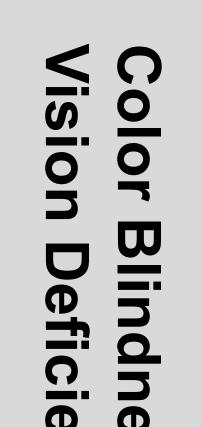
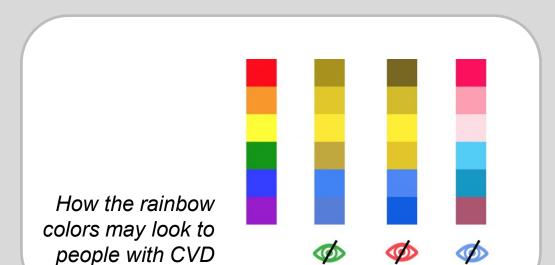
## Using color blindness simulator during user interface development for accelerator control room applications.

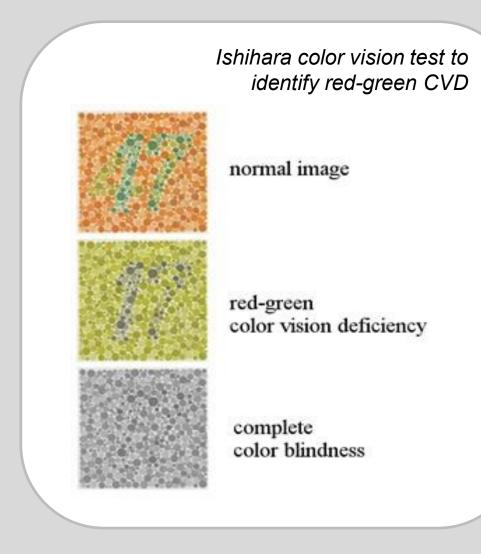
Aytac, Sakire (DESY, Hamburg, Germany)





For normally sighted developers it is hard to imagine how the user interface is going to look to a color blind person.





Approximately 8% of all men and 0.5% of all women worldwide are affected by color blindness.

In most cases CVD is the result of defects in the genes. Unfortunately people with color vision deficiency even do not know that or they are ashamed outing it. This has a

# 5 D



Our human eye contains millions of light-sensitive cells called photoreceptors. Rods are responsible for detecting brightness and cones are sensitive to three certain wavelengths. The mixture of those three different cone types generates our color vision. If any of these cone types is malfunctioning or missing, causes in color blindness (also knows as color vision deficiency).

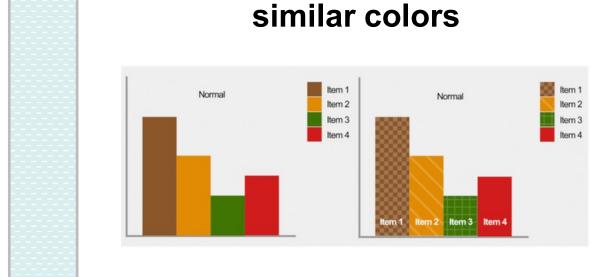
significant impact on their private and business lives.

Red-Green is the most common type of color blindness

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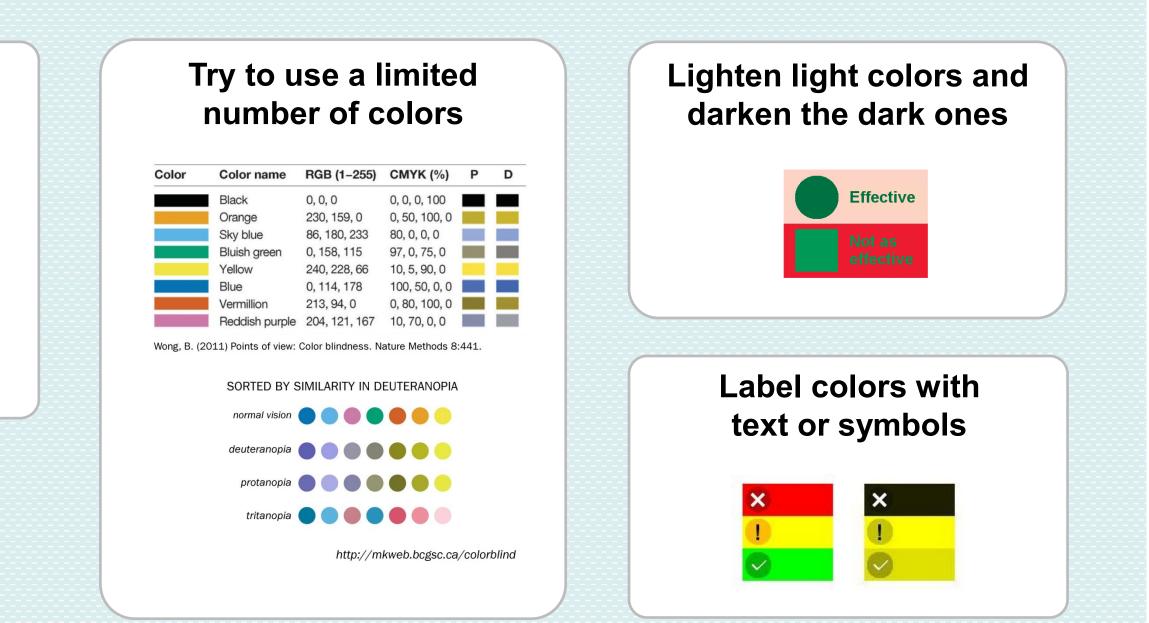
### Our aim is to abolish the barriers to operations applications because people are afflicted with color vision deficiency.

Avoid colors with important information



Increase contrast between

Appling color vision deficiency friendly design practices help us to develop applications accessible for people with CVD



#### Color vision deficiency simulation tools to validate if our design is accessible

Several software tools exist to visualize

Preview of different CVD types.

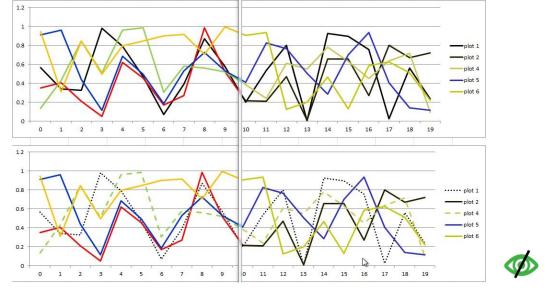
Simulation of a control room application with green, yellow, red colors.

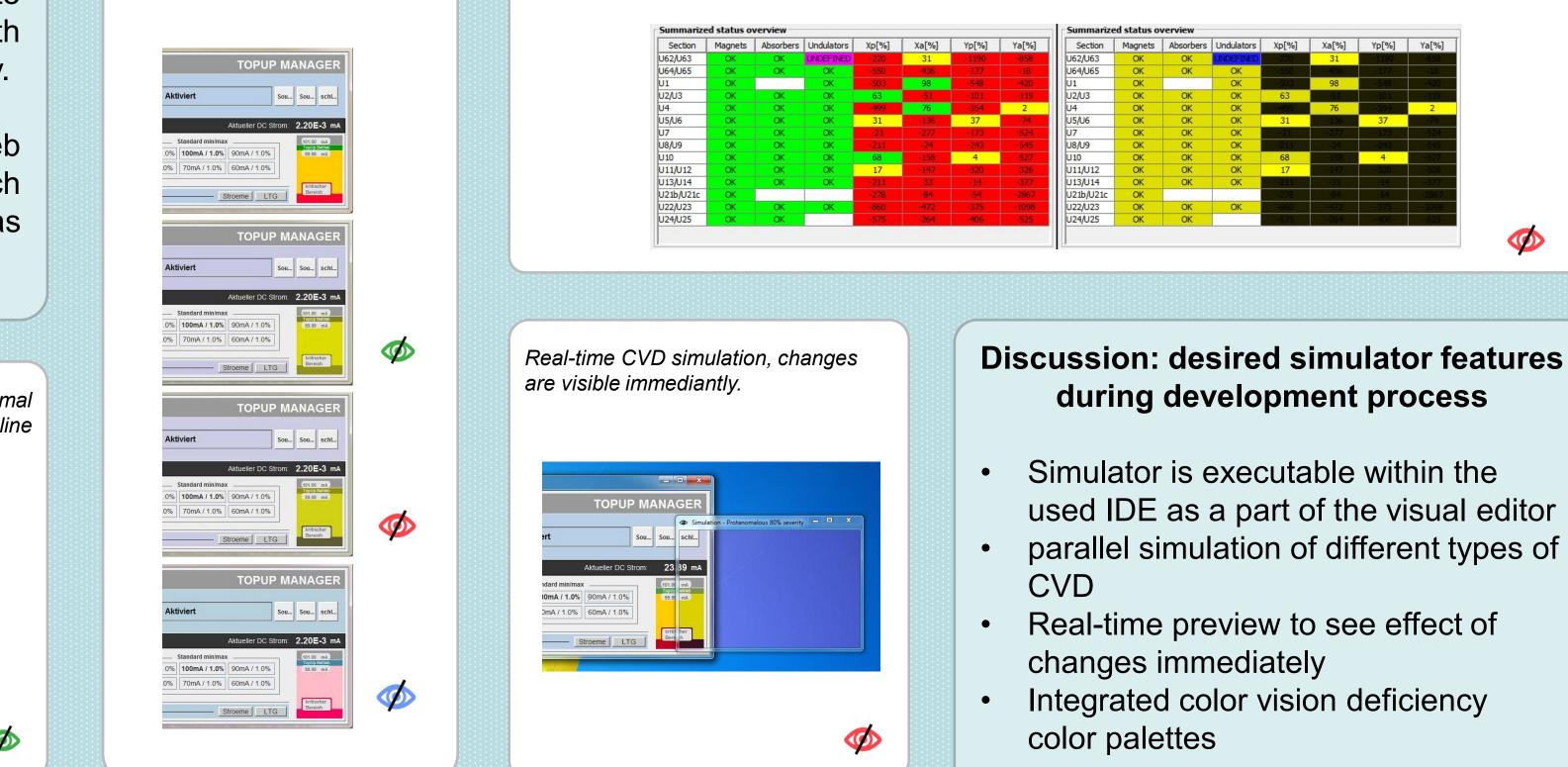


colors as they are perceived with different types of color vision deficiency.

These simulators are available as web applications, smartphone apps, rich client applications, libraries, and as plugins.

Charts are used to get history plots. Upper image is normal colored plot. The lower image is an improved plot by using line patterns. Simulated preview is on the right.





#### Being aware of color blindness in user interface design -> get a enhanced sensitivity on selecting colors

We discovered that adjusted colors for accessibility do not lead to a loss of aesthetic integrity of a design. Simulators helped us to get a good impression of how people with CVD see colors.

In our research we missed the support of visual editors to switch directly from the IDE to a simulated view. In future works we suggest providing plugins for the most popular IDEs in order to preview the CVD simulation in real-time. These plugins should implement the discussed features.

Another future work could be the improvement of available accessibility APIs in programming languages with CVD correction methods. With this, our intension is to enable features within applications, which can be used to individually adjust the application view for users with color vision deficiency.

To produce more effective visualizations, we need to devise techniques helping these people.

Appling the mentioned CVD friendly design practices and using simulators as assistance offer us the opportunity to be creative.



