The Usability Imperative in Health IT

Nancy Staggers, PhD, RN, FAAN

Today’s Presentation

- What do UX, HF, usability entail?
- How extensive are usability problems in nursing & healthcare?
- How do we improve usability?
  - Two methods to get you started
“...most electronic health record systems fail to support efficient and effective clinical work.”

AMA, 2014

Getting Started - Definitions
User Experience
A person's perceptions and responses resulting from the use or anticipated use of a product, system or service (ISO 9241-11)

Human Factors
Interactions among humans and other elements of a system
Theory, principles, data and methods of design to optimize human well-being and overall system performance." (HFES, 2011)
**Definition of Terms**

- **Ergonomics**
  - Human performance with physical characteristics of tools, systems and machines

- **Human Computer Interaction**
  - How people design, implement, and evaluate interactive computer systems in the context of users’ tasks and work

- **Usability**
  - Extent a product is used by specific users in a specific context to achieve specific goals with effectiveness, efficiency and satisfaction (ISO 9241-11)
  - Patient safety!
  - Interchangeable with HCI when the product is a computer but usability can also concern products beyond computers
Usability Considerations

- Considers users' abilities, limitations, behaviors and work processes
- Concentrates on users' cognitive abilities and behaviors within a particular context
- Is at the intersection of users, their goals, their specific tasks in a specific context
- Important for nurses’ situation awareness (Endsley & Jones, 2012)

Contemporary Usability Problems
Why Do We Care?

CellScopeOto™: $199

AliveCor™: $199

Glooko™: $59

Virtual Visit

Appointment app

DermatologistOnCall™

Game for Kegel exercises
Recent News

- Physician EHR usability
  - Increasingly negative from 2010 to 2013 (American Colleges of Physicians, 2013)
- 92% of nurses dissatisfied with EHRs
  - Survey of 13,650 nurses in Sept 2014 (PR Web, 2014)

"Physicians believe it is a national imperative to reframe policy around the desired future capabilities of this technology and emphasize clinical care improvements as the primary focus."

(AMA, 2014)
- AMA letter to Office of the National Coordinator in September, 2014
  - Called for solutions to EHR usability issues
  - Signed by over 30 physician organizations
Users must click this icon to retrieve the insulin sliding scale data.
Computerized Handoff Tool

Preferred Tool
Anywhere users need to synthesize data
- Time-pressured situations
- Looking for specific data quickly
  - What has changed since I last cared for this patient?
  - What was the total dose of insulin during the last 48 hours?
  - What are the critical issues with this patient?
Current Problem List
Potential Redesign #1

Potential Redesign #2
There is hope!
Meaningful Use
  - Safety-enhanced design
  - Vendors starting to incorporate methods
Two methods for you
  - Heuristic evaluation
  - Usability testing
Heuristic Evaluation

- A discount usability testing method
  - An abbreviated and effective method to discover usability issues
- Inexpensive
- Time efficient
- Has established return on investment
- Can find up to 80% of major UI design issues
- In use over 20 years

Nielsen, 1994

Heuristic Evaluation

- Experts
  - 3-5
- Analyze a user interface for issues
  - Use representative tasks
- Categorize issues according to type
  - 10-14 categories
- Assign a severity level
  - Cosmetic (0) to catastrophic (4)
### Heuristic Evaluation

<table>
<thead>
<tr>
<th>Zhang et al (2003)</th>
<th>14 heuristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistency</td>
<td>Feedback</td>
</tr>
<tr>
<td>Visibility of the system state</td>
<td>Flexibility and efficiency</td>
</tr>
<tr>
<td>Match between the system and the real word</td>
<td>Good error messages</td>
</tr>
<tr>
<td>Minimalist</td>
<td>Prevent errors</td>
</tr>
<tr>
<td>Minimize memory</td>
<td>Clear closure</td>
</tr>
<tr>
<td>Reversible actions (if legal)</td>
<td>Use the users’ language</td>
</tr>
<tr>
<td>Users in control</td>
<td>Help and documentation</td>
</tr>
</tbody>
</table>

### Heuristic Evaluation Example

- mHealth diabetes application and website
Methods

- 3 dual domain experts
- Short, standardized training on the website
- 8 tasks
  - Enter your blood pressure
  - Enter your AM and PM glucose
  - Retrieve data to take to your provider
- Identified issues and categorized them
Findings

- 129 problems with 274 violations
  - Dashboard – allowed only one glucose entry per day
  - Glucose diary – cannot read dates/numbers on the graph because they are too crowded
  - Vital signs – included only systolic values included in the graph

Usability Testing

NISTIR 7741 NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records

NISTIR 7804 Technical Evaluation, Testing and Validation of the Usability of Electronic Health Records

http://www.nist.gov/healthcare/usability/index.cfm
Usability Testing

- Two major types
  - Formative
    - Earlier in the systems life cycle
  - Summative
    - After development

Formative User Testing

- More informal but timing is critical
  - Before coding is done
- Purpose: Look for major content, flow issues
- 5-8 actual users (or even 3 if very early)
- Interactive session between observer and user
- Often use “think aloud” methods
- May videotape, take notes
**Formative Testing Example**

- EHR integration into ambulatory care
- 17 providers filmed while talking aloud
  - Physicians, nurse practitioners, physician assistants
- Used representative tasks, videotaping
- Brief findings
  - 90% of providers used work-arounds
  - Top issues of difficulty
    - Pre-visit data gathering (getting the big picture of the patient)
    - Interactions with the EHR during the encounter
    - Documenting the encounter in a note

**Summative Usability Testing**

- More formal
  - When application is interactive or even fielded
- 10-15 actual users
- Time, success, errors on typical tasks
  - May benchmark to compare designs
- Not interactive between observer and user
- Less use of “think aloud” methods
- Videotape, take notes
Summative Testing Example

- Purpose: evaluate task performance, satisfaction of a mHealth application for diabetes
- 10 patients
- Tasks
  - Send in glucose, interpret graph, export values
  - Measured task success, errors, time on task, satisfaction (System Usability Scale)
  - Exporting had a 30-40% failure rate, largest number of errors

Sample Benchmarks

<table>
<thead>
<tr>
<th>User Groups: Physicians</th>
<th>Nurses</th>
<th>Administrative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Usability Measurement Relative to Goals</td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>Effectiveness</td>
<td>Efficiency</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 B: 95%</td>
<td>EMR A: 4 mins</td>
</tr>
<tr>
<td>EMR B: 1.5 mins</td>
<td>EMR A: 3.0</td>
<td>EMR B: 4.5</td>
</tr>
<tr>
<td>Enter patient vitals</td>
<td>Goal: 100%</td>
<td>Goal: 30 secs</td>
</tr>
<tr>
<td>EMR A: 95%</td>
<td>EMR B: 100%</td>
<td>EMR A: 1 min</td>
</tr>
<tr>
<td>EMR B: 45 secs</td>
<td>EMR A: 4.0</td>
<td>EMR B: 5.0</td>
</tr>
<tr>
<td>Enter patient visit notes</td>
<td>Goal: 100%</td>
<td>Goal: 5 mins</td>
</tr>
<tr>
<td>EMR A: 85%</td>
<td>EMR B: 100%</td>
<td>EMR A: 7 mins</td>
</tr>
<tr>
<td>EMR B: 6 mins</td>
<td>EMR A: 3.25</td>
<td>EMR B: 4.75</td>
</tr>
</tbody>
</table>
Resources

- Usability.gov (Health and Human Services)
- HIMSS UX Community
  - Jeff Belden, “Inspired EHR Designs”
  - Usability Maturity Model
  - 2009 EHR Testing
- AHRQ’s EHR Usability Toolkit
- NIST
  - Health IT and Usability

http://www.usability.gov/
Defining and Testing EMR Usability:

**Principles and Proposed Methods of EMR Usability Evaluation and Rating**

HIMSS EHR Usability Task Force
June 2009

http://www.himss.org/files/HIMSSorg/content/files/himss_definingandtestingemrusability.pdf

Promoting Usability in Health Organizations: Initial Steps and Progress Toward a Healthcare Usability Maturity Model

1. SI Simplicity
2. Na Naturalness
3. Co Consistency
4. FoF Forgiveness and Feedback
5. EUL Effective Use of Language
6. EI Efficient Interactions
7. EIP Effective Information Presentation
8. PC Presentation of Context
9. MCL Minimize Cognitive Load

HIMSS Usability Taskforce


NISTIR 7804

Technical Evaluation, Testing, and Validation of the Usability of Electronic Health Records

Svetlana Z. Lowry Matthew T. Quinn Mala Ramaiah Robert M. Schumacher Emily S. Patterson Robert North Jiajie Zhang Michael C. Gibbons Patricia Abbott

http://www.nist.gov/manuscript-publication-search.cfm?pub_id=909701

EHR Usability Toolkit: A Background Report on Usability and Electronic Health Records

Prepared for:
Agency for Healthcare Research and Quality
U.S. Department of Health and Human Services 540 Gaither Road
Rockville, MD 20850 www.ahrq.gov

Contract No. HHSA290200900023I

Prepared by:
Westat
1600 Research Boulevard
Rockville, MD 20850-3129


AHRQ Publication No. 11-0084-EF August 2011
References - Authors

- Else Ammenwerth (UX, Europe)
- Jakob Nielsen (general and web usability)
- Pascal Caryon (industrial engineering, ICUs)
- Constance Johnson (model, HCI)
- Nancy Staggers (usability & EHR design)
- Linda Harrington (safety & EHR design)
- Ross Koppel (sociotechnical aspects of HIT)
- David Wood (anesthesia)
- Jeff Belden (EHR Design)
- Marie Beauscart-Zephir (UX, Europe)
- Ben Shneiderman (user interface design)
Contact information:
nancystaggers@sisna.com

References In Order of Appearance