Colour in the built environment: **Beyond aesthetics**

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Continuing Professional Development (CPD)

Learning objectives

1. Understand colour attributes and categories.

2. Understand the complexity of the interface between colour and human response and the factors that influence this interface.

3. Review the diverse origins of beliefs about colour, and distinguish evidence-based information from unsubstantiated claims.

4. Examine evidence-based information about colour.

5. Practical solutions for real problems in design and the built environment.

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Attributes of colour: Hue, Saturation and Tone

Most early colour theories and research studies focussed on hue only.

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Categories of colour

**Conventional colour** – Broad colour categories – ‘red’, ‘blue’, ‘green’.

**Substance colour** – Colour in the form of pigments and paints.

**Formula colour** – Pantone, Resene, NCS, car colours, etc.

**Spectral profile colour** – Colour in the form of light-waves.
Multiple theories of colour and colour models

- Newton, 1704
- Harris, 1766
- Chevreul, 1855
- Ostwald, 1916
- Hering, 1878
- Munsell, 1921
- Itten, 1961
- Albers, 1963
The interface between colour and human response

Colour

Individual differences such as age, gender
Cultural differences

Contextual factors
Perceptual factors
Temporal factors

Human perception & response

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The interface between colour and human response

**Colour**

- Individual differences such as age, gender
- Cultural differences
- Contextual factors
- Perceptual factors
- Temporal factors

**Human perception & response**

- **Cognitive responses** – Judgments, assessments and evaluations
- **Affective responses** – Mood, emotional reactions
- **Behavioral responses** – Actions, movements, way-finding

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Theories about colour – Diverse origins & influences

• Correspondences – Elements, Seasons, geometric shapes, colours

• Traditional and New Age beliefs

• 19th & 20th century pseudo-scientific theories and fallacies

• Theories from art and design – Van Gogh, Albers, Eliasson

• Colour symbolism

• Late 20th and early 21st century scientific research
**Correspondences**

**Invented patterns of connection**

Elements, planets, seasons, colours, shapes, etc.

Popular up to the Renaissance and beyond – Albers and the Bauhaus. Found in many theories about colour and colour psychology.

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<th>Autumn</th>
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<th>Octagon Octahedron</th>
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<th>Summer</th>
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Nicoletto Rosex, 16th century

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Traditional and New Age ideas and beliefs

The Chakras and colours – a Western invention?
Frequently mentioned: Health, well-being and interior design.

Colours not aligned with Chakras in original texts: Hindu Upanishads.

William Walker Atkinson
The Human Aura: Astral Colours & Thought Forms (1912)

John Woodroffe
The Serpent Power (1919)
Pseudonym – Arthur Avalon.

Charles W Leadbeater
The Chakras (1927)
Quoted Madame Blavatsky’s The Secret Doctrine, Woodroffe’s The Serpent Power and Atkinson’s The Human Aura.
19th - 20th Century  Pseudo-scientific theories about colour

Many of these theories were not evidence-based

Seth Pancoast – Blue and red light could cure ailments

Dinshah Ghadiali – Spectro-Chrome machine (jailed for fraud)

Edwin Babbitt – Chromo-Disk device (awarded himself Dr)

Goldstein and Gerard – studies lacked scientific methods

Faber Birren – successful colour consultant, widely quoted.
Theories about colour – Art and design

Vincent Van Gogh

Unique ideas about colour – may have had synaesthesia.

Josef Albers

Grouped colours and assigned them with specific meanings.
Interface between colour and human response – Highly complex

Comprehensive research review for NASA (Wise et al, 1988).

Evidence-based information for spacecraft interior design.

Lighter colours – makes interior feel more open and less small.
Interface between colour and human response – Highly complex

Comprehensive research review for NASA (Wise et al, 1988).

No hard-wired linkages between colour and human response.

Personal beliefs about colour/colour symbolism play a role:
“one makes certain associations to colours and these in turn may mediate physiological response.”

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**Colour Symbolism**

Influences the way in which colour is used in applied design and the built environment

**Colour Symbolism – Three distinct levels**

**Individual** – varies considerably and highly personal.

**Cultural** – learned colour symbolism, cultural conditioning.

**Universal** – few examples of colour symbolism on this level.

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Colour Symbolism

Culturally-based colour symbolism – highly variable

10 Cultural groups (Rings)

84 Colour meanings (Spokes)

(McCandless, 2010)
Colour Symbolism

Culturally-based colour symbolism – highly variable


<table>
<thead>
<tr>
<th>Colour</th>
<th>Anglo-Saxon</th>
<th>Germanic</th>
<th>Nordic</th>
<th>Slavic</th>
<th>Chinese</th>
<th>Japanese</th>
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<tr>
<td>White</td>
<td>Purity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Death Mourning</td>
<td>Death Mourning</td>
<td>Death Mourning</td>
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<td>Fear, Anger Grief</td>
<td>-</td>
<td>Fear Anger</td>
<td>Expensive Powerful</td>
<td>Expensive Powerful</td>
<td>Expensive, Powerful</td>
<td>-</td>
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<td>High quality, Corporate Masculine</td>
<td>Warm Feminine</td>
<td>Cold, Masculine</td>
<td>-</td>
<td>High quality Trustworthy</td>
<td>High quality Trustworthy</td>
<td>High quality, Trustworthy</td>
<td>Cold, Evil</td>
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<td>Happy Jealousy</td>
<td>Envy Jealousy</td>
<td>-</td>
<td>Envy</td>
<td>Pure Good taste</td>
<td>Envy Good taste</td>
<td>Happiness, Good Taste</td>
<td>-</td>
</tr>
<tr>
<td>Green</td>
<td>Envy, Good taste Enviro pure</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Pure Reliable</td>
<td>Love Happy</td>
<td>Pure, Adventure</td>
<td>Danger, Disease</td>
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<td>Purple</td>
<td>Authority/Power (Church hierarchy)</td>
<td>-</td>
<td>-</td>
<td>Anger, Envy Jealousy</td>
<td>Expensive Love</td>
<td>Expensive Powerful</td>
<td>Expensive, Love</td>
<td>-</td>
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Colour Symbolism – Highly context dependent

Red - a range of different connotations

Anger, aggression, danger, violence, pain and death

Revolutionary ideology, Communism, Socialism
Colour Symbolism – Highly context dependent

Red - a range of different connotations

Love, romance, virility, passion

Winning, confidence, competitive advantage
Evidence-based information about colour

Fixational Reflex

Saccades – 2-3 eye scanning movements per second.

What attracts the attention of saccades?

– Movement

– Noticeable contrast - tonal value, saturation and hue (Boynton, 1979; McPeek et al, 1999; Shang & Bishop, 2000).
The Isolation Effect – applied design and the built environment

Strong colour & light/dark contrast draws attention to key details

- ‘Call to Action’ tabs in web design
- Product controls
- Fire exits, signage
Red – ‘Attentional advantage’

Visual search times are faster for red than other colours, dependent on contextual colour (Elliot, 2015).

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Red draws attention in a film poster, hotel interior and Washington DC underground station.

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Red/warm colours – Attract attention and encourage ingress

Retail and restaurant interiors

Red attracts attention.

Red/Warm colours draw people further into a retail interior (Bellizzi, Crowley & Hasty, 1983).
Red – Acts like an aphrodisiac for men

Red leads men to view women as more attractive and desirable.

Red as important as the waist-hips ratio and facial symmetry from a male perspective (Elliot & Niesta, 2008).
Red – Associated with winning and dominance

Red is consistently associated with a higher probability of winning in sport (Hill & Barton, 2005).

Viewing red on others tends to increase appraisals of dominance (Elliot, 2015).
Colour saturation and tonal value have a strong impact

Saturation and tonal value determine whether a colour is perceived as exciting or calming (Mikellides, 2009).

Saturation and tonal value often more important than hue.

Colour saturation and tonal value have an impact

**Video:** Why do some colours make you feel emotions (2:50mins) Morgridge Institute for Research and Wisconsin State Journal. [https://youtu.be/W9cNhXNvS50](https://youtu.be/W9cNhXNvS50)

**Saturation – Correlated with Arousal and Dominance**

LinkedIn offices, NYC by 1A Interior Architects (2015).

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Colour saturation and tonal value have an impact

Variations of Light-Dark contrast → variations in ambience

Light-dark/Brightness – correlated with Pleasure and Arousal

Estancia Resort, Philippines and Bulgari Hotel, London.

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Colour saturation and tonal value have an impact

Light-dark contrast – a major contributor to ambience

Tadao Ando (b. 1941) – highly effective use of light-dark contrast

Lighting and paint colour can achieve similar effects.

Lighting impacts colour perception

The dress viral phenomenon, February 2015.

Dress was in shadow and we had to make a cognitive adjustment – leading to individual differences (Conway, 2015).

Larks
• More often awake in daylight hours
• See the dress as though it is in daylight shadow
• White/Gold

Owls
• More experience of artificial lighting
• “Correct” their visual perception accordingly
• Blue/Black
Lighting impacts colour perception

Colours appear ‘warmer’ under halogen/incandescent lights and ‘cooler under fluorescent lights.

Human colour perception may also change according to the Seasons (Welbourne, 2015).

Are the chairs yellow or orange?
Lighting impacts colour perception and ambience

Lighting

Too bright or too dark lighting has a negative impact on ambience and perception/evaluation of colour (Kuller et al, 2006).

Suburban restaurants, Sydney.
Creating calm – Address the problem of visual noise

Excessive use of contrast and visual clutter → visual complexity
(Baldassi, Megna & Burr, 2006; Yamani & McCarley, 2011).

Saccades constantly being drawn to competing elements.

Potential for visual discomfort → cognitive dissonance.

Hôtel Belles Rives, Juan-les-Pins and interior by Brani & Desi
Creating calm – Address the problem of visual noise

Creating a sense of calm – Reduce the amount of strong contrast – leads to a sense of tranquillity irrespective of hue.

‘Cocooning’ – creating a homelike interior with client-preferred colours plus minimal contrasts and minimal patterning.

Kitchen, Sydney and Hilton Hôtel Nicosia Cyprus.

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Creating calm – Address the problem of visual noise

To create a ‘calm’ interior

Use colours that the **client** considers ‘calming’.

Reduce the number of contrasts – tonal value and saturation.

Use similarity of tonal value – not necessarily neutral colours.

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Creating calm – Address the problem of visual noise

Juniperina Juvenile Justice Centre, Lidcombe

Brief – Create a calm, ‘homely’ ambience; differentiate between interior spaces; reduce institutionalised character.

Range of different hues in similar, light tones; bolder colours introduced later through soft furnishings, posters and signage.
Moderate polychromy – Supports mood and well-being

Office colour impacts mood and productivity but can vary due to individual differences (Kwallek, Woodson, Lewis & Sales, 1997).

–Stimulus screening ability, preferences.

Red may be associated with anxiety and blue with depression (Kuller, Mikellides & Janssens, 2009).

Bland interiors that prefer to remain anonymous.
Moderate polychromy – Supports mood and well-being

Moderately colourful interiors support positive mood and sense of well-being (Kuller, Mikellides & Janssens (2009).

Performance increases with physiological/mental arousal but decreases when arousal levels become too high (Kwallek et al, 1997).

Colour strategies to attract/keep quality employees

Key issue – attracting and keeping quality employees/Millennials.

- By 2025, 75% of workforce will be Millennials
- Born between mid 1980s and 2005

Preferred workplace-design: Hybrid of work and play

- Cool, fun, flexible and campus-like.

Colour strategies to support/encourage Creativity

1) A mix of moderately colourful spaces to support mood and encourage well-being.

2) ‘Blank canvas’ spaces + window views for visual respite.

3) Minimise visual clutter and unnecessary visual distractions.

Moo’s London offices by Trifle Creative (2014) and Microsoft office by Perkins + Will (2014)
Colour – ‘Humanises’ and encourages engagement


Aims: Minimise the tension between visitors and the ‘serious’ museum; create “happy buildings...that people react to”.

Colour-coded external functional elements.

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Colour – ‘Humanises’ and encourages engagement


Internal/external colour-coding indicates different interior spaces.

Aim: To create an accessible and safe place for children to play.
Colour – ‘Humanises’ and encourages engagement

Supergraphics

Transform perceptions of the built environment.

Encourages engagement.


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Colour – ‘Humanises’ and encourages engagement

Supergraphics

Supports ‘social engineering’ in educational institutions.

Motivational slogans can support teaching policies.

Achievement First Endeavour Middle School (2010), Brooklyn by Paula Scher, Pentagram.
Disruptive Colour – Visual escape and diversion

Disrupts the predictable status quo.

Enhances experience and adds novelty value.

Re-imagines: Design/architectural archetypes.

A nightclub? Office? Apartment building?

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Disruptive Colour – Visual escape and diversion

Disrupts the predictable status quo.

Enhances experience and adds novelty value.

Re-imagines: Design/architectural archetypes.

Disruptive Colour – Visual escape and diversion


Decrease in aggressive behaviour in holding cell (Schauss, 1979).

Decline in aggressive behaviour may have been an artefact of the colour intervention (Pellegrini, Schauss & Miller, 1981).

Baker-Miller Pink
255-145-175

Disruptive Colour – Visual escape and diversion

Temporary installation *Asylum* by Hot Tea/Eric Rieger (2015).

Vivid paint colour completely transformed a public pool in NYC; private commission by K&CO and Pliskin Architecture.

Paint colour completely transforms the site.
Disruptive Colour – Visual escape and diversion

Project Monsoon (2015)

Annual monsoon drains Seoul of its energy and vitality.

Water-activated hydro-chromic paint changes when it rains.

Water-activated paint adds colour and vibrancy.
Colour – Orientation and Wayfinding

Colour is an effective non-verbal mnemonic device for orientation and way-finding at a range of different scales (Lynch, 1960).

Parking stations and shopping malls.

Colour-coding in parking stations.
Colour – Orientation and Wayfinding

Colour is an effective non-verbal mnemonic device for orientation and way-finding at a range of different scales (Lynch, 1960).

Coloured pathways – retail and transportation

Narita Airport Wayfinding System by Nikken Sekkei
Colour – Orientation and Wayfinding

Coloured façade flows through into the interior.

Colour breaks down the monumentality of the façade and serves to delineate spaces within.


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Colour – Behaviour modification in commercial interiors

Active, collaborative areas – A range of mid level saturated colours to indicate work teams, social areas, meeting rooms.

Quiet /contemplation areas - Less saturated colours with minimal hue and light-dark contrasts to create a sense of calm.

Colour – Behaviour modification in commercial interiors

Pathways and lift lobbies - Standard hue to improve orientation and way-finding across different levels.

Colour identifies lift lobbies and end walls.
Colour and light: Encourages engagement and improves perceptions of safety


Glowing stones charge during the day and glow at night – encourages engagement and improves perceptions of safety.
Colour and light: Encourages engagement and improves perceptions of safety

Kings Cross Designing-Out Crime (UTS) project.
Coloured light projections in laneways behind Kings Cross area.

Alternatively – Fluorescent paint or graffiti-resistant paint.
Colour – Influences perceptions of size

Similarity between facade colour and contextual colour can minimise the visual impact of a building (O’Connor, 2011).

Effective paint colour strategy to reduce the ‘eyesore’ factor.

Waste Recycling Centre, Belrose
Colour – Influences perceptions of size

Research supports anecdotal evidence in the fashion industry – darker clothing creates the impression of a smaller silhouette.

Variations in perceptions of silhouette size.
Colour – Influences perceptions of size

Lighter tones:

– Lighter colours tend to visually enlarge an interior space (Simon & Toups, 2014, NASA report).
– Ceiling will appear marginally higher.
– Paint colour will appear lighter in a well-lit room.
Colour – Influences perceptions of size

Darker tones:

– Room will appear marginally smaller and cosier.
– Ceiling will appear marginally lower.
– Corners seem to disappear.
– May impact negatively on legibility of interior details.
Colour: Inherent vs. Perceived colour


- Changes in ambient lighting.
- Variations in surface quality.
- Influence of contextual colour (simultaneous contrast).
Colour: Children’s hospitals and facilities

Children’s colour preferences – influenced by prevailing trends in film, television and children’s toys.

Bring new trends to life with updated paint colours.

Edinburgh Children’s Hospital, Texas and Toronto Children’s Hospital.

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**Colour: Children’s hospitals and facilities**

*Children’s colour preferences* – influenced by prevailing trends in film, television and children’s toys.

Bring new trends to life with updated paint colours.

USCF Benioff Children’s Hospital, Oakland CA.
Colour: Children’s day care centres

Colour – Effective non-verbal Orientation and Wayfinding device

Colour-coded hubs for children’s activity, dining, and sleeping areas and staff area.

Childcare centre in Denmark by CEBRA.

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Colour: Children’s day care centres

Colour – Effective non-verbal Orientation and Wayfinding device

**Play areas** - Saturated contrasting colours to ignite imagination.

**Dining areas** - Neutral colours and minimal contrasts to minimise excitement and agitation.

**Reading areas** - Darker colours to distinguish from play areas and encourage quiet.

**Sleeping areas** - Minimise hue and saturation contrast to minimise visual ‘noise’ and encourage a sense of calmness.

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Colour in healthcare environments

Lack of reliable, evidence-based information

Comprehensive review on colour in healthcare settings:

— Evidence is “conflicting, anecdotal and loosely-tested” (Schwartz & Tofle, 2005).
Colour in healthcare environments

Influence of stimulus-screening ability

Investigation into colour in healthcare environments (Dijkstra, Pieterse, & Pruyn 2008).

Stress-reducing effects of green and arousal-inducing effects of orange in healthcare environments:

– More pronounced for people with low stimulus screening ability than for those who are able to effectively screen out complexity in the environment.

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Colour in healthcare environments

All-white and green colours – negative connotations

*Sterile, stark, clinical and lifeless.*

*Barren, cold and inhospitable.*

White functionality:

“Things should be seen to be clean” Florence Nightingale.

Bland interiors that prefer to remain anonymous.
Colour in healthcare environments

‘Homelike’ colours – can help to minimise anxiety.

Children prefer bright, more saturated colours (Cohen & Trostle, 1990).

Older people prefer more marginally saturated colours and stronger contrast (Leibrock, 2004).

Colour ‘humanises’ and encourages engagement.
Colour and contrast – Older people and aged care environments

Visual perception declines from middle age onwards.

Strong colour contrast – improves environmental legibility.

Colour ‘humanises’ and encourages engagement.

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People with Dementia and Alzheimer’s disease can experience difficulties with spatial awareness:

- Difficulty judging distances; identifying an object from its background; finding light-switches, toilet/bathroom floor.
Colour and contrast – Older people and aged care environments

Strong colour contrast (70%+)

• Between steps and risers, and leading edge of step;

• Contours and boundaries - walls from floors; doors from walls; windows from walls; railings from walls.

• Light switches and walls, toilet and bathroom floor.

Strong contrast supports legibility
Colour and contrast – Older people and aged care environments

**Signage**

- **Sans serif fonts** – Strong, thick strokes.
- Less than 10 words – Quickly and easily read.
- Icon representations – an effective non-verbal alternative.

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<thead>
<tr>
<th>Serif typefaces</th>
<th>Sans serif typefaces</th>
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<td><strong>Highly recommended</strong></td>
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Colour and contrast – Older people and aged care environments

**Signage**

- Typeface size

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<th>Letter Height (Poor vision)</th>
<th>Normal reader Viewing distance</th>
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<td>22-24cm</td>
<td>4m</td>
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</table>
Colour and contrast – Older people and aged care environments

**Signage**


![Colour contrast chart](image)
Façade Colour – Creates a sense of Place

Planning Policy and Façade colours

• Terms like ‘Harmonious’, ‘Sympathetic’, ‘Compatible’
  – Not defined.
  – Definitions vary considerably (O’Connor, 2009).
  – Colour Similarity ≠ Harmonious Colours.

• Research indicates people prefer some level of contrast (O’Connor, 2004, 2008).
Selected References


Selected References


Zena O'Connor, PhD
Thank you – Questions, Comments

*Beauty Remains* – Photographs of Lithuanian garage doors by Agne Gintalaite, 2015

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Dr Zena O’Connor

An independent research consultant, Zena holds a PhD from the University of Sydney, a Master’s Degree in Design (University of Technology, Sydney) and a Bachelor’s Degree (University of Technology, Sydney).

Zena delivers evidence-based insight and research reports and seminars relating to environment-behavior interactions and in particular colour in the built environment, colour psychology, colour in logo design and branding, visual literacy and colour mapping studies. Zena’s clients include a wide range of organisations in the commercial, government and academic sectors.

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