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The Thalassophile Project: Universally accessible marine science and conservation educational resources

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Accessibility for participants: The Convention on the Rights of Persons With Disabilities

The UN Convention on the Rights of Persons with Disabilities (CRPD) is an international treaty aimed at protecting and promoting individual rights, so combating discriminatory behaviours, signed in 2006.

The Convention fits into the context of the Universal Declaration of Human Rights signed in 1948, and confirms the fundamental principles in favour of persons with disabilities in relation to equal rights opportunity and non-discrimination. In general, the CRPD does not recognize "new" rights for persons with disabilities, but rather aims to ensure that they enjoy all the rights enjoyed by other citizens. A new element, not present in the Convention of 1948, is the reference to the promotion of the availability and use of new technologies, including those of information and communication, with an emphasis placed on the use of the Universal Planning methodology.

The Convention consists of 50 articles and is intended to promote, protect and ensure the full and equal enjoyment of all rights and freedoms by all people, including those with disabilities. Disability is recognized as a condition linked to the existence of barriers of various kinds (physical, psychological, social) that can limit and hinder the life of people with physical, mental, or sensory impairments.

Within the 50 articles, article 9 specifically addresses the topic of accessibility:

1. To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas. These measures, which shall include the identification and elimination of obstacles and barriers to accessibility, shall apply to, inter alia:

a) Buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces;

b) Information, communications and other services, including electronic services and emergency services.

2. States Parties shall also take appropriate measures:

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a) To develop, promulgate and monitor the implementation of minimum standards and guidelines for the accessibility of facilities and services open or provided to the public;

(…)

g) To promote access for persons with disabilities to new information and communications technologies and systems, including the Internet;

h) To promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost.

Transformative action from all citizens for a healthy Ocean

The Ocean Decade[1] provides a common framework to ensure that ocean science can fully support countries to achieve the 2030 Agenda for Sustainable Development, with specific reference to SDG 14 – Life below water[2]. It also provides a 'once in a lifetime' opportunity to create a new foundation across the science-policy interface to strengthen the management of our oceans and coasts for the benefit of humanity. Civil society's participation is a prerequisite for this framework to be implemented: in our roles in communities, in our working lives and in our political engagement, it is essential that every person is well-informed about our oceans and can think – and act – collectively.

- The journey to healthier oceans runs on a two-way street: local communities are a key knowledge source of our oceans, and citizens themselves transform policy into behavioural change. The transformative nature of the Ocean Decade framework will promote and facilitate ocean science and conservation that:
- "Strives for generational, gender and geographic diversity in all its manifestations,
- Is communicated in forms that is widely understood across society and triggers behaviour change,
- Is shared openly and available for re-use."[3]

[1] United Nations Ocean Decade https://en.unesco.org/ocean-decade
[2] Sustainable Development Goal 14 https://sdgs.un.org/goals/goal14
[3] The Science we need for the ocean we want: the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) https://unesdoc.unesco.org/ark:/48223/pf0000265198

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Education for Sustainable Development (ESD)

If human society is to overcome the growing challenges posed by climate change, our collective action must first be stimulated by education and evidence-based information. The ESD 2030 Roadmap is linked to SDG 4 (Quality Education) and gives us a Framework for Action which provides guidance for the implementation of ambitious climate change goals and commitments. UNESDOC states that the “ESD employs action-oriented, innovative pedagogy to enable learners to develop knowledge and awareness and take action to transform society into a more sustainable one.”[4] Transforming sustainable development learning environments, building capacities of educators and accelerating inclusive local level action are all priority areas for the ESD 2030 Roadmap.

The Universal Design for Learning: A design for all

Universal Design for Learning (UDL) is a teaching approach aimed at providing equal opportunities for the success for all learners. The fundamental principle of UDL is that there isn’t a ‘standard’ person and that each individual learns differently based on their personal story and growth, and on multiple other factors: physical, emotional, behavioural, neurological and cultural. The aim of Universal Design for Learning is therefore to improve the educational experience of all by introducing more flexible methods of teaching and assessment and creating truly inclusive materials that can be adapted to all types of people.

In other words, UDL promotes the use of a variety of methods and design in order to remove any barriers to learning and ensure that people learn in ways they are most comfortable with. Each person has specific ways of engaging and specific methods of acquiring information - for example, while some enjoy reading a text, others learn by listening.

UDL is rooted in Universal Design: it is a methodology which aims to conceive flexible products and accessible environments in order to be possible for all to participate in an equal way.

[4] UNESDOC Education for sustainable development: a roadmap https://unesdoc.unesco.org/ark:/48223/pf0000374802

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Universal Design's principles are:

1) Equitable Use – The design should be useful and marketable to people with diverse abilities.
2) Flexibility in Use – The design should accommodate a wide range of individual preferences and abilities.
3) Simple and Intuitive Use – User-friendly approach, regardless of the user's experience, knowledge, language skills, or current concentration level.
4) Perceptible Information – Effective communication of information necessary to the user, regardless of ambient conditions or the user's sensory abilities. For example, a video that includes audio and subtitles.
5) Tolerance for Error – The design should minimise accidental or unintended risks in the environment.
6) Low Physical Effort – The design should be efficient, comfortable, and with a minimum of fatigue.
7) Appropriate Size and Space for Approach and Use – Size and space should be accessible for all regardless of physical characteristics such as size or mobility.

The goal of Universal Design is to maximise usability by individuals with a wide variety of characteristics.

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Specific Adaptation for d/Deaf Persons

When we talk about d/Deaf people, we refer to people who cannot hear and that communicate in a different way. How they communicate differs according to the level of deafness they have, education received, the kind of family they have grown up in, when they became deaf and many other factors. Although the popular idea about deaf people is that they cannot speak either, it's important to remember that deafness does not exclude competences in speaking, or in the production of sounds.

We use a different letter, with capital "D" or lower "d", to distinguish if we refer to Deaf people who consider themselves as belonging to a cultural identity that speaks in Sign Language (SL) or to deaf people seeing the loss of hearing as a disability to cure (using hearing aids, speech-therapy, cochlear implants and so on). Of course, these two points of view should not exclude different ways to approach deafness, for example to find benefits in the use of hearing aids and in speaking sign language.

Whatever may be the perceptions of deafness or an individual's needs, in general d/Deaf people have significant difficulties in receiving external information both through spoken and written language, because the information is not acquired spontaneously. For that reason, it is important to keep in mind some general suggestions to improve communication and include everyone in the pedagogical process:

- Catch the visual attention of the deaf person before talking;
- Put yourself in front of the deaf person while you're talking or, if you are in a group, stand in a circle;
- Do not put yourself in places where a point of light is at your back, for example a window, or in poorly lit places;
- Pay attention that no object is between you and the deaf person during the conversation, so that the view is not obstructed;
- Do not chew or keep a hand in front of your face, so that lipreading is possible;
- When the person is accompanied by an interpreter, maintain eye contact directly to the deaf person, not with the interpreter;
- When possible, reduce background noises and control the discussion so that only one person is speaking at a time;
- Support your conversation with face and body expressions in order to make the message clear.

In this short framework we will focus on the accessibility of plain texts and the general rules for official videos in SL.

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a. Plain written languages

'Adapted easy format' means changing the way the content is explained, but not making it less meaningful: In plain written language, the user checks that vocabulary and style is clear in meaning, and immediately comprehensible by all.

Since deafness depends on the identity and on the story of each person, the level of knowledge of a language is different, too. In general, we can follow simple recommendations that simplify written language for all, in the framework of Universal Design.

Same content, but in a different form. That means:

- Use of high-frequency words (everyday words);
- Add of some pictures to support the text;
- Basic sentences, coordinated, not subordinated or passive forms because the basic order of the sentence is changed;
- Explanation of specific terms related to the subject.

Some concepts in ocean science, climate change and conservation might be new to many audiences, or even misunderstood. Double check that any new terms you use have been clearly defined. This means:

- Use a story to explain new ideas – explain marine species classification with reference to classification in everyday terms. For example, the shopping in your basket could be classified by food type, by weight, by colour or by brand. In the same way, it helps researchers to classify fish by species.
- New knowledge is best understood when it is built on existing knowledge, but there are many myths and uncertainties about climate change and the role of our oceans. Why not present potential misconceptions to students straight away and ask them which is right and why the others aren't?
- To motivate students to learn new terminology, open a curiosity gap: tell them what they will be able to understand by the end of this presentation.

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b. Sign Language videos

In the Deaf signer community, videos are the main tools to be used to communicate, both in informal and formal contexts. In informal communications, simple and homemade videos are exchanged, without attention to clothes and backgrounds. In formal communications, strict steps are taken, including study of the text and translation into Sign Language, recording in a studio, editing and uploading to YouTube.

In particular, the recording in the studio has to be made with suitable lights and in front of a uniform colour that can be blue or green in order to be replaced with another colour or images.

Here, for example, the recording studio in the Turin Institute for the Deaf (Italy):

In the photos above, two walls of the recording room are shown: one in blue, one in green. Artificial light is required to obtain a homogeneous light, so the window is obscured by a black curtain.

Usually, clothes are dark-coloured in order to allow one to see the hands clearly and emphasise the hand gestures. The person could be in the centre of the frame or, if images have to support the communication, on one side. Below are a couple of examples with supporting YouTube links:

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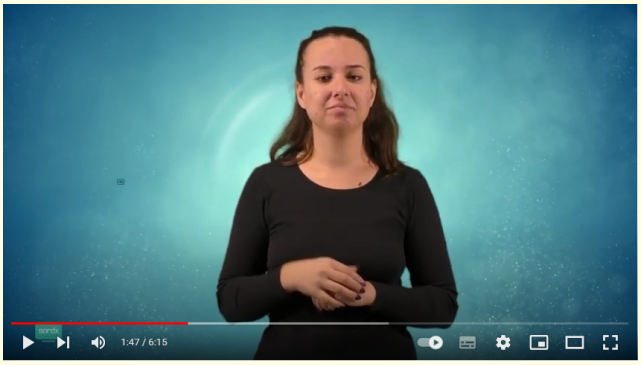

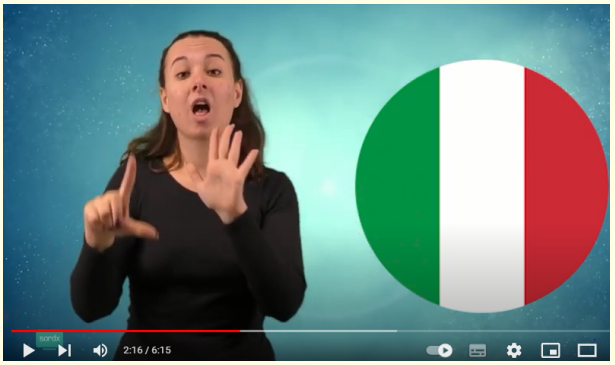

https://youtu.be/q8iA-m8qROk: These two captions are taken from a video explaining some news and views from Deaf Culture.

https://youtu.be/tBc4FILscrs

Video for children: the background is different according to the target group for which it is produced.

c. Subtitles recommendations

Subtitles are normal for deaf people, but also for people with hearing loss (those who lose their hearing in adult or old age): in this last case subtitles can also work as a support to understand a video. There are rules about the accessibility of subtitles connected mainly with the readability:

- Good colour contrast between subtitles and background. Subtitles should not be on the images, but on a plain background on a single colour. For example, white written on a black background.

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- Sentences should not be too long. Eyes must have the time to read the whole line without stressing. Usually, subtitles are composed of two lines, a maximum of 40 characters each.

- When subtitles are added in movies, different colours are used according to the main actors that are speaking, to make it clear which character is speaking.

- Writing subtitles is neither easy nor quick. YouTube allows to automatically caption the subtitles from the sound uploaded with the video, but they have to be revised and improved. Also, some editing softwares have good subtitle functions that should then be controlled and improved by a human reviewer.

- Use an accessible font: a free one like Arial and Calibri or a paid one (for companies, free for people with dyslexia) like EasyReading (https://www.easyreading.it/en/).

Specific Adaptations for Blind and Partially Sighted persons

'Lay people', or people who are outside of the deafness/blindness/educational world, tend to confuse the needs of d/Deaf people and visually impaired people. In reality, the tools needed by these two target groups are different and they coincide only when resources are universally designed for all. For example, 3D statues to touch, audios and images are helpful for all to support the mental load involved in the learning process.

Also, the visual impairments are differently interiorized: in contrast to Deaf people, people with visual impairment identify themselves as people with disabilities and don't talk about themselves as "blind people" with capital "B" as it happens for the Deaf community. The easiest explanation is that IT happens because they don't have a different language (like Sign Languages) and the sense of community tends not to be as strong as in Deaf communities.

In order to make digital content accessible for people with low vision, refer to the **Accessibility Requirements for People with Low Vision**[5] document which "describes what people with low vision need for electronic content, tools, and technologies to be accessible. It includes an overview of low vision and describes specific user needs".

[5] Accessibility Requirements for People with Low Vision: https://www.w3.org/TR/low-vision-needs/

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In this short framework we will focus on the audio description and the colour contrast specific for visually impaired people.

a. Audio description

Generally, ‘audio description’ is a method of increasing the audible accessibility of the visual images of theatres, television, movies, and other art forms for people who are blind or visually impaired.

Audio description in cinema is usually a voice that talks between the dialogues of the characters to describe all the visual aspects and actions.

Audio description in museums are the audio clips next to displays, moving the visitor along a cultural path. These audio clips should be short and clear and give the essential information on the work of art or the cultural space. To make it even more accessible, the exhibit could have a tactile support with the relief of what it is explained.

Below is an example from the Modern Art Gallery (GAM) in Turin (Italy): this is one of the ten tables made accessible for visually impaired people and is not the only accessibility method used. The work of art of Caghall has been made in relief and each colour and part has a different dot texture; the title of the work of art is written in Braille, next to the picture; on the bottom right a QR code allows the audience to connect to the audio description. Importantly, the audio description explains to the person what they are touching, from the top left, to the right and at the bottom.

https://www.gamtorino.it/it/gam-for-all

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b. Colour contrast

Each colour has a code by which it can be identified and from which it is possible to trace the proportion of the primary colours – red, green and blue (RGB) – that compose it. The most-used code in HTML, therefore, at the computer level and in the construction of the web, is the "hexadecimal code" characterised by six alphanumeric characters preceded by the # symbol.

Without going into the specifics of other technical considerations, this code is important because it allows users of colour to understand if two colours can have a good colour contrast, These contrasts were established 4.5: 1 by the latest guidelines for accessibility of WCAG 2.0 web content of the 2008 (Web Content Accessibility Guidelines).

There are sites where colour contrast can be evaluated by entering hexadecimal codes, for example: https://contrastchecker.com/ https://snook.ca/technical/colour_contrast/colour.html#fg=33FF33,bg=333333 and https://webaim.org/resources/contrastchecker/

Here some examples:

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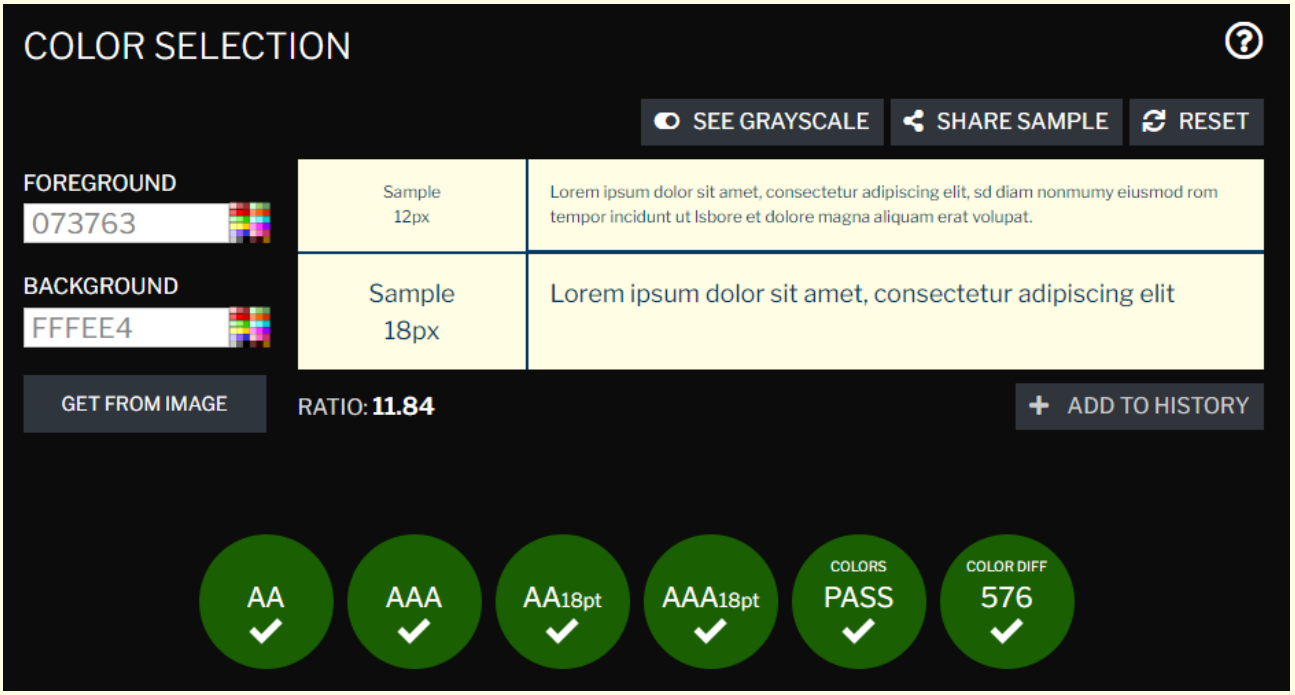
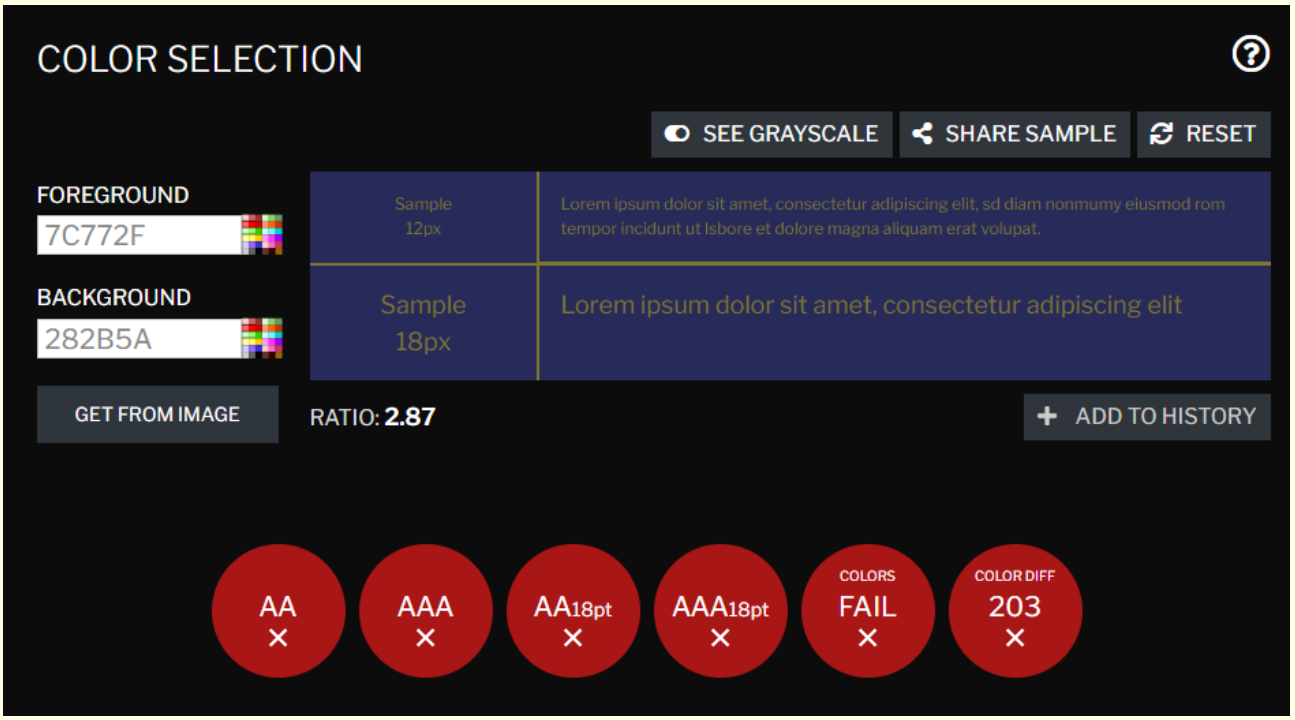


The image above shows the hexadecimal numbers of the background colour and font colour used in this Framework.



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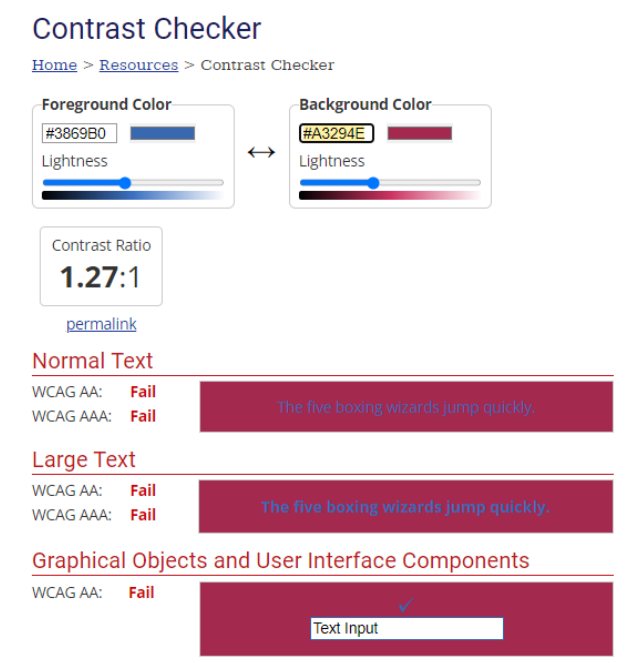

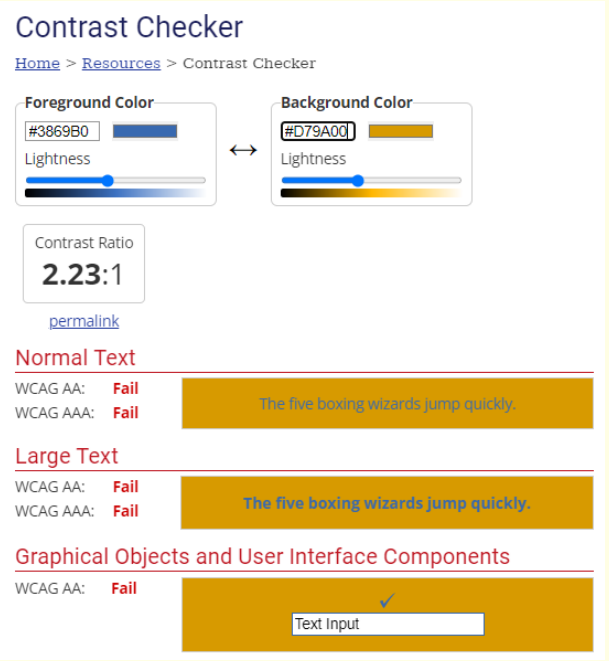

c. Daltonism and accessibility

Colour blindness is a genetic defect which reduces the ability to distinguish specific colours.

Without a doubt, colour management represents the most interesting challenge when adapting material for colour blindness, precisely because the number of colours to use is so limited. This is because many colours have little contrast (for example red and green). They appear very similar to each other, causing confusion and making it difficult to distinguish between objects in these colours.

The most common forms of colour blindness are:

- Protanopia: insensitivity to red colour;
- Protanomaly: poor sensitivity to the colour red;
- Deuteranopia: insensitivity to the colour green;
- Deuteranomaly: poor sensitivity to the colour green.

Cases of insensitivity or poor sensitivity to blue and yellow colours are much rarer.

As a practical tip, remember to reduce the proximity of colours to each other, especially the very bright ones (such as green and red). You could also use black and white images where this is possible and relevant.

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Crucial graphic aspects for all

Graphic aspects and layout rules of the written texts are important to improve accessibility for everyone, not only people with visual impairments or dyslexia. Think, for example, about exhibitions in museums in which the explanatory tables are difficult to read because of a bad font or a bad colour contrast or a bad text distribution on the page. Here are some suggestions and recommendations:

Basics

- Use **fonts** like Arial, Open Sans, Calibri (free fonts) that use a combination of sans serif letter and serif letters, or EasyReading https://www.easyreading.it/en/. This font has been studied and designed for being accessible for people with dyslexia. EasyReading is free for non-profit organisations after an agreement, whereas private and profit bodies pay a fee.
- The font **size** should be **between 11** (text) **and 14** (titles).
- Use an adapted **line spacing of 1,15**.
- The text should not be justified √ **align to the left.**
- Do not use *italics*, underlining and CAPITALS.
- **Put text in bold** to highlight it.

Structure

- **Break down** your **text** into small, easily readable paragraphs and short, clear sentences.
- **Structure** your **text** with clearly distinguishable titles, subtitles, and body text.
- Present the important items in **bullet points.**
- Ensure enough **white space between sections.**
- Use **page numbers.**
- For long documents include a **contents page**.
- For long documents include a **short summary of each section** for example in a box to provide effective emphasis of the most important information.

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Illustrations and Design

- Use colours to separate information and **be consistent in your colour codes.**
- Use clear **visual elements** without overloading them, to illustrate concepts and support the text.
- Ensure that the **images used match the text**.
- Use **descriptions to explain diagrams** and other illustrations.
- Use **off-white or pastel background colour** whenever possible.
- Make sure the **contrast** is good enough for the content to be **readable**.

Writing style

- **Be consistent** with use of language and writing style.
- Use simple language and **stick to facts**.
- **Explain acronyms** and difficult words.
- Try to **start and finish a sentence on the same page**.
- **Do not split a word** across two lines with a hyphen.

Other

- **Avoid distractions** and unnecessary information.
- **Print on matt paper** (not gloss paper) and **on one side only** to avoid having to turn pages.
- Use a **multisensory approach**: wherever possible, provide different ways for learners to interact with the content (touch, manipulate, play, etc.).
- Focus on **logic** rather than memory.
- Provide **several options** for how **to perform a task**.

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Tactile Pedagogy

Touch and movement can make it easier for some students to process new and difficult information. Educators should engage these students in activities that require movements and hands-on activity because they learn by doing. For example, the Antarctic Exhibit in Bremerhaven's Klimahaus (Figure 1) is a separate, frozen room so that participants can experience the real-world conditions of the ecosystem, and can better appreciate the conditions of climate scientists who work to understand frozen oceans. Before you exit the room, you are invited to put an ungloved hand into the holes in the iced wall.

Figure 1. Bremerhaven Klimahaus, Germany: Frozen wall in Antarctic Exhibition

https://www.klimahaus-bremerhaven.de/

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