GOOD PRACTICE 5
Accessible images in digital content

General information

This best practice offers an overview of the importance of using accessible images within digital content, respectively in a Gamified Learning Path and offers guidelines on how to adapt images for accessibility purposes.

The GLP was designed for middle school students, for testing chemistry knowledge.

Steps for customization

The image tested offers clues for the answer to the mini game linked to this part of the narratives and includes a representation of three chemical elements: Neon, Chromium and Mercury. The colour scheme for the original image included red-orange for first element (Chromium), green for the second element (Mercury), 2 types of blue for the third element (Neon) and background and dark-grey for the atomic representation of the elements (Fig. 1).
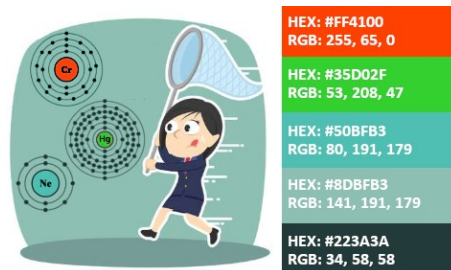

Figure 1 Color scheme of image used in the narration of the GLP

Each colour of the problematic areas from the image have been identified using GIMP application and were tested using the Colours generator for extracting the HEX and RGB codes for further analysing. As it can be seen in Table 1, the codes for Neon element and background has the same values for the green and blue components, therefore these two areas are identified as problematic from the beginning.

Table 1 Colour codes of the tested areas
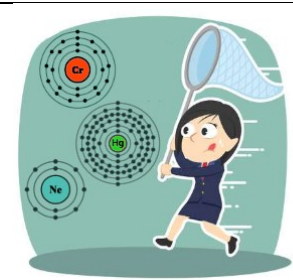
Color picked area	HEX code	RGB code
Chromium	#FF4100	255, 65, 0
Mercury	#35D02F	53, 208, 47
Neon	#50BFB3	80, 191, 179
Background	#8DBFB3	141, 191, 179
Aomic representation	#223A3A	34, 58, 58

Figure 2 provides an estimation of how a real image might be perceived by viewers with perception anomalies. The Cr element and Hg element are projected for Protanopia and Deuteranopia in similar colours and cannot be distinguished. The Ne element overlaps with the background of the image and cannot be distinguished. The Hg and Ne are projected for Protanopia and Tritanopia in similar colours and cannot be distinguished.
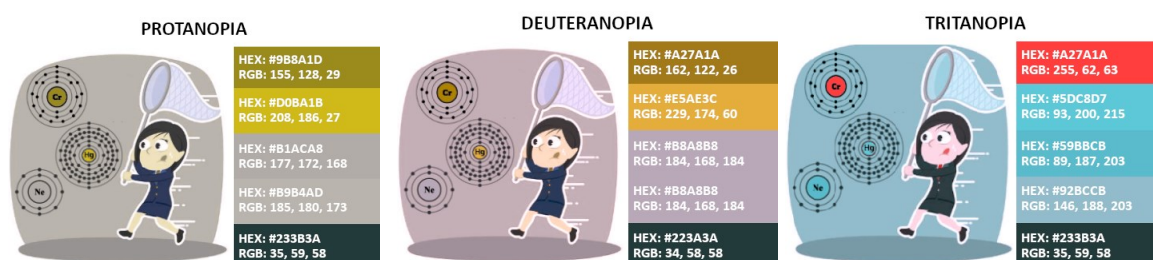

Figure 2 Simulated colour perception

Most people who suffer from colorblindness have some form of red-green colorblindness, such as deuteranopia or protanopia and it can difficult or impossible to distinguish whether a given color is red or green and even if there are used different shades of red or green the contrast between them can be very low and the colors cannot be distinguished.

Table 2 Colour codes of the tested areas

PROTANOPIA

Colour picked area	HEX code	RGB code
Chromium	#9B8A1D	155, 138, 29
Mercury	#D0BA1B	208, 186, 27
Neon	#B1ACA8	177, 172, 168
Background	#B9B4AD	185, 180, 173
Atomic representation	#233B3A	34, 59, 58

DEUTERANOPIA

Colour picked area	HEX code	RGB code
Chromium	#A27A1A	162, 122, 26
Mercury	#E5AE3C	229, 174, 60
Neon	#B8A8B8	184, 168, 184
Background	#B8A8B8	184, 168, 184
Atomic representation	#223A3A	34, 58, 58

TRITANOPIA

Colour picked area	HEX code	RGB code
Chromium	#A27A1A	255, 62, 63
Mercury	#5DC8D7	93, 200, 215
Neon	#59BBCB	89, 187, 203
Background	#92BCCB	146, 188, 203
Atomic representation	#233B3A	35, 59, 58

As it can be seen in Table 2, both for protanopia and deuteranopia, the red – orange and green colors for Chromium and Mercury elements are colored in two differend shades of yellow and also the background and the Neon element colors are similar for protanopia and same for deuteranopia. For tritanopia we have been identified three types of blue shades, for two of the elements and for the background.

A new colour scheme was created and adapted for protanopia and deuteranopia, using a purple based colour for red tones as they are perceived light blue tone and yellow tone for the green colour. For Tritanopia the blue tone of the third element were slightly modified to a more aqua tone. (Fig. 3). We did not modify the background but we changed the contrast of the atomic representation to black colour.
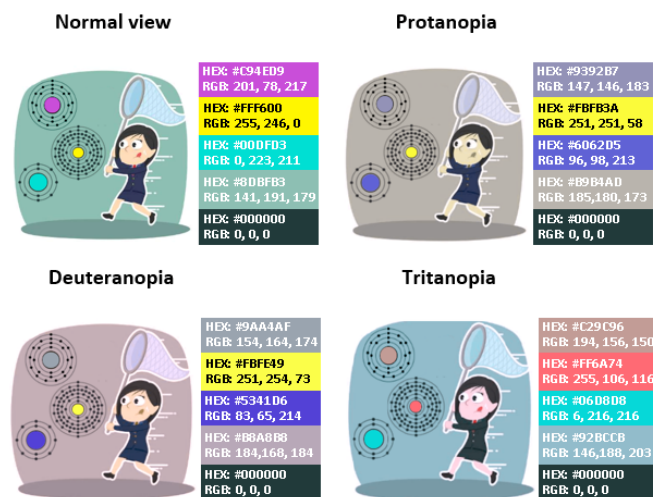

Figure 3. Proposed colour scheme and simulated colour perception

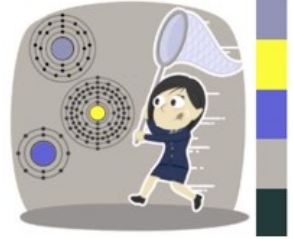*Table 3 Proposed colour scheme and simulated colour perception*

PROPOSED COLOR SCHEME			
	Colour picked area	HEX code	RGB code
	Chromium	#C94ED9	201, 78, 217
	Mercury	#FFF600	255, 246, 0
	Neon	#00DFD3	0, 223, 211
	Background	#8DBFB3	141, 191, 179
	Aomic representation	#000000	0, 0, 0

PROTANOPIA

Colour picked area	HEX code	RGB code
Chromium	#9392B7	147, 146, 183
Mercury	#FBFB3A	251, 251, 58
Neon	#6062D5	96, 98, 213
Background	#B9B4AD	185, 180, 173
Aomic representation	#000000	0, 0, 0

DEUTERANOPIA

Colour picked area	HEX code	RGB code
Chromium	#9AA4AF	154, 164, 174
Mercury	#FBFE49	251, 254, 73
Neon	#5341D6	83, 65, 214
Background	#B8A8B8	184, 168, 184
Atomic representation	#000000	0, 0, 0

TRITANOPIA

Colour picked area	HEX code	RGB code
Chromium	#C29C96	194, 156, 150
Mercury	#FF6A74	255, 106, 116
Neon	#06D8D8	6, 216, 216
Background	#92BCCB	146, 188, 203
Atomic representation	#000000	0, 0, 0

Recommendations

- It is important to adjust the colours of the elements as they offer clues to the answer to the mini game, associated to this part of the narratives.
- For a better understanding the text of the elements should be increased, although it is recommended to avoid using text in images.
- Avoid relying exclusively on colours. If the game requires each player to have a unique colour, adding a unique glyph or symbol is a handy option for colour-blind players.
- Use Monochromatic Colour Schemes in combination with various tones and contrasts to offer meaning to elements in the image and let the player understand the role of different areas
- Do not change all the colours but only these that are not compatible. Changing all of the colours that are distinguishable to those with colour-blindness makes the overall interface of the game look unnatural.

Adaption of the GLP Designing Process

To allow the designer when creating a new GLP or customizing an existing two option have been proposed to be integrated in the designing process.

- Allow the designer when creating the narratives, the possibility to recolour the images using an image section colour picker and providing accessible colour schemes. The colour picker should have integrated default colour schemes for deuteranopia, protanopia and tritanopia and a custom scheme that can offer the option to choose

the colour for the important sections in the images, for those who the pre-sets don't work for.

- Allow the designer to use already accessible images which were previously tested.