

Accessibility

Objects and environments should be designed to be usable, without modification, by as many people as possible.¹

The principle of accessibility asserts that designs should be usable by people of diverse abilities, without special adaptation or modification. Historically, accessibility in design focused on accommodating people with disabilities. As knowledge and experience of accessible design increased, it became increasingly clear that many required “accommodations” could be designed to benefit everyone. There are four characteristics of accessible designs: perceptibility, operability, simplicity, and forgiveness.²

Perceptibility is achieved when everyone can perceive the design, regardless of sensory abilities. Basic guidelines for improving perceptibility are: present information using redundant coding methods (e.g., textual, iconic, and tactile); provide compatibility with assistive sensory technologies (e.g., ALT tags for images on the Internet); and position controls and information so that seated and standing users can perceive them.

Operability is achieved when everyone can use the design, regardless of physical abilities. Basic guidelines for improving operability are: minimize repetitive actions and the need for sustained physical effort; facilitate use of controls through good affordances and constraints; provide compatibility with assistive physical technologies (e.g., wheelchair access); and position controls and information so that seated and standing users can access them.

Simplicity is achieved when everyone can easily understand and use the design, regardless of experience, literacy, or concentration level. Basic guidelines for improving simplicity are: remove unnecessary complexity; clearly and consistently code and label controls and modes of operation; use progressive disclosure to present only relevant information and controls; provide clear prompting and feedback for all actions; and ensure that reading levels accommodate a wide range of literacy.

Forgiveness is achieved when designs minimize the occurrence and consequences of errors. Basic guidelines for improving forgiveness are: use good affordances and constraints (e.g., controls that can only be used the correct way) to prevent errors from occurring; use confirmations and warnings to reduce the occurrence of errors; and include reversible actions and safety nets to minimize the consequence of errors (e.g., the ability to undo an action).

See also Affordance, Forgiveness, Legibility, Normal Distribution, and Readability.

¹ Also known as *barrier-free design* and related to *universal design* and *inclusive design*.

² The four characteristics of accessible designs are derived from *W3C Web Content Accessibility Guidelines 1.0*, 1999; *ADA Accessibility Guidelines for Buildings and Facilities*, 1998; and *Accessible Environments: Toward Universal Design* by Ronald L. Mace, Graeme J. Hardie, and Jaine P. Place, The Center for Universal Design, North Carolina State University, 1996.

Readability

The degree to which prose can be understood, based on the complexity of words and sentences.

Readability is determined by factors such as word length, word commonality, sentence length, number of clauses in a sentence, and number of syllables in a sentence. It is an attribute that is seldom considered—either because designers are not sensitive or aware of its importance, or because of the common belief that complex information requires complex presentation. In fact, complex information requires the simplest presentation possible, so that the focus is on the information rather than the way it is presented.

For enhanced readability, omit needless words and punctuation, but be careful not to sacrifice meaning or clarity in the process. Avoid acronyms, jargon, and untranslated quotations in foreign languages. Keep sentence length appropriate for the intended audience. Generally, use active voice, but consider passive voice when the emphasis is on the message and not the messenger. When attempting to produce text for a specific reading level, use published readability formulas and software applications designed for this purpose.

A variety of readability formulas and software applications are available to assist designers in producing prose with specific readability levels. The readability rating is usually represented in the form of school levels ranging from 1st to 12th grade and college. While different tools may use slightly different approaches for calculating readability, they all generally use the same combination of core readability factors mentioned above.¹

Use these formulas to verify that the textual components of a design are at the approximate reading level of the intended audience. However, do not write for the formulas. Readability formulas are primitive guides and should not outweigh all other considerations. For example, more sentences per paragraph may increase readability for lower-level readers, but frustrate readability for more advanced readers who are distracted by the lack of continuity. Simple language is preferred, but overly simple language obscures meaning.²

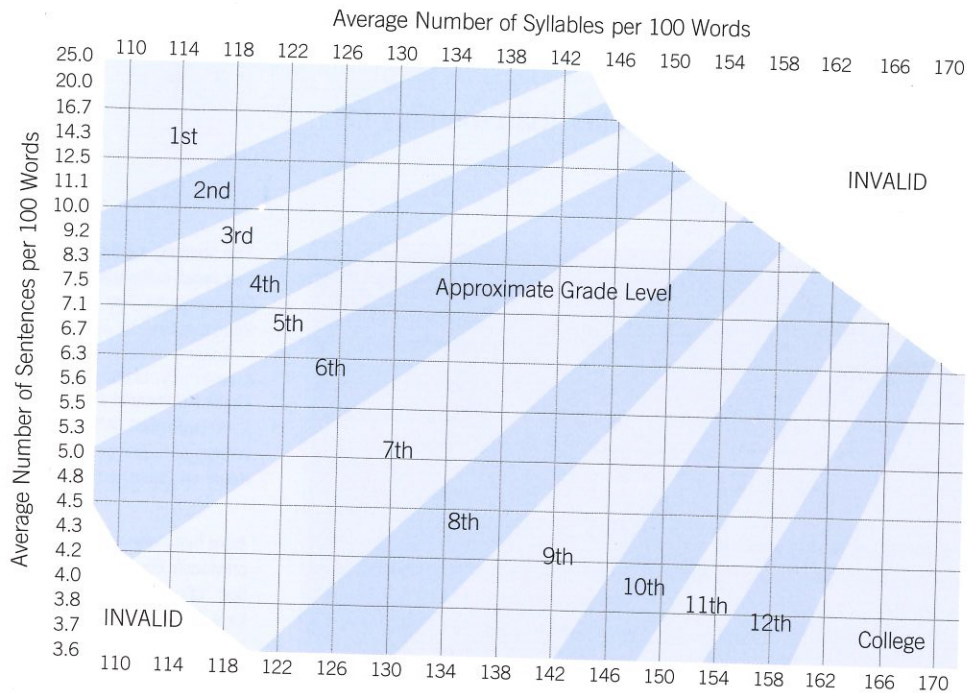
Consider readability when creating designs that involve prose. Express complex material in the simplest way possible. Follow guidelines for enhancing readability, and verify that the readability level approximates the level of the intended audience.³

See also Legibility and Ockham's Razor.

¹ Fry's Readability Graph (right) is one of many readability formulas. Other popular measures include Flesch Formula, Dale-Chall formula, Farr-Jenkins-Paterson formula, Kincaid Formula, Gunning Fog Index, and Linsear Write Index.

² "Use [readability formulas] as a guide after you have written, but not as a pattern before you write. Good writing must be alive; don't kill it with systems." *The Technique of Clear Writing* by Robert Gunning, McGraw-Hill, 1968.

³ For additional writing guidelines, see *The Elements of Style* by William Strunk Jr. and E. B. White, Allyn & Bacon; 4th edition, 2000.



Edward Fry's Readability Graph

1. Randomly select three sample passages from a text.
2. Count 100 words starting at the beginning of these passages (count proper nouns, but not numbers).
3. Count the number of sentences in each 100-word passage, estimating the length of the last sentence to the nearest 1/10th.
4. Count the total number of syllables in each 100-word passage.
5. Calculate the average number of sentences and average number of syllables for the 100-word passage. If a great deal of variability is found, sample additional passages.
6. The area of intersection on the graph between the number of sentences and average number of syllables indicate the estimated grade level. Invalid regions indicate that a reading level could not be estimated.

Sample text written at a college reading level. In the first 100 words of this passage there are 187 syllables and almost six sentences.

Chicken pox, or varicella, is an infectious disease usually occurring in young children. Chicken pox is believed to be caused by the same herpes virus that produces shingles. Chicken pox is highly communicable and is characterized by an easily recognizable rash consisting of blisterlike lesions that appear two to three weeks after infection. Usually there are also low fever and headache. When the lesions have crusted over, the disease is believed to be no longer communicable; however, most patients simultaneously exhibit lesions at different stages of eruption. Chicken pox is usually a mild disease requiring little treatment other than medication to relieve the troublesome itching, but care must be taken so that the rash does not become infected by bacteria.

Sample text written at a 4th grade reading level. In the first 100 words of this passage there are 137 syllables and almost twelve sentences.

Not too long ago, almost everyone got chicken pox. Chicken pox is caused by a virus. This virus spreads easily. The virus spreads when an infected person coughs or sneezes. People with chicken pox get a rash on their skin. The rash is made up of clear blisters. These blisters are very itchy. It is hard not to scratch them. The blisters form scabs when they dry. Sometimes these scabs cause scars. Many people with chicken pox must stay in bed until they feel better. Until recently, almost all children in the U.S. got chicken pox between the ages of 1 and 10. In 1995, the Food and Drug Administration approved a vaccine that keeps the virus from spreading. Today, most people will never get chicken pox because of this vaccine.

Legibility

The visual clarity of text, generally based on the size, typeface, contrast, text block, and spacing of the characters used.

Confusion regarding the research on legibility is as persistent as it is pervasive. The rapid growth and advancement of modern desktop publishing, Web-based publishing, and multimedia presentation continue to compound the confusion with increasing font and layout capabilities, display and print options, and the need to effectively integrate with other media. The following guidelines address common issues regarding text legibility.¹

Size

For printed text, standard 9- to 12-point type is considered optimal. Smaller sizes are acceptable when limited to captions and notes. Use larger type for low-resolution displays and more senior audiences.²

Typeface

There is no performance difference between serif and sans serif typefaces, so select based on aesthetic preference. Sentence case text should be used for text blocks. On low-resolution displays, antialiasing the text may marginally improve legibility, but primarily serves as an aesthetic enhancement of the typeface.³

Contrast

Use dark text on a light background or vice versa. Performance is optimal when contrast levels between text and background exceed 70 percent. Foreground/background color combinations generally do not affect legibility as long as you observe the minimum contrast level, so select based on aesthetic preference. Patterned or textured backgrounds can dramatically reduce legibility, and should be avoided.⁴

Text Blocks

There is no performance difference between justified and unjustified text, so select based on aesthetic preference. For 9- to 12-point type, a line length of 3 to 5 inches (8 cm to 13 cm) is recommended, resulting in a maximum of about 10 to 12 words per line, or 35 to 55 characters per line.⁵

Spacing

For 9- to 12-point type, set leading (spacing between text lines, measured from baseline to baseline) to the type size plus 1 to 4 points. Proportionally spaced typefaces are preferred over monospaced.

See also Iconic Representation and Readability.

¹ The seminal empirical works on legibility for print are *Bases for Effective Reading*, University of Minnesota Press, 1963; and *Legibility of Print*, Iowa State University Press, 1965, both by Miles A. Tinker. A comprehensive and elegant contemporary reference from a typographic perspective is *The Elements of Typographic Style* by Robert Bringhurst, Hartley & Marks (2nd ed.), 1997.

² Legibility research on low-resolution computer displays continues to yield mixed results but generally supports Tinker's original findings. However, be conservative to account for lower-resolution displays.

³ On lower-resolution displays and for type smaller than 12 point, use sans serif typefaces without antialiasing. Serifs and antialiasing blur the characters of smaller type and, therefore, compromise legibility.

⁴ Dark text on light backgrounds is preferred. High-contrast, inverse text can "visually bleed" to the background and dramatically reduce legibility. Factors other than legibility should be considered when selecting foreground/background color combinations (e.g., color blindness and fatigue), so select carefully and test atypical combinations.

⁵ The speed with which text can be visually processed is greatest on long text lines (80 characters or more). However, readers prefer short text lines (35 to 55 characters). Unless visual processing speed is critical to the design task, shorter text lines are recommended. See, for example, "The Effects of Line Length and Method of Movement on Patterns of Reading from Screen," by Mary C. Dyson and Gary J. Kipping, *Visible Language*, 1998, vol. 32(2), p. 150-181.

Size

This is 9-point Trade Gothic This is 10-point Trade Gothic This is 12-point Trade Gothic

Typeface

Serif vs. San Serif

Serif typefaces have small "feet" at the ends of the letters.

Serif
Sans Serif

Uppercase vs. Mixed Case

People recognize words by letter groups and shapes. Uppercase text is more difficult to read than sentence case and title case because the shapes of uppercase words are all rectangular.

Antialiased vs. Aliased Text

Antialiased text looks smooth because of pixels added to smooth the transition between the text color and the background color. Aliased text looks jagged because it does not contain these transition pixels.

Antialiased
Aliased

Text Cases

This is sentence case

This is Title Case

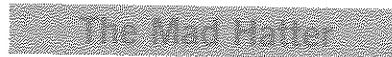
this is lowercase

THIS IS UPPERCASE

Alice's Adventures in Wonderland

ALICE'S ADVENTURES IN WONDERLAND

Contrast



Textblocks

Aligned Left, Ragged Right Text

Soon her eye fell on a little glass box that was lying under the table: she opened it, and found in it a very small cake, on which the words "EAT ME" were beautifully marked in currants.

Justified Text

Soon her eye fell on a little glass box that was lying under the table: she opened it, and found in it a very small cake, on which the words "EAT ME" were beautifully marked in currants.

Aligned Right, Ragged Left Text

Soon her eye fell on a little glass box that was lying under the table: she opened it, and found in it a very small cake, on which the words "EAT ME" were beautifully marked in currants.

Spacing

Leading

Leading (rhymes with sledding) is the amount of vertical space from the baseline of one line of text to the

baseline of the next line of text. Below, the type size is 12 points and the leading is 18 points.

"Yes, that's it," said the Hatter with a sigh: "it's always tea-time,
and we've no time to wash the things between whiles."

Baseline
Leading
Baseline

Monospaced vs. Proportionally Spaced Typefaces

In monospaced typefaces, all characters assume the same amount of horizontal space. In proportionally spaced typefaces, characters assume variable

amounts of horizontal space, depending on the width of the actual character and the relationships among groups of characters.

"Off with her head!" the Queen shouted.

monospaced typeface

"Off with her head!" the Queen shouted.

proportionally spaced typeface