

# Rethinking Digital Exclusion: Interaction Design Barriers in Adults with Intellectual Disabilities

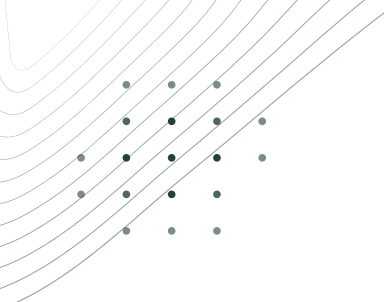
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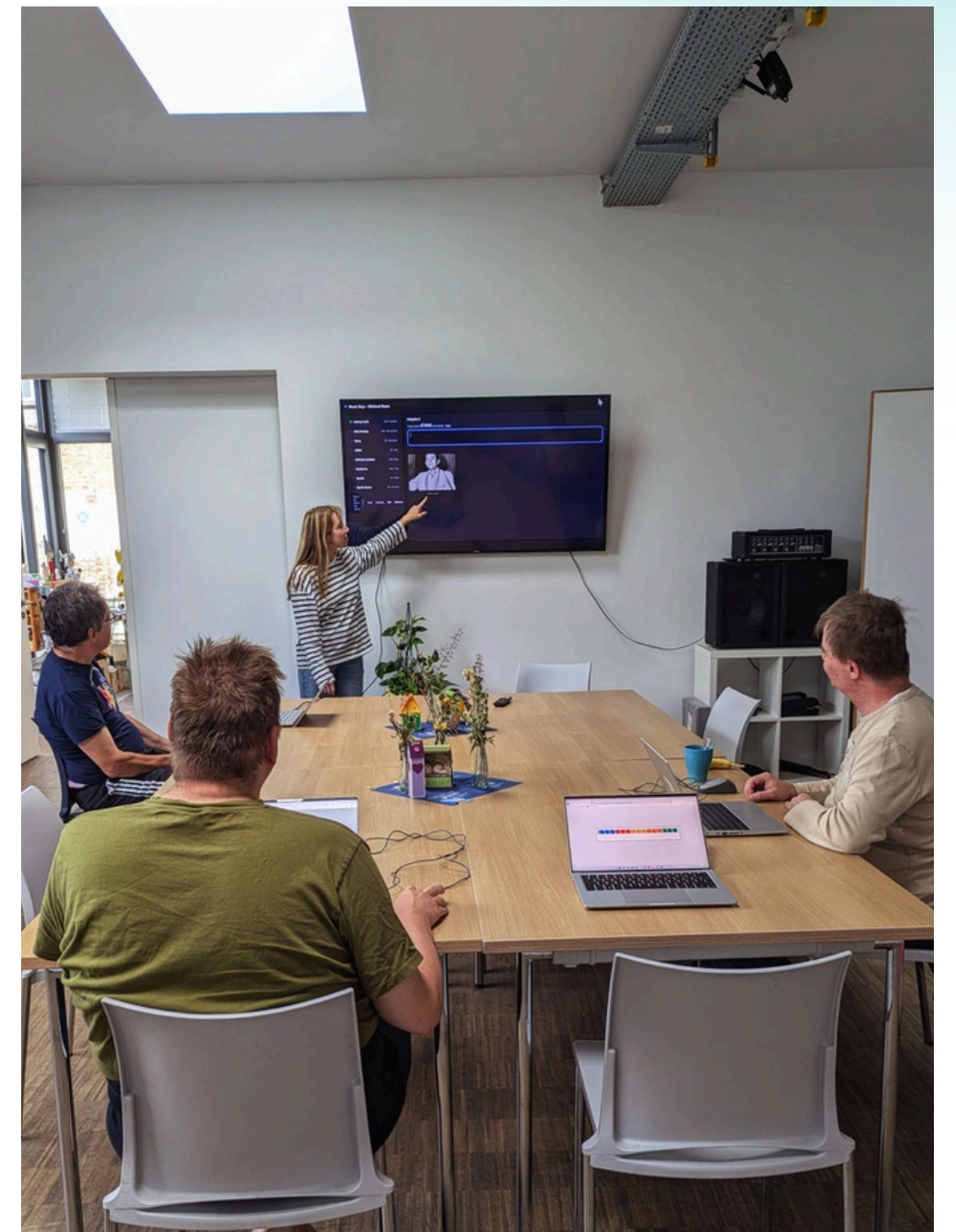


I am Kristina Deryagina, researcher in digital inclusion and accessibility specialist. With a background in Human-Computer Interaction (M.Sc), I co-founded a blind sailing team and prepared athletes as an assistant coach for the Special Olympics (Abu Dhabi & LA).



# Overview

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# Understanding the Digital Divide

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**200 million**

200 million people globally live with intellectual disabilities (ID) (Special Olympics, 2025).

**87.2%**

In Europe 87.2% of people with a disability use the internet compared to 95.2% of those without disability (Eurostat, 2023).

**44.6%**

44.6 % of people with ID and older than 18 years use a mobile phone (Patrick et al., 2020).

**>90%**


More than 90% of people with ID and older than 18 years do not have a profile on social networks (Patrick et al., 2020).

**94.8%**

94.8% of websites do not meet basic accessibility standards (The WebAIM Million, 2025)

**15%**

In high-income countries, only 15% of employers provide employees with ID access to digital tools (Dean et al., 2022).



## Understanding the Digital Divide

# Core challenges



**Social stigma and low expectations**



**Non-adaptable technologies**



**Inflexible training programs or their complete absence**

### **Critical for:**

1. Social participation
2. Education
3. Employment
4. Independent living

# Standard Approach Limits



**Rigid linear training:**  
No room for individual  
pacing.



**Lack of personalization:**  
One-size-fits-all content.



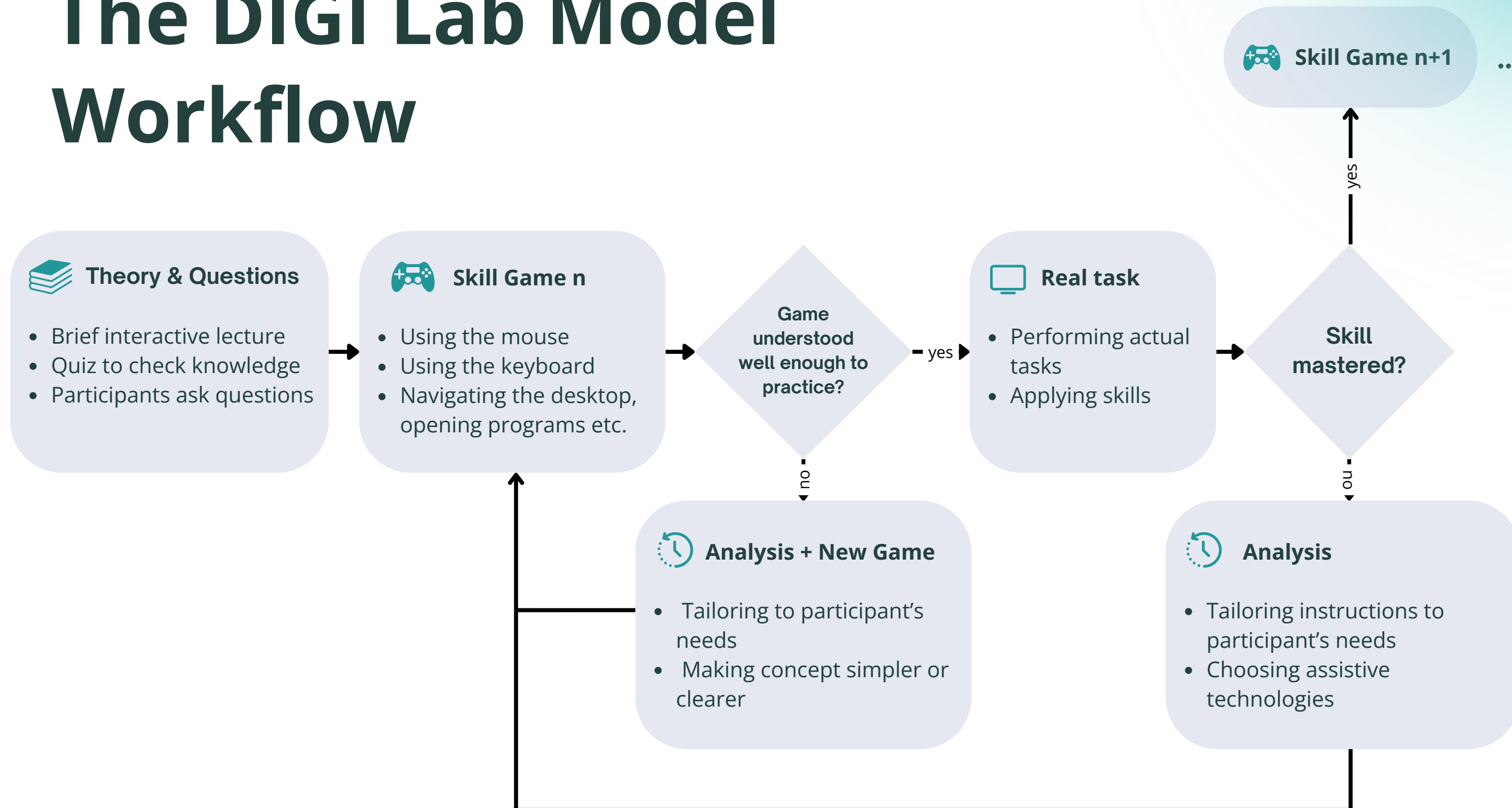
**No long-term support:**  
Skills fade without  
sustained practice.

## **Negative Outcomes:**

1. Low retention of technical skills
2. Limited real-world application.

## The DIGI Lab Siegen Model

# The DIGI Lab Model Workflow



# Foundational Learning Theories



## **“Zone of Proximal Development”, Vygotsky:**

Learning happens only when a skill is slightly above the learner’s ability and supported with scaffolding.



## **Cognitive Load Theory:**

People with ID have significantly lower working-memory capacity.



## **Motor Learning Research:**

Fine motor actions require immediate sensory feedback to be learned and stabilized.

# High-precision interactions



## Observed barriers:

1. double-click timing (200–250 ms)
2. long-press mistaken for drag
3. cursor drift and tremor
4. tiny hit-targets and weak focus

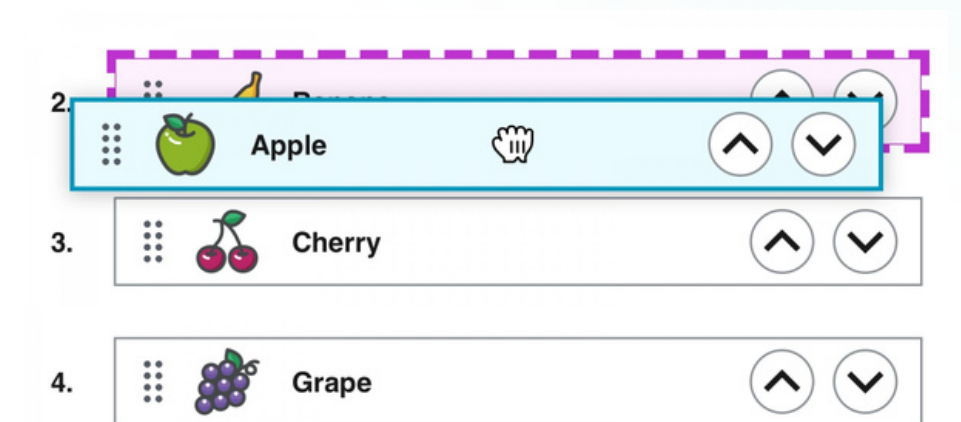
## Where:

- open file by double-click
- text selection
- sliders and resize handles
- small “X” close buttons
- checkboxes
- dropdown arrows

## High-precision interactions

# Interaction Best Practices

- ✓ Replace double-click with single-click actions
- ✓ Avoid drag, offer buttons (Move / Reorder)
- ✓ Large interactive zones
- ✓ Heavy, visible focus states
- ✓ If cannot avoid drag - increase drag-start threshold



# Structured text input

**Aufgabe 3**  
Tippe mit Leerzeichen: **11 22 33** und drücke **Enter**.

- Johnny Cash USA • Country
- Elvis Presley USA • Rock & Roll
- Nena DE • 80er/90er
- ABBA SE • Pop
- Michael Jackson USA • Pop
- Madonna USA • Pop
- Queen UK • Rock
- David Bowie UK • Art Rock

11 222 3333

Nutze die Tasten wie **Enter** **Shift**  
Leertaste Rücktaste

**Aufgabe 4**  
Tippe mit Leerzeichen: **44 55 66** und drücke **Enter**.

- Johnny Cash USA • Country
- Elvis Presley USA • Rock & Roll
- Nena DE • 80er/90er
- ABBA SE • Pop
- Michael Jackson USA • Pop
- Madonna USA • Pop
- Queen UK • Rock
- David Bowie UK • Art Rock

4456

✗ **Noch nicht richtig. Prüfe Ziffern, Abstände und Zeilen.**

Nutze die Tasten wie **Enter** **Shift**  
Leertaste Rücktaste

# Structured text input



## Observed barriers:

1. sequence collapse (11 22 33 → 112233)
2. spacing not perceived
3. repeated items collapse

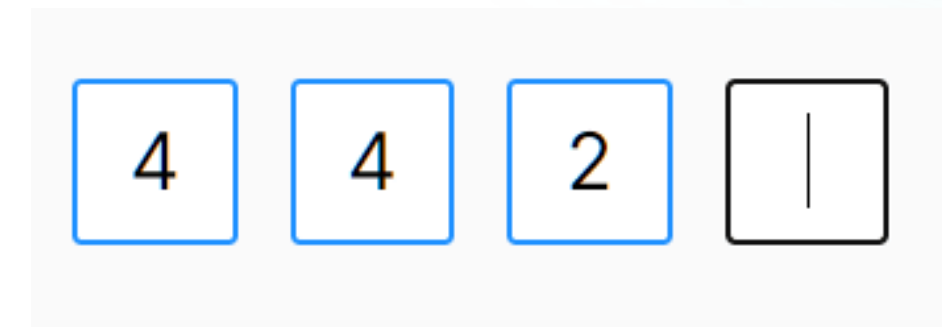
## Where:

- passwords
- form fields
- captcha
- ticket numbers

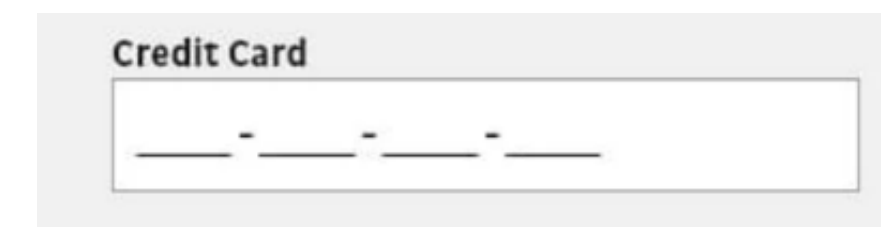
## Structured text input

# Interaction Best Practices

- ✓ Segmented inputs (PIN blocks)
- ✓ Chips/tags instead of space-delimited text
- ✓ Auto-trim + auto-normalize spaces
- ✓ Always show placeholders
- ✓ Never rely on exact whitespace



A visual representation of a segmented PIN input field. It consists of four adjacent square boxes. The first three boxes contain the numbers '4', '4', and '2' respectively. The fourth box is empty and contains a vertical line, representing a placeholder for the final digit.



A visual representation of a credit card input field. The label 'Credit Card' is positioned above a rectangular input box. Inside the box, there are four horizontal lines, each followed by a hyphen, representing a placeholder for the card number.

# Text interaction and reading support

Heute scheint die Sonne hell. Die Blumen blühen im Garten. Ein Vogel **singt** auf dem **Baum**. **Kinder** spielen draußen fröhlich.

W3Schools Online... SAP Business Wareh

1. Barcelona hat viele schöne... dort Fabriken. Im Jahr 1992 wa... gebaut, damit sich Menschen c

2. Die Kirche Sagrada Familia... schön. Ein Mann namens Anto... war. Heute wird weitergebaut.

3. In Barcelona gibt es viele bu... heißt „Casa Batlló“. Es sieht at

3. In Barcelona gibt es viele bunte Gebäude. Antoni Gaudí hat viele davon gemacht. Ein Haus heißt „Casa Batlló“. Es sieht aus wie aus einem Märchen. Viele Menschen machen dort Fotos.

2. Madrid

A- A+ report issues

### 3. Valencia



1. Valencia liegt auch am Meer wie Barcelona.
2. Die Stadt ist bekannt für das Essen „Paella“. Das ist ein Gericht mit Reis, Gemüse und oft Fisch oder Fleisch.
3. In Valencia gibt es alte Gebäude und moderne Bauwerke. Ein modernes Gebäude heißt „Stadt der Künste und der Wissenschaften“. Dort gibt es ein großes Aquarium und ein Kino.

# Text interaction and reading support



## Observed barriers:

1. selecting text requires high precision
2. hard to start selection mid-line (less space)
3. difficult to jump to next line
4. users remember only the last spoken line

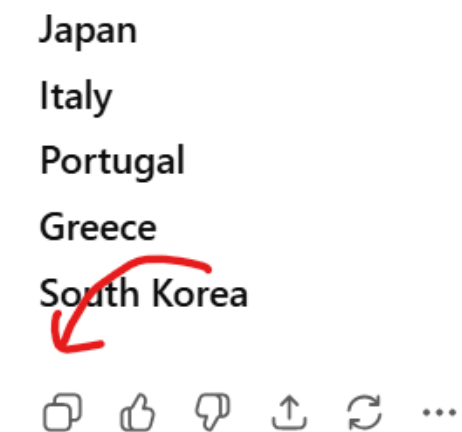
## Where:

- selecting text on websites
- copying information
- form-filling
- reading long instructions

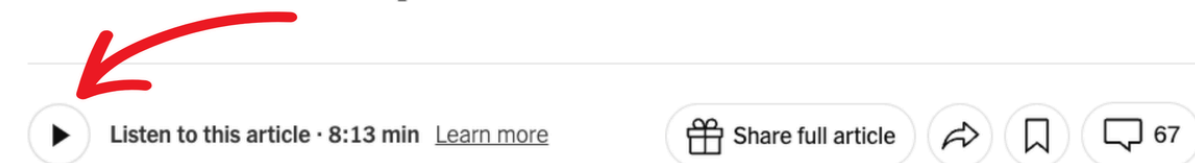
Text interaction and reading support

# Interaction Best Practices

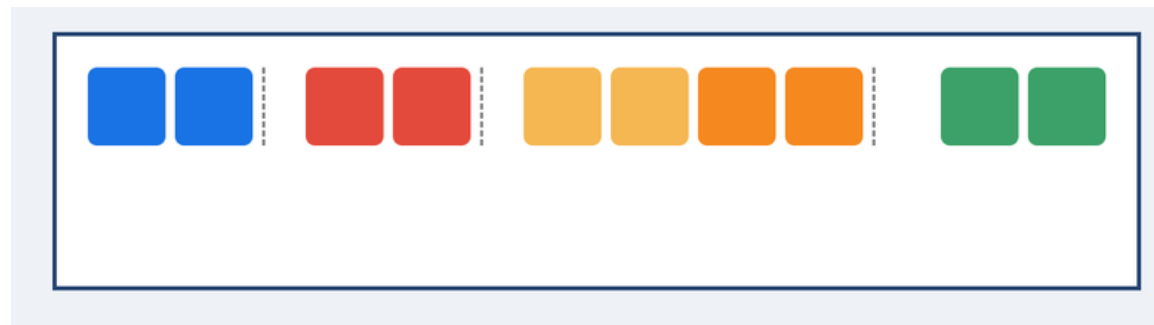
- ✓ Turn selection into action buttons
- ✓ Keep instructions short
- ✓ Chunk content
- ✓ text-to-speech support



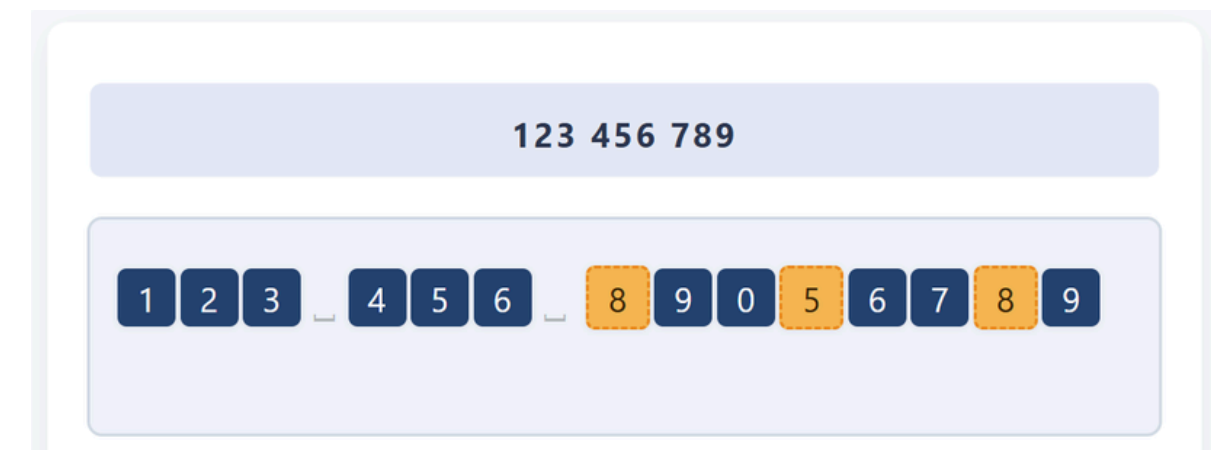
The Senate overwhelmingly passed the Kids Online Safety Act on Tuesday, but the legislation faces an uphill battle in the House because of censorship concerns.



# Visual discrimination and cognitive overload



**Aufgabe:** Baue genau **4 Züge** (jeder mit **3 blauen Wagen**, getrennt durch ein Leerzeichen) in **einer Zeile**.



# Visual discrimination and cognitive overload



## Observed barriers:

1. Low color discriminability (yellow–orange confusion)
2. No visual example → rule not understood
3. Weak or low-contrast focus state
4. Too many visually similar elements

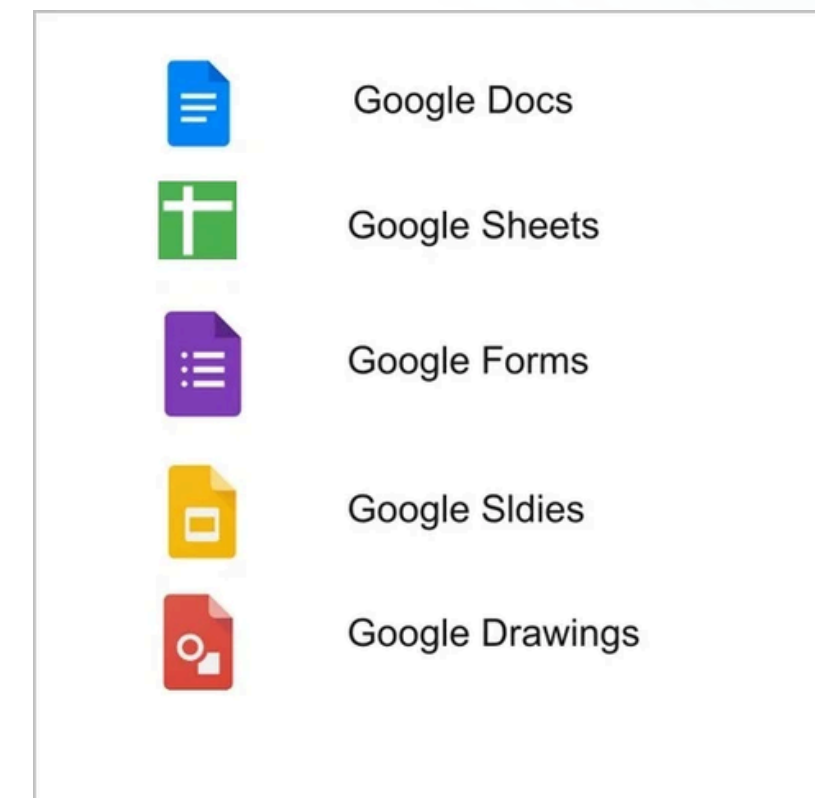
## Where:

- color labels (Google Calendar/Notion)
- dropdowns with similar icons
- multi-step menus
- charts and dashboards

Visual discrimination and cognitive overload

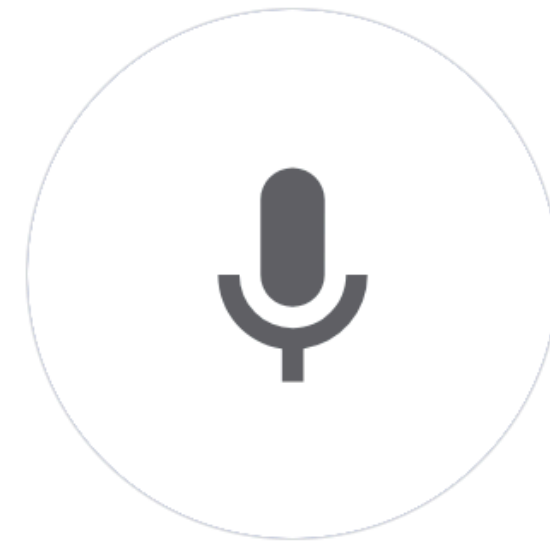
# Interaction Best Practices

- ✓ Avoid color pairs that are too close
- ✓ Pair color with icon/shape
- ✓ Use explicit visual examples
- ✓ High-contrast hover/focus



# Voice Interaction

Didn't get that. [Try again](#)



# Voice Interaction



## Observed barriers:

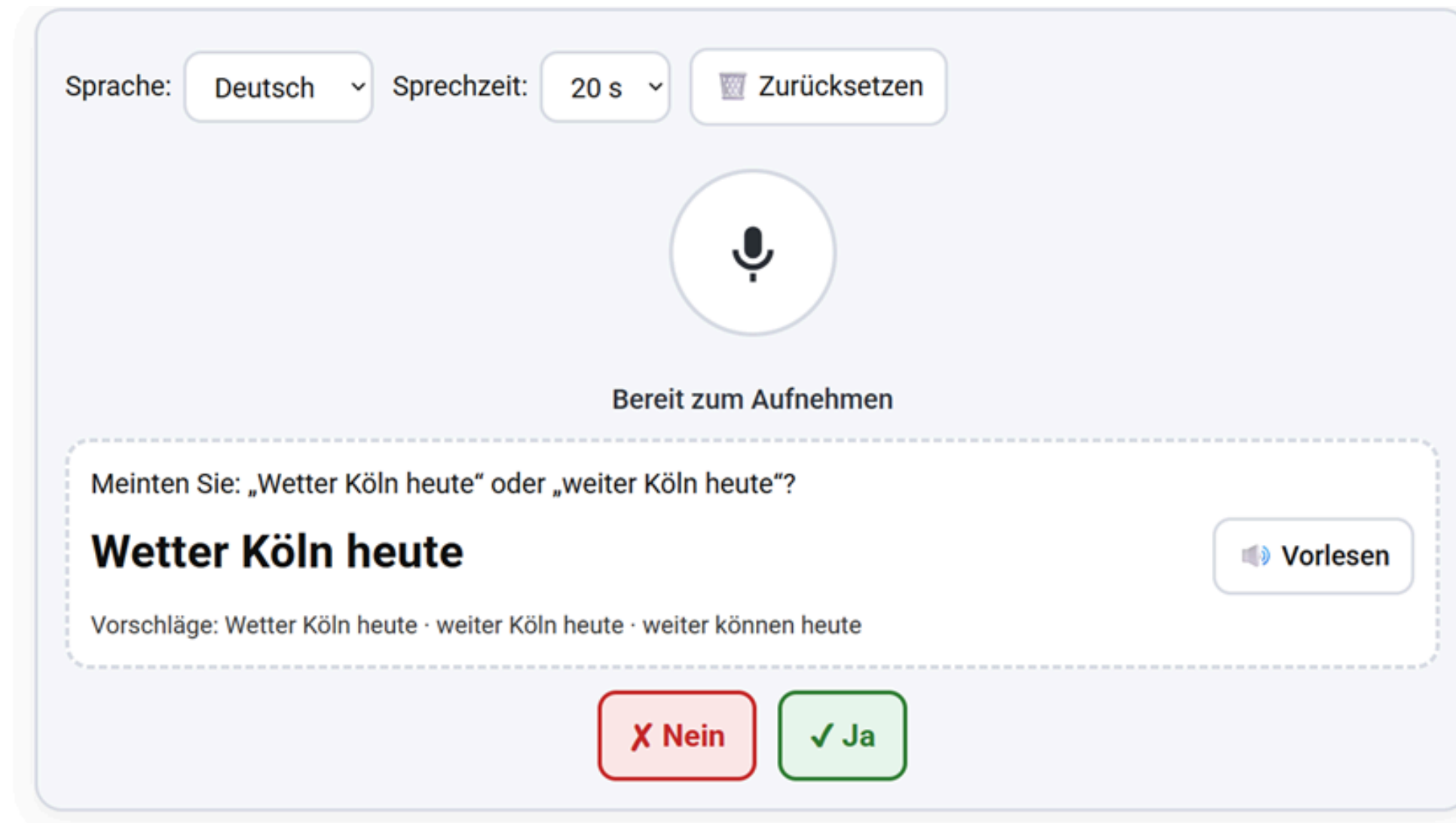
1. Dysarthria
2. Long natural speech patterns
3. Social fillers ("please tell me...", "could you maybe...")
4. Slow speech onset
5. Lack of a confirmation step

## Where:


- Google Assistant
- Web speech input
- YouTube search voice input

## Voice Interaction

# Interaction Best Practices




Sprache: Deutsch ▾ Sprechzeit: 20 s ▾ Zurücksetzen



Bereit zum Aufnehmen

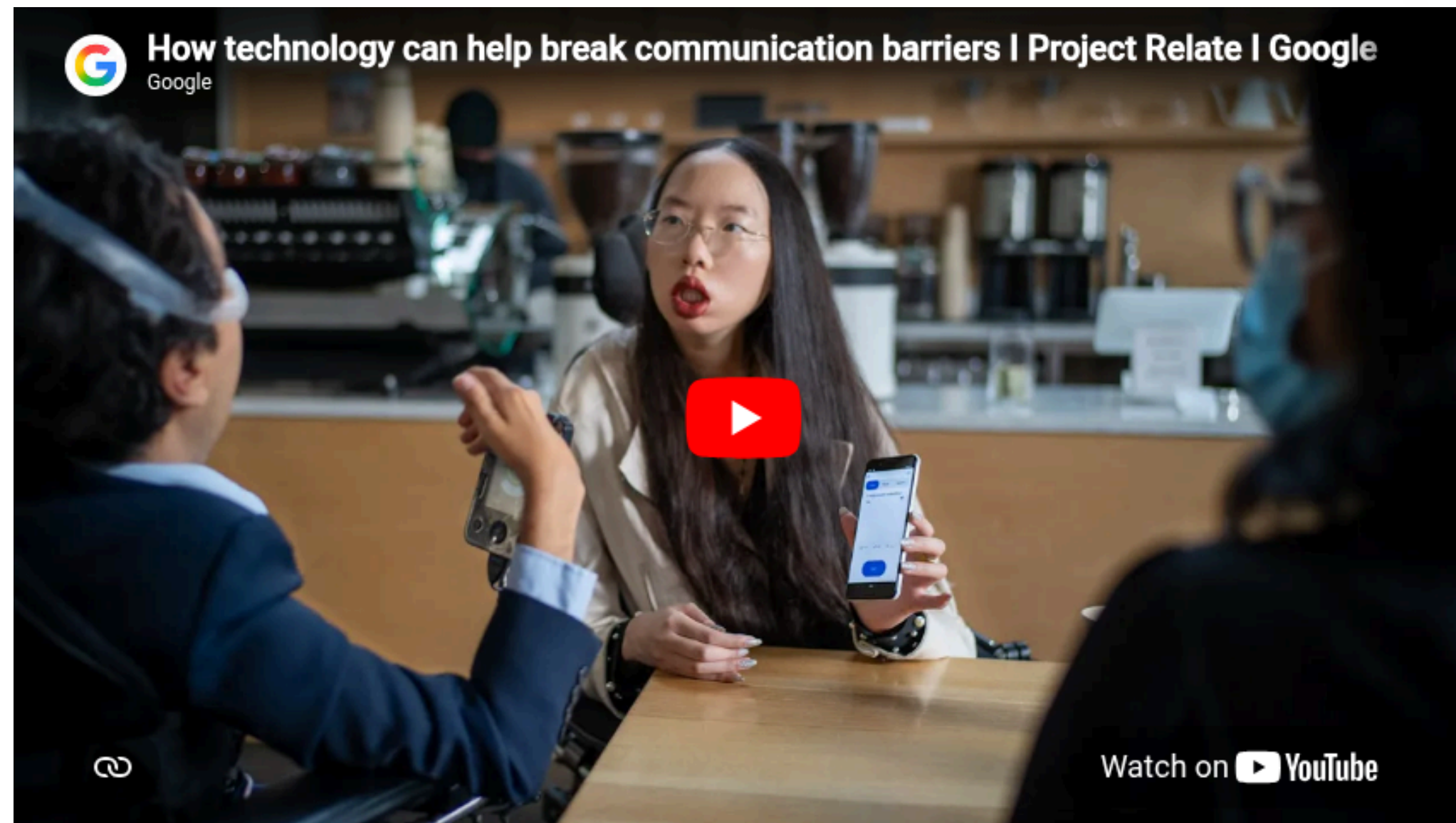
Meinten Sie: „Wetter Köln heute“ oder „weiter Köln heute“?

**Wetter Köln heute**  Vorlesen

Vorschläge: Wetter Köln heute · weiter Köln heute · weiter können heute

Voice Interaction

# Interaction Best Practices





# Recommendation Summary

- Help users by reducing precision demands
- Help users perceive differences through clear visual cues
- Use clear and understandable content
- Help users avoid mistakes and know how to correct them
- Help users focus
- Ensure processes do not rely on memory



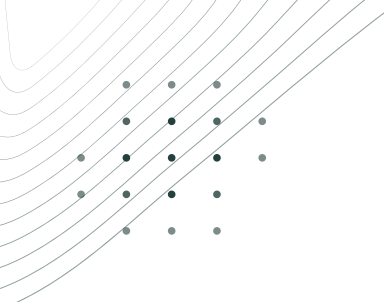
# Conclusion

- ▶ Digital literacy for individuals with cognitive disabilities requires more than traditional, technical instruction.
- ▶ Designing for cognitive accessibility improves usability for everyone is including people with temporary, situational, or stress-induced limitations.
- ▶ Digital inclusion is not only about teaching skills, it is about redesigning interaction patterns to be **forgiving, predictable, and perceptually clear.**



# References

1. Special Olympics. (2025). What is Intellectual Disability? <https://www.specialolympics.org/about/intellectual-disabilities/what-is-intellectual-disability>
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5. Dean, E., Garrels, V., Sigstad, H., & Wendelborg, C. (2022). Employer willingness to hire people with intellectual disability: The influence of employer experience, perception of work, and social responsibility. *Journal of Vocational Rehabilitation*, 57, 1–11. <https://doi.org/10.3233/JVR-221201>



**Thank  
You!**

