

Assistive lighting for people with sight loss

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Introduction

The importance of lighting as an assistive technology, hence ‘assistive lighting’, has been largely overlooked. When there has been attention given to lighting, this has often been concerned with security or energy consumption rather than with the benefits of lighting in enabling tasks to be undertaken more safely or easily, in reducing falls and helping people to navigate around their homes. Both of the latter benefits can be particularly great for people with sight loss and are important, therefore, in the context of people’s independence and control over their home environment. Giving attention to assistive lighting now carries greater importance than hitherto because of the implications of demographic change – where the ageing of the population means that there is an increasing proportion of, mainly older, people living with sight loss. The extent of such sight loss generally increases with age.

The increased attention on lighting for people with sight loss in the United Kingdom is demonstrated in the work of the Thomas Pocklington Trust and also in the activities of the several hundred rehabilitation officers and occupational therapists and the agencies for which they work.[1,2] It is highly relevant, therefore, that the research work on which this paper reports resulted in a good practice guide. The range of people informed by the guide includes people with sight loss

themselves; and the agencies (including those involved in housing design) that endeavour to address their needs.[2]

People with Sight Loss

There are nearly two million people with sight loss or who are blind in the United Kingdom, though far fewer are registered as such.[3] An estimated one in six people with sight loss have a dual sensory impairment - i.e. both a sight and hearing loss.[4] Some loss of visual capacity takes place through the natural ageing of the eye. But additional contributors to sight loss in older age are macular degeneration, glaucoma, diabetic retinopathy, cataracts and retinitis pigmentosa; together with some neurological conditions (including forms of dementia) that can affect the way that the brain interprets information 'seen' through the eyes.[5]

People with sight loss trip, fall or stumble more often than others. A third of respondents to a United Kingdom 2006 study of over 1000 adults with sight loss reported having had a 'serious injury' as a result of a fall.[3] In another study, for England, nearly half (47%) of people aged 50 or over with 'poor vision or registered blind' had fallen in the two years 2002 to 2003; compared to just 30% of people over 50 with good vision.[6] An Audit Commission study was reported in 2007 as noting that the 90,000 falls in one year (in England and Wales) attributable to visual impairment cost a massive £130 million to the National Health Service.[7]

In the study, poor quality lighting was pointed to as putting people with impaired vision at ‘greatly increased risk’ (e.g. of hip fractures).

Assistive Lighting and Housing Design

Assistive lighting has a key role to play in reducing the likelihood of falls, in helping people to undertake specific tasks or in **facilitating** their movement and orientation. It can be portable or fixed. Fixed assistive lighting, however, normally carries a higher cost. Portable devices are, therefore, more widely used. These range from battery powered lights within handheld or stand magnifiers, to mains-powered portable lights and their floor-standing equivalents. Many are adjustable and different lamps (light bulbs) can be used to suit the needs and preferences of people with different eye conditions.

The impact of the provision of assistive lighting in the United Kingdom has been authoritatively reported in work commissioned or undertaken by the Thomas Pocklington Trust. Where people with sight loss have been directly engaged in such work, most notably through the provision of fixed assistive lighting in their homes, the feedback reported in evaluative studies has been good and sometimes eulogistic.[8]

In a study of lighting interventions in Sweden that was focused on a particular range of tasks, fixed installations in kitchens, hallways and bathrooms resulted in

people with sight loss reporting an improved ability to differentiate colours, negotiate stairs, take medication, prepare food, do paperwork, use a computer, shave and/or put on make-up.[9]

However, for people with sight loss to benefit more widely from appropriate lighting, it needs to be the subject of greater consideration in the design of new and in the refurbishment of older dwellings. In relation to the same, the government in England has championed the principle of universal design, at least, for new dwellings. The principles of universal design include equitable use (i.e. useful to people with diverse abilities); flexibility in use (accommodating people's preferences); being simple and intuitive to use; and offering tolerance for error (minimising hazards).[10] Dwellings built or refurbished with universal design principles in mind should, therefore, offer greater accessibility and usability for people with sight loss and may, it has been contended, 'be especially helpful for reducing falls among older persons'.[11,12] Guidance for the design of new dwellings produced by RNIB Cymru is notable, here – this giving both attention to lighting and to the wider considerations of colour, reflectivity and contrast.[13] But as with other countries, much of the housing stock in the United Kingdom is a long way from offering 'universality'.

With regard to the refurbishment of older dwellings, the attention given to universal design principles has been less. Some potential benefits of lighting interventions in such contexts have, therefore, often been overlooked. The use of guidance from

Foundations (aimed at agencies involved in helping people to adapt or improve their homes) is a notable exception.[14]

In this context the Thomas Pocklington Trust commissioned a study whose outcomes would be useful to people with sight loss and would support ongoing practice-based research. The study enabled the publication of clear and simple guidance for rehabilitation officers, occupational therapists and other professionals and practitioners. Key outcomes of the study are in the published guide, elements of which are borne testimony to in this article.[2]

Methodology

The study was primarily concerned with the impact of assistive lighting on what people with sight loss can be enabled or assisted to do. It was concerned, therefore, with the potential of assistive lighting to help people retain or regain the ability to undertake tasks – reducing the risks to which they would otherwise be exposed and increasing their personal control over the home environment. Each of these has potentially beneficial effects for their overall well-being.

A goal of the study was to develop a series of tenets for the provision of assistive lighting. These tenets were developed from information collected in a review of the literature (e.g. the work undertaken in Sweden [9]); consultation with an expert advisory group that was established for the project; and feedback from service

providers, both directly and through **the** focus groups **that ensued**. Expert knowledge, drawn from different perspectives was pooled, including that derived from prior work undertaken by and/or published by the Thomas Pocklington Trust.

The **service providers who contributed to the** focus groups **or through other feedback were recruited as a result of** extensive networking throughout the United Kingdom. **They, in the main, comprised** rehabilitation officers and occupational therapists. The most notable of the organisations with whom contact was made (and networking facilitated) was the Social Care Association (SCA) which hosts the Rehabilitation Workers Consultative Network. **Sight loss is a central aspect of their work**. Mailings to their members offered details of the research work reported on in this paper. Other circulations of information regarding the research were undertaken by the College of Occupational Therapists (Social Services Network), the Royal Institute of British Architects (Architects for Change Group), Foundations (the organisation supporting home improvement agencies in England), the Association of Directors of Social Services (ADASS), the Centre for Accessible Environments; and the ACCESSIBUILT group via the JISCMail academic network. Responses to such mailings enabled the researchers to follow up directly with individual respondents and, in some cases, with the professional groups within which they participated.

The project Advisory Group comprised four people who were leading experts in, respectively, sight loss, rehabilitation, social housing services and home

adaptations. The Group met on four occasions during the course of the study. On each occasion **they discussed** interim findings and **helped** to turn a range of parameters that had been identified by the researchers into the key tenets on which this paper reports.

The focus groups, seven in total **with between eight and 24 participants**, enabled direct engagement with over 80 rehabilitation officers and occupational therapists. The majority were employed by statutory agencies responsible for supporting people with sight loss; **and** others by third sector bodies including charities specifically concerned with sight loss. At each of these focus groups the authors of this paper initially established, through discussion that was guided by a topic list, the kinds of lighting interventions undertaken or commissioned by the teams in question and the specific reasons why these were selected. This then facilitated a debate around the wider range of assistive lighting that could help meet the needs of their clients from the point of view of supporting tasks and risk reduction; and their broader well-being.

These focus groups took place between 2008 and 2010. In geographical terms they spanned from the very rural (bringing together members of the Devon County Council Adult and Community Services Sensory Team - operating in the South West of England) to the densely urban (bringing together the Birmingham City Council's Visual Impairment and Rehabilitation Teams - operating in England's second largest city).

For many of the rehabilitation officers and occupational therapists the debates within the focus groups meant an expansion in their knowledge of lighting options. Hence, discussion took place around the 'normal' fare (often more focused on safety) that often related to the use of halogen lights with dimmer switches (for general lighting), or task lights under cupboard units in kitchens. This was then extended by stimulating discussion on the potential merits of other interventions such as wardrobe lighting, lighting tracks and automated bedside lighting (see examples below).

The different forms of assistive lighting were discussed in relation to parameters that might underpin the approach to their provision. Eight such parameters were initially identified as follows:

1. Promoting independent living and social inclusion
2. Reducing risk
3. Promoting good design, dwelling usability and accessibility
4. Disseminating information, promoting knowledge and awareness
5. Close working with users
6. Promoting / demonstrating partnership working between agencies
7. Offering low cost and, therefore, more accessible (affordable) solutions
8. Being relevant and informed.

These parameters had been set out by the researchers and related to understandings of what was considered likely to represent good practice. They drew on relevant publications – three of which offered ‘guidelines’ for lighting provision by different agencies.[14,15,16] All, albeit with different emphases, pointed to the importance of adopting practices that spread knowledge and involved, where appropriate, partnership working. Central to each, however, **were** approaches that reflected a commitment to universality – though they took their reference point as one of ‘inclusive’ rather than ‘universal’ design. In the words of Hanson, the concern was in ‘creating environments and products that are usable by all without the need for special adaptations ... homes that are safe, convenient, equitable and enjoyable to use by everyone regardless of their age, ability, ethnicity or gender.[16] **With** respect **to** lighting interventions, Hanson pointed to the need for them to be ‘appropriate’ and **to provide** an ‘even’ distribution of light – taking cognisance of the varied nature of people’s visual impairments and the need for ‘tailored’ and flexible solutions.

Debate and discussion within the Advisory Group enabled these parameters to be rethought in relation to the lighting interventions themselves rather than the broader service context and the manner of service provision. This meant the initial adoption of the tenet concerned with the necessity of lighting being ‘appropriate’ in order to meet different and often changing needs. Other tenets followed from this, and were crystallised as knowledge increased regarding the different types of lighting intervention being made, together with the feedback and views of rehabilitation

officers and occupational therapists in the focus group meetings **and in correspondence.**

As well as helping in the identification of different examples of lighting interventions, the focus groups and correspondence with rehabilitation officers and occupational therapists facilitated visits to the homes of four people with sight loss where such interventions had been made. These interventions evidenced good knowledge, on the part of the rehabilitation officers and occupational therapists concerned, **their familiarity with** some kinds of assistive lighting and a good understanding of the broader context relating to décor and the use natural light.

It was strongly apparent from both the focus groups, the visits and the correspondence that there was close working between rehabilitation officers and occupational therapists and the people with sight loss. **Also** apparent was the extent to which the rehabilitation officers and occupational therapists saw lighting interventions as, on the whole, either focused on tasks (**helping** people with sight loss to cook, eat, wash, dress, shave, etc.); or **on** risk reduction (i.e. helping with navigation around the dwelling). Their day to day practice was, therefore, most closely aligned with concerns that related to the tenets of appropriateness, sufficiency, evenness and adjustability of assistive lighting.

Tenets for Assistive Lighting

Following the literature review, consultations and further scrutiny through the project Advisory Group, the following seven tenets for assistive lighting are put forward. Some examples of specific lighting interventions are then offered and the relevance of specific tenets identified. The seven tenets relate to the sufficiency, distribution, and control of assistive lighting; and to considerations around the simplicity, sustainability and flexibility of the lighting interventions. Each is explained. None, it should be noted, are suggestive of higher levels of illuminance being always necessary or desirable. A minimum level of illuminance can, however, normally be regarded as appropriate in different parts of the home and as desirable for all people (with or without sight loss). But for people with sight loss, their different visual impairments will result in different lighting needs and, importantly, different experiences of glare. Therefore, different levels of illuminance can be appropriate. Consideration of assistive lighting options must, therefore, take account of this fact – with careful attention given to people’s ability to control the lighting (its level and direction) and, for instance, the potential use of shades or diffusers. The tenets are as follows.

Tenet 1: Appropriate

The appropriateness of lighting reflects the importance of assessments (most likely undertaken with rehabilitation officers and occupational therapists) that take account of the person’s needs and relates these to what is both possible and desirable. It also requires that simple low (or no) cost interventions are initially considered. **With regard to the latter, aside from the option of eye tests and**

spectacle renewal there are potential interventions outside the home to e.g. remove trees or other foliage in order to let in more natural light. Within the home there is a wider range of potential interventions that can include changes to room decoration, adjusting furniture positions, changes to carpets and furnishings, the use of curtains, blinds and shades, curtain tie-backs, changes to light fittings, window cleaning and reducing the number and variety of items in the visual field (i.e. 'visual clutter').

Tenet 2: Sufficient

The sufficiency of lighting recognises that there is a minimum level of light that is desirable and should be provided. Through circumstances will vary, we have recommended that the illuminance at floor level in each room should be between 100 and 300 lux.[2] This is broadly in line with the values given in the lighting guide for communal buildings of the Society of Light and Lighting.[17] The key point is that, provided that glare is minimized, people with sight loss will usually prefer and get benefit from higher levels of illumination. Higher light levels are, in any case justified in areas where tasks are performed by people with severe sight loss and for whom there may be particular risks. Such lighting levels do not mean that any desired ambience needs to be sacrificed. Rather it is a matter of portable or fixed lighting fulfilling a localised need.

Tenet 3: Even

An even distribution of light avoids deep shadows or sharp changes in light levels. The need for evenness in the distribution of light arises from the confusion (and, therefore, increased risk) that can arise where people with sight loss simply do not see or mis-interpret objects or features within or between rooms. The misinterpretation of either of these represents a risk of bumps, trips or falls – with there being particular danger when it is associated the location of or distance from stairs and/or fittings in kitchens, bath and shower-rooms. The need for an even distribution of light also responds to the fact that the vision of many people with sight loss is slow to adjust when moving from a well-lit to a poorly-lit space (and to a lesser extent, the other way around). This heightens the level of risk during the adjustment period.

Tenet 4: Adjustable

Adjustability responds to the fact that people have varying and often changing needs. Many people with sight loss will, furthermore, live with sighted household members who will wish to have different levels of light when they are occupying parts of the home. Importantly, when lighting is adjustable, people are more easily able to exercise control over lighting levels. It is not surprising, in this context, that dimmer switches are the most commonly installed lighting intervention used by or for people with sight loss in the United Kingdom.[18]

Tenet 5: Sustainable and Energy Efficient

Affirming the importance of sustainability for lighting interventions reflects a broader recognised need for energy efficiency. The pursuit of such efficiency will reap longer term dividends in relation to what are often overall higher levels of energy consumption – because of the need for most people with sight loss to have higher levels of lighting. The adjustability of lighting and the ability of people to control light levels and light usage (e.g. through the use of curtains, blinds and shades) relates to this tenet. In addition, the cost of light fittings or lamp replacements is a consideration.

Tenet 6: Simple

The need for simplicity in lighting interventions reflects the desire to minimise disruption to a person's home. The 'simple' replacement of some switches and fittings (perhaps complemented by some portable lighting) may, therefore, be all that is needed. Simplicity also means that different ways of using natural light will have been considered and different lamps and shades tried out. Of course, it will be appropriate for more complex lighting solutions to be considered where there are greater needs and/or where a wider range of home adaptations or refurbishments is planned.

Tenet 7: Adaptable

The need for adaptability follows from the fact that the extent and nature of people's sight loss changes. It also responds to the changing nature of dwelling

occupancy – where people with sight loss may or may not be present. Portable lighting, with accessible fittings and power sources, has an important place in this context. In addition, the adaptability of installed lighting may be facilitated by, for instance, ceiling mounted light tracks.

A potential addition to the seven tenets is automation. Automated lighting at the bedside (activated when someone gets out of bed) is increasingly welcomed in the homes of people who are prone to falls, regardless of any sight loss (see example below). We are, however, mindful of the potential risk that arises if a person with sight loss becomes reliant on automated lighting that fails. Where automated lighting is used, a back-up power supply or warning in the event of a lighting failure may be necessary.

Several of the tenets of assistive lighting relate to the principles of universal design. This is most clearly the case with regard to the tenets of simplicity (which resonates closely with the principle that affirms the need for designs to facilitate ‘simple and intuitive use’) and adjustability (that is aligned with the principle of ‘flexibility in use’). Other tenets, such as **the one** concerned with sufficiency, resonate with the principle that calls for ‘tolerance for error’ by means of which risks can be minimised; and **with** ‘perceptible information’ insofar as the lighting interventions can help ensure that the **information in the** environment is more easily understood. Appropriate lighting interventions, therefore, support the realisation of several universal design principles.

In this context, and with regard to lighting, it may be appropriate that designers and others who are accustomed to working with universal design principles rethink some of their approaches by reference to the tenets put forward herein. In support of this we can note that Mace and his colleagues who have championed universal design principles pointed to ‘other factors’ being important as well as those that they set out.[10]

Examples of Assistive Lighting

Examples of assistive lighting are provided here in order to illustrate the way that some different interventions relate to the proposed tenets. These derive both from the focus groups and from other work directly undertaken by or for the Thomas Pocklington Trust.

The first example is one of the more common-place. It focuses on the provision of task lights in the kitchen, most notably in the form of strip lights **that are mounted under units and over working surfaces (see Figure 1). These lights are shielded from direct view in order to avoid glare. They supplement the main source of light in the kitchen – ceiling mounted halogen lights. Meanwhile, blinds are used to control the level of natural light.**

The use of assistive lighting in this way reflects an approach that relates most notably to the tenets concerned with its appropriateness in helping the dwelling occupant with food preparation and cooking tasks; but with the wider room lighting provision being both sufficient and adjustable. The benefit of such lighting to people with sight loss can be substantial - especially when complemented by other assistive technologies that may help in cooking (microwave ovens, tipper kettles, etc.) and reduce some of the risks (cuts, burns and scalds) associated with food or drink preparation.

Insert Fig 1: Under unit and over hob strip lighting in kitchen (Source: Pocklington).

The principle of using shielded linear fluorescent lights also applies to lighting within wardrobes or cupboards. **This** provides our second example (see **Figure 2**) and offers people with sight loss the ability to more easily find and select clothes, therefore being better able to dress according to their choices. The risk of the light remaining on within the wardrobe, in this instance, is avoided through use of a pneumatic timer switch. The use of assistive lighting in this way reflects an approach that relates, in particular, to the tenets of appropriateness, sufficiency, sustainability and energy efficiency. Clearly, the fact that in-wardrobe lighting can assist people with sight loss in the task of selecting clothes is not just a matter of importance for his or her independence but also for his or her **self-image**.

Insert Fig 2: Strip lighting, linked to pneumatic timer switch fitted in wardrobe (Source: Pocklington)

Our third example points to the use of lighting attached to a ceiling mounted track (see Figure 3). Ceiling mounted track lighting is easily installed (normally using existing fittings) and provides the potential for a generally good and even level of lighting as well as (through e.g. halogen spot lights) more focused lighting to help with key tasks. This kind of intervention can have merit in different parts of the dwelling. In this application in the bedroom pendant lights with paper shades (to avoid glare) are accompanied by directional spot lights to aid the undertaking of tasks such as ironing or dressing.

Lighting tracks afford the option of locating different lamps in different places, with the fittings readily adjusted, added or removed. The use of assistive lighting in this way reflects an approach that relates, in particular, to the tenets of appropriateness, sufficiency, evenness, adjustability, simplicity and adaptability.

Insert Fig 3: Lighting mounted on ceiling track in bedroom (Source: Pocklington).

The fourth and final example of assistive lighting is one that is increasingly being offered by telecare service providers in the United Kingdom. The example is a bedside light that is activated by a bed occupancy device (see Figure 4) or passive infra-red sensor (PIR). The rationale for this, though not known to have been authoritatively researched, is that automated lighting can guide a person getting out of bed during the night and increase their safety by reducing the likelihood of falls. It is, furthermore, a simple and low cost intervention in that such lighting requires little more than a power point in the right location. This use of assistive lighting

reflects an approach that relates, in particular, to the tenets of appropriateness and simplicity (see Fig 4).

Insert Fig 4: Automated bedside lighting linked to bed occupancy device
(Photo: Renfrewshire Council).

Noteworthy is the fact that this approach to assistive lighting can be used in more complex ways through linking (via a carephone or an environmental controller) to lights on landings, hallways or in bathrooms. The use of programmable timing facilities mean, furthermore, that alerts can be sent to a monitoring and response centre if the person has not returned to bed, after the light has been activated, within a pre-set period.

Conclusion

There is increasing attention being given to the importance of lighting in helping people with sight loss maintain or regain their independence. The recognition of lighting as an assistive technology, albeit often overlooked, becomes clear in this context. To help to create further awareness of its benefits, we have both coined the term 'assistive lighting'; and by putting forward seven tenets, we have set in place a broad framework by which the contribution of such lighting can be considered for people with different kinds of sight loss.

Part of the reason for the approach taken relates to the joint imperatives that arise from demographic change and the desire of most people with sight loss to live

independently at home. Independence carries with it the need for people's homes to be configured in ways that minimise risks. For people with sight loss, this means that lighting should play a more important part than has, to date, been the case.

The tenets set out in this paper do not, of course, provide the answers to questions about the particular needs of people with sight loss. They do, however, support the ways of thinking that need to be emphasised when lighting needs are being considered, not just by rehabilitation officers and occupational therapists, but also by designers, architects and others. The tenets may be seen as both adding to and **extending** the principles of universal design. They carry specific relevance in an area where people's needs that arise from sight loss can be assessed alongside interventions that can help address those needs.

Finally, four examples of assistive lighting have been offered and their potential contribution in the context of the tenets discussed. Importantly these interventions do not just help to support independence by reducing the risk of falls and other accidents, but they may also contribute to the engagement and participation of people with sight loss in family, community and economic life.

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