Keep Occupants "SATISFICED"

How do occupants perceive their indoor environments — and why? What makes them productive? How can we apply the answers to these questions to make buildings more successful — and profitable?

BY ADRIAN LEAMAN AND BILL BORDASS

There have been plenty of studies of building occupants' likes and dislikes, so we know a great deal about their preferences, attitudes, and likely behavior in given circumstances. Early work was often prompted by health and safety considerations, or by acute threats such as fire or disease. We also know a lot about human comfort — often from the

controlled conditions of laboratories, and more recently, computer models. Field studies, however, have produced different results, particularly in buildings with operable windows.

In the 1990s, there was a greater interest in linking findings on health, comfort, productivity at work, and how people react to changes in their indoor environment, not just from theoretical standpoints, but also in the real world. This is partly because buildings are now more mission-critical. An organization's fate is increasingly governed by how their buildings can cope with increasingly volatile change in requirements, location preferences, and changing lifestyles.

Real World Research

The Probe (Post-Occupancy Review of Buildings and their Engineering) studies share this growing interest in

real-world outcomes. Bill Allen, who had been chief architect at the U.K.'s Building Research Station in the 1950s used to say, "building research should be no more than one step away from a design decision." Over the years, much research seems to have moved away from this. In Probe, we adopt his maxim, but say "design or management decision" to emphasize their linkages.

The Probe Occupant Surveys follow this tradition by examining how people perceive their indoor environment, studying some of the consequences and learning lessons from them. We are interested more in the risks involved with designing and managing things in certain ways than with theory or hypotheses.

Given Probe's real-world agenda, what findings from the Occupant Surveys help inform future strategy? Four things stand out, all of which are known about already, but have not had enough prominence:
- The persistence of chronic problems
- The importance of "satisficing" behavior
- Simple ways to add value without increasing effort
- "Non-linear" outcomes, where the effects (outputs) are much larger than the inputs. Let's take a look at each.

The Persistence Of Chronic Problems

Almost every building we've studied — Probe or not — suffers from chronic deficiencies to a greater or lesser extent. This is inevitable. It is unrealistic to expect everything to work well all the time. However, with more forethought, many of the most harmful consequences could be lessened.

From the occupants' viewpoint, noise and thermal comfort are now the worst offenders; the 1980s problems associated with chronic ill-health appear to be declining, but are by no means eradicated.

Of course, noise, poor comfort conditions, and ill-health are all linked, so we can't treat them as independent causes and/or effects. As with many things in buildings, improvements in one area can have virtuous knock-on benefits elsewhere.

Why is the noise problem worsening?
• Intensified space use, along with higher occupancy densities.
• More open-plan working, often with poorly thought-out space planning and desk arrangements and intrusive circulation routes.
• More verbal communication in teams, on telephones, and these days, the sounds of conversations and feedback from computers.
• Absence of any single design "solution." Coping with noise involves integrating measures throughout the design and occupancy process. Noisiness may therefore be a symptom of weak integration between professional/client teams across the design process as a whole.
• Increasing use of thermal flywheel principles, leading to floors, walls, and ceilings that are less noise absorbent.
• More intrusive equipment noises, especially telephones, computers, and their peripherals.

Noise nuisance is difficult to judge from physical measurements. For example, noise from activities of team colleagues may be acceptable, or even liked as it conveys useful information, while that of an adjacent team can be highly annoying. Many people also accept — and may even like — some external noises. These "masking" noises remind them of the outside world.
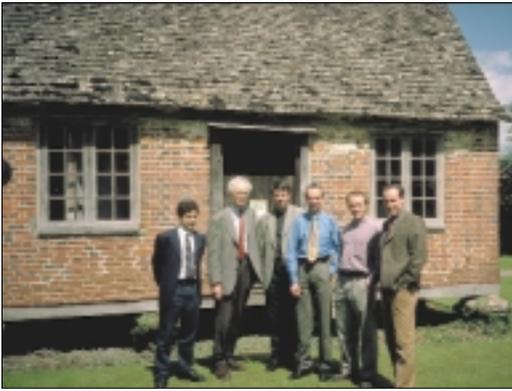
Thermal comfort is still close to the top of the list of chronic complaints despite (or perhaps because of) the increased use of computer-controlled systems. Perpetual problems include:
• Overheating in the summer and even in the winter (although this is less serious). The best buildings for thermal comfort tend to be perceived as better in summer than winter, and sometimes slightly on the cool side. Cooler buildings also have better occupant ratings for healthiness.
• Conditions that are too variable, and thereby difficult for occupants to predict from day-to-day. This leads to seemingly trivial — but unmanageable — complaints such as, "We don't know what to wear." Conditions may also become uncomfortable — perhaps too cold and drafty in one area, and too hot in another, with no consistency. This

The Probe Team, Phases 1 and 2: From left: Robert Cohen, Bill Bordass, Adrian Leaman, Paul Ruyssevelt, Mark Standeven, and Roderic Bunn.

tends to infuriate occupants, especially if they have no effective means of control.

Users Are "Satisficers," Not "Optimisers"

"Satisficing" is a term a coined by the economist and polymath Herbert Simon to describe economic behavior that adequately meets perceived needs without going to extremes. This applies just as well to building occupants. Most people want the conditions they work in to be "good enough," and only in exceptional cases "just right." They tend to tolerate offsets, as long as they're given something in return. That something is a degree of control over what they are doing and how they are doing it.

Designers and managers who follow their own rationalist precepts rarely fully appreciate the importance of this. As a result, controllability (*e.g.*, operable windows) is removed and replaced with control strategies, often linked to computer-controlled automation, which are supposed to provide optimal conditions but rarely do with consistence. This is the design version of the "optimising" economic behavior that Herbert Simon has shown to be so rare in real life.

The Probe Occupant Surveys — along with many other contemporary studies — show that it is vital to give occupants power of intervention to control, override, or at least trade-off some of the main heating, cooling, ventilation, lighting, and noise parameters. If direct physical control isn't available, then this should be compensated for by a highly responsive facilities staff that treats complaints seriously and does something about them quickly. This type of compensation is particularly important in larger, more complex buildings.

Improving Conditions for Occupants

Although it's tempting to focus on design and technical features for explanations of good occupant satisfaction, the real reasons are more often connected with how design and management factors interact to create a virtuous total system.

Better performing buildings all tend to have good ratings of perceived quickness of response. These "quick-response" buildings — irrespective of their plan form, office type, or ventilation design — are rated more highly by occupants for comfort, health, and productivity.

Occupants rate the following characteristics as desirable in buildings:

- Usable controls that are easy for occupants to understand, deliver acceptable performance, and can be observed to be working
- A diligent facilities management team backed up by a proactive help desk that deals with complaints sensitively and rapidly
- Comfortable conditions for the majority of the year, with the ability for occupants to trim and fine tune if things alter for the worse (this is where operable windows and mixed mode strategies help)
- A space plan that accommodates workgroups properly to maximize within-group requirements and minimize between-group conflicts (*e.g.,* people within a group can decide for themselves how to set the window blinds without affecting the preferences of the adjacent group)
- A management culture that takes staff needs seriously and strives to achieve them, even if everything is not always working in their favor.

Buildings created with means put before or confused with ends (*e.g.,* higher space densities before comfort, flexibility before a realistic assessment of management resources) often create potentially revengeful problems later on (comfort is compromised and the promised flexibility doesn't materialize because it's too costly in management time and resources). Difficulties often lie not with the eventual space layout or appearance of the building, but with less visible interactions between performance, operation of technical systems and their manageability.

Simple Ways To Add Value Without Increasing Effort

We can't overstate the importance of occupants' satisficing behavior. It can be used to add value without undue extra effort. With many things that are important to people — like comfort, safety, and needs in a wider sense — one must consider not just their provision, but also what to do when boundary

conditions are breached. Crises of discomfort, unsafe situations, and a lack of provision — the antitheses — are ultimately more important to user perceptions.

Occupant behavior demonstrates this time and time again. Even in the best buildings surveyed, 65% of occupants say they're unhappy with some aspect of the heating, cooling, lighting, ventilation, and noise conditions.

"Just right" conditions are rare. "Good enough" can be achieved by giving occupants the means to alleviate their discomfort, rather than expect them to rely solely on automated or management support systems to do it for them. Simpler systems with usable

One Aldermanbury Square, London — the "only truly speculative building in the whole Probe data set."

controls and interfaces for occupants can often provide better results than more elaborate and often energy-consuming systems with control interfaces that are poor in function, location, clarity, and responsiveness — or even nonexistent.

Usability is usually recognizable when three conditions are present:
• Predictable and reasonably acceptable "default" states, which form the normal background to what people are habitually doing
• Opportunities to make interventions or corrections if requirements or conditions alter
• Ability to act quickly and to know immediately that an appropriate response has been obtained.

Usability is the satisfactory combination of all three, not just the last, because people tend to concentrate more on the functionality of what they're working with, and less on the background context in which it finds itself. Simplicity and convenience are paramount. This doesn't mean that computer-assisted intelligence can't help. There is scope for automation and intelligence in:
• Establishing (and especially restoring) safe, comfortable, convenient, and efficient default states

• Providing effective integration of control actions
• Improving user interfaces and providing feedback to users and managers.

It's usually a mistake, though, to allow automation to completely remove occupants from feedback and control loops, except in managed public areas where user intervention is inappropriate, and in managing plants, etc., behind the scenes.

Occupants get frustrated when:
• They can't change physical settings from undesirable existing states to preferred new ones (*e.g.,* interlocked furniture that they can't move to block afternoon glare from a window).
• They have to work outside of normal business hours in substandard conditions (such as it's too dark or too cold), and they can't override the defaults.
• They receive poor support in stressful situations either personally, or in an imposed emergency.
• They're unable to achieve speedy and effective response from their own actions, control systems, or other people (*e.g.,* facilities staff).
• They're victims of adverse effects over which they have little influence. These may include drafts from grilles or distant windows; sun glare through a manager's glass partition; occupancy-sensed lights in peripheral vision; banging doors; near circulation routes; or random intrusions from nearby semi-public areas such as kitchens or photocopiers.
• They're unable to choose the lesser of two evils (*e.g.,* between increased ventilation or less noise when it's hot and humid).

Worse yet, they become completely infuriated if subjected to arbitrary changes in conditions they can perceive but are not able to override (*e.g.,* from automatic external sun blinds that come down when the sun comes out — some people may want to see the sun on a Spring day; or from automated windows that open to cause drafts or let in noise, fumes, or insects).

Positive Strategies

Considering the above, what positive strategies can you implement? Consider the following:
• Look at whole situations ("big pictures") including the background states with their defaults...not just people-machine interactions.
• Consider the full range of users and contexts (*e.g.,* staff at their workstations, other staff, visitors, cleaners, security, contractors, passers-by). Don't focus on average subsets

(especially a caricature of a "typical" user, workgroup, task, or department).
• Put people in the control loops...but only where it makes good sense. Gratuitously adding controls for their own sake can be as problematic as taking them away.
• Take default states seriously. Systems will spontaneously tend to adopt states that give the least trouble, but are neither comfortable nor efficient. Typical examples include blinds closed, lights on, which does away with the problem of glare; and a bit hot, which means that the coldest people don't complain as much, while the warmer ones, usually men, remove their jackets. Is this what you want? If not, think about what you can do to prevent it.
• Provide good ways for people to handle situations themselves. People who can solve their own complaints tend to be happier and more productive.

If you remove opportunities for individual adjustment, how will you replace what you take away? This will often require more design time, money, and management effort than you may think.

Non-Linear Outcomes

Many things connected with occupant behavior are non-linear in that they can have:
• Small inputs, but much larger consequences (*e.g.,* the "straw that breaks the camel's back")
• Self-reinforcing cycles that may be either "virtuous" (*i.e.,* mutually improving) or more usually "vicious" (*i.e.,* mutually destructive).

Given these, it becomes important to:
• Encourage virtuous processes through management and design
• Understand the circumstances that may trigger behaviors (*e.g.,* an occupant wants to turn off a light and can't; the inability makes him or her angry or frustrated so they vandalize the control device or switch that doesn't do what they want it to do).

High occupant satisfaction is easier to achieve when all or most of the following features are present in the total system. These include:
• Shallower plan forms and depths of space
• Cellularization
• Thermal mass
• Stable and comfortable thermal conditions
• Controlled background ventilation without unwanted air infiltration
• Operable windows
• Outside views
• Usable controls and interfaces
• A non-sedentary workforce (including relatively low VDU usage)
• Predictable occupancy patterns

Summaries of Detailed Findings

Health-Comfort-Productivity Interactions. Occupants who perceive that they are comfortable tend to say they're healthy and productive at work. Therefore, health, comfort, and productivity are often surrogates for one another.

Perceptions of Speed of Response. Probe has confirmed that respondents' perceptions of performance are linked to how rapidly they think that buildings' systems and facilities staff respond to their needs — the faster the better (note, however, that the observations are not currently split by ventilation type).

Perceived Control. The surveys show that occupants' ratings of perceived control continue to decline. Although high levels of perceived control are normally associated with better comfort, health, and productivity scores, this isn't invariably so, because over-provision or poorly functioning controls can be even more problematic.

Lighting. One of the emerging findings from Probe (it has yet to be tested more fully) is that lighting has little influence on occupants' ratings of overall comfort or associated variables, unless it is either very good or very poor.

Noise. Next to thermal comfort and personal control, occupants usually complain most about noise and its consequences. Noise is particularly difficult to deal with because relevant noise (perhaps workgroup colleagues' conversations) is acceptable to many, whereas random noise or irrelevant conversation is not.

Occupant satisfaction with noise isn't just a matter of whether or not people have their own office away from open areas. Other factors that may take their toll in different situations include: task, acoustic treatment, density, absorption, layout (*e.g.,* of kitchens, meeting areas), circulation routes (*e.g.,* cutting through clusters of workstations), poorly integrated and badly located workgroups, proximity to stress, parking lots, loading bays and railways, operable windows, noisy colleagues, and a lack of attention to detail.

- Well-informed, responsive, and diligent management
- Places to go at break times inside or away from the building.

The tendency for things to become unmanageable, and for occupants' tolerance to decline, can be made worse by some or all of the following:
- Deeper plan forms
- Open work areas
- Larger workgroups
- Greater mixes of activities
- Higher densities
- Longer working hours
- Presence of complex technology
- Ineffective, absent, or bossy facilities management staff.

Ends Before Means: A Targeted Strategy

Knowing about and acting on these (and other) risk factors is not enough. Crucial factors for success include:
- A targeted strategy, preferably expressed in a jargon-free brief
- Constant review of actual performance against objectives during design, handover, and occupancy
- Not mixing up ends and means (the most important factor of all!).

Clients for modern office buildings often (sometimes unwittingly) put fashionable image or workplace factors — such as open planning or higher densities — before performance criteria such as energy efficiency, comfort, health, or productivity. It is now commonplace for design briefs to include liberal sprinklings of references to image and appearance, space planning layouts, more openness in the physical plan, flexibility, adaptability, increased occupant densities, and perhaps also less hierarchical organizational structures (open plan often mistakenly is used as a metaphor for a more open culture). These all serve as means to broader ends, but they are often mistakenly treated as ends in themselves.

Conclusions

Chronic occupant problems are still rife in buildings. Many of these never get high enough on anyone's priority list to get fixed, so slamming doors, glare from sun and sky, hot offices, poor controls, random noise disturbances, and so on, are the norms for occupants everywhere. These often significantly reduce occupant satisfaction and perceived productivity.

When we discover exceptions, we want to explore factors for success and try to make them widely applicable. However, with buildings, there is usually no magic formula, mainly because contexts and circumstances change so much from case to case, so what works well in one context may not be readily transferable to another. The current quest for standardization in buildings tends to want to destroy context; but good buildings are often the epitome of context-responsiveness!

The sensitivity of buildings to contexts makes them different from consumer products like cars. Success often emerges from

"If direct physical control isn't available, then compensate with a highly responsive facilities staff that treats complaints seriously and does something about them quickly."

a combination of clear-minded foresight and a happenchance of factors, most of which will not be repeatable on the next job. (At a Probe Seminar, the designers of one of the buildings we studied reported that — three years after its completion — they had not yet found themselves in team/client circumstances that had offered similar chances for success.)

Because of volatility and the difficulty of predicting outcomes, strategic thinking in the early stages eventually becomes more important than "fixing things when they

break" later on. Especially vital is constant evaluation and re-evaluation of performance outcomes against targets as a project progresses. A well-structured brief with clear targets and a program of reality checks throughout the design process protects the occupants' interest by keeping ends within range.

Many of the things occupants want in buildings are obvious: comfort, health, and safety being the most prominent. Most clients will not even think of asking for these in a project plan or brief because they will assume that they come as part of the service. However, as the Probe cases show, delivering occupant satisfaction is not always formulaic; the best-laid plans can be undermined by factors such as rogue lighting control, too much noise, or too few usable controls. At each stage of the design, and during the early stages of occupancy, basic issues of risk and relevance need to be set against perceived occupant performance.

If some or all of the features that satisfy occupants are not present for whatever reason (*e.g.,* because the building is large, complex, and deep-plan), their absence must be compensated for by all-around excellence in design and responsiveness.

These need to be additionally underpinned by a stream of managed feedback about performance, not just relating to occupants' main preoccupations such as comfort, but also data on topics such as cost-in-use, space utilization, energy, cleaning, and maintenance outcomes.

This managed feedback stream creates the self-fulfilling loops so necessary for quality control. Outcomes should be constantly reassessed against benchmarks and/or in-house targets and remedial action taken where necessary.

A Message From *E&EM:* Armed with this information, how will you apply it to your own situation? How will you keep occupants happy, comfortable, and productive? Will you re-evaluate your control system? Take

Tanfield House, administrative headquarters for Standard Life — the first Probe building studied.

another look at your space plan, noise levels, and the manner and speed in which you respond to complaints?

If you're a facilities professional, you may be able to enhance your position in your organization by taking these steps. If you outsource, the information may encourage you to take a closer look at the level of service you're receiving from your existing vendors and help you set high standards for potential vendors.

If you're an owner, property manager, real estate executive, or are in the process of constructing a new building, applying these principles may help you add value and attract and retain tenants. Your challenge? Review existing systems/procedures and make improvements where necessary. If you're constructing a new facility, make sure the design takes into account occupant satisfaction. It could save you a great deal of money in the future.

This article was adapted from the "The Probe Occupant Surveys and their Implications," which contains more information including data summaries and calculations.

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For more information, visit: ww.usablebuildings.co.uk. E&EM

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