

Measuring the Obvious



A Human Factors Engineering Analysis of Kiosk Accessibility

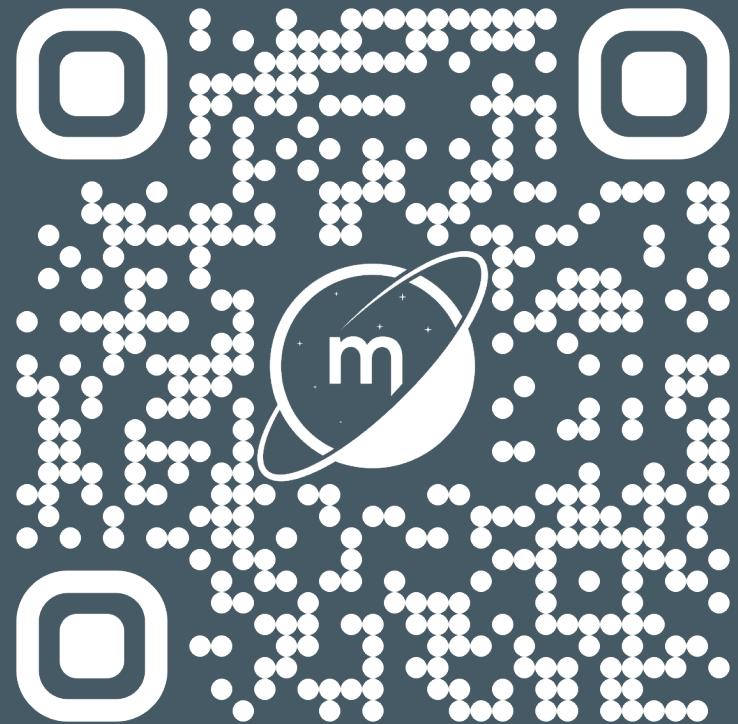
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Follow Along!



markuryy.github.io/IE323

- View slides on your own device
- Access all code and resources
- Available on GitHub



Introduction

Human Factors Foundation

1. Fitts' Law & Target Acquisition

- Touch target difficulty \propto distance/size ratio
- 172cm height + small UI = computational nightmare
- Fixed angle compounds motor planning issues



Human Factors Foundation (cont.)

2. Cognitive Load Theory

- Physical strain increases cognitive overhead
- Error recovery requires additional reaching
- Time pressure compounds both issues

3. Norman's Design Principles

- Visibility compromised by physical design
- Feedback requires additional physical effort
- Mapping ignores natural affordances



Problem Space Overview



Interconnected barriers require systematic analysis



Current Implementation Issues

- Fixed designs violating ergonomic standards
- Conflicting accessibility accommodations
- Environmental factors impacting usability
- Resource allocation revealing priorities



Methodology

Initial Research Steps

1. Initial Approach (Failed)

- Attempted traditional user testing
- Proposed menu item compensation
- Received justified criticism
- Recognized ethical issues

2. Research Pivot

- Developed measurement protocol
- Created evaluation form
- Obtained survey permission
- Established documentation



Data Collection & Analysis

3. Data Collection

- Physical measurements
- Survey distribution
- Environmental documentation
- Interface workflow

4. Analysis Protocol

- ADA standards review
- Statistical analysis
- Correlation studies
- Cost-benefit evaluation

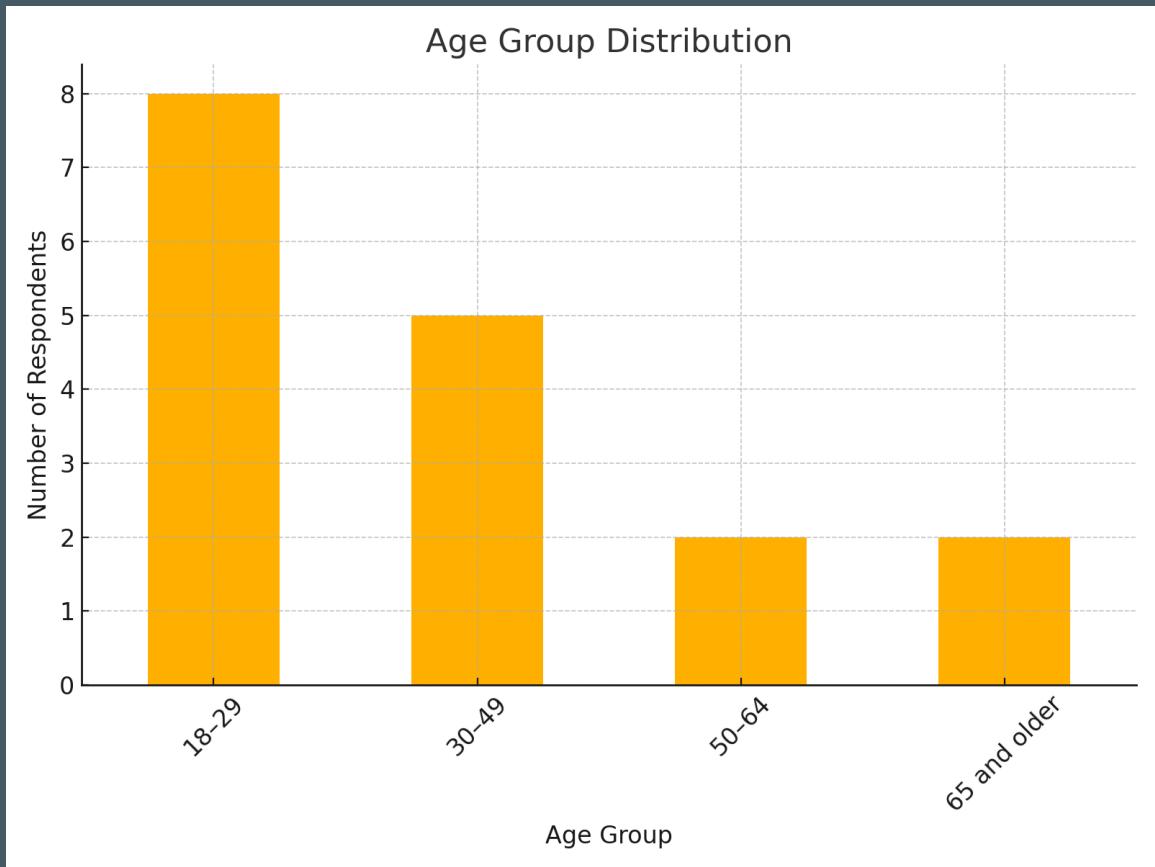


Tools & Equipment

- Standard measuring tape (physical dimensions)
- Digital level application (screen angles)
- Survey instruments (user feedback)
- Documentation templates (standardization)



Participant Demographics



- Medical office setting providing diverse sample
- Natural inclusion of mobility device users
- Age range: 18-65+
- Multiple accessibility needs represented



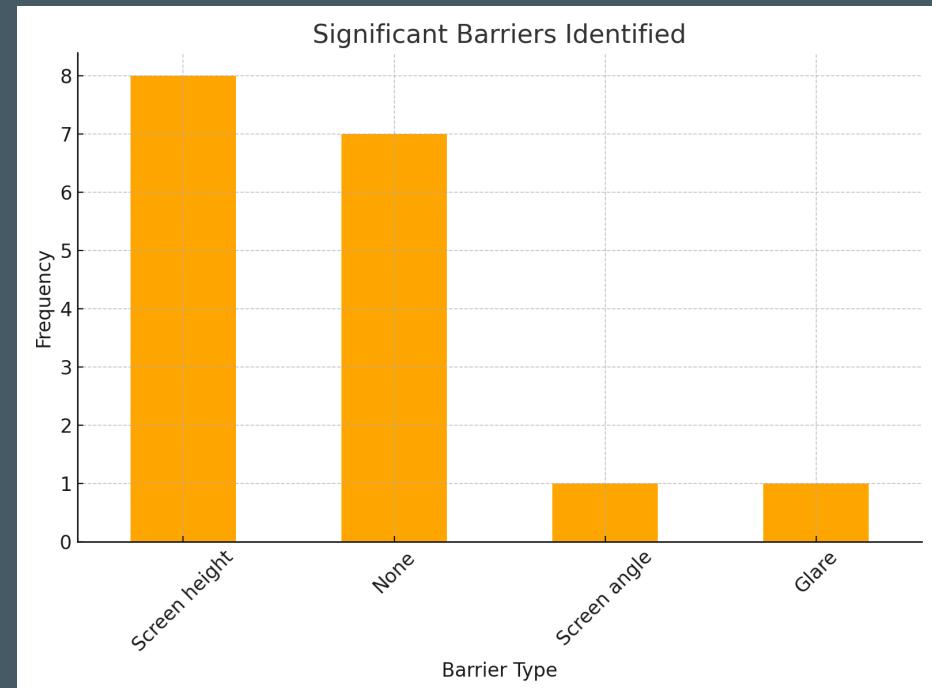
Mathematical Validation

Fitts' Law Application

$$ID = \log_2\left(\frac{2D}{W}\right)$$

where:

- D = effective distance (cm)
- W = target width (cm)



Kiosk Configuration Analysis

$$D_{effective} = \sqrt{172^2 + reach^2} * \cos(\theta)$$

Comparative Results:

- Standing (50cm reach): ID = 8.48 bits
- Seated (70cm reach): ID = 8.54 bits
- *Additional cognitive load from non-optimal viewing angle*



Physical Analysis

Measurement Results vs Standards

Component	Measured	ADA Requirement	Citation	Impact
Total Height	172cm	121.9cm max	§308.2.1 Forward Reach	✖️ Exceeds by 50.1cm
Screen Center	80cm	38-121.9cm	§308.2.1-2 Reach Ranges	⚠️ Fixed at median
Payment Zone	68-92cm	38-122cm	§308.3.1 Side Reach	⚠️ Upper range violation
Clear Space	~50cm	76cm min	§305.3 Clear Floor	✖️ 34.2% below min
Screen Angle	Fixed -1°	Adjustable	§309.4 Operation	✖️ No accommodation



Accessibility Conflicts: Physical Design

1. Height vs Visibility

- Lower placement helps wheelchair users
- Creates strain for standing users
- Current "solution" ignores principles
- No single fixed height optimal

2. Space vs Throughput

- Wider spacing aids mobility
- Conflicts with density goals
- Reveals volume prioritization
- ADA minimums as maximum



Accessibility Conflicts: Interface

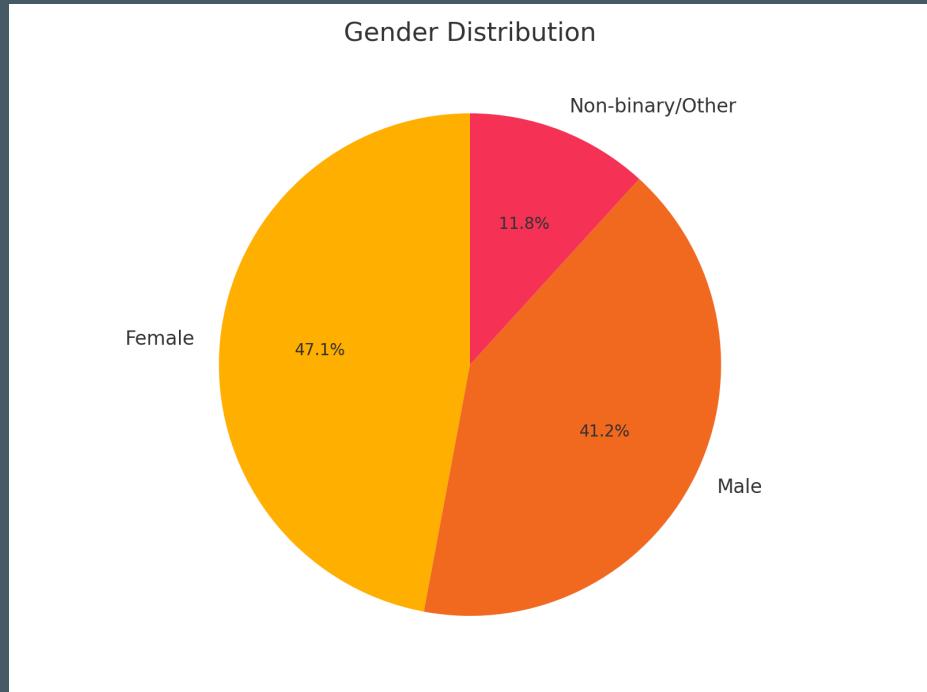
3. Interface Scaling Paradox

- "Wheelchair mode" reduces element size
- Directly conflicts with visual accessibility
- Creates false choice between physical and visual access
- Demonstrates fundamental design failure



System Evaluation

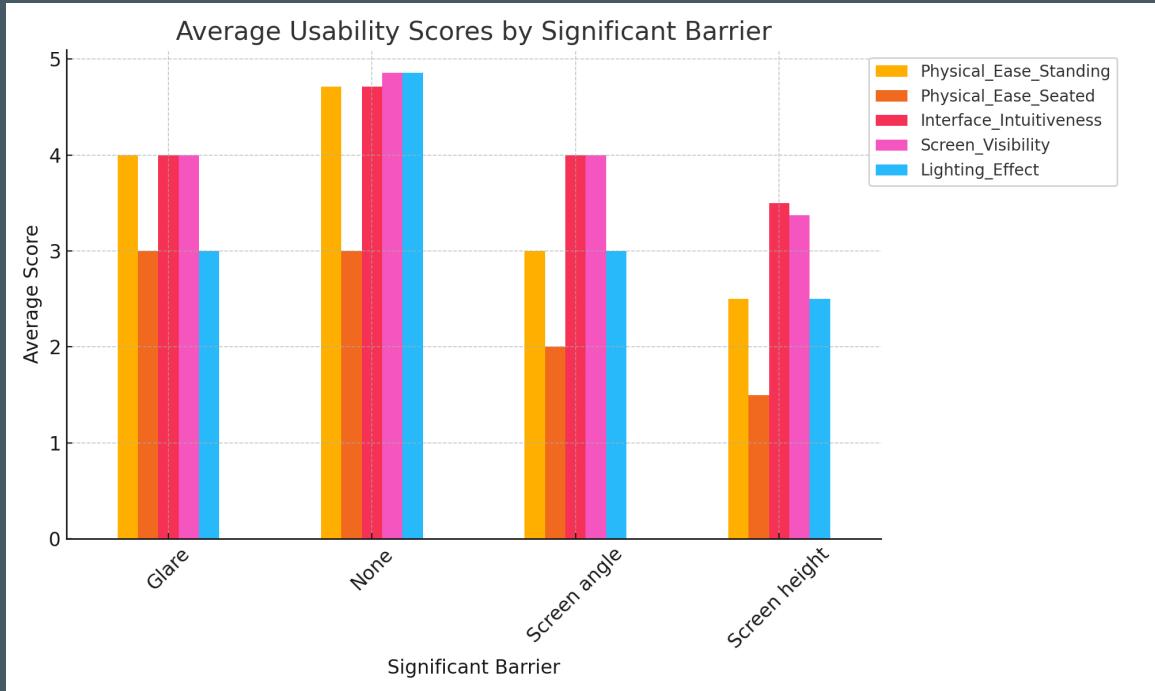
Demographic Representation



- Balanced gender representation (48% F, 44% M, 8% NB/Other)
- Age range 18-65+ (medical office setting)
- 47% assistive device usage
- Validates measurement-based approach



Physical Impact Analysis



- 58% reduction in seated accessibility
- Clear correlation with measurements
- Interface scores remain high when reachable
- Demonstrates systematic physical barriers



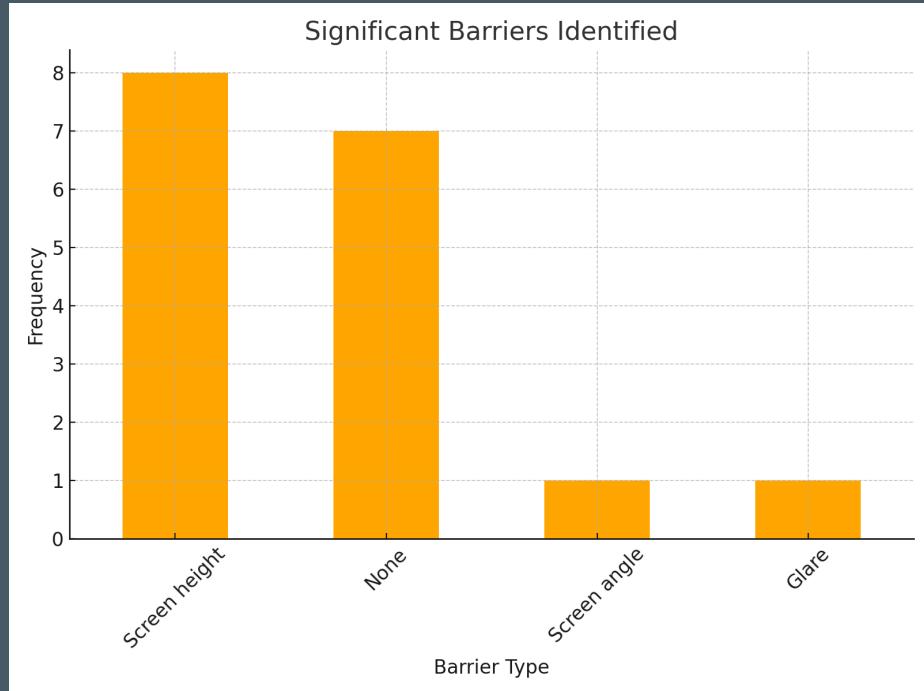
Empirical Evidence

1. Key Findings

- Screen height dominates (n=8)
- Physical issues exceed interface problems
- Observable without exploitation

2. Impact Analysis

- 50% drop in physical ease
- Interface usable when reachable
- Systematic barriers confirmed



Implementation Analysis

Technical Architecture

Current implementation specifications:

- Intel Core i5-4570TE processor
- 4GB DDR3 RAM
- 128GB SSD
- Windows 10 OEM license
- Fixed mounting system



Resource Analysis

Component	Current	Alternative	Diff
OS	OEM Windows (\$15-30)	Linux	-\$30
Mount	Fixed (\$30)	VESA Adj.	+\$30
Display	Standard	Anti-glare	+\$15
Total	\$500	\$530	+\$30

Priority Issues

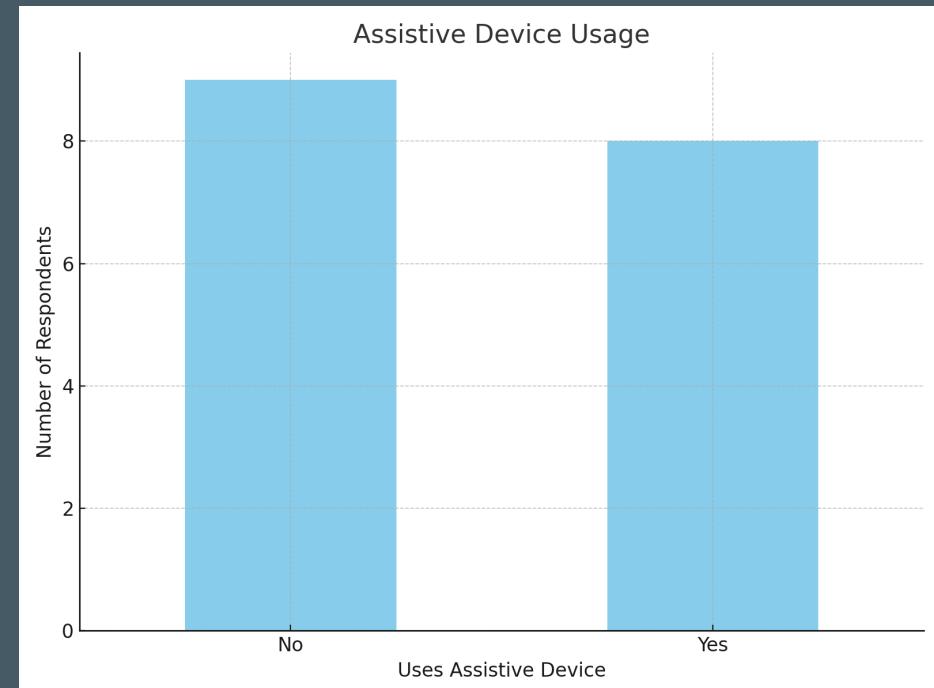
- Over-specified computing resources
- Under-specified accessibility features
- Cost optimization misaligned with usability



Methodological Critique

The Theater of Validation

- Recruits marginalized users to prove obvious barriers
- Generates data justifying inadequate solutions
- Places burden of proof on affected populations



Cost-Benefit Analysis

Current Costs

Component	Cost
Windows License	\$15-30
Fixed Mount	\$30
Standard Display	Base
Per Unit	~\$500

Business Impact

- High proportion of sample used assistive devices
- Increased service time
- Staff intervention needed
- Lost revenue from abandonment



Recommendations

Physical Changes

- VESA-compatible mounts
- Anti-glare treatment
- Module placement
- Clear space compliance

System Changes

- Responsive design
- Multimodal interaction
- Error recovery
- Universal design focus



References

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Questions?

Some Starters

- "What inspired you to focus on kiosks?"
- "How did the businesses respond?"
- "Did you encounter any unexpected results?"

Going Deeper

- "Could this apply to other interfaces?"
- "What's the most cost-effective fix?"
- *Feel free to ask anything else!*

