

Lighting for Low Vision

Ambient Lighting

General room lighting usually comes from fittings anchored in the ceiling and as a result, light may be compromised by shadows created by furniture or partitions, or it may become a source of glare when it is in the line of sight, or reflected off a computer screen.

When performing a task such as reading, the surface of the page is unlikely to be at right angles to the ambient source, and is likely to be inadequate for satisfactory visual performance. So to perform a task in optimum illumination we require **Task Lighting**.

Task Lighting

Task lighting refers to light positioned specifically to illuminate a task. If the task is fixed, the source may also be anchored to a surface, however it may be portable and supported on a desk or floor mounted base.

Task lights may be low voltage [typically 12V - if Tungsten Halogen], but frequently their source will be an incandescent lamp (GLS).

The lamp may be shielded by a shade that may also direct forward some of the light emitted from the rear of the lamp. The shielding may prevent stray light from becoming a glare source for the reader or for others sharing the space.

A 'reflector' or 'spot' lamp is an efficient way of providing a bright light source for reading. The reflector acts as a shade and directs the light and heat forward reducing the surface brightness of the source and the radiation of heat on the face. Reflector lamps for reading reduce the heating of the shade and may be in the form of the GLS spotlight, or the dichroic spot Halogen lamp mentioned above. As these sources are quite directional, they must be carefully positioned to direct the light onto the page.

Task lights from lighting warehouses frequently utilise Tungsten Halogen 'acorn' lamps, with very poor or minimal shading and limited articulation. It is very difficult to position them in a manner that avoids glare for the user, or for others in the room. These 'acorn' lamps are extremely hot [over 1000⁰C] and are dangerous if accidentally touched when they are pushed aside to enable the user to stand up out of their seat.

Positioning of Task Lighting

It is a popular misconception that the best position for the reading light is 'over the shoulder'! It is undoubtedly the worst possible position because the incident light will bounce off the page back into the eye, becoming a source of **indirect discomfort glare**.

All paper reflects unwanted light, even when it is matt, but when it is reflected from a glossy page into the eye, contrast may be destroyed or at least visibility is markedly reduced.

Rotating the page to reduce the reflections may resolve the problem, but this compromises the posture of the reader. It is much more satisfactory to reposition the light source.

The correct position of the source can easily be determined by placing a mirror on the surface of the page; if the light is seen in the mirror, shift the light to change the angle.

If others are sharing the room, consider the effect of the position of the task light as a source of **disabling or direct glare**. Shift the light forward and if another person is looking towards the lamp while communicating with the user, place it on the same side as the companion and it will be directed away from them.

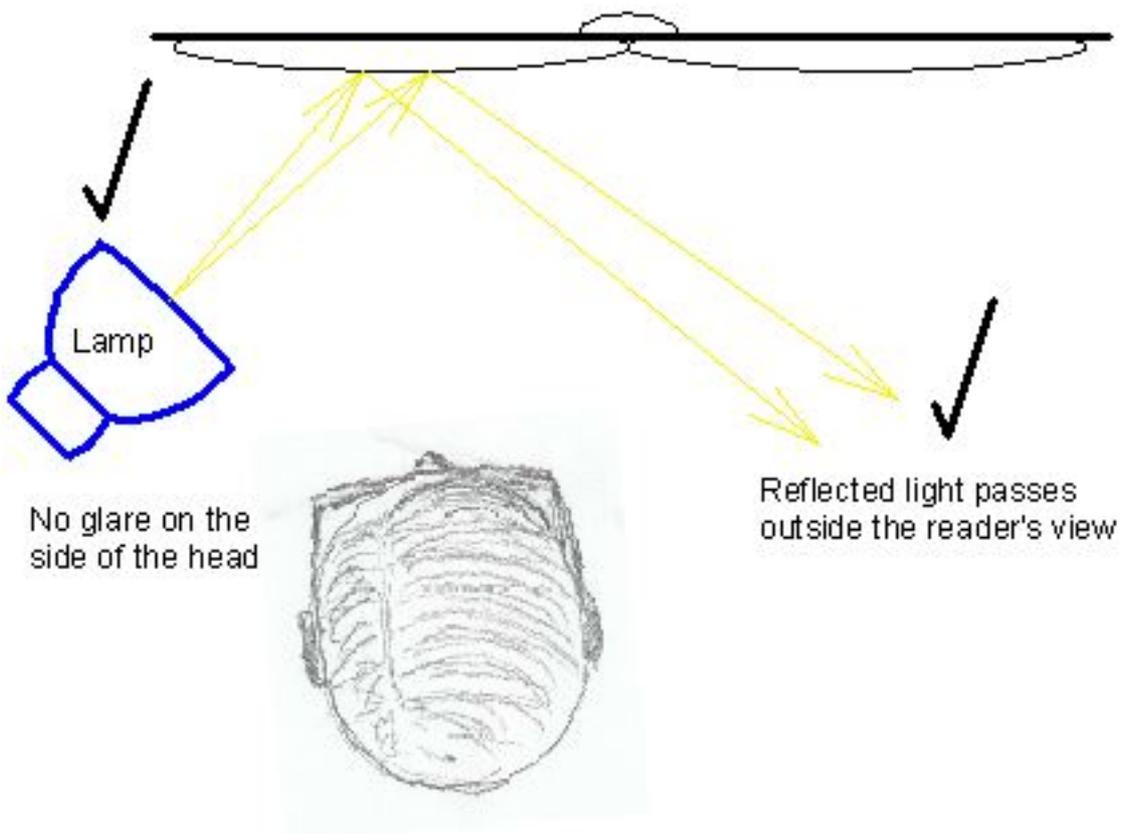


Diagram 1 – Effective lighting and glare problem resolved!

When using a magnifier position the fitting further forward still – not too flat an angle however, otherwise the contribution of light to the plane of the page will be minimal.

Light passes behind magnifier providing maximum luminance

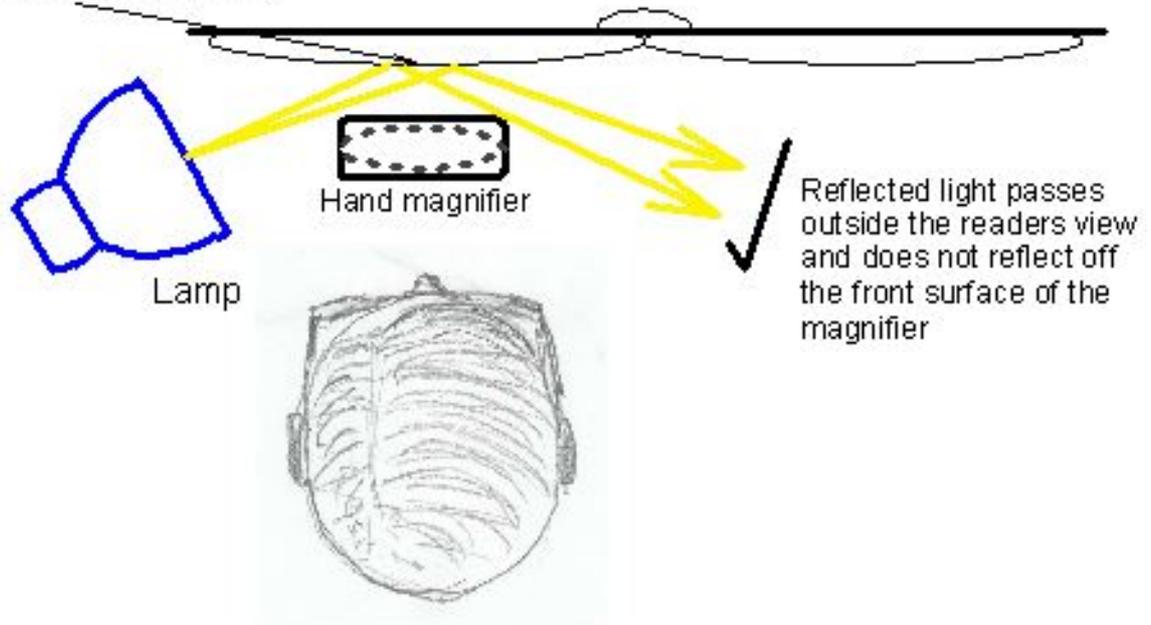


Diagram 2 – Lighting the page behind a magnifier.

Glare

Light striking the eye while looking at an object, reduces visibility. An example of direct glare is driving against oncoming headlights while concentrating on the road ahead.

The degree of reduction in visual performance is related to aging factors. As the lens in the eye gradually becomes cloudy, the transmission of light is reduced and some of it is scattered over the retina; this is the 'flare glare' problem - like the dirty windscreen when driving against the sun.

Enhancing Low Visual Performance

Functional vision may be enhanced for the visually impaired person by:

- increasing the image brightness [luminance]
- increasing contrast [black/white]
- enlarging the retinal image

Increasing the brightness of the image

As our hearing is reduced, we need more noise! Similarly visual function may be enhanced by stimulating the eye and optical system with a very bright image. Nobody can read in the dark, however the naturally aging eye needs more light to see as we get older. The lens of the eye gradually loses transparency. About twice the light is required by 50yrs of age, 3 times at 60yrs and maybe 10 times at 80Yrs. This is 'normal' - no pathology need be present.

Obviously it is wasteful cranking up the light levels 10 times brighter over the whole room. That why it is so important and efficient to consider task lighting as we get older.

Contrast

Contrast may be enhanced by photocopying or other electronic enhancement, or simply selecting media that is printed on good quality paper in black, bold font. Coloured/pastel print on poor quality paper such as newsprint should be avoided. Organisations providing services for the elderly including banks, Local Body Authorities and Government Departments, should be counseled to avoid funky information pamphlets and forms, cluttered with unnecessary graphics and information, with poor contrast and small font sizes.

Magnification

When the eye practitioner is looking at strategies to assist the person with Low Vision, they begin carefully refracting the eyes to focus the image on the retina with the appropriate optical correction, either in the form of spectacles or contact lenses. Even if the central vision is severely affected a clear image on the peripheral retina may be appreciated.

If there are areas of the retina that have **relative** or **absolute** loss that cannot resolve the image even if it is in focus, then functionality may be assisted by magnification. This may be achieved:

- directly with larger, bolder print,
- indirectly with optical magnification such as telescopic aids,
- electronic magnification, or
- focusing on the print at a close working distance.

Working Distance and Magnification

Focusing on print at a normal working distance [WD] at a desktop [say 50cm] or on the lap, is considered to be a magnification of 1X.

If the viewing distance is halved then the image at the retina is 2 times bigger - a magnification of 2X. Similarly at a 1/4 of the normal WD then the magnification is 4X

Focusing on print at 25cm requires a higher correction than for normal reading. The Low Vision practitioner may recommend one correction for eating, writing, etc, and a much closer focus for reading fine print.

The lens needed to focus at the close WD may be either in a spectacle frame so that the print is held very close to the face [and is more difficult to illuminate and hold steady] or the lens may be held in the hand as a 'magnifying glass' that restricts the visual field

For prolonged periods of reading it is convenient to have the hands free and not have to hold a magnifier. A bookstand enables the elderly with weaker arm muscles to maintain the print at a close working distance for long periods.

Illumination for Activities of Daily Living.

Illumination for key areas about the home should receive special attention. Particularly the kitchen bench or food preparation areas, stove dials, the bathroom mirror, the washing machine controls, etc.

Clusters of downlights or spots can be mounted on the ceiling and directed to key areas on the bench, sink, etc. Permanent wiring is not essential as long as the flex to the fitting is safely clipped out of harm's way.

A rechargeable torch is useful on the kitchen wall to illuminate the recesses of cupboards, drawers, etc.

A miniature tramper's torch can be carried in the handbag or pocket for illuminating hard to see labels while shopping.

Bearing in mind that macular degeneration results in a loss of cone function and hence colour vision, it is frequently helpful to not only move the TV set as close as necessary to be able to resolve some detail, but also the controls need to be adjusted for the viewer with low vision.

Accentuating the colour, brightness & contrast to the point where the normally sighted may consider the result to be hideous, however the effect may be to significantly enhance the visibility of the image.

Cautions Regarding Low Energy Lightbulbs

From a technical perspective the new energy efficiency CFL lamps are not an equal substitute for old style incandescent lights. For a start the performance of the lamp is entirely dependent upon how the light is diffused, reflected or radiated from its fitting. The elongated or coiled shape of a CFL may result in quite a different pattern of light being shed and where the lamps stick out beyond the rim of the shade they may cause annoying glare. They are also an unsuitable replacement for reflector lamps as without the reflector a CFL will direct only about 25% of the light into lighting the room!

CFL's are best suited to illuminating living spaces when installed in central pendant style fittings where the light can radiate sideways. They are not suitable as sources of task lighting unless used in a purpose designed fitting that captures and directs the light from the coiled of the CFL. The new energy efficient lights are also temperature dependent and optimal lighting will not be achieved until the lamp reaches a temperature above 30 degrees Celsius. This is why it takes a while for the light to get fully bright and in very cold climates at subzero temperatures, the lamp may not even start!

It is not a good idea to install a CFL in a corridor that only needs to be illuminated for the time it takes to walk it's length, as it will have reached only perhaps 20% of it's final brightness by the time it is switched off again. Similarly substituting a CFL for a GLS in a toilet or bathroom may not be very sensible. Older people and people with reduced vision must be particularly careful that they do not reduce safety in their homes due to decreased light levels and inferior lighting arising from use of low energy lighting.

(Source: P J Turner, 2008).