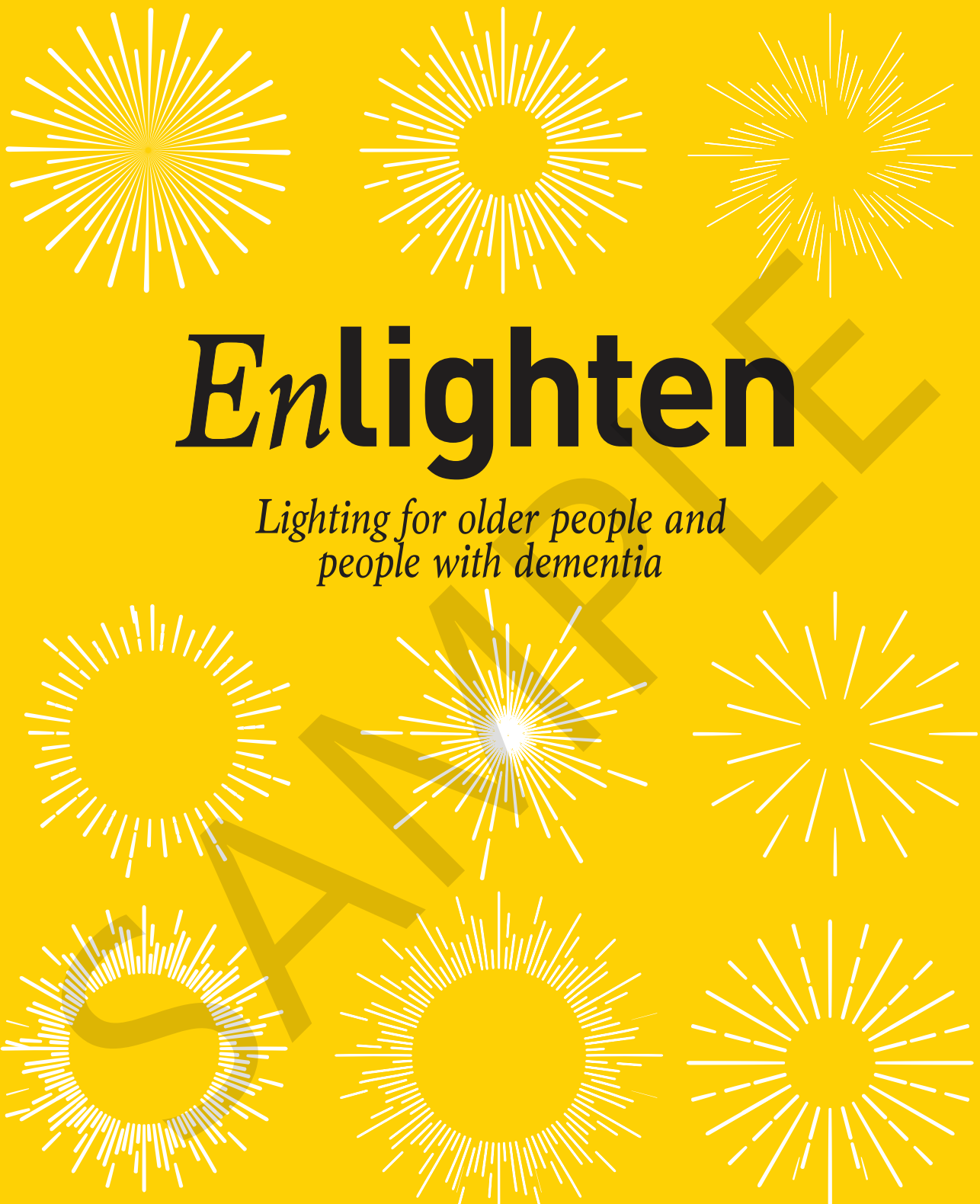




*En*lighten

*Lighting for older people and
people with dementia*

David McNair *and* Richard Pollock
with Colm Cunningham

DEMENTIA DESIGN ESSENTIALS

Published by HammondCare 2017

Sydney Australia
publishing@hammond.com.au
hammondcare.com.au dementiacentre.com

ISBN 978-0-9945461-7-3

© David McNair, Richard Pollock, Colm Cunningham. The moral rights of the authors have been asserted.
© HammondCare

Except as permitted under the Australian Copyright Act 1968, no part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without prior permission of the copyright owner and the publisher of the book.

Cover and internal design: Melissa Summers of sd creative
Printing: The SOS Print + Media Group (Aust) Pty Ltd



A catalogue record for this book is available from the National Library of Australia

Dementia care knowledge and research is continually changing and as new understanding develops, so to does the support provided for people with dementia. All care has been taken by the authors and publishers, as far as possible at time of publication, to ensure information is accurate and up-to-date. The information in this book is not intended to be used to diagnose, treat, cure or prevent any disease, nor should it be used for therapeutic purposes or as a substitute for your own health professional's advice. The authors do not accept liability for any injury, loss or damage incurred by use of or reliance on the information contained in this book.

HammondCare's Dementia Centre is committed to providing excellence in dementia care. Older and younger people living with dementia deserve services that are designed and delivered based on evidence and practice-based knowledge of what works. This is achieved through providing research, training and education, publications and information, consultancy and conferences. Thank you to everyone who supported the publication of *Enlighten: Lighting for older people and people with dementia*.

The authors and publishers welcome feedback on this book and the topic of light and lighting design in the care of older people and people with dementia. Please contact us at hammondcaremedia@hammond.com.au

Enlighten is published in association with the Institution of Lighting Professionals (ILP). With members worldwide, the Institution is the UK and Ireland's largest and most influential professional lighting association, dedicated solely to excellence in lighting. The key purpose of the ILP is to promote excellence in all forms of lighting. The Institution is a registered charity and a licensed body of the UK Engineering Council.

CONTENTS



Foreword	5
Introduction: dementia, ageing and light	7
01 How people see	13
02 Light, health and falls	21
03 Light and circadian rhythms	25
04 Benefits of vitamin D	31
05 Supporting general wellbeing	37
06 Natural light and lighting design basics	43
07 Dementia-inclusive lighting	49
08 Designing for daylight	55
09 Practical advice for getting light right	61
10 Light level targets	75
11 Key summary and appendices	87
Appendix 1: Circadian entrainment for night shift workers	90
Appendix 2: More about vitamin D	93
Appendix 3: UV index	95
Appendix 4: Contrast and colour	97
Appendix 5: Additional LED information	99
Appendix 6: Building codes and regulations	100
Appendix 7: Frequently asked questions	103
Glossary	106
References	109
Further reading	120
Acknowledgements	121
About the authors	122



‘After food, lighting is the most important environmental input in controlling bodily function.’²⁴



FOREWORD



The field of lighting is rapidly changing as new technologies are developed and refined, and more is discovered about the impact of light on the biology of the human body. As knowledge advances, it's important we apply it practically to care homes and spaces for older people and people with dementia.

This book, which is a substantial update to *Light and lighting design for people with dementia*,¹ is primarily directed to people in the field of dementia, whether in aged-care services or home domestic environments. It is written for architects, electrical engineers, building code consultants, care staff and operators of buildings used by people with dementia in Australia, New Zealand and the UK. It has also been written to inform people with dementia, their carers and family.

While the recommendations can be applied more widely, regulations, cultures and traditions vary with each country. These differences need to be carefully considered when applying lighting recommendations to your care setting. Decisions made in the course of designing or modifying a building have major and long-term impact on the access to light people with dementia receive. Many of the issues raised and recommendations made apply to older people in general.

The reader should keep in mind that every person with dementia is different. While they might all have dementia—each person experiences different challenges, triggers and pleasures. There are also differences in age, degree of dementia, cultural background and routines and interests. Please keep these individual variations in mind when reading through this book.

Professor Mary Marshall OBE

01

HOW PEOPLE SEE



Light and vision

Before we examine the nature of the ageing eye, we will first explore the specific relationship between lighting and vision. An incredibly complex process—light not only facilitates vision, it enables the brain to make sense of the surrounding environment.

For a person to see, there has firstly to be a light source, and light from it has to reach an object. Light reflected from the object has to reach the eye. Then the eye sends signals to the brain and the brain processes these signals to form a picture.

The important things to consider are as follows.

Light source:

- The output power i.e. the luminous flux (measured in lumens).
- The distance to the surfaces being viewed affects the level of light. The further away the object or surface is, the lower the impact of the light.
- The range of output wavelengths (colours) impacts the viewing of surfaces. A good spread of colours helps improve the scene by allowing easier differentiation of objects and making the overall space more interesting.

Objects:

- Their reflective properties: dark (low reflection) or light (high reflection), shiny (specular reflection) or matt (diffuse reflection).
- The angle at which light hits the surfaces, this affects reflection.
- Contrast between surfaces. If there is insufficient contrast between

adjacent surfaces a person can have difficulty detecting them.

The eye:

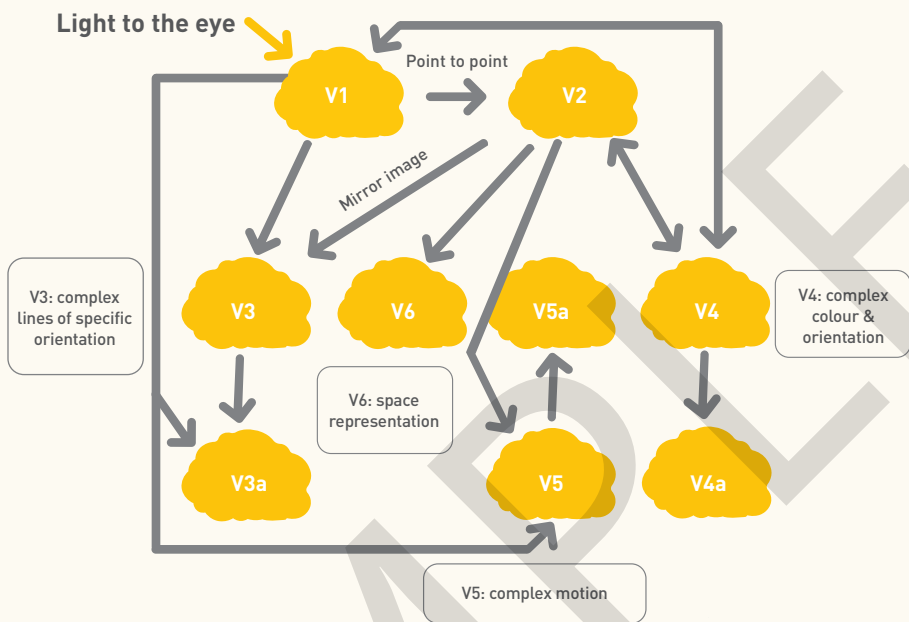
- The position of the observer is sometimes important depending on the properties of the surface.
- The eye has at least five detectors that convert light to electrical signals that are sent to the brain. Different detectors have varying sensitivity to different wavelengths of light.
- The age of the observer is important, as older people need much more light to achieve the same visual performance of the younger.

The brain:

- There are at least six different areas of the visual cortex that communicate with each other to form a visual construct (a picture of the scene being viewed).
- Without good signals from the eye it is more difficult to form a visual construct.
- Many people with dementia have increased difficulty forming a visual construct as the communications in the brain are less efficient—their interpretation may be different to that of others. Good tonal contrast is essential for most older people. On the other hand some contrasts can be misinterpreted, making it impossible to accurately interpret some patterns.⁹

This visual process may not only be affected by dementia but also the ageing eye. Understanding how the eye works and how it ages is vital to carers, designers and architects of care homes as the environment can help

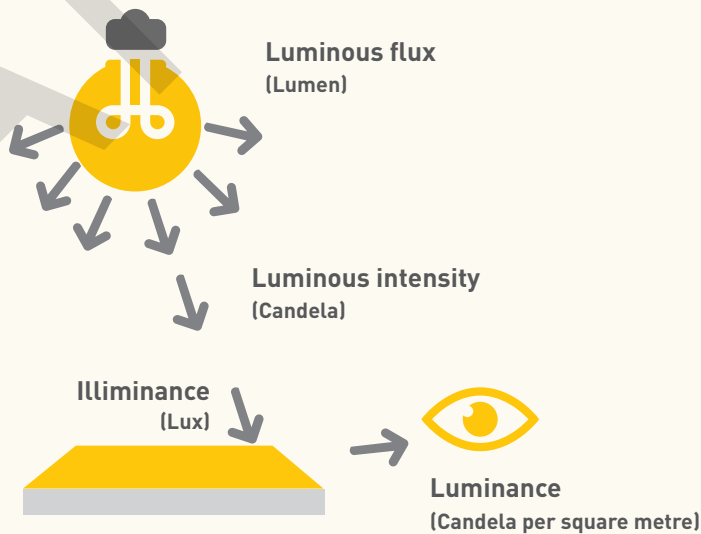
Figure 1.1 Simplified human visual cortical connections



How our brains construct a picture of the scene being viewed

Diagram adapted from Zeki.¹⁰

Figure 1.2 Lighting terminology



02

LIGHT, HEALTH AND FALLS



Why light matters to health

It is important to understand that many researchers now believe that light is similar to a drug because its effects can be considered in a dose-related manner. Whether or not you agree with this concept, it is indisputable that exposure to light triggers various mechanisms within the body, many of which have beneficial effects. Proven benefits of exposure to lighting include:

- better sleep
- reduction in falls
- improved resistance to disease.

This exposure can be to artificial light or daylight, which is a combination of skylight (light diffused and reflected by the sky) and sunlight (light directly from the sun).

It is also important to remember that overexposure to sunlight can have serious adverse consequences—skin cancer.

The sections that follow explain the health benefits of light in more detail and provide recommendations for implementing and incorporating light into models of care. Topics include light and its relationship to falls, circadian rhythms, vitamin D, and general wellbeing. The information can be applied to the general population, and in particular, older people.

Falls and older people

More than 80% of injury-related hospital admissions of Australians aged over 65 are due to falls.²¹ Of these falls leading to hospitalisation, 26% occurred in a care home for the aged. Women accounted for 68% of the falls, with injuries predominantly to shoulders, upper limbs, hips and lower limbs.²² This pattern is repeated across the world. In addition, 60% of aged-care residents fall every year, half of whom fall repeatedly.²³

In England and Wales, falls are the largest cause of emergency hospital admissions for older people and in 2014, some ten people died from the effects of a fall **every day**.²⁴

Risk factors

In most cases, falls are due to:

- human factors e.g. age, vision, mobility, strength, health and medication
- environmental factors e.g. changes in level, uneven or slippery surfaces, poorly fitting shoes, surfaces liable to misinterpretation.

‘...it is indisputable that exposure to light triggers various mechanisms within the body, many of which have beneficial effects.’

06

NATURAL LIGHT AND LIGHTING DESIGN BASICS



Good daylight penetration but beware of confusing shadows.

So far in *Enlighten*, we have explored the proven benefits of incorporating both natural and artificial light into the care of older people and people with dementia.

The next part of the book will focus on practically applying this knowledge to your care home (or other setting) and making changes to create a space which is more enabling and inclusive for older people and people with dementia.

Before we move on, let's look at some of the fundamentals of giving older people and people with dementia access to natural light and the related health benefits. And then we'll provide a crash-course in lighting basics for readers without a technical background.

‘Going outside to be exposed to daylight and controlled periods of sunlight is beneficial to people’s health and wellbeing.’

Access to natural light

Going outdoors

Going outside to be exposed to daylight and controlled periods of sunlight is beneficial to people’s health and wellbeing. When this exposure to light is combined with outdoor activities and a little exercise, the benefits are even greater.

As a consequence, buildings should be designed to provide easy access to a secure outdoor area where people can participate in activities or sit and enjoy the brighter light and fresher air, together with the different smells and sounds and pleasing contact with nature. For ground floors this is usually straightforward with doors opening into secure gardens or courtyards, possibly with a verandah. On upper floors more design effort is required, with terraces, balconies and roof gardens all possible.

Getting daylight indoors

Good daylight penetration into living rooms and dining rooms will allow people sitting near windows to be exposed to light levels sufficiently high to entrain their circadian rhythms and reduce the incidence of seasonal affective disorder. As explored in Chapter 3, lighting has an important influence on healthy sleeping patterns. With this in mind, bedrooms should be dark overnight so as not to disturb sleep and to help stabilise circadian rhythms.

In warmer climates, careful design of external shading devices will be needed to minimise heat issues by solar gain. In single storey buildings and on the top floor of others, skylight windows and light pipes will make a significant contribution to the lighting requirements for public rooms and corridors. In warmer climates,

DEMENTIA-INCLUSIVE LIGHTING



The primary features of dementia-inclusive lighting are:

- lighting at twice ‘normal’ levels
- exposing people to the 24-hour cycle of light and dark
- considering surfaces: reflection, contrast and perception
- using daylight wherever possible
- sufficient ‘domestic style’ fittings to help promote a recognition of place.

Alongside these, other lighting design considerations include:

- ensuring there is good uniformity and satisfactory light levels shed on walls and ceilings
- avoiding sudden changes in light level
- ensuring good colour rendition
- designing for low glare.

Primary features explained

Provide lighting at twice ‘normal’ levels

Lighting design standards are determined by firstly assessing the complexity of the visual task at hand and then deciding how much light is needed to facilitate effective viewing of it. Saturation occurs when additional illumination does not improve visual performance but increases energy use.

Consider, however, that the human visual system reaches optimum capability at a very early age and that light transmission through the eye deteriorates continually with life. Some writers cite the well-known work of Weale¹⁰¹— 60-year-olds require three times as much light as 20-year-olds. As authors, we entirely agree with this. However, lighting design standards are generally specified for people in the age range 45 to 50 years¹⁰² and most people with dementia are older than 75. Taking these age groups together it can be determined that a 75-year old requires twice as much light as a 45-year-old for equivalent visual performance.¹⁰³ This recommendation is based on age alone without allowance for the additional challenges presented to people living with dementia.

‘The use of local lighting at key task areas can make a significant contribution to achieving the necessary lighting levels.’
