Calculating Contrast

Analysis and suggestions
For color and contrast choices
On HP calculators

Gene Wright
GeneLA@comcast.net
HHC 2004

Calculating Contrast

Quote from Douglas Adams The Restaurant at the End of the Universe

“ ‘It’s the wild color scheme that freaks me,’ said Zaphod… ‘Every time you try to operate one of these weird black controls that are labeled in black on a black background, a little black light lights up black to let you know you've done it. What is this? Some kind of galactic hyperhearse?’

‘Perhaps whoever designed it had eyes that responded to different wavelengths?’ offered Trillian.

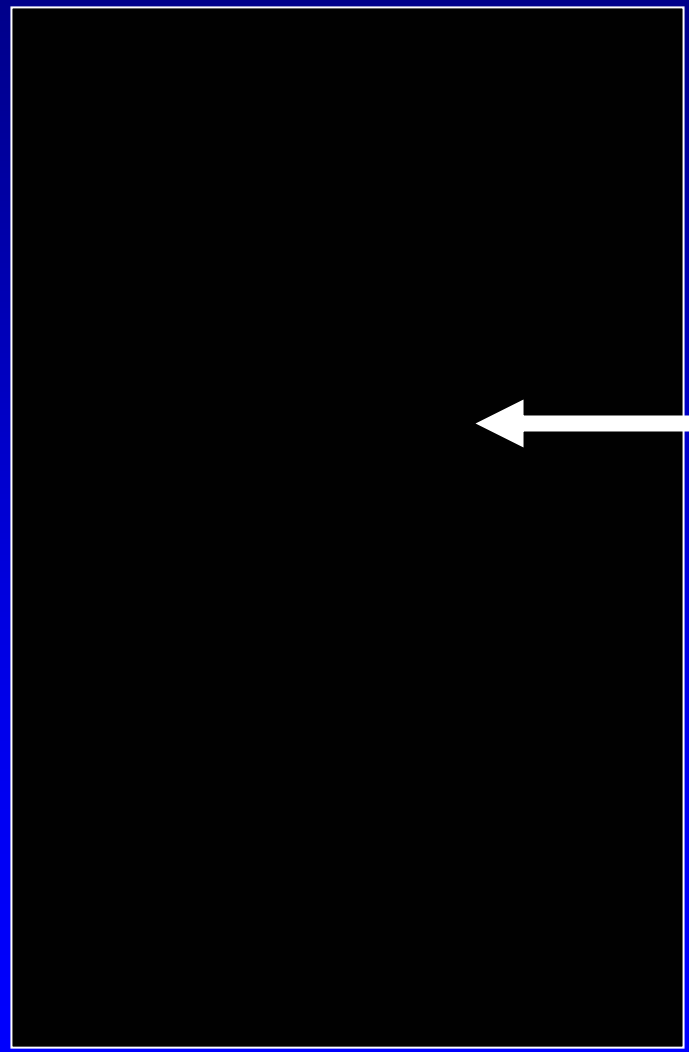
‘Or didn't have much imagination,’ muttered Arthur.

‘Perhaps,’ said Marvin, ‘he was feeling very depressed.’ ”

Calculating Contrast

The Device

In question



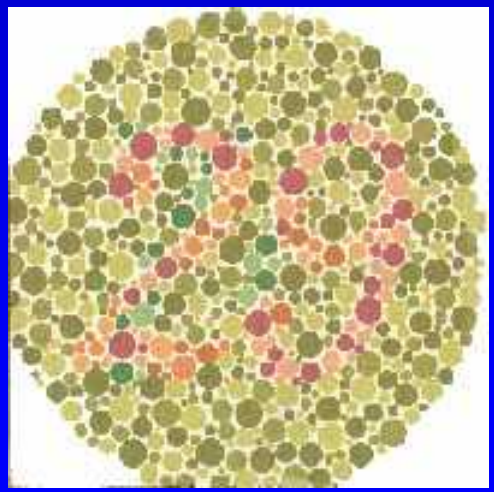
Note third row of keys ☺

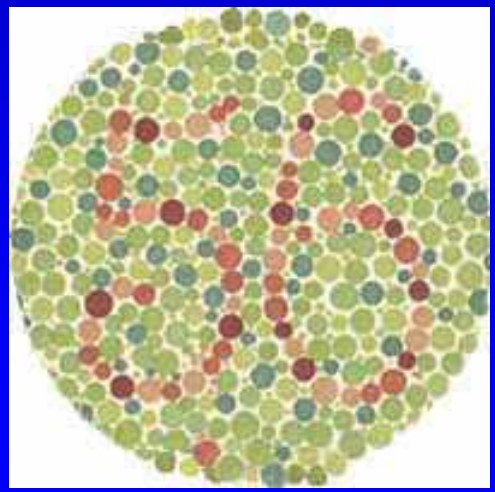
Calculating Contrast

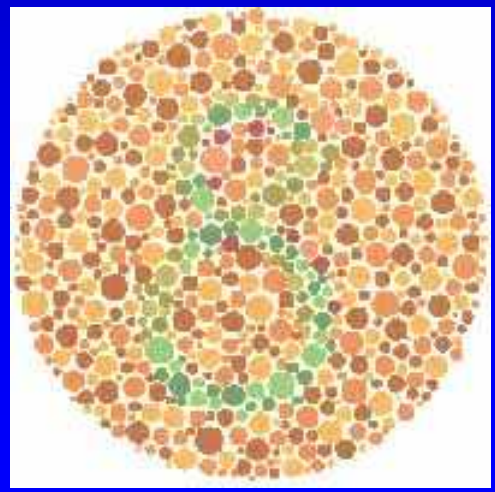
Calculator color scheme selection

Important principles:

1) **Remember color blindness!**
   - **A color scheme is bad if a 10-20% of people can't see it**







Calculating Contrast

Calculator color scheme selection

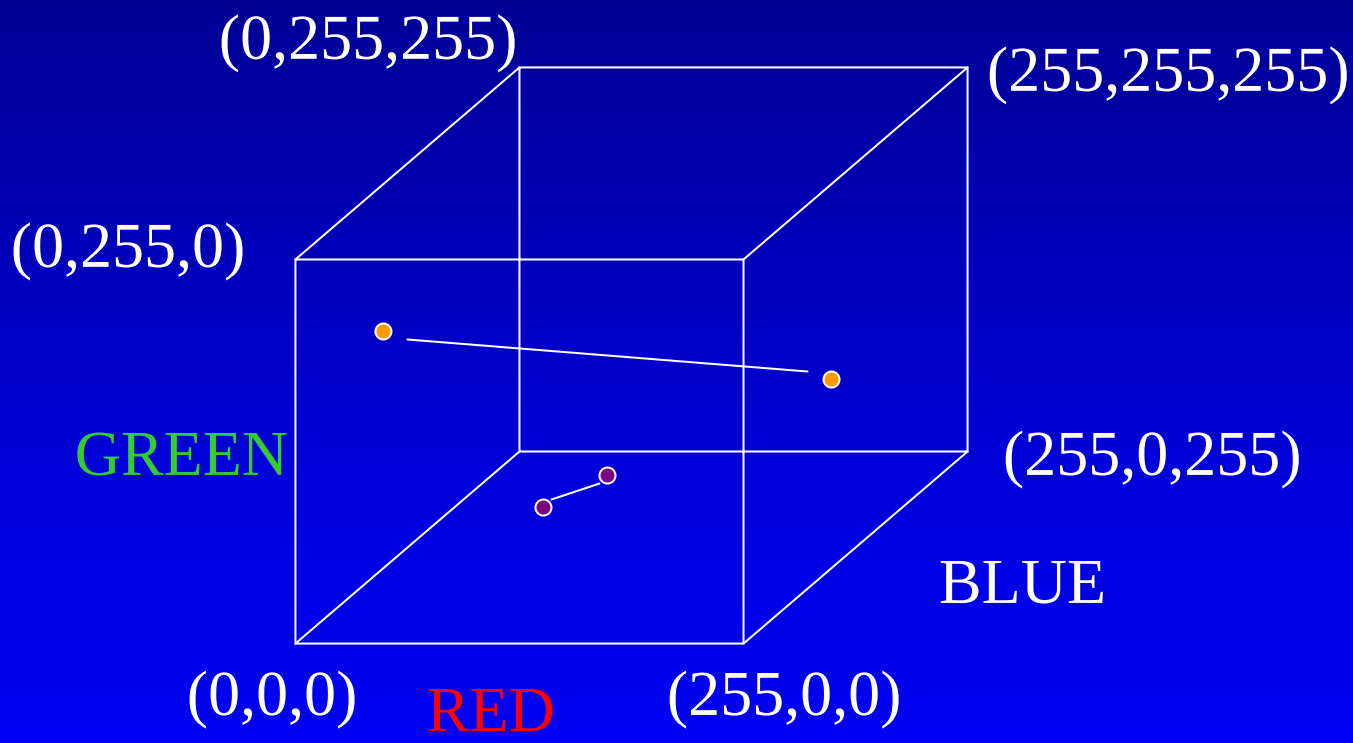
Important principles:

1) **Remember color blindness!**
   - **A color scheme is bad if a large % of people can’t see it**
2) **Contrast!**
   - **A color scheme must indicate a difference in colors**
   - **Otherwise, why bother? ☺**
3) **Good taste!**
   - **Subjective, but we do want these seen on our desks!**

Calculating Contrast

- The calculation
- Intended as a relative ranking – not an industry approved technique!
- Each color can be represented as values from 0 to 255 in the Red, Green, and Blue color map
- This color is R 75, G 170, B 165 ➔ 
- White is R255, G255, B255
- Black is R0, G0, B0
- Calculation is a variation of the distance between two points
- Formula:
- SquareRoot ((R1 – R2) ^2 + (G1 – G2) ^2 + (B1 – B2) ^2)
- Maximum score is 441.673

Calculating Contrast

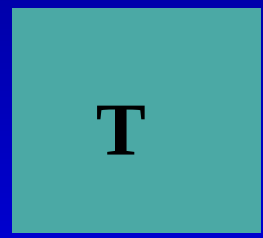


Distance between two 3D points → more distance = more contrast

Calculating Contrast

- This color is R 75, G 170, B 165 ➔

- Try black letters on this background



- SquareRoot ((75 – 0) ^2 + (170 – 0) ^2 + (165 – 0) ^2)
- Score = 248
- Try white letters on this background

- SquareRoot ((75 – 255) ^2 + (170 – 255) ^2 + (165 – 255) ^2)
- Score = 218

Calculating Contrast

- Good or Bad? VOTE!
- Yellow = R 44, G 44, B 42
- Black background = R 227, G 156, B 114
- Contrast Score =

  SquareRoot ((227 – 44) ^2 +

  (156 – 44) ^2 + (114 – 42) ^2)
- Contrast Score = 226.3
- White keytop = R 238, G 220, B 216
- Black background = R 227, G 156, B 114
- Contrast Score = 295.4
- Blue = R 127, G 187, B 247
- Contrast Score = 245.4
- Calculator? HP 12c

Calculating Contrast

- Good or Bad? VOTE!
- Blue = R 81, G 170, B 186
- Black/Gray = R 56, G 61, B 67
- Contrast Score = 163.3
- Yellow = R 242, G 213, B 121
- Contrast Score = 246

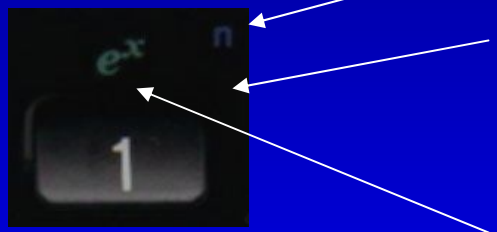
- Calculator? HP 9G

Calculating Contrast

- Good or Bad? VOTE!
- Green = R35, G 95, B 130
- Blue = R 88, G 139, B 185
- Contrast Score = 88.2

- Calculator? HP 39g+

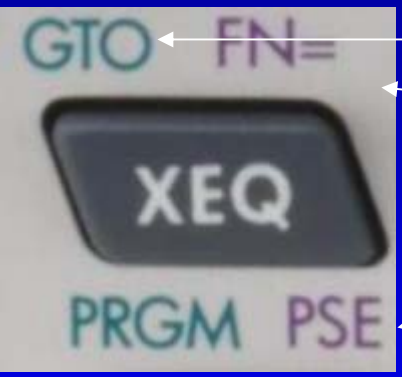
Calculating Contrast



- Good or Bad? VOTE!
- Purple = R 52, G55, B 88
- Black background = R 1, G 2, B 2
- Contrast Score = 113
- Teal = R 55, G 80, B 72
- Contrast Score =116

- Calculator? HP 10B (Teal version)

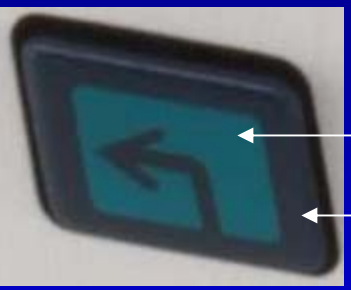
Calculating Contrast



- Good or Bad? VOTE!
- Teal = R 25, G 91, B 103
- Silver background = R 174, G 172, B 173
- Contrast Score = 183
- Purple = R 81, G 55, B 90
- Contrast Score = 171

- Calculator? HP 33S

Calculating Contrast



- Good or Bad? VOTE!
- Teal = R 25, G 91, B 103
- Grey background = R 43, G 53, B 63
- Contrast Score = 58! ←
- Purple = R 81, G 55, B 90
- Contrast Score = 43←
- Calculator? HP 33S

Calculating Contrast

- Good or Bad? VOTE!
- Blue = R 40, G 30, B 30
- Silver background = R 236, G 233, B 224
- Contrast Score = 344!
- Red = R 160, G 33, B 45
- Contrast Score = 280!

- Black keytop = R 63, G 60, B 55
- Green keytop = R 95, G 110, B 95
- Contrast Score = 72
- Calculator? HP 48gII

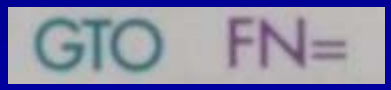
Calculating Contrast

- Good or Bad? VOTE!
- Blue = R 0, G 100, B 150
- White background = R 232, G 233, B 238
- Contrast Score = 281!

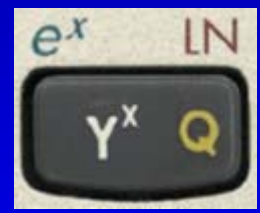
- Calculator? HP 9S

Calculating Contrast

- **Scores < 200**



- **Scores >= 200**



Calculating Contrast

Suggestions:

1) **Remember color blindness!**
   - **Do not use colors that a 10-20 % of people can't see**
2) **Contrast!**
   - **Consider using color combinations that generate at least a 200 score on this contrast calculation.**
   - **Even if this makes them "boring". ☺**
3) **Good taste!**
   - **Not every calculator user is 13 years old ☺**

Comments?