

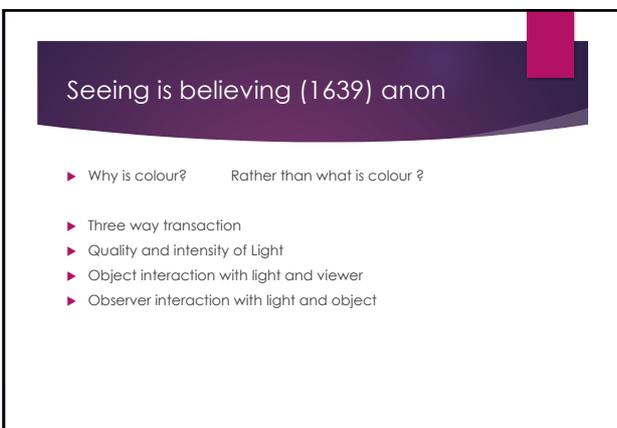


Colour communication
RICHARD TAYLOR



Objectives

- Everybody connected ?
- What do you see? Survey
- Research results
- The background what is colour? How do we communicate colour?
- The colour systems we looked at
- Reasons and analysis



Seeing is believing (1639) anon

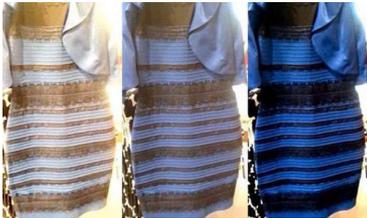
- ▶ Why is colour? Rather than what is colour ?
- ▶ Three way transaction
- ▶ Quality and intensity of Light
- ▶ Object interaction with light and viewer
- ▶ Observer interaction with light and object

Are you colour Blind?

- 1. Yes
- 2. No
- 3. Don't Know
- 4. Not sure

POLL OPEN

What colour is that dress?



POLL OPEN

What colour is this?

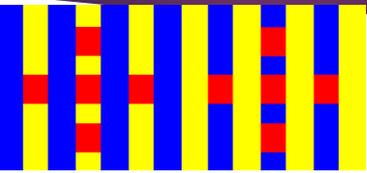
- 1. red
- 2. blue
- 3. green
- 4. pink
- 5. Don't know



POLL OPEN

10

Do you see the colour of the 5 red blocks on the left identical in colour to the 5 red blocks on the right ?



1. Yes
2. No
3. Don't Know

POLL OPEN

What colour is this?



1. Green
2. yellow
3. blue
4. brown

POLL OPEN

What colour is this?

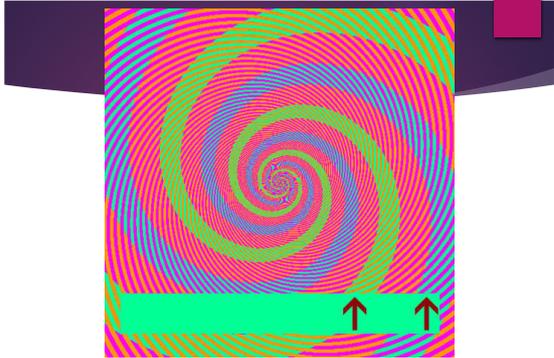


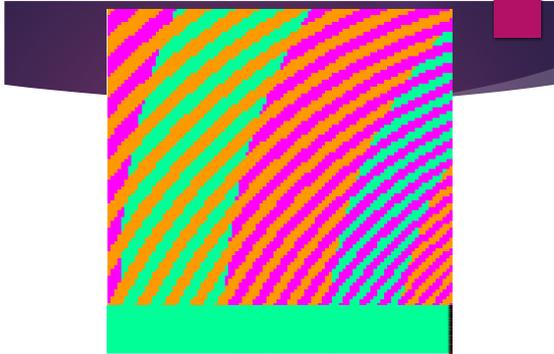
1. Red
2. Orange
3. Brown
4. Green
5. Terracotta
6. Umber
7. Carnelian/ carnelian

POLL OPEN

Can you see a blue and green spiral between the pink spirals?





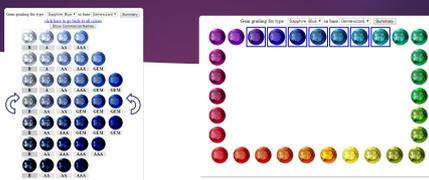


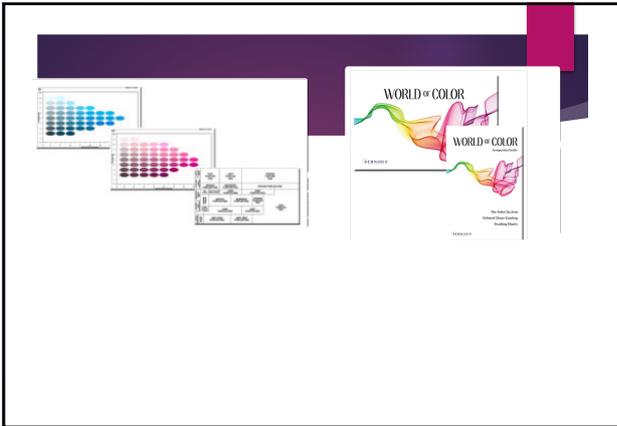
Colour communication applications

- ▶ Printing
- ▶ Film and imaging
- ▶ Car paints
- ▶ Textiles and fabrics
- ▶ Car finishes
- ▶ Wallpaper
- ▶ Tiles
- ▶ Gemstones?

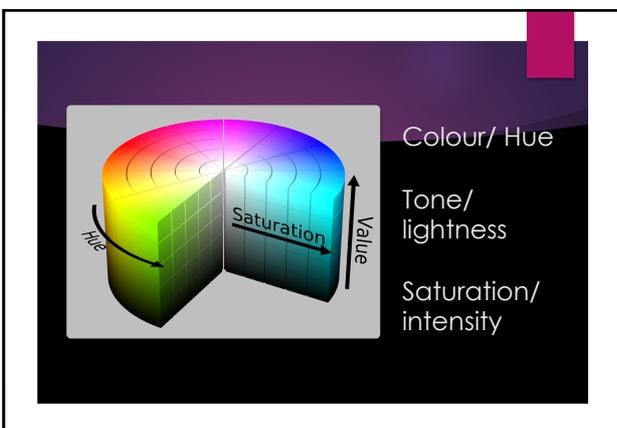
The objectives of gemstone colour communication

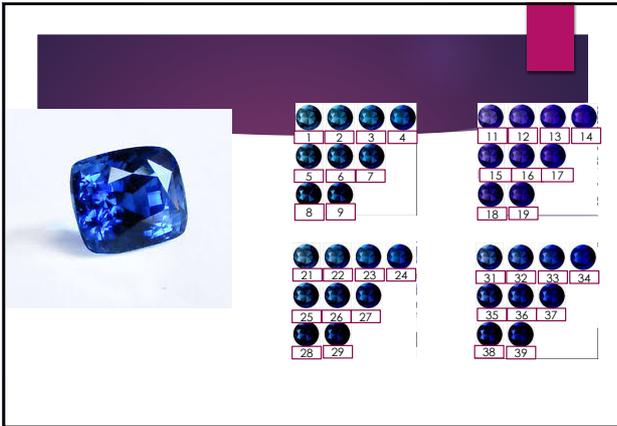
- ▶ Identifies a colour or concise range of similar colours that has good agreement between different viewers
- ▶ Reproducible
- ▶ Reliable
- ▶ Consistent
- ▶ Accurate











Is one colour enough to describe the stone?

POLL OPEN

- 1. Yes 0%
- 2. No at least two colours 0%
- 3. No a range of colours is needed 0%

Do you see the squares A and B as different colours?

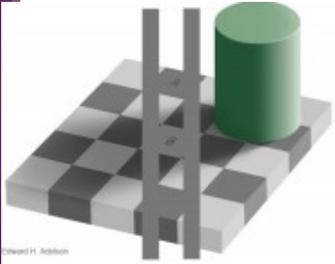
Yes

No

Lock Screen

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Do you still trust your eyes?



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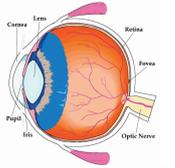
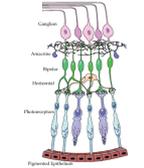
1775 Marie Antoinette



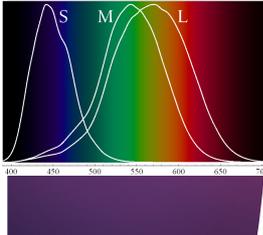
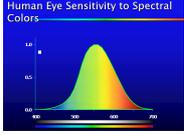
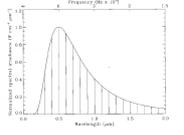
What country is associated with this colour?
Carrots orange?



How the eyes work

Human Vision

A source of 500 nm was viewed what would the RGB colour signal be measured by the retina in a

POLL
OPEN

1. Green 100% signal 0%
2. Red 25%, green 50%, blue 25% 0%
3. Red -10%, green 130%, blue -20% 0%
4. None of the above 0%

Some factors that affect colour perception

- ▶ Light intensity
- ▶ Quality of light (colour temperature or relative intensities of composite wavelengths)
- ▶ Background
- ▶ Light adaption of viewers eyes
- ▶ Differences between viewers including 'colour blindness'
- ▶ Age

Colour (spectral) vision

- ▶ Has evolved 90 million years ago vision limited to two colours yellow and blue
- ▶ Differently in different species
- ▶ Some species see in infra-red
- ▶ Some species can see into the UV
- ▶ 30 million years ago full colour vision evolved within our ancestors
- ▶ Originally only 2 types of opsin then genetic defect duplicated green opsin gene and then this modified/ mutated and became sensitive to red

- ▶ Empedocles 493-433 BC
- ▶ Aristotle 384-322 BC
- ▶ Alhazen 965-1040
- ▶ Leonardo De Vinci 1452-1519
- ▶ Kepler 1571-1630

Prior to Newton colour

Color Temperature of a Black Body Radiator

900K 1750K 3200K 5500K

Figure 1

History

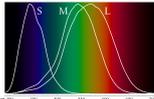
- ▶ In 1801 Thomas young first proposed the eye detected colour through 3 distinct colour receptors Trichromatic vision
- ▶ Goethe 1810 published the results of his 'significant research' into the concept of colour
- ▶ 1852 Helmholtz formalised Trichromatic colour vision

History

- ▶ 1902 Johannes Von Kries was a little less confident in his Theories
- ▶ The three signals from the long (Red) medium (green) and short (Blue) wavelength cones are converted to XYZ tristimulus values
- ▶ $L_a = k_l L$ $M_a = k_m M$ $S_a = k_s S$
- ▶ Where k_l, k_m, k_s are individual adaption factors to adjust initial cone signals and L_a, M_a, S_a are post adaption cone signals

History

- ▶ Three signals to brain but incorporate opponent colour theory
- ▶ Signal 1 red to green is given by $L - M + S$
- ▶ Signal 2 Yellow to blue is given by $L + M - S$
- ▶ Signal 3 intensity of light $L + M + S$



- ▶ Between 1977 and 1986 Edwin Land (MIT) founder of the Polaroid corporation, developed the Retinex theory. This effectively acknowledges variations in colour perception due to variations in the background
