Creating an Organizational Culture Based on Usability

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Professor, Informatics
University of Maryland, University of Utah

HIMSS
transforming healthcare through IT™
Nancy Staggers

- Professor, Informatics
- 25 years in Health IT
- Research program in usability for clinical products
- Recipient, 2013 AMIA Signature award for a distinguished career in informatics
- Former IT executive, enterprise EHR projects
- Army nurse x 25 years
Purpose of Today’s Presentation

✓ What is usability? Distinguish between the terms: user experience, human factors, usability, and ergonomics
✓ Why should you care about usability?
✓ How might a focus on usability help?
✓ How do you create an organizational culture based on usability?
What is usability?
Interrelationship of Terms

User Experience

Human Factors

Ergonomics

Usability

Human-Computer Interaction
Definition of Terms

✓ The User Experience
  ✓ Is “a person's perceptions and responses that result from the use or anticipated use of a product, system or service”
  (ISO 9241-11)

✓ Human Factors
  ✓ Is “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.”
  (HFES, 2011)
Definition of Terms

✓ **Ergonomics**

✓ Is used interchangeably with human factors by the HFES and in Europe, but in the U.S. and other countries, its focus is on human performance with physical characteristics of tools, systems and machines.

✓ **Human Computer Interaction**

✓ Is the study of how people design, implement, and evaluate interactive computer systems in the context of users’ tasks and work.
Usability Definition and Goals

Usability is the extent to which a product can be used by specific users in a specific context to achieve specific goals with effectiveness, efficiency and satisfaction (ISO 9241-11)
Role of Usability

EFFICIENCY
- people get things done quickly and productively
- the technology does not get in the way

EFFECTIVENESS
- they get the info they need, complete work accurately & achieve their goals
- they don't make mistakes

SATISFACTION
- they feel confident & pleased
- they are not frustrated

USABILITY
Why should you care?
Current Pain Points

✓ Increased disillusionment and frustration for HIT users
  ✓ Low adoption, under-utilization or refusal to adopt healthcare systems

✓ Workflow is the #1 EHR usability pain point in the majority of EHR usage models
  ✓ Poor usability can contribute to medical errors affecting patient safety

Usability = Patient Safety
Usability = Patient Safety
**Patient Information**

- **Name:** Carey, Christopher U.
- **Age:** 55 years
- **Gender:** Male
- **Location:** 4S: 418
- **Fin#:** 4809
- **Inpatient [9/29/2003 4:20 PM] (C)**

**Critical Care**

### ICU Vitals

- **ICU Measurements**
- **Hemodynamic Measures**
- **Cardiovascular Assessment**
- **Arterial Line Insert**
- **Arterial Line Monitoring and Management**
- **Arterial Line Discontinue**
- **Pulmonary Artery Line Insertion**
- **Pulmonary Artery Line Monitoring/Care**

**Pacemaker**

**Pulmonary**

- **Mechanical Ventilation Settings**
- **Neurologic Assessment**
- **Neuromuscular Blockade**
- **ICU Nursing Lab**
- **Progress Notes**

---

**October 06, 2003 12:00 AM - October 06, 2003 8:00 PM**

### Find Item

- **Critical**
- **High**
- **Low**
- **Abnormal**
- **New**
- **Unauth**
- **Or**
- **And**

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<td>Rogers, Stephanie</td>
</tr>
<tr>
<td>CVP</td>
<td>! 13 mmHg</td>
<td>10/6/2003 1:15 PM</td>
<td>Rogers, Stephanie</td>
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### Vitals

- **RR**
- **SBP/DBP Manual**
- **MAP**
- **Hemodynamic Measures**
- **CVP**
- **PAS/PAD**
- **PAM**
- **PAWP**

<table>
<thead>
<tr>
<th>Date</th>
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<th>SBP/DBP Manual</th>
<th>MAP</th>
<th>Hemodynamic Measures</th>
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### ICU Vitals

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### Pulmonary Artery Line Insertion

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### Pulmonary Artery Line Monitoring/Care

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</table>
### Fish, Broiled

- **MRN:** 00010918
- **DOB:** 5/17/1988
- **CSN:** 10918
- **Sex:** Female
- **Admit Date:** 11/27/2010

#### Medicaions

<table>
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<th>Date</th>
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<td>11:25</td>
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- **Status:**
  - Not Done: Patient 1
  - Ending Validation

- **Icon Indications:**
  - Icon indicates orders for nurse review
  - Icon indicates a patient's care plan
  - Icon indicates a temporary notation
### Fish, Broiled

**MRN:** 00010918  
**DOB:** 5/17/1988  
**CSN:** 10918  
**Sex:** Female  
**Admit Date:** 11/27/2010

### Time View

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### Scheduled Medications

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</tr>
</tbody>
</table>

### Icons:

- **Icon indicates orders for nurse review**
- **Icon indicates a patient’s care plan**
- **Icon indicates a temporary notation**

**As Of** button: 15:08
## Nursing Summary Report

### Vital Signs

<table>
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<tr>
<th>Time</th>
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<th>SPO2</th>
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<td>70</td>
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<td>106/74</td>
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<tr>
<td>11/04/09 04:00 35.5</td>
<td>106/74</td>
<td>70</td>
<td>94</td>
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<td>11/04/09</td>
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</table>

### Active Inpatient Medications

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<th>Medication</th>
<th>Route</th>
<th>Start Date</th>
<th>End Date</th>
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<tbody>
<tr>
<td>Ibuprofen</td>
<td>PO</td>
<td>11/04/09</td>
<td>11/04/09</td>
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<tr>
<td>Acetaminophen</td>
<td>PO</td>
<td>11/04/09</td>
<td>11/04/09</td>
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<tr>
<td>Sertraline</td>
<td>PO</td>
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<td>11/04/09</td>
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</table>

### Admission Diagnosis

- Bladder Cancer

### Allergies

- None specified

### Problem List

- None specified

### Laboratory Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>WBC</td>
<td>5000</td>
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<tr>
<td>Hgb</td>
<td>10.5</td>
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<tr>
<td>Platelets</td>
<td>150</td>
</tr>
</tbody>
</table>

### Treatment Plan

- Daily weights should be taken.
- Medications should be administered as prescribed.
- Patient should be monitored for side effects.

### Notes

- Patient has been discharged on 11/04/09.
- Discharge instructions will be provided.

---

**Bladder Cancer**

Date: 11/04/09

Staggers, Clark, Blaz & Kapsandoy, 2012
### Nursing Summary Report

No visual trend

---

**Date:**

**Admit Date:**

**Weight:**

**Medical History:**

- Fall from height 3 days ago
- History of back pain
- No history of respiratory issues

**Allergies:**

- Penicillin
- Aspirin
- Codeine
- Ibuprofen

**Medications:**

- Ibuprofen (600mg)
- Codeine (30mg)
- Hydrocodone (10mg)

**Nursing Interventions:**

- Pain management
- Oxygen therapy
- Bed rest

---

**Active Inflammation Medications:**

- Ibuprofen (600mg)
- Carisoprodol (350mg)

**Active Pain Medications:**

- Ibuprofen (600mg)
- Hydrocode (10mg)
- Naproxen (500mg)

**Other Medications:**

- Pantoprazole (40mg)
- Metoclopramide (10mg)

---

**Signs and Symptoms:**

- Nausea
- Vomiting
- Fatigue

**Lab Results:**

- WBC: 12,000
- Hb: 10.5
- Platelets: 200,000

**Plan:**

- Pain management: IV hydromorphone and oral codeine
- Oxygen therapy: 2L/min via nasal cannula
- Bed rest and monitoring for signs of infection

---

**Assessment:**

- Vital signs: BP 120/80, HR 80, RR 18, O2 saturation 98%
- No fever
- No jaundice

**Nursing Diagnosis:**

- Pain: Acute/Chronic
- Respiratory: Hypoxia

**Goals:**

- Pain relief
- Oxygen saturation > 92%

**Interventions:**

- Administer pain medication
-Monitor oxygen saturation

**Evaluation:**

- Pain score reduced to 3/10
- Oxygen saturation 95%

---

**References:**

- Staggers, Clark, Blaz & Kapsandoy, 2011

---

**Nursing Summary Report**

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**Admit Date:**

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**References:**

- Staggers, Clark, Blaz & Kapsandoy, 2011
Nursing Summary Report

No visual trend

Orders truncated

Staggers et al., 2011
**Nursing Summary Report**

**Hand-written grid for medications due across patients**

**Orders truncated**

**No visual trend**

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Staggers et al., 2011
Nursing Summary Report

Orders truncated

Hand-written grid for medications due across patients

No visual trend

Missing information

Staggers et al., 2011
Nursing Summary Report

Orders truncated

Hand-written grid for medications due across patients

No visual trend

Missing information

Static information

Staggers et al., 2011
### Nursing Summary Report

**Patient Name:** [Redacted]  
**Date:** [Redacted]

#### Vital Signs
- **Temperature:** [Redacted]  
- **Blood Pressure:** [Redacted]  
- **Pulse:** [Redacted]  
- **Respirations:** [Redacted]  
- **Weight:** 82.1 kg  
- **Height:** 181 cm  
- **BMI:** [Redacted]

#### Allergies
- No known allergies

#### Problems
- None specified

#### Meds
- **Dobutamine Conventional (Dobutamine) 40mcg IV q15min (IV):** [Redacted]  
- **Labetalol (Labetalol) 15mg IV slow push 30min:** [Redacted]  
- **Allopurinol (Allopurinol) 150mg po once daily:** [Redacted]  
- **Furosemide (Lasix) 40mg po once daily:** [Redacted]  
- **Carvedilol (Carvedilol) 12.5mg po once daily:** [Redacted]  
- **Hydrochlorothiazide (HCTZ) 25mg po once daily:** [Redacted]  
- **Premarin (Premarin) 0.625mg po once daily:** [Redacted]  
- **Flucloxacillin (Flucloxacillin) 500mg po every 6h:** [Redacted]  
- **Bisoprolol Fumarate (Bisoprolol Fumarate) 2.5mg po daily:** [Redacted]  
- **Rabeprazole (Rabeprazole) 20mg po once daily:** [Redacted]  
- **Budesonide (Budesonide) 9mg po once daily:** [Redacted]  
- **Pyridoxine (Pyridoxine) 50mg po once daily:** [Redacted]  
- **Folic Acid (Folic Acid) 0.4mg po once daily:** [Redacted]  
- **Amlodipine Besylate (Amlodipine Besylate) 10mg po once daily:** [Redacted]  
- **Metformin HCl (Metformin HCl) 500mg po every 8h:** [Redacted]  
- **R�tadine (R�tadine) 30mg po every 6h:** [Redacted]  
- **Docusate sodium (Docusate sodium) 150mg po once daily:** [Redacted]  
- **Folic Acid (Folic Acid) 0.4mg po once daily:** [Redacted]  
- **Allopurinol (Allopurinol) 150mg po once daily:** [Redacted]  
- **Furosemide (Lasix) 40mg po once daily:** [Redacted]  
- **Carvedilol (Carvedilol) 12.5mg po once daily:** [Redacted]  

#### Lab
- **Complete Blood Count (CBC):** [Redacted]  
- **Chemistry Profile:** [Redacted]  
- **Liver Function Tests:** [Redacted]  
- **Renal Function Tests:** [Redacted]  
- **Electrolytes:** [Redacted]  
- **Urine Analysis:** [Redacted]  
- **Stool Analysis:** [Redacted]  
- **X-ray:** [Redacted]  
- **ECG:** [Redacted]

#### Notes
- [Redacted]
A Synthesis of Device Evaluations

✓ Potential errors with medical device designs
  ✓ Limited interface visibility
  ✓ Confusing labels
  ✓ Poor navigation
  ✓ Getting lost in prompts

Alexander & Staggers, 2009
How might a focus on usability help?
HIMSS Usability Maturity Model

White paper developed for the HIMSS Usability Taskforce by
- Nancy Staggers (co-lead)
- Melanie Rodney (co-lead)
- Patricia Alafaireet
- Cecelia Backman
- Janet Bochinski
- Jean Respass-Dunbar
- Yan Xiao
- Edna Boone, HIMSS Liaison at time of publication

Intent: provide resources for healthcare organizations to:
- Raise awareness of role of usability in effective EHRs
- Provide resources to objectively assess usability of EHRs
- Provide tool to assess organizational status of usability practices
Usability Maturity Model Background

- Review of current maturity models
  - Schaffer’s
  - Nielsen’s
  - Earthy’s
- Assessed each for applicability to healthcare
- Developed unique model incorporating best features of each
  - Simplicity
  - Practicality
  - Actionable
Value of Usability to Health Organizations

- Increased Individual Effectiveness, Efficiencies
- Increased User Productivity/Efficiency
- Decreased User Errors/Increased Safety
- Improved Cognitive Support
- Improved patient, provider organizational outcomes

- Increased Organizational Efficiencies
- Decreased Maintenance Costs
- Decreased Customer and Individual Training and Support Costs
- Decreased Development/Time Costs
How do you create an organization with a focus on usability?
## Usability Maturity Model

<table>
<thead>
<tr>
<th>Stage</th>
<th>Title</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unrecognized</td>
<td>Lack of awareness of usability. No practices, policies or resources</td>
</tr>
<tr>
<td>2</td>
<td>Preliminary</td>
<td>Sporadic inclusion of usability. Very limited resources</td>
</tr>
<tr>
<td>3</td>
<td>Implemented</td>
<td>Recognized value of usability. Small team doing usability</td>
</tr>
<tr>
<td>4</td>
<td>Integrated</td>
<td>All benchmarks of usability implemented including a dedicated user experience team</td>
</tr>
<tr>
<td>5</td>
<td>Strategic</td>
<td>Business benefit well understood, usability mandated, budget and people part of each year’s budget, results used strategically throughout the organization</td>
</tr>
</tbody>
</table>
# Elements by Stages

<table>
<thead>
<tr>
<th>Phase</th>
<th>Focus on Users</th>
<th>Management</th>
<th>Process &amp; Infrastructure</th>
<th>Resources</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>Preliminary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>Implemented</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 4</td>
<td>Integrated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 5</td>
<td>Strategic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Steps for Improving User Experience

1. Include usability in contracts
2. Create feedback loops from users to vendors
3. Talk about tasks and workflows
4. Educate about ROI related usability
5. Engage organizational leaders in usability
6. Include usability metrics on one project
7. Interview users to determine key usability issues
8. Compile evidence from usability assessments
9. Look for and document usability wake-up calls
10. Find a business/organization driver supporting need for usability
Getting Started with Usability

Common Methods for Launching Usability in Organizations

- “Wake-Up Calls”
- Individual Infiltration Methods
- Finding Internal Champions
- Using External Experts as a Catalyst
More Work? Yet another project?

- Fits into a focus on patient safety
  - Cases in point: Baylor Health, Toronto hospitals
- Fits into quality improvement
  - Intermountain Health and Brent James’ work
- An organization based on usability can be a strategic asset
  - Doable!
- Resources available
  - HIMSS white paper – browse for usability maturity model
Many types of usability measures

<table>
<thead>
<tr>
<th>User Behaviors</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Task times, completion, errors. training time</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Fit with workflow, task sequence</td>
</tr>
<tr>
<td>Perceptions</td>
<td>User satisfaction ratings, comments</td>
</tr>
<tr>
<td>Physiologic</td>
<td>Heart rate, Galvanic skin response, EEG, perceptions about anxiety</td>
</tr>
<tr>
<td>Motivation</td>
<td>Willingness to use an application</td>
</tr>
</tbody>
</table>
Many types of usability Measures

<table>
<thead>
<tr>
<th>Expert Evaluations</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Number of keystrokes per critical task, observations of expert users for task completion</td>
</tr>
<tr>
<td>Adherence to known guidelines</td>
<td>Evaluate application using heuristics, e.g., Nielsen or Zhang</td>
</tr>
<tr>
<td>Perceptions</td>
<td>Expert comments about the design</td>
</tr>
</tbody>
</table>
Many types of usability measures

<table>
<thead>
<tr>
<th>Organizational</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>Training costs, number of Help desk staff to support a product, calls per module</td>
</tr>
<tr>
<td>Risk management</td>
<td>Errors related to product use, usability</td>
</tr>
</tbody>
</table>
## Set Usability Goals & Benchmarks

<table>
<thead>
<tr>
<th>User Groups: Physicians</th>
<th>Nurses</th>
<th>Administrative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Usability Measurement Relative to Goals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Task</strong></td>
<td><strong>Effectiveness</strong></td>
<td><strong>Efficiency</strong></td>
</tr>
<tr>
<td>Schedule a new patient</td>
<td>Goal: 100%</td>
<td>Goal: 2 mins</td>
</tr>
<tr>
<td>EMR A: 80%</td>
<td>EMR A: 4 mins</td>
<td>EMR A: 3.0</td>
</tr>
<tr>
<td>EMR B: 95%</td>
<td>EMR B: 1.5 mins</td>
<td>EMR B: 4.5</td>
</tr>
<tr>
<td>Goal: 100%</td>
<td>Goal: 30 secs</td>
<td>Goal: 4</td>
</tr>
<tr>
<td>Enter patient vitals</td>
<td>EMR A: 95%</td>
<td>EMR A: 1 min</td>
</tr>
<tr>
<td>EMR B: 100%</td>
<td>EMR B: 45 secs</td>
<td>EMR B: 5.0</td>
</tr>
<tr>
<td>Goal: 100%</td>
<td>Goal: 5 mins</td>
<td>Goal: 4</td>
</tr>
<tr>
<td>Enter patient visit notes</td>
<td>EMR A: 85%</td>
<td>EMR A: 7 mins</td>
</tr>
<tr>
<td>EMR B: 100%</td>
<td>EMR B: 6 mins</td>
<td>EMR B: 4.75</td>
</tr>
</tbody>
</table>
# Current Problem List

<table>
<thead>
<tr>
<th>Annotated Display</th>
<th>Name of Problem</th>
<th>Code</th>
<th>Life Cycle Date</th>
<th>Course</th>
<th>Onset Date</th>
<th>Responsi</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHO Doppler (2/01...</td>
<td>AORTIC VALVE DISORDERS...</td>
<td>424.1</td>
<td>10/30/2003</td>
<td>Stable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glaucoma, sees NM...</td>
<td>GLAUCOMA</td>
<td>365</td>
<td>8/11/2003</td>
<td>Stable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BPH</td>
<td>HYPERTROPHY (BENIGN...</td>
<td>600.0</td>
<td>9/29/2003</td>
<td>Stable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asbestos exposure: ...</td>
<td>NONSPECIFIC ABNORMA...</td>
<td>793.1</td>
<td>2/23/2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High LDL, Low HDL</td>
<td>Pure hypercholesterolemia</td>
<td>272.0</td>
<td>9/29/2003</td>
<td>Stable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM- type 2</td>
<td>type II diabetes mellitus Ino...</td>
<td>250.00</td>
<td>8/7/2003</td>
<td>Stable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYPERTENSION</td>
<td>UNSPECIFIED ESSENTIA...</td>
<td>401.9</td>
<td>8/25/2004</td>
<td></td>
<td>8/25/2004</td>
<td></td>
</tr>
</tbody>
</table>
Problem List Redesign #1

Hypertension
- High Cholesterol

Diabetes
- Kidney Stones
- Low Back Pain

Asthma
- GERD
- URI

Allergic Rhinitis
Problem List Redesign #2

Berkowitz, 2011
Use of Metaphors
Conclusions

✓ Current state of the art includes products with poor usability
  ✓ Decreases effectiveness, efficiency and satisfaction
✓ Known methods can mitigate poor usability
  ✓ Increased effectiveness, efficiency and satisfaction
✓ A culture based on usability can be a strategic asset
Thank You!

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TAKK!