Hello Tomorrow

Emirates

Colour is in the eye of the beholder

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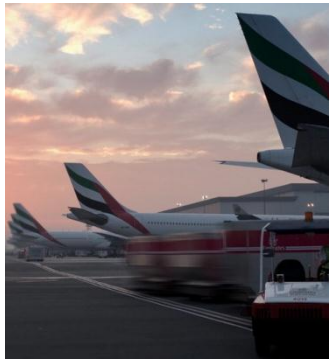
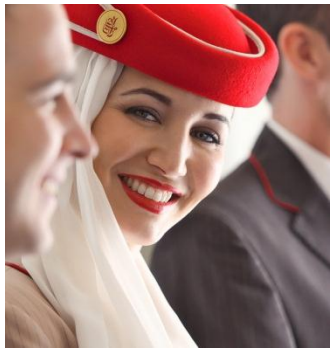
Disclaimer





- I work for Emirates Airline
- The views and opinions are my own and don't necessarily reflect the position of the company
- I do not have financial benefit in producing this audit
- I have not been paid or gained any financial benefit from any external organisations in producing this report/ audit
- (I have normal colour vision)

Questionnaire

- Anonymous
- Question regarding self declaration of colour vision deficiency to be done separately and only once
- Data will be sent back to Tony Evans to distribute

Visual standards

- .....No active pathological condition, congenital or acquired, acute or chronic

- *"The applicant shall be required to demonstrate the ability to perceive readily those **colours** the perception of which is necessary for the safe performance of duties"*

ICAO 2001


Glaucoma
Retinal disease
Anisometropia
Laser eye surgery
Presbyopia
Dark glasses
Contact lenses
Amblyopia
Macular degeneration
Floaters / distortion
Cataract
Acuity
Field of vision
Colour vision
Photopic / mesopic / scototopic
Stereopsis
Dynamic
Flight critical vision

Background

- The first scientific paper on colour deficiency was in 1798 by the English Chemist John Dalton
- Up to 8% of European males have a colour deficiency
- X linked recessive
- Deuteranomaly (Green receptor deficiency) commonest (5% of males)
- Protanomaly (Red receptor deficiency) 1% of males
- Numerous colour vision tests have been used to allow individuals to start and or continue with their chosen career paths
- Commonest used test world-wide are the Ishihara plates

What is wrong with Ishihara?

- 15% of normal trichromats fail
- Almost all protanopes and deuteranopes will fail, but the severity cannot be determined
- Tritanopes may pass (it only tests red/green)
- There are only 15 numbers – they can be memorised
- Not a functional assessment
- Lighting conditions need to correct

Normal

Red = Protan

Green = Deutan

Blue = Tritan

-ope = absent

-anomalous = deficient

Performance Limitations of Colour Defectives

- Reduced visual range
- Slower reaction times
- Increased processing errors
- Increased thresholds
  (decreased performance)
  - Under reduced illumination
  - Hypoxia

Performance Limitations of Colour Defectives

- **Colour vision defectives are not normal**
  - They have a scientifically established disability regardless of level of defect
- Their performance reductions go beyond signal lamp recognition skills to include degraded colour-based flight information transfer (EFIS)
- Their performance reductions degrade disproportionately (compared to normals) when environmental conditions degrade and with hypoxia

Other colour sensitive tasks

- Parking indicator lights (red alongside green = veer to green; two greens = correct)
- Runway lights
  - Runway edge Lights are white (or amber)
  - Runway Threshold Lights are green
  - Runway End Lights are red
  - Runway Centre-line Lights start white, become red-white intermittent and then red only
  - Touchdown zone lights rows of white light bars (with three in each row) on either side of the centre-line over the first 914m of the runway (or to the midpoint, whichever is less)
  - Stopway lights are four unidirectional red lights equally spaced across the width to mark the end of any stopway

Other colour sensitive tasks

- Taxiway Edge lighting is blue
- Taxiway Centre-line lighting is green
- Stop-bar lights are a single row of red
- Runway guard lights are either a pair of elevated flashing amber lights installed on either side of the taxiway, or a row of in-pavement yellow lights installed across the entire taxiway

Colour Assessment and Diagnosis (CAD)

- A validated functional assessment

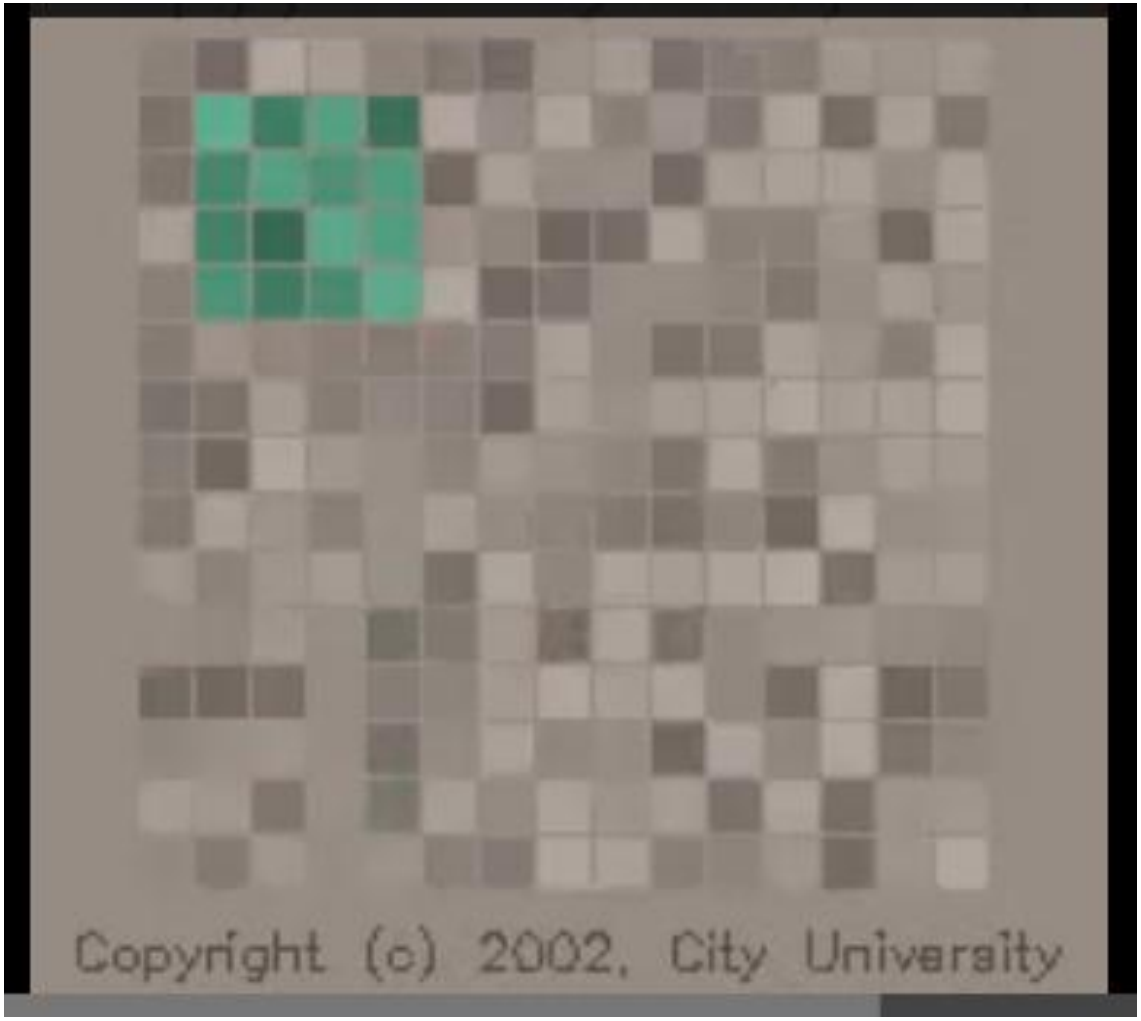
- Is reproducible test system for pilots
  - It negates all visual clues except colour
  - It is relatively quick to do
  - It requires little equipment
  - Allows 35% more people to pass than current tests

- Can detect & classify even minimal deficiencies and can help in disease monitoring

Colour Assessment and Diagnosis (CAD)

- Negates the problem of luminance variation
- Random 4-option response makes memorising impossible
- Detects colour anomalies AND measures the severity
- Works on red/green and blue/yellow axes (although only red/green in used for pilot testing)
- Has 100% specificity and sensitivity as to whether the individual has normal colour vision

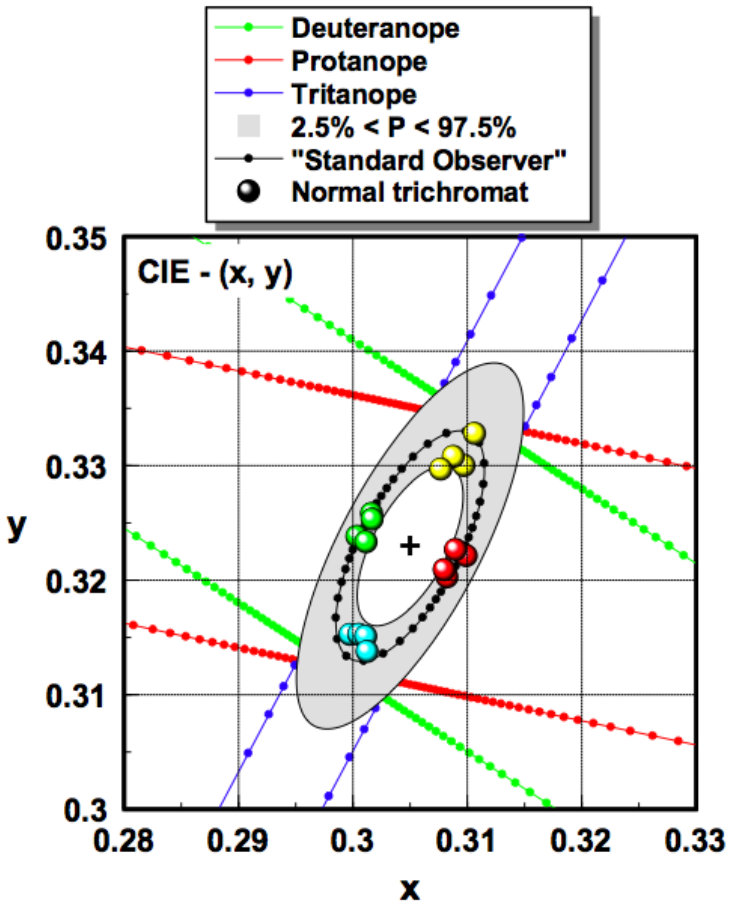
CAD test



Colour Assessment and Diagnosis (CAD)

- A comparative test based on a “Standard Normal” = SN units

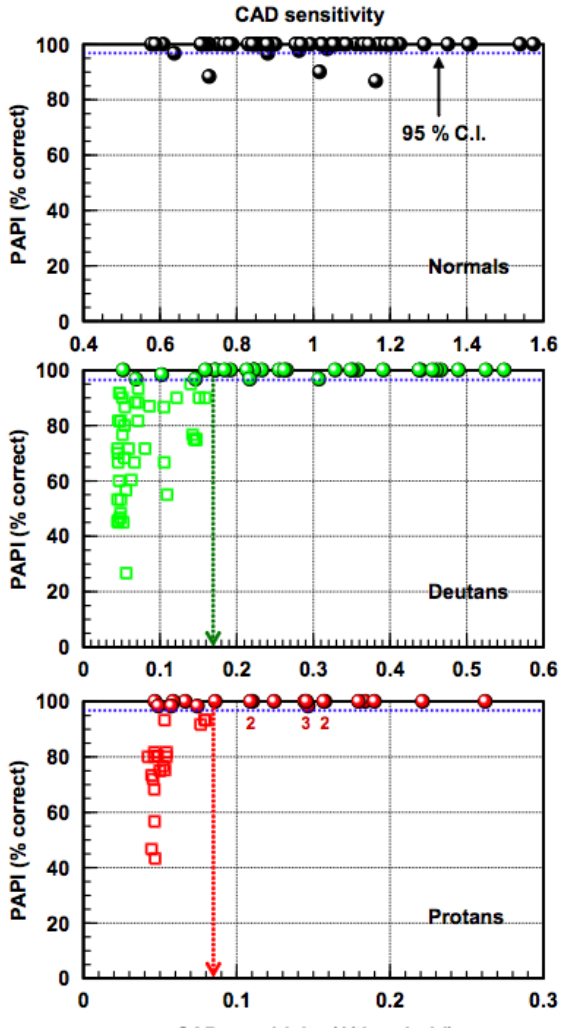
- A value of 2SN means that the subject needs twice the saturation of colour to see it like a normal subject



CAD for pilots

- Colour deficient pilots need to see PAPI lights the same as normal pilots

- Protanopes must score less than 12SN and deuteranopes less than 6SN to pass the test




TIME FOR QUESTIONS