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DESIGN, USABILITY AND UNSAFE BEHAVIOUR IN THE HOME

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Each year, almost 4,000 deaths occur within the UK as a result of a home accident and 2.8 million domestic accidents result in the casualty requiring hospital treatment. New homes include many safety features to protect occupiers from injury, however the effectiveness of these can be dependent upon user behaviour. This research examined how behaviour interacts with design and how this may lead to an increased risk of injury. Forty, in-depth, semi-structured interviews were conducted with individuals inhabiting a new home. Various behaviours were reported in relation to building features including fire doors, pipes and loft access. The accounts demonstrate that designers need to give greater consideration to the interaction between occupier behaviour and building features so that improvements in design and occupier education may lead to improved health and safety.

Introduction

Unintentional home injuries are a serious public health and safety problem worldwide. In the United Kingdom, almost 4 000 deaths occur annually as the result of a home accident (DTI 2001) and approximately 2.8 million home accidents occur which result in the casualty requiring hospital treatment (DTI, 2003).

House fires also present a cause for concern. Every year, more than 400 people are killed and over 10,000 injured in house fires within the United Kingdom (ODPM 2004). The effects of fire can be devastating due to the disruption of domestic life and the loss of personal belongings. The average cost of damage caused by a house fire in the UK is £21,500 (ODPM, 2004).

The careful design of dwellings can help minimise the risk of unintentional injury. Despite this being widely recognised within governments and advisory groups, injury in the home remains common. In 2002, 20.1% of all UK home accidents were associated with a construction feature within the home (DTI, 2003). The features involved included stairs, banisters, stair posts, walls, windows, doors and door frames. According to Bonnefoy et al (2004), human behaviour and dwelling design are important contributory

factors in home accidents, structural features can present physical dangers (steps, stairs and balconies) and occupiers themselves can create additional hazards through their behaviour. Haslam et al (2001) for example, identified a number of unsafe behaviours in relation to stair use amongst older people, including hurrying and the carrying of bulky or heavy items. They also identified patterns of behaviour that changed the nature of the environment itself, such as the leaving of obstacles on the stairs.

Legislation aims to protect the health and safety of individuals within their home through the application of national standards, codes and Building Regulations. Heimplaetzer & Goossens (1991) argued that whilst many 'solutions' to health and safety problems have been translated directly into building codes or Regulations, these are then interpreted by architects and designers as a guarantee that maximum safety is provided. Architects and designers do not see the need to go any further than this. Heimplaetzer & Goossens claim many accidents within buildings continue to be 'architecturally triggered', arising from an interaction between occupant behaviour and design. For example, falls may occur due to the need to climb on things to reach windows or cupboards, and impact injuries occur due to the positioning of doors, windows and low ceilings (Heimplaetzer & Goossens, 1991). Interestingly, they also claim that many solutions aimed at reducing the number of domestic accidents are chosen on the basis of partial or incomplete modelling. For example, in preventing children from falling down the stairs a closure may be fitted at the top of the stairs, but the consequences of this modification for adult occupants is ignored. In this manner, safety measures introduced to protect occupiers from one element of danger, can introduce additional hazards within the home. Pickett (2003) also highlighted this in a report on finger-trapping risks created by fire doors installed within dwellings.

The aim of this investigation therefore, was to gain an improved understanding of the ways in which people interact with their homes and to identify how behaviour interacts with design to affect health and safety. This included attention to the problems people have using home features and systems. This knowledge should be of value to those responsible for the design and construction of new homes.

Methods

Forty face-to-face, semi-structured interviews were conducted within the participant's home to collect information on the personal experiences of individuals inhabiting a new-build home. Home audits were also undertaken to identify where problems arose with design features and where modifications had been made. Each interview was conducted by the same researcher, and lasted approximately one and a half hours. The interviews were recorded, and later fully transcribed.

The qualitative data analysis followed three steps: data reduction, data display, verification and conclusion drawing (Miles and Huberman, 1994). Data reduction was achieved by coding of the data using the qualitative software NVivo and subsequent pattern coding of the initial codes (Miles and Huberman). Validation of the coding was achieved by independent review of a sample of the data and subsequent interpretation by another researcher. The pattern coding provided the basis from which the conclusions within this study have been drawn.

Results

The mean length of occupation of the properties in this study was 12.5 months (SD = 8.6). The age of participants ranged from 20 years to 65 years, (mean = 37.5 years, SD = 12.9). All participants were recruited on the basis of being the first occupiers of the property. Of the 40 properties visited, 4 were classed as detached, 3 as semi-detached, 5 as terraced, 20 as 'town houses' and 8 were apartments/flats.

It was observed that 26 of the 40 properties were fitted with self-closing fire doors in line with UK Building Regulations. In all 26 of these, the occupiers had interfered with the doors in some way. Participants reported removing or jamming the self-closing mechanism itself in 9 of the properties, and in 25 of the properties, fire doors were wedged open preventing them from closing

A 25-year-old male living in shared accommodation said:

'I think obviously they are a good idea...I'm sure there's another way of doing it'

A 35-year-old married female commented:

*'I understand the health and safety behind it but it drives me [mad],
it worries me, they really go with a bang'*

The participants provided a number of reasons for disabling their fire doors including inadequate internal lighting when the doors are shut, noise due to the doors slamming and the prevention of finger-trapping injuries.

Unsafe behaviour was also reported in conjunction with design features and systems within the home. Of the 40 properties visited 32 had been built with a loft (roof void accessible via a hatch), and a purpose built extending loft ladder had been fitted by the occupiers in only 5 of these properties. A loft-ladder had not been provided as standard by any of the house builders. In the remaining properties, access to the loft was achieved by various means including the use of general-purpose ladders, stools, furniture and fixtures. A 33-year-old male described how he had fallen from the loft access hatch when the drawers he was standing on fell:

*'So I could have fallen down the stairs quite easily. It's right
next to the stairs. It fell that way fortunately, if it hadn't, I would
have gone over the stairs.'*

Unsafe behaviour was also reported in relation to DIY tasks undertaken in the home, specifically in relation to electrical and water safety. In all the properties visited, the service cabling and piping was located within the walls. In 10 of the properties, occupiers reported that they did not consider the location of these services before drilling into the plasterboard, and described taking risks when hanging pictures or curtain rails. A further 15 properties stated they were unaware of the location of these services but did take care when drilling. However, 8 households had purchased a services detecting tool. Of these, 2 of the items only located electricity cables and in one instance, because of this, a water pipe had been damaged as a result of drilling. Only 2 of the householders recalled having been given a services map by the house builder outlining the location of electricity cables.

Participants spoke of problems in relation to a number of design features and systems within their home. Scalding occurred in 2 cases resulting from high water temperatures and 9 occupiers complained that the water temperature was too high. Although mixer taps were fitted in some bathrooms, the design did not always prevent the problem of scalding. A 21 year old female described the problem.

'Even when you have hot and cold on at the same time it still comes out in columns, and if you put your hand under, ironic as it sounds you can still actually scald yourself'

In 2 of the 40 properties, the occupiers identified stair newel posts as dangerous features within their homes (newel posts are located at the top and bottom of a stair case and positioned at stair turns for structural support). These lead to the risk of injury as the result of head impact.

Another feature resulting in an increased risk of impact or head injury was sloped internal ceilings. These were located above the stairs and also within bathrooms on the top floor of three story properties. In 3 properties visited, occupiers complained of having struck their head due to these low ceilings.

Sloped external access to properties, in line with current UK Building Regulations, was suggested as presenting an increased risk of slips and falls during bad weather. Participants from 2 properties reported that the floor surface of the external access became slippery due to ice and water.

An installed safety feature, introducing an additional risk for falls, particularly for children, were emergency egress windows [a window provided for emergency egress purposes which should have an unobstructed openable area that is at least 0.33m² and at least 450mm high and 450mm wide, (ODPM 2004)]. An emergency egress window was fitted to windows on the first floor in 18 of the properties visited. Only 5 of these windows could be locked and only 8 were fitted with a restrictor bar which could be overridden in the event of an emergency. In 6 of the 18 properties the windows could not be locked or restricted in any way. This led to a concern for the safety of children.

Discussion

This study has identified a number of unsafe behaviours present among occupiers of new dwellings, arising as a direct result of the occupant's interaction with the building features and systems within the home.

The study has also identified a number of problems that are experienced with specific architectural features and systems of the home. These problems may lead to a risk of injury as a result of interacting with the feature or through inadequate occupier modification.

The behaviours and problems identified in this study arose as a direct result of the occupant's interaction with the features and systems within their home, and are amenable to prevention through alternative design. This supports the suggestion by Heimlaetzer and Goossens (1991) that improved design of architectural features would reduce the potential for 'architecturally triggered' accidents within buildings. The main cause of unintentional injury to children of all ages is falls. The provision of unlockable fire egress windows at height presents additional risk of falling for young children. This is a further example of what Heimlaetzer and Goossens' (1991) refer to as 'partial' or 'incomplete modelling'. In providing a safe egress route for occupants of the property, the installation of an egress window at height may have consequences for children in relation to falls. 'Complete modelling' in this case, would refer to designers having taken into account all categories of users and all predictable patterns of use and misuse.

The findings also support Bonnefoy's (2004) claim that both human behaviour and dwelling design are important contributory factors in home accidents. This study has shown how structural features can present physical dangers (fire egress windows, loft

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access hatches) and also how behaviour can create additional hazards (tampering with fire doors, drilling into electricity cables). Complex interactions arise between the occupant and building features and it is important that architects and designers are aware of these interactions in order that preventative efforts through alternative design will be successful.

The results also support the work undertaken previously by Pickett (2003) in relation to self-closing fire doors. In the present study, it is notable that in each of the homes the occupiers had interfered with the fire-door mechanism in some way, thereby reducing the level of protection afforded through their installation. If the results of this study are indicative of behaviours practised in other homes, as suggested by Pickett (2003), the provision of internal self-closing fire doors is ineffective as a safety measure.

The findings reported in this paper are based on self-report data gathered during retrospective interviews with occupiers and the limitations of this methodology should be acknowledged. The sample of participants were self-selecting and may have held particularly strong views or had particular experiences, motivating their participation. The study called for participation at a very busy time for individuals, subsequent to moving into a new house and this may have influenced response levels.

This study has provided insight into the interactions of occupiers and their homes. The findings should be of interest to those responsible for the development of building standards, procedures and guidelines, informing them of the impact of occupier behaviour.

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