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INSTITUTIONAL ANALYSIS OF RESEARCH  
AND SOCIALIZATION IN HOUSING: A PRELIMINARY  
EXPLORATION

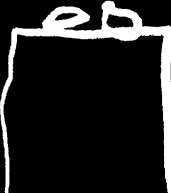
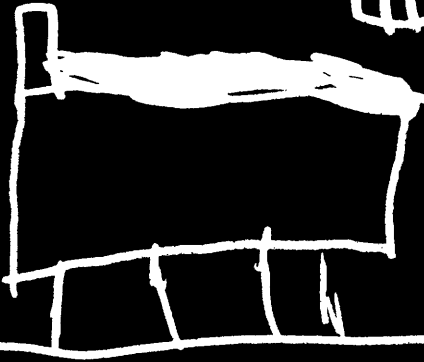
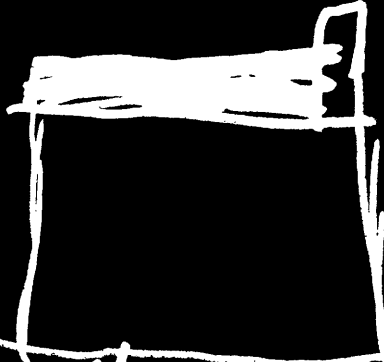
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MIT Energy Laboratory Working Paper MIT-EL-79-015WP

March 1979

The Photovoltaics Project under which  
this work was completed is funded by  
the Department of Energy under Contract  
No. EX-76-A-01-2295, Task Order no. 37.



Melita



## ABSTRACT

This paper is one of a series prepared under the sponsorship of DOE's Photovoltaic(PV) Program as part of the institutional analysis of housing. It considers research and socialization functions of housing. In addition to a brief discussion of the theory and methods of institutional analysis, the paper presents a brief historical review of building in the US, identifying an historic heritage for the independence of institutional entities in the building industry. A review of the building industry's response to innovation (including a brief description of the introduction of PVC piping) suggests that the industry may be characterized as fragmented and localized, with many actors, each responsive to the dispositions of all others (especially the ultimate source of motivation, the consumer and his/her purchasing power). The building industry is structured such that no single actor predominates, but that any or several may be the source of either facilitation or obstruction of innovation. Overcoming economic and technological constraints is not enough. Given the normative importance of housing, anything identified as "new and different" will meet resistance, while innovations labelled as providing "the same with less uncertainty" will find a more willing audience.

The authors gratefully acknowledge the assistance of Richard Tabors and Jeff Cruikshank in the preparation of this paper.

Housing means different things to different people. The drawing is by a five year old in response to the request, "Draw me a picture of your house."

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For most people housing constitutes the single largest monthly expenditure. That fact alone would be sufficient to prompt most people to pay attention to the nature of their dwellings. However, this economic reality is typically an uninteresting attribute of housing. True, housing is a cost item. But more importantly for most individuals, the home is an expression of one's personality--indeed, of one's life. It is the largest, most overt, and most durable symbol of what is important in a person's life. (it is certainly not by chance that the cliches which concern "home" focus on sentiment--e.g., "Home Is Where The Heart Is"; "A Man's Home is His Castle"; "I'll Be Home for Christmas"; "Home Sweet Home.")

Housing is intensely personal; it is more ego than economics. A home is personal in a way which transcends Corbusier's aphorism, "A house is a machine for living". This personal quality of housing clearly has its visual dimensions: i.e., the appearance of the home, and its design and decoration, both interior and exterior. But beyond the immediately visible level is the *perception* of home, the sense of meaning that is attached to the home and its uses. This perception may include thoughts of events past or anticipated, of work done in or on the structure, of meals served and shared, of tragedies endured and joys celebrated; in short, the perception of all of the things that occur over time and are associated with the home.

Housing, then, is more than its physical components. It is a manifestation of life, and life-style, densely focused in and around a physical form.

This personal and perceptual quality of housing extends beyond those who own and/or live in the particular structure. It includes those who have a part in its development and construction, as well as those who are concerned with its continuous use. In this group are those with direct connections (builders, architects, repair persons, and real estate brokers, for example) as well as those whose connections are less direct (for example, neighboring property owners and town officials, attempting to encourage community stability).

It is this personal and perceptual quality of housing that makes the field so complex. The meanings attached to housing (and individual housing units) by persons in the housing arena vary tremendously. The fact that these meanings are personal, perceptual, and densely focused on discrete housing units requires that an adequate exploration of the housing institutional arena must include this normative dimension.

In the context of the theory of institutional analysis which is being applied in this series of papers on housing, the normative dimension incorporates the *research* and *socialization* functions. Research (the consideration of what is and what might be) and socialization (the transmittal of norms through formal and informal mechanisms) are obviously meaning-connected. An understanding of the normative perceptions typically associated with housing--and the process by which perceptions come to be associated with housing--is central to any effort to introduce innovation into the housing arena. No matter how apparently compelling a new product or process (for example, a fast building system for the production function, or a cost-saving energy system for the finance and service function), it must

ultimately be *perceived* as compelling by the various institutional entities in the housing arena. If its perceived meaning is negative (systematically, or by some critical entity or entities) it will not be adopted. This paper investigates this perception of meaning.

This paper is one of several *preliminary* explorations of the housing institutional arena. Such explorations constitute a beginning step in the methods of institutional analysis. (These methods are described briefly later in the paper.) These studies are undertaken with the sponsorship of the US Department of Energy as part of its Photovoltaic (PV) Program. In addition to institutional questions, DOE is interested in economic, marketing, and technological issues, and is sponsoring a series of studies and field tests on these topics. Institutional analysis studies have typically been undertaken in relation to particular PV field tests, though in some cases studies have focused on comparable technologies and institutional forces influencing their acceptance. The studies on housing are being conducted in relation to the HUD-DOE Solar Heating and Cooling Demonstration Program. This program provides grants to builders and developers to encourage their adoption of solar thermal technologies in various residential applications. Other papers in this series of preliminary explorations focus on housing production, government involvement in housing, energy provision in housing, and standard setting. (Swetky and Nutt-Powell, 1978; McDaniel and Nutt-Powell, 1978; Reamer, Heim and Nutt-Powell, forthcoming; Parker and Nutt-Powell, forthcoming)

There are three sections in this paper. The first section is a brief presentation of the theory and methods of institutional analysis. The second



section is an historical review of building in the US. The final section is a consideration of the building industry and innovation, which includes a specific discussion of the response of the building industry to a recently accepted innovation, PVC piping. A brief conclusion suggests avenues for further study within the framework of institutional analysis.

## THEORY AND METHODS OF INSTITUTIONAL ANALYSIS

Theory

An "institution" is defined as a discernible entity that carries or is the repository for social meaning. (For a detailed discussion of this theory see Nutt-Powell, *et.al.*, 1978). Institutions are characterized by function (finance, regulation, research, and so on); and role (vendor, linking-pin, translator, and so on). There are six types of institutional entities: formal and informal organizations (the US Ford Foundation; a pick-up basketball team); members (a Town Meeting Member); persons (Walter Williams); collectivities, whether known or unknown to members (the viewing audience); and social orders (the importance of good design). Institutional entities combine and interact to form an institutional arena. Within that arena, exchanges occur between and among institutional entities; institutions are stability-seeking and routine-establishing. Exchanges between and among institutions which occur over time combine to create a resource configuration. Institutional analysis is the study of how and in what forms social meaning is created, transmitted, maintained, and/or changed. The particular structure of a given institutional arena is simultaneously stable and changing, but it is identifiable. Information in exchanges is the key source of data for institutional analysis.

Innovation (such as the introduction of PV into the Nebraska agricultural sector) is a deliberate and substantive alteration in the institutional arena. Once again, information is vital, for it is the currency of innovation; it is of two types: (1) technical--What do you trust?; and (2) personal

--Whom do you trust? Exchanges within the institutional arena exhibit one or both types of information. Because institutions are stability-seeking and routine-establishing, they are considered to be "risk-averse."

Innovation creates the potential for risk by disrupting social meaning. Rather than attempting to maximize benefits (which would support rapid acceptance of innovation), the institutional arena tends to minimize risks (which leads to resistance to the quick adoption of innovation). Institutions are more likely to accept an innovation (i.e., institutionalize it) if their information about that innovation is personal, rather than technical, since such exchanges are more likely to link to routine, stable meaning, thus creating some confidence that risk has been minimized.

#### Methods

There are seven steps in conducting an institutional analysis:

- (1) Identify the sector (i.e., economic, geographic) to be studied, and determine study objectives
- (2) Prepare a preliminary sector exploration--including both an overview that could be applied to any such sector, and material that is location-specific
- (3) Construct an hypothesized institutional arena
- (4) Identify the "perturbation prompter"
- (5) Devise the specific research design
- (6) Monitor perturbations
- (7) Analyze the institutional arena.

It is important (and sometimes confusing) to remember that the researcher him/herself is an institutional entity, engaged in exchange within the

institutional arena. When performing in institutional analysis of innovation, it is also important to come to grips with the problem of the "gnat on the elephant": that is, it is necessary to have an innovation which is sufficiently significant to cause perturbations that will be taken seriously within the institutional arena; however, the innovation and its perturbations may well "*poison the well*," that is, they may prompt institutional exchanges that would be characteristic only of such experiments. Thus some innovations are less suitable than others for research and demonstration-based institutional analysis. The selection of perturbation prompters must be guided by the recognition that such prompting must come via an already accepted (institutionalized) and credible means if it is to be perceived as worthwhile, but it must not be unique to the extent that it reflects only the experiment itself.

## A HISTORICAL REVIEW OF BUILDING IN THE US

Building in the US derives from the European tradition, which since its inception has differentiated among its components. Although there is some overlap of subsets in the building industry in the Western tradition, there is no hierarchy, and no all-inclusive and unifying principle. Building is an activity characterized by the ideological independence of building, building components, and builder from the broader environment. This independence is so ingrained in the Western tradition that it takes some effort to conceptualize the Oriental approach that provides no discrete division among the design of the house, the palace, the marketplace, the city and the world. To this approach each component is sufficient unto itself, but is also an integral, contributory element of its inclusive, hierarchical superior.

The independence of parts to which we have referred has historically been evidenced in the division between the *monumental* and the *vernacular*. The former is the province of "Architecture," and concerns itself with structures capable of grand statement--office buildings, universities, schools, law courts, theaters, palaces, expensive homes, and churches. Here the determinants of form are the historic and the artistic, expressed through grandeur and style. The second is the field of the owner-gilder or contractor, and is concerned mainly with housing, (although factories and warehouses have been part of this domain as well). Compared to the monumental, vernacular building is referred to as functional, impermanent, "small," and apart from the world of fashion. The monumental is well documented, and

is the domain of the critic and commentator, while the vernacular-- despite a long and expressive history--has only recently been considered worthy of study.

Since the turn of the century, there has been a blurring of the distinction between these two approaches, as the architectural profession has expanded its province to include much that was previously the field of the anonymous builder, and has thereby rendered every builder (potentially) "monumental." In turn, the builder/contractor has made incursions into the architects' realm, rendering all structures (possibly) common. As an example of the former process, architect-designed low-to-moderate income housing developments now receive design accolades. A comparable example of movement in the other direction is the vernacular quality of recently built legislative buildings, including (notably) the new Senate and House Office Buildings in Washington, D.C.

But the process of blurring the distinctions has not yielded a unified, Oriental attitude toward components of city form. These components remain distinct, independent, and non-inclusive. Although the blurring has occurred in terms of the nature of the building, increasing complexity of design, sophistication of construction, and improvement of materials have meant that different distinctions have resulted concerning the meaning of and responsibility for various stages of the building production process. Where we once saw "domain" issues (regarding type of building--i.e., monumental vs vernacular) we now find jurisdictional issues in stages of building production. (For a discussion of the housing production process, see Swetky and Nutt-Powell, 1978).

In a field characterized by fragmentation and by an increasing range of numbers and sophistication of actors, the issue is no longer the nature of the structure, but rather the control of its production. From this development have emerged housing and building codes, union work rules, professional certification, utility regulation, monitoring of financial practices, standardization of materials, and so on. The effect has been to increase demand for codified skills and/or products. Thus, where the building process could once be divided into the monumental and the vernacular, it is now described by reference to the wide range of actors participating--developer, designer, contractor, subcontractor, financier, lawyer, planner, laborer, broker, inspector, insurer, and so on.

Thus far we have focused on the emergence of control over (rather than the nature of) buildings in the development of building in contemporary America. However, America did not become significantly urbanized until the 20th century. The tradition (essentially undocumented in a formal sense) of vernacular building, and the forces shaping it, are also an important element of US building, contributing to a still strong social order in today's housing. Thus some discussion of that tradition, and its heritage, is appropriate.

First, American cities in the 18th and 19th century were not of the same nature as our contemporary urban areas. Almost without exception, they may be called "towns" (using contemporary terminology) in that within their boundaries there was sufficient space to accommodate their populations while maintaining an ease (in style, distance, and time) of travel. Densities--though high for their time in comparison with rural areas--were low

by today's standards. Single-family detached dwellings were typical. (Witness reconstructions such as Sturbridge Village or Plymouth Plantation in Massachusetts.) There remained close connections between the people and the land. The "Commons" of New England towns are examples. (Boston still has a city ordinance providing that residents may graze their cattle on Boston Common, a right symbolically observed each June during Dairy Week.)

The growth in America's population, even with the influx of European immigrants in the mid-19th century, was not in the cities, but in rural areas. (Warner, 1972) Thus the American vernacular developed in a rural setting, permitting strong connections between housing and land, and a continuation from the European tradition of the single-family (albeit, in some cases, extended) dwelling. The invention of the nail-making machine, and the consequent development of the inexpensive building method now known as framing, facilitated this trend. (Recall accumulation of wealth.)

The immigrating population itself had a predominantly rural orientation, expressed in its housing demands. This continued as a characteristic even through the turn of the century, when the demands of an increasingly industrial economy for a large, readily accessible work force for its factories meant that the cities began to fill rapidly with both immigrants and domestic emigrants (rural to urban). Though densities increased, they were not as dramatic as might have been expected given the sudden leaps in population. A significant factor in enabling population increases, but holding reasonable density levels, was the coming of the street-car (and later the automobile). With this single innovation, density



as a constraint on form and as an important determinant of the building tradition of America was removed. This permitted separate houses to dominate the form resolution of US vernacular housing, for which both European immigrants and American emigrants had a preference. It is a building type that became the paradigm for "decent" housing, and is, in most respects, a thoroughly institutionalized social order. It is a form which, if it could not be provided in its pure form (the single-family detached dwelling on its quarter-acre lot), was provided in a suitable variation, such as side-by-side duplexes, double- or triple-deckers, and, in what is perhaps quintessential Americana, the mobile home.

There is one final area for historical review, a real comprehension of which provides the backdrop against which to assess the socialization and research functions of housing in the US. That area is the development of public control over land use, and the historic tension between public and private domination in this area. One quick (and not overly facile) summary is that public control has been supported insofar as it has been perceived as enhancing private control.

In early American cities, shared traditions and a fairly homogeneous population made the task of living in groups relatively easy, and resulted in minimal governmental regulation. With the coming of the Industrial Revolution, and the attendant growth in population, the arrival of people who did not share established traditions, the increasing spatial separation of classes, and the social horrors which followed the packing of the poor into the cities--we can assume that one major incentive for reform was that some form of regulation was essential. Disease and

destruction did not, like the poor, remain in the slums.) Controls over slum housing were, therefore, not perceived as building regulation *per se*, but as part of an extended system of health standards. The tension between public and private domination of land use which was to develop from this was not yet obvious, being overshadowed by the obvious benefits to society.

Perhaps because the appeal for public control was cast in terms of the public health, safety, and welfare, the provision of housing never really became the province of the government. Housing began and continues as a private market good and such direct public involvement as now exists is accepted only grudgingly. (For a discussion of government involvement in housing, see McDaniel and Nutt-Powell, 1978.) The first specific public housing act was not passed until 1937, in Roosevelt's second term. Even then, because of court decisions regarding the original provisions, the federal government removed itself from the direct construction and management of housing, making these local responsibilities to be discharged by public housing authorities. This direct involvement at the municipal level was legitimized in the public health and welfare tradition through the principle of "equivalent elimination," whereby the number of new dwellings built under the act were to be matched by a "substantially equal number" of unacceptable housing units destroyed.

Beginning with the public safety appeal (and extended in the decent housing premise of direct construction), two forms of public control became legitimized. The first is the principle of minimum standards of housing to which everyone is entitled, and the second is a broad concern with amenity and efficiency in urban life.

The former took its expression in health and building codes, the latter in zoning (and later, housing and urban renewal). The former was restrictive and passive, and the latter expansive and active. The result is that government has a broad range of legitimized activity in housing, but it is a range where specific manifestations are arguable. In theory, at least, all such activity conflicts with the tradition of jurisdiction control (by producers of housing) and aesthetic/style preference (by consumers of housing). Both of these traditions are rooted firmly in a building climate of independence, while the government's activities appeal to mutual dependence. Thus, it is not surprising that there is a situation of tension among the three dominant forces in the building industry -- government, producers, and consumers.

## THE BUILDING INDUSTRY AND INNOVATION

The transformation of much of the built environment from a series of independent elements directly reflecting the dominant force in development (monumental structures by architects; vernacular houses by builder-owners) into *commodities* has meant that housing is now an *industry*, concerned with profit, within which many actors contribute to the production of any given structure. This "industrialization" of housing places control over the sector into the hands of others than the users of the building. If one were to divide the participants in the building industry into two groups--users and producers--the longer list by far would be under producers. Consider this brief listing:

Users

owners  
renters  
employees  
shoppers  
viewers

Producers

builders  
developers  
financiers  
architects  
engineers  
inspectors  
planners  
suppliers  
managers  
unions  
tastemakers

While the listing is not intended to be all-inclusive, it is immediately obvious that most participants are producers, and not users. Thus, it is not incorrect to say that the majority of actors in the housing arena perceive of housing not for its use, but as a source of funding and employment. This fact has significant ramifications, because it is the

simultaneous financial reliance on and detachment from the *use* of the product that most contributes to creating barriers to change in the industry. The conservatism of the user is not a significant factor, when compared with the interrelated, reinforcing conservative tendencies of the producers. (Here recall centrality of jurisdiction in the contemporary housing production process.) If to this is added the extensive fragmentation of the industry, exacerbated by the risks of financial exposure of any one actor, it is clear why the industry is disposed to resist innovation.

#### Innovation in General

The nature of the building industry is such that the extensive acceptance of a given innovation is almost miraculous. Other industries--e.g., transportation, drug, steel, and oil--are usually centralized and aggregated. There are few corporate entities, few unions, and few inspectors. On the other hand, the building industry (and in particular, the housing industry) can be characterized as:

an activity which is highly fractionalized involving many small operators and consumers; undercapitalized and therefore a captive of national economic cycles; operating in a very powerful somewhat unique and frequently difficult labour environment; carrying on very little basic research and development in comparison to others of its size; largely reinventing the specific team of participant actors to carry out each construction project and due to all of these attributes, comprising an extremely risky sector of the US economy. As an example of how fractionalized the industry is the largest producer of housing in 1973 controlled less than one half of one percent of the market (compared to General Motors (with) forty percent of the automobile market. (Schöen, 1975, p.38.)

Research is a typical route whereby innovation reaches an industry. The research function in the building industry is quite unlike that of other industries. When one attempts to categorize the actors in research,

it becomes clear that those defined as "building industry researchers" are actually outside the industry. In most cases, the industry is seen as an incidental market for researchers elsewhere. The plastics industry developed pipes for the building industry, as an addition to other more important uses of plastics. The steel industry developed I-beams for building use only after exhausting its railway market. Plywood was designed by the timber industry as a packing material. Today, much of the research is carried out by the education industry and by the large oil producers. The latter have given us plastic insulation materials, and are supporting much of the advanced research in solar energy.

The fragmentation of the industry is the major determinant of this situation. It is highly unlikely, in any industry, that research bodies should be bigger than suppliers. With the major producer in housing supplying only one half of one percent of the market, the possibility of its supporting a research body is minimal. It is for this reason that more homogeneous industries (like the timber industry) or more centralized industries (like the oil industry) exploit the building industry as a market for their products. Their lack of fragmentation allows them to support a research branch which in many cases may have a larger budget than the largest housing producer. A consequence, however, is that the research first serves the interests of the materials suppliers. Rather than devising products or processes to meet housing production needs, housing production practices are created to use products and processes. The results may be beneficial; but if they are, it is as often by chance as by intention.

The process of innovation in the building industry is perhaps most easily understood by considering the history of the acceptance of a major innovation. This method should clarify the interrelationships of the aids and barriers faced by one product.

Major innovations in the building industry include the rediscovery of concrete and the invention of the nail-making machine, the elevator, mechanical heating and cooling systems, and the electric light. All are innovations which contributed to a major *restructuring* of the industry. There have been, aside from this, other innovations which infiltrated the industry in such a way that they *replaced* an existing part of it rather than contributed to restructuring.

It is not possible at this point to say whether the dissemination of conservation techniques and alternative energy sources (which would include photovoltaics) will lead to a restructuring of the housing industry. Most conservation techniques (including that aspect of solar energy known as "passive") are, at best, replacement techniques. Active solar energy systems do not seem to require a substantial restructuring of the housing industry either. They are certainly more additive in their effects than passive systems, but aside from implications of formal changes to some buildings, one would expect no restructuring of the industry. Photovoltaics also imply some architectural constraints, but no major industry change.

The restructuring of the energy industry, which would result from massive adoption of alternative (and especially dispersed site or non-central power) energy sources is an institutional factor of great importance.

If, for example, the photovoltaic cell were seen as a revenue source by major oil corporations, then the support of the corporations would eventually have an impact on the building industry.

It is this restructuring/replacement distinction which makes the search for an example of innovation within the building industry difficult. There are numerous examples of replacement innovations within the industry, but are there any which were the result of a major restructuring within other industries? The production of steelbeams and columns, as we have indicated, came at a time when steel producers had exhausted their market for railroad tracks; they virtually restructured their industry to supply the building industry. But the nailmaking machine, which made frame construction possible and which rendered heavy timber construction obsolete, was only a minor change in the steel industry. Another consideration in selecting an innovation for study is that it must be a relatively new product because of the complexities of contemporary regulatory practices--a situation which did not exist to any appreciable extent prior to the early 20th century.

Some of the more significant replacement innovations which have been introduced over the last few decades are aluminum siding, aluminum window frames, poly-vinyl-chloride (pvc) piping, foam insulation, single-pipe toilet plumbing, composting toilets, aluminum electrical wiring, and stainless steel tubing. (The last is an example of an innovation which failed because of an inability to overcome one institutional barrier--worker resistance.

Of these, aluminum siding, pvc piping, and foam insulation have been the most successful. Compared to pvc piping, aluminum siding and foam insulation had only minimal institutional barriers to overcome. Let us



consider these barriers. While siding involved a union (in this case, the carpenters' union), it affected only part of the union's work in each building. Furthermore, because siding played a relatively small role in the structural stability and function of buildings--it was considered one of a number of different cosmetic treatments--it had few code barriers with which to cope. Once technological and economic barriers were overcome, it was basically a matter of changing consumer bias through advertising. Foam insulation, on the other hand, had some code barriers to overcome, but since there was no prior union involvement of any magnitude (because it did not have to confront simultaneously code barriers and union opposition. Though pvc pipes are not the result of major restructure external to the building industry (as energy innovations can be assumed to be), the fact that the many barriers obstructing its acceptance were overcome makes the acceptance of the product a worthwhile subject of study. Therefore we will consider the case of pvc piping.

#### Innovation in Particular: PVC Piping

Plastics were first used in piping in 1941. Though pvc piping entered the marketplace in the late 1940's, it was not until the late 1950's that technological and economic factors were overcome to the extent that pvc pipe was in a position to make significant inroads into the market. Certain institutional barriers had to be confronted, including manufacturers, unions, and codes. (Kollar and Youngworth, 1976)

The two primary institutional barriers were manufacturers (iron and steel pipemakers) and unions (plumbers.) In each case the introduction of pvc piping was as a replacement innovation, in the first instance

replacing a product, and in the second instance replacing a process. Both institutions used informal means (such as the established consumer taste and political leverage) and formal means (such as building codes) to oppose pvc piping. Manufacturers and unionists were able to use building codes as a means of opposition because they were influential in code setting processes (Hemenway, 1975.) In each instance, the fragmentation of the building industry--and the inefficient flow of information which resulted--meant that such barriers could be effective over long periods, and could remain intact in certain areas of the country even though they had fallen in others.

The earliest formal opposition to the introduction of pvc came from pipe manufacturers. Unions had the luxury of allowing the manufacturers to lead the opposition, as they had no cause for concern if pvc were not adopted as a replacement product. A 1958 article in a trade publication notes the consolidated efforts of metal pipe manufacturers against the acceptance of plastic pipe. The 1966 version of the Southern Standard Building Code (one of several "model" national codes) excluded pvc piping without explanation; its inclusion in two later modifications was attacked through the courts. (National Commission on Urban Problems, 1968) In 1968, the Cast Iron Soil Pipe Institute brought suit against the Building Officials Conference of America (BOCA) to stop BOCA from publishing a model code permitting use of pvc pipe. (ENGINEERING NEWS, 1968) Since building codes are state and/or locally adopted and are developed in the context of the law (which is inherently conservative) the delay in moving to include new products or excise old restrictions can be substantial.

As noted earlier, housing is an industry characterized by very personal involvements, and many decisions in the industry are governed by taste. The element of taste was one on which metal pipe manufacturers could rely in their opposition to pvc piping. Through much of the Post War building boom, copper piping was the standard, with steel pipe a second choice. "Plastic" denoted "cheap," "brittle," and "insubstantial," a prejudice which the metal pipe industry encouraged. Thus, when copper became very expensive or simply unavailable, steel pipe was a ready substitute, and consumer tastes were sufficiently established to resist the introduction of plastic pipes.

To a large extent, the fragmentation of the market reinforced this barrier. In industries with both a focused market (pipelines, food production, pulp and paper, for example) and national regulation, pvc piping faced few barriers once technological and economic obstacles had been overcome. (FOOD PROCESSING, 1970; PETROLEUM WEEK, 1960; PULP AND PAPER, 1959) Similarly, in countries with a more centralized housing industry (including centralized codes) pvc pipes were more readily accepted, and their use grew rapidly. In Germany, for example, the year that pvc standards were introduced, sales of 13.5 million lbs. occurred; a year later they were at 40.4 million lbs. (ECONOMIST, 1962) In England, Allied Ironfounders, the largest manufacturer of cast iron rainwater and soilpipes, began selling pvc pipes at a price 5 percent below that of cast iron, holding its role in the market by shifting its product. (ECONOMIST, 1962) There is some evidence that a comparable process occurred in the US. (HOUSE AND HOME, 1968) The centralized nature of

regulation in Europe meant that sources of opposition or skepticism--manufacturers, unions, architects, engineers, builders and so on--had only a limited forums for their efforts. Once positive resolution was reached, the innovation's diffusion was rapid, and proceeded according to a single standard. Thus, for example, one notes the rapid growth in use of pvc piping in Germany (a factor of three in one year as noted above), as compared to the projected US rate where the equivalent increase in use was projected to take ten years. (OIL, PAINT, AND DRUG REPORTER, 1971) It is estimated that by 1980 pvc piping will account for 90 percent of natural gas piping, vs. 20 percent in 1970.

The localized nature of building codes has permitted continuing union opposition to pvc piping. As late as the end of 1974, nearly one-third of a century after its introduction, union opposition to pvc piping is still in evidence, most commonly taking the form of plumbing inspectors fighting against the introduction of plastic pipe into high rises. Even now, regulations restricting the use of pvc piping persist--in Boston, for example, plastic pipe may be used only in rises of fifty feet. (ENGINEERING NEWS, 1974) South End houses, which are often sixty feet high, must start their plumbing with two or three feet of steel or copper pipe.

There have been instances where a centralized participant under budgetary pressures has been able to force alteration in local codes and overcome union opposition. One such case occurred in San Francisco, where unions--using the mechanism of local codes--opposed the use of pvc piping. HUD supported the use of pvc; its funding power (involved directly in the given project, and indirectly in other programs) ultimately proved

to be sufficient to counter opposition. (AIR CONDITIONING, HEATING, AND REFRIGERATION NEWS, 1971; HOUSE AND HOME, 1971; HOUSE AND HOME, 1972.)

Thus the story of pvc acceptance in housing is long. The process has been complicated in the housing arena because of the fragmentation of use and regulation. The housing industry is structured to maintain its current patterns, not to accept innovations of either product or process. PVC piping is an instructive case because it is a replacement technology (both product and process), for which the path to acceptance was characterized by both formal and informal resistance.

## CONCLUSIONS

The preceding sections have explored the nature of the housing industry in the context of socialization and research, relative to the initiation and acceptance of innovation. The housing industry may be characterized as follows:

- \* fragmented and localized
- \* consisting of many actors
- \* responsive to the subjective dispositions of actors, especially the ultimate source of motivation: the consumer and his/her purchasing power
- \* structured so that no single actor predominates, but any actor may be a source of either facilitation or obstruction of innovation.

The localization, fragmentation, and plurality of actors combine to create a felt mass of barriers of such intricacy that any one actor finds it difficult to force a viewpoint on the others.

The involvement of any given actor in the housing industry is partial--i.e., not dominant in either the field or a given project. This creates a dependency on a wide variety of other actors, a situation of considerable risk. Thus, it is not surprising that the field is in many respects conservative. Given that much housing is developed on an entrepreneurial basis by small firms, there is a strong tendency to minimize financial risk and exposure. Research into building techniques and materials is similarly conservative, in that it is almost totally in the domain of the private market, and thus is undertaken to contribute to profit. When a marketable item is developed, research often ceases, and the gains

are consolidated. Similarly, the legal structures pertaining to housing are conservative. The rationale in governmental involvement is primarily to protect public health and safety, and only secondarily to increase the pleasure and amenities of housing. This premise--and the fact that housing is a durable good--yields an approach which is slow and protective. Each of the actors in the housing industry--professionals (architects, engineers, planners, lawyers, and so on), builders and tradespeople, manufacturers and suppliers, public officials, consumers (buyers and renters), and so on--can be described similarly. There is, in short, a context of socialization which supports realization of Plato's "Brass Mean." It is important to minimize risk, and to create an "acceptable" product. The reduction of uncertainty, in a context of considerable uncertainty is the desideratum of the industry.

Given this context, confusion and uncertainty within the domain of any given actor (for example, a new vendor industry) will increase the resistance of other actors to utilizing the services/products of the uncertain actor. The housing industry will not willingly move to an unknown, especially one characterized by turbulence. Interestingly, the solar energy industry is presently in such a state of turbulence. Not only is there a division between advocates of passive and active systems, there are also divisions among advocates of various solar thermal approaches (flatplate collectors, evacuated glass tube collectors, heat mirrors and so on) and between solar thermal and photovoltaic technologies. Thus, the socialization process that would be facilitated by the tastemakers (news reports, magazines like POPULAR MECHANICS, glossies like HOUSE AND GARDEN,

and professional journals such as PROGRESSIVE ARCHITECTURE) cannot proceed without some substantial risk on the part of the tastemakers. (They might be advocating the use of the wrong product!)

Thus the nature of the socialization/research functions in housing argues strongly for the presentation of single, clear innovations, precisely conveyed and systematically pursued with particular attention to those actors to whom uncertainty of the slightest is sufficient to generate resistance. In a very basic sense, "new and different" is exactly what causes resistance to innovation in housing, while "the same with less uncertainty" will generate a more positive disposition to accept. Since this paper began with the assertion that institutions are expressions of meaning, a focus on attaching to an innovation a "conservative" meaning in order to facilitate its acceptance is a clear institutional strategy, which is only understandable in the context of an institutional analysis.



## NOTES

1. Unfortunately, the format of this paper does not permit adequate attention to the critical problem of the manner in which meaning is made manifest and communicated. For purposes of textual discussion we have simply taken it as a given. However, we do wish in this note to treat this problem briefly.

The predominance given linguistic communications as a mode of institutional expression obscures the reality that meaning is found and conveyed in other forms. Thus the phrase "meaning of a building" implies that the physical artifact--building--communicates meaning. But that meaning is the consequence of where and how the building stands in a context--not only of place, but also of time and society. Therefore, when we consider institutionally the communication of meaning by a building, we are really seeking its function(s) in the culture. In this institutional sense, the communicative function of a building is not for it to tell its own story, but, as part of our culture universe, to contribute to our experience of its meanings.

We are deliberately avoiding at this time a discussion of whether or not forms have a meaning if they are not formally cognated (i.e., given a linguistically-based symbolic form--words, numbers.) This is an issue arising in part from the mind-body dualism of Descartes and others. In art, it is asked, is there beauty unless it is appreciated? Collingwood, for example, held the position that you can only "grasp" (or be aware of) what is "immediate" or "luminous"; i.e., art; and, on the other hand, that you cannot express what you mean without mediacy (i.e., thought.) (Collingwood, 1964, p. xi.)

Much of the literature which considers the meaning of buildings/architecture is in the "arts" tradition, and is concerned with explaining the aesthetics of buildings/architecture. The opening sentences of Gauldie's volume is a good example:

"Somewhere above the level of brute survival, man begins to cultivate the search for pleasure in the things that make survival possible. One of these is shelter. Man builds first of all for protection; but as he extends his skill in building, he begins to create a language of form which, as he develops it, becomes capable of touching the emotions, producing delight, surprise, wonder or horror. At this level a building not only fulfills a practical purpose, but commands an audience; in a word, it communicates. (Gauldie, 1969, p. 1)

In expanding on the place/form of a building; attributes, Gauldie suggests that "the forces which brought it into being were the needs and aspirations of human beings in that place at that time, and the restraints were those imposed by their technical, material, and economic resources as well as by the code of social behaviors (whether embodied in unwritten convention or in statutory instruments) which that particular culture saw fit to impose

on its designers." (Gauldie, 1969, p. 169.)

This concept is explored in depth by Amos Rapoport, House, Form and Culture, 1969.) The predominance which he gives to socio-cultural determinants underscores this aspect of communication, not simplistically as if the building were used by the builder to communicate with other individuals, but in the sense that subsets of the culture communicate with and affect other subsets through the medium of the building (as much as through other artifacts), moreover Rapoport holds that this communication affects the form of later structures. It is this "dialectical" relationship between the socio-cultural determinants and the buildings of the culture that meaning is manifest. It is in this sense that we would tend to resolve the dilemma by requiring the mediation of meaning through language. Though a building encompasses and carries meaning, what that meaning is precisely depends on formal cognition and ultimate expression in language.

2. The trend of incursions in the field of housing by the architectural profession is a significant development of the twentieth century. Because designs are deliberate expressions of possible building meaning, this development has served to blur the distinction between grand intended meaning (the monumental) and ordinary overlooked meaning (the vernacular). Of course, it is not the architect who changed the profession's activities in building. Industrialization, immigration and new transportation technologies changed the operations and role of the city, and pulled the architect willy-nilly into the domain of the vernacular. In certain respects the functional overwhelmed the aesthetic.

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