# Multisensory Pre-Alarm System for Physicians

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Mystery Machine

Oral Report 6
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# Problem Statement

- Distracting alarms and sounds in Intensive Care Units
- Leads to patient and physician fatigue
- No differentiation between different parameters

# Needs Assessment

- **UX**
- Patient Efficacy
- Safety
- Hospital System Efficiency
- **Technical Needs**

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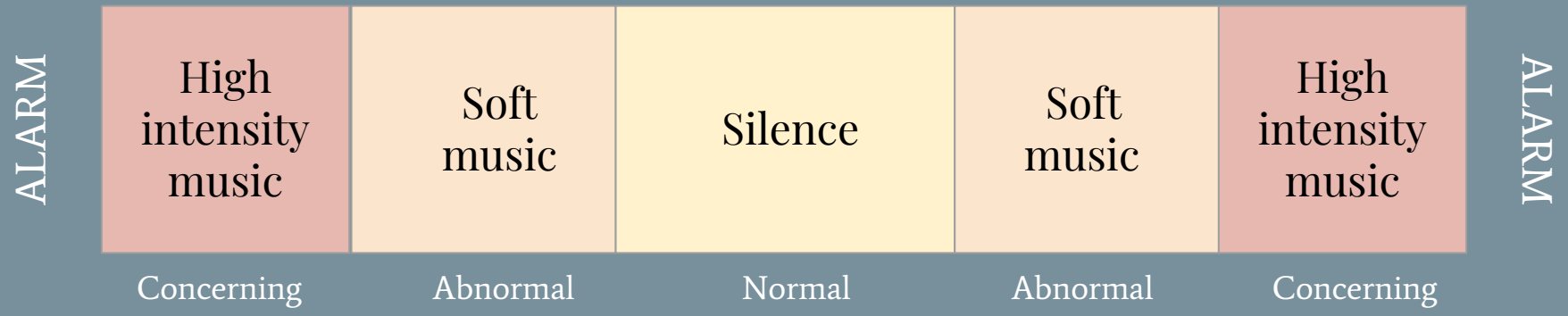
# Needs Assessment

- UX
- P
- S
- H
- T

## Audio Input




## Haptic Input
on wrist and ankle

### Discrete

- Brief pulses indicating a state change
- Convey information by length of pulse and number of pulses

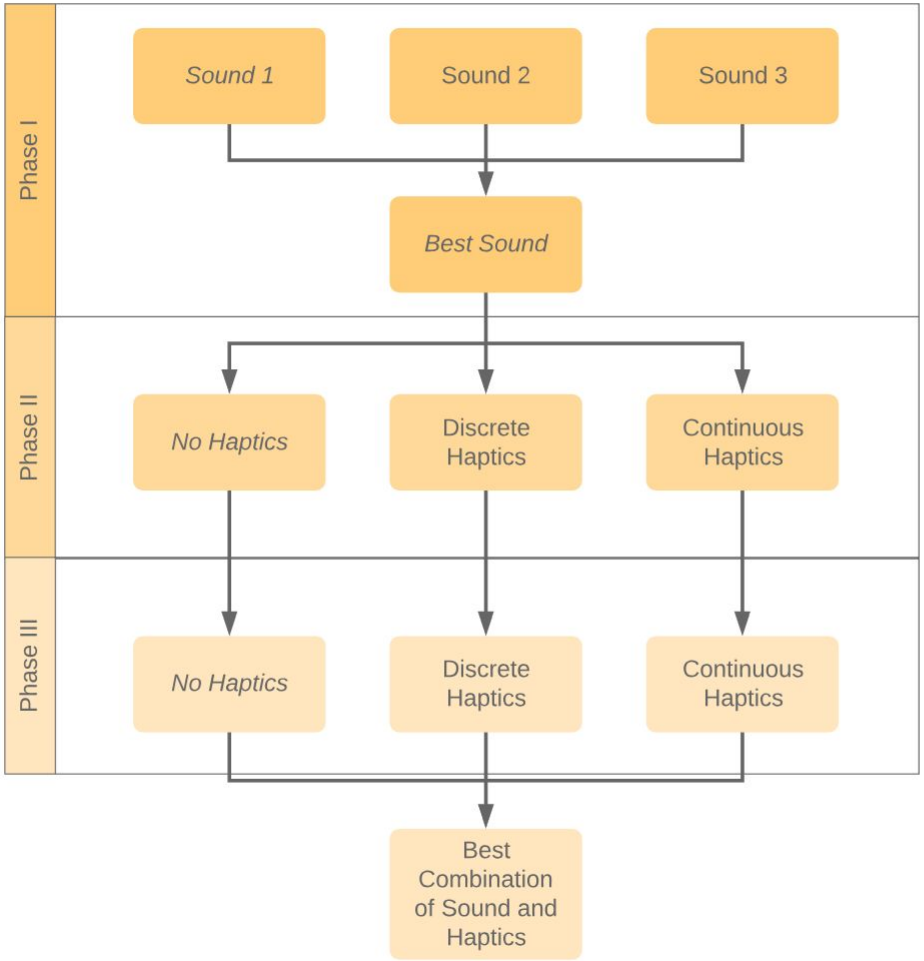
### Continuous

- Sounds reduced to very low, subwoofer frequencies (20-200 Hz)
- “Feel” the change in sound

# Updates

1) Phase III
2) Phase I Data Analysis
3) Phase II Data Analysis

# Phase III of Study


Phase I
Sound 1
Sound 2
Sound 3
Best Sound
Phase II
No Haptics
Discrete Haptics
Continuous Haptics
Phase III
No Haptics
Discrete Haptics
Continuous Haptics
Best Combination of Sound and Haptics

# Phase II Overview

Repeat for Iterations 2 and 3

Haptics Training/Testing

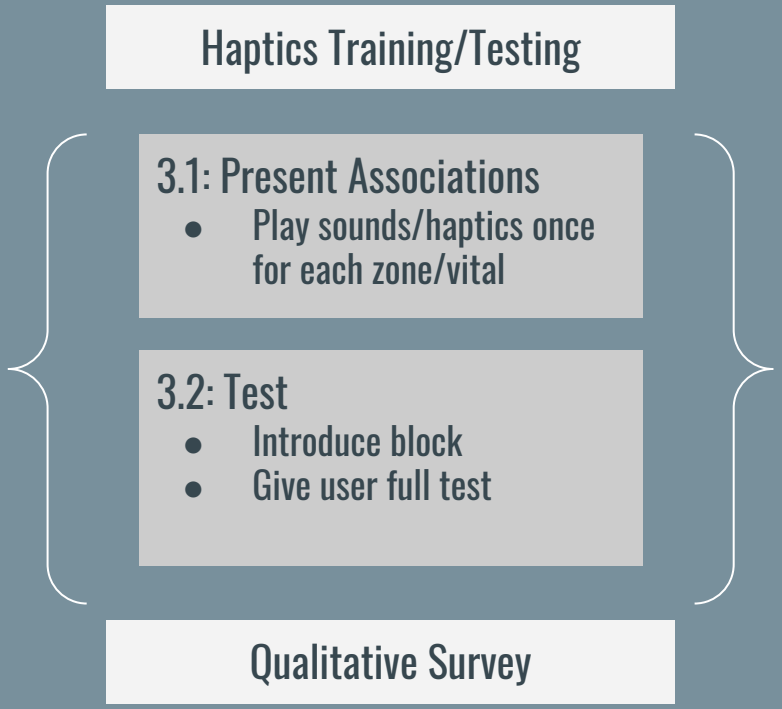
2.1: Introduce Haptics
- Play training clip
- Exploration
- Quiz

2.2: Test
- Introduce block
- Give user full test

Qualitative Survey

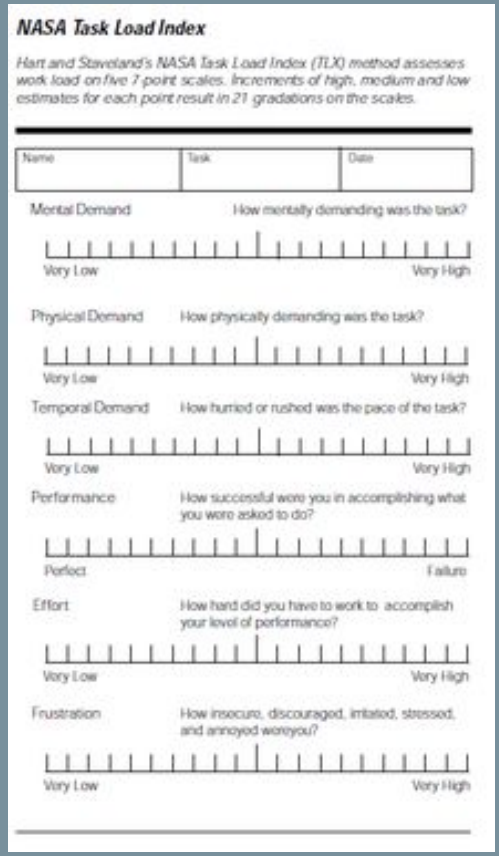
# Phase III Overview

Repeat for Iterations 2 and 3



# Qualitative Survey

- NASA Task Load Index (ranking from 1-7)
  - Temporal Demand
  - Mental Demand
  - Effort
  - Physical Demand
  - Performance
  - Frustration
- System Usability Scale (SUS) - Assess how easy system was to use



**NASA Task Load Index**

*Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.*

| Name | Task | Date |
|---|---|---|
| | | |

Mental Demand — How mentally demanding was the task?
Very Low — Very High

Physical Demand — How physically demanding was the task?
Very Low — Very High

Temporal Demand — How hurried or rushed was the pace of the task?
Very Low — Very High

Performance — How successful were you in accomplishing what you were asked to do?
Perfect — Failure

Effort — How hard did you have to work to accomplish your level of performance?
Very Low — Very High

Frustration — How insecure, discouraged, irritated, stressed, and annoyed were you?
Very Low — Very High

# Data Analysis: Phase I

## Data to be collected:

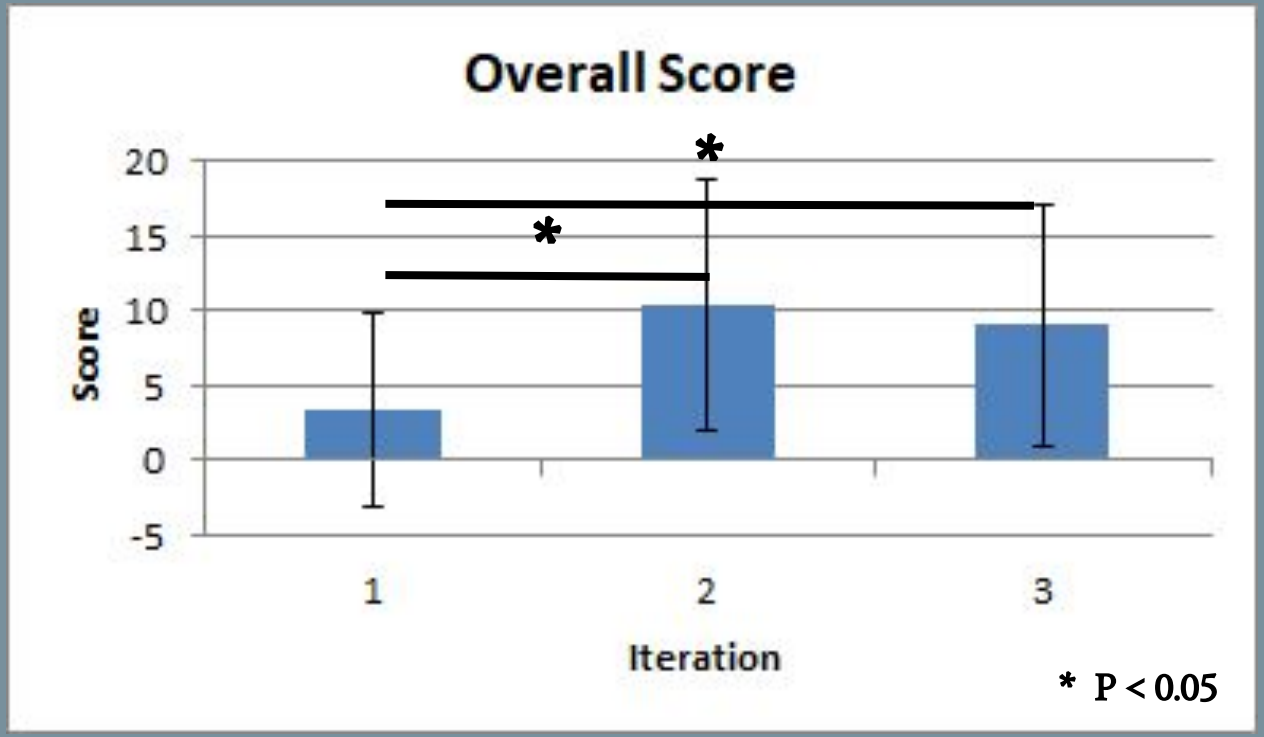
Response Time

Accuracy
- Vital
- Zone
- Change detected

# Rubric for Overall Score

| What Occurred | What Subject Thought Occurred | Points |
|---|---|---|
| No Change | Change | -0.33 |
| Change | No Change | -0.33 |
| Change | Wrong Vital | -1 |
| Change | Correct Vital | +1 |
| | Correct Zone | +0.5 |
| **Maximum possible score = 25.5** | | |

# Results



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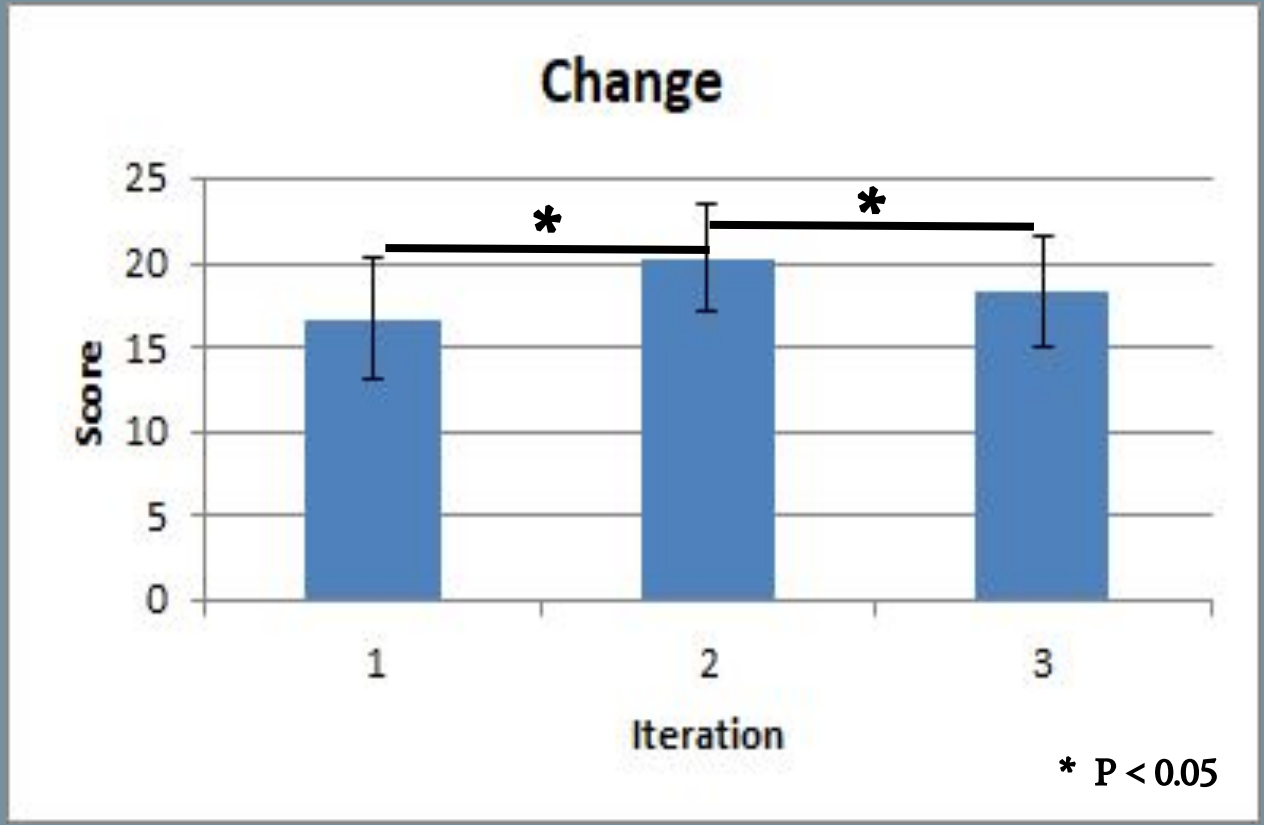

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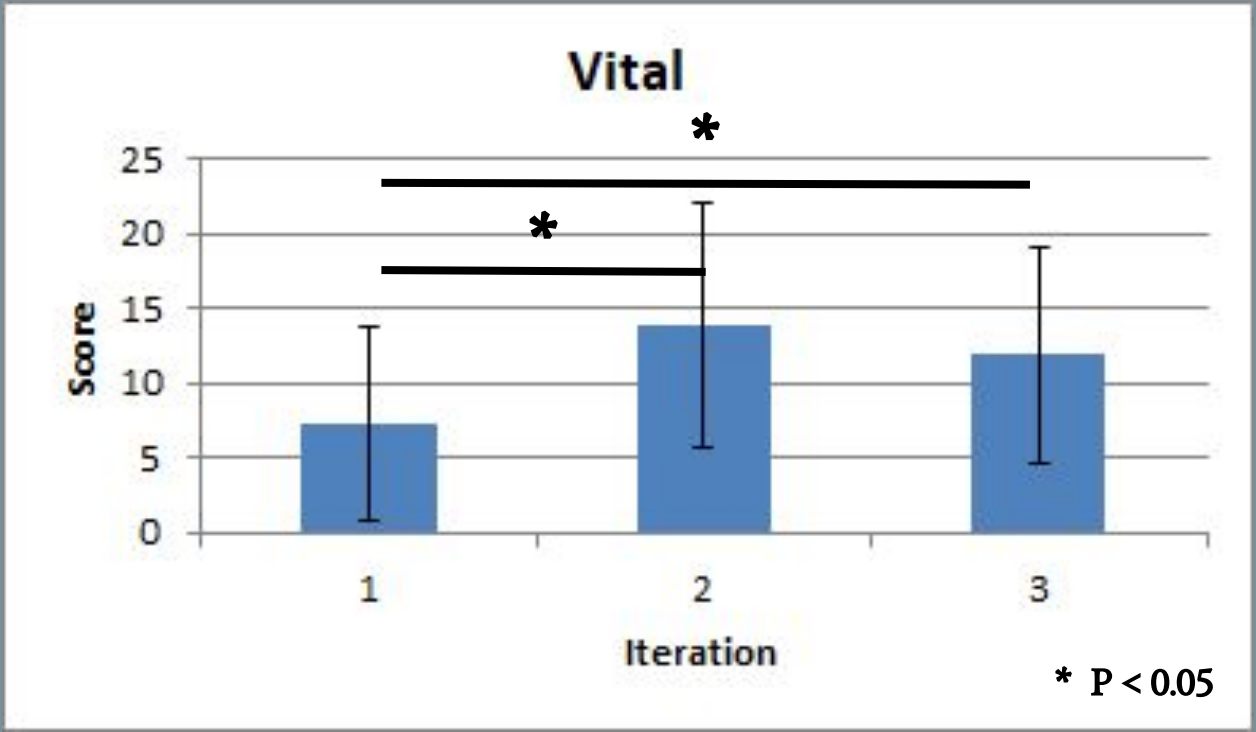

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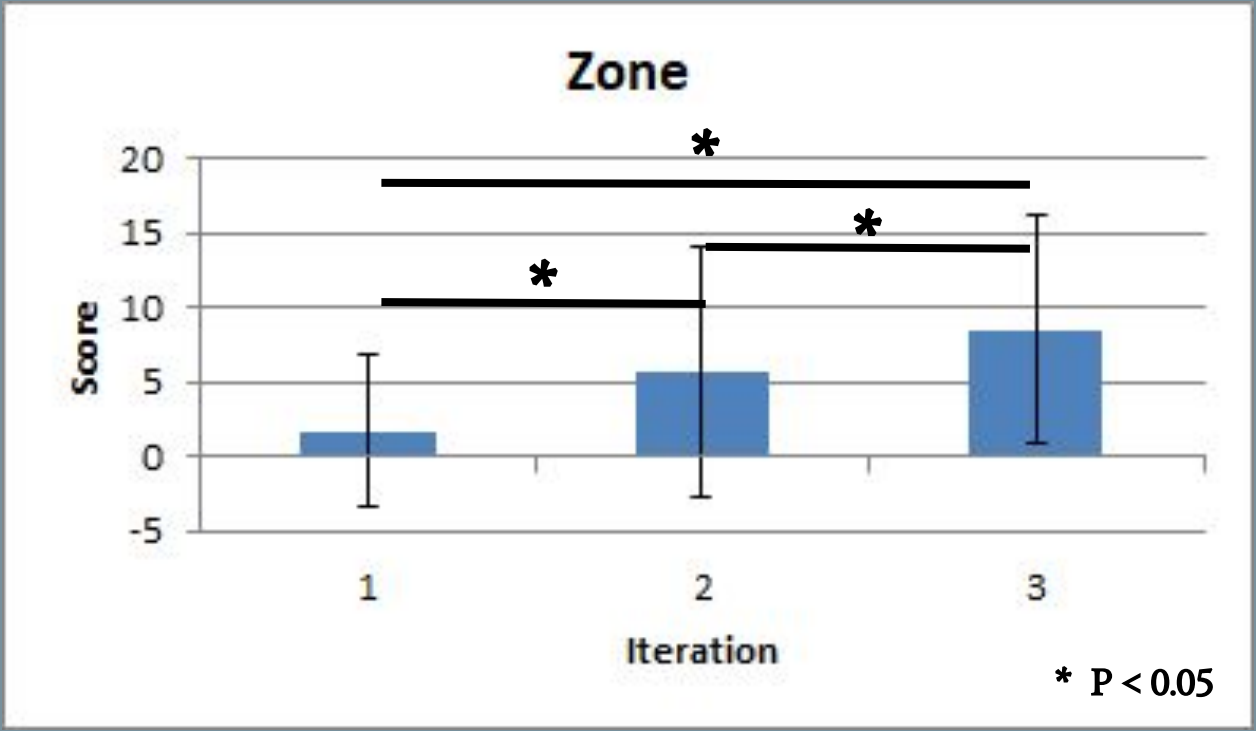

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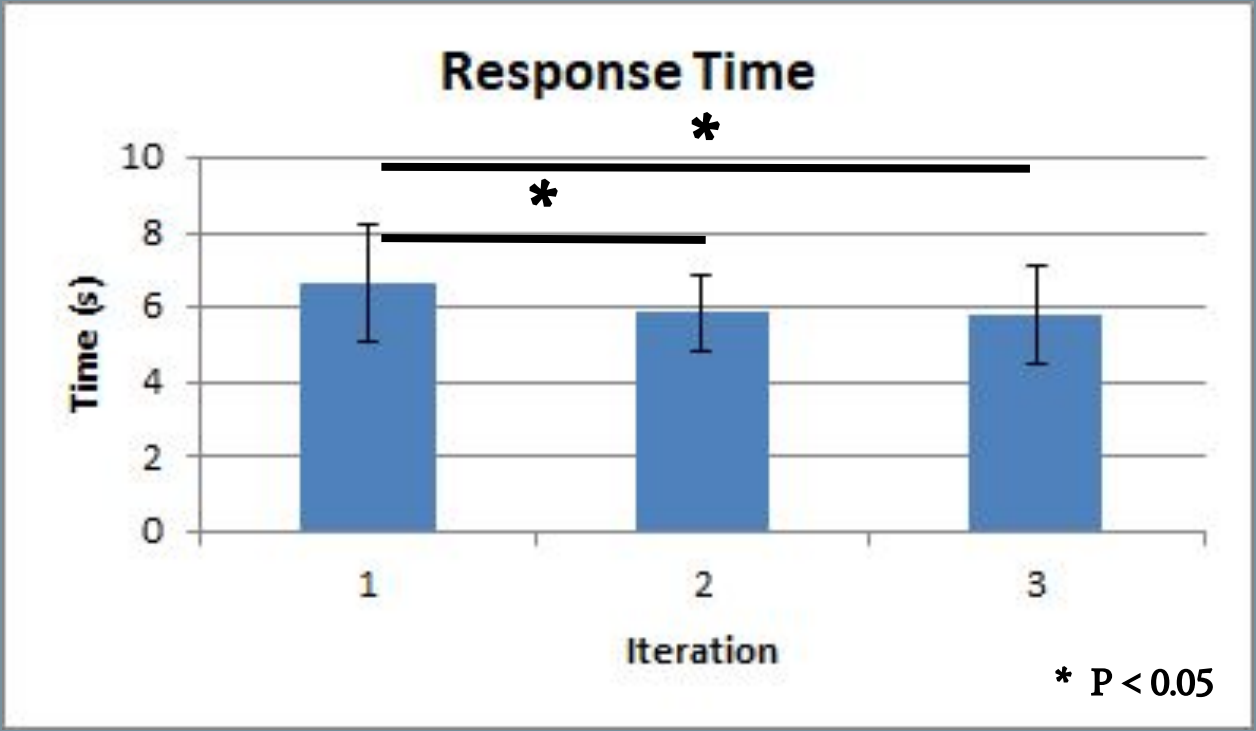

# Results

- Iteration 2 was chosen for further use in Phases II and III based off of quantitative and qualitative data
  - Significantly better than Iteration 1 for all tested metrics
  - Significantly better than Iteration 3 for subjects' ability to detect a correct "change"
- Iteration 3 was significantly better for detecting the correct "zone"
  - Haptics indicate zones, but change viewed as more important

# Data Analysis: Phase II

# Preliminary Results: Phase II

- Preferred the use of discrete over continuous haptics thus far based on qualitative subject feedback
- Need for normalization?
- Still need to analyze NASA-TLX and SUS data to assess comparative load on user

# Next Steps

- Phase II/III data analysis
  - Response time
  - Accuracy
  - Statistical tests
  - Qualitative analysis
- Analysis of training/success correlation
- Write paper
  - Rough draft due to Dr. Schlesinger week of March 18th

# Questions?