TURF: A Unified Framework for Defining, Evaluating, Measuring, and Designing EHR Usability

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What is Usability?

• Usability refers to how
  – useful,
  – usable,
  – satisfying

• a system is for the intended users to accomplish goals in the work domain by performing certain sequences of tasks

TURF Framework for EHR Usability

- **Functions**
- **Users**
- **Representations**
- **Tasks**

- **Usable**
- **Satisfying**
- **Useful**

**Electronic Health Record**

- **Intrinsic Complexity**
- **Extrinsic Difficulty**
How to Measure Usefulness?

- Function Saturation
- Overhead
Function Saturation

= #Domain Functions in Designer Model
= #Domain Functions in All Three Models

In the system
Not wanted by users
Not used in activities

In the system
Wanted by users
Not used in activities

In the system
Wanted by users
Used in activities

Not in the system
Wanted by users
Not used in activities

Not in the system
Wanted by users
Used in activities

A Small EDR System

\[
\frac{37}{80} = 46\% 
\]

(From Chen, 2008)
Overhead in Designer Model = \# Domain Functions + \# Overhead Functions

- **CPOE 1**
  - Domain Functions: 58%
  - Overhead Functions: 42%

- **CPOE 2**
  - Domain Functions: 64%
  - Overhead Functions: 36%
How to Measure Usableness?

- **Learnability**
  - # trials to reach a certain performance level
  - # items that need to be memorized
  - # sequences of steps that need to be memorized
  - Etc.

- **Efficiency**
  - Time on task
  - Task steps
  - Task Success
  - Mental effort

- **Error Prevention and Recovery**
  - Error occurrence rate
  - Error recovery rate
Time on Task (seconds)

- CPOE
- ePrescribing
- Clinical Summary
- Smoking Status
- Problem List
- Growth Chart
- BMI
- Vital signs
- Demographics

Time on Task:
- CPOE: 330 seconds
- ePrescribing: 70 seconds
- Clinical Summary: 560 seconds
- Smoking Status: 20 seconds
- Problem List: 200 seconds
- Growth Chart: 50 seconds
- BMI: 20 seconds
- Vital signs: 20 seconds
- Demographics: 20 seconds
# of Task Steps

- CPOE: 400
- ePrescribing: 100
- Clinical Summary: 650
- Smoking Status: 10
- Problem List: 150
- Growth Chart: 10
- BMI: 10
- Vital signs: 10
- Demographics: 70

0 100 200 300 400 500 600 700
Mental Effort

- CPOE: 33.3%
- ePrescribing: 25%
- Clinical Summary: 33.8%
- Smoking Status: 52%
- Problem List: 36.2%
- Growth Chart: 38.1%
- BMI: 37.5%
- Vital signs: 31.6%
- Demographics: 37.9%
How to Measure Satisfaction?

• User’s subjective impression of how likable the system is

• Likert scale type of evaluations
  – System Usability Scale (SUS)
  – AHRQ Survey Instruments for EHR usability (in development)
  – Other measures
How to Improve Usability?

TURF in Action
TURF in Action: Redesigning EHR

- OpenVista: Open Source EHR
- NIST Use Case §170.302(e)
- Maintain active medication allergy list
  - Add allergy; Modify allergy; Review allergy

<table>
<thead>
<tr>
<th></th>
<th># Steps</th>
<th>Time (seconds)</th>
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<tbody>
<tr>
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<td>Record</td>
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<tr>
<td>Prototype: Steps</td>
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TURF in Action: Redesigning EHR

OpenVista CIS Modify Allergy Entry

Prototype Modify Allergy Entry

14 Steps

91 Steps
TURF in Action: Redesigning EHR

- 81% reduction in Overhead Functions
- 89% increase in Domain Functions

![Bar chart showing Overhead Functions and Domain Functions comparison between OpenVista and Prototype. The chart illustrates a significant reduction in Overhead Functions (99 vs 19) and a noticeable increase in Domain Functions (28 vs 53).](chart.png)
Usability at SHARPC

• Rapid Usability Assessment Protocol

• Comprehensive TURF Evaluation

• Redesign

• Training
  • Short Course
  • AMIA 10x10 Course
  • Certificate, MS, & PhD
Summary

• Usability is defined

• Usability is measurable

• Usability is doable
EHR Usability Symposium

October 21, 2011

Washington Hilton

Pre-AMIA Event