Achieving visual contrast in built, transport, and information environments

everyone, everywhere, everyday

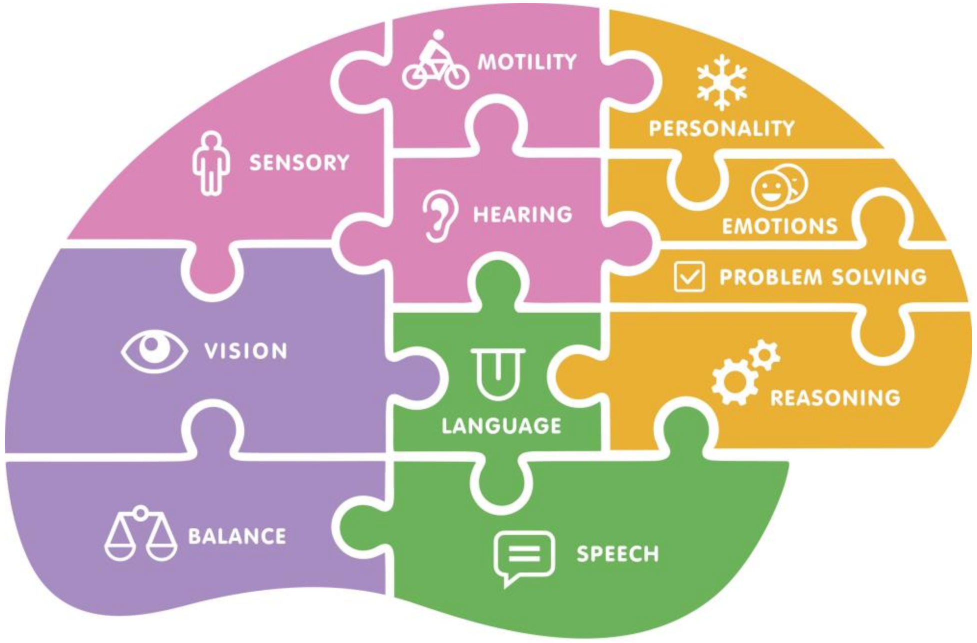
Dr Penny Galbraith

Outline

- Vision
- Luminance contrast
- Quick physics
- Research
- Application
- Questions

Vision - Dominant sense

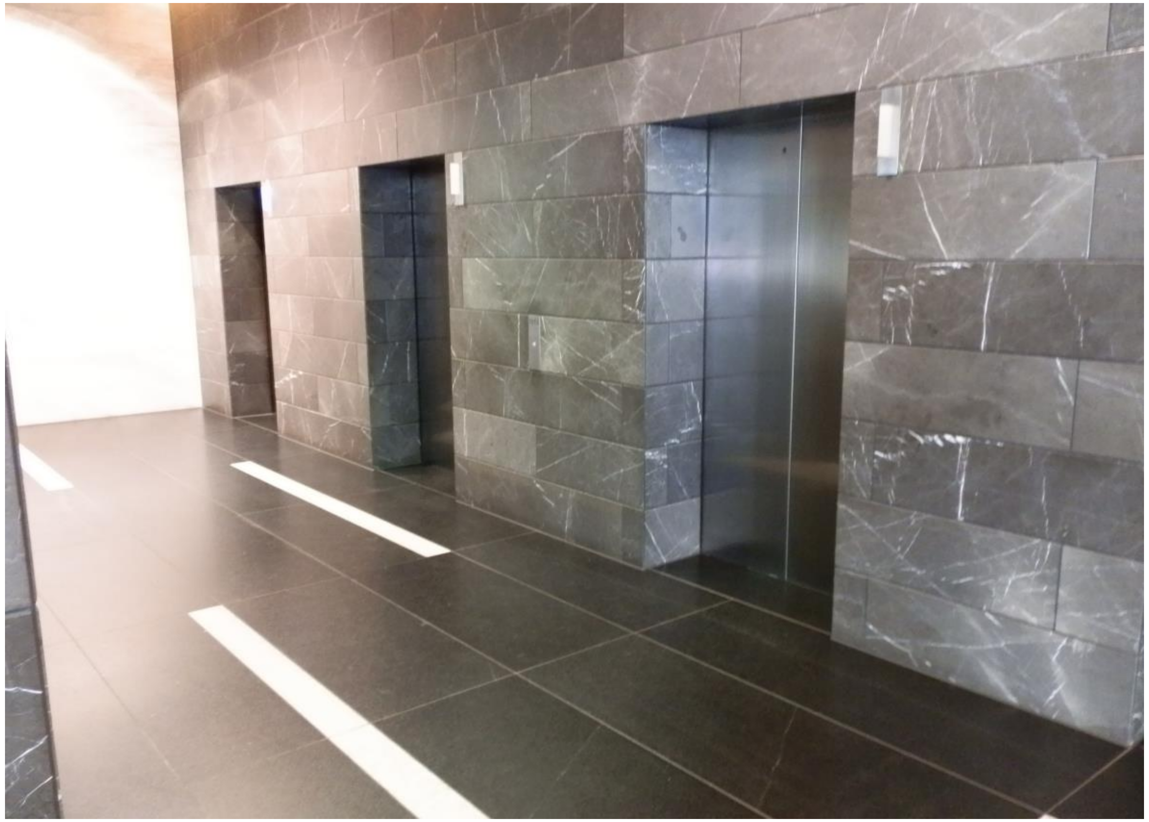
- process of deriving meaning from what is seen
- Half the human brain is devoted directly or indirectly to vision
- About 80% percent of our perception, learning, cognition, and activities are mediated through vision



Vision - Dominant sense

- Generates appropriate motor, and/or cognitive responses to the world around us
- Visual contrast sensitivity is a crucial part of this process
  - allowing detection of objects and
  - discriminating objects or details from their background.

Vision - Visual contrast



- Part of how people experience and interact with the world around them
- Poor visual contrast affects everyone, but especially people with a vision impairment, and older people
- Visual contrast - often referred to as luminance contrast

Luminance contrast (LC)

- Worldwide - recognised in standards and codes as the **most relevant measure of how a person visually perceives** their environment.
- Mainstream issue, crucial for
  - safety, amenity and accessibility.

https://news.bitcoin.com/countries-imf-global-standards-crypto-regulation/

But, is a tiny fraction of compliance requirements.
Assessed by:

- Measuring luminance reflectance values (LRV) of adjoining surfaces, and
- Calculating their contrast using a formula

Luminance contrast

Compliance standards

- Measurement - prescribed equipment

<u>Lab/site</u>
Colorimeter placed on a surface
Controlled light source

Konica Minolta – Precise Color

<u>Site</u>
Photometer on tripod
Ambient light conditions

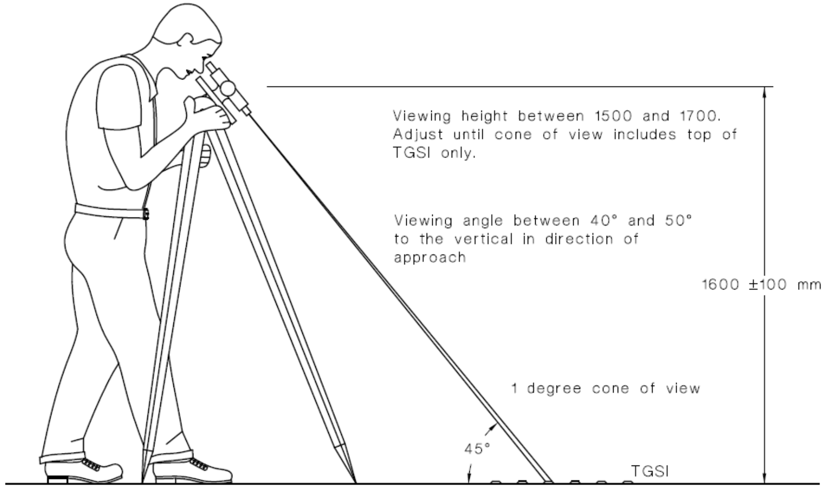


FIGURE E3(A) POSITION FOR MEASURING THE LUMINANCE OF THE TACTILE INDICATOR MEASURED BY THE LUMINANCE METER

From AS1428.4.1

Quick physics

Controlled light v ambient light

Colorimeter - measures ‘pure’ colour

- Not reflect ambient lighting, or
- how an environment is experienced by users.

Konica Minolta – Precise Color

Photometer – measures reflected light

- Are sensitive to surface conditions and ambient light,
- better reflect how users are experiencing the environment.
  - eg pools of light and dark, glare, effect of texture and reflectiveness of surfaces.

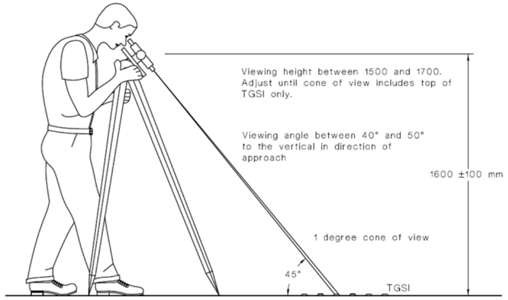
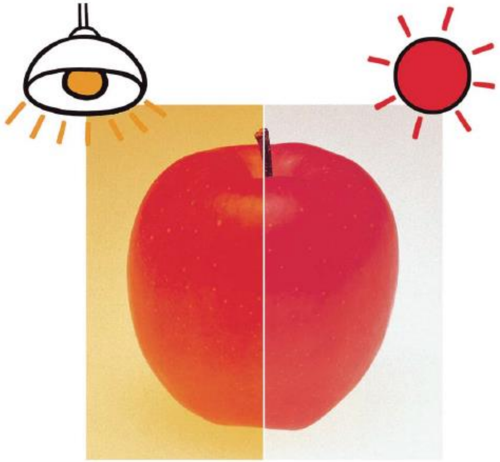


FIGURE E3(A) POSITION FOR MEASURING THE LUMINANCE OF THE TACTILE INDICATOR MEASURED BY THE LUMINANCE METER

From AS1428.4.1

Quick physics

- Perception of colour, light and contrast:
  - Light source
  - Shading
  - Texture
  - Wet and dry etc



Konica Minolta – Precise Color

Research

https://www.clipartkey.com/view/iihoJm_data-clipart-research-study-research-and-studies-png/

The problem

- Prescribed equipment
  - expensive $$$$ - barrier to use
  - bulky – photometer plus tripod
- As built LC not measured
  - A survey of access practitioners (n = 84) revealed 66% relied on ‘by eye’ judgement to determine luminance contrast compliance with the NCC.
- LC not achieved on site
  - Ambient conditions

Is there a better way? – more available and more accessible tools to support practitioners to achieve better outcomes?

Research

- Objective to provide a readily available tool that could
  - measure LRVs
  - representative of user experience
- Representative LRVs could then be used to calculate the luminance contrast experienced by users.
- Research hypothesis
  - based on the premise that a camera captures the scene, ‘as seen’.

Research

- Image analysis algorithms from print, web and photographic technology brought together and tested.
- With known lux and luminance values, the LRV results from each algorithm were compared against the LRV obtained using the ISO 21542 formula:

→ Best algorithm

- Interestingly:
  - Australian Standard AS 1428.4.1 clause E3.3(e)

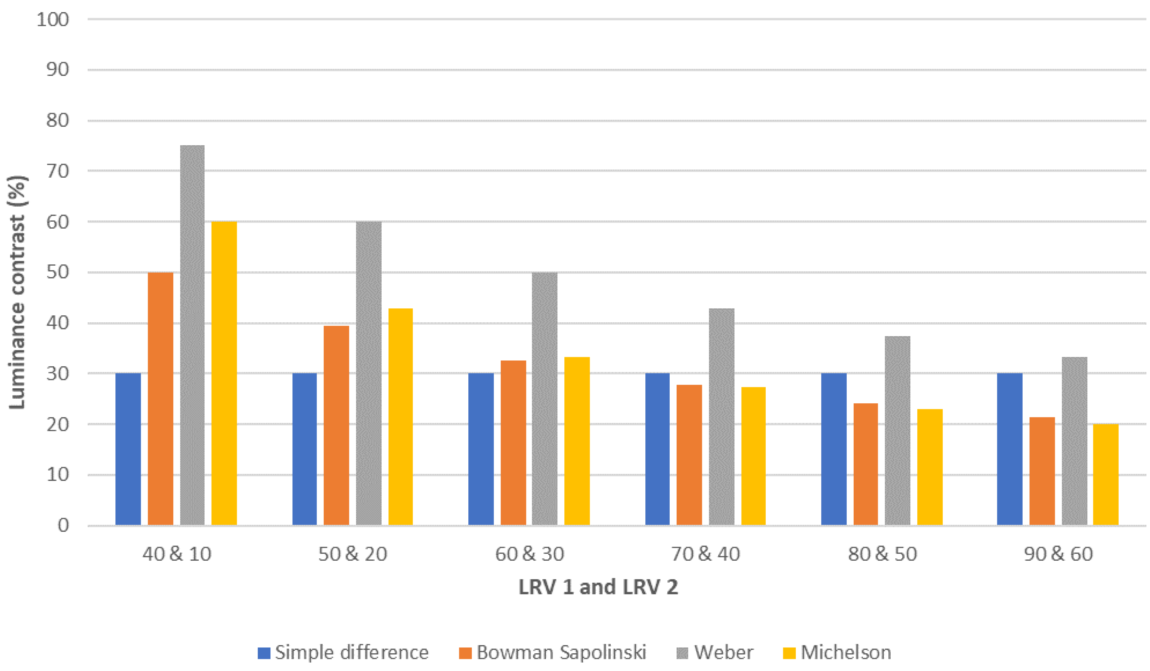
"A more accurate calculation [of LRV] might be based on the relative proportions of each colour (where these proportions might be determined by image analysis techniques)".

Research

LC Calculation methods

There are 4 main methods which provide very different answers! There is no consensus worldwide.

1. Simple difference
2. Bowman-Sapolinski
3. Proportional difference (Weber)
4. Michelson



Galbraith and Bowman paper at the IEA conference, Vancouver 2021 discusses a variety of issues, including the extent of research underpinning the development of standards and the need to reflect user experience

Application – Get Luminance

Free iOS and android App utilising:

- Verified image analysis algorithm
- 4 main calculation methods

Portable and affordable (free!) tool

Key benefits: Measuring LRV that reflects user experience including:

shadowing, glare, gloss and uneven surfaces.

Application – Get Luminance

- The research demonstrated how image analysis techniques can be used and incorporated into a smart phone App to provide portable, affordable on-site measurement tool that reflects user experience.
- However, further research is required to provide a consistent luminance contrast calculation to reflect human visual experience.
- Both are required to achieve safe and accessible outcomes in the built environment.

Universal design - everyone, everywhere, everyday

Questions

Please get in touch:

- Penny Galbraith
- penny@box50.com.au
- 0420 415202