

# Dyslexia-Friendly UI/UX

## Design Standards and Engineering Guidance for Inclusive Digital Governance

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About 5–15% of the global population experiences dyslexia, a neurodevelopmental difference affecting the processing of written language. Although not linked to intelligence or comprehension deficits, dyslexia is associated with differences in orthographic decoding, working memory, and visual attention. In text-intensive digital environments, these differences can translate into increased reading effort, slower processing, and greater susceptibility to error under visually dense or structurally unstable conditions.

As public services migrate to digital platforms, the impact of such design barriers becomes systemic. Government portals, benefit systems, and transactional forms are often cognitively demanding. Even modest increases in reading difficulty can lead to higher error rates, repeated submissions, and reduced service access at scale.

While standards such as WCAG 2.1 address technical accessibility requirements, compliance alone does not guarantee cognitive usability for dyslexic users. Interfaces may meet formal criteria yet still impose excessive decoding effort or memory dependence.

To address this gap, this article introduces the Cognitive Friction Model, a systems-level framework that conceptualizes dyslexia-related interface barriers as accumulative sources of cognitive strain. By translating findings from cognitive science into operational UI/UX standards, the model provides a structured approach to reducing reading-related friction in large-scale digital systems.

### Conceptual Framework: The Cognitive Friction Model

Dyslexia-inclusive UI/UX design can be understood through the lens of cognitive friction—the cumulative mental effort required to decode,



Technical and design standards for dyslexia-friendly UI/UX in digital government services are presented, grounded in cognitive science and aligned with WCAG 2.1 AA. Emphasis is placed on typography, layout, color, and interaction design choices that reduce cognitive load and improve readability. The guidance extends beyond visual design to implementation, content authoring, and user testing, ensuring long-term accessibility, consistency across platforms, and resilience against accessibility regressions as systems scale. Dyslexia-inclusive design is positioned as a core requirement for effective, equitable, and trustworthy digital governance.



interpret, and act upon written information within a digital interface. While all users experience some level of cognitive load, users with dyslexia encounter disproportionate friction when visual, structural, and interactional demands exceed their processing comfort threshold.

The Cognitive Friction Model proposes that task difficulty in digital systems is not determined solely by content complexity, but

by the interaction between four interdependent variables:

**Cognitive Friction = Visual Crowding + Memory Demand + Layout Instability + Interaction Ambiguity**

Each variable contributes independently and multiplicatively to decoding effort.

#### Visual Crowding

Visual crowding refers to the difficulty in identifying individual letters or words when spacing, contrast, or typographic clarity is insufficient. Research in visual perception demonstrates that closely packed visual stimuli impair letter recognition, particularly in peripheral vision. In digital interfaces, crowding is amplified by:

- Tight line spacing
- Narrow letter spacing
- Long line lengths
- Justified text with irregular spacing
- Overuse of visual emphasis

Reducing crowding through controlled spacing, moderate line lengths, and stable typography directly lowers perceptual strain.

#### Memory Demand

Memory demand arises when users must retain instructions, eligibility criteria, or previous inputs while performing subsequent tasks. Dyslexia is frequently associated with reduced working-memory efficiency for verbal information, increasing the likelihood of task breakdown when interfaces rely on recall rather than recognition.

Memory demand increases when:

- Instructions are separated from input fields
- Multi-step forms lack visible progress markers
- Error messages require interpretation without guidance
- Users must re-enter information after submission failures

Design strategies that favor recognition over recall—such as inline hints, persistent labels, and step indicators—reduce memory-dependent friction.



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## Layout Instability

Layout instability occurs when visual structure shifts unpredictably across screens or interaction states. Changes in heading styles, button placement, alignment, or spacing require users to recalibrate their visual scanning patterns.

For dyslexic users, repeated recalibration increases orientation errors and rereading frequency. Stable layout templates, consistent navigation zones, and standardized component systems reduce this instability.

## Interaction Ambiguity

Interaction ambiguity emerges when system feedback, instructions, or control behavior is unclear. Ambiguous error messages, unclear required fields, and inconsistent affordances create uncertainty, increasing cognitive effort and emotional stress.

Clear, immediate, and actionable feedback reduces ambiguity and strengthens user confidence during task execution.

## Friction Accumulation and Threshold Effects

Importantly, cognitive friction is cumulative. A system may meet accessibility guidelines in isolation (e.g., compliant contrast ratios) while still generating high friction when multiple minor stressors coexist. For example:

- Slightly dense text
- Moderate memory reliance
- Mild layout inconsistency
- Generic error messaging

Individually manageable, these factors together may push dyslexic users beyond a functional threshold, resulting in task abandonment.

Thus, dyslexia-inclusive design requires systemic optimization rather than isolated compliance adjustments.

## Design Implications

The Cognitive Friction Model reframes dyslexia-inclusive design as a problem of friction minimization rather than accommodation. Effective UI/UX engineering must:

- Reduce visual crowding
- Minimize memory dependence
- Ensure structural stability
- Eliminate interaction ambiguity

By treating cognitive friction as a measurable systems variable, institutions can evaluate digital platforms not merely for compliance, but for operational readability and task resilience.

## Cognitive Load Reduction

Digital interfaces impose cognitive load through visual complexity, information density, and memory dependence. Users with dyslexia are disproportionately affected when interfaces require sustained decoding effort or simultaneous processing of multiple textual elements. Reducing cognitive load through controlled spacing, clear hierarchy, consistent patterns, and linear task flows directly improves comprehension and task accuracy.

From an engineering perspective, cognitive load reduction is not a subjective design preference but a measurable usability objective. Interfaces that minimize unnecessary decoding effort reduce error frequency, task abandonment, and reliance on external assistance—outcomes that are critical for high-volume public service platforms.

## Perceptual Stability and Predictability

For users with dyslexia, perceptual stability—the consistency and predictability of visual patterns over time—is essential for effective reading and task execution. Frequent changes in layout, typography, spacing, or visual emphasis increase decoding effort and cognitive fatigue by forcing continuous reorientation.

Predictable interfaces reduce the need for repeated visual recalibration. When headings, navigation, controls, and content structures

behave consistently across screens, users can rely on learned patterns rather than reinterpreting information at each step. This is especially critical in transactional government services involving multi-step workflows and time or stress constraints.

From an engineering perspective, perceptual stability is achieved through consistent layout templates, standardized typographic scales, and uniform interaction patterns. These practices support dyslexic users while also improving system learnability and reducing user error across the broader population.

## Typography: Precision Over Aesthetics

Typography is the primary interface through which users engage with written content. For individuals with dyslexia, typographic decisions directly affect reading speed, comprehension accuracy, and cognitive fatigue. In contrast to brand- or aesthetics-driven approaches, dyslexia-friendly typography prioritizes perceptual clarity, consistency, and symbol differentiation.

Every typographic parameter—font family, size, spacing, and emphasis—must be selected to minimize visual ambiguity and decoding effort. In transactional and information-dense public services, typographic clarity is a functional requirement and must not be treated as a stylistic preference.

## Font Selection

- **Font family:** Use clear, widely supported sans-serif fonts such as Arial, Open Sans, Verdana, or Helvetica to ensure consistency across devices and operating systems
- **Glyph differentiation:** Letterforms must clearly distinguish commonly confused characters (e.g., b/d, p/q, l/l/1, O/O). Fonts with uniform stroke widths and open counters are preferred
- **Avoid:** Decorative, cursive, condensed, or italicized fonts for body text, as they introduce unnecessary visual complexity

Fonts selected for dyslexia-friendly interfaces should prioritize functional clarity over stylistic variation, reducing the likelihood of letter misidentification and rereading.

## Font Size and Scaling

- **Minimum body text size:** 16–18 px for desktop and responsive web interfaces
- **Responsive scaling:** Text size must scale proportionally across viewports without truncation, overlap, or loss of hierarchy
- **Zoom compliance:** Content must remain readable, usable, and layout-stable up to 200% zoom, in accordance with WCAG 1.4.4

Appropriate sizing and robust scaling behavior reduce visual crowding, support sustained reading, and prevent users from losing context

## The Cognitive Friction Formula

Task difficulty (symbol) is not merely content complexity, but a function of cumulative environmental stressors:

$$\text{Cognitive Friction} = V_c + M_d + L_i + I_a$$

Where:

- $V_c$ : Visual Crowding (Typographic density)
- $M_d$ : Memory Demand (Recall vs. Recognition)
- $L_i$ : Layout Instability (Structural shifts)
- $I_a$ : Interaction Ambiguity (Unclear feedback)

## Technical Checklist for Engineering Teams

(For quick reference during Sprint reviews)

Category	Engineering Standard
Typography	Min 16px; Sans-serif; No forced Justification
Spacing	Line height $\geq 1.5$ ; Paragraph spacing 2.0
Forms	Persistent labels (no disappearing placeholders)
Navigation	Sticky/Predictable locations; no layout shifts (CLS)
Color	Contrast $\geq 4.5:1$ ; avoid pure #000 on #FFF

when magnifying content.

### Spacing Parameters

- **Line height:** Minimum  $1.5 \times$  the font size to prevent line collision and tracking errors
- **Letter spacing:** Approximately  $+0.05$  em to improve character separation without disrupting word recognition
- **Word spacing:** 30–40% greater than default to enhance word boundary detection

Adequate spacing reduces visual interference, supports smoother eye movement, and improves reading fluency, particularly in longer text passages.

### Typographic Governance

Typography used for body text in transactional or informational services must not be overridden by brand typefaces if they compromise legibility or spacing requirements. Brand expression should be limited to headings, logos, and non-critical interface elements.

From a governance perspective, typographic standards should be centrally defined and consistently enforced across platforms to prevent accessibility regressions during redesigns or vendor-led implementations.

### Text Emphasis and Highlighting

Text emphasis must be used sparingly and consistently to avoid visual overload. For users with dyslexia, excessive or inconsistent emphasis increases visual noise and disrupts reading flow.

- **Preferred emphasis:** Use bold text to highlight key terms, labels, or critical information
- **Avoid:** Italics for emphasis in body text, as slanted letterforms reduce character recognition
- **Underlining:** Reserve exclusively for hyperlinks; do not use for emphasis
- **Capitalization:** Avoid all-caps text for sentences or paragraphs; it reduces word-shape recognition and slows reading

When highlighting important information, emphasis should be applied at the word or short-phrase level, not across full sentences or blocks of text. Consistent emphasis rules support visual stability, improve scanability, and reduce cognitive fatigue.

### Layout and Structural Hierarchy

Beyond individual typographic choices, the spatial organization of content plays a decisive role in readability and task efficiency. Users with dyslexia benefit from layouts that are linear, predictable, and visually calm. Dense text blocks, inconsistent alignment, or weak structural cues increase orientation errors, rereading, and cognitive fatigue.

A disciplined layout strategy enables users to scan, locate, and process information with minimal effort. In large-scale digital governance systems, consistent structural hierarchy is essential for reducing user errors and ensuring reliable service completion.

### Text Alignment and Line Length

- **Alignment:** Left-aligned (ragged right) text for all body content.
- **Line length:** Optimal range of 50–60 characters per line; maximum 80 characters.

Justified text creates irregular spacing patterns (“rivers of white space”) that interfere with eye tracking and disrupt reading flow, particularly for users with dyslexia.

### Information Chunking and Content Segmentation

- Use short paragraphs (ideally 3–5 lines; avoid exceeding 7 lines)
- Prefer bullet points and numbered lists over dense paragraphs
- Break complex instructions or workflows into discrete, clearly labeled steps
- Chunking supports sequential processing, reduces memory load, and improves navigability,

aligning with WCAG 2.4 (Navigable)

### Hierarchical Headings and Visual Structure

- Enforce consistent use of heading levels (H1, H2, H3) without skipping levels
- Maintain uniform visual treatment for headings of the same level, including size, weight, spacing, and alignment
- Ensure headings accurately describe the content that follows

A clear and consistent heading hierarchy allows users to scan efficiently, build a mental map of the content, and return to sections without losing context.

### Layout Predictability and Reuse

Layouts should follow consistent structural patterns across pages and modules. Navigation placement, content ordering, and control positioning must remain stable wherever possible.

From an engineering and governance perspective, layout predictability is achieved through reusable templates and standardized components. These practices reduce user disorientation, shorten learning curves, and lower the risk of interaction errors—benefiting dyslexic users and the wider population alike.

### Color and Contrast: Ensuring Visual Stability

Color and contrast decisions influence not only aesthetic quality but also perceptual comfort and reading stability. For many users with dyslexia, extreme contrast, glare, or visually noisy backgrounds can cause text to appear unstable, shimmering, or difficult to sustain focus on over extended periods.

Effective color systems must therefore balance accessibility compliance with visual comfort, ensuring sufficient contrast for readability without introducing visual strain.

### Contrast Standards

- **Minimum requirement:** WCAG 2.1 AA —  $4.5:1$  contrast ratio for normal text and  $3:1$  for large text
- **Recommended for critical content:** WCAG AAA —  $7:1$  contrast ratio for essential transactional or instructional text
- **Non-text elements:** Interactive components and focus indicators must meet minimum contrast requirements under WCAG 1.4.11

Higher contrast beyond accessibility thresholds does not necessarily improve readability and may reduce visual comfort. The objective is clarity, not intensity.

### Recommended Color Combinations

- **Text:** Dark grey, charcoal, or deep navy (e.g., #212121, #1A1A1A, #1F2A44)

- **Background:** Off-white, cream, or light neutral tones (e.g., #F8F8F8, #FEFAF0, #F5F5F5)

- **Interactive states:** Use color combined with underline, iconography, or shape changes—never color alone

Slightly softened foreground and background combinations reduce glare while maintaining readability.

### Background and Visual Noise Avoidance

- Avoid patterned, textured, gradient, or image-based backgrounds behind text

- Do not place body text over photographs or moving visual elements

- Avoid rapidly flashing or animated color transitions

Stable, uniform backgrounds support sustained attention and reduce perceptual interference during reading.

### Redundant Visual Coding

Color must not be the sole means of conveying meaning. Error states, warnings, confirmations, and required fields must combine:

- Text labels
- Iconography or symbols
- Color differentiation

Redundant coding ensures comprehension even when color perception, screen quality, or environmental lighting conditions are suboptimal. This aligns with WCAG 1.4.1 (Use of Color).

## Interaction Design and UX Engineering

While visual presentation governs readability, interaction design determines task completion and service reliability. Users with dyslexia are more vulnerable to breakdowns in text-heavy forms, ambiguous instructions, memory-dependent workflows, and unclear feedback states.

UX engineering must therefore minimize memory burden, prevent avoidable errors, and provide explicit guidance at each stage of user interaction. In high-volume public platforms, interaction clarity directly affects service completion rates, grievance load, and administrative efficiency.

### Form and Input Design

- Minimize reliance on free-text input wherever structured alternatives are feasible

- Prefer radio buttons, checkboxes, dropdown menus, and auto-complete fields

- Provide inline hints, examples, and formatting guidance before submission

- Clearly label required and optional fields

Structured inputs reduce spelling-related

errors, improve completion speed, and decrease task abandonment.

### Error Handling and Feedback

Error messages must be:

- **Immediate** — displayed adjacent to the relevant field

- **Specific** — clearly explain what is incorrect and how to correct it

- **Actionable** — provide corrective examples where appropriate.

- Redundantly coded — combine text, color, and iconography

Avoid generic system messages such as “Invalid input” or “Submission failed.”

Clear error communication reduces frustration, repeat attempts, and escalation to offline support channels. (Aligned with WCAG 3.3.1 and 3.3.3)

### Sequential Task Flow and Progress Indication

- Break complex services into clearly defined, sequential steps

- Provide visible progress indicators (e.g., Step 2 of 5)

- Allow users to review and edit prior steps before final submission

Sequential structuring reduces disorientation and perceived task complexity, especially in multi-page government forms or eligibility workflows.

### Instructional Clarity and Microcopy

- Use concise, direct language

- Avoid bureaucratic phrasing or compound sentences

- Present one instruction per sentence wherever possible

Instructional clarity reduces rereading and misinterpretation, improving task efficiency across literacy levels.

### Alternative Access Modes

- Offer a built-in Dyslexia-Friendly Mode with adjusted spacing and simplified layout options where feasible

- Integrate high-quality text-to-speech (TTS) functionality for content-heavy sections

- Ensure compatibility with screen readers and assistive technologies

Multimodal access supports comprehension, reduces fatigue, and broadens equitable participation in digital governance systems.

## Broader Impact and Public Value

Dyslexia-friendly UI/UX design delivers benefits that extend beyond regulatory compliance. By improving clarity, predictability, and error

tolerance, these principles enhance the overall reliability and effectiveness of digital public services. In large-scale governance systems, small usability barriers can produce disproportionate operational consequences—higher form rejection rates, repeated submissions, increased helpdesk dependency, and citizen frustration. Designing for dyslexia mitigates these risks by reducing cognitive friction at critical interaction points.

From a public administration perspective, inclusive design strengthens:

- Equitable access to essential services

- Service completion rates in transactional workflows

- Trust and perceived fairness in digital systems

- Operational efficiency through reduced support escalation

Importantly, the design measures outlined in this document benefit a broad user base, including individuals with low literacy, temporary cognitive stress, aging-related changes in processing speed, and situational constraints such as mobile use in low-visibility environments.

Inclusive design should therefore be treated as a strategic infrastructure decision, not a discretionary enhancement. Systems that are readable, predictable, and error-tolerant are more resilient, scalable, and trusted by the populations they serve.

## Conclusion

Designing for dyslexia requires disciplined typography, structured layouts, perceptual stability, and interaction clarity grounded in cognitive principles. These measures are not stylistic adjustments but engineering decisions that directly influence readability, task accuracy, and service reliability.

Digital systems that reduce decoding effort and cognitive friction perform better for all users. By embedding dyslexia-inclusive standards into design systems, development practices, and governance frameworks, institutions strengthen accessibility, operational efficiency, and public trust.

Dyslexia-friendly UI/UX is not a niche accommodation—it is a marker of engineering maturity and responsible digital governance.

Contact for more details

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