Why design starts with people

Sue Hignett

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Importance of good design in healthcare

Design in healthcare unites a diverse group of disciplines across product design, architecture, and engineering by 'the common aim of making it better for the user' as good (functional, safe, and usable) design. The conceptualisation of the user(s) presents a major challenge, as design in isolation can result in the product, building, or technology being delivered into an existing system without considering on-going implications (ripple effects).[2,3]

The concept of Human Factors/Ergonomics (HFE) is the key to good design, in that it directs focus upon the systems with which people interact in physical, organisational, and social environments to give two key outcomes: wellbeing and performance. There has been a tendency to use the term 'ergonomics' to refer to interactions with the physical environment, and 'human factors' in connection with psychological and organisational issues. However, from both theoretical and professional perspectives, one cannot be considered without the other, so the terms are now used interchangeably.

HFE typically takes a 'hierarchical approach where environmental design to fit the human is seen as the priority and selecting people to fit the environment or training people to fit the system is only considered when the former is not possible'.[4] As the importance and relevance of HFE in healthcare have grown, there have been examples of bright, action-oriented healthcare professionals, interested in safety and quality but with only a superficial understanding of the fundamental concepts, rushing off to 'do human factors', resulting in 'do it yourself HFE'.[5] This article provides an example of successful HFE design achieving evidence-based standardisation for emergency ambulances. A new theoretical model (DIAL-F) is discussed, reflecting the central role of HFE design in healthcare systems to include everyone providing and using healthcare services.

Emerging ideas in research on design: ambulance design

Prior to 2006, NHS Ambulance Trusts produced individual vehicle specifications, resulting in over 40 different designs of emergency ambulances in the UK. This presented an increased risk to patient safety, as the interior layout, and the location of equipment and consumables, varied in each vehicle, with a consequent impact on safe systems of work and efficiency of clinical care. In 2003 a programme of HFE research began, with the aim of standardising the design of emergency ambulances. The projects included a comparison of ambulance loading systems[6] and an evaluation of vehicle and equipment risks for both paramedics and bariatric patients.[7] The research provided an evidence base for the national specification of emergency ambulances, with nine areas of design recommendations: access/egress, space and layout, securing people and equipment in transit, communication, security, violence and aggression, hygiene, vehicle engineering, and patient experience.[8] The evidenced-based emergency ambulance is now being used by 6 of the 11 ambulance trusts in England, bringing estimated procurement savings in excess of £2.5 million (P Liversedge, personal communication, 2012).

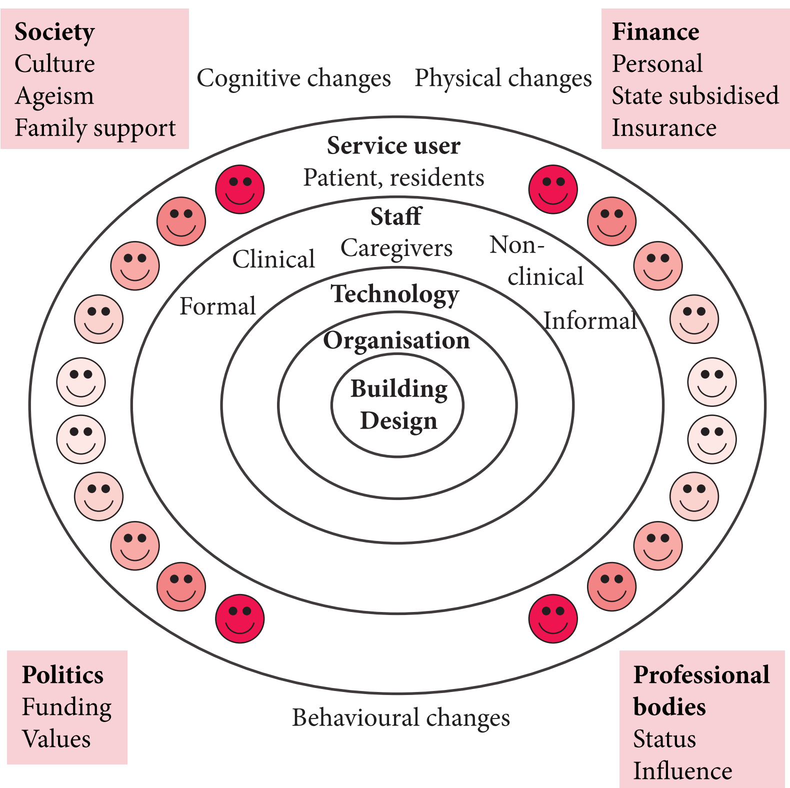
The focus of the research then turned to HFE design for pre-hospital (urgent) care. In 2004 the Department of Health commissioned a strategic review of NHS ambulance services in England, focusing on how they could shift from providing resuscitation, trauma, and acute care, towards assessing, diagnosing, treating, and discharging patients in the community.[9] To provide portable and mobile (vehicle) technologies to support this change, the Smart Pods collaboration involved 125 staff and 88 patients from six NHS Trusts over 18 months to explore the design and systems requirements. The outputs were a three-level technology system for personal kit, assessment packages (and storage for other clinical treatment packages), and a clinical workspace, located in a mobile pod.[10] These design outputs are now being developed as an electric vehicle mobile triage and treatment unit.[11]

Understanding human factors and systems thinking

The challenge of healthcare complexity has led to the generation of new theoretical systems models, including the Systems Engineering

Initiative for Patient Safety (SEIPS available online at www.ncbi.nlm.nih.gov/pmc/articles/PMC2464868/figure/fig1/). SEIPS provides a process framework to consider how system components can influence human behaviour at the organisation, employee (caregiver), and patient (service user) levels. Input data are both complicated and complex, with the Person category representing a wide range of physical and cognitive abilities for all stakeholders, including clinical and non-clinical staff, patients, families, visitors, volunteers, and contractors (clinical and non-clinical service providers not directly employed by the organisation). This amalgamation of the patient into the Person category models the system as providing care and treatment to passive recipients (analogous to a production line with inanimate components), also described as a 'warehousing model of care' (minimum risk environment).[13] This model persists at the time of writing (2013): Thornton[14] comments on the government response to the Francis Report as 'still unfortunately rooted in paternalism and the overriding ethos of the patient being 'done unto' rather than being in active control.'

Figure 1. DIAL-F model for describing patients as active participants[15]



A more stimulating, riskier system involving active patient engagement can be described as the 'horticultural model of care'.[14] For good design the end user must be involved as an active (albeit transient) participant, independently initiating and engaging with the system and carrying out tasks (eg using a call bell).

The DIAL-F model (figure 1) reverses the passive model by describing the system elements in terms of transience (duration of action/involvement).[15] The environment (building design, layout, decor, signage, lighting levels etc) is at the core of the model, as the least frequently changing (that is the most stable) element requiring major investment of financial and human resources for either refurbishment or new building works with accompanying closure of clinical areas. The hospital's organisational policies and procedures will probably be modified/updated on an annual basis, but will be a more stable part of the system than technology (equipment, furniture, and medical devices), which may move around the hospital between wards and departments. The staff layer of the model includes clinical, non-clinical (including contractors), and formal and informal (visitors, family) caregivers. Clinical staff will vary, in terms of their permanence, number on duty, knowledge, skills and competencies, between shifts and areas in the organisation. Patients are the most transient element of the system (based on a voluntary agreement/engagement[16]) and are represented in the DIAL-F model as personas (archetypal descriptions) in the outer layer. External factors (society, finance, politics, and professional bodies) impact throughout the system on patient expectations, and staff terms and conditions, as well as on organisational policies. The two outer layers, staff and patients, represent a people boundary through which the design of both physical artefacts (products, buildings, and technology) and system (organisational) changes must pass, eg as an industrial safety case[17] before introduction, implementation, and embedded use.

Personas are fictitious representations of target users[18]; they are used in design to describe archetypal (rather than actual) people. They have been used previously to describe patients with physical changes at five levels of functional mobility ranging from 'independent for activities of daily living with or without a mobility aid but susceptible to fatigue', through to 'wheelchair users with some or no ability to stand and sit without support', and finally to 'fully dependent patients (bed bound) to describe terminal stages of care'.[19] These example personas do not include cognitive or behavioural changes; a systematic review of risk factors for falls in dementia identified eight categories including visual and functional impairments[20] which could be used to develop a wider range of personas.

Key risks and benefits of new technologies in healthcare organisations

The benefits of using design to improve patient safety have yet to be fully realised in healthcare. In 2004 Clarkson et al[2] remarked that the NHS was 'seriously out of step with modern thinking and practice with respect to designing for safety … with insufficient grasp of the value and significance of design, and the techniques for managing and implementing design improvements.'

The uptake of HFE in healthcare has also been slow, and has been limited by healthcare professionals adopting the systems rhetoric without really understanding what a system is, or how to approach understanding/analysis/improvement from a systems perspective.[21] This has been exacerbated by a dichotomy in the approach to safety, with the focus being directed towards either staff health and safety or patient wellbeing (often with the two managed by different parts of the organisation) rather than on the whole system, its interactions, and opportunities for integration. This lack of integration[22] is also seen horizontally, with separate risk assessments for falls, pressure ulcers, mobility/safe patient handling, continence, and confusion (including dementia), notwithstanding duplication, overlapping, and nested interventions relating to product (beds and mattresses), technology (call alarms), and building design (equipment turning space, sight line monitoring, independent hygiene navigation).

As Clarkson et al stated, 'to be successful, any design-led initiative must be underpinned by a thorough understanding of the complex systems of interactions.'[2] The reconceptualisation of healthcare systems to include the transient role of patients (DIAL-F) illustrates how poor design at the core can permeate and result in a system that is trying to fit the human to the environment (relying on behaviour changes and training) rather than beginning the design with people and fitting the environment (physical, organisational, and social systems) to the human. Greater use of HFE and design will create many opportunities for healthcare to take giant leaps in improving safety.

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