THE PERFORMANCE CONCEPT AS A MODEL LINKING RESEARCH AND DESIGN

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[Abstract] Past EDRA research has been of such an abstract, theoretical nature that it has been largely unrelated to useful design. Since EDRA members have in common the goal of applying human requirements as an essential shaping force in design, the performance concept, also based on human requirements, is offered as the best model to bridge the present gap between research and design. The performance approach, now past the experimental stage itself, has been used by Federal agencies to evaluate buildings' performance. A brief history of human factors engineering examines the split between architectural design and human factors. Examples of behavioral science research, translated into performance statements, are included.

An unsettling suspicion in the past year has increasingly returned to plague me--the suspicion being that EDRA research is not nearly as useful as it should be. Looking through 1973's two EDRA volumes I was struck by the vagueness of much of what we are trying to share with each other. Consider our title: EDRA, the Environmental Design Research Association. It is the word design that troubles my conscience. Are we really serving design? We have spent too much time building highly personalized jargons, esoteric research methods, and frothy models which are too abstract for application to design. This has derailed us from our true goal, producing the kind of research which those in applied fields can draw on to create more comfortable, happier places for people. If we cannot discover why our research efforts elude descending into useful design recommendations and correct the problem, then there is no hope for EDRA's research.

EDRA Research Dilemmas

Having done my share of research, I feel (if with some trepidation) that I am an appropriate figure to hurl rocks at EDRA's house. It is mine, too. It is because I do not want to see the house become only a place where once a year we let off steam--maybe I should say hot air--where we discuss the research fantasies we have developed, mostly at unreachable levels of academic abstraction, then go home to repeat the process. We must begin to build more substantial foundations for our research than we presently have, in my opinion.

I do not enjoy the role of Cassandra, prophesying a futile future history for EDRA unless we mend our ways. I too like the rarified air of the ivory tower--it is heady, euphoric stuff. But I don't want to perish up there with my fellow EDRA associates, choked on unapplied research. No one

in his right mind cherishes the notion that his work is an exercise in futility, but I wonder if we are in our right mind if we stay up in the ivory tower, constructing castles in the air which, after all, are the easiest kind to build. I do allege that that is where we are most of the time--up in the tower.

To begin the descent, we might profitably ask what is wrong with much of present EDRA research.

Confusion Between Designer and Researcher's Role

The first cause of too much impractical research is confusion about the role we are playing. Are we designers? Are we researchers? Both roles are essential for success in shaping the environment. And we can play either role, but not at the same time. We should never blur the distinction between them. One way to clarify these activities in our minds is to think of three roles--those of the scientist, philosopher, and architect. The scientist objectively observes the real world, he analyzes what exists, and says, "This is how it is." The philosopher ponders the scientist's discoveries and makes a judgment, "This is how it ought to be." The architect joins these two points of view by taking what exists and trying to create what should be. These different approaches, which we need to keep separate in our mind as researchers, might make the following sequence: The scientist (let's say a social scientist) observes the new fact that many people young and old are living in communes, that this has become a popular mode of living. The philosopher might judge that if people are doing this in increasing numbers to their happiness, then we ought to abandon antiquated taboos against such life styles. And the architect would join the two concepts by designing and constructing communes, hopefully ones well-suited to the needs of their communal residents. The point to remember is that we in EDRA can play more than one role as long as we understand which one it is. Furthermore, since designer and researcher represent two distinct roles we will need a bridge between the roles. Are we researching (being scientists); deciding what ought to be (as philosophers); or, are we designing (being architects, using the findings of research, which began with a clear intent to reach conclusions that can be converted to recommendations on the environment)?

Last Year's EDRA Conference Sees Problem

I think this point was touched on by one of our distinguished EDRA members, John Eberhard, then Dean of New York State's Architectural and Environmental Design College in Buffalo (and now President of the American Institute of Architects Research Corporation). In his closing address to last year's EDRA conference in Blacksburg, (Eberhard, 1973) Eberhard made this remonstrance: "I would be the last to say that your research interests should be abandoned no matter how esoteric or inessential they may seem to me." He adds in the same address, "But I also would not be happy with any intolerance on your part about someone else not really being a 'researcher'." Eberhard praised Robin Moore's method of improving playgrounds by reacting to what he observed happening and making small changes in the environment that pleased the children with whom he was interacting.

Robin Moore is on the right track. He is down on the playground, in the market place if you will, interacting and designing for the users' needs in a particular space. And yet even Robin Moore--one of the more pragmatic

among us in that his design ideas are out in the land of the living--even Moore whom Eberhard admires for his "interaction with imagination and sensitivity to design opportunities" is perhaps approaching the limits to what can be done with a designer's outstanding use of imagination and sensitivity.

Design and Research Need Special Models to Act as a Bridge

Although Moore is applying his research, or ideas, which is the first big step, even such creative talent needs help if it is to be translated onto a larger scene. As Eberhard notes: "We need more effective methods than solo action, more advanced technologies than a few hard tools" because "the model is more complex as the problems get larger, but the model is Robin Moore." I would agree and then expand this thought further. Moore with his talent and awareness of the need for incorporating research into his design is the model for a designer. No one, however, should expect him also to be the model for a researcher (though as a Renaissance man par excellence he may become that, too). The analogy is that Moore is like the skillful doctor who consults new medical research in his treatments for individual patients; he keeps careful records for medical data banks. But no one expects this practicing physician to carry on a full medical practice and simultaneously research the cure for cancer (although the connection between his work and the cure is evident). Certainly, all of this confirms the confusion over roles, most particularly here, the role of research as related to design in practice. It is one possible cause of undirected or unapplied research in EDRA.

Need for Proper Models

Besides confusion in the role of designer and researcher, a second cause of impractical research lies in our fascination with models. Many of us fail to start our researches with any clear intent of reaching conclusions which can then be converted into recommendations for the environment. Because our research is not aimed at application it is aimless. We do need models, but good ones. Good models, whether those of researchers or those of designers, have one quality in common: they relate abstractions to real world conditions. In doing this, it seems obvious that the models used by architects and engineers would differ from those used by social researchers. And they do differ. For instance, an architect uses as a model the topographical map (a model being a tool not only for organizing research or design but also to illuminate the ordinary realities common to everyday life). A topographical map gives a better idea of the terrain, an understanding of a particular piece of the earth which is unavailable without that map. This is the simple purpose of any model--to let its user better perceive reality, to simplify it, or to make it accessible for shaping. In a similar way, the social sciences need models to organize their large fields of information. Ways to explain behavior, for instance, have created useful and heuristic models from "survival of the fittest" to "the games people play."

Gulf Between Research and Application

The heart of the problem, to sum up, lies in the gulf that separates most of our research and its models from the grasp of designers using their own paradigms. How to bridge this gulf is the crucial question; how to get a flow of information going out in practical accessibility to those who can

use it, the design professionals in the building industry? We also need to reach specialized programming consultants who could benefit from our research. Medical facility consultants who advise designers on intensive cardiac care units should know about new psychological studies on the coronary victim's need to control, if only infinitesimally, his environment. Psychologists with special knowledge about troubled adolescents' behavior have research information which might profitably be incorporated into design of juvenile delinquent centers. This list is as endless as troubled human beings who need specialists' help.

Interface Between Research and Design Needed.

Models then are useful, even essential, tools for both researcher and designer. Yet, it appears that a gulf yawns between the researcher's abstract models and those which the designer can use. The answer comes quickly to your mind--some method of interfacing between the theories of the researcher and the practicalities of the designer. But before you rush out to invent such a research-to-design interface, let me save your time. The interface--called the performance concept--already exists. And performance itself is a model--one which cannot do injury to any scientific or design model, but can only serve to make a symbiotic union between the two.

Before I describe the highly effective performance idea, and indicate how it can direct otherwise aimless environmental research into productive channels, let me briefly discuss human factors research. Its history began earlier and is different from that of other types of EDRA research.

Human Factors Began as Specialized Practical Research

Human factors was born from World War II's need to adapt machines to men and men to machines. Tanks, planes, and ships had to be operated and maintained under life and death conditions. A fundamental understanding of the threshold limits of both men and machines was essential. Is it disgraceful or only sad that architects and other designers did not step forward to undertake and solve these crucial problems which seemed to fall into their province? Or perhaps designers did not have the necessary research skills which psychologists and engineers were able to provide. When World War II ended, human factors had consolidated into position in the military estaablishment and was ready to take on new man-machine problems in industrial plants, medicine, computers, and the exploration of outer space. But, at that later time, human factors specialists were unable to expand rapidly into the burgeoning field of environmental research. Earlier, architects could not take over the human factors field, and now human factors specialists cannot take over architecture. Human factors was trapped by its own man-machine concepts where hands-on operation is the rule. But in environmental research, hands-on approaches are only partially applicable and only in such spaces as kitchens, typewriter work stations, and laboratories. In most other spaces where a person might sit in a chair conversing or just day-dreaming, hands-on concepts cannot approach any research problems or even identify their exsitence. Hence, the problem for human factors was not that its model was too personalized, esoteric, or frothy but rather that it was too narrow for application to environmental design.

Human factors, which emerged mainly from psychology, largely remains a branch of psychology. Not unexpectedly, there is a philosophic barrier between the human factors engineer and the architect and neither appreciates the competencies of the other. This has meant that human factors, with all that it has to offer, appears today in stunted form, not penetrating significantly and in depth into the building field. Human factors researchers should--but have not yet been able to--contribute importantly in solving today's serious building and other environmental problems. They have some admirable strengths going for them. By definition, they weld application to research and their working model is practical. However, it must be broadened if it is to be expanded past machines to larger pieces of the environment.

Solution in the Performance Approach

But--and here lies the thesis of my entire message--if human factors' experts and other environmental researchers adopt the performance model, I believe their knowledge can be propelled into the market place, that world where humans with their myriads of needs live in varying degrees of discomfort in a poorly designed (if designed at all) environment. The performance approach, now being implemented to incorporate peoples' needs as a shaping force for the built environment, is more closely related, moreover, to human factors engineering than to other types of environmental research.

The performance approach, no dreamy theoretical notion, has already been widely used for school procurement following Ezra Ehrenkrantz's pioneering School Construction Systems Development Project (SCSD: An Interim Report, Educational Facilities Laboratories, 1965). Performance has also been used in evaluating housing for HUD's big innovative experimental project, Operation Breakthrough, with nine prototype phase sites and over a hundred volume production phase housing projects across the country. Operation Breakthrough has the three-part goal of 1) advancing innovative methods of manufacturing indistrialized (prefabricated) housing; 2) introducing new materials on the building scene through the performance concept (how plastic pipe, say, must perform when installed because copper pipe and other traditional materials are in scarce supply; and 3) most important to this audience, studying ways in which human needs can be incorporated via performance statements into better future housing for people.

What Performance Is

The performance method has been well defined by Dr. James R. Wright (Scientific American, 1971), Deputy Director of the Institute for Applied Technology, the National Bureau of Standards (NBS):

Performance tailors "housing closely to the needs of its users. The performance approach aims at both qualitative and quantitative housing solutions." (Although Dr. Wright's context is housing, his definition applies to any area where design and human requirements need linking to create a better built environment.)

"It (performance) also aims at inspiring innovation in the technology of buildings." I might add most research, when applied, produces innovation whereas unapplied research produces only dust-gathering reports. "The performance approach demands a statement of performance in terms of function (emphasis mine). Since buildings serve people, function is defined by the attributes necessary to satisfy human requirements. The means of delivering an attribute is left open. The philosophy of performance puts its principal emphasis on the satisfaction of human needs." By attribute we mean a normative attribute, a desirable quality we seek to embody in the built environment such as safety, efficiency, comfort, privacy, etc.

This approach, in my opinion, is perfectly tailored to gathering and applying environmental design research. Although many of you are already familiar with performance you may not have thought of it as mediator between your own research projects and practical application. Therefore, let me expand the definition further with Dr. Wright's words:

"In the performance approach a specific building system, component, or material is subservient to the delivery of an attribute. That in turn is subservient to the satisfaction of human needs." He cites a heating system's ability to achieve the attribute of warmth as being of "less concern than the attribute itself, and the attribute is of less concern than the thermal comfort of the people using the building." So, satisfying human requirements is the basic intent of performance. The concept, which rests on careful attention to human requirements, is expressly intended to include research (if properly presented) from the behavioral sciences' growing body of new information on the way people live in their environment.

Performance specifications (Dept. of Housing and Urban Development, Guide Criteria, 1970), no longer in the realm of speculative theory, have already been 1970), no longer in the realm of speculative theory, have already been written at NBS for the Department of Housing and Urban Development as part of HUD's experimental housing program, Operation Breakthrough. These performance criteria will soon be appended to the FHA Minimum Property Standards to serve for evaluating innovative housing submitted for FHA mortgage financing. Also, NBS has written specifications for office buildings on behalf of the Public Buildings Service of the General Services Administration. Writing such specifications is not too difficult once the simple and straightforward format is clearly understood.

How to Cast Research into Performance Statements

Performance specifications have a standardized format, the performance statement, which is derived from users' needs. A performance statement consists of three essential substatements, and a possible fourth substatement when and if necessary: these parts are a requirement, a criterion, a test, and a commentary.

The requirement identifies some building component or space and the attributes needed to describe it. These qualitative elements in the performance statement involve such normative attributes as privacy, comfort, safety, etc. Second, the statement converts the attribute to a criterion which a designer, builder, or manufacturer can follow. The criterion is the quantitative element and identifies how wide, how strong, how much illumination, etc. Third, the statement establishes the procedures for testing the criterion (to see if the proposed building will, or the constructed building does, in fact perform as specified; i.e., is it that wide, that strong, etc.) And the fourth and optional part of the statement, the commentary, provides the place for explaining how the performance statement was researched or identified, references of interest, or any other background information to clarify the performance statement. In this way any statement can be challenged and revised as fresh information from research becomes available.

An Example of a Performance Statement

Robert J. Kapsch and I made a study at the Center for Building Technology on improving design of hospital nursing units (Wehrli, et al., 1972). We used the performance approach on a patient's need for lighting (among other things), and discussed the performance application as follows:

"The requirement is usually a single simple sentence explaining what is required of the building. For example, 'Adequate lighting shall be provided for all patients.' The criterion sets the measurable levels that are required: thus, 'Fifty foot-candles of light shall be provided four feet above finished floor.' The third part of the performance statement, the test, gives the method by which the quantitative level is to be evaluated. One test for illumination is to take readings with a calibrated light meter to determine whether or not the criterion level of 50 foot-candles has been met." The commentary references the standards of Illuminating Engineer's Society (IES). Of course, many experts now challenge IES lighting standards for being based on "quantity" of light and for requiring more light than users actually need, thus wasting energy resources. But this sort of controversy is contemplated by performance--as soon as new, better standards are developed through research, they will be adopted and the old ones discarded.

Our nursing unit study points out that this satisfying of a particular user's need--in this case a patient's need for reading comfort--specifies only that in some way 50 foot-candles of light at the level of his over-bed table must be supplied. The precise means of providing the light is not stated, thus allowing the maximum freedom for the introduction of new fixtures, new materials, new methods. It is in this way that performance statements are open-ended, not closed and prescriptive as traditional building regulations and codes usually are. Again, since the point of performance is to provide buildings more attuned to users, assumptions about their needs should be tested continually and revised as new information is accumulated.

Performance statements have an added bonus in that they are ideally suited not just for mandatory or concensus building standards but also for architectural programming statements, permitting a consistency of format for all of them. Moreover, Kapsch and I showed how a set of these same performance statements can be used in evaluating alternative nursing unit schemes in the schematic phase of design. The idea here being to select, at this early phase, that floor plan best aimed at satisfying the needs of future patients and staff.

Not All Parts of Performance Statement Need be Written by Researchers

It is a legitimate anxiety on the part of researchers in the behavioral sciences to worry over how to write all four parts of a performance statement, since establishing the criterion and test may go beyond the scope of their particular discipline and lead into other scientific/technological skills involving physical optics, structural engineering, economics, and many others. The answer lies in researchers writing only the requirement and the commentary, leaving the criterion and test to others. Human research can thus point the way to needed environmental change in design. It can announce, for example, that emerging information about people (such as NBS' present research in figure-ground contrasts which would mean lower lighting intensities) is becoming available in specified areas and point out exactly where such information might usefully make its way into design. The commentary will provide the place for such supporting background information to establish why the researcher's requirement is a good one.

One example of this is a study on how safer stairs can be designed through incorporating knowledge about perceptual selectivity (what people chose to notice and not to notice) into stair design. The study, made by a psychologist, Dr. Robert Cormack of the New Mexico Institute of Mining and Technology (Cormack, 1973), is important for reducing injuries. Stairs, next to bicycles, are the second largest cause of accidents at home and work. Users do need safer stairs and psychological research is the avenue for designing them. Dr. Cormack writes a performance requirement on stairs related to peripheral vision as follows: "A visual indication of the beginning and end of a stairway should be provided at eye level, and observable with peripheral vision." His commentary: "This often occurs naturally, except where there is an encroachment...The bend in the wall, a change in wall color, a vertical molding in a contrasting color, or a change in lighting can signal the top or bottom of the stairs to a person whose vision is obstructed by an armful of packages. The redundancy involved in using at least two dimensions (lightness, hue, saturation, texture, and pattern) increases the likelihood of observing the steps and makes the accurate discrimination of position and depth easier, thereby making missteps less probable. (In this regard, lightness is more critical than for example hue and saturation.)"

As you can see, Dr. Cormack is on home ground here as a psychologist and is using performance to remove barriers to his casting specialized knowledge on human perception into a potentially useful, accessible form for designers.

Now, Cormack's ideas have not been tested in practice; hence he cannot be sure they are accurate. The important thing, however, is that his requirements are down in black and white and couched in a language which designers can understand.

Other Matters to Consider in Styling Your Research for Application

The performance model, as is evident from the above, makes it possible for environmental design researchers to frame their research in performance statements--if not all four parts, then at least the two parts used by Cormack which makes the useful skeleton of a bridge, the performance bridge, between research and application. There are other areas researchers should consider.

Select a Target Audience

Unfortunately, many researchers demonstrate no clear intent to reach conclusions which can then be converted into recommendations on the environment. The researcher needs to select a target audience and be aware that such an audience falls into two parts: First, the researcher must identify who will be the ultimate user of the particular study he has in mind. Second, he must identify the applier of his research. This kind of sharp focus is essential in creating useful results in the field of environmental design--a field which has a growing market for new findings cast in performance language.

Two-Stage Performance Statements

Some performance statements are not just based on research but constitute a demand for additional specific research. These are two-stage performance statements in which the first stage is the call for local research in order to shape and perfect the performance statement into a more concrete, specialized second stage. The second-stage statement, customized through local research to a particular population, is the one used by the designer. This is good news for researchers who are already interested in special populations-ghetto or Indian, teenage or elderly, hospital or prison, etc. To illustrate such two-stage statements I will return to the performance requirement for hospital lighting: Hospital lighting should be suitable to the hospital population. Then researchers assisting in the design for a particular hospital can investigate their special needs. If they find a large number of patients with eye disease, they can provide second stage lighting and other requirements to reflect this need. By calling for added research to define the special needs of a particular population, performance can assist designers in satisfying the needs of that population.

Precedent in Building Codes for Two-Stage Performance Specifications

In housing and building codes and standards, a precedent has already been set with two-stage performance standards for heating and cooling systems where such performance specifications require that such systems be appropriate for local climates. Essentially this calls in the first stage for data gathering to specify the vagaries of the local climate, and in the second stage for designing the mechanical systems to that climate. But the first stage data gathering could also extend to local, or specific building users with their specialized needs.

Need to Consider Who Will Apply Your Research

Who will apply your findings when you cast them into performance language should enter into your research planning as much as who will be the ultimate user. Again, selecting the applier, just as selecting the ultimate user, will channel your research into specific topics--topics which lend themselves more readily to design application than the vaguely abstract studies I complained about in the opening of this paper. Appliers of research might be architects, engineers, designers, builders, the professional writing a program on building procurement specifications, building regulatory agencies, financial institutions involved in building mortgages, housing managers, etc. Each has its special objectives, competencies, and purview which you as a researcher bent on seeing your studies enter the real world should be somewhat familiar with. If you select your applier and cast your findings into the performance model, your work has an excellent chance of leaving the never-never land of idle theory. As stated previously, performance can also be used in the field of design programming in which performance statements outline the program. Performance here offers a way of thinking about research in terms that convert such studies into design. An example of this is Dr. Cormack's report on human perception and stair safety which he concludes with a set of performance requirements plus their commentaries for improved stair design. If EDRA researchers familiarize themselves for such areas as these in which performance interfaces with the built environment, their research can be pulled toward practical use.

Precise Language Needed to Create Good Models

Besides identifying the user of research and the applier of it, there is a third matter which EDRA associates should consider if they would style their work into a form that lends itself to application. And that is the problem of abstract language. Unless absolutely essential, the researcher should jettison his discipline's cargo of special gobbledygook which is more apt to make him look unworldly than erudite. Such language is always suspect and must be defended with outside disciplines. If jargon is needed, use it--but if you must speak of "behavioral ecology," for instance, please translate into lay terms and identify the place of activity. Is it an office? What kind of office? And identify the office users and their behavior in common terms. Precise language applied to specific people and places in the environment won't lend itself to castles-in-the-air research.

Is Your Research About People, Behavior, or Environment?

A last suggestion that may help the researcher cast his studies into useful performance statements is classifying research recommendations in the following manner: 1) are they centered on people 2) their activity or 3) their environment? If your recommendations are to be made for direct use by designers they should aim at governing the environment. This is the usual and appropriate form for building performance statements and for building codes and standards. Examples of environmental recommendations are: Hot and cold water shall be supplied at all lavatories, and flues shall be protected from combustible construction. If on the other hand your recommendations are for housing or building managers, then they aim at governing people, such as: retarded children shall attend special schools, or patients with measles shall be quarantined. Or, your recommendations may aim to control behaviors; e.g., no smoking or no running at poolside.

Since the interactions of these three elements is one way of looking at the material we research, we should be aware of the differences between the three elements.

Conclusion

If I have painted a hopeless picture, I didn't intend to. It is only that I am convinced that we badly need the performance model, and I strongly urge its adoption. I believe that here at EDRA we are merely going through three spheres of development common to most neophyte organizations such as ours. In the first phase, which is evangelical, members serve not so much as researchers, but as leaders of the movement, aiming at bringing respect, interest, money and membership to the new association. I think we are nearly out of this ahd moving into the second phase, that of model building. Here members produce techniques, methods, appropriate models, whatever is needed to develop and present their particular points of view. This second stage is something of a vacuum, although a useful one, with members seeking to transfer models from other sciences to their own new subjects. Phase two while essential should be transitional to the third stage, which we should be striving to enter if our organization is to be productive. This is the problem-solving phase. Here a mature and established research should be applied to genuine problems whose solutions will benefit humankind.

Although we are mixed disciplines--urban planners, operation researchers, computers scientists, architects, anthropologists, members from most branches of the behavioral sciences--we share the belief that human needs should play the leading role in shaping the environment. We know that our varied disciplines lend themselves in differing ways to achieving this shared goal. I suggest the performance model as the common method we could all master with relative ease to link together our separate findings. The performance language, one all could read, begins with human needs before moving into the practical specifications for building requirements, criteria, and tests. Nor does it matter with the performance model whether we fall into the category of designers or researchers. At whatever place our individual talents happen to come down, performance will cast our work into as utilitarian a form as the material permits. Because both EDRA and the performance approach have the common denominator of human needs, we are ready--I hope willing--to move into that third stage of a fruitful research organization, the problem solving phase where theory moves surely and swiftly into application.

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