

The Productive Workplace: themes and variations

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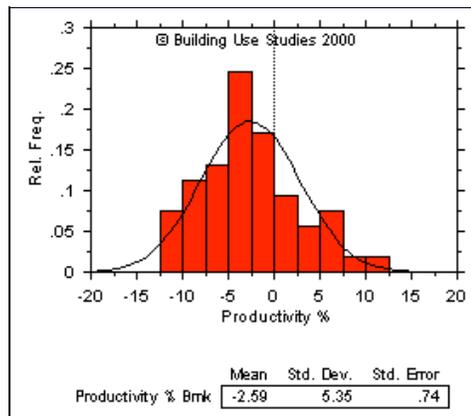
Introduction

Researchers on buildings have an annoying habit of picking some of the most abstract words in the language, tying them up in a neat phrase and then expecting that sensible answers will jump out of the porridge. One such in vogue at present is "design quality" ("design" and "quality" by themselves are hard enough, but design quality, I ask you?). Another is the "productive workplace".

Obviously, it is useful to know whether investment in buildings and new fit-outs affects the productivity of the workforce. The trouble is that workplace productivity is much harder to measure than some of its siblings from macro-economics like labour productivity. Only a few tasks in the workplace are capable of precise measurement of inputs and outputs. Where these are constantly monitored - as in some call centres, for instance, which have Orwellian screens with data on queuing and response times - one suspects that the monitoring can be more of a problem than a solution. If you have data on call centre telephonists, you don't have information about their managers' productivity. So you tend to be caught between the devil and the deep-blue sea - you have specific data on a few staff, which are not representative of the workforce as a whole. So the question of the whole workforce is begged. Also, because the staff know they are being monitored, their responses are suspect - they may be playing the system to suit their own ends. If you monitor without staff knowing, they may get upset about it.

These are some of the reasons why it is better to use subjective assessments of productivity. "Subjective" can be a dirty word outside the social sciences, implying bias. In fact, with proper sampling, subjective data give all the information that is needed, usually much more cheaply, and with less threat to management or staff. Over the years, Building Use Studies has collected information about perceived productivity using a single question on the BUS Occupant questionnaire (which has about fifty variables altogether). Figure 1 shows some of the results for the UK, using the dataset for 1999. (BUS uses the last 50 buildings surveyed as a "moving average" benchmark dataset). For this sample, the average perceived productivity is minus 2.6 per cent. We have added a normal plot to the frequencies so that the likely spread, given the found mean and standard deviation, can be assessed. With this, we can give a rough answer to the question: "How important are buildings to workplace productivity?" Answer: In the UK, the best buildings have a perceived productivity lift of up to plus 12.5 per cent, the worst a productivity fall of up to minus 17.5 per cent - a difference between the best and the worst of 30 per cent. Under 30 per cent of the buildings report any kind of productivity gain - that is, their scores are greater than zero. Further details of this technique are in Reference [1].

Figure 1



Caption to Figure 1: Perceived workplace productivity. This is based on the last 50 UK buildings surveyed by Building Use Studies. Respondents are asked to rate on a percentage scale how much they think their productivity at work is affected by their environment. The histogram shows the distribution of the averages for the fifty buildings. The average is minus 2.6 per cent with a spread from minus 17.5 per cent to plus 12.5 per cent. The vertical scale shows relative frequencies: that is the proportions of the total that fall into a particular category (eg 0.25 (25%) fall between 0 and -2.5)

These numbers simply tell us whether staff think that things are made better or worse by the indoor conditions, design and layout. We do not attempt to go beyond this straightforward level because you quickly get lost in a methodological miasma of cause and effect, normalisation and other statistical black holes. Real buildings are much less tidy than laboratory experiments or computer models. Statistical models were designed for controlled experimentation, and reality in buildings is usually too rich to reduce down to formulaic expressions with a random error term attached to explain away the residual complexity. For example, data on health, comfort, satisfaction and productivity are usually strongly correlated with each other. When one goes up, all the others go up. It's tempting to try to look at cause and effect, but the more you do this, the more likely that you need more and more information about more and more variables. With buildings, the variables tends to be connected like a cat's cradle. Usually you cannot influence most of the important variables in a given situation. Often you find that actions and reactions are non-linear (e.g. step-change improvements or accelerating decline; tolerance of discomfort in one situation, intolerance in another, very similar, one).

With workplace productivity, two things seem to be invariably important - the "themes" of our title. These "must haves" are:

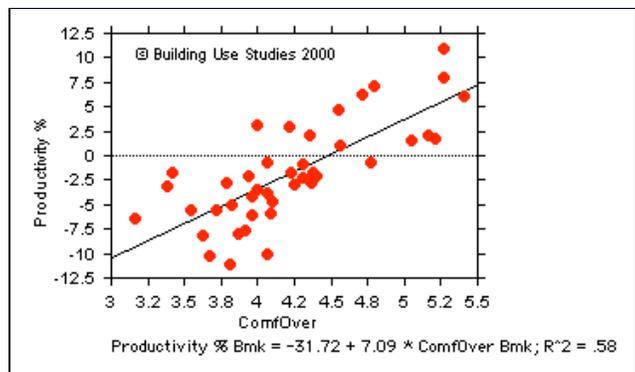
1. Conditions which are perceived by the occupants as both a) comfortable for most of the time, and b) capable of rapid change for the better if necessary.
2. A working environment where occupant needs are perceived to be met, or are at least capable of being met, rapidly.

Point 2. is a more general version of point 1., but baseline comfort is so important to perceived productivity that we prefer to emphasise it separately.

The important thing about point 1. is that it is vital to provide the ability to alleviate discomfort when it arises. Providing comfort is one thing, alleviating discomfort is another. Many engineers mistakenly concentrate on comfort provision without bothering about discomfort alleviation. There is a subtle difference conceptually, but a real difference if you are an occupant on the receiving end!

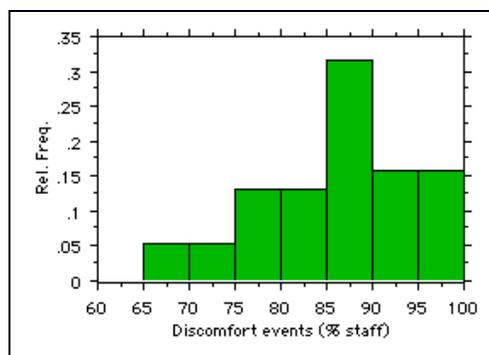
Evidence for Point 1 is in Figures 2 and 3. There is a strong association between perceived comfort and productivity ($r=0.76$; $p=0.0001$) - from Figure 2. This is high for "soft" ,i.e. non-engineering, variables. Figure 3 has the prevalence of discomfort in UK buildings. Here, the best buildings (to the left on the histogram) still have 65% staff saying that they are uncomfortable with at least one of heating, cooling, ventilation, lighting and noise.

Figure 2



Caption to Figure 2: Comfort and Perceived Productivity : This scatter plot has the average scores for occupants. ratings for perceived productivity (see caption to Figure 1) and overall comfort (using a seven point scale from 1=uncomfortable to 7=comfortable). Productivity and comfort are closely associated.

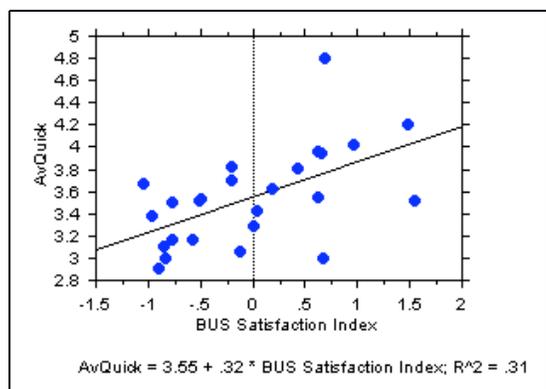
Figure 3



Caption Figure 3: The prevalence of discomfort. A "discomfort event" is our jargon for an occupant who rates something as uncomfortable (i.e. between 1-3 on the rating scale). We use seven comfort variables covering heating, cooling and ventilation (in summer and winter), lighting and noise. This histogram shows the percentages of staff for 50 buildings who say they are uncomfortable on at least one of the seven. For example, 5% of buildings (0.05) on the vertical relative frequency scale) have been 65 and 70% of occupants who say they are uncomfortable. In 15% of our buildings 95-100% are uncomfortable in some way!

Point 2 is harder to demonstrate because perceived responsiveness is difficult to pin down exactly. We think these results are good enough to at least indicate its importance - the more people think that their needs are met quickly the happier they are. Perhaps other researchers might develop this topic further. Figure 4 shows how occupant ratings of "quickness of response" (an average of "quickness" ratings for heating, cooling, lighting, ventilation and noise) are associated with the BUS Satisfaction index (itself a combination of productivity, health, design and needs scores) ($r=0.56$; $p=0.0038$).

Figure 4



Caption to Figure 4: Quickness of Response and Satisfaction. This scatter plot is to show the association between the variables. It is not intended to illustrate cause and effect.

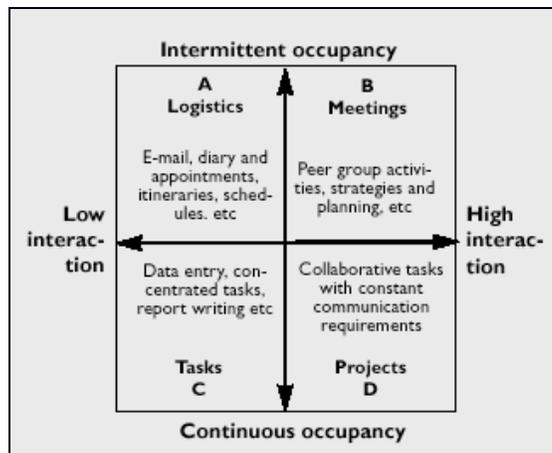
Our two themes - 1. stable, controllable comfort conditions and 2. responsiveness to need in a wider sense - may be met by buildings of most construction or ventilation types, although some are intrinsically better than others for this purpose. For example, naturally ventilated buildings tend to give better workplace productivity results across the whole sample of buildings than air conditioned, but this does not mean that air-conditioned buildings are incapable of good productivity scores. Similarly, cellular (or at least small, well-integrated workgroups) is better than open plan, but open plan can still be good in some circumstances.

If these are the themes that underly workplace productivity what are the main variations? Three candidates stand out, amongst many possibilities (this is another possible quagmire of variables). Work setting, work type, and sector (i.e private or public) are all important here.

Work settings

Office work settings can be usefully classified with two dimensions - interaction and occupancy, as in Figure 5. This gives four basic work settings for Tasks, Logistics, Projects and Meetings (this is written up in more detail in reference [2]). For Tasks, people usually work by themselves, preferring to have uninterrupted spans of time. Tolerance of interruptions differs, depending on the task. Software developers, for example, may have very low tolerance thresholds when concentrating on a complex algorithm. These people may only occasionally need to meet, and may work at VDUs for long hours. For Logistics, e.g. sales staff, the requirements are less onerous. People may only be in the office for short, often unpredictable periods. For Projects, as in, say, a design office or a newspaper, people may need to be with colleagues for most of the time, thus the bullpen open-plan may be most appropriate for most of them most of the time. A Meeting environment is more suited to executives. Of course, anyone in the course of their work may need to operate in some or each of these settings, not just one of them. All of them are different from the design perspective, especially with respect to the big productivity killer - noise. Putting people who need few interruptions into spaces which are very noisy is guaranteed to lower productivity fast. For example, designers often assume that the openness of open-plan often leads to better communication. It may for some staff who may actually need to communicate with each other on a continuous basis, but for many, like Finance, Legal and Tax departments, this can be a serious distraction.

Figure 5



Caption to Figure 5: Work settings. Office work can be simply classified with two dimensions - occupancy and interaction amongst staff.

Many managers report better productivity, but these are the people who have their own offices, plenty of meeting space and more control over their own time. Others are not so fortunate. Academics, for example, are often now put into high density open-plan layouts. The reasoning is that they are not at their desks most of the time anyway, so why waste space on them when utilisation levels are so low? But academics tend to have needs which are not usually met in the open plan. These include 1. books and manuals (sometimes in prodigious quantities); 2. tutorials and/or personal meetings with students; 3. bursts of time when they need to concentrate on getting something written in private. If these needs are not met, they will work in the library or go home, adding to the Marie Celeste tendencies in many a university department.

At a basic level, it is important to put needs first, not as an afterthought. This often boils down to the quality of the work task being adversely affected by random interruptions. Here, cellularisation or small, well-integrated workgroups are the answer. It is not advisable to assume that everyone needs to communicate with each other all the time.

Work type

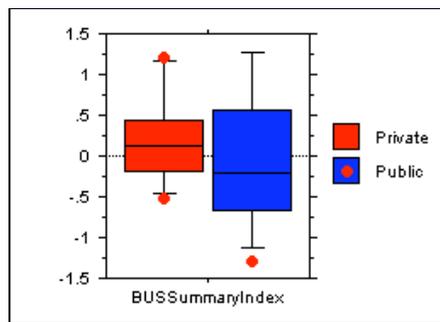
Like work settings, this can be complicated, but there is a rule of thumb. The more control you have over your time and your environment, the happier and more productive you are likely to be. This does not just apply to managers and other senior staff, who fall clearly into this category, but also to, e.g. part-time staff - or at least people who do not have to come into their building 5 days, 40-hours a week. The reverse is also true: the more you sit at a desk, the more you use a VDU, the less likely you are to say you are productive.

So what's new? This kind of thing has been known about for a long time. We all experience it ourselves, so there is no great surprise that the research result show this as well. This takes us straight back to the basics: sedentary and lower grade staff need excellent comfort conditions and plenty - but not too much - controllability. Take lighting, for example. We find the best productivity results in work settings which are basically split, with good individual control over lighting for the particular task. This way differences in visual acuity can be catered for, as well as all the subtle contextual variations in daylight and glare conditions around the office at different times. This helps also to avoid the lights on / blinds down scenario, a sure sign that the conditions are bottoming out to the lowest common denominator.

Sector

Despite strenuous efforts by the public sector in recent years, we still find substantial differences between benchmark averages for private sector and public sector organisations, as shown in Figure 6. The five horizontal lines of the box plots (working down from the top) show the 10th, 25th, 50th, 75th and 90th percentiles, so you can compare both the medians (the 50th percentile) and the spreads. The median for the private sector sample is higher and the spread narrower, indicating that standards are both better and more consistent. This chart uses the BUS Summary Index, which covers both occupant comfort and satisfaction. We do not have the benefit of a large sample of buildings on which to base these remarks - again we are using the 50 that make up the BUS dataset. Also, we have not investigated the reasons in detail, but think that many public-sector buildings require resourcing beyond the levels many can afford (or are prepared to commit). This is not to say that the buildings they occupy are particularly different from the private sector (we don't really know if they are), but that maintenance and facilities management budgets may be much lower.

Figure 6



Caption to Figure 6: Sector differences. Private sector buildings (left) have a higher median Index score and a narrower spread (i.e. less variation) than public sector buildings (right) on the Building Use Studies Summary index (vertical scale). The Summary index uses eleven occupant rating scores and covers comfort and needs.

This brings us back to another basic theme. Workplace productivity is strongly influenced by the chronic conditions introduced to buildings by unmanageable complexity. We are talking relatives, not absolutes here. Organisations with well-endowed facilities budgets are usually able to manage their buildings reasonably well. In fact, the main reason why organisations are successful is that they are good at managing and delivering certain types of complexity. As soon as budgets and skills fall below a certain threshold (itself governed by how challenging a building is to manage) chronic problems set in. There is an element of Catch-22 in this. Once poor conditions become the norm, they are extremely hard to eradicate. This applies to cleaning, decoration, planned maintenance and to many of the tiny details that aggravate occupants so much - low frequency noise from the fans, banging doors, glare from around the edges of blinds which don't fit the window properly and have been put there grudgingly as an afterthought anyway. There are countless examples like this, all of them never high up the priority list to be fixed. So many buildings only get fixed when threats of a health and safety inspection become a reality.

Any others?

Work settings, work type and sector only scratch the surface of possible variables that might be important in any given situation. High on the list are things like workplace stress, lifestyle factors like journey-to-work, locational factors like city centres/business parks, individual predispositions (some people more likely to complain than others), circumstantial factors like morale of the workforce and quality of local managers. Any or all might be relevant in any given building. Most, though, are extremely difficult to separate out either because of "noise" in the data - created by the sheer number of possible variables, most of which are connected in some way - or because of the large samples that are required to give meaningful findings when you split the main sample up into sub-samples.

Given these, we usually steer clear of attempting to measure these circumstantial variables, but try to be aware of their possible influence in any given situation. This especially applies to impending redundancy, takeovers and mergers and culture change programmes. Most of these also fall under the heading of factors which cannot be directly influenced by the physical design or the intervention of facilities managers. We find it best to stick to those things which are, in Bill Allen's words, "one step away from a design decision".

Workplace productivity boils down to:

1. Excellent discomfort alleviation in a basically comfortable environment, especially in summer.
2. Meeting perceived needs quickly, and with as little fuss as possible.

Only about 10% of British buildings - perhaps 20% if we are generous - actually meet these criteria in the eyes of their occupants. Why? Because designers and clients alike are too myopic with technology. They unwittingly think that technology will solve problems without creating any new ones. Technology begets complexity. The best buildings are procured by people who understand this. They either resource their facilities and maintenance budgets properly and protect the budgets, so that the inevitable technological downsides can be managed, or they have very simple buildings which do not impose these problems too much on their occupiers in the first place. Unmanageable complexity is the bane of workplace productivity. The answer lies in putting needs first, and constantly revisiting them to make sure they are properly met.

References

[1] Leaman, A. and Bordass, W. (1997a) Productivity in Buildings: the killer variables, Chapter 12 of D Clements-Croome (ed) Creating the Productive Workplace, pages 167-191 London:Spon (1999), and downloadable from the authors' website www.usablebuildings.co.uk

[2] Leaman, A., Cassels, S. and Bordass, W. (1999) The New Workplace: Friend or Foe?, Environment by Design, 5, 1, Autumn 1999, 21-37 and downloadable from www.usablebuildings.co.uk

Adrian Leaman runs Building Use Studies, which carries out post-occupancy surveys of buildings and manages feedback for briefing. Further details may be found on www.usablebuildings.co.uk