighted the goods inside to perhaps a hundred footcandles; and then next door to him, a merchant moves in with 150 footcandles in his showroom window.

All of a sudden, he says "whoops", I better get 300 footcandles. It is now something of a competition. Finally, they each put out around 1,000 footcandles and have done about as much damage as they can.

So, we find that merchants are looking for some way to alleviate the problem so that they can compete on a more sensible basis.

We have found that type of reaction, not only from merchants, but from commercial office building operators who have similar problems.

7.3.9 Mr. Kinson: *Please elaborate on your inference that lamp manufacturers constitute a barrier to change.*

Dr. Ross: What I implied in the statement was that if one wants to look at where barriers might be, one should look at those industries that have the greatest stake in the marketplace and see where to try to adjust your development so that at least you get the cooperation from that group rather than antagonism.

Then I wrote about research. I think that the sponsorship of research largely comes from them. I am not criticizing the research; it is good, but there are many things to do and few of them can be funded. The tendency is to fund those research projects that are of interest to the sponsors. The golden rule is "He who has the gold, rules."

The research tends to follow that pattern.

Mr. Unglert: These will be the last two questions. They are sort of related. This is to the panel.

7.3.10 *Energy costs so far do not take into account office population density. Luxurious space might use twice as much energy per person.*

7.3.11 Mr. Florence: *Should we think in terms of Btu per person per year?*

Prof. Smith: The IES lighting power registered system does recognize density of occupancy.

Mr. DeKoker: No.

Mr. Clark: Yes.

At least originally this was handled in Section 9 of 90-75 because we were matching lighting needs which happen to relate to how many task locations there are. If we don't do this I believe we are making a big mistake. This concept applies to lighting perhaps more than the other building energy-related factors. How much lighting is required is not just a matter of what illumination level is needed.

We can readily design buildings that are inefficient in occupancy. This obviously is a waste of energy. In theory, if we want to save energy we ought to build as few buildings as possible and use the present space as much as possible. That suggests a "greater" density of lighting.

Obviously there are limits to this idea, but as a philosophical approach I proposed this to Walter Meissen at GSA six or seven years ago. During one of the Architectural Record Roundtables in which we both participated he almost bought this idea.

Lighting is particularly vulnerable to an overconcentration on power density, and furthermore, this approach can readily be counterproductive in the effort for energy conservation.

Mr. Squillace: Mr. Waldbauer, Neil left an impression here. It says:

Money was at the top. I think Bob showed that perhaps money is not always the consideration. If you think for a moment that 85 percent of the people who design lighting systems as George mentioned don't do it by any means except to plunk here and there, if you don't think the same thing applies to the kind of industry that is out there, you have another thought coming. Not everybody is a Westinghouse or a GE. There are 90 percent of the industries who don't give a damn, who don't look to correct power factors or do energy audits.

Why do you think we have an energy department in our firm?

Mr. Cornish: I think now we are going to close off for today by having some questions from the audience on this very interesting topic.

7.4 ORAL QUESTIONS/COMMENTS BY AUDITORS

Mr. Goldin: This is probably a very difficult subject, energy, because 100 years ago, it was discussed from an entirely different point of view.

It was discussed from the point of view of how much light a human being ought to have and how much space a worker ought to have. And how much heat and how much natural light, you see.

Now, we are talking about energy with our heads in the sand. We can talk about how efficient General Motors is, but do we want to talk about whether the product that they produce is necessary for consumption.

These are terribly hard issues for a society which has built its strength and its power in the world on the basis of waste. Unless we deal with that issue, we are not going to get to the bottom of it. Personally, because I am into light, I resent the way we treat it in the first place. I don't believe it is a commodity like toilet paper--expendable--or that it should be dealt with in that casual way.

I think when we didn't have any electric lighting or whatever, the practitioners like Stephen's ancestors didn't have to worry about having to deal with the clients. They knew the question and they knew the answer.

We don't even know the question. So that is why we can't deal with our clients and why we can't contribute to the solution of the problems. All of this has to do with regulation which frustrates me to no end. We have a bureaucracy which unfortunately doesn't recognize the design professional has a unique contribution to make in an atmosphere of freedom, you know. If America had anything, it had a vast abundance of creativity which is being stuck in the sewer somewhere.

I really have difficulty in not getting emotional about this thing. I think about the ideal watts per square foot without regulating the size of a home and an office, you know, these basic things that tie it in like George says.

George would be absolutely murdered by the building industry to suggest for a minute that we talk about density or making our cities more exact with less wasteful streets and sewers--all of the things that are energy conserving.

As a society, I don't think that we are any better than anybody else so that we can deal with this issue better than our government, you know, but I think that we need to talk to the point rather than around the point.

Dr. Atkinson: I asked Don Ross to explain what he meant by his inference to the lamp manufacturers and I guess he explained it.

He mentioned that the lamp manufacturers would be loath to support research that would be inimicable to their interests. I want to reject that and I want to reject it in this forum for this reason.

The history of development of light sources is replete with constructive and progressive improvements, and not minor improvements, but quantum improvements. I would suggest that if the diesel locomotive or the internal combustion engine had been improved to the point that light sources had since their inception, today there would be no energy crisis. So, I reject fully out of hand that we constitute a barrier to change in energy conservation or any kind of a change.

Mr. Christensen: I would just like to point out something that deals with government controls.

One thing that I have observed about controls. It is hard to discover any product in this country that was ever in short supply that wasn't at one time or another controlled by the government.

Controlling the use of light may have the same effect.

Also, there are really two motivators. One is greed and one is patriotism. I submit that by saving money, and that is what industry is striving to do, and I disagree with you, Steve, this policy applies to both large and small companies.

To evaluate a company, I divide their sales by the profit. For our particular company, when I do that, I get a number, $15.98. That means every dollar that we can save, in maintenance or in operating costs, in terms of profit dollars is equivalent to $16 worth of products that we don't have to make and sell. That is where greed and patriotism come together.

It takes energy to make that $16 worth of products, thus saving money saves energy. When I look at changing lighting, I look at it in the way it will affect our company. I look at people because they are the ones affected by lighting. People are one of the most expensive things we have. Thirty-eight percent of our company's sales dollar goes to people.

If I were to take only one percent of our labor and related costs, assuming that we are going to affect the performance of people by only one percent, that would cost our company $72,000,000.

The total operating cost of our lighting in the entire company is about $39,000,000. I think even Don Ross will agree then, because the studies Stan Smith did show that a half of one percent change in productivity is cost effective for higher lighting levels than are currently being used.

We can all think of cases where we can find productivity increases that are far greater than that one percent. I think we ought to let free market operate here and let industry light the way they want to light and not add additional controls.

If you start to control lighting, pretty soon it will be in short supply, also.

Mr. Cuttica: I feel I have to say something from DoE on the beating that we have taken over the standards.

First off, let me say that some of what I say may not be totally correct because I am not in the standards area. But I believe that it is not the intent of DoE to restrict the lighting designer or any other designer of buildings or spaces.

What they are really looking at in the standards area is to come up with a building energy budget and then leave creativity to the artistic ability of architects or designers of lighting - to stay within that budget as opposed to coming up with a strict lighting standard so that you would restrict then the designer. Put a budget on the building and leave it to the architect and the lighting engineer to determine how much will go towards lighting and how to do it in an efficient manner.

The other point I wanted to make was that, yes, there are industries that are out there that are very conscious of energy and are doing a very good job. Again, as somebody else pointed out here, there are a lot of buildings that are put up and the people who build them are not going to be the people occupying them and paying the utility bills.

Then it becomes a matter of putting it up the cheapest way we can. They don't always take a look at first cost versus energy conservation.

Getting back to the energy budget for the building, this will help to force people to take a look at this. Whether it is good or bad, I guess we can argue that forever. I think there is a little bit to be said in defense of the type of energy budget that we are trying to accomplish.

Mr. Cornish: Ladies and gentlemen, it is beyond 5:30. I would suggest that we finish off for today's session now. See you tomorrow.

(Time noted: 5:35 p.m.)

8. SECOND DAY OF ROUNDTABLE

Mr. Cornish: Ladies and gentlemen, let me welcome you again to the IES/NBS Lighting Roundtable. This morning we have one less panelist. Neil DeKoker had to leave us last evening.

Generally speaking, the procedure will be that each of the panel will be asked on a five-minute basis to sum up any statements that they may have or may wish to make and then the two hosts, Dick Wright and Bill Fisher, will be asked to make a five or so minute sum-up of the entire conference.

The first issue this morning is the establishment of illuminance levels. There will be statements read by Norm Bott, Alan Lewis, Don Ross and Steve Squillace, in that order.

9.0 ISSUE NO. 6. "ESTABLISHMENT OF ILLUMINANCE LEVELS"

9.1 WRITTEN STATEMENTS BY PANELISTS

9.1.1 Mr. Bott: One of the most important concerns of the application engineer in the federal construction establishment has been in the area of illuminance levels.

GSA's standard design practice has always been to provide conservative illuminance levels in the office portions of our buildings.

In the 1930's lighting in federal buildings was provided by incandescent lamps in the 15 footcandle range. In the 1940's the fluorescent lamp was introduced and illuminance levels were increased to about the 30 footcandle range. As late as 1961, GSA design standards called for 35 footcandles for general office lighting and 50 footcandles for prolonged close work and difficult seeing tasks.

In the early 1960's the modular design concept was adopted where entire floors of buildings were designed to have the same illuminance level (50 footcandles).

In 1961, GSA raised the difficult seeing task levels to 75 footcandles. And 30 footcandles was specified for ordinary or intermittent seeing tasks. In effect this raised all illuminance levels in new buildings to 75 footcandles as lighting was designed for maximum tenant flexibility. Thus people became accustomed to working in the higher intensity illuminance levels.

In January 1973, integrated ceiling standards were issued by GSA for modular design at 70 footcandles for general office lighting on the task.

While our new construction design standard prior to the energy crisis was 70 footcandles, our guidelines for existing building remodeling allow for 50 footcandles of lighting. It is interesting to note that although we have numerous buildings where the predominant illuminance level was in the 50 footcandle range, prior to the energy crisis, we have no record of visual problems at these locations. It is understandable that employees accustomed to brightly lighted offices will psychologically react to the lower lighting standards.

Our standard practice then, for many years, has been to design for a maintained average illuminance level in the area of 70 to 75 footcandles. This design procedure resulted in a maintained illuminance level of from 70 to 105 footcandles depending on luminaire efficiency, maintenance, size of partitioned area, etc.

The typical office area in our buildings was designed around a modular construction concept and provided with uniform lighting. The module in most cases was 60" by 60" with each 25 square foot ceiling module generally containing one 12" by 48" recessed, two-lamp, 40 watt combination light and air troffer with a louver or prismatic lens. This resulted in a power density of nominally four watts per square foot (3.68 watts).

Occupant surveys conducted a year after occupancy in each building indicated that our employees felt that lighting was the most satisfactorily met design requirement in their new buildings.

Serious consideration by GSA of moving to more energy conserving building illumination design began in 1972 at a jointly sponsored GSA-NBS Roundtable on Energy Conservation in Public Buildings. Consequently by the time of the oil embargo in 1973 we were well underway on our energy conservation demonstration federal building in Manchester, New Hampshire.

As energy problems became more evident, the practice of uniformly illuminating every square foot of office space to the recommended illuminance level for the

most difficult seeing task was one of the first items questioned. We in government were directed to find a less wasteful means of providing adequate, comfortable lighting in federal offices.

A multi-discipline team of GSA personnel was instructed to reevaluate our practices in designing office space. Generally, GSA regulations and practical limits prevented the location of more than one worker per hundred square feet of office area.

The task area of one office worker was determined to be approximately 12 square feet. Therefore, in an office with a uniform illuminance level, over 80% of the area was used primarily for circulation of an occasional conference task. Obviously fewer fixtures consuming less wattage could provide adequate and satisfactory task lighting with sufficient spill lighting to meet IES office lighting practice for variation of intensity within this space. This non-uniform, task-oriented lighting concept using relocatable luminaires fit very well into GSA's office excellence program.

Office excellence was a GSA open office concept that consisted of a floor-ceiling sandwich containing illumination, air conditioning, telephone, background sound, power distribution, specially designed furniture, carpeting, movable partitions, and interior landscape materials.

At the same time that this work was being done in GSA, illumination consultants and acoustical consultants were engaged to recommend and develop techniques, standards, and tests to insure that these new approaches would result in satisfactory office environments. As a result of these studies and later ones underwritten by the Department of Energy (DoE), the illuminance level was set at 50 footcandles on the task with 30 footcandles in the intervening area. A power density of 2 watts per square foot was permitted to obtain the 50 footcandle level in new construction. Similar restraints were placed on the 10,000 existing buildings under GSA control.

In surveying existing buildings, we found that many factors that contribute to effective seeing were present besides illumination. These included such things as task size, color contrast, viewing distance, and time available to do the task, to mention a few. The surveys indicated that these and other variables in an overwhelming majority of work places were favorable and lower levels of quality illumination would be adequate to maintain an acceptable degree of work efficiency. The proportionately smaller instances with unfavorable characteristics could then be offset by changes in the lighting or other means on a case-by-case basis.

Conversion to non-uniform task lighting was accomplished and lighting levels checked in three steps. The first step was to go through the building and facilities to remove or de-energize lamps from all space where it was obvious that lighting levels exceeded the acceptable range. The second step was to go through the working space on a room-by-room basis to accomplish the specified non-uniform lighting level at work stations and approximate 30 footcandles in work areas (other than at the task). The third step was to verify reduced lighting levels and make necessary adjustments to insure an acceptable environment.

These inspectors were given detailed procedural instructions regarding the relationship between the light source and the task, where illuminance measurements should be made, and what constituted an acceptable range of illuminance levels.

Certain building areas did not receive the non-uniform treatment. Where more difficult seeing tasks required a higher level of illumination, reductions were made only to the level appropriate for the task being accomplished. These areas included/drafting rooms, computer rooms, and accounting or payroll offices.

Employees dissatisfaction over reduced illuminance levels was relatively short-lived and minimal. In some cases other factors of the work environment were

found to be the basis of complaint. In areas where an otherwise acceptable environment was held intact, the illuminance levels were reduced without serious complaint.

With regard to our new buildings, we have over 6 million square feet of non-uniform task lighting office space. Most of the buildings have been occupied and we are attempting to obtain meaningful measures of visual effectiveness, employee morale, and work output. However, the acceptance of the program in existing buildings (which represent a worse case) would seem to indicate that, in new facilities, non-uniform task lighting specifically designed into the office excellence program will gain general acceptance rapidly.

In the area of future developments we now have three new federal office buildings which are scheduled for occupancy within months. They are designed to provide an illuminance level of 50 footcandles with a power density of less than one (.88) watt per square foot.

Two of these projects provide a system of uniform illumination which utilizes a checkerboard arrangement of single lamp, 48" open bottom luminaires containing a specular parabolic reflector with transverse baffles.

The Lumen II computer program was used to predict ESI, classical footcandles and VCP. The IES approach suggests that a good way to analyze ESI performance is to determine the value which is equalled or exceeded at 80% of the possible viewing situations. That is to say, the value which is equal or exceeded by 80% of the total computations. The 80% ESI value predicted for this project is 25 with an average ESI value of 28. The average VCP is 99.

Naturally, we have no occupancy data as yet. However, agency representatives of the future occupants who have visited the building are quite enthusiastic and feel the illuminance level provided is very satisfactory.

The remaining project utilizes the nonuniform task lighting concept with relocatable luminaires. This project utilizes one 24" x 48" recessed combination light and air troffer located in each 100 square feet of office area. The luminaire contains two 40 watt lamps enclosed by an acrylic lens. Again, occupant reaction is not yet available so only time will tell whether this is a "hit or miss."

But those of us who have visited these facilities are very encouranged. We believe they may provide "in situ" evidence that an illuminance range of 50 to 60 footcandles can meet most of GSA's prevalent task visibility needs in general office space. Further, that it can be done for less than one watt per square foot without undue sacrifice in production, accuracy or comfort.

9.1.2 Dr. Lewis: 1. Luminance, not illuminance, should be the specified quantity. Since virtually all lighting design is, or should be, referenced to a particular task or group of tasks, the constraints of using luminance as the metric should present no insurmountable problems. Even today, for many tasks, the illuminance recommendations are derived from luminance and luminance-based contrast requirements.

2. Time must be included in the equation. The fatigue factor, especially for visually demanding tasks which require accurate and sustained accommodation and fixation, has received little direct attention in the past by the lighting community. We must develop data on the relationships between performance and task duration; this will prove to be a major factor in the determination of luminance requirements.

3. The responsibility for determining luminance levels should rest with the designer, not with government nor with the technical societies. Energy- and cost-effective lighting design cannot be accomplished by simplistic formulae

applied to generalized spaces. Luminance levels should be established only for specific spaces with known uses. Lighting for spaces which have unknown uses should be at a minimum level until such time as the use is determined.

4. Lighting design should be performed only by persons who have knowledge of the subject. Perhaps certification at the society level would assist potential builders and owners in choosing a competent designer and would create a demand for more intraprofessional education in lighting design.

5. The quality of lighting must be part of the luminance level considerations. Freedom from veiling reflections, concern for color harmony, and comfort criteria allowances must be included in the design because they will affect the requirement for luminance.

6. Until more is known about the effects of lighting on human performance, standards and specifications concerning levels should be only as rigid as is necessary to prevent abuses that will be detrimental to the public safety. Adequate, or even superior, lighting will be achieved in practice through the intelligent use of design principles and informed judgment.

9.1.3 Dr. Ross: 1. The process by which Recommendations of illumination levels by the IES have become minimum standards through operation of many building codes and OSHA, requires prompt correction of the listed values. Codes should properly require only minimum values for health, safety, and public welfare. The user is then free to increase these to optimum values if desired.

2. When the task is well defined, specification of either illuminance or brightness is somewhat equivalent. When tasks are ill defined, then brightness should be the preferred metric.

3. Brightness (and illuminance) should be specified in logarithmic units to give proper weight to the manner in which changes are perceived by the human system.

4. The concept of brightness and illuminance should be modified to account for experimental data showing the variation in perception caused by changes in the amount of energy in each portion of the visual spectrum. There is evidence that "white" light can vary in effectiveness as much as 40% from this cause alone.

5. For tasks where contrast rendition is believed to be important, the minimum contrast of a selected target (viewed in a lighting system under consideration) should be specified, as well as the brightness of the target. Combining both of these elements (together with many other visual cues) in a single value such as E.S.I. adds a great deal of unnecessary complication and is questioned by many regarding its application in a real-world environment.

6. Relationships between illumination/brightness levels and task performance should be based only on experimentally derived data for each specific case until such time as there is general acceptance of a model of human performance that has been demonstrated to provide, a priori, a valid basis for using its predictions. It may not be required to determine such a relationship, but only that level below which performance deteriorates substantially from optimum.

9.1.4 Mr. Squillace: It has long been my opinion that there should not be such a thing as "illumination levels". There can only exist, in my opinion, experimental data, properly reported, so that qualified professionals can interpret and use the data to achieve certain solutions to their clients' needs.

Certainly, no "body", such as the IES or any governmental agency, has any right to place upon any part of the construction industry a requirement to provide a given level of lux (footcandles) for a given task. It seems to me that the

dissemination of knowledge about the art and science of lighting is to report the results of experiments for interpretation by all peers, and for general use by the world-wide community.

The profession of lighting cannot ever be respected as a profession as long as we don't allow "professionals" to grow in the industry. The lawyer or the doctor is not told how to conduct his legal or medical practice, or how to prescribe for his patient. The results of experiments are reported and the opinions of researchers are weighed against the results that the researchers have obtained, and then the doctor is on his own as far as his patients are concerned.

The lawyer also studies the facts in precedent cases, studies the opinion of judges in precedent-type cases, but then he is on his own as far as interpretation and solutions for his clients are concerned.

And so it should be with lighting designers. They should be given proper education, examined by their peers for state (and perhaps federal and international registration) and then should be left to their own devices as far as their conducting of their practice.

Further, one should recognize that illumination level is only a "tool". The amount of flux per unit area impinging on a surface is only useful to gain other knowledge of that surface such as its luminance, luminance gradient, the interaction between surfaces, and other factors of this type. Therefore, it is not really a prescriptive number, but a number to be calculated, used by the discriminating designer, and then filed away for future reference.

It is, therefore, my emphatic plea that we abandon as quickly as we can, this mad rush to find a suitable "number" for illumination for two major reasons:

1. Such a procedure can only serve Mammon and not people.

2. A single number (or even a range of numbers) will not, and cannot, satisfy all situations. However, the qualified designer can design for any given situation and could probably provide for more visibility than is possible with any range of numbers.

9.2 PANEL DISCUSSION

Ms. Harrold: This is probably sheer nonsense and utter folly to ask a question of Steve Squillace. But at that risk, I will do so.

This goes back to the point that George Clark made yesterday, that much of the lighting design is being done by technicians, or those that we might characterize as not necessarily the professional lighting designers.

I would like to ask Steve what system these non professionals should utilize, particularly those that maybe are not capable, unfortunately, and I know that he and I debated this before, but not capable of doing the kind of calculations that might be necessary to arrive at an illuminance level.

How do we handle those?

Mr. Squillace: You can't. Obviously, in any profession - I don't care whether it is medical, legal or otherwise - quacks do exist.

If you have cancer, you can go to a quack and he can say to do this or that or the other; maybe the good Lord decides to cure you or not, but it hasn't anything to do with the quacks as far as I am concerned.

I don't know whether it is 85 percent or 90 percent or 95 percent of the buildings that are done by technicians who don't understand the complexities of how a task should be done and how a person responds to electromagnetic radiation and the

surfaces around it, that is a complex subject. If people are willing to just throw it aside and say the hell with it, put it in any way, give me a cheap job, that is their business. We have no right to tell them anything. If they want to spend their money unwisely, who are we, whether as a society or anybody else, to tell them differently. They will soon find out if things go very awry. Then they will have to pay the piper. For those who want to do a good job, then I think that we should be constituted where we can provide the service.

As we are doing it now, we are perpetrating a fraud. We are simply saying that it is simplistic. You know, put two watts per square foot or five watts per square foot, whatever it is, and then the hell with it. The old zonal cavity method gives you nothing more than that. It is an average level which does not respond to the needs of people. Albeit, whether when Philip O'Brien came along and gave us a more accurate way of computing interreflectance. So what! That has been in the literature for years, but since it has not been used correctly until recently, we have not benefitted.

The mechanical engineers in calculating the radiation effects within induction furnaces have used the above methods for years. They have no quacks taking care of their furnaces. I don't know why we should cater to the quacks either. Let them do what they want.

Mr. Clark: Let me take another view with respect to this particular problem. I refer to the discussion between Rita and Steve. I happen to feel personally that this Society has a social obligation to try to do the best it can for users of light, whether they have the most competent or the least competent designer doing -

Mr. Squillace: Why?

Mr. Clark: Let me come to the point. We should remember that for thirty or forty years there have been incompetent lighting designers designing lighting -

Mr. Squillace: Who says so?

Mr. Clark: Wait a minute. I am just saying that there are these people and Rita has raised the point. The problem that I have with your view, Steve, is that while I would love to see only truly competent designers, we need to deal with the practical view that there are not presently enough to do all of the lighting design required in the United States.

Somehow the situation we are dealing with reminds me of a comment given to me some years ago relating to the issue of lighting levels. I was told that this particular organization was planning to reduce lighting levels until people complained. I then said, "I am not sure that is a good criterion. By the way, define complaint. Is it one percent, 51 percent, all women, what is a complaint?"

Coming back to you, Steve, if you are saying let them live with it - that is, poor lighting - you can paraphrase Rita's comments from yesterday to suggest that they are living with it and will continue to do so.

What we are talking about is not jobs that are so bad that nobody can live with them but the fact that we think there are better ways of doing them. Its not like a building which is about to fall down.

So I don't think there are the leverages involved here that you are addressing for the rest of the world. It doesn't mean that we should make everything to the least common denominator either, I am certainly not saying that.

I do have trouble, though, with the idea that we forget the rest and concentrate on only the absolutely competent person. I also have trouble in a legal

sense and other ways, especially at this point and time, with the idea of having our Society registering people as to their competence. Perhaps it can be done at some time but there are obstacles to be overcome.

And again, I must point out that I am someone who would like to see everybody out there doing lighting design as being highly motivated and highly competent. In my business and professional experience I have not found this to be so.

I had one other comment and then I will break.

Mr. Cornish: Please.

Mr. Clark: Thank you. As we have used illuminance levels I don't believe that subjective appraisals of adequacy are enough. You can't really tell, your eye doesn't measure illuminance.

Some of us have had practical experience going back many years which seemed to support this belief. As a matter of fact there were situations for which we still don't have answers to questions which are raised at the time.

A very good example is the comparison between luminous ceiling lighting installations and those using recessed troffers. Even when the lighting level was the same people invariably would judge the illuminance level under the luminous ceiling as being less than that under the recessed luminaires.

The question which I have is in which does one work better? The one which is thought to have the higher level, the lower level or does it make any difference? I don't believe we still know the answers to that.

It was experiences such as this that made many of us worry about the kind of preference data that came out of Europe some years back. This seemed to show a preference for 2,000 lux. I happen to think that the preference can be controlled over a wide range by careful design of the environment in which the judgments are made.

Prof. Smith: I want to support George in his comment. I feel very strongly it is the responsibility of the Illuminating Engineering Society, particularly of the lighting industry as a whole, to offer guidance and part of that guidance can be the establishment of a guide for illuminance levels, or luminance levels or whatever the case may be.

I am a little troubled by Steve's comment, "and let them do as they want." It is not the designers that use the spaces. The designers leave. They have gone forever.

I teach in a classroom that is obviously not designed by Steve Squillace. I am going to be teaching in there for the rest of my life. It is a poor lighting job and the designer could care less. He is never going to be in that room.

If we completely withdraw the guidance aspects from our society, I think the lighting quality would diminish to even a poorer point than what it is now. I don't understand that philosophy at all.

Mr. Ross: I have to take Steve's point of view. What we have done I think is couched in an aura of scientific credibility--a list of lighting levels that have no basis in fact. They really are fraudulent, as you said, Steve.

As a matter of fact, Bob Smith, your very poor classroom lighting was probably designed according to those standards.

Prof. Smith: No.

Dr. Ross: We don't have to establish a design methodology for people who don't know their math from a hole in the ground. But it seems to me that what we should be doing is, as Steve says, giving people the knowledge as to how performance is affected by lighting and lighting levels. Let's do the research which hasn't yet been done, and find out what we are talking about.

We don't know even how to define illuminance at the moment.

Mr. Cornish: A short rebuttal.

Prof. Smith: In theory, I think it is a great idea. I just don't see it working in practice.

I have said before and I will say it again, that I believe that the 5th edition of the IES Lighting Handbook is going to be a very valuable handbook and is going to be a very valuable commodity, because they are going to be in demand after the 6th edition comes out and does away with the illuminance.

We are not the typical designers up here. The people who are doing most of the lighting designs are going to relish that. It is going to be a cherished spot on their shelf. They are going to keep it.

Mr. Frye: Good morning, ladies and gentlemen. I just have a very short comment to make.

It is absolutely clear to me that they are both right.

Mr. Squillace: I would like to answer both George and Bob. First of all, probably you misunderstand me. I did not say let the designer do what he wants. It is the owner that I am talking about. It is he who engages or doesn't engage a designer.

If indeed the practice that I have seen carried out by them is supposed to make big giants in the industry, what everybody says it is, 85 percent of the people who are not really designing, let me tell you that they don't look at the Handbook either, Robert.

I have in mind a so-called Brand X down the street from me, that is a very great architectural firm; the watts per square foot is prevalent.

As a matter of fact, I really believe that they don't know what they have when they finish. They simply put the lights where the architect says they should be. Such designs are usually made from an architect's very narrow viewpoint, and therefore, have little validity in my opinion - when one considers the whole spectrum of items needed to be considered for a good, logical, feasible design. You cannot legislate morality, engineering or anything else that is human in nature. It simply cannot be done.

The only reason why the codes exist is to violate them, most people feel. I don't understand. I am not talking about the designer that leaves you in the poor position.

If there were designers involved who were worth even half the salt of the earth, I think you would get a decent job. The point is that the college did not want to pay the money. Somebody put it in like a contract. That's the problem. It has nothing to do with illuminance levels. After all, they are the wrong things to use anyhow. So, what are we talking about?

George, if indeed 85 percent of the people are not designing their job now, do you think that they have even the slightest inclination to look at the handbook or to the guidelines?

What are the social needs of people? How do we serve people and not mammon?

I have sat in the office of wholesalers who look to me like bookies at a racing game. They sit there with their phones couched close to their ears, taking orders over the phone from contractors with specifications that are catalogue numbers. I don't call that design. I call that picking fixtures. I don't understand people. I really don't.

If indeed that is what people want to do, owners, building manager, whoever they are, they are going to do it.

Mr. Cornish: Is there anything else from the panel before we close off with the discussion and start with the readers who wish to comment?

We'll turn it over to the readers then.

9.3 WRITTEN QUESTIONS/COMMENTS BY AUDITORS

Mr. Unglert: We have several questions here that I guess sort of relate to 9-80. Maybe that is where we should start.

9.3.1 Mr. Goldin: *Isn't Table 9-80 deep in your subconscious?*

Mr. Squillace: Saul, my ancestors would applaud you. Remember that I am a lover and not a fighter. Remember that the Germans have the three B's: Beethoven, Bach and Brahms.

The Italians have the four I's: Toscanini, Verdi, Puccini, and Rossini.

Mr. Goldin: Our difficulty is that we are not dealing with the art of illumination.

Mr. Squillace: Da Vinci did and he is another I.

9.3.2 Mr. Waldbauer: *What illumination or illuminance levels should be used in the interim while the body of proven experimental data is established.*

9.3.3 *If we abandon 9-80, how would you structure the 6th edition of that handbook for the 1980 publication?*

Dr. Ross: For office work we subscribed to the 50, 30, 10 infamous ruling with permission to raise those levels where there is specific knowledge that by doing so, it would serve some purpose. I think that is probably adequate, knowing full well that 50 doesn't mean 50 plus or minus zero; 50 means plus or minus 10 or 25 percent. It doesn't make any difference. The eye can't see any differences of 25 percent, in my opinion.

Dr. Lewis: I really don't know what level should be used. I have a pretty good idea of what levels are going to be used in the interim, I think, depending on the board's action. They are going to be the proposal if based on the consensus, which is primarily based on the CIE report 29, moved by the IES, the phases of the IES here and of course they relate to the past including things such as task size and who is doing it.

The fact of the matter is that you can't specify intelligently illuminance illumination levels without knowing what you are lighting for.

So, there is no single answer to that. It is going to have to be based in the interim on judgment and what we have done or what we are proposing to do is as the judgment for the large number of people to come up with numbers that probably nobody can agree on but at least in the range that everybody won't think will be too bad. That will be the interim, I believe.

9.3.4 *If we abandon 9-80, what do we do with the 6th edition of the handbook?*

Mr. Squillace: To answer the question directly, I will look for an example to the handbook for chemical engineers. I don't see any table in there that tells them how to structure a formula or an equation to get something made like a piece of plastic. It gives them a lot of data on what happens -- the results of experimentation.

Any handbook, in my opinion, should do exactly that. For example, why haven't we published the bidirectional distribution functions measured to date? Is it indeed the present VL system that should be and can be used, at least in certain specific instances?

Nobody has that data except the very few. I think that we are not dissimilar in what we have learned in the laboratories. Somebody is stepping in between and interpreting the results, and putting them in the Handbook.

I say that that is wrong.

What should be done is that the results are reported and that design professionals use those results to the best of their ability to solve problems in the field. That is what the handbook should do. It should not prescribe.

9.3.5 Mr. Scutt: *The environment in yesterday's conference room was a curious amalgam of routine motel hokey decor with violet lighting. The only difference between yesterday's room and today's room is that the designer used the same basic fixture, except in this room he employed column mirrors to maximize the reflection of his errors.*

9.3.6 Mr. Hattenberg: *Don Ross, please elaborate on your suggestion to express illuminance on a logarithmic scale.*

Dr. Ross: Yes. That requires a substantial amount of time to answer. In the April issue of LD&A, there is an article which discusses that point of view. I would like to refer you to that.

All I am proposing is that since the eye perceives brightness on a logarithmic basis that that would be a preferred measure. Incidentally, brightness is always plotted that way.

9.3.7 Mr. Kahn: *Why 50, 30, 10? Technically, why not 25, 15 and 5?*

Dr. Ross: You asked for my opinion.

25 is too low and I think 50 is sort of reasonable.

Mr. Brandston: *What are we doing to safeguard against promulgation of standards that are based on questionable research?*

Mr. Squillace: I am not sure that we are doing anything. Any research that is not verified and is in some way fraudulent, I don't know that we are trying to protect it at all.

I suppose we are still operating on the principle of caveat emptor, let the buyer beware.

Dr. Lewis: I think it is to have committees in the society to evaluate the terms and try to determine their usefulness which is, by the way, in most cases, not the research but it is the problem.

It is the interpretation of that research to supply the practice. That is the problem.

I think what we are doing about it is hopefully having responsible people looking at these in trying to interpret it in an intelligent fashion.

Dr. Ross: It is a great concern of mine. I feel that a lot of past actions prevail in the society are in the standards today as a result of poor interpretation of research and not enough critical discussion of that before they were accepted.

We went blindly down some avenues. It appeared to be plausible but in the light of experience, they continually showed that these techniques don't do what they were supposed to do.

You don't predict relationship between lighting and performance. We have to take a step back. I think that that has happened. There is a little fresh air running through the groups who are concerned about these things.

I am very optimistic that these kinds of changes will be taken care of.

Mr. Amick: The next three are directed to Steve from Howard Brandston first.

9.3.8 *What about empirical knowledge? Why must we have objective documentation?*

Mr. Squillace: Nothing wrong with empirical knowledge with those who have it and who want to use it. Be my guest.

Mr. Amick: Another one from Howard.

9.3.9 *How many practices that we have don't meet the client's needs because of some of our reported data?*

Mr. Squillace: I am not sure that I understand that, Charlie.

Mr. Amick: Howard, did I miss a word?

Mr. Squillace: The reported data, assuming that the experiments are properly conducted and recorded, if it is used improperly, maybe there are lots of jobs that are done incorrectly because of improperly interpreting data.

I am sure there are lots of examples of that.

9.3.10 Drs. Berman and Clear: *For a typical job, what's the difference in cost in hiring a lighting designer or just having the job done?*

How much money does he think he saves over Mr. Bott's building?

Can you justify the indicated lighting designer effort?

Mr. Squillace: If I assume that the building owners hire an architect to do the building, and not the 85 percent that George talks about, who don't hire anybody, frankly, except maybe some contractors, if you were to hire an architect such as we are, there is no extra fee for doing the lighting.

We do it except perhaps when we ask for criteria, the criteria are not known and, together with the owner, we say, "You ought to explore this area," that is outside of the scope of the normal lighting design job. We ask for an extra fee there.

Beyond that, I know of nothing that we do in lighting that is not already part of the standard fee. It is in competition with every other architect that we have.

Since we believe that no lighting should be done without knowing what the tasks are and how the people react and who they are and how they use the space, these are things that go in many cases beyond what is covered in the ordinary fee.

Mr. Amick: The last one, also from Bob Clear for Steve.

9.3.11 Dr. Clear: *Do you design with flexible desk lamps when the tasks are not known beforehand?*

If you don't know what the tasks were, would you then specify furniture mounted or flexible desk lamps?

Mr. Squillace: The answer to that question has a lot to do with how the owner perceives his space.

If it is just speculative buildings, then you really do nothing. We usually go after an ESI rating if it is appropriate. Then we leave it go to a certain criterion level and then the tenants come in and do their thing.

If we know something about the use of the space and/or the owner does and reports it to us, we may go to task-ambient lighting in addition to other supplemental lighting for other purposes.

But, we hardly use the lamps of the flexible type. It is usually a combination of task-ambient and indirect overhead systems lighting.

9.3.12 Mr. Kahn: *Can you as a GSA engineer, on any technical basis, justify why GSA would use 70 footcandles on the task, instead of, say, 40 footcandles on the task; or use any number, say, 50 footcandles on the task, instead of 30 footcandles? The point of my question is that if you can answer this, you would find that the technical answer would also provide the answer and basis for saving GSA hundreds of millions of dollars presently wasted in GSA buildings by using nonvisually productive illumination.*

Mr. Bott: I have been attempting to answer Mr. Kahn's question for 15 years and it seems like 25.

Mr. Kahn: You may get to it one day. Face the issue.

Mr. Bott: We have Mr. Kahn's panel under test in Manchester.

Mr. Kahn: I am not talking about panels.

Mr. Bott: Oh, sorry. We in GSA are not researchers. We do not generally design our buildings. We hire consultants and we have guidelines definitely in mind, which these consultants are required to follow. These guidelines indicate to them that they should consider all aspects of illumination, of energy conservation or what have you and give us the best product that they are capable of producing.

Most of the time we accept their recommendations; this is the way that we do business. We depend on them to exercise their design judgment and give us the system which they feel will most effectively light our buildings in accordance with our needs.

Mr. Kahn: You are passing the buck, I am sorry to say.

Mr. Bott: I know. You have said that many times but that design procedure happens to be the one used.

Mr. Kahn: Thank you.

9.3.12 Mr. Brandston: *Have any positive evaluative studies been made on your Norfolk, Virginia building? Part one. Part two says:*

I have surveyed the building lighting and the lighting is fine until you look away from the task. How are you going to fix this lighting and the environment that results?

Mr. Bott: This is one of the buildings that I mentioned is due for occupancy in a month or so.

We have every intention of surveying this building after occupancy. We have a number of professionals on the staff who will be making this follow-up survey of the building. If additional lighting or other changes are needed, they will be made.

If worthwhile information is obtained, then it will be made public just as it is being made public on the Manchester project.

9.3.13 Dr. Beck: *"You started this!"*

Physicians are restricted by patients who must give informed--it is underlined -- informed consent. Physicians are reviewed by their peers to see if their results meet average figures, and by government which examines and licenses. Should not IES define levels of adequacy?

Mr. Squillace: Of course. I said in my remarks that the professional should be examined. Go to school. Be educated in the proper manner. Be examined by your proper peers. Give state, federal, even international registration.

When we talked about education, and we will talk about that a little more, sure, they should be qualified. That is my whole point. Once they are, then they can be allowed to interpret the data that comes from research and use it to their clients' best needs. I think that is what the doctor does.

9.3.14 Mr. Waldbauer: *In every profession now using registration and certification at the time of implementation there was permitted a grandfather's clause. Thus, the level of confidence would only gradually be improved.*

9.3.15 *How can 9-80 be abandoned now?*

Mr. Squillace: Obviously, 9-80 has nothing to do with the qualification of people. If you look at what happens with 9-80, you get no more visibility out of that compared to somebody who just slapped in some fixtures. You may or may not get good visibility by accident unless the geometry is studied and put in writing.

For those who know enough about that, they are probably already qualified. So I don't see where 9-80 ends up in the fixture.

9.3.16 Mr. Wotton: *The professional associations say that they cannot restrict lighting design to registered professional engineers. Searchlighting has been designed solely by people who are not professional engineers. No court will hold that the act applies to lighting design.*

Mr. Squillace: Each jurisdiction, I am sure, will rule differently on these things.

As an electrical engineer, I can tell you there are an awful lot of electrical engineers who are neither graduates of schools nor registered people because they didn't apply themselves at the time of the grandfather's clause and now it is too late for them. For example, now you must be a graduate in Michigan to even apply for the examination. You can't apply any more if you are not a graduate.

At least there are a lot of engineers that I know who are good ones and who are practicing now.

9.4 ORAL QUESTIONS/COMMENTS BY AUDITORS

Mr. Kahn: I have a number of comments, but in the interest of time, I want to make a recommendation first.

I think we are subject to oversimplifcation on one hand and complication on the other. I don't agree with the standards that are being recommended, on the watts-per-square-foot basis, nor do I agree with ASHRAE 90-75 recommendations, because they don't relate to vision and they don't relate to real energy conservation.

We do have a footcandle section in the Handbook that the design fraternity is familiar with. Footcandles have been the basis of IES design recommendation for years, and as a matter of fact, Steve, you can't talk it away. But they have to be practically modified.

I make this suggestion to the IES:

Take the present "footcandle recommended standards" in the IES Handbook, and simply add to each numerical recommendation where it states: "50 footcandles; 30 footcandles,"--or whatever, for example, the task or areas called for--the following words" "or the equivalent in visual performance (asterisk) with the lowest energy input." Make this addition a fundamental part of every footcandle recommendation in the Handbook, so Norman Bott or anyone else can gain the benefit of either the recommended footcandles or "the equivalent visual performance alternative," "with the lowest energy requirement." One additional factor should be included. Visual performance should be identified: "(Asterisk) In terms of ESI and contrast rendition factors, in accordance with current Illuminating Engineering Society recommendations for ESI." That will solve the problem, and assure receiving the best in lighting for vision, and at the lowest energy requirement.

Voice: Mr. Frye, in dealing with the coordinates of contrast and the background illuminance, shouldn't the Society adopt a broader definition of visibility to take into account all of the cognitive factors involved in seeing the illumination and the viewer?

Dr. Lewis: How visibility is defined is less important than the necessity for us to all define it in the same way. It has been defined in a particular fashion in the present system.

In the system to be recommended in the Handbook it won't be defined at all. It will not be a concept. But, as I say, how you define it is irrelevant.

I think people are cognizant that the ability to see is dependent on all of the things that you measure. How you define visibility has been argued and can be argued some more.

I think we all have to use the same definition. That is my response.

Dr. Atkinson: George pointed out the difference in perception between two different types of lighting restrictions.

I would also like to point out that there is a real difference in perception between, for instance, a cool white and a warm white situation. I am sure many of you have had experiences of this.

Yet, in the performance evaluation conducted by Stan Smith on high pressure sodium versus cool white lighting, which is a tremendous difference in color temperature, there was little or no difference in performance.

George, I ask you, do you think that this is representative of the visual perception? And, if not, why not?

Mr. Clark: I think the situation there, Russ, was that we were dealing with white and black tasks so that there was no chromatic contrast involved in it and we were not making the kind of subjective brightness appraisals to which you referred when you talked about the cool and the warm.

I don't think that was of issue in this particular experimental approach, which is the reason it came as it did.

Dr. Yonemura: Both Dr. Ross and Dr. Lewis recommended that luminance be kept as the relevant metric. You also made a point that you wanted designers to interpret, evaluate and use experimental data, which takes a lot of expertise.

As I understand it, the reason why luminance cannot be used as the metric is because of the objective of practitioners saying it is too difficult to calculate.

How do you resolve that?

Mr. Squillace: You said illuminance is too difficult or too complex?

Dr. Yonemura: No, luminance which is the thing that both Mr. Ross and Mr. Lewis recommend.

Mr. Squillace: I suppose that the reason or the difficulty that arises in the field is once you have illuminance, (if you calculate) then in order to get luminance on the surface, you need to know how it reflects light.

Most of the calculations done today are done with a reflection factor that is an overall integrated value of the surface's various facets. This number times illuminance is luminance.

If one were to properly define that, I suppose one would look at both the complete hemispherical reflectance of the surface and the luminance that existed at all kinds of angles.

If you get that complicated about it, it gets very complex. If you leave it as an integrated value, I don't think it is too complex.

One of the complexities that my colleagues in the field object to is that it is very hard for them to come up with a value of reflectance for the various surfaces. They don't know the reflectance of the ceiling tile, for example, at least so they say. Most of that is just plain laziness. They do know. If they can overcome that, they have no problem, as I see it. Those are the only complexities as I see it.

Voice: Since ESI is known to vary by a factor of two or more for representative tasks at the same station, isn't it a difficult metric to use and establish as a guideline for a lighting environment, and I direct this to anyone on the panel?

Dr. Ross: The only justification at all of the complexity of ESI is that it was supposed to be or hypothesized as a model which would predict performance based upon its value.

It turns out that it doesn't do that. In fact, in every bit of evidence that I have seen on experimental results demonstrates there is no correlation at all, or at least if there is, it is very, very sparse.

Therefore, there is no need to go, in my mind, with the complexity of calculating ESI. It is completely unjustified. I think it is almost irrelevant, and the fact that it varies so dramatically from location to location and from target to target and from viewing angle to viewing angle and for every bit of geometry involved, in my mind, makes it a very poor criterion, particularly coupled with the fact that it doesn't do what it was originally created to do.

Mr. Jewell: I think the morning's discussion has been extraordinarily important in terms of design. I would support almost everything that has been said on that basis.

I would, however, caution those in the room who are here observing this day and a half with respect to conservation, which is, of course, an important issue to me. Yesterday, as you know, some of us felt that there was curtailment. So we are very concerned about daytime lighting tricks.

I think it is important to remember that one saves energy in lighting systems by turning them off. I would counsel you that we may debate levels endlessly, but I would counsel you that conservation in lighting comes from the control in lighting systems in time and that at some point past the determination of these kinds of nuances designs must be made, the decisions about the controls of those systems.

Dr. Clear: In line with Don Ross's skepticism on ESI, and I gather the skepticism on footcandles, I am a little curious why anyone classifies something as complicated or as detailed as a footcandle level per task instead of just saying we don't really know what is going on so why not just say you do 3 watts per square foot, because that way I won't use too much energy. If you think that you can do a job much better, then go do it.

Dr. Lewis: The reason that we have to put it into two steps is because there is a concern that if we don't, the abuses will be worse than the uncertainties. It is as simple as that.

There is concern within the Society that if no levels at all were specified, then more damage would be created than if the levels were specified.

Mr. Crouch: Mr. Chairman, I guess I need to bring to the attention of everybody that IERI has been conducting a research program at universities for the last 35 years. We have been conducting symposia internationally and attempting to obtain the discussion of the scientists from various countries to obtain a system of evaluation, including a system of assessment of the lighting necessary for the various degrees of performance. That system of assessment is now before the Kyoto Conference of the International Commission on Illumination.

It has been approved by a 19 to 1 vote of all of the scientists of the various countries. Our studies of such a system have been going on since 1950.

I am surprised that some of our panelists haven't mentioned the fact that on quantity of illumination alone, we have spent a half million dollars in a series of experiments to find out what system is appropriate to assess the illumination necessary.

10.0 ISSUE NO. 7. "INTEGRATION OF SUBSYSTEMS"

10.1 WRITTEN STATEMENTS BY PANELISTS

10.1.1 Dr. Ross: 1. The principal interaction of an electric lighting subsystem is with the overall visual system of the human observer. Too often in the past, the only variable to be optimized has been lighting intensity. It has been repeatedly demonstrated that the demands placed on the electric lighting subsystem are very minimal if proper attention is given to improving other portions of the visual system, such as glare, contrast, color, size, and viewing angles of objects of interest.

2. Secondary interactions occur between electric lighting and natural lighting systems. Each should be incorporated to optimize the visual system, subject to the other constraints in the built environment.

3. The major remaining interaction is with the heating, ventilating, and air conditioning systems. This relationship is well understood and only becomes quite complex when the effects of natural lighting are included, and the overall human-building environment is to be optimized.

10.1.2 Prof. Smith: The relationship of associated systems and their impact on the design and operation of electric lighting systems.

Daylighting

The complexity of daylighting design has significantly increased as it has become appropriate to evaluate the design by its energy efficiency and its cost effectiveness.

To achieve these goals requires a multiple discipline understanding of the concepts and of the ramifications of daylighting design. In almost all cases, the Architect, the Illumination Designer, the Electrical Engineer and the Mechanical Engineer will have to make decisions on the same issues but at varying levels of specificity and with different objectives at stake. In the early stages of design, the designer must have available generalized information that requires a minimum of computation time to test concepts for feasibility. As the design progresses to the working drawing stage, the computation requirements become more rigorous as the design objectives are achieved.

Unfortunately, at the present state of the art, the needed information to make many of the necessary decisions is either not available or is not in appropriate format for use by the professional design team.

> A Daylighting design handbook of acceptable practice should be developed. This handbook should be formatted to fulfill the needs of the disciplines involved and should include needed algorithms for calculator and computer programs.

Calculators and Computers

The programmable calculator and the "smart" terminal are powerful computing tools that are now within the budget limitations of even the smallest design office. These tools make possible systems analysis that previously was considered too laborious and they assure a higher degree of accuracy than was probable by hand methods.

These small computers have numerous applications in lighting design and with properly prepared software will enable a designer to explore several design options for each situation. The end results should be higher quality lighting designs that are also sensitive to other systems.

For the designer to use this hardware effectively, programs and input data must be readily available and in a format that facilitates the process.

> Data standards for the lighting industry should be established with built-in assurances that the data is within acceptable tolerances. Also, algorithms and documented programs should be made readily available to the designers.

A concern of mine which is germane to this issue is the tendency for an increasing number of designers to become dependent on lighting product manufacturers for computer services. I do not mean to infer that these services have had a negative effect on the quality of lighting designs to date, but rather I am concerned that a black box syndrome may develop. If a significant segment of the design population begins to accept computer designs without understanding the algorithms that were used to produce those designs, a market situation may develop that is unhealthy for both the design professionals and the manufacturers.

10.1.3 Mr. Squillace: I am reminded by a friend of mine in the audience that there are other Italians other than Anthony and I such as those ending in A, such as Yonemura.

I shall define Subsystems of Electric Lighting as follows:

1. Daylighting
2. Task and Ambient Lighting
3. Lighting Controls
4. Mechanical Systems Interface

When a space is studied for lighting purposes, calculation should be made comparing all of these systems in some sort of combination. Daylighting should be set so that artificial lighting is either dimmed or shut off during the daylight hours; but this only after interfacing with the mechanical calculations to find what the heat loss/heat gain implications are when turning off the electrical lighting energy and introducing glass structure to take its place.

Further, the above calculations should be made only after the mechanical and electrical engineers have properly optimized the efficiency of motors, transformers, feeders, appliances, process loads, etc. and also optimized the power factor of all circuits and totally for the building. (Optimization here means optimization for energy and life cycle costing for reasonable payback period.)

It is my opinion that the electric lighting and envelope of the building do not make up the significant users of energy within that building structure (especially in industrial plants). It seems, therefore, foolish to chase only 5% or 10% or 20% of the load when one should chase 50% in all the other building components before chasing the last 15% or 20%. One should optimize all systems, but first things first; priority is in order.

The best procedure to follow, whether for new or existing buildings to be remodelled, is to produce an energy audit for all load components in the building. Then follow a step-by-step evaluation of all subsystems, i.e.:

1. Energy audit.
2. For the large components of energy users, make load profile curves so that KW or BTU peaks can be compared on an individual basis against each of the individual loads.
3. Determine from this a feasible way to reduce or shut off loads at various times of the day.

4. Provide both micro-processor control and manual override.

5. Use the most efficient and high power factor components possible.

6. Then check lighting loads in the same manner (profiles) against daylighting variations and against the other individual large load components.

7. Decide how to underwrite proper dimming and/or shutting off of lighting loads.

8. After all this, then write the computer software for computer control.

It bears emphasizing that calculations for transmission and distribution within the building should minimize I^2R losses from all causes such as large voltage drops and low power factor; and further, that lighting, electrical and natural, should be based on visibility criteria at least in equal proportion to aesthetic criteria.

10.1.4 Ms. Harrold: In the future we must move away from prescriptive standards, which deal only with sub-component performance, and begin to analyze the total performance of a building through the relationships and integration of subsystems. Herein should lie the possibility of the design team being able to fully address the energy usage of a facility, rather than just its power or connected load limit, and therefore being able to design buildings for anticipated use.

The IES Energy Management Committee this month has begun to investigate usage, having spent some four or five years coming to grips with the budgeting procedure for power, as developed for the ASHRAE 90-75 and proposed 100 series standards. With a thorough knowledge of how to calculate limits, we can now look for the methodology of creating a true energy performance set of criteria for lighting, suitable for integration with other building factors in determining usage patterns.

In order to create such an energy budget for lighting, as opposed to a power limit, and especially differing from the oversimplified single number watts per square foot types of limits adopted by some states, we must include contributions from daylighting and consider the use of controls for improved operating schedules.

Such effective interaction of subsystems for lighting should result in optimizing the operation not only of individual luminaires, or groups of lighting components in one area, but through the balance of electric lighting with daylighting and HVAC systems, the reduction of peak demand for that facility.

In addition, energy management through total building performance computer programs should be an increasing trend as more large industrial plants, some stores and office buildings are made aware of the multiplicity of systems options and the monitored benefits become apparent. Small programmable units may control lighting, air conditioning, heaters, freezers etc., while larger energy management system computers are capable of monitoring and controlling system power requirements to reduce total energy consumption and keep demand within a desired limit.

The daylighting input is going to be a very valuable contribution to whatever we do in terms of an energy budget procedure. I would encourage and urge if any of you have any daylighting studies, please pass the information along because we need it desperately.

Again, Neil DeKoker made some mention yesterday of GM utilizing those kinds of systems as many other large individual users are doing. I think one of the other panelists made mention of the fact that we need to be careful of relying on

computers and I would wholeheartedly support that. We can't rely totally on the machine. There is a lot of human input that still needs to be evaluated.

Mr. Cornish: Thank you, Rita. As you say, there seems to be a fair amount of consensus on this subject by the panel. I would ask the members of the audience, the auditors, to put their questions in to the readers and I would open up the subject for debate amongst the panelists.

10.2 PANEL DISCUSSION

Dr. Ross: There seems to be a good deal of agreement between the panelists on this particular subject. I don't think anyone would take exception to what was said. The way of the future is integration of systems in the buildings. I am sorry that the illuminating engineers in Great Britain feel put upon by being put in that group. We sort of welcome it here, I believe.

Rita, if I could maybe take issue with you a little bit on one of the things you said regarding watts per square foot. It reminded me something of a parable because our differences of opinion were made clear yesterday, I suppose, but I am reminded of a parable that some of you might have heard me express before.

In olden days in Russia when they wanted to take the cow to market, it was customary to weigh it. The procedure went somewhat like this. They would take an ax and put it up in the arc of a tree with the sharp edge upright and put a beam across it. From one end they would drop a rope with a sling in which to put the cow and from the other end they would drop a rope from a platform. Then they would gradually take this platform and fill it with rocks until they got an even balance. Then all they had to do was to estimate the weight of the rocks.

It seems to me that the procedure in ASHRAE 90-75 does somewhat that kind of thing. First you estimate the lighting levels required for a task that you are not really sure of. Secondly, you estimate or prescribe the number of square feet that this task is supposed to occupy, and thirdly, you multiply it by a number called coefficient of utilization, which has as a result no relationship to task lighting, and get a number. Then you crank these things through a very laborious process into watts per square foot, which you feel is more representative of the right watts per square foot.

My approach is simply to estimate the watts per square foot based upon the experience of various kinds of buildings. I guess that is our major difference.

Ms. Harrold: The only thing that we feel, and this is the fundamental difference, is that our particular IES procedure results in a watts-per-square foot limit, which is based on sound criteria. It is probably the best method we know to attack the problem at the moment, rather than somebody just saying that a certain watts per square foot is appropriate.

Mr. Frye: I am not sure if I am just being continuously misunderstood or misquoted, but I never said it was a bad thing that the IES was necessarily going to be a member of the CIBS. All I said in my reserved judgment was that there were some doubts by other people in the community in the UK that this might destroy the importance of lighting as such.

Mr. Squillace: All of us have mentioned this energy thing. There is probably something else we ought to look at. We should not lose sight of the fact that there is, after all, some aesthetics and artistry that goes into this thing. We have been talking of vision, disability, criteria, geometry and all of the rest of it, and optimizing on all of these things.

Obviously the designer should use his or her sense of artistry to bring to bear for the client. They are working for a solution that is suitable to the aesthetic sense and the artistic sense. That has to be right in here. No question about it.

Saul Goldin kids me about my ancestry and their artistry. Let me say it is built into every fiber of my being. I do like good music and I like good art. That has to be factored into this equation.

I don't know if that will waste any energy. I am not sure. I think it could be optimized just like all of our systems.

So, as another factor, and I had four factors in my discussion, which are daylighting, task lighting, ambient lighting controls, economical subsystems interface, and--there should be another--aesthetic and artistic interface.

Mr. Clark: May I just mention once more acoustics as one aspect of the environment. Nobody seems to have touched on it though we discussed it briefly yesterday.

Commenting on the British situation, I have always found it quite interesting that they have in their lighting code reference to the so-called deep plan office. I have not been able to determine that we use the term architecturally in North America. If you look at the recommended illuminances there is a separate recommendation pertaining to deep plan offices calling for a basic in service illuminance of 750 lux. From my British friends I have determined that this concept relates to the distance of the inner wall from the window wall. It follows that there is an assumption of daylight availability in addition to the 750 lux. In our own case we do not suggest whether the levels should be achieved by completely electrical lighting or completely by daylighting or by some combination.

A final point relates to the IES versus CIBS in the United Kingdom. From my own close relationship with a number of the people who were active in the British IES, including George Cole, the former secretary, I have learned that there is concern that since there is not an active academic backup for lighting the need for concentration of attention to this discipline may be lost in the integration into CIBS. While it may work out fine I think that is the essence of their concern.

10.3 WRITTEN QUESTIONS/COMMENTS BY AUDITORS

10.3.1 Mr. Goldin: *For daylighting data, check IES journal, November issue, year of 1914.*

Ms. Harrold: May I ask Mr. Goldin to send me a copy.

Mr. Goldin: We are fortunate to have the entire library of the IES. I started from the first volume.

10.3.2 Mr. Burkhardt: *Would the IES approve easy-to-use approximations which could provide for daylighting for insertion into this 90-75 standard?*

Prof. Smith: I believe there is very much of a need for this. I have read our most recent publications on daylighting. I find that the architect cannot relate to them and, yet, the architect is the basic person making the decisions about daylighting. The architects are the ones who decide what and where the windows are, what shape and kind of glass goes in them. I believe they are the key persons in the daylighting design. They need simplified information because at the conceptual stage they don't have time for large computations. However, I hope it is fairly accurate, fairly simplified information.

Ms. Harrold: I think one of the important words in that statement, and not just relevant to daylighting, is the word "simplified". Whenever we have a data bank, we accumulate information. If we don't take that, we the independents, we IES, or whoever, to translate for the end user, I don't think that we have anything at all. If we just put out the bare research data without some kind of interpretation, we will be in trouble.

Unfortunately, for the uneducated layman type of person or practitioner, we have not really done very much of a job. We are only 50 percent on our way in creating useful information.

Mr. Frye: I don't know, but I suspect that I am the newcomer to the lighting industry. I would like to re-endorse what Rita has said. It is amazingly difficult to begin to understand what is going on in the lighting industry when you first come into it. It is very complicated. There is a lot of interpretation going on. It is very hard to understand the simplest things. This is something that is truly missing.

Mr. Amick: A question from yesterday morning that we didn't get to from Morgan Christiansen. It may be applicable here.

10.3.3 Mr. Christiansen: *Because of the lighting system to some extent affects the entire electrical industry, to what extent does the IES cooperate with other engineering societies?*

Mr. Cornish: I suggest that the technical vice president of the Society be the appropriate person to answer that question.

Mr. Squillace: I will do my best, George.

We do interface and do so very strongly and for a lot of reasons with ASHRAE, obviously. We have not only interest in ASHRAE 90-75 but ASHRAE has been thrown into the lighting bullpen. We must work together on the problems that are there. We are doing a lot of interfacing there.

As a result of codes and budgets--well, mainly energy--we will be interfacing, I am sure, with IEEE. We have not done too much interfacing with electrical engineers except as individual members. We have, of course, worked with them, and the office or staff in New York has kept in touch all of the time. But we are just beginning to come to grips together with working out some of the problems that are concerning us about energy. I don't know that there has been any interfacing other than the standards-making body like ANSI and NEMA and the rest of them--which are not societies in a sense. IEEE and ASHRAE, I am sure, have. Perhaps the staff can help us on that, too.

Mr. Cornish: We will get that when we go to the discussion from the audience, Mr. Squillace.

10.3.4 Mr. Kahn: *Don't overestimate the value of daylighting. Its quality varies too widely and it in itself can diminish the value of interior lighting quality because of the brightness differences.*

Ms. Harrold: Absolutely, agreed. No contest with that statement, but it is a factor that we must look at in creating an energy budget.

10.3.5 Mr. Berman: *Is daylight given any energy credit in ASHRAE 90-75?*

Mr. Squillace: Not that I know of. Don, maybe you want to--

Dr. Ross: I don't believe it is in 90-75 as far as the lighting portion of 90-75 is concerned. There are some proposed energy codes coming up that do consider daylighting as a portion of them. I think it could be interpreted in 90-75.

Prof. Smith: That's correct. It is not addressed in 90-75. I also want to point out that it is not addressed in the Calendar which has been or is a DoE-1, which is a large computer program that is used--supposedly going to be used in support of the members' program. It doesn't recognize daylighting either.

Mr. Clark: It is a 90-75 in one context. If you have a situation, and I say can be, if you have a situation where you have daylight at all times and you don't have

to meet non-daylight circumstances, okay. The difficulty is that since 90-75 doesn't address energy, it addresses power. There is no way to reflect the cycle of usage, the profile of usage in there at the moment. That is the issue in that.

10.3.6 Dr. Clear: *How do occupants respond in artificial lighting in response to changes in daylight levels?*

Mr. Amick: I assume perhaps meaning how do you design, as daylight levels change, you change the artificial lighting also. It has been covered in a recent LD&A article.

Mr. Frye: I don't know how many such factories there are in the States, but I saw a whole factory in an office block in West Germany. There was a balance by having shutters outside of the windows. They kept a constant level with optical equipment sensors.

I personally found it very irritating every time I was trying to make a statement to find that the shutters came down in mid-sentence.

In terms of maintaining levels, I wonder if there is anything similar to this being carried out in the United States. Certainly it would be of interest.

Dr. Ross: I think the other approach has been tried here on several occasions. That is photoelectrically controlling the electric lighting system to try to maintain a better balance.

Mr. Frye: I suppose the results are good or bad?

Dr. Ross: Most of the systems I have seen have been disabled.

10.3.7 Mr. Waldbauer: *None of you differentiated between connected load and energy usage. Are not the use of individual controls basic to task-ambient systems to gain minimum kilowatt hours?*

Mr. Clark: I would like to take exception to Walt's comment that none of us has addressed this point.

This has been my persistent comment on several occasions, when addressing energy, as opposed to power, we would have an opportunity to do it. Until we do, it is difficult to weigh those into the equation.

Prof. Smith: I think it has been mentioned several times. This is where we are right now. The energy management committee under Rita's direction is just now launching into this particular area. I know it seems to take a long time to get EMS-1, and EMS-4 out.

As you know, we are a totally voluntary organization. It does take time. Now we are launching into the energy area, so I certainly hope that we will be successful.

Mr. Amick: Two questions both from Myron Kahn for Steve.

10.3.8 Mr. Kahn: *First, who is this artistic designer you talk about. The engineer or the architect?*

Mr. Squillace: It is truly artistic and is indeed a derivative of an area of Italy. He has his feet on the ground and he knows how to interpret peoples' feelings, make subjective innuendoes of people and design for them.

All kidding aside, there is a relationship that grows between clients and engineers and architects because there is a lot of repeat business done with people and certainly they begin to understand the client's facets, the client's desires,

and the people who work for the client are somehow interfaced with the client. When that happens, there is more than just the business of understanding the science and its genesis. There is more than just numbers. You have the factor in there of some sort of human understanding of the other person and that is what I am talking about.

I don't know if it is the architect or the engineer. Maybe it is both in many, many cases.

Mr. Amick: There is the second one.

10.3.9 Mr. Kahn: *If you give an owner an alternative between aesthetics in the working environment, or functional lighting, and aesthetics cost him double--like $100,000 extra in electricity each year--you know there will be one choice; namely, function.*

Mr. Squillace: That is right. I think you are going to an extreme there. I don't think that is the way it would turn out most of the time. But if it did, the owner makes that decision. I think again it is up to the profession to point out what he or she believes are pertinent to the solution at hand, the needs of the client. If the client wishes to decline, fine. You have at least done your job.

10.3.10 Dr. Berman: *How can an existing building with an existing lighting system be moved to respond effectively to time of day, kilowatt hour rate? I am assuming he assumes there are different kilowatt hour rates for the different times of the day.*

Mr. Squillace: Sam, I think what your meaning is, and you correct me if I am wrong, there may be differences between valley hours and peak hours in the rate that the utility charges?

Dr. Berman: Supposing the utility moves the time of day pricing and you have an existing building with an existing lighting system. How can you effectively move that so that you give the building owner or the manager a system which will be economical?

Mr. Squillace: I suppose that one starts by looking at the profile curves of the load itself as well as the profile curves of cost versus the kilowatt hour, to see where the peaks and valleys are so that one can phase the lowest cost for the highest wage in accordance with utility commission rules. To do that of course one may need some instrumentation. Maybe putting on some recording meters in order to get a full cycle of use, hopefully for all four seasons. That is the approach that we use.

As a matter of fact, we are doing a job for one of our clients right now doing exactly like that. We have put on the recording instruments. We are going to be mixing kilowatt demand and kilowatt hours and several other factors, the power factor and some other things, where we can predict what is going on for the next three months and then we can see how that compares with a lot of things and not just the rate structure.

Dr. Ross: I don't know why Steve should have a corner on these ethnic stories. I was reading in the Wall Street Journal appropos of what we are talking about here, that with the advent of the new Polish Pope with his rather keen intellect, that Polish jokes are now going out of vogue and are being replaced with American jokes.

The story asks how many Americans does it takes to change a light bulb? The answer is five; one to turn the bulb and four to make an environmental impact statement.

The answer to your question. I think unnecessary lighting shouldn't be installed at all. If the electric rates go up during a certain period of time in the day, the object should be to keep the demand down during that particular time. This should make the use of daylighting a lot more economical than it is at the present time and the additional controls required would be more cost effective.

Prof. Smith: Finally it has arrived. I agree totally with Don. If I were establishing a hierarchy as lighting design priorities, the power companies need for demand control would be at the very bottom of that hierarchy, the reason being very basic. There are many other things that we can do that have a greater impact on the electrical demand of the building, and if our lighting system is designed properly, then we need every bit of that light at that point in time. We better cut down on the ventilation rather than reduce the productivity of the people in the space.

10.3.12 Dr. Ventre: *The architecture profession was the original integrator of subsystems but evolution of subsystems specialists has outrun integrating methods. Thus, construction management, specification writers and interior design have "spun off" to their own groups. Is it inevitable that more precise knowledge of experts will pull things further apart?*

Prof. Smith: I can tell you that in the College of Architecture at the University of Illinois, we recognized this problem. Next year we are asking the practitioners throughout the State of Illinois and in the general area to advise us how we can improve our educational offering at the University so that they can deal better with the subsystems approach. It is very complex.

All I can say is that we recognize the need to treat this area. How we are going to do it, we will just have to wait and see.

Mr. Squillace: I think, Dr. Ventre, you are right. There will be a tendency to pull things even still further apart. I think it behooves the architect and the structure of the schools, as Bob mentioned, to recognize that and become the coordinator. I still feel that the architect could be the coordinator of all of those systems. Whether she or he will be or not remains to be seen. Obviously it depends on the personality. A strong architect could do that, not say that they would understand and be able to deal with all of these things, but certainly they could be the conductor. Toscanini could not play every instrument in the orchestra, but he sure as hell knew when somebody was off-tune.

Mr. Amick: Dr. Ventre, as part of the same question, says:

one way to integrate environmental qualities is to trace the interdependencies of environmental attributes.

Prof. Smith: I guess I am going to be the brave one. What bothers me is that I am afraid I am not always like this.

It is a very complex list. We can start out about anything, the color of the fluorescent lighting, to the perception of the temperature within the space. We can go on and on.

Am I misreading the question?

Mr. Amick: No.

10.3.13 Mr. Atkinson: *How many watts per square foot can you spare for esthetics? Then he has a little parenthetical phrase here, "Italian or otherwise."*

Mr. Unglert: Steve, if I can have just one minute. Don, it takes fewer Italians to change a light bulb compared to other kinds of people. It only takes two, one to call the electrician and one to mix the Martini.

Mr. Squillace: Russ, I suppose that the watts per square foot to be allowed for aesthetics is obviously an unknown quantity. I don't think anybody is qualified to say how much we allow.

It seems to me there is that human need to see what we psychological feel is good or pleasant for us, it is pleasurable, whatever the words are, and if that gains you -- I can't see be sure that that doesn't gain us some productivity, too--but until we know what those answers are and obviously some of the work that Dr. Flynn and Fox in England have done or started at least can start to lead to that.

I don't know that we are going to be able to quantify it like some of the other terms, but certainly we can make an approach.

Ms. Harrold: I am not sure from what basis Russ is asking the question. If you are talking about watts per square foot derived from a calculation for a power budget, I would like to stress and underline the fact that EMS-1 and EMS-4 could not have been developed as design tools. They are very simply calculation procedures to arrive at a limit beyond which the designer must not go when he does the design.

The calculation does not have anything whatsoever to do with selecting luminaries that are going to be used in the end design, or selecting light sources that are going to be used in the end design or in any of those parameters.

What the designer then does with that limit is up to them. He could do one space entirely with a very efficient incandescent system if that is his choice because aesthetics are important. As long as his building budget is not exceeded then his design choices are open-ended.

Mr. Frye: I think we are asking a question that is asked and answered in apples and oranges. Aesthetics can't be calculated in watts per square foot.

I think the question needs to be answered not in apples or oranges, but answered in melons. The object of that is very simple. Do you prefer democracies or do you prefer a socialist system? Do you prefer a controlled state where everything is to a rigid standard or not?

In that sense there is a degree of freedom to be able to incorporate some aesthetics standards within the building.

Prof. Smith: I believe it is easy to infer, if you study John Flynn's work, that in fact you can reduce the illuminance level and maintain productivity while you are enhancing the space that would lead to an actual overwattage in the space. That takes a little bit of inference. I am not trying to quote John on that, but trying to extrapolate from his research in an applied fashion.

10.3.14 Mr. Kahn: *You commented on the use of Squillace's calculation system. You might have been referring to your comment about justifying ESI calculations. I don't know whether you referred to lumen 2. I don't think you referred to that word.*

Mr. Amick: Mr. Kahn says, was your comment based on aesthetic or engineering considerations?

Dr. Ross: I really don't understand the question.

Mr. Amick: The only calculation system I believe that you mentioned had to do with calculating ESI?

Dr. Ross: That's right. I said it was a very complex calculation.

10.3.15 Mr. Kahn: *If 90-75 does not address itself to energy conservation, since it's a power budget, how come DoE recommends it for adoption as a state energy code for conservation of lighting?*

Mr. Clark: The history of ASHRAE 90-75 goes back to the Bureau of Standards. In February of 1974 the Bureau released a document, the number of which I can't remember, which was eventually passed along to ASHRAE for further development and consensus treatment. I can recall that about three days before the Bureau was to finalize this document John Kaufman, Bill Tao, Frank Coda and I were at the Bureau where we struggled with the notion of energy versus power. We were unable, however, to determine how to make the architect and engineer designing the building responsible for its usage. This is what one gets involved with in new construction.

We are still struggling to find an answer. As some of you know the BEPS (Building Energy Performance Standards) proposal is expected to make an attempt.

Faced with this difficulty we had to move to a power concept at the NBS meeting which I referred to and it has been continued in the 90-75 document.

Nonetheless, we are still arguing, discussing and suggesting to DoE that for existing buildings we have "another ball game". We ought to seriously consider the use of kilowatt hour constraints rather than wattage constraints.

Mr. Kahn: It is recommended to save energy.

10.3.16 Mr. Waldbauer: *What is your definition of a reasonable payback period?*

Mr. Squillace: That depends on the client. Everyone has a different way of doing it. It depends on the system, too, I suppose, to a great extent. At least we found that to be true.

I have seen payback periods ranging from three or five years or as much as 40. So it depends on the system, the client, the way they write things off, their capitalization, their interest rates and other things. I don't know what it is. It depends.

Mr. Cornish: The government sometimes look to a hundred years, don't they.

Mr. Squillace: That's right.

10.4 ORAL QUESTIONS/COMMENTS BY AUDITORS

Mr. Fisher: A quick comment about some additional liaison, communication with other technical societies. Steve mentioned the ASHRAE, of course, and the IEEE. But in the Washington scene, we have four representatives with two different groups down there in liaison with other technical committees or technical societies.

There is the Research Corporation of AIA, the work that they did, and there is also Architectural Engineering in the Federal Energy Agency.

I think those groups, liaison groups, did a lot of work in inputting things appropriate in the organization.

Then, the president of the Illuminating Engineering Society does have quite a number of functions with many other professional groups, with technical groups in the year, I rather imagine that you are going to see more contact with the AIA in the coming year, with John Quinn, as the president of that.

Dr. Atkinson: This is a comment to Michael Frye. I think you hit the nail on the head, Mike. The term that comes across which hadn't been used very frequently by the panel is "quality of life."

Quality of life in the United States, five or seven years ago, was big eight-cylinder automobiles, driving around and eating up gasoline. Quality of life is changing. Is it going to change in lighting as well? That is the big question when facing aesthetics. How many watts per square foot or whatever metric that you are going to use can you afford to put into aesthetics--and aesthetics is going to cost you no matter what. You are going to give up something in terms of energy to get the kind of aesthetics that the designers want.

Mr. Frye: I think that is right. I think this whole issue is about what do people want and what is the philosophy. I think the reality of what people want or are demanding is changing very substantially.

The answers that are correct today may not be correct tomorrow. I think we want dynamic systems and dynamic interrelationships to satisfy what is wanted in the outside real world as opposed to what is the solution for just today.

Mr. Squillace: There is no question that aesthetics costs watts and is going to cost us some money and decrease from some of the other wattage that is left if we leave an upper limit.

It is not only necessary but it is also productive. In our building, for example, our company moved from a rented space to a space that they bought and remodeled, and it looks, I think, pretty nice for an architect's office.

There is no question in my mind that the greatest percentage of people, not everyone of course, is much happier in that building compared to the one that we had before, and they are somewhat more productive.

Until we put that kind of gauge on it, I don't know that we have any real cost that might not get us something better, too.

Dr. Beck: The first comment is that there are relationships growing between our profession, the medical, the hospital profession and AIAS.

The second one is that windows are a two-way affair. Aesthetically it is great for me to look out the window to see it is a nice day. I think this deserves important consideration.

The third is the aesthetics. I recently had the opportunity or the unfortunate opportunity of being with a client who criticized his designer, and his designer said, "Who dares criticize Van Gogh?"

Dr. Clear: I wanted to respond to the response of Dr. Berman's comment on the time of day pricing. It is in response to Mr. Smith's and Mr. Ross' response.

The lighting costs money, obviously. I am somewhat surprised that they did not feel that lighting should be sensitive to the cost of electricity because what you are doing is balancing the productivity against its cost.

Further on, I was particularly surprised with Prof. Smith's comments that he did not feel that ventilation, heating and cooling, particularly at a time of peak pricing, which is generally the time when the ventilation is being used the most and is the hottest outside, that these factors don't affect human productivity too. In fact, perhaps just as much or even more so than lighting, so you might want to respond more to the use of lighting and cooling.

Prof. Smith: I think you misread me a little bit. I did not say that ventilation couldn't affect productivity. What I said was if the lighting was properly designed, i.e., it was already at a minimal level, then there were areas where greater savings could be achieved to reduce peak demand.

In other words, I guess, I would rather have a little more odor in the space than I would a little less light. That is my contention.

I think my productivity would be affected less because I stink than it is because I can't see.

Mr. Goldin: I don't understand this discussion about aesthetics. If the purpose of life is not aesthetics, then I don't know what the purpose is of life. There is an awful lot of confusion about what the answer is, all of these fruits that you were describing a moment ago -- all of that sort of thing. The question that was asked about specialization is the critical question that we have to deal with as a society.

Specialization in the United States, which has made us a great and productive country, has also caused us problems of narrow vision. It is that narrow vision where we are at. If this meeting is for the purpose of extracting more relevancy of the work of this society, then we have to make some definitions.

We have been talking about responsibility and irresponsibility--quacks and prayers, knowledge by education, experience and all of this stuff, and knowledge by virtue of a half-minute course in some interior design school and you are a lighting designer.

Take this room, which has been referred to; you notice it is all in the eyes of the beholder. If you can see this through my eyes.

Dr. Ross: I want to respond to Saul Goldin's comments on aesthetics. We should realize that there are many ways to create pleasant atmospheres, and those that use energy ought to be looked at as being less desirable. You can put color in a space and do a lot of things that use available lighting, otherwise needed for performance, to create a mood, without creating aesthetic details that in and of themselves just waste energy. In other words it might be possible with a little creativity to get the aesthetic effects of lighting without necessarily adding more energy.

Should it be necessary to save energy by curtailing our use of things, we can do with lower levels of lighting than what we might normally design for, particularly when the lighting is to be used for short periods of time, and changing activities.

It depends on the relative perception of these needs. Maybe in California they are thinking of energy savings techniques today, but they wouldn't have considered them several years ago.

Mr. Hart: I don't agree that the aesthetic considerations necessarily will increase the load. When display windows went from the extremes from above and below to a couple of spots, the aesthetics improved the load going down.

When the interior or merchandising areas started to be exposed with displays and with counters with the general level lowered, the aesthetics improved, the load went down. I just want to counter the thought that it has to cause more.

Prof. Smith: Right.

Mr. Frye: That is absolutely true. You can achieve both. That is a crucial point.

Ms. Harrold: I wholeheartedly support that last comment. I am just surprised that most of the discussion before seems to really be divorcing aesthetics from a function of lighting. Who is to say that aesthetics is not a prime factor in the function of a very particular space? It doesn't mean that you cannot have one without the other.

Mr. Florence: Many people have talked about the watts for aesthetics. I too believe that you simply cannot accept them because after all, what we are really trying to do, in much lighting, say lighting for business, or the artist's lighting, is to provide a productive environment.

So the aesthetic part of it, the lighting part of it, affects our psyches and that in turn affects productivity. A case in point might be task lighting by getting rid of a whole wash of intense lighting all over a space and creating local, focal glow at the task. We made the task and the task environment more attractive to people. I think that is the possibility. Also, I would comment on this question of integration of subsystems. I wasn't quite sure of what subsystems we were talking about. Is our electric lighting a subsystem of the building, or are we talking about subsystems of electric lighting?

Surely we can't classify the daylighting as a subsystem there. But the integration of simple things, like the lighting with the ceiling and lighting with the acoustics and the lighting with the air is a very difficult thing in practical commercial practice. I think it is up to the architect. Somebody has to coordinate these things.

Mr. Cornish: Mr. Florence, you are running well over your time. Sorry. It is very hard for a designer of equipment to define who the other people are. So that is a plea to the architect accordingly. Thank you.

Ms. Harrold: I agree with you. I think most of us on the panel had trouble trying to decide what some of these topic descriptions really meant. I think most of us really attack it from the standpoint of lighting as being a subsystem of the building and not subsystems within the lighting.

Prof. Smith: I agree with that. I look to the total building as being the system. I want to make one comment about the aesthetics.

I graded a student's paper down rather severely one time because the student chose high color rendition lamps, the delux type as opposed to the more efficient warm white lamps. When he came in to discuss the low grade, he said, well, the reason I did it was that I wanted to have all of the girls look nice. So this is a drafting room, you see, and you can't justify that type of energy waste.

It's not to say that I am against aesthetics or good-looking girls. It's just that is an inappropriate use of energy in the drafting room, is the way I defined it.

Dr. Ventre: I proposed in my question, I might say, that the methods of specialization were outrunning the methods of integration. The response, mostly from Mr. Squillace, was that leadership--and charismatic leadership when he cites Toscanini--is what is required to pull this together. Charisma is not liberally sprinkled through society.

It is arguable whether you can run a society with the liberal sprinkling of charisma. Does the panel feel that we should wait for charismatic leadership; and what do we do when there is no charisma around?

Are there more practicable and tractable issues that could be looked at, as may be beginning in Illinois on integration of systems?

Mr. Frye: That is a very difficult issue. How do you bring a complex sort of thing together like this. There is a trend that might be interesting that we were beginning to pick up in Europe where in Germany in particular they are beginning to suggest that the best place -- I am sure you won't mind hearing it, but you have far more lighting designers and consultants here, than we have as a proportion, in Europe.

The lighting designers and consultants should be more closely linked to the lighting fitting and light source manufacturers so that the architect would only have one person to deal with, perhaps, in that role.

I am not saying that that is a good thing, but that is certainly one of the trends that we are seeing there.

Prof. Smith: I address this briefly. I believe that even an engineer like myself agrees that the architect should be the synthesizer of building processes. It has to be somewhere and I believe that person is best equipped. If you realized how many pressures there are in the architectural faculty to teach so many different complex issues, why there is illumination, right down the line. The list is endless.

I believe that we will make a stab at it. One thing that the independents can do to help is what I listed in my paper here--give us guidelines, things usable by the architects.

Much of our time is spent trying to extrapolate the architecturally usable information from very complex documents that the engineer has.

Dr. Ross: As you look around to the many buildings you see, you can tell we are not doing a very good job. Some of them are excellent but many buildings you see, you can tell we are not doing a very good job. Some of them are excellent but many of them are neither functional in terms of performance, or appealing to look at.

One of the things that has happened that distorts the picture of the architectural leadership in the field is that for a building today, at least for any complex modern buildings, about 80 percent of the cost is related to those fields properly taught in engineering schools. I am talking now about the structure, the mechanical systems --

Dr. Ventre: Of the first cost or of the life cycle cost?

Dr. Ross: The first cost. Perhaps the life cycle cost gets to a higher percentage than that.

Dr. Ventre: We can talk about that some more.

Dr. Ross: You should consider the structure, the elevators, power systems, the lighting, the heating ventilating, air conditioning, fire safety, controls, etc.--all of which are dealt with by engineering disciplines.

So it becomes difficult for the architect, trained improperly as he has been historically, to get a handle on the overall systems, to understand them, and be able to keep them all in a little bag with a string around it.

Mr. Cahaega: In regards of how people are affected by daylighting. We have two buildings. It has four sides with windows. It runs east and west. In both cases, we ended with a conclusion that it wasn't of good footcandle value level. It was mostly the psychological feeling that the day was getting over a period of working time.

Mr. Clark: A quick comment on Pablo's opening comment relating to the fact that the architects didn't make the judgment relative to the lighting levels. That is what I think we have been saying for a long time. It isn't the illuminance that is the determinant on a subjective basis as to the space. It is the other factors in the space on which the architect makes his subjective appraisals.

Mr. Brandston: I think on the issue of aesthetics, the judgment I think must be left with the architect. Until the professional engineering licensing committee includes aesthetics and we get some minimum degree of competence there, I think it is best left where it lies.

Mr. Squillace: The first time since I met Howard I disagree with him. If you are implying that I have no aesthetic sense, the hell with you.

Mr. Brandston: Thank you.

Mr. Kahn: We have been ranging from aesthetics to philosophy and engineering and vision, many subjects. I've only got sixty seconds, so I've got to talk real fast. First of all, I believe that aesthetics is a visual, impressionable area, which should be left to the owner and the architect; and I think that the purpose of this session is to define the interests of the Illuminating Engineering Society, composed primarily of engineers who are concerned with lighting design, in view of the current problems we are all facing because of the energy situation. If we relate ourselves to aesthetics, I think that aesthetics becomes a cop-out. You talk aesthetics, Mr. Squillace, yet Mr. Bott of GSA referred to you as some kind of technical expert, providing him with engineering calculations on the ESI. I'm trying to figure out what you are. Are you the Toscanini you earlier referred to or are you an engineering expert?

Now, George Clark, you talked about ASHRAE 90-75, which under federal law obtains access to federal funds for states wishing to build energy departments, and states think of ASHRAE 90-75 as an energy conservation measure, which we know it is not; it is just a power budget.

If it's a power budget, shouldn't we advise the federal government, and stop giving states money under the National Energy Act for energy conservation? This is the kind of confusion that exists in the federal government today; and DoE doesn't know which end is up--they encourage use of federal money and don't understand the subject, while we're trying to find a way to define engineering principles to conserve energy along with improving vision for building occupants.

Would Mr. Squillace or Mr. Clark care to give a very brief comment?

Mr. Clark: I think you made a statement beyond that which I made. I said that the ASHRAE 90-75 addresses power rather than energy. I rather see it in energy terms. It doesn't mean that it doesn't save energy.

Dr. Clear: I just wanted to add what the other gentleman said about this sprinkling of charisma. That doesn't produce great designers or good designers. Is it a competent designer or competence that should be sprinkled more liberally rather than charisma?

Mr. Cornish: Thank you very much.

Letting the architect have the last say on this particular subject, I have an editorial comment from Der Scutt that he sent up to me. He says:

"I am elated by the pervading attitude of this august group that the architect is still assured a place of prominence in this hysterical world."

11.0 ISSUE NO. 8. " PROFESSIONAL DEVELOPMENT AND LIGHTING EDUCATION"

11.1 WRITTEN STATEMENTS BY PANELISTS

11.1.1 Prof. Smith: Higher education's activities, aspirations and needs required to serve the lighting community with progressive, comprehensive educations programs.

In preparing for this paper, I followed the usual procedure by first conducting a literature search. We, at the University of Illinois, are fortunate to have a computerized search capability; so, I asked for a ten-year search of two well-known Indexes, the Engineering Index and ERIC.

The ERIC Data Base Educational Resource Information Center identified 1,586 papers written since 1969 on the subject of engineering education--but not one of the papers responded to the keywords of the illuminating, illumination or lighting. The search of the Engineering Index was only slightly more productive with a total of thirteen papers, eight of which turned out to either be in a foreign language or to be inappropriate.

I am sure that most of you are fully aware of the measure of success in academia--publications, research, public service and teaching. In reality, the publications and research are the catalysts that cause and maintain the activities in public service and teaching.

> Lack of publications on illumination studies points to the possibility of serious problems in academia that serves the lighting industry.

State of the Art

In order to give validity to a statement on "state of the art" of illumination studies, a survey was conducted with nine schools responding. (A copy of the survey form and summary of responses is attached.) The following are my reactions to the responses:

1. The courses offered are limited in scope and do not provide comprehensive coverage of the subject.
2. The vast majority of the students are in architecture curriculums.
3. There is a need for more and better educational materials (texts, computer programs, visual aids, etc.)
4. The schools need test equipment, demonstration packages and financial help.
5. There is only a limited number of continuing education programs.
6. The faculty perceives there is a need for advanced training.

A program needs to be developed to identify all the schools offering courses in illumination studies and the faculty teaching those courses in order to facilitate the exchange of ideas and research.

Student Involvement and Support

We in the lighting industry, are one of the few major groups that do not have a strong student recognition program.

Although it is only one of many possible activities, in order to demonstrate our sincere support for the student-related endeavors, the Department of Architecture, University of Illinois, volunteers to provide in-house support to coordinate a student design competition to be conducted during the 1979-80 school

year. We invite interested parties to contact the author of this paper and indicate their willingness to support this endeavor and give their thoughts on its structure.

Academic Aspirations

For the lighting community to attain a high level of respectability, there must be appropriate degree programs. There are, at present, many graduates of former programs, such as was conducted at the University of Illinois, that are now holding high level positions throughout the industry; but, the universities are not graduating the necessary replacements. I believe the lighting community should indicate its recognition of the need and its willingness to support academic programs.

It is my personal opinion that five geographically located universities should be designated to offer a Master's of Science in Illumination. The prerequisite would be a Bachelor's Degree in either Architecture of Engineering with designated prerequisite courses in each discipline.

This arrangement would provide the balance of arts and science that is essential to the illumination designer and would assure the graduates of qualifying for registration as either an architect or engineer. I further believe that one of these schools should have a Doctoral Program.

Although I believe the new degree program should be our ultimate goal, the desirable educational objective can be achieved within the present degree structure.

For a program of revitalization to take place, it will be necessary for the lighting community to provide financial support. It is my estimate that from $250,000 to $500,000 a year for a period of ten years would be required with the larger amount being necessary if the new degree program is desirable.

Academic Needs

The credibility and vitality of an academic program is measured largely on its ability to attract research activities. Those outside the educational system often fail to realize the only opportunity for an educational program to prosper is through research funding or direct grants. With outside funding, the faculty can participate in professional activities, tests and demonstration equipment can be purchased, guest speakers can be contacted and student assistantships are possible, to list only a few of the fringe benefits.

> The academic institutions who are active in illumination studies and have the appropriate expertise should be given first priority to participate in appropriate research activities.

There is a need for workshop programs to update our faculty. These programs could be organized along the lines of the civil preparedness workshops or the AIR/RC energy design workshops held for the last two years in Massachusetts. The Department of Architecture, University of Illinois, volunteers to host the first illumination studies faculty workshop. Agencies interested in supporting such an activity should contact the author of this paper.

Benefit to the Lighting Community

Thus far, this paper has addressed issues that require financial assistance to the academic community, but I would be remiss if I failed to enumerate some of the benefits the lighting community can gain from that investment:

1. Better Prepared Students:
   The research and the fringe benefits from having research funding have a positive effect on the classroom achievements.

2. Development of Nonproprietary Resources:
Academic achievements are generally nonproprietary and are thus available for public use. As an example, last week, I released for publication a TI59 Calculator Program for the Lighting Power Budget Procedure. This program has an estimated development cost in excess of $2,000.

3. Development of Educational Resources:
Using the classroom as a laboratory, the educator is in an enviable position to develop quality educational material. During the next two years, if plans go as expected, several of my academic colleagues, lighting authorities throughout the country and myself will be producing a series of educational modules; these will be organized to facilitate presentation of specific lighting topics at three levels of specificity.

4. Academic Credibility:
The academic enjoys a complete freedom of expression and has the opportunity to devote time to the examination and development of new ideas. These features can make them very valuable for committee membership and other activities within the industry.

ILLUMINATION STUDIES
PROGRAM SURVEY

Indicate the degree of emphasis that is given to each of the following illumination studies topics. Circling a 5 would indicate that students completing the regularly offered courses would have achieved a high level of understanding in that particular topic. Circling a 1 would indicate that the topic was only introduced. Circling a 0 would indicate the topic was not identified to the students.

		0	1	2	3	4	5
1.	Optics	-	5	-	1	1	-
2.	Physics of light	-	2	4	3	-	-
3.	Visual perception	-	2	2	4	1	-
4.	Physiology of vision	-	2	2	4	1	-
5.	Color vision	-	3	1	2	3	-
6.	Visibility performance levels	-	2	2	2	1	2
7.	Color rendition	-	-	2	7	-	-
8.	Psychological visual needs	-	1	3	3	1	1
9.	Sources of artificial lights	-	-	1	4	1	3
10.	Luminaire selection	-	-	1	4	1	3
11.	Point-to-point calculations	-	1	1	3	1	3
12.	Average illumination calculations	1	-	-	3	1	4
13.	Area source calculations	-	2	1	2	2	2
14.	Luminaire layout for uniform illumination	1	1	1	2	2	3
15.	Luminance differences	-	-	2	4	2	-
16.	Visual comfort probability	-	1	2	2	2	2
17.	Equivalent sphere illumination	-	1	3	1	3	1
18.	Daylighting	-	1	2	-	3	3
19.	Life cycle cost benefit analysis	1	2	2	2	1	-
20.	Lighting power budget determination procedure	1	2	3	-	2	1
21.	Lighting applications	1	-	1	3	2	3
22.	Facade lighting	1	2	2	1	1	2

Provide the following information concerning the students who complete the illumination studies program.

1. The typical student will receive a Arch. or Arch. Eng. degree.

2. On the average, 685/9 students complete the course each year.

3. The students (2 do) participate in the student branch of the Illumination Engineering Society.

4. The textbooks required for the courses are 7 different texts.

5. Required reading for the courses include: handouts.

Provide the following information concerning the instructor's needs and activities.

1. If $1,000 were made available for improving the illumination studies program, how would the money be spent?

   Visual aids; models; demonstration equipment; computer time
   If $10,000 were made available?

   Visits to Nela Park and Danvers, Massachusetts; scholarships; laboratory; equipment

   If a large amount were made available?

   Lab assistants; faculty positions, full scale models

2. What continuing education and/or extension programs in lighting studies are regularly offered?

   Two schools have regular programs

3. In which professional organizations do the lighting faculty participate?
   IES, AIA, ASHRAE, NSPE, ASID, IALD

   8, 4, 2, 2, 0, 2

4. Do you perceive a need for an annual illumination studies faculty workshop?

   All positive

5. What do you perceive to be the crucial issues facing the department that wishes to expand its illumination studies program?

   Need for research funds, funding equipment purchases and student scholarships.

11.1.2 Ms. Harrold: An increasing awareness of the importance of lighting -- the benefits, limitations, design possibilities -- has lead to a greater interest in pursuing the development of expertise in the field from professionals already in practice to students looking for future careers.

Lighting design has been made more challenging by the present energy climate in which we find ourselves, leading to more opportunities for ingenuity and talent. Hand-in-hand with the recognition of lighting as a system to be studied and understood along with other components in the design of a building, that is, an industry, or practitioners' awareness, is the questioning ability of the consumer. The using public--from the residential homeowner, who is presented with a wealth of lighting concepts, although not always sound advice, or desirable design solutions through the shelter magazines, to the industrial user who is

seeking advice on efficient solutions to lighting problems, which at the same time will result in savings on operating costs--are audiences ripe for information.

These consumers are much more demanding, sophisticated and knowledgable than any audience we have had before about their wants and needs, requiring a higher standard of consultation from the industry. We have a tremendous educational opportunity to insure that the information flow is there through published articles, contact with other organizations or individuals in related design fields, individual business contacts, wherever and whenever the chance is presented.

What about the industry's obligation for involvement with those about to enter the profession in future years? Student intern programs such as the one offered by the International Association of Lighting Designers demonstrate the concern by lighting consultants to not only provide a working experience for the student, but also to broaden the choice of qualified future employees. Such programs need to be expanded and offered through more channels.

A recent conversation with one of these student interns, a 1980 graduate-to-be from an architectural engineering program, revealed one viewpoint on the appeal of pursuing a career in lighting. It offers the challenge of mathematical calculations for the individual with a fascination for numbers, and at the same time affords the opportunity to be creative in determining how a space should be seen and how it should function. This student sees the two sides of the lighting specialist's role not as an either/or choice, but as two aspects of one stimulating job.

11.1.3 Mr. Bott: The charter of the General Services Administration does not designate us as a research and development agency. However, it does give use the responsibility for providing occupancy space for a large portion of the civilian side of the government. The majority of this space is for general office use. Our goal has been to provide modern satisfactory office space at reasonable construction, maintenance and operating costs; and this in turn has led us into the research and development area.

In the field of illumination, we attempt to provide an adequate and satisfactory visual environment but with due consideration for the human values. All this with a constantly diminishing expenditure of electrical energy. As a result unique designs, innovative installations, unusual operating techniques or new products that assist in this regard are always seriously considered.

Through the years, this approach to design has led GSA to fund studies on various lighting systems in general, high pressure sodium luminaire applications for office use, hand calculation techniques for ESI design, task-lit systems furniture and systems designs based strictly on performance criteria.

These are merely a few studies which directly affect lighting. Practically all of these efforts were followed by actual demonstration projects.

Many of these same areas have been studied by others with differing results. More of this kind of work needs to be done by more people to provide an even wider base of knowledge on which the building owner and his application engineer can base their decisions.

The many and diverse segments of our industry and our society involve themselves and their funds, hoping (at least subconsciously) that the particular research will bear out their own impressions, predictions, desires, etc. There are very few of us so altruistic that we look for answers which are not in our best interest. This is normal human nature and not likely to change. So what we need are more and varied studies on performance, whatever from a wider divergence of sources. It should then become more obvious when a consultant bends his study

ever so slightly, but still within the bounds of professional ethics of course, to suit his client. I'm not knocking divergent points of view, honest men can have an honest difference of opinion.

The IES has already funded and participated in an amazing amount of research considering the funding limitations which exist from year to year. In my view NBS is contributing in this area. We need more universities participating, particularly involving "in situ" research. The new boy on the block, the DoE, is entering the field in various ways including the development of building energy performance standards.

Unfortunately or perhaps fortunately we view each other's research, whether it be basic or superficial, with suspicion and find ourselves in adversary positions. We even have difficulty agreeing on interpretation of the same material.

Luckily the statement on the objectives of this roundtable indicated this was not a problem solving session; because I don't pretend to have the answers. But some of the greatest illumination problems we have encountered over the years do not arise from conflict with the architects, engineers, scientists or consultants that we engage to design our office buildings.

These problems develop when the space planners, interior designers, building managers, employee representatives and others with less technical background appear on the scene. I remember an old-timer in the IES once said "Many a good lighting job has been sacrificed on the altar of Commerce." I would paraphrase that to say "Many a good lighting job has been sacrificed on the altar of indifference."

Some of these otherwise bright and intelligent people seem to be totally unaware of what is overhead; no doubt harking back to the days when we had luminaires and glare in every module of the ceiling. Which of course meant task location and viewing direction could do very little to degrade or improve visibility no matter what was done. One of my other pet peeves involves those interior designers who insist on chocolate colored walls and gray carpeting with practically zero reflectance.

In my opinion the task lighting concept offers excellent opportunities to produce adequate, satisfactory office space and still conserve energy. But our partners in planning that have been mentioned need some direction. Direction in understanding the advantages of properly selected task locations; what constitutes reasonable surface reflectance; also, how to best utilize luminaire distribution and the basic principles of task visibility. Improved understanding will allow them to factor into the illumination system, as an essential component of space planning and interior design, their particular contribution.

I think a major effort in this area may be more productive in improving visibility and conserving energy over the short term than scientific treatise based on laboratory experimentation. That is not to say we don't need both.

Beyond those directly involved in space planning, we should equally attempt to develop an awareness of illumination and the visual environment in the individual consumer and the general public. Probably starting with visual aids demonstration material, etc., even down to the elementary school level.

I would also agree with others in the IES who have said we must tell the public who we are and what we are doing. Using whatever means becomes available whether it be holding workshops, providing speakers or having joint meetings with other societies, clubs or organizations.

11.1.4 Mr. Squillace: As I mentioned earlier in the U. S. role in world-wide community, each individual country needs to establish some university chairs (with proper

funding) for the teaching of illumination science. This should become its own curriculum and not just a few elective subjects under the auspices of the Electrical Engineering Department or the Architectural Department.

Illumination must be given discipline status in the schools. That takes dedication and money.

After graduation, the student (just like any other engineer) should be required to take a first part examination to quiz the candidate on theory. Then, after some years of practice, the candidate may sit for his second or practical exams and become, thereby (if passed), a registered professional lighting designer recognized by state and federal authorities as qualified to practice lighting design.

CEU should be required for re-registration.

There are, of course, many problems to be overcome before this becomes a reality; but until it does, no "professional" lighting designer can or will exist.

11.2 PANEL DISCUSSION

Mr. Clark: As someone who took the kind of course that Steve has described and who grew up on the "eight factors of lighting design", I have more than a casual interest in the subject and so has the IES.

I'm looking at a man right ahead of me, Charlie Amick, who was a leader in many of our efforts to try to establish lighting education at the college and university level. It turned out to be a bit of the chicken and the egg situation.

We got a few schools interested in the idea of offering courses. Then they didn't have any students. To help that situation we then produced some brochures for high school students indicating that lighting offered great career opportunities.

I believe it was 1969 at the IES Annual meeting in Boston we had a seminar on lighting education. One of the gentlemen invited to participate was from the University of Karlsruhe who discussed the work they were doing in Germany and described the very excellent course which they offered. He then proceeded to say that only about six illuminating engineers could be absorbed per year in all of Europe.

At the time I think it was probably about what this country could absorb as well. Hopefully there will be some changes. I have some feeling that there have been.

I can tell you from a personal standpoint that it is difficult to get a one hundred percent full-time lighting job because there are so few of them. This has led me to believe reluctantly that we need to have a system which produces part-time lighting people. Perhaps it needs to be the kind of thing that is going on at the architectural/engineering type of situation at Penn State University and the University of Colorado where people get more than the amount of lighting education they now get in most schools but not necessarily leading them to believe they will be full-time lighting people in their working careers. I think they will be disappointed unless there are dramatic changes quickly in professional organizations and others in hiring them.

Ms. Harrold: In support of what George has just said, and I think also perhaps in support of trying to find some uniformity in our system of teaching illumination. There are many people graduating from certain lighting courses today who are not really qualified to be a part of the growing industry. Yet somewhere along the line we are intrigued sufficiently to think that lighting was a possible career pursuit.

I am thinking specifically of some of the interior design students who have decided at some point along the line that they don't really want to pursue interior design as a career but the smattering of lighting that they get; it looks like it might be a lot more appealing.

Unfortunately, there are not too many jobs available for those people because they are not really qualified to enter the lighting profession as such.

Maybe they could fill some part-time role. I don't know. But it is a problem in how to place them.

Mr. Frye: I would like to reinforce a lot of what Rita said. It is very contrary in Europe that there is a complete lack of lighting engineers or designers. I think it is not just a question of providing the material in general to various places and providing the universities programs.

I think that is a part of it but the other issue is educating the public itself directly. That is particularly a problem. As George said, you may not be able to find jobs for the lighting designers full time. That is a direct result of the public not being able to define the issues.

Prof. Smith: One of the elements that I proposed was that those people graduating where they had a Bachelor's having another expertise. I recognize that but at the same time I think it is discouraging. If we can only train those who are full-time lighting people, we will never go forward. We need the kind of person who can be the engineer or the architect and has expertise in lighting. I think there is a big demand for it.

Let me say again if I didn't say it strongly enough.

The reason the programs die in the universities is not because there are no jobs. It is because there is no research coming into the programs. Many of you attended the University of Illinois. The reason we don't have an illumination program at Illinois is because there wasn't any research coming into the school. That is the key.

If you give us research, I am talking about across the country, not just the State of Illinois. Give us research, say, hey look, there are dollars for research in illumination, if you will put on educational programs in illumination, the educational programs will appear overnight.

If you don't believe it, offer some dollars.

Dr. Ross: I wanted to add a comment or two. I subscribe to the philosophy that Illumination perhaps shouldn't be a full-time course. It shouldn't be a full-time course. I like the concept of a Master's degree if somebody felt, after having a few good courses as an undergraduate, he wanted to go and pursue it.

The electrical engineer needs to know about some things, he needs to know about motors, computers, about lighting. I think he has to know some of each of these, all of which are essential to his professional practice and then perhaps the specialization which you suggest.

Mr. Squillace: What I mean by full status is just that. It could be the electrical or mechanical engineer who then specializes if he so desires in the illumination specialty.

You should be given full discipline status because as the illumination specialty that will be taught in the last two or three years contains the specialized items that pertain to lighting. He already had the background of calculus and all the rest of it, physics, chemistry and so on.

I would like to suggest that there is something else that has caused the degradation of the teaching of illumination in schools. Bob mentioned that we can get plenty of jobs and courses going if we had the research. I would like to suggest that one of the reasons why we don't have any more illumination in the schools is because the IES is at fault. We promulgated some time ago starting back in the 1940's probably the very thing that caused the demise of the illumination courses in the schools.

I want to disagree with George in that there are no jobs out there. There is one hell of a lot of jobs. The fact is that there is nobody to fill them. There are no more courses left and I don't say this is the only reason. We gave them pabulum. We made it damn easy to do lighting design. All they need is the C.V. and with the maintenance factor that I pluck out of the air, put it into an equation and I have finished the lighting design. Nonsense.

One of the reasons that we have no more lighting courses is that they are not needed. All you need to do with lighting is to draw up a simple little formula. As a matter of fact, a lot of people have reverted to the idea that you don't even need that.

I look at the space from the zonal cavity formula, the engineer tells me how many lighting fixtures are needed and the architect and designer decide on a certain configuration of fixtures. All that the engineer need do now is to circuit the power for the fixtures and the job is done. It is that simple. Do you need four years of calculus? Do you need chemistry, physics, metallurgy? Hell no.

So where there is no longer any need for educating people, then there is no longer need for any courses. We have to sometimes look introspectively. It is just like the Philistine in the back of the church, mea culpa, mea culpa, mea culpa.

Dr. Lewis: One of the alternatives that I have not heard raised here, which I think would respond to the kinds of comments that were made today, it the need for some identification of Illuminating Engineering as a discipline, a specialty, or a field of endeavor worthy of credentialing by a degree program or an intramural type of program.

Academic administrators, who may receive many requests for new degree programs each year, will require substantial justification for the need for such a program.

I suspect, from listening to the comments around the table, that it might be difficult to establish a degree program if there is not already a foot in the door. However, one of the alternatives is intramural credentialing; a move by the profession itself to determine what credentials are needed and what the standards for credentialing ought to be.

The field of medicine does intramural credentialing, and so do other professions. However, I do not mean for one moment to have restrictive credentialing, as do the health professions, which would prohibit persons not possessing the credential from practicing. Instead, the credential should be of the type that allows the potential purchaser of the service to say, "If the person has their credential, then I am assured that I am going to get something for my money." Perhaps that is the way it would start. A degree perhaps falls out of that. Perhaps even out of itself, this would create the demand.

Mr. Clark: I share in Steve Squillace's frustration. Many times over, as a matter of fact. I still have the feeling that we don't have very many full-time lighting jobs for people. If I am wrong and there are, I would be glad to learn of them.

Citing from my own situation there was another element that got into the issue of lighting education at the academic level. It was World War II. The illumination course became a victim of the war and its demands for other disciplines. Unfortunately it was not sufficiently supported to be reestablished in the post war period.

There was an attempt later, which never got off the ground, to move the course from the electrical engineering to the architectural department. The problem we have in the field is that it is not straight engineering as this discipline is normally taught. It represents a combination of things including physiology and psychology. This in the academic administration presents problems in trying to determine the appropriate assignment in the college or university organizational structure.

Mr. Frye: Sometimes it is interesting to look back in history. I would like to say that engineering and lighting was discovered in England. I just don't say that facetiously. In fact, many of the guild systems that are very similar to what is being described sum up the mechanical engineering mystery. The point I am trying to make and reinforce has to do with this idea of what you call credentialing.

These guilds were highly successful. They kept the standard that the people wanted to keep. They were very successful during those old colonial days in the 17th, 18th and 19th centuries. They did exactly what is described here. They maintained a level of craftsmanship.

Prof. Smith: It came up a couple of times earlier, but I did not address myself to it. This has to do with certification. I say this word as opposed to licensing.

Licensing is a term, a sort of legalistic type of operation, whereas certification can be within the society.

What I want to make clear, what I would like to do is to invite those people who have feelings about certification to send their comments to the IES and that perhaps maybe we can get them published in order to get some feedback on it so that we can begin to think seriously about certification.

Mr. Clark: I do have a couple of items on which I made notes here. One relates to the fact that in the educational process for lighting there is need to have visualization for the student and perhaps more an opportunity for experiencing some of the effects of lighting. Some of this has been done. There comes to mind Gjorgy Kepes who headed the visual design department of the School of Architecture at MIT and also Harry Rodman, now retired from Rennselaer Polytechnic Institute. They both gave students an opportunity to see, to feel the effects of lighting through models or other means.

The other item which I noted is a recommendation to the panel and to Bob regarding a gentleman by the name of Pollo Hansen that some of us, including John Flynn and Howard Brandston, met a few months back. I was tremendously impressed in the evening I spent with him to learn of what he has been doing at the university where he teaches in Delft, The Netherlands. It is quite unique.

The architectural school there has a curriculum on lighting which they are following that is really outstanding. I think it might be well for any of you in the academic field to investigate their program and its degree of success.

Prof. Smith: In the first part of my presentation, I said I thought it is essential to identify who is teaching illumination and what we are doing in trying to convey information.

I would hope that this would happen soon, although I do not know the exact vehicle for getting it going.

Oh, yes, I forgot one thing. I want to stress too that the educational system would welcome any kind of help. I had an offer today and I think the person i going to follow up on it just to give some ideas, some demonstration ideas.

I am not saying that we have to have $50,000 a year in order to operate, but whatever you have in the way of responding to the needs of the educational schools, anything from a chair to some ideas, will be gratefully accepted.

Mr. Cornish: With that commercial splurge, we will wrap up this sesssion. There is of course the closing wrap-up session and we hope that you will all return to it. I will turn it over to Charley Amick.

11.3 WRITTEN QUESTIONS/COMMENTS BY AUDITORS

11.3.1 Mr. Florence: *"Do lighting consultants educate their staff, and if so, how?"*

Mr. Squillace: By and large, I guess lighting consultants don't educate the staff because lighting consultants aren't educated themselves.

That sounds cruel, but I believe that. Most of the engineers do not practice that way because of a lot of reasons. But there are of course those who do. One of the things that we have been accused of is that we are conducting a school. We educate architects, electrical engineers, and we train them in our own way of doing things, which I think is fairly good, and so is the case with interior designers.

We have in our staff right now only two engineers and the rest are interior designers and architects.

Dr. Ross: Some of the best programs for educating people, I think, the professional staffs, are the programs conducted by the Illuminating Engineering Society, which we find to be quite good, and I think everyone who comes on board in our office at least, who has a function to perform, goes through those programs. I think they have been worthwhile. At the same time, we attempt to get contracts and assignments from clients that do challenge our people. We do this so that in the process of working with them, they will develop.

We are trying to get some of the other firms to do the same thing. We are trying to get involved more than just in footcandles or lumens. Sometimes that is all the client wants and you cannot do much more than that. I think there is an opportunity within the industry. We are just beginning to learn, I think, that the clients are willing to pay for creative design and for energy conservation design especially.

Mr. Cornish: Thank you, Don.

11.3.2 Mr. Kahn: *To Mr. Norman Bott. Your prepared statement, Mr. Bott, at the beginning of today's session, indicated a greater awareness of lighting needs. We know of the relatively limited lighting experiment at the Norris Cotton General Office Building in Manchester, New Hampshire, which was known not to employ proper evaluation procedures.*

Would you, Mr. Bott, wish to comment on evaluation procedures used by GSA?

Mr. Bott: My only comment would be that I am thankful to Myron because whenever he asks a question, I get much warmer.

Mr. Amick: Yes, and I tempered it some.

Mr. Kahn: I have lots of patience.

11.3.3 Mr. Brandston: *"Health, welfare and safety are the requisites for most professional registrations. Won't it be a hard thing to convince the states that lighting meet these criteria?"*

Prof. Smith: What I am suggesting is a recognition of lighting specialists in line with what the societies are doing. I think that is important for us to get involved in, not registration.

11.3.4 Dr. Clear: *"Isn't the problem in getting more education in lighting a problem in convincing the public that there is much more to lighting than what an engineer needs to know beyond the ability to use lighting tables? In other words, our job is to convince the public that lighting is sophisticated and scientific engineering kind of work."*

Prof. Smith: I think I could use what Steve Squillace said--it is the chicken and egg type of argument. I do not believe that the educational institutions ought to try to regulate their flow of students according to whether or not jobs are available. This may seem to be harsh to you, but I do not think that that is our role.

What our role is, is to train competent people to serve professionally and serve other needs of the Society and our students will not go unemployed.

There are some architects who end up not being designers of Taj Mahals and structures like that, which they anticipated when they entered school. But they do believe that they will go on to work.

Mr. Squillace: If I can make one quick comment. The problem I think is one of the image of illumination, since I would have to call it that, and not the image of the IES.

This is a separate thing altogether. It is true that those professions that are concerned with the activities of people are much more in the public's eye, which is something like illumination.

If you are sick, you know you have misery. If you are getting divorced, again you know you have misery, don't you? So the doctor and lawyer image are instantaneous because of our need to take care of our misery.

In order to build the image of the illuminating engineer (and, therefore, his course of study) it is necessary to become skilled and proficient. Let's learn how to give clients good, comfortable visibility at an optimum of least cost and least energy. To do this one needs the colleges to teach and the profession to market. When we do this, I think the image will blossom. If we want to add fertilizer to that, I suppose then that television and some other marketing devices can embrace the image, but it would have to be coordinated in order to do it. But there is that need, yes.

Dr. Ross: There is one clever definition of an engineer; that he is a person who for $1,000 can build a bridge that anyone else can build for $10,000. I think this concept has to be carried over into the lighting design profession, too. We cannot dispute the fact that there are many lighting installations installed that are too wasteful in energy costs and even in first costs. What we have to do is to prove that by using professional help one can get something better for the dollar. It may cost them more money initially, but perhaps not, but with proper engineering, a system should operate more efficiently and effectively, and have a good payback.

11.3.5 Mr. Kahn: *A statement to Mr. Squillace. It's the fundamentals of vision and polarization that must become a part of the education of the lighting designer. Steve is correct about the need for education of the lighting designer or engineer, but optics is a prerequisite in his education.*

Mr. Squillace: I would agree with that. Optics and some other subject such as perhaps psychology -- well, I don't know, but there are a lot of things.

Mr. Amick: We were talking a moment ago about educating the public. From yesterday morning's session on the public image, Bill Erhardt has made the comment that we do not have the time for this. He recalls having seen a recent television show where there were four contestants on "The Newlyweds" game and that two out of the four knew the meaning of an incandescent light and a fluorescent light.

Mr. Cornish: Well, you need not have that qualification to get married.

Prof. Smith: Were they architects or engineers?

Dr. Lewis: I do an awful lot of work with schoolchildren. To show them prime examples of bad lighting, to indicate quality, is to do this (shading the eyes). It always seems to work out that if they do that and they feel more comfortable, the lighting is good. When I come back the following year, most of them have their hands up like that. It is one effective way of knowing what lighting quality is. It works well to impress the student of the difference between good quality and poor quality lighting.

11.3.6 Mr. Erhardt: *"Why is so little of the vast work of visual perception, and color theory discussed in the Journal or in the Handbook?"*

Really, you have two questions. Why don't we do more in education and publication on color theories; and secondly, why is there solely visual perception in our publications.

Mr. Squillace: I think the answer to that is that, from my experience, it has been the committees have not involved themselves in those areas and therefore have not recorded them. It is as simple as that.

On the other hand, we have been taken up with the idea of publishing the illumination levels. This has occupied a great deal of our time. Our volunteers just do not have time left. I think Erhardt is right. We have got to report everything that is important and perhaps some of these other things have to be drummed up. That is why I keep harping on 9-80.

Mr. Cornish: Thank you. Ladies and Gentlemen, we are about to commence the question period from the floor.

11.4 ORAL QUESTIONS/COMMENTS BY AUDITORS

Mr. Jewell: I would like to make a statement which is simply by way of observation on jobs. I represent a firm which has 50 positions that have lighting responsibilities. It has been 12 years since we have been able to employ someone from the engineering schools in the State of California who has a major in illumination discipline.

During the time that I have held administrative responsibility for illumination programs, I have been able to employ one individual who I can say is qualified with illumination discipline.

We hire from 25 to 20 a year. The lighting positions that the corporation is trying to have filled are not being filled. It is difficult to hire people for those jobs.

Mr. Waldbauer: Gentlemen, one of the things that I feel has not been touched on relates to the question of both education and the public image. I feel the responsibility belongs to those firms that do business along these lines. This is not a function of the IES or of the university alone.

Our company has three programs, namely, the fundamentals program, an event program, and a computer program, each lasting five days. We put approximately 150 people through the fundamentals program. These people are primarily administrators/salesmen and our own agents, and in addition, any consulting engineers who wish to come.

We also have as I said a computer program that uses the ST-59 Module that we have developed for that in this task.

So I think each company in this field should have its own responsibility to generate part of the image for the lighting industry.

Mr. Wotton: Mr. Smith referred to a doctoral degree. It seems to me the qualification for people in lighting seems to be getting progressively higher. It might be interesting to comment that I believe that Western University, that has done some British work which is the cornerstone in British IES, had no degree at all to the best of my understanding.

You mentioned, sir, that there is very little published on education of lighting. I do refer you to the British publications again because this has been discussed strongly there. I was asked to teach there; because at one time I did, I was asked to return, but I can say that I know the situation fairly and I do know the pains which they are going through.

It seems to me, in our discussions here today, that we have not really asked ourselves what these educated lighting people are going to do. We have tended to say that we are talking about lighting buildings, but there is a lot more than that in terms of what a person should do and --

Mr. Cornish: Ernie, you are well over your time.

Dr. Murdoch: If I can just jump in. I think everybody knows me. We need help. I am not only talking of the Bob Allens, the John Flynns, but those few of us who are trying to keep lighting alive in the universities in this country.

I think it is great that there are courses such as what has been pointed out by Walt Waldbauer and what the others are doing, the rest of us, but it is time, folks, if you want to do it all yourselves, then we are going to have to get out of it. If you want us to keep on going, then I say help us.

There is room for different kinds of curricular offerings here. I think the kind of thing that Bob put together at the University of Illinois, in the Department of Architecture, might be somewhat different than what I would put together as far as a Master's Degree level would be concerned at the University of New Hampshire.

I am happy to think there is room for more universities involved here. I should think that a program that has some components of energy and conservation contribution systems, control systems, and computer systems in terms of illumination, optics, if we get help, then I think I can turn out a pretty darned good qualified Master's Degree.

In terms of research, I think it is great getting consulting firms involved in doing research, but you are feeding each other all the time. You are not feeding us. I ask that you consider seriously helping us.

Prof. Smith: Absolutely.

Dr. Murdoch: If we do not get the research money, some help to support those studies, then we are not going to make it.

Mr. Goldin: I teach at USC. It is incredible what hunger there is by the architect for this knowledge. What about the architectural students and what they have to

do? Steve, at this point in the game, we can identify a lot of what is technology, but we cannot identify yet what is design, nor can we identify who practices design. That is really not clear.

There are engineers who practice good design, and there are engineers who don't. You people have to understand there is still a mystery here.

I met Howard Brandston in San Francisco and I still don't know what he does.

Nevertheless, hopefully with this new approach that the Society is taking towards developing forums and abilities, get a committee together, and hopefully some suggestions might be made.

Mr. Erhardt: What I have to address has to do with education, that is, dealing with education provided by the standards.

I would like to commend the committee that put together the most recent industrial standards. It addresses itself to human needs and emphasizes quality ahead of quantity, and it recognizes that lighting may create or influence an emotional response. It includes aesthetic consideration as part of quality.

Mr. Brandston: I want to go back to Bob for a minute. IES is a technical society, not a professional society. I don't know if really it is the technical society's place to certify its members as being qualified to do a design function because we don't cover a lot of those points as yet. I have often wondered who would write up the tests. Would it be some lady in Massachusetts? I really think that we have to be very careful when we are addressing ourselves to certifying people as being qualified to practice lighting design.

Mr. Cornish: Thank you, Howard.

Dr. Lewis: Rest assured that the people out there also cannot pass the entering examination.

Mr. Brandston: It goes to Health, Education and Welfare.

Mr. Squillace: That is right.

Prof. Smith: I am saying, I don't believe yet we are at a point where we should be seeking registration as lighting engineers. That is a legal role. I am really saying that somebody ought to be certifying lighting designers. Don't tie me up on the semantics of the title here, because I would prefer that we would change a little bit. I think the IES ought to take the leadership role in this type of situation. Somebody else is going to do it if we don't.

Mr. Cornish: Well, that wraps it up. For your information, we are right on schedule.

For the wrap-up, it is proposed that each of the panelists will make a very short statement. It can be on any subject covered or on any other subject that they think is appropriate relative to the debate that has gone on these past two days.

Following that, I will call on Dick Wright of NBS and Bill Fisher of IES to say a few closing words, after which I would like to say a few things and then the session will be finished.

12.0 CLOSING STATEMENTS BY PANELISTS

12.1 Dr. Lewis: I really have nothing profound to say. The meeting speaks for itself. We covered a lot of issues and I feel we have identified those problems within the Society as to what the IES is.

We simply have to go on from there. Whenever there is something that is an issue, we are here to discuss what it is and hopefully to resolve it for the future. I feel that we have found at least one major problem that needs to be addressed, and quite frankly, we have not addressed ourselves to it very carefully in the past. Thank you.

12.2 Mr. Clark: I have no comments to say except that this meeting simply has reinforced what I have always felt and that is an exciting field to be in.

12.3 Ms. Harrold: We have covered so many topics and so many different points of view of the different aspects of the profession.

From my viewpoint, I hope that in the future we will not only do all of the kinds of things that we have talked about yesterday and this morning in education, but go right ahead and establish something on a higher plane. At the same time we should not forget the general consuming public out there, which I think represents a tremendous audience to receive lighting information. As far as the consuming public is concerned and with respect to what is usable information, I would point out it is very possible in England to walk into a bookstore and find, without a great deal of difficulty, a range of consumer publications on the subject of lighting. I would put anybody to that challenge if they were to go to any bookstore here in New York. They simply couldn't do it.

12.4 Mr. Frye: I wish to thank everyone for putting up with me for the last two days. One thing I would like to say is that I would complain about the lighting in this room. It's given me a terrible cold. I have learned a lot, and I would say that everyone has been very hospitable towards me, particularly in light of the rare contentious remarks I have occasionally made.

I very much appreciate the comments that have been made, particularly those which much support the development of an international relationship covering all of the aspects that we have discussed. I would like to reemphasize the importance of America's dominance and position in the lighting community, and thus, its responsibility.

Another point I would like to draw out is that there is a tremendous demand for information on lighting by the general public. I think the issue of how to integrate the various elements is paramount. Perhaps it has not been emphasized enough.

We should satisfy the needs as they relate to all of the aspects of the issues that have been discussed, not just in terms of research into the quality levels and the human levels, the environmental levels; I think we must do research in all of those areas. We do need to have more education programs, and so on. We must create a balance. There's definitely a need for more research, more education and more dynamic solutions.

Mr. Cornish: Thank you, Michael. We appreciate the fact you have come from so far.

12.5 Prof. Smith: Certainly it has been an enjoyable experience for me. One of the reasons why I was permitted to participate in this function has to do with my department head, of course, who decides whether I was to arrive here or not.

We try to keep on the cutting edge, if you will. Let me go back to the very first statement I made on this conference dealing with education. I don't know how to be more serious than Joe has been. It is very serious.

Joe Murdoch, Bob Allen and myself are almost begging for your help. We have only just begun to tell you a little about it. I have spent more money on traveling than many people in my department.

The reason I am permitted to do that is because I bring in more research dollars. If I don't get the research dollars in any one particular year, I will have only $350 to spend in 1981. This trip alone has cost over $400.

So I am not trying to make a personal plea in any sense, but I do say that it is desirable that if you want research to continue and to have more educational participation in the professional activities, then it is up to those members of this community who need the education, who need the research done, to look to us for the expertise, then help us along.

12.6 Dr. Ross: I do want to express my appreciation to the community for being able to express my opinions which may not or which may be somewhat controversial, at least in terms of some of them being argumentative. They were really basically put out to foment discussion.

I believe, as I said before, there is now a strong trend in a direction to consider lighting topics which have heretofore been closed, and I believe we have been able to assist here, by demonstrating that there are alternate solutions to many previously fixed concepts.

This conference has been billed as a joint IES/NBS proceeding. I am a little disappointed that we did not have more input from NBS. The gentlemen from NBS here who are taking part in the proceedings indicate that they are becoming more interested in the field of illumination and lighting, and perhaps we can expect more input from that very noble establishment in terms of supportive research and assistance than has been expressed.

12.7 Mr. Squillace: First of all, I would like to thank my fellow panelists for putting up with me. I would like to thank the Bureau and the IES for inviting me to give me this chance to say once again what I feel about this profession. I understand that Howard does not think it is a profession. I think it is a profession. Lighting is a profession.

To the auditors, I would like to thank them as well because it is they who have stimulated conversation at this Roundtable. I hope that we can continue to do something like this in the future.

You know something? I feel something a little bit like Pope John XXIII. Do you remember him? He was the interim pope. That is the way he was classified.

My God! What a change! We have, as Don Ross expressed, entered into that interim period perhaps with new popes who have instigated some full changes that will carry us hopefully into a better future.

We have opened up the black box, as Don has said, but perhaps at the same time maybe all of the worms will be crawling out, but I don't think it will be so bad.

I have a couple of other matters. We, as people, love to live instantaneously. There are many people who are worried about energy, that we are going to be facing a crisis in two years or ten years or whatever they say it is. My God! We won't hit that kind of problem for the next one hundred years.

We will have enough fuel that will last as long as the sun. Maybe it will be called nuclear fusion, maybe it can be called a lot of other things. The point is that we will solve the problem. That is not our big problem. Our desire right now falls in the area of education, how to transmit this education to the public in each of our areas of specialization.

It seems to me that the architect should be the coordinator because he started out that way. This is our tradition and our heritage. I think it is true internationally, if you will, that he tries to be, but the fact is that education is not present in that area and it has not kept up with the times. They are not educated enough to be the master coordinators.

I will take one exception to charisma as Francis Ventre earlier spoke to this morning, and that is that I do not have to live with myself alone. There are other people around.

The point is that there is a lot of charisma. I disagree that there is not enough. I say there is a lot of it. It has to be nurtured and brought to the front so that we can use it, so that they can use it and then demonstrate it. That is what needs to be done. Education will do that for us.

I think you have hit the key. This will start to conserve energy and all of the other good things we want. Thank you again.

12.8 Mr. Bott: Thank you, Steve, for using up my time.

We in the government look to the ideas of IES and to the societies and universities for guidance in this field. We encourage you to continue your efforts in this area.

We are not really in favor of government regulation of anything. Those of us who work in the government, are working in a regulated society. We don't recommend it. That is a personal point of view.

13.0 CLOSING STATEMENTS BY CONFERENCE ORGANIZERS

Mr. Cornish: Ladies and Gentlemen, that is the wrap-up from the panel. I would like now to call on Dick Wright, who is the Director of the Center of Building Technology, to come forward as one of the two hosts for this Roundtable to say a few words in conclusion.

13.1 Dr. Wright: As one rather ignorant in lighting technology or for that matter in lighting art, but as an experienced listener and research manager, I will summarize what I have heard as the issues.

Please remember that these are not the answers. We did not convene to answer questions but to bring questions into focus.

I will organize the issues under a few major topics: research, education, standards, design practices and the Illuminating Engineering Society's activities itself.

On Research

- How can research on vision be linked to research for lighting practices?
- How can physiological and psychological aspects be integrated to characterize human needs, consider multi-sensory effects, the duration of exposure, and activity and variables associated with other lighting?
- What public benefits are likely to be accrued from the augmented lighting research?
- How can lighting technology be made useful to lighting designers and to architects in the process of making a schematic design?

On Education

- How can an education system be provided to support the lighting community? This certainly includes lighting design, but it includes many other elements of the community.

- How can the research activities essential to a viable educational program be funded in the universities?

On Standards

- How can energy waste be avoided without seriously inhibiting lighting quality or aesthetics?

- What public purpose, if any, is served by promulgating standards for lighting?

- Is knowledge now available for improvement of lighting standards, or should we wait for research results? We know that the criteria should be based on luminance, but is this now possible?

On Design Practice

- How can lighting designers be registered or accredited to help clients find competent consultants?
- How can design practices be organized to provide proper opportunities for lighting design professionals?

On the IES

- Would not the stature of IES be enhanced by its leadership of a concerted effort to improve lighting practices?

- How can IES develop broad public support for and participation in its work?

The energy issue is an issue of survival. I think all of us should be alerted to the fact that we have to start making some real progress in reducing oil consumption or we may not have too much of a future to look forward to.

That is the piece of the elephant that I see. I say it objectively with no rancor. I hope you all take it that way.

I do not object to lighting's being in the spotlight as it has been for the past several years. I think we are getting some results now within the Society, within the nation, that are very necessary and very desirable. We have identified some of the issues here in this Roundtable, one of which is the image of the IES.

We have been very much aware of this problem and that was one of the issues that I addressed myself to in the Society last year when I became the president. We have achieved some real results, even though we continue to get the same old comments from our critics.

Despite the comments from our detractors, we will just have to keep on being a fine organization, and I am sure under John Flynn's leadership, we will continue to do just that in the coming year.

Dealing with the education issue specifically, I do agree with Steve, and with many other people, that education is extremely important. It is a key issue with respect to many. I do not have an answer myself, but perhaps we have laid the appropriate grounds in the Society and in the country for working on it.

I would like to pick up on a comment that Dick Wright made yesterday morning. It has to do with the fact that there is presently a low level of expenditures for non-proprietary research going on in lighting. There is need for more research. This has been repeated over and over during this session. I quite agree with this thought.

There is also the interaction of various environmental factors and the matter of aesthetics regarding lighting. Practically everybody on the panel and in the audience was unanimous that environment affects attitude and productivity and this sort of thing. I feel that way as well, but I think this is due to intuition at present. Dr. Peter Boyce, well-known English researcher, has said that there is no proof yet that there is a trade-off between aesthetics and performance, and so that is another area where we definitely need some research. Because of our feelings on this subject, it has got to be a factor. Research on visual performance is where a lot of IERI money has gone in recent years, and the money expended is not very much compared to what is needed to put us on a sound scientific basis in illumination recommendations.

The biological effects of light is another area of extreme importance which must be researched.

I know that there are some members of the Society who think that we are probably going to take a step backwards next week when the Board of Directors meets and, perhaps, votes to move away from the illumination system that we have had since 1958 to this so-called interim system. I don't know how long the interim will be. It may be some five to ten years.

We definitely do need a greater budget for research. We don't have to start from ground zero. We have a great mass of valid, scientifically defensible knowledge on light and vision. We just don't seem to have the system to put it all together at the moment. We have outlined a research program and get all of the help that we can in order to determine what should be the elements that will put us back on a scientific basis in the future. We don't care what the numbers are. We just want to know what the truth is.

Finally, I would like to say that we from NBS appreciate the participation of each of you in this Roundtable.

Mr. Cornish: Thank you, Dick. I would like now to call on your IES president, Bill Fisher.

13.2 Mr. Fisher: I have certainly been very pleased with this Roundtable, not only from a personal point of view, but I am pleased that a number of people have brought out some rather stimulating conversation. So I think we have taken a pretty good look at all parts of the elephant's anatomy that were mentioned yesterday.

I feel that Dick has done an outstanding job of identifying some of the issues in his summary. I suppose we will have these on the record to use and put forward to the appropriate groups within the Illuminating Engineering Society together with any additional dialogue that may be needed which can be followed up with personnel from the Center for Building Technology later on. We have done a far better job in outlining the lighting issues than I could possibly have imagined.

I would like to take a minute to pick up something that I said yesterday in view of the feedback that I got on this particular subject, because it has to do with the relationship of lighting to the use of oil and the fact that lighting energy reductions will not save oil.

I did not say that lightly. I did it on the basis of quite a few months of very laborious calculations. We started out with a procedure that was reviewed by a paid consultant.

We took weather data from 50 states and made computations for the existing building inventory. Our numbers come out just as I said, that if you establish some energy limit or a certain watts per square foot limit to lighting uniformly throughout the whole country, you are not going to save any oil, net.

In 16 states real oil usage could be reduced with reductions in lighting energy, but in 34 states more oil will be used. The net effect is zero impact on real oil usage in the U.S.A.

My previous remarks must not have been heard quite clearly, because I did not say that you should not reduce lighting energy because of its contribution to heating. We need to save all forms of energy. I was trying to make the point that energy savings in lighting are not going to show up as savings in oil on a net basis. And, unfortunately, there are many who believe that reducing lighting will reduce oil consumption. That is not true. My purpose in raising the issue at all was in the hope that our discussions on lighting would be more objective with the oil issue set aside.

Frankly, I am much concerned for our national security and economic stability because we have not as yet begun to make any progress nationally in reducing oil use. We are still losing ground.

This country has not yet really addressed the major problem that we have in terms of energy. I kind of hesitate to make this point, because nobody in this audience has any policy responsibility for oil, but I think frequently about Alexander Solzhinetsyn's commencement address to Harvard University last year in which he charged that, "The West has lost its courage."

His point was that the United States was not willing to stand up for the big issues against the big countries in international diplomacy. However, on small issues and against small countries which is the paramout energy issue in security, safety and survival. However, great pressures have been exerted against lighting, one of the small issues.

So we are going to have to wrestle with this in the very near future. When we get this research program put together, then we will have to determine how much it is going to cost.

Frankly, we would like to come to the Center for Building Technology to discuss this whole situation and see if we can chart some paths that will allow us to accomplish the needs that we see. That is what the Society wants and apparently what all the auditors want and panelists want.

I would like to say that it has been great to have the stimulating questions and comments of the auditors, and the observers as well, and of course those of the panelists. I think the steering committee made excellent choices. I wish to thank everybody again for coming to this Roundtable.

13.3 Mr. Cornish: Thank you. Ladies and Gentlemen, this pretty well wraps it up. I would like to say that I believe the lighting community indeed owes a debt of gratitude to both the IES and the NBS for having sponsored this particular Roundtable.

I believe it has done a great deal to improve the understanding of where we stand at the present time.

On behalf of Joe Murdoch, who is the chairman of the steering committee that set up this Roundtable, I would like to say thanks to a few people.

First of all, I would like to thank the IES staff who have been in the back of the room wandering around and picking up all of those questions from the auditors. I believe we should say thank you to them.

I would also very definitely like to thank the readers, Mel Unglert and Charley Amick, for their great assistance in pulling together those questions that were asked by the auditors.

Finally, our thanks are extended to the auditors and to the audience. Thank you for coming and participating in this Roundtable.

Of course I think our farewell should be said to the panelists because they should be complimented on their excellent performance that they provided to us for the past couple of days.

It has been a real privilege to have been the moderator of this panel. I think there should be within the lighting community more of the same kind of meeting because it is the best way to voice our different points of view. Thank you for attending.

(Whereupon, the Roundtable Meeting concluded at 1:05 p.m.)

APPENDIX A

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16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

The Lighting Roundtable described in this report was conducted to foster an open discussion of the goals, issues, and responsibilities of the lighting community. It was not a problem-solving session, but rather a time to examine the long-term aspirations and objectives of lighting and barriers that may stand in the way of achieving them. Eight major issues were addressed by nine panelists and a number of invited auditors. The issues are as follows: 1. The Public Image of the Lighting Community; 2. U.S. Role in the Worldwide Lighting Community: 3. Factors Affecting Human Activities in the Built Environment; 4. Effect of Lighting on Environmental Quality; 5. Effects of Barriers; 6. Establishment of Illuminance Levels; 7. Integration of Subsystems; and 8. Professional Development and Lighting Education.

The present publication consists of two parts: (1) A summary of the proceedings and (2) a complete transcript.

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