Measuring the Obvious:

A Human Factors Engineering Analysis of Kiosk Accessibility

Introduction (3min)

Human Factors Foundation

1. **Fitts' Law & Target Acquisition**

   - Touch target difficulty ∝ distance/size ratio
   - 172cm height + small UI = computational nightmare
   - Fixed angle compounds motor planning issues
   - Demonstrates quantifiable design failure

2. **Cognitive Load Theory**

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

3. **Norman's Design Principles**

   - Visibility compromised by physical design
   - Feedback requires additional physical effort
   - Mapping ignores natural affordances
   - Error prevention/recovery fundamentally flawed

Problem Space Overview
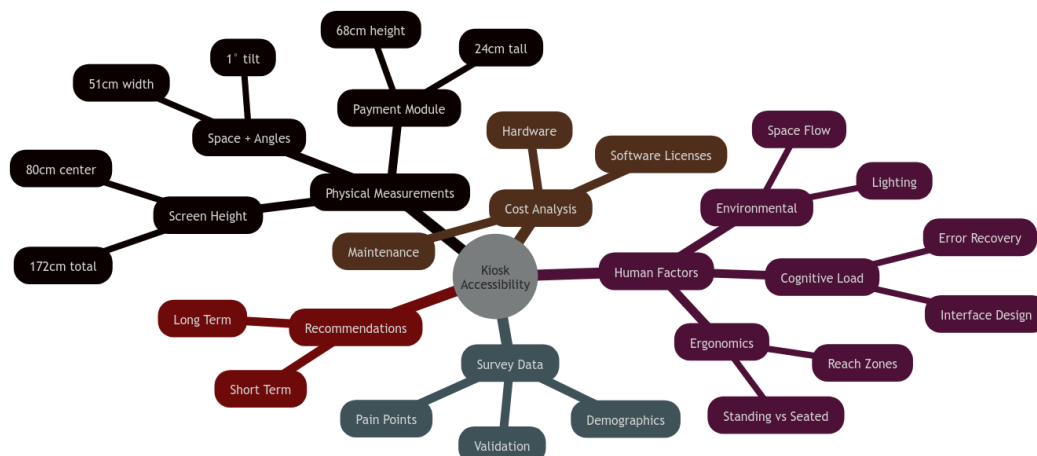
Interconnected barriers require systematic analysis

Current Implementation Issues

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

Methodology (4min)

Step-by-Step Process

1. **Initial Approach (Failed)**

   - Attempted traditional user testing
   - Proposed menu item compensation
   - Received justified criticism from potential participants
   - Recognized ethical issues in methodology

2. **Research Pivot**

   - Developed measurement protocol
   - Created standardized evaluation form
   - Obtained medical office survey permission
   - Established documentation standards

3. **Data Collection**

   - Physical measurements using calibrated tools
   - Survey distribution in medical setting
   - Environmental condition documentation
   - Interface workflow recording

4. **Analysis Protocol**

   - ADA standards cross-reference
   - Statistical analysis of survey data
   - Correlation of measurements with feedback
   - Cost-benefit evaluation

Tools & Equipment

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

Participant Demographics

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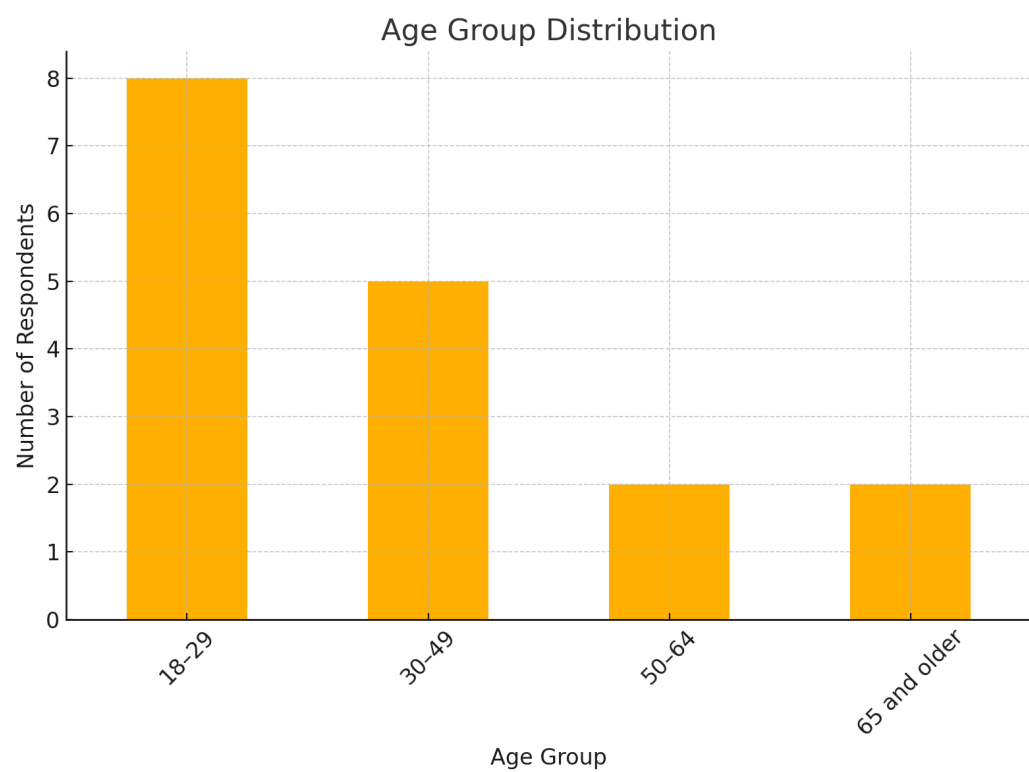
- Medical office setting providing diverse sample
- Natural inclusion of mobility device users
- Age range: 18-65+
- Multiple accessibility needs represented

Physical Analysis (4min)

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

Note: Measurements documented during peak operating hours, validated across multiple locations

Accessibility Conflicts

1. **Height vs Visibility**

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

2. **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
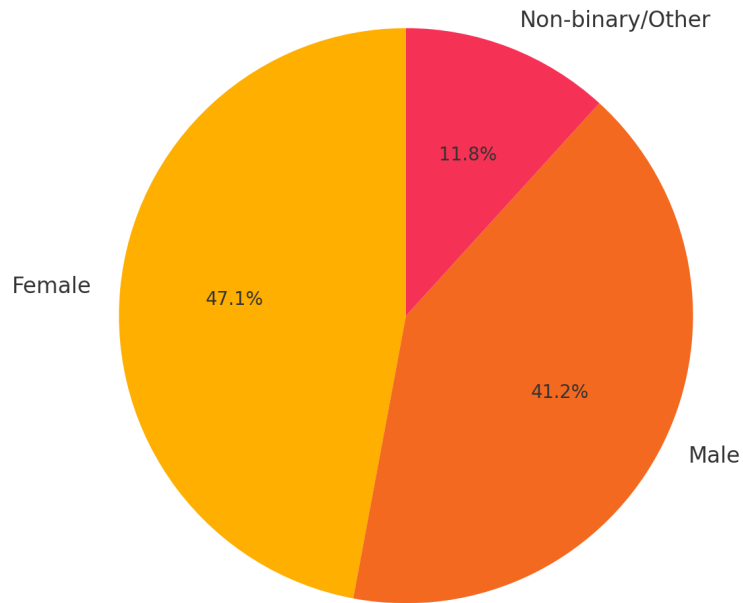
3. **Space vs Throughput**

   - Wider spacing aids mobility devices
   - Conflicts with installation density goals
   - Reveals prioritization of volume over access
   - ADA minimum requirements treated as maximum
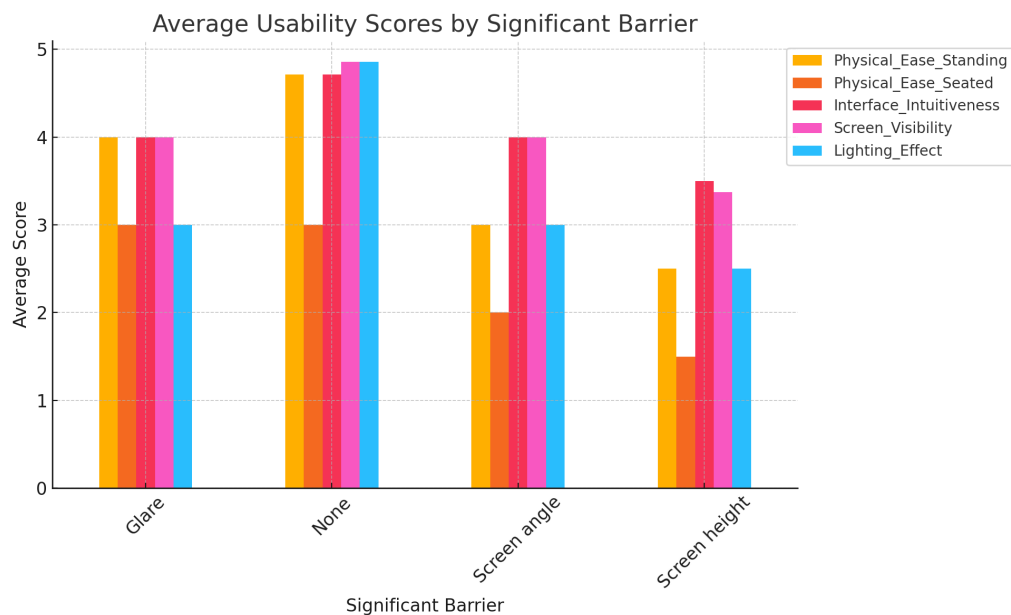
System Evaluation (4min)

Quantitative Validation

Demographic Representation

Gender Distribution

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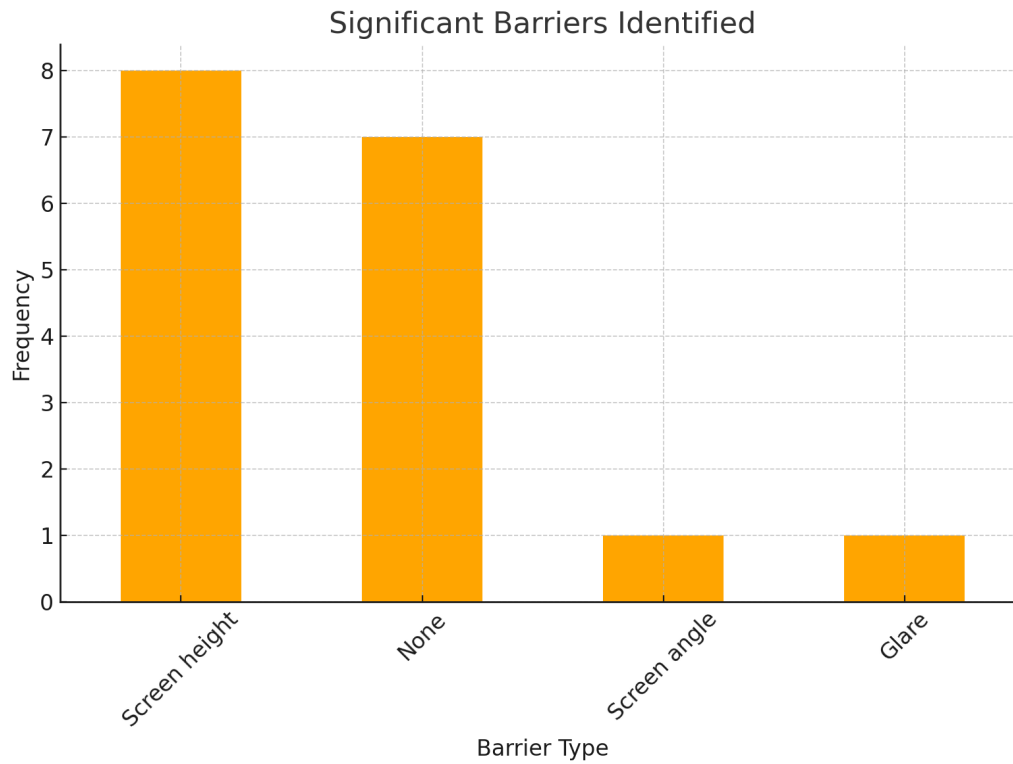- Validates measurement-based approach

Physical Impact Analysis

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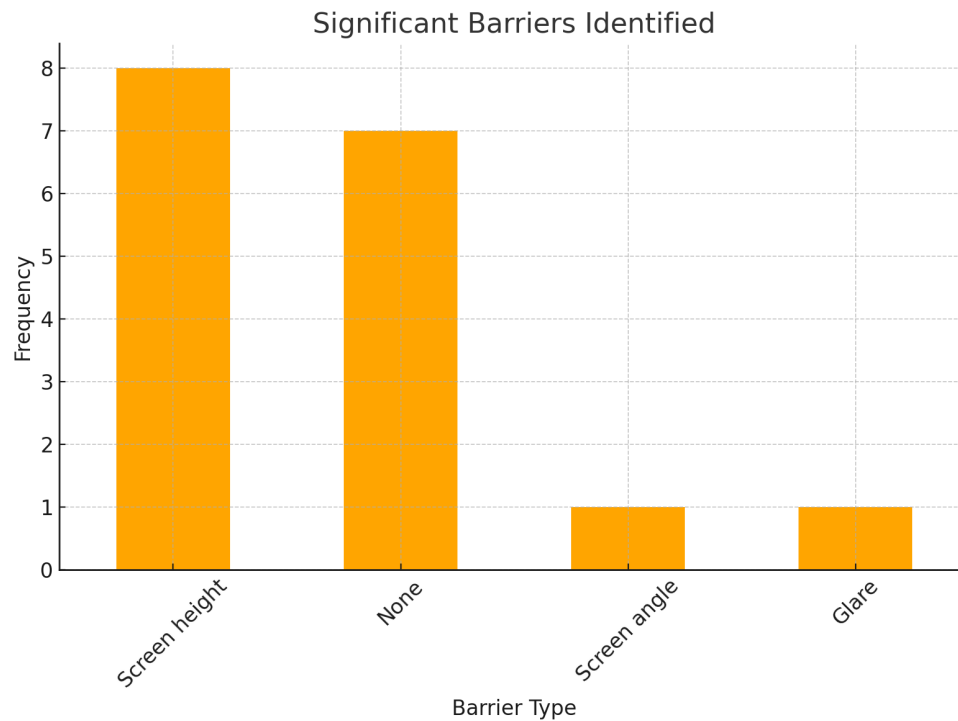- Interface scores remain high when reachable

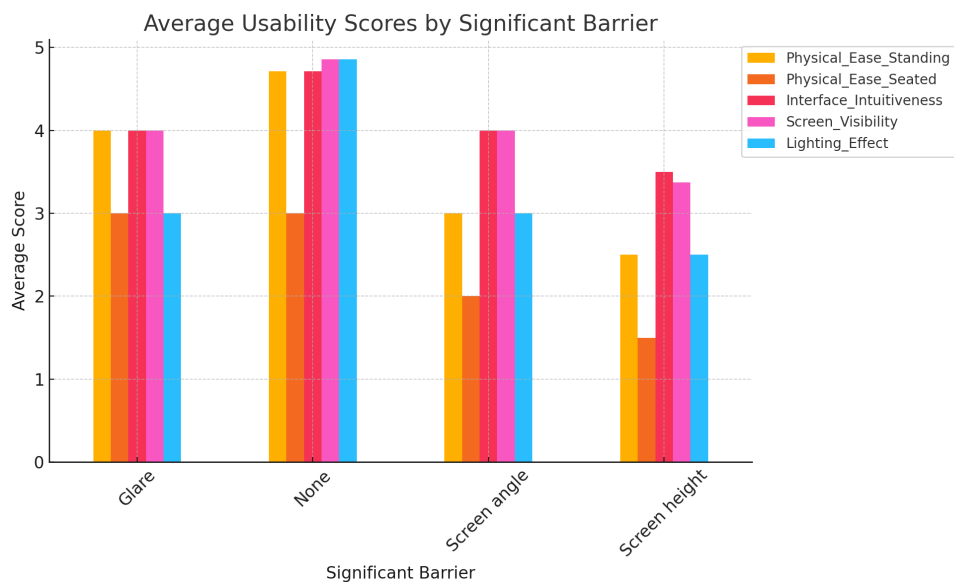- Demonstrates systematic physical barriers

Empirical Evidence

- Screen height dominates (n=8)
- Physical > interface issues
- Validates measurement-first approach
- Observable without exploitation

1. **Barrier Identification**

Significant Barriers Identified

- Screen height dominates reported issues (8 reports)
- Physical design issues > interface complaints
- Validates measurement-first approach
- Barriers obvious without exploitation

2. **Impact Analysis**

Average Usability Scores by Significant Barrier

- Seated users report significantly lower scores
- Screen height creates 50% drop in physical ease
- Interface remains usable (when reachable)
- Demonstrates systematic physical barriers

3. **Sample Validation**

Assistive Device Usage
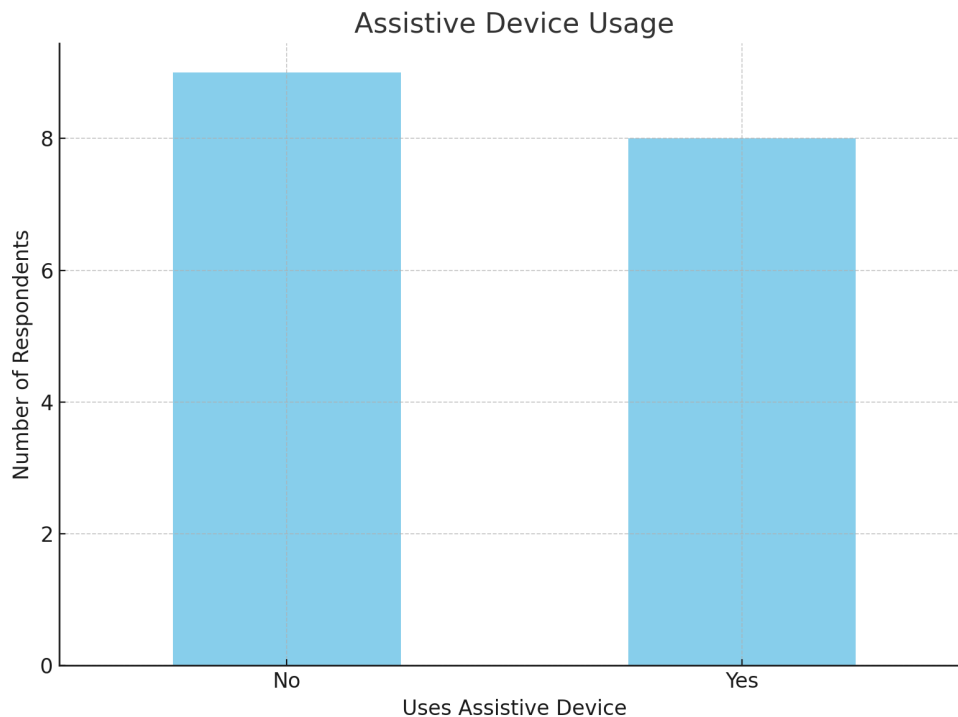
- 47% of respondents use assistive devices
- Medical office setting provides actual user base
- Higher representation than student sampling
- Validates measurement concerns

Implementation Analysis (4min)

Technical Architecture

Current implementation specifications:

- Intel Core i5-4570TE processor
- 4GB DDR3 RAM
- 128GB SSD
- Windows 10/11 Pro license
- Fixed mounting system

Resource Allocation

Component	Current	Accessible Alternative	Differential
OS	Windows ($15-30)	Linux Kiosk	-$30
Mount	Fixed ($30)	VESA Adjustable	+$30
Display	Standard	Anti-glare	+$15
Total	**$500**	**$530**	**+$30 (6%)**

Priority Analysis

- Over-specified computing resources
- Under-specified accessibility features
- Cost optimization misaligned with usability
- Known solutions ignored for aesthetic uniformity

Recommendations (3min)

Immediate Interventions

1. **Physical Accessibility**

    - Install VESA-compatible adjustable mounts
    - Add anti-glare screen treatment
    - Reconfigure payment module placement
    - Ensure adequate clear space

2. **Interface Optimization**

    - Implement responsive design
    - Add multimodal interaction options
    - Improve error recovery mechanisms
    - Reduce cognitive load

Systemic Solutions

1. **Design Philosophy**

    - Prioritize universal design principles
    - Move beyond compliance minimums
    - Address conflicting accessibility needs
    - Implement measurable accessibility metrics

2. **Resource Reallocation**

    - Optimize technical specifications
    - Redirect savings to accessibility features
    - Focus on empirically validated improvements

Conclusion

This measurement-based evaluation demonstrates:

- Empirical evidence of systematic barriers
- Conflict between different accessibility needs

- Cost-effective solutions exist but are ignored
- Need for human factors-driven design approach

Strategic Q&A Setups

Methodology Questions

1. "How does your measurement-based approach compare to traditional testing in terms of resource efficiency?"

   - Eliminates participant recruitment bias
   - Provides quantifiable, reproducible results
   - Avoids ethical concerns of exploitation
   - Actually proves what we already know

2. "Could you elaborate on the decision to prioritize physical measurements over user testing?"

   - Observable facts don't require validation
   - Measuring tape doesn't have sampling bias
   - Ethical obligation to avoid unnecessary testing
   - More efficient use of research resources

Technical Implementation

3. "What influenced your choice of measurement points and standards?"
   - ADA guidelines provide clear benchmarks
   - Human factors principles dictate interaction zones
   - Ergonomic research establishes optimal ranges
   - Real-world usage patterns inform priorities

Cost Analysis

4. "How do you justify the additional cost of accessibility features?"
   - Current implementation already overspends
   - Optimization opportunities exist
   - Accessibility costs < Windows license
   - ROI includes reduced support needs

Future Directions

5. "What aspects of this framework could be applied to other self-service systems?"
   - Measurement protocol is universal
   - Cost analysis reveals priority misalignment
   - Human factors principles transcend context
   - Methodology prevents exploitation