REVALUING CONSTRUCTION:

BUILDING USERS' PERSPECTIVE

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ABSTRACT

Buildings are built for people to use, but few methods and procedures exist for ensuring that the users' perspective is incorporated into building decision-making. Most design and construction decisions involve trading off building quality with construction cost. Cost is usually defined in a short-term, one-time framework with little consideration of the long-term impact of cost-cutting decisions. As a result, quality for users is compromised. In spite of efforts to systematize pre-design briefing and post-occupancy evaluation, this cost-oriented perspective typically extends through all stages of building delivery and occupancy. An alternative approach known as Building Performance Evaluation is based on feedback loops at each stage of building delivery and throughout occupancy. The feedback is generated by users and stakeholders for systematic incorporation into decision-making. Feedback on users' experience of buildings needs to be structured around a functional theory of building occupancy. Classifying building users' experience into the three categories of physical, functional and psychological comfort provides a useful framework for collecting and analyzing user feedback. The users' perspective can then more easily be fitted into the feedback loops that are useful to design and construction decision-making.

1. INTRODUCTION

It is sometimes hard to remember that buildings of all shapes and sizes are fundamentally built for one reason: because people are going to occupy and use them. Relatively few buildings are constructed for no human occupancy (telephone switch centers, barns and warehouses, Lenin's Mausoleum, are some examples). In this paper, we examine the apparent paradox that people almost never have a say in the buildings that they will be using, that their interests are routinely discounted in favour of other priorities of a technical and financial nature, both during the construction of new buildings and during the lifetime of the structure, and that major research efforts and knowledge-gathering over the years have failed to influence significantly the way building design and construction decisions are made.

Some of the ways in which the construction industry has historically failed to meet its obligations towards the ultimate consumers of its products are a result of financing requirements. The priorities that make most sense to banks and other financing institutions are accepted at an early stage. Unfortunately, these criteria are not necessarily those that ensure quality in the final product, as they tend to favour solutions providing a short-term return on investment rather than solutions that provide a quality environmental experience for building users. Capital funds are loaned under conditions that favour speed over thoroughness, are limited to the short-term time-frame of building delivery without reference to the long-term considerations of building operation, and have the effect of discouraging innovation and risk at all levels. The conflict between long-term - but not proven - environmental quality objectives, and short-term, tangible returns on investment is played out at every stage of building decision-making. Little data are yet available on the financial and social costs to society of building and occupying buildings that do not work for users and that ignore issues of habitability and sustainability.

This financially-driven perspective means that conventional building practices are often

preferred on projects, creating an industry-wide culture that inhibits innovation because it is risk-averse. Innovative materials and technology are hard to justify financially before they are 'proven', thereby discouraging builders from experimenting with innovation even though conventional practices may lead to outcomes that are less effective, comfortable, or adaptable once the building is completed. Quality in buildings tends to be defined more by marketing criteria than in terms of the level of comfort and functionality of the spaces people will occupy. For example, in office buildings more tends to be spent on public spaces that have no real function, such as large high atria with expensive marble and bronze finishes, than on narrow office floors with high ceilings that ensure daylight for everyone, as well as screen-based work-friendly indirect artificial lighting; or on high-grade mechanical system solutions that allow users both to open windows and to receive good quality ventilation for a variety of office and workstation layouts.

In a recent seminar on productive work environments, an engineering firm described two options for renovating and upgrading an ageing office building near London. One alternative allowed the windows to remain operable while sheathing the building envelope in a glass 'skin' that ensured daylighting penetration while at the same time controlling heat gain and providing cooling. The other option required sealing the building (specifically, the windows) and installing a conventional air conditioning system. While the first solution increased user comfort by offering control over window operability as well as user satisfaction by vastly improving the building's appearance, the second solution was the one selected owing to the relative ease of financing and marketing an "air conditioned office building". The front-end costs of both renovation options were comparable but the vastly different effect on users and on the long-term liveability of the building did not apparently enter into the calculation.

Innovative (read, improved) building design often stops short at the level of architectural design. The new "gherkin" on London's skyline, the new "tallest in the world" structures being built in Shanghai and Tokyo, the proposals for the World Trade center site in New York

City – to name a few contemporary examples of innovative buildings – are more oriented to form and appearance than they are to improving the environmental quality of interior spaces occupied by users. Efforts to innovate at the level of building systems and technology performance and energy management, for example, where the impact on users is likely to be more pronounced, are discouraged both by the low visibility of such improvements (they are hard to 'market' because they cannot be seen), and by the reluctance of client and tenant decision-makers to pay higher rents for a better quality work environment for staff. In a recent example in Montreal, Canada, one of the downtown's newest buildings is a 'high-tech' intelligent office tower where the developers, seeking high-profile high-tech firms as tenants, installed underfloor 'task' ventilation. The extra cost obliged them to offer leases at 2-4 per square foot more than other Class A office buildings. The relatively high vacancy rate meant that they had to market the building's innovations and increased 'habitability' in order to compete, but these features were not attractive enough to convince most tenants to move into their more expensive building, causing the developers to regret their 'investment' in this innovation.

As a result, therefore, of the way the building industry operates and is seen to operate, commercial buildings are often inflexible, costly to run, uncomfortable, not ecologically responsible and over time require significant reinvestment to 'make them work'. This process, which has been characterized as dysfunctional by many writers, is in part due to the fragmentation of the building professions and the lack of informed decision-making at every stage. In addition, whereas traditionally the architect or master-builder exercised control over the entire building process, and could, by implication, ensure a quality result, now the architect is one of a series of specialists involved in a complex and expensive project over which no single participant exercises control, including the relatively 'new' professions of project management, facilities management, interior design and space planning.

2. QUALITY AND COST

Because the building industry as it currently operates in most countries is largely cost-driven, cost calculations are applied to every stage of construction, and "time is money". The opportunities for gathering and applying information about users to building decisions are therefore limited. A large and exhaustive array of books and publications on briefing or programming bear witness to the obvious value of systematically consulting users and recording their requirements, but ignorance still persists in the construction industry not only on what briefing/programming is, but also what it could be, and how to carry it out (Barrett & Stanley, 1999).

Some projects, such as office buildings, are built to preset standards to meet zoning requirements and respond to market demand. Briefing is not considered necessary in these cases as long as the amount of 'rentable' or 'useable' space is maximized. On buildings with more complex functions, such as hospitals, programming is confined to technical performance requirements and systems specifications. Information-gathering initiatives such as programming and post-occupancy studies, as well as using sustainable materials and processes, take extra time if they are 'added on' incrementally to a pre-existing, linear building delivery process. Most building project cost-estimating is based on a series of sequential steps based on estimates of time needed to complete them. Thus, using conventional evaluation criteria, taking the time to acquire more or better information, seek feedback from stake-holders, and otherwise inform decisions adds to the length of time needed until the building is built and occupied and starts generating revenues, and thus to the cost of the financing needed for the project,.

Several years ago, this author wrote, "Environmental quality is that combination of environmental elements that interact with users of the environment to enable that

environment to be the best possible one for the activities that go on in it." For building developers, quality in buildings can mean concessions to a higher level of comfort for occupants than clients may be willing to pay for. In a more user-oriented building industry, quality would not be an extra that clients have to buy, but is rather a basic responsibility that building providers and managers have towards the users of buildings. Replacing time and money with quality at the centre of the building construction and operation process would do away with the short-term, cost-driven, piecemeal approach to delivering and managing buildings, and therefore with the added costs of managing buildings resulting from this process. It would also do away with the notion that taking time to acquire information and feedback to inform decisions is not cost-effective.

Briefing is a crucial tool in the process of defining building quality, yet tying design and construction decisions too strictly to client/user requirements can also engender long-term costs (Blyth & Worthington, 2001). It is important to remember that flexibility is an important ingredient of building quality. As modern office buildings built in traditional ways lack the ability to adapt easily and cheaply to changing functional demands, lack of flexibility adds to operating costs. But the decisions that would have made a building 'flexible' are made while a building is being planned, designed and financed and not after it is occupied. Decisions that increase building quality by providing flexibility are not usually taken at the appropriate time, either through ignorance, or because a cheaper option is chosen. Flexibility is that building property that enables the organisation's activities to be supported into the future, even as technology and business processes are changing. Flexibility thus has value to the occupying organization, and lack of it increases operating costs.

If the building industry does not always and everywhere build the cheapest building with the cheapest materials, it is because clients and tenants attach value to quality. This goes beyond the value for an individual user: the meaning of 'quality' for facilities managers is related to the needs and requirements of their clients and of the building users that are their customers.

Through being attached to and involved with the organisation, facility managers usually come to know what their customers need, and they translate this into quality criteria such as service level agreements, which they can monitor. A major part of the facility manager's task is to drive down energy costs, as well as 'churn' costs incurred from reconfiguring workspace in order to move people around, maintenance and repair costs, and to balance operating plus capital costs with possible income generated by leasing out space. Facility managers benchmark their costs against those of other companies and buildings using preset performance indicators that provide an assessment of whether or not the building is efficiently run. Theirs is a cost-driven definition of quality, which often fails to address other definitions of quality, or even other costs (v. Wagenberg, 1997).

Unanticipated costs arise as a result of the separation between construction financing and operating budgets that is built into the traditional approach. Thus all repair and renovation work that must be done after a building is occupied to correct performance problems, to increase occupants' comfort, and to accommodate changing uses and needs is not calculated as part of the cost of delivering the building; they are considered operating costs. Moreover, if the building systems do not function as expected, the cost of time lost by occupants who cannot use a space or a piece of equipment is rarely added to the cost of repair or replacement. This 'downtime' signifies the negative economic value of disruption of work processes caused by the facility infrastructure not functioning properly. Applying knowledge of how people use buildings, not only in terms of requirements as determined by briefing, but also by placing the user's experience at the center of the building delivery/procurement and management process would create a more reasonable balance between quality and cost.

3. POST-OCCUPANCY EVALUATION (POE)

An important tool has been developed to generate more knowledge of how people use buildings that can be applied to all stages of design and construction. Post-Occupancy Evaluation (POE) is the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time (Preiser, Rabinowits, White, 1988). POE started with one-off case study evaluations in the late 1960s, and progressed to system-wide and cross-sectional evaluation efforts in the 1970s and 1980s. Early POEs focused on the residential environment and subsidized housing, especially as a result of rapid home construction after the Second World War. Many urban renewal projects in North America, and New Town construction in western European countries, built large quantities of housing with little knowledge of the needs, expectations, behavior or life-styles of the people who would live there. The kinds of social and architectural problems that arose led to an interest in systematic assessment of the physical environment in terms of how people were using space (Vischer, 1989). This approach was later seen as a mechanism for collecting useful information for the building industry on the impact of design and construction decisions over the long term. POEs have since targeted hospitals, prisons and other public buildings, as well as offices and commercial structures.

Evaluation and feedback during the planning, programming, design, construction, and occupancy phases of buildings is often limited to technical evaluations related to materials, engineering or construction practices. Commonly applied evaluation procedures include structural tests, reviews of load-bearing elements, soil testing, and mechanical systems performance checks, as well as post-construction evaluation (physical inspection) prior to building occupancy. POE differs from these in several ways, and is considerably less common. POE addresses the needs, activities, and goals of the people and organization using a facility. In some cases, POE results are published and widely disseminated; in others, they are uniquely available to the architect, to the client or to the stakeholder who commissioned

the study. The findings from POE studies, while primarily focused on the experiences of building users, are relevant to a broad range of building design and management decisions. Many building problems identified after occupancy have been found to be systemic: information the engineer did not have about building use; changes that were made after occupancy that the architect did not design for; or facilities staff's failure to understand how to operate building systems.

3.1 POE in the U.K.

To date, POE has focused primarily on users' experience of the performance of buildings; the most recent step in the evolution of POE is one that emphasizes a holistic, process-oriented approach. This means that not only the buildings in use, but also the forces that shape them (political, economic, social, etc.) are taken into account (Preiser, 2001). POE in the UK first emerged in the 1950s and 1960s. In its 1963 Plan of Work for Design Team Operation, the Royal Institute of British Architects included a final Stage M (Feedback) in which architects examined the results of their design decisions. Although this was later removed, building feedback began to be collected systematically by the Building Performance Research Unit at the University of Strathclyde. In 1999, a new call for "systemising feedback and in instituting post-occupancy evaluation" was issued, and in 2003, the RIBA Practice Committee re-introduced POE into its published documents.

In the UK, as in most other countries, POE continues to be the exception rather than the rule. In part, this is because conventional building project stakeholders are not paid to perform POEs, because disseminating and applying the results is difficult and time-consuming, and because effective POE has to a tread a fine line between generating useful new knowledge about building use and criticizing building professionals whose building decisions are often made in circumstances that have changed by the time the building is built and occupied.

However, whereas in most countries POE remains an academic or research exercise, or else a private and 'one-off' initiative whose results remain confidential, in the UK a nation-wide effort to solve these problems was established known as PROBE (Post-occupancy Review Of Buildings and their Engineering). Measurement included quantitative tools for 'hard' issues (the TM 22 energy survey method published by CIBSE in 1999) and a more qualitative tool, the Building Use Studies' occupant questionnaire, both of which have reference benchmarks. The results addressed not only the physical features of building design and construction, but also the activities of briefing, procurement, operations and facilities management (Leaman and Bordass, 2004).

After undertaking a number of studies and pooling POE results, the Probe team concluded that cultural change is necessary in the building professions in order to incorporate feedback routinely into design, construction, procurement and management practices. It is difficult to get clients to adopt and pay directly for building feedback. In addition to a lack of interest by top management, who are rewarded for rapidly-delivered buildings at or below budget, many clients know little about the range of techniques available, how they should be used, and what value they might add. Clients who carry out post-completion checks to ensure that buildings comply with their requirements often have property portfolios with procurement departments oriented to individual projects, much like most designers and builders. As a result, they seek project sign-off checklists rather than real engagement with the in-use performance of buildings. Effective briefing also affects the feasibility and value of POE. Probe found that client requirements are not always stated clearly enough at the outset to be rigorously applied to post-occupancy verification. Typically, briefing is reduced to a minimum in conventional building projects to increase the speed of the delivery process. Even where requirements are clear initially, they may change in the course of the project; if changes and their consequences not formally incorporated into revisions of the brief or drawings, the initial briefing document loses its value.

Some feel that the weakness of POE to date is failure to develop consensus around methods of data-gathering and analysis, to manage effectively the data collected, to identify benchmarks and comparators, and to disseminate results without compromising the intellectual property of the service providers. These problems can be addressed by a more process-oriented approach to POE. A broader and more sweeping approach, known as Building Performance Evaluation, places POE at the center of building design, delivery and operations (Preiser and Vischer, 2004).

4. BUILDING PERFORMANCE EVALUATION (BPE)

The BPE framework was developed in order to broaden the basis for POE feedback; it enables POE to be relevant earlier in the design process and applied throughout building delivery and life cycle. The goal of BPE is to improve the quality of decisions made at every phase of the building life cycle. Rather than waiting for the building to be occupied before evaluating decisions, ongoing feedback cycles provide information designed to inform key decision-makers. This helps avoid common mistakes caused by insufficient information and inadequate communication among building professionals involved at different stages.

Building Performance Evaluation (BPE) is based on feedback and evaluation at every phase of building delivery --ranging from strategic planning to occupancy, and covering the useful life of a building from occupancy to adaptive re-use/disposal. BPE came into being as a result of knowledge accumulated from years of post-occupancy studies of buildings, the results of which contained important information for architects, builders and others involved in the process of creating buildings – information that is infrequently accessed and even more rarely applied in most building projects. How then to systematize not only the research needed to acquire appropriate feedback from users, but also to ensure that such feedback is directly

applied to the building delivery process, such that a response to it is incorporated at every stage? BPE is a way of systematically ensuring and protecting building quality while they are being planned and built, and, later, occupied and managed (Preiser & Schramm, 1997).

The BPE process with feedback through ongoing evaluation can be conceptualized as a series of loops through which information is fed back as continuous evaluation, leading to better informed design assumptions, and ultimately, to better solutions. In using such a process, stakeholders are able to make better and more user-oriented decisions as they are able to access the information gathered in evaluative research and stored and updated in information systems. The theoretical foundation of BPE has been adapted from the interdisciplinary field of cybernetics, which is defined as "the study of human control functions and of mechanical and electronic systems designed to replace them, involving the application of statistical mechanics to communication engineering" (v. Foerster, 1985). A systems model is appropriate in building construction because it holistically links diverse phenomena that influence relationships between people, processes and their surroundings, including the physical, social and cultural environments. Like any other living species, humans are organisms adjusting to a dynamic, ever-changing environment, and the interactive nature of the person-environment relationship is usefully represented by the systems concept. Specifically, the systems approach to research in construction studies the impact of human actions on the physical environment – both built and natural – and vice versa. BPE has built on this tradition; it is multi-disciplinary and it generates the kind of applied research studies that, as diverse applications of POE, lacked a coherent theoretical framework.

As previously stated, applying BPE means that each phase consists in one or more feedback loops, such that relevant information from stakeholders is sought out and applied to important building decisions. This must be done effectively without increasing project costs. Real-world examples indicate that the costs of such projects are less than might have been expected. And why? Because rational decision-making based on the right information at the right time was

built into each project. The BPE approach ensures that feedback from stakeholders - not limited to the building's occupants, but also facilities management, client/owners and lending institutions, as well as professionals in the building industry - informs each stage in the process in a systematic way. It is important to note that none of these phases, feedback loops and information tools are new. What is new is putting them together and presenting them as a whole and a holistic approach to restructuring the way buildings are built and managed. The BPE approach is a comprehensive and overarching methodology of ensuring that a range of issues related to building quality are not just taken into account separately and occasionally at the whim of the client or the project manager, but actually drive the process.

4.1 BPE Phases and Feedback Loops

The six phases and feedback loops of BPE are shown in Figure 1. In Phase 1, Strategic planning is implemented using different types of feedback in the form of effectiveness review. At this stage, clients make the first, critical decisions about their move, renovation, or new building. The data gathered at later phases in the project indicate that investing time in strategic planning saves time and money later on. Conversely, a wrong or bad decision at an early stage creates problems and costs throughout the rest of the process. A strategic planning process can be structured to include all stakeholders, including diverse user groups, as long as the process is explicit and roles and responsibilities are clearly outlined.

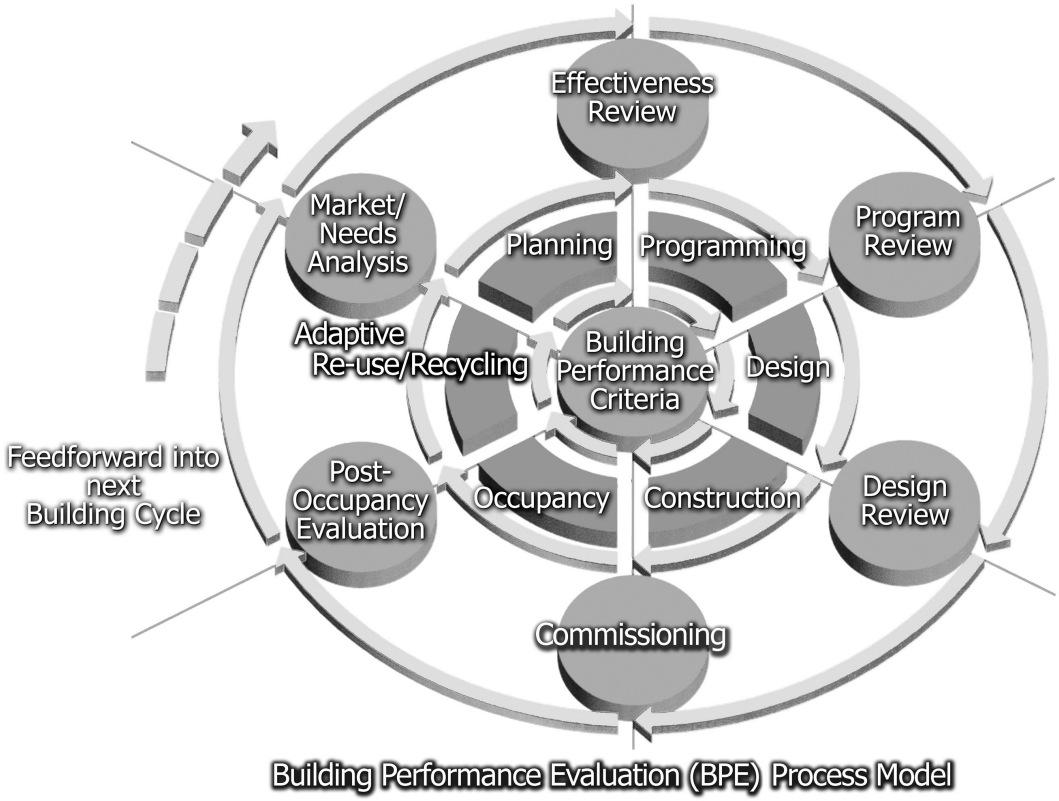

Figure 1: Building Performance Evaluation (BPE) Process Model
Source: Jay Yocis, University of Cincinnati

The 2nd phase of BPE is Briefing/programming. Programming requires a thorough and systematic analysis of users' needs, resolution of potential conflicts, establishing priorities, and enumerating performance criteria. Inadequate programming increases project costs by failing to resolve or even to identify conflicts that emerge at a later stage, requiring design revisions, change orders during construction, and changes and renovations after occupancy. A variety of programming methods and techniques have been published, mostly oriented to identifying stakeholders, eliciting their input, and finding ways to set priorities, resolve conflicts, and reach consensus on project objectives. If programming is effective, users and other stakeholders move smoothly through Phase 3, Design and design review. Depending on how it is

structured, design review is another opportunity to engage users in design decision-making in a valid and constructive way that enables information to feed forward into the next cycle of decision-making. A managed participatory process at this stage may appear to take longer, but ultimately results in a high quality building that costs no more than a conventional project because there are fewer delays and less disruption as the process advances.

A commissioning methodology for Phase 4, Construction, is designed to ensure that the client/owner gets the building that was expected and anticipated. Again, if implemented correctly, feedback from testing and inspections, from referring back to programming criteria, and from checklists and guidelines is increasingly sought as a building project nears completion and moves towards occupancy. As with the previous phases, if planning, programming and design review have been performed well, discrepancies between what was specified and what has been built should be minimal. Once a building is built and occupied, other tools are available to optimise building operations and ensure a quality experience for users. The principal tool for Phase 5, Occupancy, is Post-Occupancy Evaluation (POE), and this type of feedback is sought by facilities managers during this, the longest phase of the BPE process. Systematic feedback on building performance from users places the user at the centre of the decision-making process, thus supporting and enhancing the role and responsibilities of facilities managers.

The 6th phase of BPE, Adaptive re-use/building recycling, signifies the end of the building's useful life. As a building ages, questions proliferate about the relative value of investing in upgrades and renovations, and, ultimately, the feasibility of mothballing and even demolishing a structure. Again, systematic evaluation of alternatives using techniques like KPI (Key Performance Indicators) and the Balanced Scorecard approach, allows all viewpoints to be represented and ensures that relevant information from a variety of perspectives is taken into account. Direct and indirect input from all stakeholders helps make cost-effective decisions and resist political pressure to respond to only one interest group's perspective.

To make sure the phases of BPE run smoothly and the feedback loops are implemented in a constructive and efficient fashion, key decision-makers, such as project managers, architects, clients or tenants' representatives, and construction and facilities managers benefit from training in group process and facilitation. In addition, trained facilitators with their own skills and techniques can and should be employed to make sure the feedback loops are enacted appropriately, that consultations with non-professional stakeholders (users) as well as the involvement of all professional stakeholders are effective and constructive. Trained facilitation ensures that the process is cyclical and integrated, rather than linear with handoffs at every stage, and that it moves forward in a responsible fashion.

It is essential that BPE not be limited to functioning in only one culture or context. On the contrary, BPE offers a broad and adaptable framework for professionals affiliated with the building industry at all levels and in diverse cultures to find ways of implementing a user-oriented, cost-effective and high quality approach to producing all types of buildings. In effect, BPE represents an optimistic and common-sense option for the future, the implementation of which can and will lead to better quality buildings and a better organised and functioning building industry.

5. MEASURING PERFORMANCE THROUGH FEEDBACK FROM BUILDING USERS

In order for the BPE approach to work effectively, data-gathering and analysis activities are necessary at every stage. These can be carried out in a variety of ways, including but not limited to traditional social science research techniques. In view of the fact that performance criteria at each stage are constituted of both quantitative and qualitative performance

evaluation, it is necessary to effect both quantitative and qualitative research. For instance, expected building performance in an area such as temperature levels inside a building can be compared with users' ratings of thermal comfort. For this comparison to be effective, both the expected and actual performance must use the same or comparable units of measurement. In some fields this can be complicated. For example, expected acoustic performance is usually given in the form of construction or materials specifications – distance on center of wall studs, sound absorption coefficient of ceiling tile – but actual acoustic comfort of users is mostly received in the form of a satisfaction rating, in spite of the fact that users' satisfaction levels are often attributable to complex issues that go beyond building performance.

One of the challenges of the BPE approach is therefore to encourage more precise measures of user comfort than are conventionally used. Asking people whether they are satisfied is a rather broad and general outcome measure that tends to include far more than the performance criterion under consideration. Vischer (1989,1996, 2001) has proposed a technique for approaching users with more direct questions about their comfort levels in relation to various building systems, in order to derive a more specific equivalent to objective environmental measures. The Building-In-Use (BIU) Assessment system is a validated and reliable standardized survey that can be administered to occupants of any office building in order to collect simple reliable measures of their comfort in regards to key environmental conditions. From the responses, scores on each comfort dimension can be calculated and compared to a typical or average office building standard derived from a large database of user ratings that provide 'norms' against which building scores can be assessed. Thus, deviations from the norm for each building condition, in both a positive and a negative direction, provide a quantitative rating of what is essentially a qualitative measure.

The original seven building performance dimensions addressed by BIU Assessment are: air quality, thermal comfort, spatial comfort, privacy, lighting quality, office noise control and building noise control. More recent results indicate that the comfort of the modern office

worker, who must access a variety of equipment and perform a variety of tasks, incorporates in addition a perception of comfort in terms of security, building appearance, workstation comfort and overall visual comfort. User feedback in this relatively simple form can be applied to briefing, to design decisions, to operating and budgetary decisions, and by design professionals who seek a measurement of comfort in an older or about-to-be replaced environment or in a new building soon after a move, as well as by building owners and business managers who seek to determine a baseline comfort level for employees in their buildings (Fischer and Vischer, 1998).

One advantage of the BIU Assessment system is that it permits measured and perceived levels of performance to be compared. In parts of the building where certain areas of comfort are lower than the standard, instruments can be applied to measuring conventional comfort parameters and determining whether or not objective standards are being met. The user feedback provides a diagnostic data point that permits a wide variety of follow-up actions. However, it is not always the case that a direct correspondence can be determined between user feedback and the data provided by calibrated measuring instruments (Vischer, 1993). This is not surprising, in that a number of factors influence building users, and their experience of one may affect their judgement of another. An important stage of BIU Assessment is therefore following up on user feedback and using other measurements to determine performance problems and likely causes of low comfort ratings.

In addition to BIU Assessment, there is an ever-increasing choice of instruments for collecting and measuring user feedback on environmental conditions in buildings.* The human or qualitative comfort rating is usually the summing up of a wide variety of perceptions and judgments over a given time period to do with human memory; on the other hand, a new condition or one that causes particular concern may be subjected to short-term judgement that

* See, for example, the tools developed for Probe and now available on the following web-site: useablebuildings.co.uk

is not indicative of the long-term operation of the building. No single type of user feedback technique predominates: in addition to measuring instruments, evaluators may interview users, question them on psychosocial factors, such as employer-employee relations, and seek feedback on other factors that influence health and morale and therefore environmental judgments. Moreover, there are important decisions to be made in the selection of diagnostic measuring instruments for gathering follow-up data on building performance in areas such as indoor air quality and ventilation performance, thermal comfort and humidity, lighting and visual comfort, and noise levels and acoustic comfort. In each of these cases, the researcher must determine how to approach qualitative and quantitative measurement: data-logging over a extended time period, usually in a limited number of places; or spot checks in a compressed time period, but over a larger geographical area. A further issue is how to calibrate the instruments, in terms of its baseline settings or standard of comparison.

5.1 Applying a Theory of User Comfort to Feedback Results

Such considerations indicate that, although users are not routinely consulted as part of building design, procurement and even occupancy, both techniques of effective user input and constructive and cost-effective ways of applying feedback from users to decision-making are complex. In an effort to disaggregate and study some of the ways in which users are influenced in their assessments of the environments they occupy, a theoretical model of user comfort in buildings is being developed that permits some of the complexity of user responses and perceptions to be classified. Such classification facilitates not only future research but also the honing and refinement of feedback techniques to increase the validity of the information received and to render it more directly relevant to building decision-making (Vischer, in press, 2005).

The model is illustrated in Figure 2. It distinguishes between the physical, functional and psychological comfort of building users, each of which is measured slightly differently and each of which merits consideration in differing ways or at different times during building delivery and occupancy. The model explains that in real-world construction practices, decision-makers benefit most from applying user feedback to decisions on where and how to invest in building features to balance costs with the beneficial effects on users. The concept of 'investment' as a long-term perspective on building decisions – based on the value of building features and performance to clients/users – is more tangible and useful than the older cost-benefit paradigm in which the one-time cost of a building feature is supposed to (but cannot, in fact) be balanced with the projected benefit to users, and thereby to the client, over time.

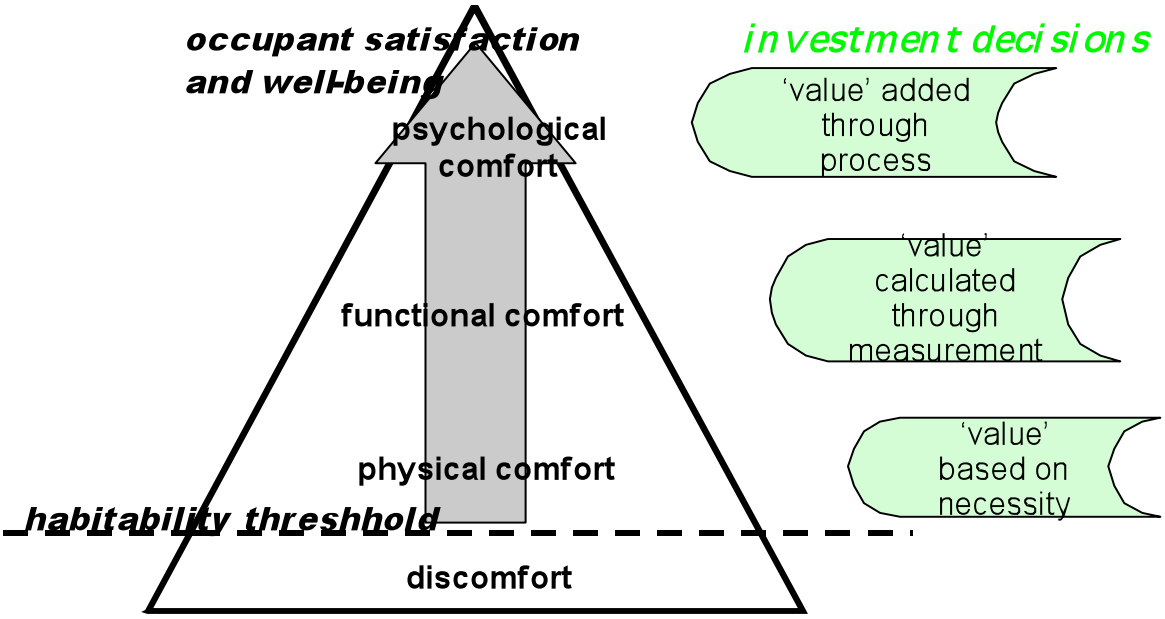

Figure 2 : The Habitability Pyramid
Source: J.C.Vischer Space Meets Status: Designing Workplace Performance Spon Press, 2005.

Investment in physical, psychological and functional comfort is evaluated differently. Decisions about physical comfort are usually basic to building habitability and depend on existing codes and standards. Investment in functional comfort is assessed according to

systematically-gathered user feedback on tasks and activities and the environmental requirements thereof – such as is provided, for example, by Building-In-Use Assessment. Finally, investing in psychological comfort should not be ignored, as all user responses and perceptions are influenced by psychosocial factors. The principal components of psychological comfort are territory, status and control. The more users are systematically and explicitly engaged in the planning and design process and kept informed, as suggested by the BPE cyclical feedback loops, the more effective the impact on users' psychological comfort and their eventual level of comfort in the building.

Using this broad theoretical approach to user involvement generates not only appropriate tools and techniques for participation and feedback, but also a knowledge base that decision-makers can draw on to apply more of a user orientation to each stage of building decision-making. This helps to organize and classify the results of user feedback initiatives and to develop ways of making different types and levels of feedback directly relevant to building decisions.

6. LOOKING TO THE FUTURE

In this paper, we have looked at various ways in which a more user-oriented perspective can thrive in the context of financially-driven building delivery and operation processes. In spite of years of effort, the two main applications of user needs research – briefing and POE – are not carried out as often or as well as they could be, and, in the case of POE, usually not carried out at all. One way of integrating these and related user feedback activities into building decision-making is to apply the Building Performance Evaluation approach to industry-wide decision-making. A number of tools and techniques exist to capture, analyse and apply feedback from stakeholders at different stages of the construction process. In addition a theory of user comfort that is more complex that the common measure of simple

satisfaction can help organize this information and provide decision-makers with a way of determining the value of different environmental investments. Thus the purpose of the feedback loops built into the six BPE phases is to provide opportunities and mechanisms for gathering information on which decisions about quality can be based. Quality is composed partly of generic facts about human comfort generally - human comfort in buildings in particular - and partly of information that is specific to a situation or building project. The value of gathering generic information from data banks such as design guidelines, codes and standards, research results and the like, as well as applying user surveys, focus groups, observation and other techniques is defined in terms of increased environmental quality.

How, then might one expect a building industry to change from what we have now to one focused on quality? In applying Building Performance Evaluation, all the phases of strategic planning, programming, design, construction, occupancy and adaptive re-use/recycling will be carried out routinely and legitimately on every project, and not just in some situations with special requirements. Financial lenders will calculate their loans and incentives for new building projects not just according to short-term returns, but also by taking quality criteria for long-term building operation into consideration. The time invested in ensuring that the feedback loops of each phase are implemented will be more than compensated by the reduced time spent later on in the life of the building correcting problems, repairing elements that do not work, and adapting to new uses. Users will feel empowered instead of imposed upon: one of the spin-off effects of consulting them about their needs will be better informed users capable of and interested in participating in decisions about their environment. This will translate into fewer complaints and less service calls, and a constructive partnership between users and facilities managers.

The component parts of BPE are already in existence and proven in many parts of the world. In order to see a complete implementation of the BPE approach, the process of linking them up must be set in motion by competent and experienced professionals. They must ensure that

decision-makers are involved in each of the phases, and carry through on applying user feedback to building design, construction and operation. The qualities of such leaders require training in group process and communication for all building professionals, including architects, project managers, interior designers and facility managers.

In view of the proliferating amount of user needs research and initiatives that are established in numerous countries, and the number of other books and projects they in turn refer to, we can only speculate for how much longer the commercial building industry will continue to place the needs of and our knowledge about users at the end of their list of priorities. Small gains are being made as more efforts are expended on proper briefing, as POE becomes more prevalent, and as a growing number of people outside the traditional closed circle of financier-developer-designer-builder are becoming involved both in supplying buildings and in examining details of their operation over their lifetimes. These include researchers, process facilitators, non-traditional architects, interior architects and managers as well as traditional building industry professionals. Some of these initiatives are technical, some are cost-oriented, and some are humanistic - but all point in the same direction: change. It is inevitable that as more knowledge accumulates and is disseminated, and as momentum gathers to change traditional building processes and recognize the complexity of modern and future construction, that the quality of the built environment people occupy will become the major goal of construction.

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