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Navigating To and Through Large Hospitals

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Abstract
Navigating around large hospitals can be a highly stressful and time-pressured/consuming experience for patients, visitors and staff alike, with significant impacts upon operational efficiencies and overall 'user experience'. The sheer size, complexity and continual reconfigurations of such environments are all factors, as are the hugely diverse needs and abilities of those visiting and working there. Despite an array of navigational information and aids to address such issues, from more traditional directional signage to web and app-based interactive maps, 'getting lost' continues to be an everyday problem. This study aims to identify the 'real' navigational issues which impact upon users of such spaces, as a basis for informing new navigational approaches, technological or otherwise. This paper will begin by outlining the current issue(s) involved in navigating large hospitals and the subsequent aim of a study; the study design and particular methodology; the findings to date and finally a brief discussion of potential navigational solutions.

Keywords: Healthcare service design, hospital environments, navigating, wayfinding, user-centred design, evidence-based design, Critical Incident Technique.

The issue

Hospitals are typically large, complex and evolving spaces, which are being regularly reconfigured and extended as operational needs shift and change, often resulting in a confusing, non systematic layout (Li, Brown, Pinchin & Blakey, 2015). They are also often situated within dense built-up areas, making not only the journey 'through', but also 'to' the hospital a major navigational challenge. In addition to this, hospitals need to accommodate a hugely diverse range of needs, and emotional states, from those of a family member accompanying an emergency admission or a junior doctor on a night shift, to a routine day-patient. They also need to address a range of abilities both physical, including everything from the injured and infirm to the partially sighted (Mollerup, 2009); and also cognitive, including a wide variation in individual spatial abilities (Allen *et al,* 1996).

It is not surprising, therefore, that navigating around large hospitals can often be a major source of anxiety, frustration and overall stress for those visiting and working there. It also has significant and direct 'cost' implications in terms of missed appointments, whilst also putting an overall strain on staff time and resources in guiding others (Martins & Vasconcelos de Melo, 2014).

To overcome such issues a host of navigational and locative aids have been incorporated into hospital environments, based upon a well-documented understanding of spatial cognition (Thorndyke & Goldin, 1983), wayfinding (Arthur & Passini, 1992) and signage design (Calori & Chermayeff, 2007). Typically these include directive signage; wall mounted 'You are here maps'; colour coded flooring; alphabetical/numerical naming systems; turn by turn directions on hospital letters and more recently, web and app-based interactive maps and 'journey planners'. However, such a diversity and volume of information can also appear correspondingly both fragmented and overwhelming, with more recent examples often being more technologically motivated than necessarily user-driven. Indeed, despite such a wealth of navigational information, getting lost in hospitals is still a common, everyday problem (Rooke, Koskela & Tzortzopoulos, 2010).

The focus of the current study has therefore been to first identify and understand the 'actual' navigational issues for 'real' users of hospital spaces and then to examine their relative significance and impact. These results in turn providing a user-driven, evidence base upon which to improve existing navigational aids and/or inform new forms of adaptive, locative guidance. The overall aim being for such improvements to significantly reduce everyday navigational inefficiencies and improve the overall 'user experience' for patients, visitors and staff alike.

The study

The study forms a collaboration between Horizon Digital Economy Research Institute-University of Nottingham, UK and Nottingham University Hospitals Trust and is funded by Nottingham Hospitals Charity. It emerged in response to an earlier collaborative project between Horizon and

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NUHT, which focused on the problem of junior doctors getting around / working efficiently and effectively on night shifts (Brown et al, 2015).

The current study, however, focuses more broadly on 'hospital users'. Participants were therefore recruited through a mixture of hospital FaceBook pages, Twitter feeds, staff bulletins, printed flyers and hospital contacts. 11 participants were recruited, 5 males and 6 females ranging from 31 to 77 years of age, each with recent experience of navigating the Nottingham hospitals (Queens Medical Centre and City Hospital). Participants included: 3 patients, I administrative staff, 2 volunteers, 2 medical students, 2 ward sisters and 1 night shift coordinator.

Each participant was interviewed using 'Critical Incident Technique' (Flanagan, 1954), an acknowledged qualitative research method for eliciting real-life human experiences, their relative meaning and significance. This method requires participants to focus on a recent, first-hand experience e.g. navigating through a hospital and to describe it, in as much detail as possible, in terms of both its more positive and negative aspects and their relative impact. For example, "I'd like to begin by asking you to think about your own experiences of arriving and finding your way around a hospital environment. . . . if you could think of 2-3 examples that you felt were more positive . . . starting with your more positive experiences, can you describe 1) the circumstances or background to this experience? 2) why this experience was positive? 3) what were the implications/impact of this experience?". Interviews took place at the Queens Medical Centre and City Hospital campuses, Nottingham. Each interview was audio-recorded and supporting notes were made. Interviews were transcribed, individual statements or 'critical behaviours' were identified (Hughes, Williamson & Lloyd, 2007) and subsequently organised into categories of increasing specificity, through an iterative process of re-examination and reorganisation. This process of analysis served to highlight a framework of core navigational issues, which will now be discussed.

The results

Interviews (11) ranged in duration from 9.49 to 28.15 minutes, depending on the time participants had available and also their ability to recall and describe individual examples/instances. Indeed, as the interviews progressed it became apparent that hospital staff in particular, often found it difficult to identify discrete navigational experiences, tending to describe more generalised issues, and benefitted from some 'thinking time' prior to the interview. Despite this, a total of 3hrs 20 minutes of verbal data was generated which was subsequently transcribed. From this body of textual data, 788 individual statements or 'critical behaviours' were identified e.g. *"if you know the areas of the hospital well and you can navigate quite successfully",* each of which was subsequently summarised in a 'descriptive code' e.g "*Benefit of survey knowledge*". These descriptive codes were then numbered in terms of the nature of the content / concept they represented. Through this process of iterative re-examination and re-organisation, 5 overarching categories emerged (in no particular order), See: Table. 1. In some cases a particular descriptive code might fit into two

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overarching categories e.g. "*Increased time to find different exits - trial and error via stairs*". In these instances, both categories were listed in order of relevance i.e. "*1 and 3"*. Indeed, the 1) 'Impact of Quantifiables' clearly had a significant impact upon 3) 'Barriers to in-hospital navigation', with 27 of the 67 category 1) codes also identified as relevant within category 3).

The descriptive codes within each of the overarching categories were then further re-examined, reorganised and re-numbered into smaller, increasingly specific and meaningful categories. For example, category **2) Sources of in-hospital navigation** was further classified into 12 sub-categories. See: Table.1.

Table: 1 - Developing framework of core navigational issues

1	**Impact of quantifiables** (including: time, financial cost, procedures, availability) e.g. "*Negative impact of distance/time when escorting ill patients.*"	
2	**Sources of in-hospital navigation** e.g. "*Volunteers.*"	
	1	Human help / guidance (nurses, volunteers, receptionists, general public, bus drivers)
	2	Textual information (hospital letters, wall-mounted ward listings)
	3	Verbal information (turn by turn directions, word of mouth communication of dept. moves)
	4	Identifiable physical landmarks, visual cues (Main Entrance sign, movement of people)
	5	Colour coding (flooring, signage)
	6	Physical maps (hand-held/printed, wall-mounted)
	7	Spatial, survey knowledge / mental maps
	8	Numbering, naming systems (hospital Block, floor, ward)
	9	Signage (directional, naming, informational symbols)
	10	Transport (hospitals 'tugs', Medilink buses, staff escorting)
	11	External information (on-line 'to-hospital' directions, bus times)
	12	Potential / future solutions and ideas (app-based maps, verbal confirmations given in lifts)
3	**Barriers to in-hospital navigation** e.g. "*Absence of visible people Out of Hours.*"	
4	**Enhancers to in-hospital navigation** e.g. "*Impact of visually, directionally clear sign.*"	
5	**Specific navigational needs** e.g. "*Visitors navigating between multiple services-bereavement.*"	

During this process of iterative analysis, a diversity of key navigational and locative issues became apparent, some more obvious or expected than others. For instance, some of the more anticipated issues included: inconsistent, directionally confusing, temporary and/or redundant signage (Fig. 1);

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difficulties with the capacity and location of car-parking relative to hospital buildings (Fig. 2); a lack of visual cues especially in 'linking' corridors; difficulties in navigating between multiple appointments in one visit; staffs' tendency to only be familiar with their own area; and difficulties in retaining verbal directions particularly when anxious, to name just a few.

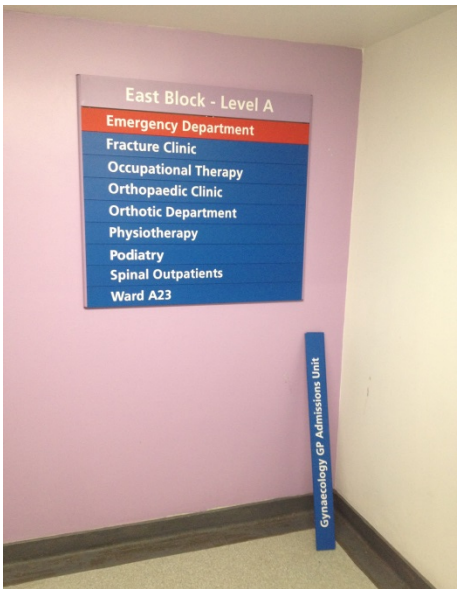

Figure: 1- ambiguous signage

Figure: 2 inadequate, inconvenient parking

Some of the less anticipated issues included: incorrect or ambiguous (locative, navigational) information in the hospital letter; feelings of isolation/ 'trespassing' whilst navigating out of hours; staffs' feelings of inadequacy / responsibility if unable to direct others; lack of awareness or recognition of colour coded routes (Fig. 3); blocked / inaccessible routes through multi-levels (Fig.4); inclination for public to blame themselves if unable to find their way; need to be proximal to a given route to 'pick it up' and the regular relocation of departments and clinics.

Figure. 3 information recognition issues

Figure.4 restricted access issues

These represent just a small selection of the navigational and locative issues which were highlighted in the process of developing the overall framework of categories. This framework will serve to form the basis of a UK wide, hospital-navigation survey, for patients and staff alike, aimed at quantifying the relative prevalence, significance and impact of the navigational issues identified.

The results of this survey, to be presented at the Design4Health Conference, 13-16th July 2015, will then be used to guide the improvement of existing navigational aids and/or the development of new forms of guidance, technological or otherwise. Some of the potential navigational solutions under tentative consideration will now be discussed.

Potential solutions

It was apparent early in the process of data analysis, that different solutions may be required for different hospital 'users'. In addition to the issue of staff getting lost themselves e.g. particularly junior, new or transient staff, was a need for them to be able to give directions both to the public and other colleagues, quickly, easily and accurately. This could be addressed with an in-hospital, mobile navigational app, which could be down-loaded onto staffs' work iphones, providing an up to date ward/clinic level map, including multiple floors, walk time estimates and orientation facility. Indeed, there are an emerging number of hospital-based navigation apps already in use, as issues with in-door mapping and positioning resolve. e.g. at Miami's Children Hospital and the Mayo Clinic Rochester, Minnesota (Plotnick, 2013).

However, such a technology-based solution may be less appropriate for the significant numbers of older / elderly people in hospitals, who may not have a phone or feel comfortable using an app; or for those in a hurry / emergency; or for those without a suitable phone, although increasing

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technological advances will reduce this issue. Indeed, the overwhelming focus for patients and visitors navigating the hospital was 'human help' i.e. nurses, volunteers, receptionists, porters etc. It was apparent the great comfort people received and value they placed in being able to ask staff for directions, and equally the willingness and commitment of the staff to help. In this case, a potential solution may be to enhance the volunteer 'meet and greet' role, by increasing their numbers, distribution and visibility. However, as many volunteers are themselves of advancing years and maybe reluctant to walk to / patrol outlying areas of the hospital, 'FaceTime' points could be used, particularly in more remote corridors, which people could touch to connect to a 'live' volunteer. Verbal, turn by turn directions could then be given 'remotely' by a volunteer, from the particular FaceTime point accessed, maintaining a human connection.

Such locative, adaptive information could also be achieved through the use of QR codes on hospital letters. Patients and visitors entering the hospital could pass their letter, printed with the particular department or clinic's code, over a reader which would then display turn by turn directions from that point, to their destination. This textual information could be further augmented with a map, locative images and/or a route video. However, although this solution may be useful for scheduled appointments, there are obviously a host of navigational situations / users it wouldn't accommodate.

The hospital letter itself was also identified as a source of navigational and locative confusion, often with the particular hospital, Block or building name being omitted, with just the name of the department or clinic being given. Some letters included specific route directions, maps and on-line links, whilst others simply stated the department's name. As such, another 'low-tech' solution would be to re-design the hospital letter itself, ensuring any navigational information was clear, consistent, comprehensive and current.

Conclusions

The difficulties of navigating to and through large hospitals are well acknowledged within the wayfinding literature, emerging healthcare delivery/user studies and indeed through personal experience. Recent solutions have typically, and understandably, focused on the increasing developments within in-door mapping and positioning technologies e.g. navigation apps. However, although such advances are of considerable value, the focus of the current study has been to first identify the issues surrounding why hospital users continue to get lost, a selection of which have been presented in this paper. The next stage of the study will be to estimate the impact of these issues, through a UK wide, hospital-based survey. This information, to be presented at Design4Health 2015, will then be used to both guide the improvement of existing navigational aids and/or inform the design of new forms of guidance. However, whatever potential solutions are developed, they will not only need to work effectively amongst the existing plethora of navigational information, but overtime and within a continuously evolving environment.

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