

FLEX PICTURE EBOOK

**A Digital Book for
Inclusive Learning**

**Guidelines for adapting illustrations for children
with visual impairments and/or learning disabilities.**

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Introduction

The simplification of illustrations plays an important pedagogical and inclusive role in the development of literacy skills. Children with visual, learning and cognitive impairments are not only integrated into the learning experience, they also better understand the content and participate in learning activities. For example, children with visual impairments can benefit from more perceptible illustrations, such as those with solid colours and sharp outlines. Similarly, children with Attention Deficit Hyperactivity Disorder (ADHD) may find highly detailed illustrations complicated and distracting, so a simpler adapted illustration can reduce sensory overload and allow them to concentrate on the main subject.

This document provides guidelines and methods for specifying and creating effective picture adaptations in picture books for young literacy learners. Although this document describes strategies for simplifying visual content and improving its perceptibility, it is important to remember that the main aim is to communicate a message, through illustrations, in the most comprehensible way possible for readers with special needs.

Suggested reader profile

The professionals who can benefit most from this document are authors of children's books, visual artists and teachers who work with illustrations with learners at the literacy stage. Illustrated book authors can find guidelines for creating inclusive illustrations that can be easily adapted to readers' specific abilities. Visual artists will find recommendations for adapting illustrations to audiences with specific abilities and for creating adapted illustrations. Finally, teachers will find the suggested procedure for understanding how to adapt illustrations useful.

Procedure for adapting the illustration

When it comes to adapting illustrations for disabled children, the process can begin before or after publication. Ideally, the adaptation of illustrations should be taken into account at the ideation stage, so that the illustrations can be easily adapted to meet specific needs. However, it is also possible for adaptation to take place after publication, for example when adapting illustrations from a book that has already been published. In this case, additional measures must be taken to ensure that the purpose and essential messages of the illustrations are given priority in the adaptation, while preserving the author's style.

In both cases, it is important for illustration designers to adopt an inclusive approach throughout the creative process. In this way, they provide inclusive illustrations that appeal to a wider audience and are easier to adapt to readers with specific abilities.

Although there is no single procedure for adapting illustrations, this document proposes a recommended action plan that professionals can use as a starting point.

1. **Audience, reader needs and illustration requirements.** Specify who the target audience is and what their needs are. With this information, it is possible to know the requirements that the adaptation must meet.

For example, the target audience is visually impaired children who are unable to perceive small details. As a result, the objects in the adaptation must be easy to identify and contain no small details.

2. **Purpose and message.** Clearly describe the purpose of the illustration and the main message it conveys. If this is addressed during the creative process, it is easier for the designer to specify the purpose and messages. However, if the illustration has already been published and the creator cannot be contacted, it is necessary to carry out a thorough examination of the illustration and the publication medium in order to clarify the purpose and messages.

For example, a treasure hunt storybook with an illustration of a map that needs to be adapted. In this stage, we see that the illustration is at the beginning of a children's adventure book. It shows a map of an island with a signposted path ending in a large "X". The aim is to give the young reader the context for the story that is about to be told. The main message, meanwhile, could be defined as a map of an island with a signposted path.

3. **Resources for addressing the public.** There are many resources available to make illustrations attractive to the target audience and effective in conveying their messages. The aim is to check whether the resources used are still effective for the adaptation's target audience. If so, these resources must meet the requirements of the adaptation. If not, they must be modified or, if the general approach is not appropriate for the adaptation target audience, a more effective strategy must be used.

For example, the illustrator could have chosen bright colours because the target audience, young children, tend to prefer this style. Then, if there isn't enough colour contrast between the significant objects, the colours used in the adaptation should be more contrasting.

4. **Apply strategies for adapting illustrations.** Visual artists can apply guidelines and best practices for accessibility and simplification of visual content while ensuring that the requirements specified in the previous steps are met.

Guidelines for adapting illustrations

There are many guidelines and good practices concerning the accessibility of digital images and adaptations for audiences with specific abilities. However, the focus here is on illustrations in illustrated children's books and on audiences with visual and cognitive impairments.

1 - Target audience and needs

The first step is to recognise the experiences of the target audience. It is always advisable to consider a wide range of people with different abilities. In this way, the resulting illustration is less likely to create barriers for some. The recommended approach is to consider the "special cases" of the target audience and then generalise. Usually, people who are unable to read printed text and images are the most affected.

A good starting point for defining requirements is to apply the requirements of the general accessibility guidelines. These provide a basis for ensuring accessibility. We can then look at the specifics, i.e., the particular abilities, circumstances and needs of the target audience. In this case, we're talking about children learning to read and write. Once we have shown understanding and

learnt more about them, we can define the adaptation requirements once we have full knowledge of the facts.

Accessibility requirements for digital images

Digital illustrations are non-textual digital elements. These elements must at least meet the accessibility requirements for digital content. The following requirements are based on the [Web Content Accessibility Guidelines](#) (WCAG), which are the industry standard. This is a good approach to making illustrations accessible to as many people as possible.

- There must be an alternative text (AltText). It must convey the information contained in the illustration. See [WCAG - 1.1.1: Non-textual content](#).
- Colour should not be used as the sole means of transmitting information. Bear in mind people who are colour-blind. See [WCAG - 1.4.1: Use of colour](#)
- Colour contrast must be high enough to distinguish adjacent elements. See [WCAG - 1.4.14 Non-textual contrast](#).
- <https://www.w3.org/WAI/WCAG21/Understanding/images-of-text.html> Illustrations must not contain any significant text. All text must be machine-readable and must not be part of an image. This allows the use of certain reading aids such as screen readers. See [WCAG - 1.4.5: Text images](#) and [WCAG - 1.4.9: Text images \(without exception\)](#).

Accessibility requirements for specific audiences

Accessible digital images may not be suitable for some people. Adapting illustrations to specific disabilities addresses this problem. Each type of disability requires different approaches and accessibility requirements. Here are the most relevant requirements for each type of reading disability.

Blindness

Blind readers receive visual information through other senses such as audio and touch. They frequently use technical aids such as tactile images, screen readers and Braille displays. To provide them with accessible illustrations, it is essential that the content is machine-readable or that there is an equivalent alternative that the technical aids can handle. Here are some accessibility requirements for adaptations:

- The illustration is accompanied by a short alternative text (AltText) that conveys the main message.
- If the illustration is complex and contains a quantity of information that cannot be summarised in the AltText, it should be accompanied by a long description text.
 - just before or after the illustration appears
 - a means of directing the reader to this text, for example a link to the long description.
- As an option, it is necessary to enable adaptation to the tactile image :
 - Use an extensible vector graphics format (SVG)
 - The illustration must contain the smallest possible number of elements.
 - It should not contain decorative elements or insignificant details.
 - The objects represented must be simple shapes.

Low vision

This group covers a range of problems related to vision loss. Accommodations to overcome barriers to accessibility depend on the level of the disability.

- Severe low vision. People with this disability can perceive light, certain shapes and certain colours. But they need major adaptations.
 - The illustration should contain as few elements as possible.
 - The level of detail should be minimal. Use only basic shapes to convey the main message.
 - Colour contrast must be particularly high.
 - There must be an alternative text.
- Moderate low vision. People may have difficulty perceiving printed content. Eyeglasses may not be enough. They may also be unable to distinguish colours.
 - The illustration should limit the number of elements. Only elements that convey relevant information should be taken into account.
 - The level of detail must be low. Only simplified objects underlined in bold are used. The various objects must be separated.
 - Colour contrast should be high.
 - The image must be high resolution or scalable.
- Mild low vision. This is a difficulty in reading small print. It may also be difficult to distinguish between similar colours.
 - The illustration must not contain any decorative elements.
 - Relevant objects are represented with minimal or no simplification.
 - Colour contrast must comply with accessibility standards.
 - The image must have sufficient resolution to be enlarged. Accessibility standards must be respected.

Cognitive disability

This disability is also known as intellectual disability. It is a group of conditions that affect intellectual functions. It can be difficult to remember, solve problems and make decisions in everyday life. The emphasis should be on reducing complexity. Simpler illustrations should be accessible to people with this disability. Here are some requirements that might be suitable:

- Simplicity: The objects represented must be basic geometric shapes or groups of basic geometric shapes that are simple and clearly defined.
- Small number of elements: Only significant elements should be displayed.
- Low level of detail: Details are used sparingly to highlight the main objects.
- Colours that help to understand: With good contrast, use colours that can be naturally associated with the object to reinforce understanding and retaining information.

Learning disabilities

Also known as learning difficulties. These are problems relating to the acquisition, processing and use of information. This disability generally has an impact on specific academic areas. Some examples of this type of disability are dyslexia and attention deficit hyperactivity disorder (ADHD). The key to an illustration that is accessible to readers with this disability is to focus on the main subject and avoid distractions. Here are some requirements:

- Simplicity: It should be simple and uncluttered to avoid overwhelming the reader.
- Minimum number of elements: only the most important objects should be represented.
- Detail is used to improve comprehensibility: the level of detail should be low. But it can be higher if it improves the comprehensibility of the main subject.
- Limited number of colours with good contrast: colours should be used to enhance the perception and understanding of the main subject.
- Alternative text: this type of text is always required by the general accessibility guidelines. However, it should be noted that this group of readers can benefit greatly from obtaining information in several ways.
- Consistency: if other illustrations need to be adapted, for example if they are part of a book, they must all have a consistent style and layout.

2 - Objective and message

The aim is to produce an adaptation that can effectively convey messages to an audience with specific abilities. It is therefore essential to clearly specify its purpose and the messages it conveys. These fundamental elements of the illustration are necessary to make an informed decision about the approaches and techniques likely to produce an effective adaptation.

If the author is involved, this stage is straightforward. It is the author who clearly defines the objective and the message. If the author is not involved, the professional responsible for the adaptation has to find out what the message is. Here are a few techniques for doing this:

- Look for the genre: There are many genres in children's literature. Be as specific as possible. Although this study focuses on illustrated children's books, it can be applied to other types of publications.
- Consult the publisher: The publishing house can provide additional information about the work and the author.
- Read the accompanying text. The textual information attached to or surrounding the illustration can provide valuable information. It can provide context and, hopefully, the main message, i.e., a well-written AltText.
- Analyse the illustration. Identify the elements that convey meaning. And rank them in order of importance.

3 - Addressing the public

Illustrators use visual resources to create works that are more attractive and more effective in communicating a message to a specific audience. Here are some of these resources for young children:

- Bright, contrasting colours to attract attention and convey emotion.
- Simplified shapes representing real objects.
- Consistent use of textures to convey meaning and enhance involvement in a series of illustrations.
- Play with the size of the objects to highlight them and arouse interest.
- Use of metaphors to simplify complex ideas.
- Play with perspective to improve comprehension and alertness.
- Use of typography to convey tone and mood.



They need to be examined carefully, as they may not be suitable for a number of readers.

1. Some visual resources may not meet basic accessibility requirements. For example, the exclusive use of colour to convey meaning, such as emotions, creates a barrier to accessibility for many people, such as colour-blind readers.
2. The target audience of the adaptation has other needs that must be taken into account. For example, enlarging certain important objects may make the illustration more suitable for readers with learning disabilities, but this may be counterproductive if the illustration's target audience is visually impaired readers who cannot perceive other relevant objects that have been reduced in size.

4 - Strategies for adapting the illustration

During this final stage, the approach to be adopted for the adaptation is defined. The information needed to make informed decisions in this respect comes from the previous stages. The illustrator has the following elements at his disposal

- The capabilities and needs of the target audience.
- Accessibility requirements for adaptation.
- Purpose of the illustration.
- Messages to be conveyed by adaptation.
- The visual resources used in the original illustration and the potential barriers to accessibility for the adaptation audience.

The guiding principle must be to modify the illustration as little as possible while conveying the messages to the new audience in an accessible and effective way. To achieve this, the illustrator must :

1. Make the changes that have the least impact to remove barriers to accessibility.
2. Find a way to improve public perception and understanding of key messages.

Creation of illustrations with interactive simplification for new digital books.

Understanding the framework

The aim is to create interactive illustrations that enhance learning for disabled children by offering multi-sensory exploration, personalisation and a focus on key concepts. The next step is to decide how many levels of simplification/understanding to implement. In the FPB project, 5 levels are used:

1. **Original illustration:** Full of detail, colour and complexity.
2. **Reduced detail:** Non-essential shadows and textures have been removed.
3. **Flattened perspective:** The focus is on 2D shapes, perspective is limited and the remaining textures are removed.
4. **Targeted message:** removal of non-essential illustrative elements and improved contrast.

5. **Essential message:** A highly simplified representation of only the most important objects, with the most appropriate colour contrast.

Another approach and another number of levels are acceptable, just bear in mind:

- A user-centred mindset: trying to adapt as much as possible to the audience;
- Inclusive approach: involving users with different abilities and asking them for feedback.

The technology stack used by the illustration includes : SVG, CSS and JS.

- **SVG (Scalable Vector Graphics):** Ideal for layered illustrations, maintaining clarity at all levels of simplification.
- **CSS (Cascading Style Sheets):** Controls colour and provides a means of dynamically displaying layers across simplification levels.
- **JS (JavaScript) :** Enables interactivity by changing the levels of simplification, focus and magnification of objects.

The design process: Creating a multi-level interactive illustration

1. **Message and main objects**
 - **Define the message:** Determine the unique and clear concept that the illustration conveys. What is the key message?
 - **Identify the essential elements:** Make a list of the objects that are absolutely essential to represent the message visually. These objects will form the basis of level 5 (the most simplified).
2. **Overlay strategy**
 - **Planning the appearance:** For each additional element (beyond the basic set), determine the level of simplification at which it should be visible first.
3. **Basic drawing (level 5)**
 - **Essential objects first:** Using vector graphics software, create separate layers (or groups) for each essential object. Name them clearly (for example, "tree", "house").
 - **Absolute simplicity:** Design these objects with the most basic shapes adapted to the target audience.
4. **Sublayers for progressive detail**

For each object, create sublayers under the main object layer.

 - Example: Under "tree", you could have :
 - "tree-branches-L4
 - "Tree leaves-L3
 - "texture-tree-L2
5. Level-specific redraws (if necessary)

Perspective changes: If an object changes radically in appearance from one level to the next (for example, from 2D to 3D), create a completely new layer for the more detailed level(s).

- Example: "house-L2" would be a separate layer from "house-L3" (if level 2+ introduces perspective and/or translation).

6. Testing and improvement

- **Simulate simplification:** Use your software's layer visibility tools to move from one level to the next and ensure the desired visual progression.
- **Naming convention:** Adopt a system such as "objectName-L[levels]" (for example, "batWing-L123" to display this stack at levels 1, 2 and 3) for ease of management.
- **Stack grouping:** Create logical groups of layers/sublayers to ensure correct visual overlap at each level.

7. Interactive highlights

Mark important elements by adding a special character (for example, "*") to the name of the layer stacks that you want to make focusable/zoomable in the final interactive version (for example, "*maincharacter-L1").

A girl building a castle" case study

Understanding the message

Before we start drawing, let's define the main message we want to get across with this illustration. The possibilities are as follows:

- **The emphasis is on construction:** the act of building and creating is the central theme.
- **Imagination and play:** the illustration can highlight the joys of imaginative play.
- **The child's point of view:** The scene can be presented primarily through the visual experience of a child.

Level 5: The absolute essentials

- **Girl:** simplified silhouette, possibly stooped (girl-N5)
- **Castle blocks:** Basic geometric shapes representing the structure of the castle (squares, rectangles). (castle-N5)

Level 4: Adding context and detail

- **Girl:** Define the basic features - hair, limbs - in a more active construction position. (girl-N45)
- **Castle blocks:** Add slight variations to the shapes of the blocks to suggest different castle features (tower, door). (castle-N45)
- **Floor:** A single line to establish a floor plan. Note that the floor is not displayed on level 5 but on all the others (floor-N1234).

Level 3: Introduction of a set index

- **Girl:** Add clothing details, perhaps a slight facial expression (concentration, joy). (girl-N345)

- **Castle blocks:** More distinctive shapes for towers, flags, etc. (castle-N345)
- **Shelf:** A simplified rectangular shape in the background (shelf-N3)

Level 2: Environmental improvement

- **Girl:** More detail on clothes, hair and facial features. Observe the new layer stack for the girl object, as it has changed position for levels 1 and 2 (girl-N12).
- **Castle blocks:** Texture of the blocks (brick patterns), more elaborate structure (castle-N12)
- **Shelf:** Individual books become visible, while remaining simplified. (shelf-N12)
- **Other toys (optional) :** Simple shapes revealing toys scattered in the background.

Level 1: The complete illustration

- **Girl:** Detailed clothing and hair, dynamic expression (girl-N1)
- **Castle:** Full details with depth and full perspective, perhaps decorative elements such as flags (castle-N1)
- **Setting:** Colourful books, detailed toys, playroom features (carpet, window, etc.). (background-N1)
- **Shadows and textures:** Add realism and depth where appropriate. (shadows-N1)

Adaptation of printed illustrations to simplified interactive digital content.

This process builds on the design principles described above, but incorporates the unique challenges and steps associated with using an existing printed work.

Digitisation and analysis

- High-quality scanning: Obtain the best possible digital copy of the printed illustration. A high-resolution scan or photograph is essential.
- Identifying objects: Examine the illustration meticulously and make a list of all the objects depicted. Take into account background elements, foreground characters and decorative details.
- Message hierarchy: Rank the objects identified according to their importance in conveying the illustration's main message. This ranking will guide your simplification decisions.

Vectorisation by levels of simplification

Although vector graphics software offers plotting tools, for optimum control and overlay, it is preferable to follow a manual vectorisation process:

- Base layer (level 5) :
 - Select the most essential objects (in your hierarchy).

- Using vector tools (the Pen tool in Illustrator, for example), carefully draw these objects in their most simplified form.
- Create separate layers or groups for each object.
- Next layers (levels 4 to 1) :
 - Working backwards: Start with the basic level 5 objects.
 - For each object, create new sub-layers within its group.
 - Add details progressively from one level to the next, following the layering strategy described in the "Design process" section.

Other considerations

- Cleaning: The original artwork may have imperfections (stains, printing artefacts). If possible, clean them up when you vectorise.
- Colour separation: If the original is complex, consider separating the colours into layers to facilitate simplification (for example, a background layer with its own levels, simplifying foreground objects independently).



Appendix 1: Project summary

Flex Picture Ebook: A digital book for inclusive learning

Existing teaching materials often do not meet the specific needs of children with disabilities. In addition, adapted books are often expensive and pose problems when it comes to integrating them into inclusive educational environments.

In partnership with digital accessibility experts, teachers and a children's book publisher, this project aims to design an illustrated digital book that is accessible to all children, including those with disabilities. In addition to the text to be configured, a "Flex Picture Ebook" includes adapted illustrations with several levels of simplification, interactive elements and an audio narration, while remaining affordable. A quick demonstration of how to set up the *Simplify Isolate Animate Zoom* illustrations can be found on the project website.

Our aim is to increase the availability and quality of accessible digital books that fit seamlessly into inclusive learning environments.

The main expected results :

- Digital Flex Picture Ebook "Ben wants a bat" (V Cuvellier, R. Badel) in 5 languages.
- Raising awareness and providing support for teachers and parents by supplying teaching scenarios that have been tested in the classroom.
- Training for content producers in the publication of Flex Picture Ebooks and provision of free software and guidelines.



Appendix 2: Useful resources

Understanding disabilities and accessibility

- [Making information accessible to all - European Blind Union](#)
- [A to Z of assistive technology for low vision - Perkins School for the Blind](#)
- [Accessibility requirements for visually impaired people - W3C](#)
- [Making content usable for people with cognitive and learning disabilities - W3C](#)

Guidelines for subtitling images

- [How to write Alt text and image descriptions for the visually impaired - Perkins School for the Blind](#)
- [Learning resource for describing images - Inclusive publishing in practice](#)



Appendix 3: European partners

France

Les Doigts Qui Rêvent, Talant
Ludosens, Bègles
Institute for the Young Blind (IJA), Toulouse

Austria

Johannes Kepler University, Linz

Italy

Fondazione Robert Hollman, Padova
AbilNova, Trento

Lithuania

Lietuvos Aklųjų ir Silpnaregių Ugdymo Centras (LASUC), Vilnius

