Solving an invisible problem - Designing for Colour-blindness

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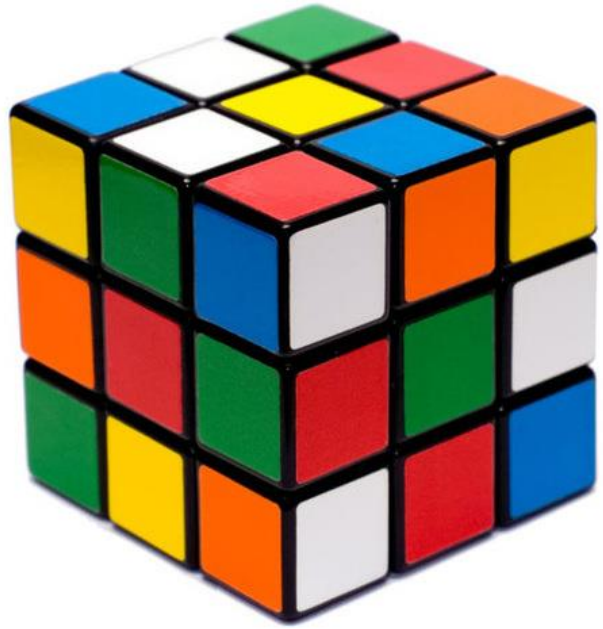
CREATIVE ASSEMBLY™

Introduction

- Former QA tester – Microsoft/CA
- Associate Development Manager – CA Console Team
- Colour-blind (Severe Deuteranopia)



Sections

1. What exactly is colour-blindness?
2. Common colour-blindness issues in video games
3. Developing Halo Wars 2 with colour-blindness
4. Why is developing for colour-blindness difficult?
5. Solving the problem: Designing for colour-blindness

What exactly is colour-blindness?

The inability (or decreased ability) to distinguish certain colours.

Colour-Blindness

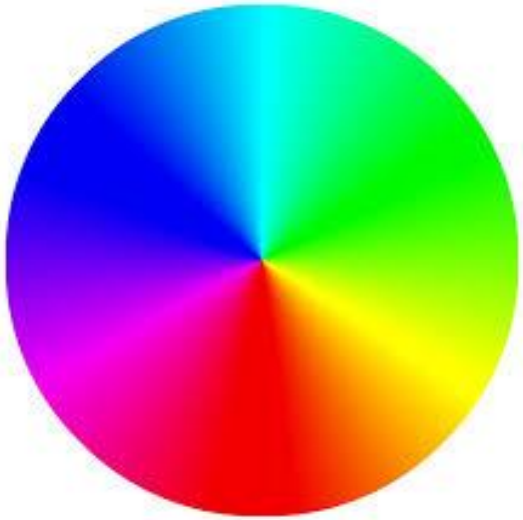
Daltonisme

Daltonismo

Farbenblindheit

Daltonismo

How do we see colour?

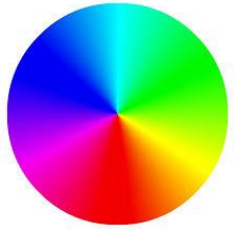


- Two types of photo-receptor cells
- Rods
  - Detect low level light
  - Do not detect colours
- Cones
  - Detect intense light
  - Detect colours
  - 3 types: Red, Blue, Green
- Normal vision is known as Trichromacy

Types of colour-blindness

Anomalous Trichromacy

Trichromacy



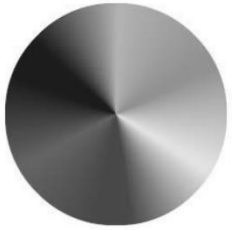
Deuteranomaly

Protanomaly

Tritanomaly

Monochromacy

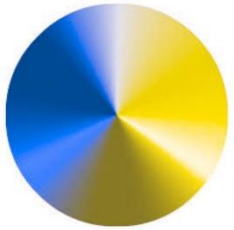
Achromatopsia



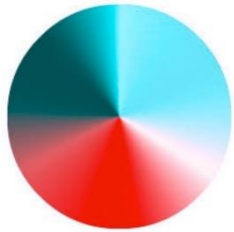
Dichromacy

Deuteranopia

Protanopia

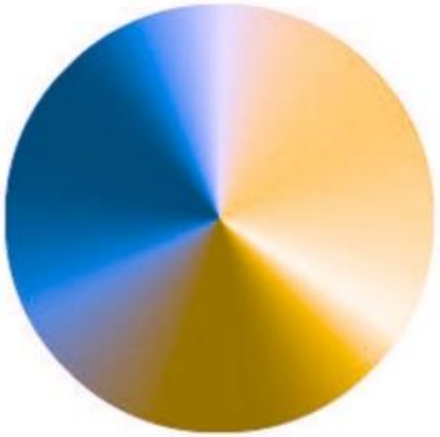


Tritanopia



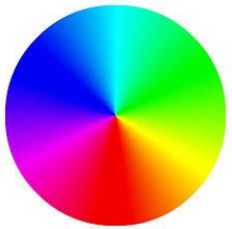
Types of colour-blindness

Deuteranopia

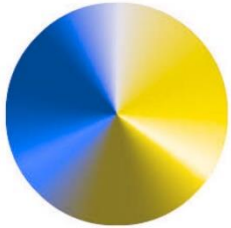


- Most common type of red-green colour-blindness
  - ~75% of colour-blind males
- Reduced sensitivity to green light (aka “green-blind”)
- Sufferers often confuse:
  - Reds, greens and browns
  - Blue-greens and greys
  - Light greens and yellows
  - Reds, oranges and yellows
  - Blues, purples, and dark pinks

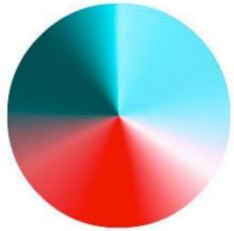
Trichromacy



Protanopia



Tritanopia

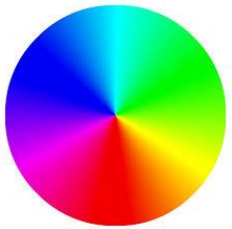


Types of colour-blindness

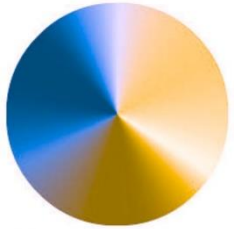
Protanopia

- Another type of red-green colour-blindness
  - ~25% of colour-blind males
- Reduced sensitivity to red light (aka “red-blind)
- Sufferers often confuse:
  - Black with red
  - Browns, greens, reds and oranges
  - Blues, purples and dark pinks
- Many reds/oranges are very dim

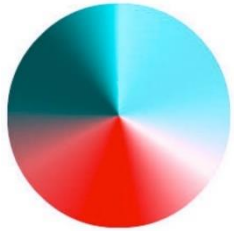
Trichromacy



Deuteranopia

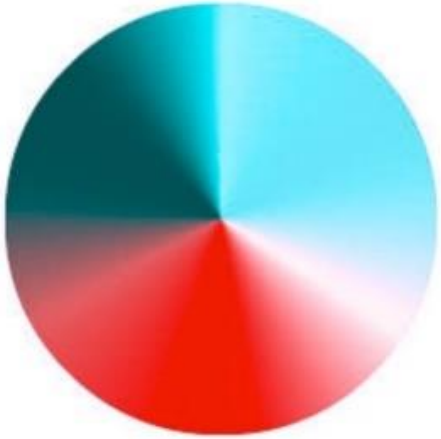


Tritanopia



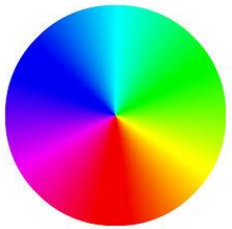
Types of colour-blindness

Tritanopia

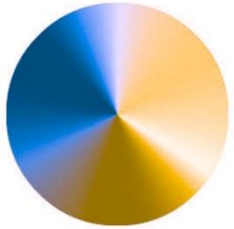


- Very rare
  - ~1 in 10,000 people
  - Affects men and women equally (chromosome 7)
- Reduced sensitivity to blue and yellow light (aka “blue-blind”)
- Sufferers often confuse:
  - Blues, greens and greys
  - Dark purples with black
  - Oranges with reds

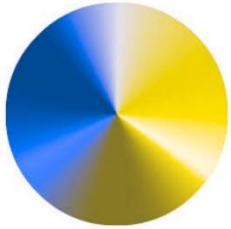
Trichromacy



Deuteranopia

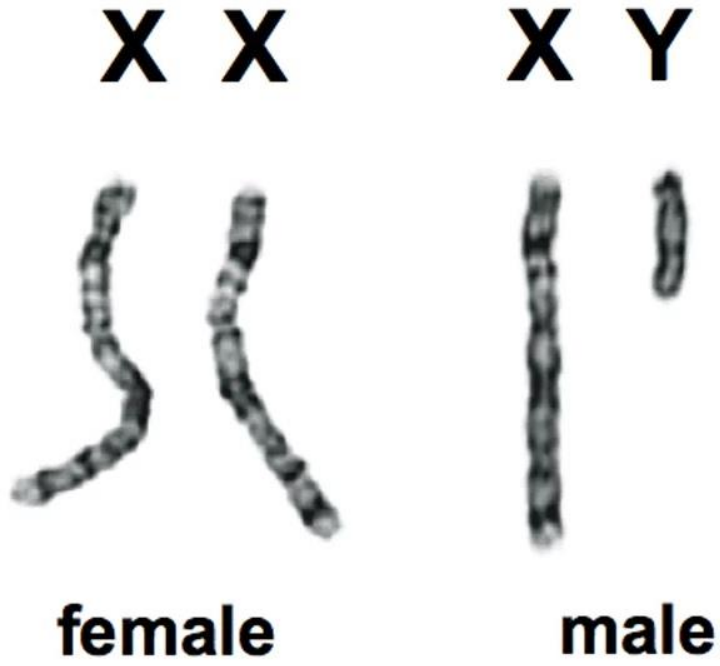


Protanopia

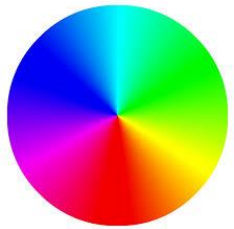


What causes colour-blindness?

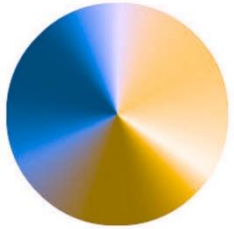
- Mostly hereditary
- Deuteranopia/Protanopia
  - Defective X chromosome
- Tritanopia
  - Defective chromosome 7
  - Illnesses/injuries/medications
  - Age



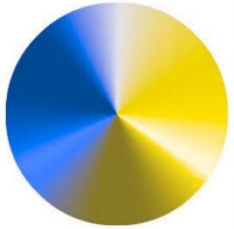
Trichromacy



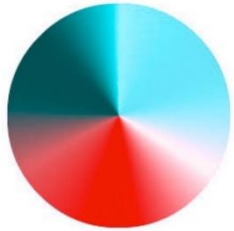
Deuteranopia



Protanopia



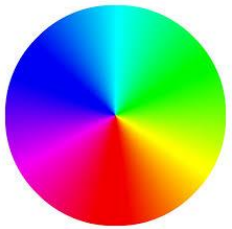
Tritanopia



Colour-blindness around the world

- 1 in 12 men are colour-blind (8%)
- 1 in 200 women are colour-blind (0.5%)
- More common in Caucasian populations
  - 10-11% of Scandinavian men
  - 5% of Asian men
  - 4% of African men

Trichromacy



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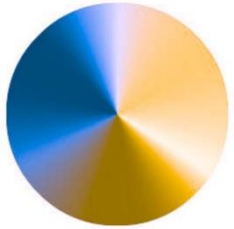

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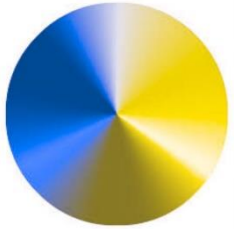
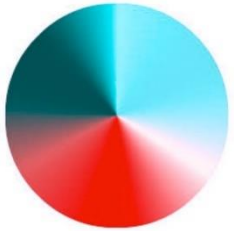
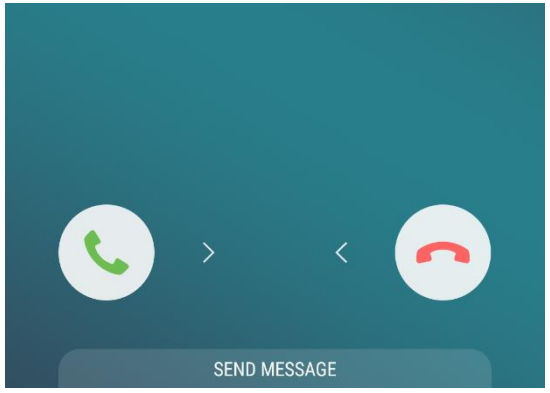
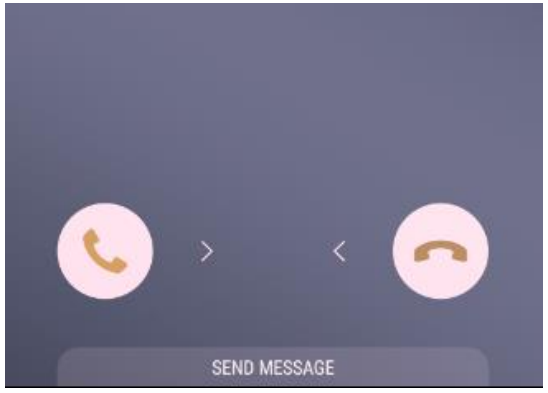


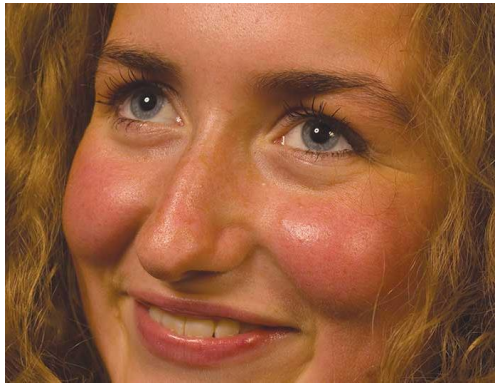
Tritanopia



Impact on life



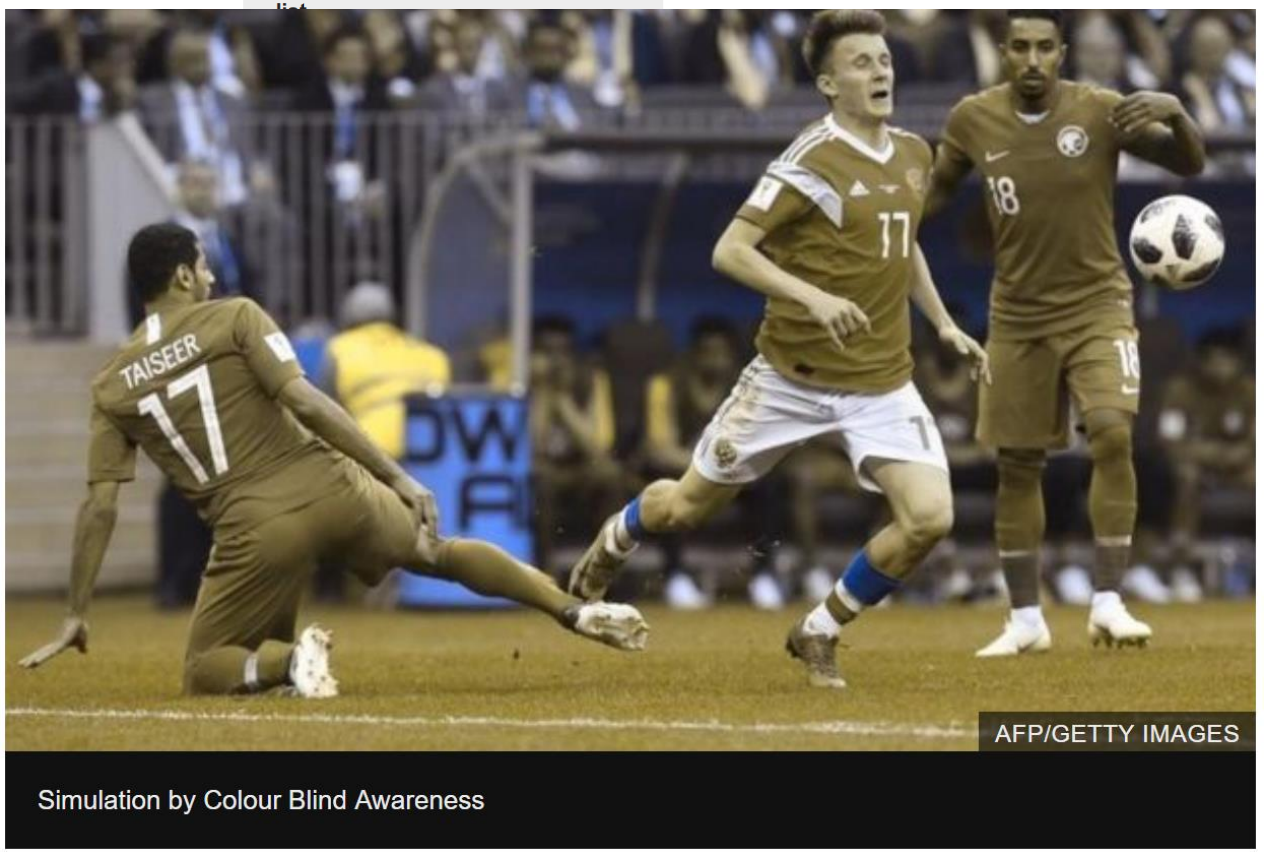




World Cup 2018: Why millions of fans see the football like this

Top Stories

Men dominate BBC's star salaries



Simulation by Colour Blind Awareness

Deuteranopia

Trichromacy (normal)

Deuteranopia (me)

Protanopia

Tritanopia

Mythbusting

Can you drive?

Mythbusting

Can colour-blind people can be pilots?

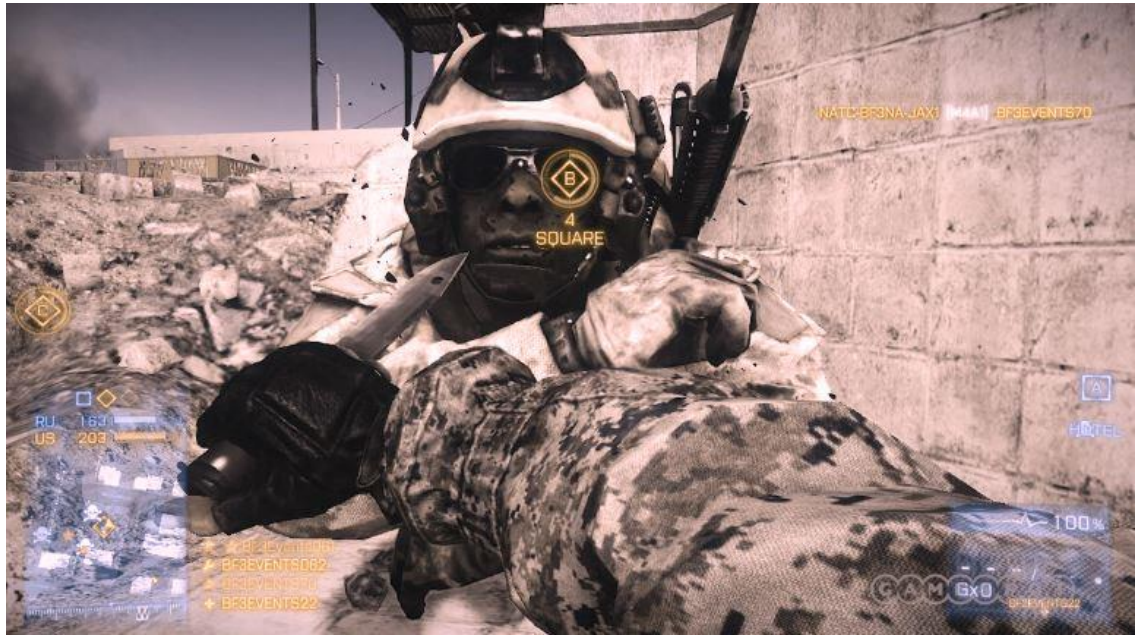
Mythbusting

Common colour-blindness issues in video games

- Team Colours
- UI vs Characters vs Environment
- Puzzles
- UI information

Team Colours

Deuteranopia



UI vs Characters vs Environment

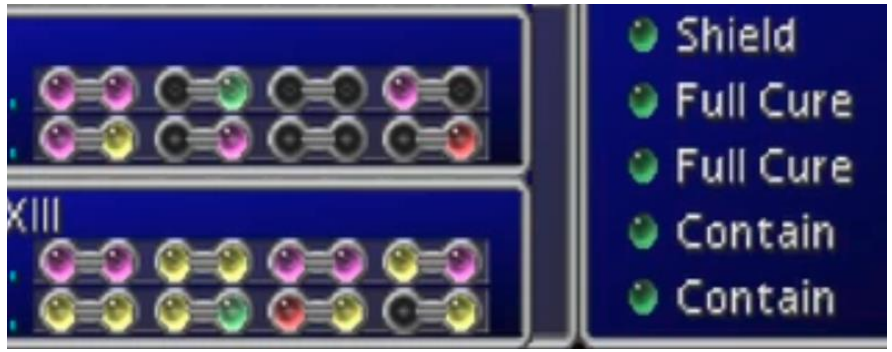
Deuteranopia

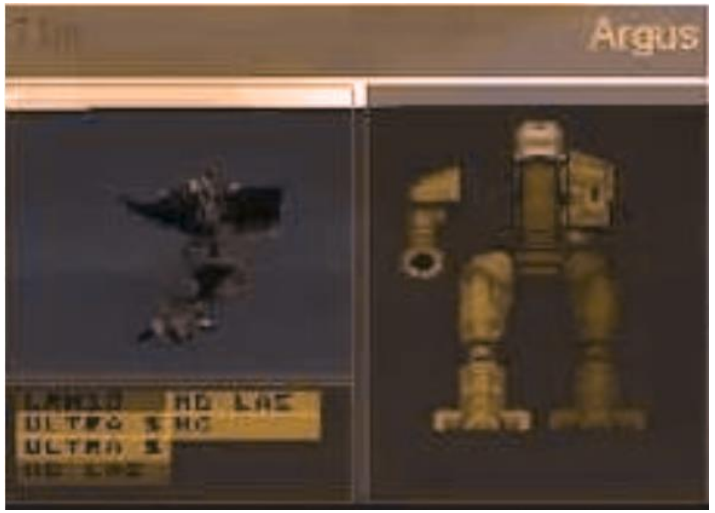
Puzzles

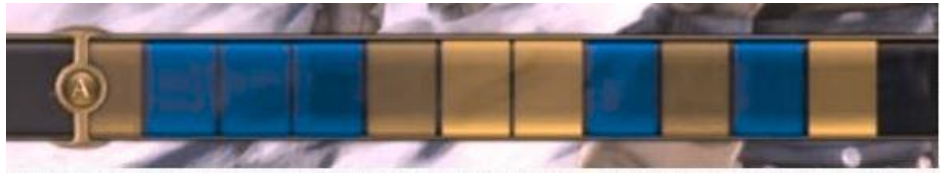
Deuteranopia

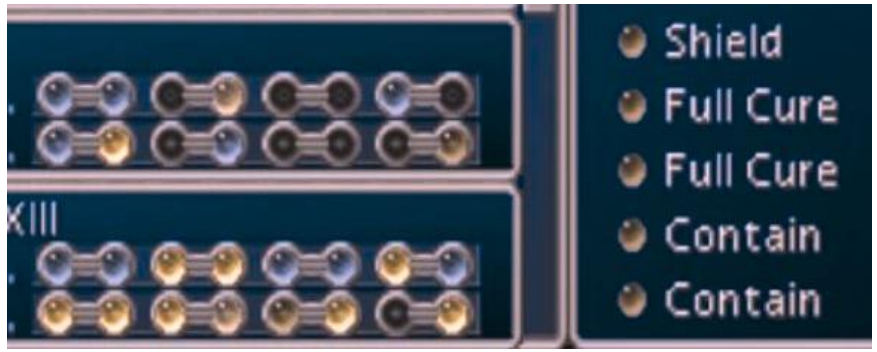
UI information

Deuteranopia









Developing Halo Wars 2 with colour-blindness

- Team Colours
- Minimap
- Campaign
- Blitz Card UI

Team Colours

Deuteranopia

Minimap

Deuteranopia

Campaign

Deuteranopia

Blitz Card UI

Deuteranopia

Complex palette

Deuteranopia

Why is developing for Colour-blindness difficult?

1. The ***problem*** is invisible to normal-sighted developers
2. The ***features*** are often invisible to colour-blind developers


A L I E N
I S O L A T I O N

Normal Vision

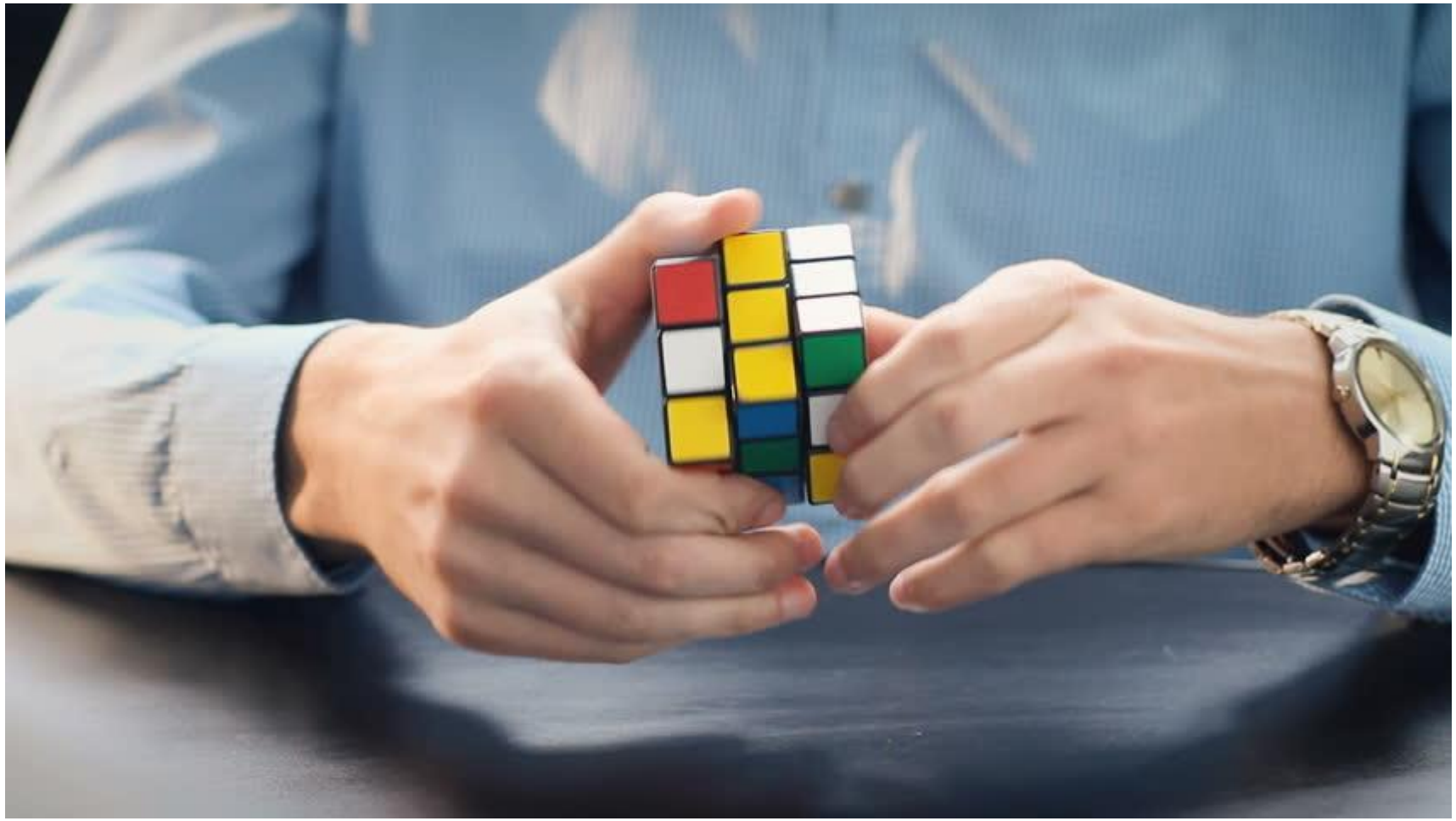
Deuteranopia


XBOX 360
KINECT
REQUIRES
KINECT SENSOR
KINECT
STAR WARS
12
www.pegi.info
LUCASARTS
Microsoft Studios

Normal Vision

Deuteranopia

Solving the problem



Don’t Just Use Colour for Information

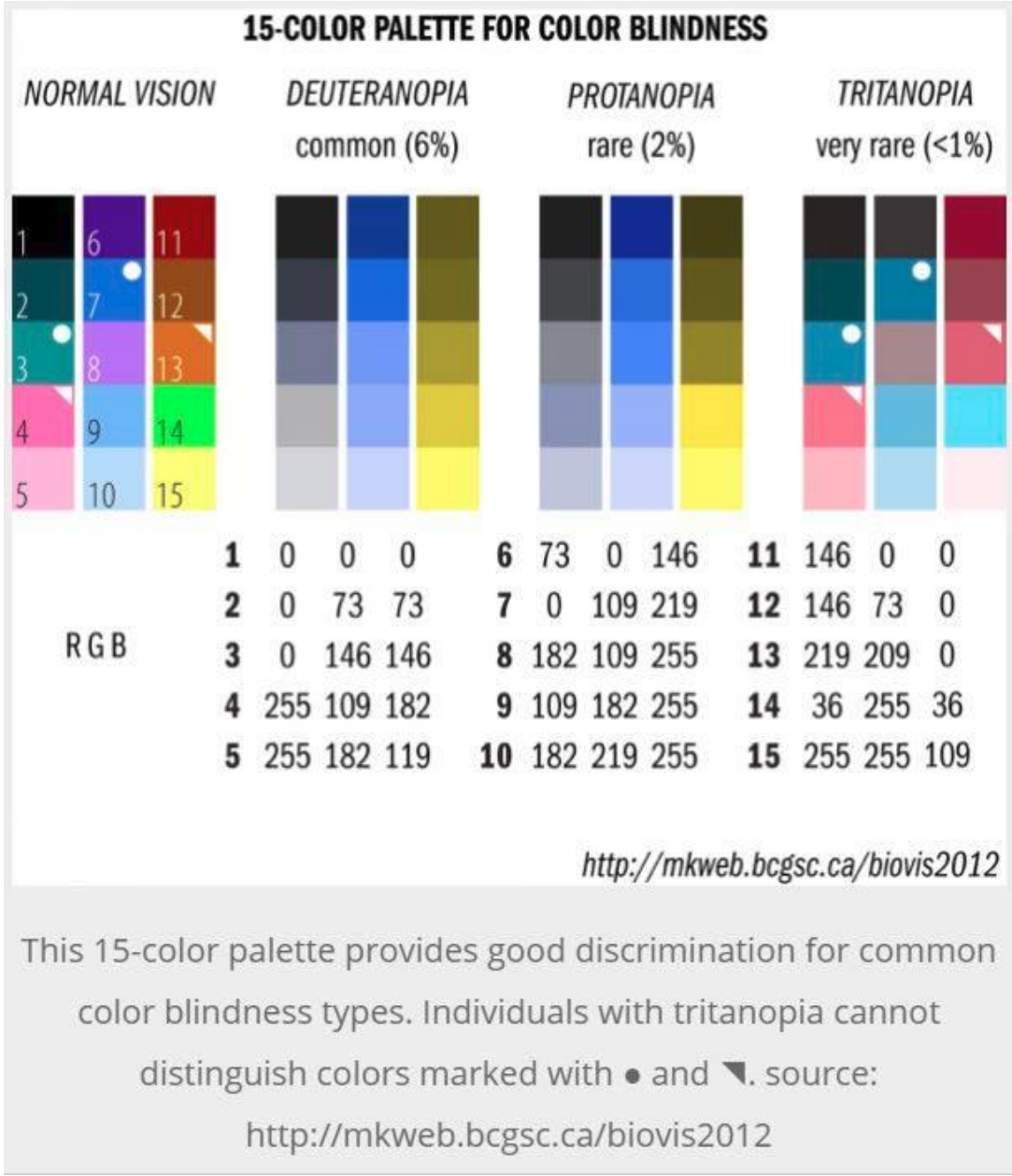
- Web Content Accessibility Guidelines (WCAG)
- https://www.w3.org/WAI/WCAG21/quickref/?versions=2.0#use-of-color

1.4.1 Use of Color — Level A

Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.

Palette Design

- Many resources are available
- Good standard practice
- Doesn’t cover everything



This 15-color palette provides good discrimination for common color blindness types. Individuals with tritanopia cannot distinguish colors marked with ● and ◥. source: http://mkweb.bcgsc.ca/biovis2012

If in doubt, use Blue and Orange

Identify your colour features

- Puzzles
- Maps
- UI
- Teams
- Items
- Lights
- Text
- Complex palette

Identify your colour features

- Puzzles
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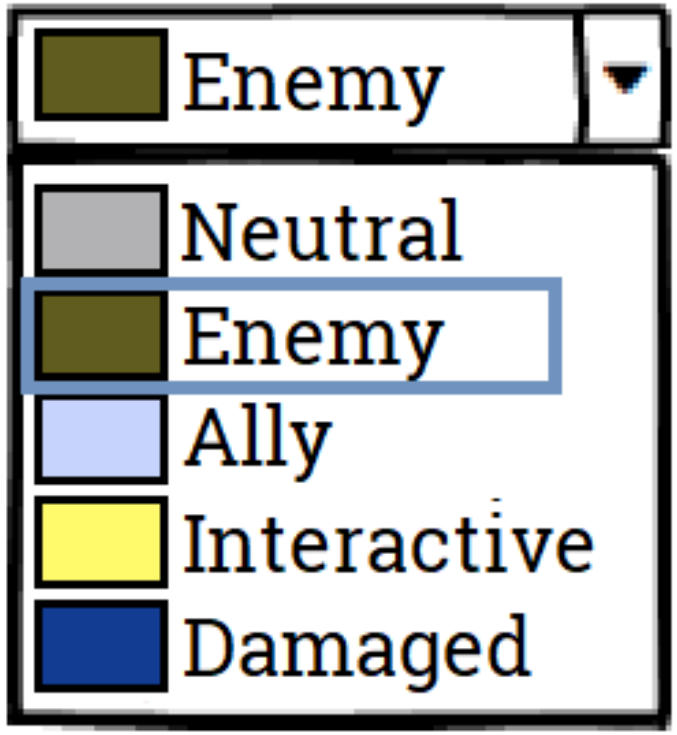
Use presets to manage your colours

- Figure out your colour information categories
- Set up colour presets using colour-safe palettes
- User-test the presets in context
- Artists/designers can safely use presets
- Allows for systemic management of colours/colour-blind support



Use colour-blindness simulator tools

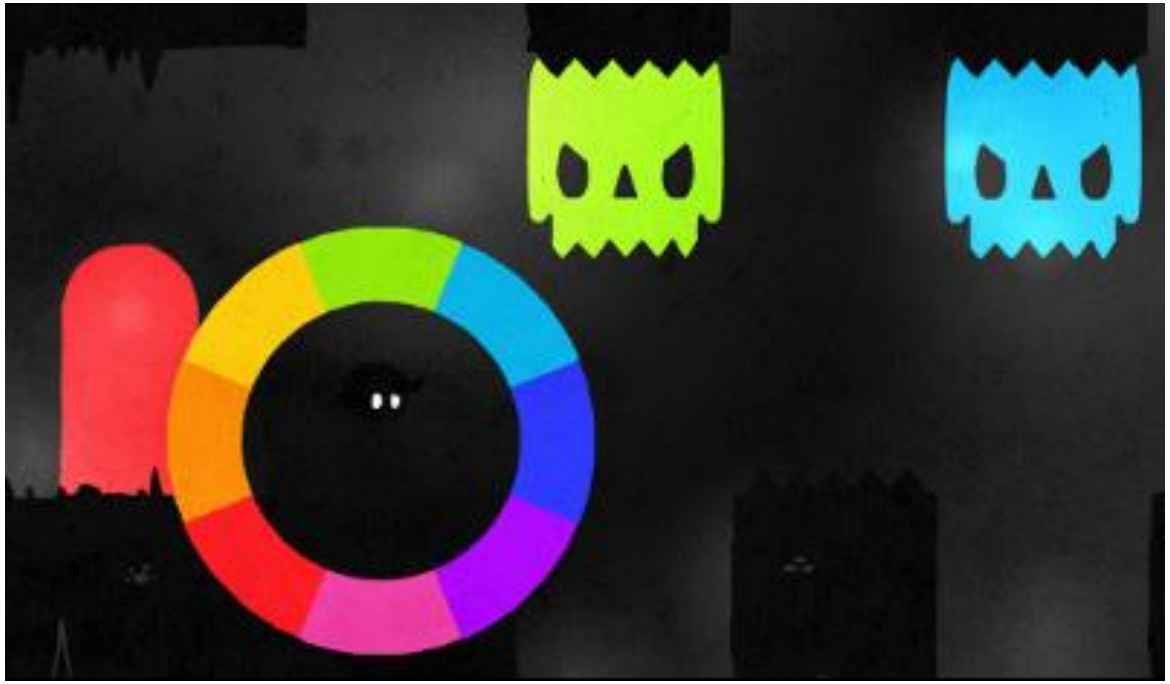
- Color Oracle – free simulator software
- Unity – *ColorBlind Unity package*
- Unreal Engine – *Color Vision Deficiency Preview*
- Photoshop Colour-blindness Simulator
- Sim Daltonism – Real-time simulation
- Chrome plugins
- http://www.color-blindness.com/coblis-color-blindness-simulator/

Reach out to colour-blind players/colleagues

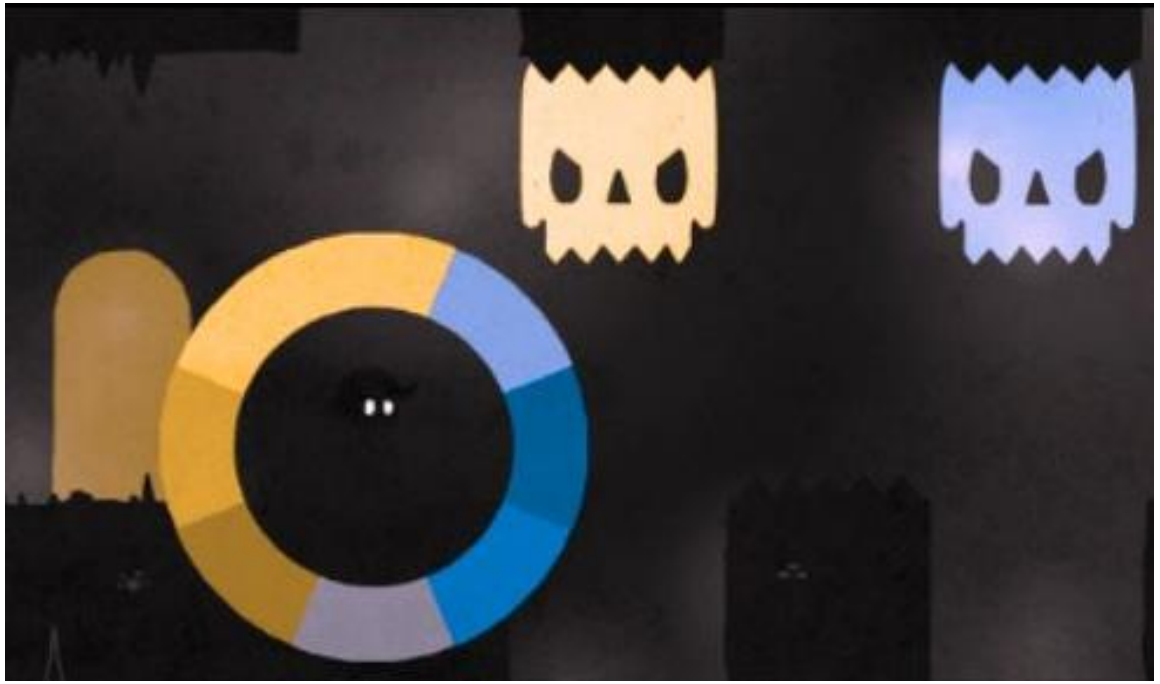
Examples of solutions in games

Hue – Level colours

Normal Vision

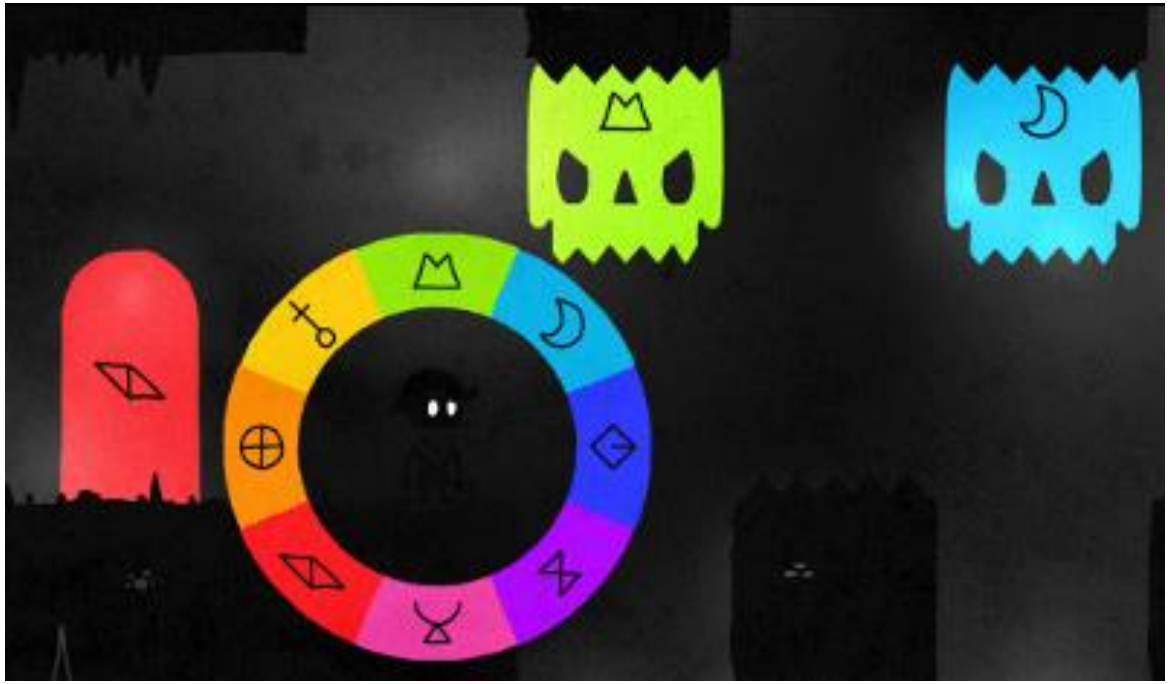


Deuteranopia



Hue – Level colours

Normal Vision



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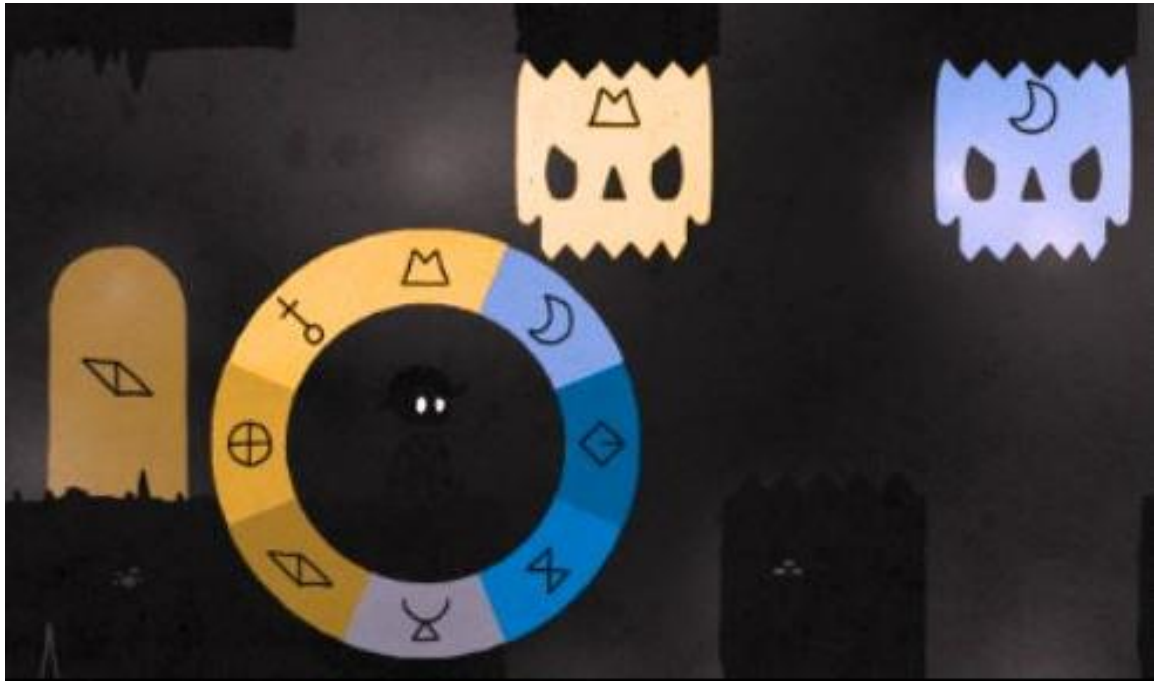


With Colour-Blind Mode

Left 4 Dead 2 – Player Auras

Normal Vision

Deuteranopia

Left 4 Dead 2 – Player Auras

Normal Vision

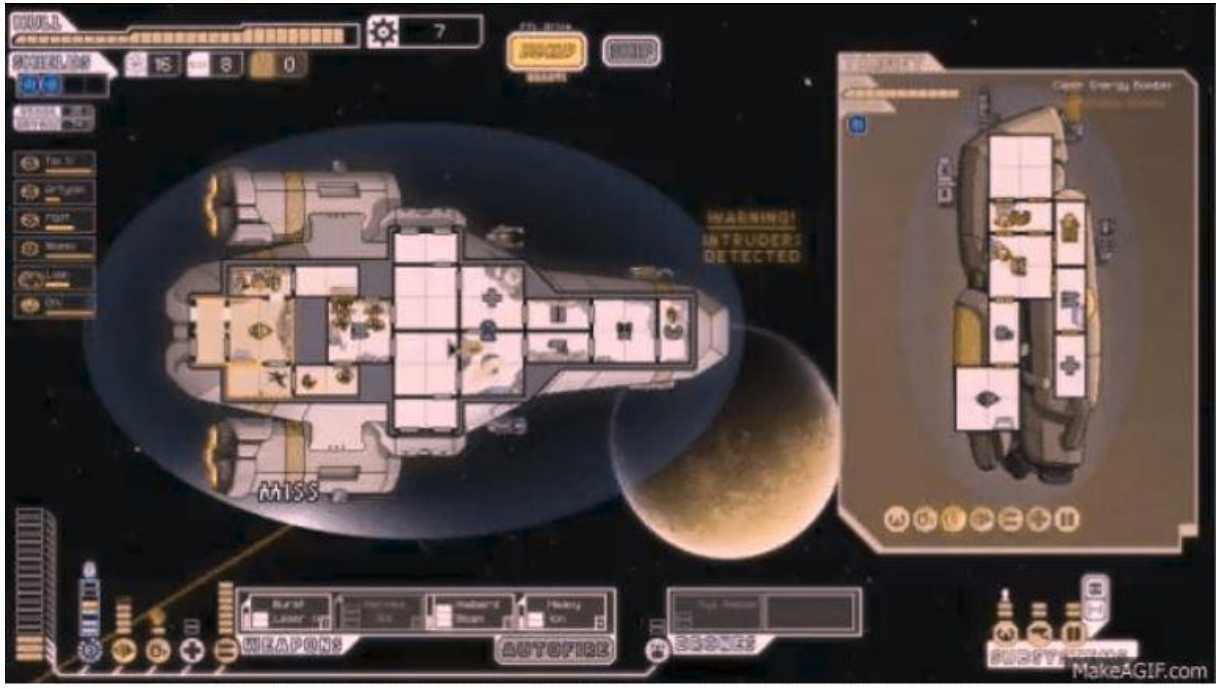
Deuteranopia

With Colour-Blind Mode

FTL: Faster Than Light – Status/Oxygen

Normal Vision

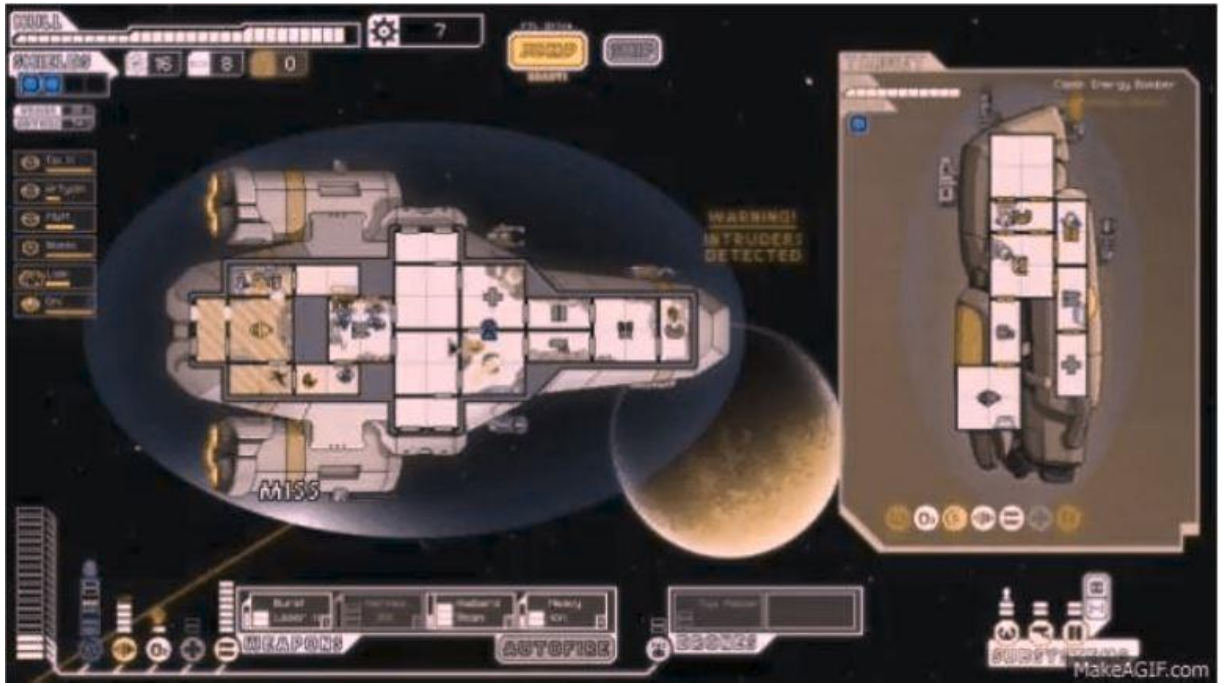
Deuteranopia



FTL: Faster Than Light – Status/Oxygen

Normal Vision

Deuteranopia



With Colour-Blind Mode

Total War: Warhammer II – Teams/Status

Total War: Warhammer II – Teams/Status

Total War: Warhammer II – Teams/Status

Normal Vision

Deuteranopia

Total War: Warhammer II – Teams/Status

Normal Vision

Deuteranopia

With Colour-Blind Mode

Total War: Warhammer II – Teams/Status

Normal Vision

Deuteranopia

Total War: Warhammer II – Teams/Status

Normal Vision

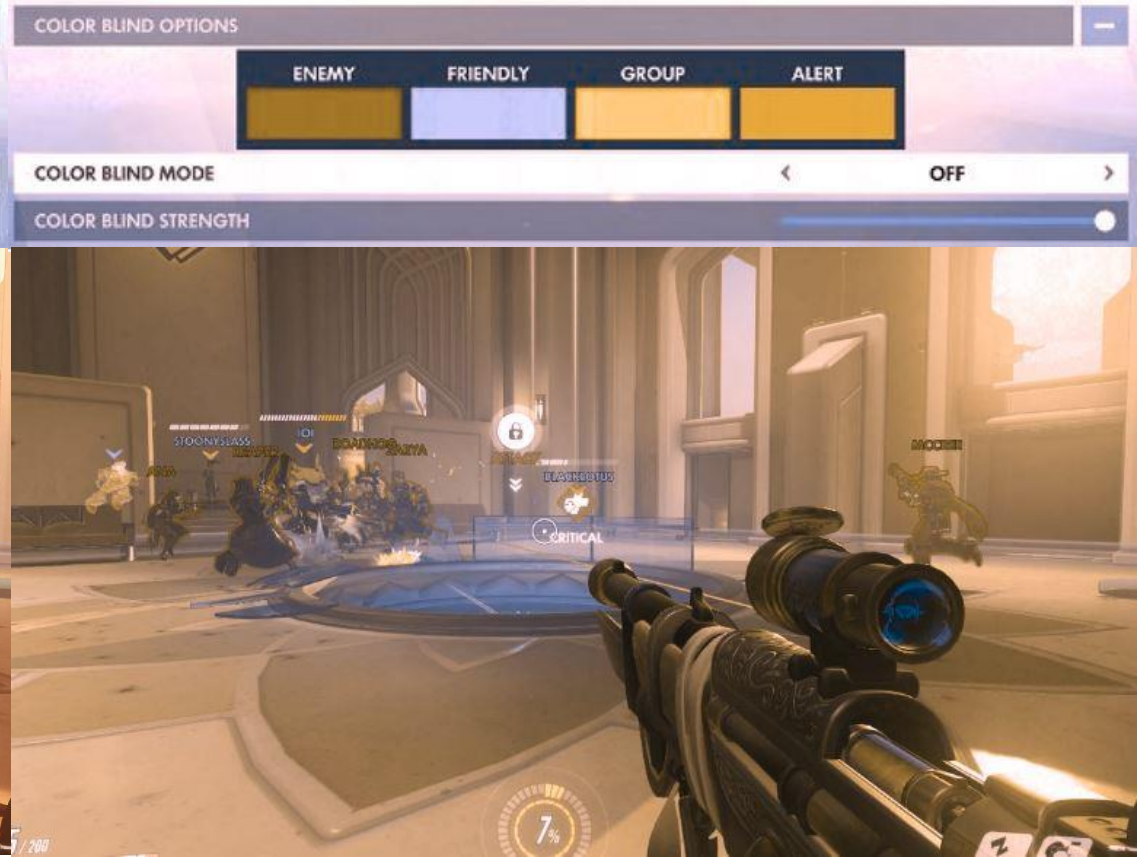
Deuteranopia

With Colour-Blind Mode

Overwatch – UI/Auras

Normal Vision

Deuteranopia



Overwatch – UI/Auras

Normal Vision

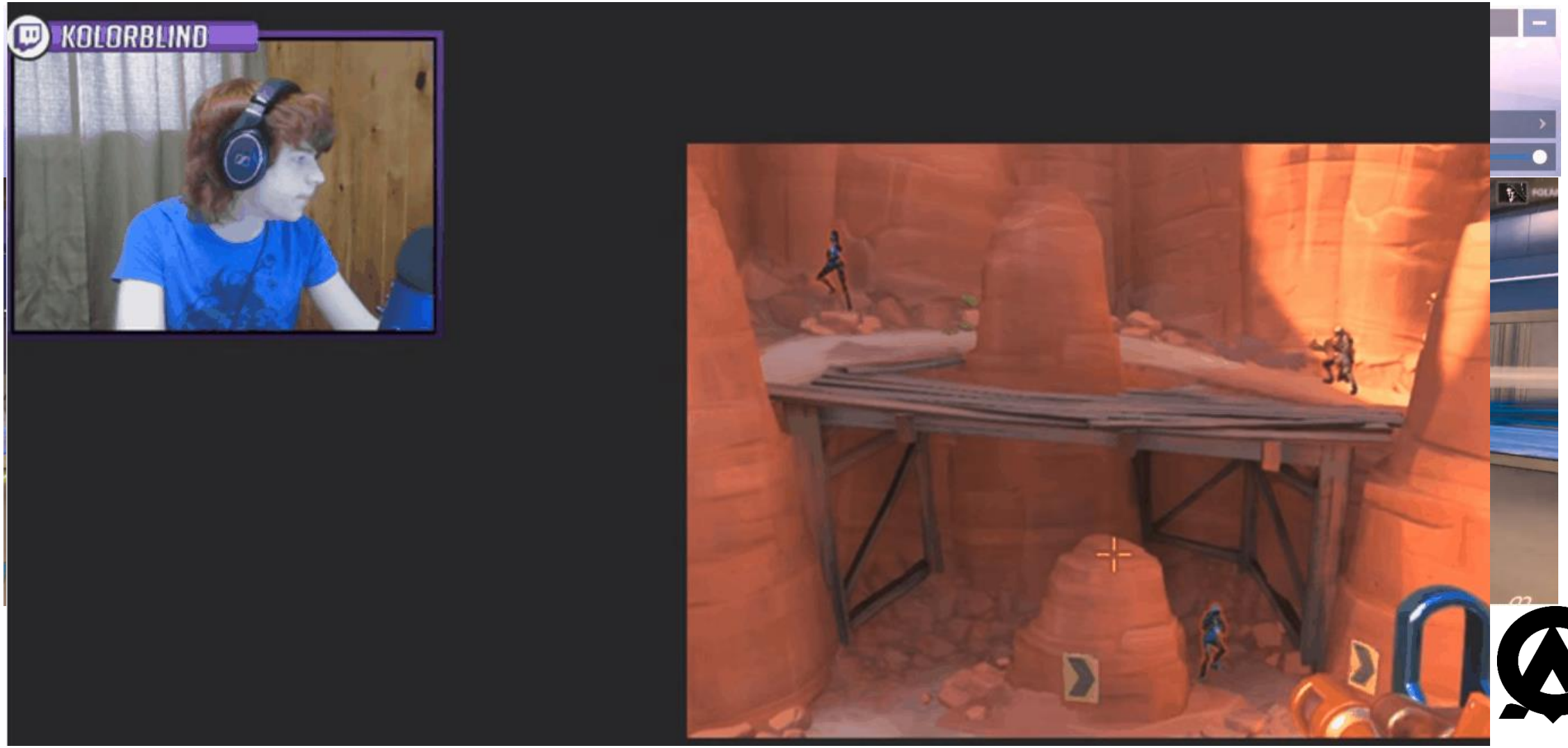
Deuteranopia

With Colour-Blind Mode

Overwatch – UI/Auras

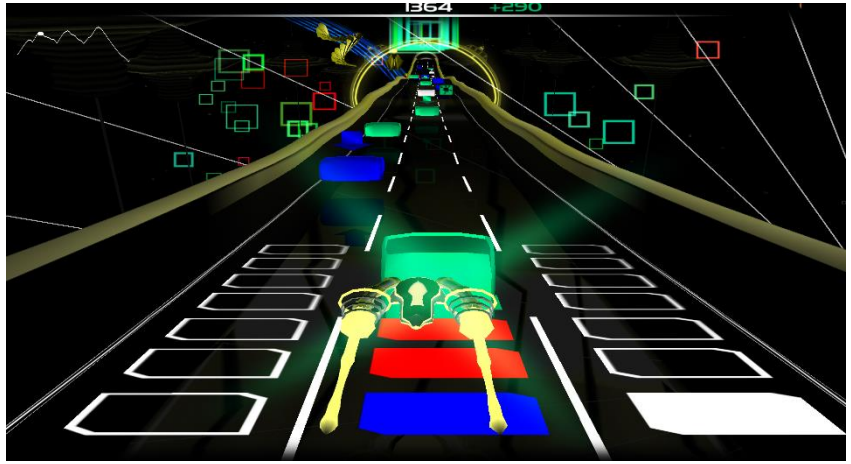
Normal Vision

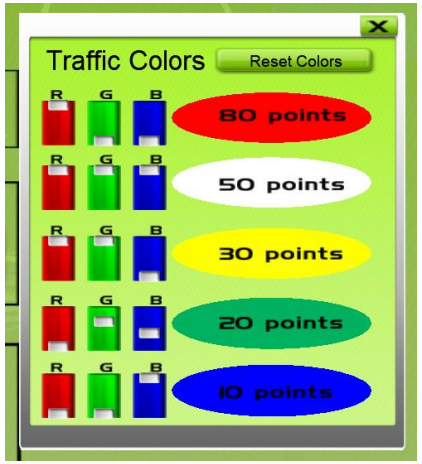
Deuteranopia



Colour Selection Controls

Audiosurf





Worms Armageddon

Red Alert (1994)

Colour Selection Controls

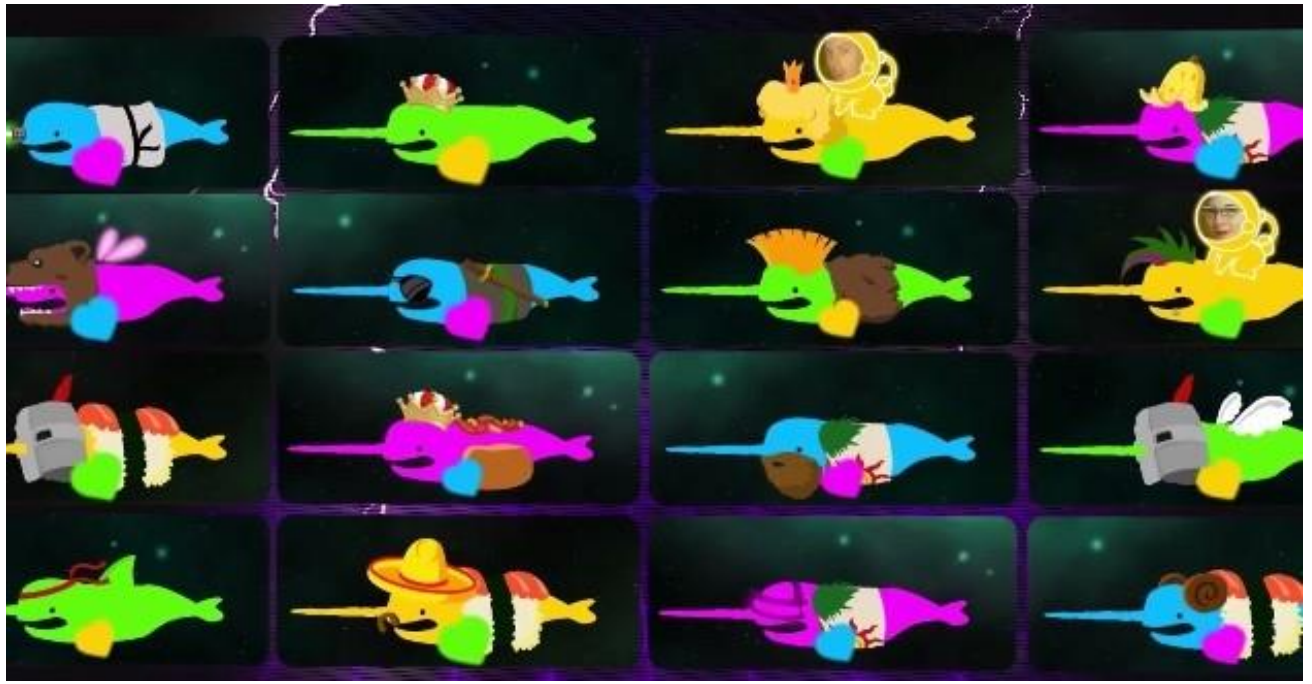
Colour Selection Controls

Colour Selection Controls

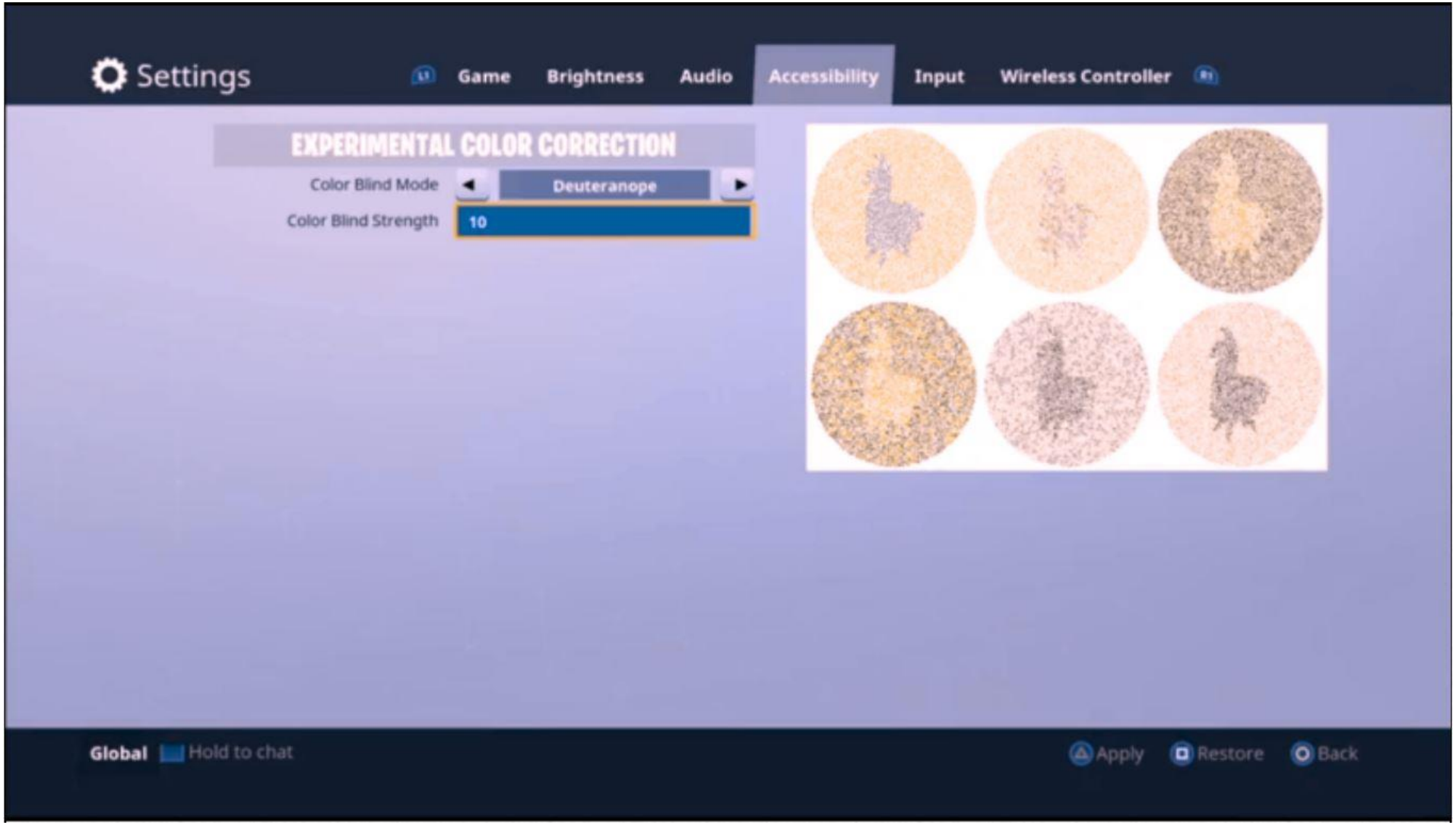
Character Customisation

Gang Beasts

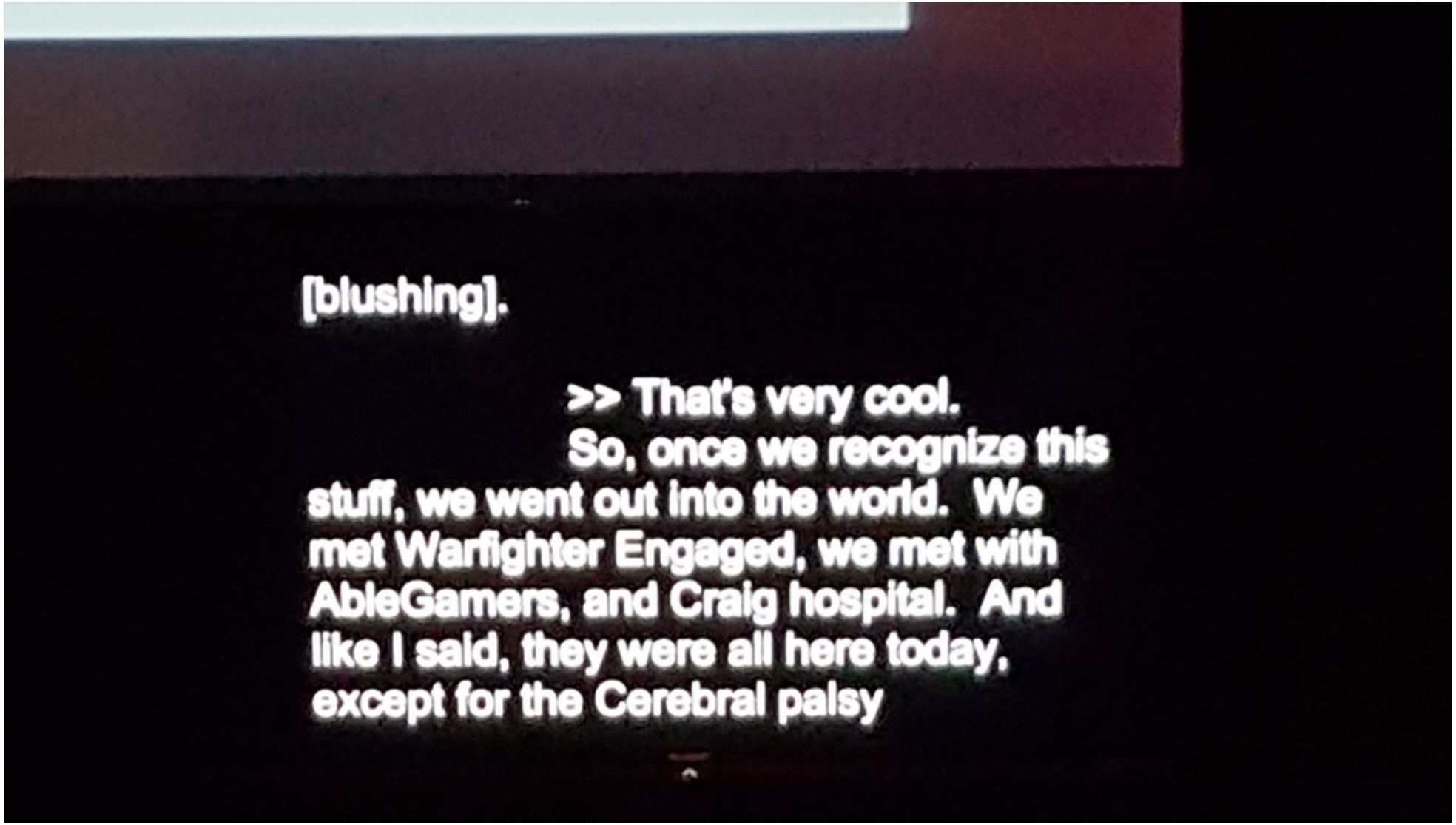
Starwhal



Accessible Accessibility - Fortnite



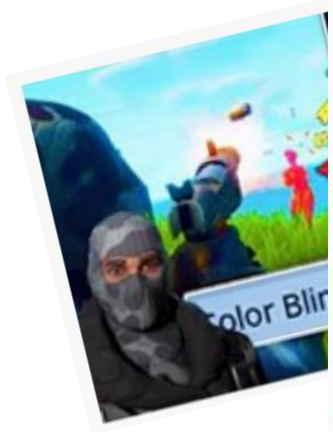
Accessibility beyond colour-blindness



Accessibility beyond colour-blindness

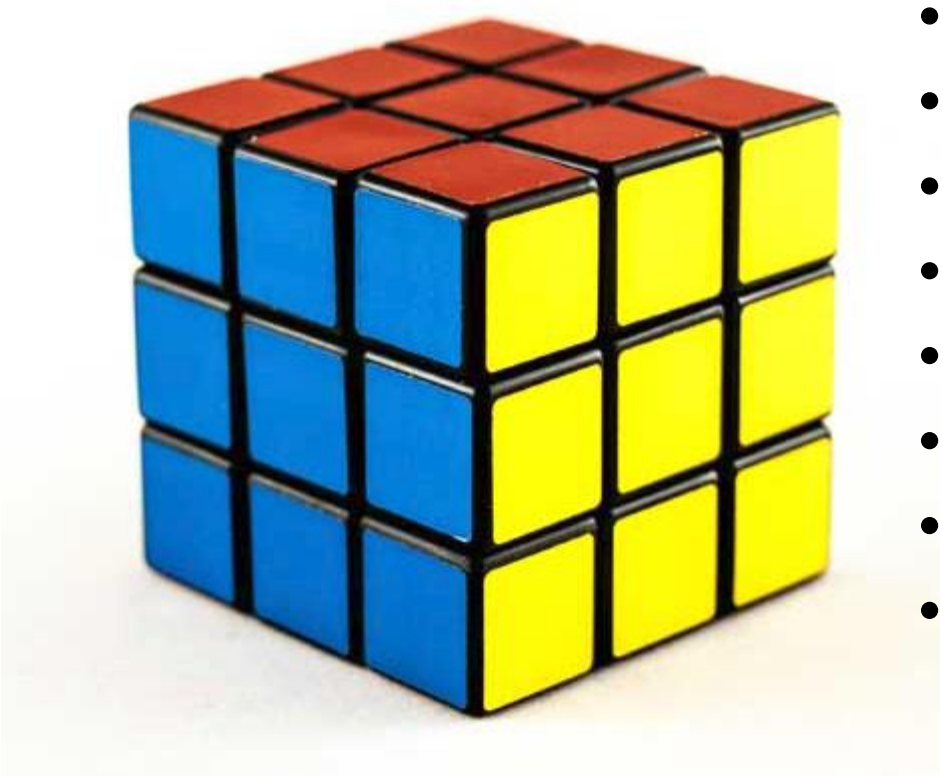
- Improving visual clarity helps colour-blind people…
- …but also helps people with:
  - Achromatopsia
  - Low vision
  - Cataracts
  - Brain injuries
  - Impaired hearing
  - Cognitive disabilities
  - …and everyone else?

Accessibility beyond colour-blindness



y#/ BADGES

Key steps for supporting colour-blindness



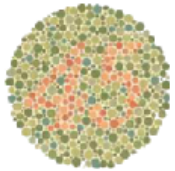
- Don’t just communicate with colour
- Understand your palette/colour features
- Preview tools
- Colour-preset system
- Think about wide-reaching solutions
- Find the best solution for *your* game
- Test with colour-blind players/colleagues
- Make your accessibility options accessible!
- Ask for community feedback

Thank you for listening!

Statistics taken from:
http://www.colourblindawareness.org/

Filtered images created with:
http://www.color-blindness.com/coblis-color-blindness-simulator/

Awesome colour-blind simulator android app:



ColorBlindness SimulateCorrect
Seewald Solutions Health & Fitness
PEGI 3

Trichromacy Deuteranopia Protanopia Tritanopia