Usability in buildings: the Cinderella subject

Introduction

Usability, or the lack of it, never quite makes the top of the list of horrors reported by occupants of modern buildings. Discomfort, lack of personal control, too much noise and distraction, too little natural light and too much artificial with excess glare usually come higher. Even aesthetics and design quality (yes occupants do notice sometimes!) are mentioned. As more is now known from research on buildings in use (rather than just laboratory or design theory studies) it is slowly dawning that usability (and its running mate manageability) are essential to good building performance. Obvious, maybe, but, in buildings, usability is a Cinderella subject. If a client wishes to commission a usable building where do they go for help? In the UK there is not a single design practice that readily comes to mind as the first port of call.

Usability in computer software

The story is different in the software world. Usability in computer interfaces has been a hot subject since the first text-based, line-oriented computer displays from the 1950s. Some, like Nielsen, say not hot enough, because web usability still leaves a lot to be desired in spite of a generation of effort on GUI (graphical user interface) design (Nielsen, 1993). There is also ergonomic work on human-machine interfaces (like aircraft controls) which predates this by at least a generation (visit Systems Concepts' web site at www.system-concepts.com for a review of ergonomic material).

Early on in his latest book *Designing Web Usability* Nielsen says that usability is essential in web design because you will be driven away if you cannot get access to what you want easily and quickly. With most products – buildings included – you do not find out about poor functionality until you are committed (Nielsen, 2000). Often, features triumph over functions because point of sale considerations (e.g. proliferation of features which are thought to be attractive at the point of purchase) trump usability issues (which, by definition, are experienced only after purchase – buy in haste, repent at leisure). This leads to products which have many more functions than any normal user ever requires (for instance, Microsoft Word version 8 has over 1300!). A further consequence is software 'bloat' – programs which are much larger than strictly necessary – or over-complicated user interfaces.

Dancing bearware

Alan Cooper calls this 'dancing bearware': feature-bloated computer programs that perform poorly for the things that people most want and need. It's possible to teach a bear to dance, but it doesn't do it very well! (see Cooper, 1999, www.cooper.com). Most buildings are dancing bears. They are stuffed with features and functions, but they always seem to promise more than they deliver.

Tolerance of chronic failure

Building users quickly recognize this when the things they need are recognizably absent – usually comfort, health, safety, ease of use and quickness of response when they want to change something. A lot of research and legislative effort goes into the first three, but much less for the last two – the essence of usability. Why? Because acute failure – like fire, extremes of discomfort, structural collapse and fatal disease – must be avoided totally, whereas chronic failures (low-level disfunctions and inefficiencies affecting everyday performance – including health, comfort and productivity) may be tolerated or absorbed to varying degrees.

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'Good enough' not 'just right'

People do not want perfection, but conditions which are 'good enough' more often than 'just right'. If not, they like plenty of opportunities to correct things in their favour. However, they do not want relatively trivial decisions and actions constantly intruding on what they are supposed to be doing, so there is a balance to be achieved between appropriate physical conditions (which need to be acceptable to them most of the time) and interventions when things need to be changed (which need to be timely and effective). This applies both to user's perceptions of their comfort, health and safety, and to everyday use of technology. In general, the more people are forced to intervene to try to make things better for themselves, the less likely they are to perform tasks to their full satisfaction, capability and effectiveness. However, if people cannot intervene to change things to their liking, they like it even less!

Users like...

Our experience of users' likes and dislikes is available on www.usablebuildings.co.uk within 'Publications'. With buildings, we find that users normally prefer:

1. Situations where they need to intervene to change things only occasionally, with predictable 'normal' or 'default' states which they can utilize habitually, and, for most situations, forget about
2. Opportunities to act quickly to make corrections or interventions if conditions alter
3. The ability to carry out interventions quickly and effectively

Good usability is the effective combination of all three of these to meet the user's goals in particular circumstances. Because more attention is given by designers to user interfaces in well-defined contexts (e.g. the layout of a kitchen where user behaviour is relatively predictable), good usability is normally associated more with point 3 (the interfaces) than with 1 and 2 (background contexts and speed of response).

The 'background' includes the conditions within which users and occupants may work comfortably and safely. These have upper and lower tolerance thresholds of temperature, luminance, noise, ventilation, attributes such as cleanliness, as well as a host of other factors like slipperiness of floor surfaces in operation at any particular time. There are also default states of activity settings, such as normal day-time use, changeover in mornings and evenings, and night-time patterns. Weekly, monthly, seasonal and organizational (e.g. financial year end) variations all contribute, as do changing activities. Given that buildings always have default settings, successful usability depends on anticipating how these work in reality.

Designers oversimplify real behaviour

Poor usability often results because designers oversimplify – and do not take enough trouble to understand – actual use patterns and behaviours. They tend to concentrate too much on provision (of, for example, comfort and safety within performance 'envelopes') at the expense of alleviation (e.g. giving users strategies for coping with discomfort when things become uncomfortable). They are prone to underestimate effects of additional complexity over and above design intent (e.g. resulting from higher-than-planned-for occupant densities or changed space layouts), so that it becomes even harder to achieve optimum or even satisfactory outcomes. Designers also often ignore (or at least do not fully account for) out-of-range differences between people, needs, activities and uses, preferring to design to norms or averages, or within regulatory limits.

Users' frustrations

For building users, greatest frustration arises when they are:

- Prevented from intervening to change physical settings from an undesirable existing state to a preferred new one
- Subjected to arbitrary changes in conditions which they perceive and are affected by but cannot themselves over-ride
- Working in an unfamiliar setting which may require intervention to make things habitable or comfortable (e.g. in the evening or at weekends when the heating is switched off)
- Required to act quickly and/or in stressful circumstances, e.g. in an emergency

- Unable to achieve speedy or effective response from other people who may control settings which affect them (e.g. facilities management contractors running the building management system)
- Are prevented from making trade-offs of their own choosing between lesser evils (e.g. in the summer, preferring to block out external noise in the morning and let the building heat up, but open the windows in the afternoon and be disturbed by noise from outside)

More than one operating mode

Buildings tend to be designed to operate in only one default state – their normal daytime use. Operation of e.g. HVAC automatic control and cleaning then tends to be built around a standard occupancy pattern e.g. 08:00–18:00. During this period, major office services, e.g. helpdesk, reception, vending, stationery and IT support, will usually be operational. Occupancy patterns, however, are now much less clear-cut, especially in offices with longer operating hours, flexitime, more part-time and contract staff and less predictability in, for example, lunch breaks. To this can now be added (although less common), shared desks, teleworking and other space and time-saving strategies. What was once a fixed temporal cycle of use (e.g. with everyone leaving the building between 17:30 and 18:00) has now become more diffuse (e.g. with fewer staff at their desks at any one time and with more people in the building in the evening and at weekends). Although this may present greater operational flexibility, it introduces new usability and manageability dysfunctions. For example, staff working in the evenings, at night and at weekends often expect 'normal' levels of servicing, for example, vending, car parking and personal security, as well as fully operational computers, telephones and office service like fax and photocopiers. For staff working at night, new requirements arise for environmental control - e.g. they may perceive themselves to be colder (as blood sugar levels decline during the night) and also may want less ambient light than normal daytime settings. If they have no control over heating/cooling/lighting levels and the vending/restaurant services are not operating at that time of night, then they will be adversely affected.

User behaviour and building feedback

If conditions move outside preferred parameters of comfort, health and safety, people will usually try to do something about it, either by changing things if they can (e.g. using lighting controls, or adjusting settings on equipment) or modifying their normal behaviour (e.g. staying at home in icy or foggy weather, going home early in a building they perceive to be unhealthy or avoiding places perceived to be unsafe).

Habit

Everyday behaviour is usually habitual, with people using tried-and-tested routines. Habit is one way of coping with the complexity of life, more so in the modern world and especially for people with active lives. Even though people are habit-driven they still like to perceive that they are in control, or at least think they are part of a control loop or involved in decision-making which affects them. Whenever an intervention is required they like it to be as simple and with as little fuss and interruption as possible. Thus anything other than straightforward actions, quickly carried out, will usually be ignored (people may try things once). Anything which involves effort or skill (e.g. any kind of programming with telephones, computers, video recorders, etc) will usually be abandoned by all but the most persevering or technically-minded.

Given these difficulties with building operations, users should always have available to them:

- Clearly defined operating modes, the base rules for which are understood by all classes of users, with unambiguous changeovers from one period to the next
- Potential for rapid response to any type of change in conditions.

The design of everyday things

Most tools and technologies are developed to be used in situations which are relatively well-defined or obvious (e.g. cookers used in kitchens, bread knives on bread boards, etc) and it is usually clear from the technology itself, or the instructions, in what circumstances they should be used. Objects also have 'affordances' – chairs obviously 'afford' sitting on, knobs are for turning, etc – which give strong additional cues for use. Affordances are reinforced by physical, cultural, semantic and logical constraints. Together, constraints and affordances are exploited by designers to help improve usability. (This terminology comes from the work of Donald Norman whose books include *The Design of Everyday Things*, 1988 and *The Invisible Computer*, 1998. There is also collection of Norman's work, 'Defending human attributes in the age of the machine', a CD ROM from Voyager published in 1994. This runs with Hypercard on Apple computers, and is great fun!)

Side effects

Usability issues do not only apply to individuals and how people operate things, but consequences and side effects. These include:

- Unwanted noise (e.g. created by keyboard, telephone and computer operations)
- Misuse and breakdown (e.g. attempted remedial action on photocopiers making things worse)
- Tampering and vandalism (e.g. often the result of frustration because the intended effect cannot be achieved (e.g. door entry systems))
- Chronic faults which persist because people may be fearful of making things worse ('if it ain't broke, don't fix it')
- Technophobia and/or misinformation about what devices are supposed to do (e.g. occupants leaving things alone because of fear that they may 'upset the system' or management not telling occupants – about trickle ventilators on windows – knowing that they will upset the system!).

The nearly obvious

Technologies which are best liked by users tend to 'invite' them to share the problem and help them participate creatively in solutions without a sense of alienation or making them look silly. Details work so well that they are not normally noticed by the user. They become, as Schon has said (in Winogradt, 1996) 'invisible' to them. They will have unobtrusive clues about which user actions will be appropriate, and guide people quickly through the most appropriate courses of action. In many cases, user actions will be nearly obvious or intuitive, as with doors and door handles, light switches, taps, and control knobs on cookers, radios and televisions. With many of these devices, a *de facto* standard has arisen, sometimes with a 'natural' mapping of the control action onto the physical layout of the device, e.g. door knobs turn left and/or right with pull or push; taps turn anticlockwise for on, clockwise for off with hot tap on the left of the basin; light switches toggle up for off, down for on; volume controls turn clockwise to increase volume; low settings are to the left, high to the right, etc.

Good usability

As Donald Norman shows in *The Design of Everyday Things* familiar conventions and mappings are tending to disappear, so things can be more confusing to use e.g. taps and showers, as conventions change from device to device; light switches, as later devices supersede familiar toggle switches, and newer controls, such as thermostats, imply one function (i.e. volume control via a dial) and deliver another (altering temperature set points) thus offering potential for confusion and misuse.

Can intended user behaviour be achieved in practice? A device should:

- Be easy to understand and preferably intuitively obvious without undue recourse to instructions
- Be easy to use, otherwise people may take an easier or more convenient route
- Operate and be effective as close to the point of need as possible, which may vary with time and the user
- Work effectively, with sufficient fine control to give the required level of adjustment
- Give instant tangible feedback (e.g. a click) to indicate to the user that the device has operated
- Give immediate feedback to show that the intended effect has occurred

- Take into account that facilities may be used only occasionally, so that people may forget basic actions (e.g. phone diversion)

More chronic inefficiency or better performance all-round?

We are nearly back full circle to where we started with software design. Now that people spend so much time with computers, the efficiency of their activities when operating them is of no little concern. The remorseless drive to increase human productivity while simultaneously lowering overheads has been given a huge boost by software. But with bad interface design we are simply contributing another layer of chronic inefficiency to the one that already exists in our buildings. Both have a lot to answer for, and a lot to learn from each other!

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