Safety in Radiation Therapy: Usability from a Software Engineering Perspective

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Co-Chair | ROSSI WG Usability of Error Messages

Agenda

1. **Usability in Radiation Therapy Software**
   Define usability and in the process learn to identify usability problems
2. **ROSSI | Error Messages**
   Error message guidelines with examples from the Radiation Therapy field
3. **Ways to Improve Usability**
   Overview of the usability engineering process and related standards
4. **Collaboration Venues**
   Clinicians and vendors have opportunities to work together to help address usability issues

IT DOES NOT KILL MY EYES ANYMORE.

Medical physicist's reaction to a re-design of the planning software.

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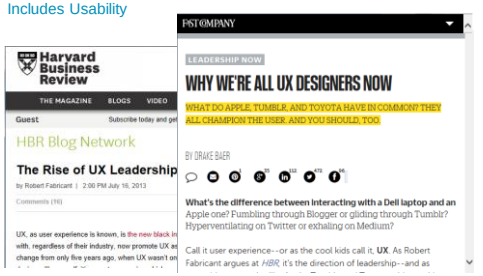
What is Usability?

- Usability is a quality attribute that assesses how easy user interfaces are to use.

- Human Factors Engineering is the application of knowledge about human behavior, abilities, limitations related to the design, to achieve usability.

UX – User eXperience Design

Includes Usability



World War II – Aircraft Cockpit 7

What is Usability?

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Definitions cont.

- Jakob Nielsen, a world leading expert in the human factors field, defines usability by five quality components.

http://tabtimes.com/feature/ittech-developers/2011/12/02/user-interface-guru-jakob-nielsen-right-now-i-think-kindle-fire 8

1. How Steep is the Learning Curve?

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http://www.retronaut.com/2012/11/trail-to-the-yukon- goldfields/ 9

1. Ease of Learning

Usability Attributes

- How easy is it for users to accomplish basic tasks the first time they use the device?

Usability Issue	▪ Seemingly long and arduous training, that leaves you unsure of whether you can use the software comfortably.

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2. Efficiency

Usability Attributes

- Once users have learned the design, how quickly can they perform tasks?

Usability Issues	▪ Slow system performance. For example loading a plan takes forever. ▪ Too many button clicks just to get to the window you want.

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3. Memorability

Usability Attributes

- When users return to the design after a period of not using it, how easily can they re-establish proficiency?

Usability Issues	▪Only a few staff members seem to be able to use the device ▪ There are sticky notes all around the system.

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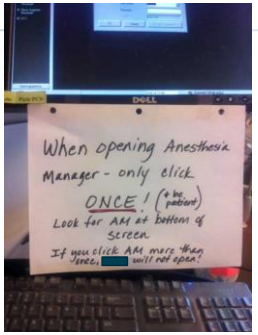

Source: http://www.interaction-design.org/encyclopedia/usability_evaluation.html

4. Error Prevention

Usability Attributes

- How many errors do occur, how severe are these errors, and how easily can users recover from the errors?

Usability Issues	▪Too many warnings and errors causing alert fatigue.

5. Satisfaction

Usability Attributes

- How pleasant is it to use the design?

Usability Issues	▪ Controls are hard to find or poorly located creating frustration in addition to inefficiency.

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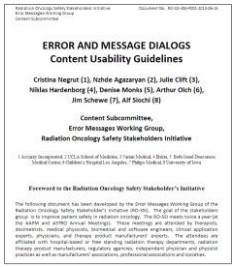
Error and Message Dialogs

Six Content Usability Guidelines



ERROR AND MESSAGE DIALOGS
Content Usability Guidelines

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Content Subcommittee, Error Messages Working Group, Radiation Oncology Safety Stakeholders Initiative

Foreword to the Radiation Oncology Safety Stakeholder's Initiative

Radiation Oncology Safety Stakeholder's Initiative (RO-SSI).

Problem Definition

Message Dialogs

- In many instances message dialogs are poorly written and therefore not very useful
- Can be misinterpreted or ignored by the user with the potential for improper use of the system and even patient harm.

Recommended Structure

Error Messages

- **Problem**
  - Informs the user what problem has occurred.
- **Cause**
  - Explains why the problem occurred
- **Solution**
  - Provides guidance so that users know how to fix the problem.

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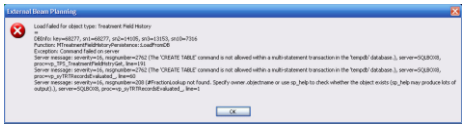
1. Avoid Technical Jargon

User Centered



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2. Clear Language

"You need to deselect the previous selection to select a new dataset."

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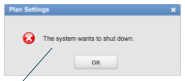
Clear Language

- System does not have feelings and needs



"The system wants to shut down."

- Avoid acronyms

3. Actionable

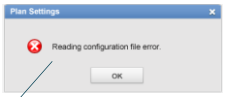
Provide a solution

- Users should either perform an action or change their behavior as the result of the message.
- Don't recommend contacting technical support.

4. Specific

Indicate file names, values

- The message should describe the problem giving specific names, locations, and values of the items involved.



"Reading configuration file error."

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5. Concise

- Remove unnecessary words but don't leave out essential information.
- Users don't read while using the application, they scan. Use the keywords early in the message.

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6. Clinically Reviewed

Ask clinical users for feedback

- The message and the use case/scenarios when the message is displayed need to be reviewed with clinical representatives.

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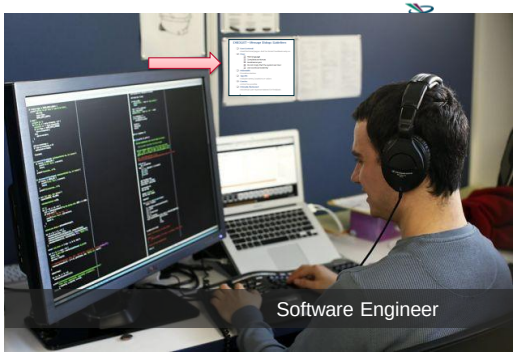
Message Usability Guidelines

- ❑ Avoid Technical Jargon
- ❑ Clear
- ❑ Actionable
- ❑ Specific (which ROIs, which File)
- ❑ Concise
- ❑ Clinically Reviewed



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The "Perfect User" vs Real User

Design Issues – Root Causes

- Tendency to create applications for a mythical "perfect user". (William Hudson, UK)
- Implicitly assume device operated by users with:
  - Visual acuity of an eagle
  - Memory of an elephant
  - Navigation skills of a bat
  - Stamina of a camel
  - Dexterity of a monkey

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Usability Engineering

Part of the Solution

- Using a set of methods and tools, usability trained staff members follow a systematic and scientific process focusing on real user needs and goals in the context of use.
- User centered design brings real users' needs and goals to the forefront of every design decision.

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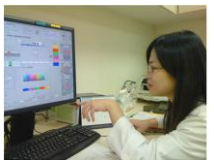
User Research

Ethnographic studies

Gather user input



- User has to deal with constant interruptions
- Tight schedules
- Work with sick patients and concerned families
- In a basement with no natural light
- Monitoring 3 or 4 computers at the same time

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Cultural Differences / Internationalization Implications

Conceptual Design + Requirements

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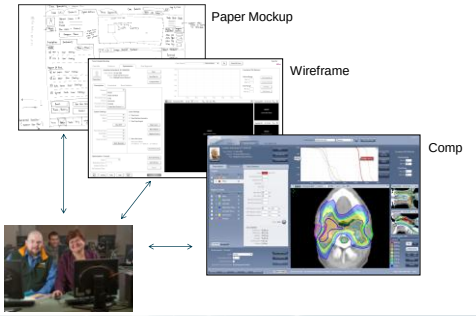
Detail Design and Usability Testing



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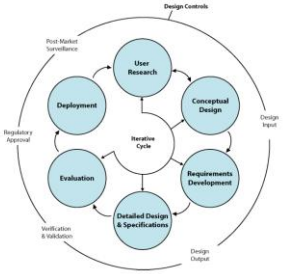
Usability Engineering Process



Human Factors Key Standards

HE75: 2009

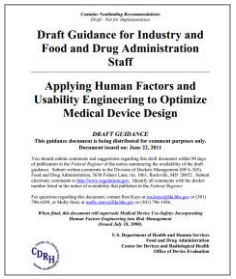
IEC 60601-1-6, 60601-1-8

IEC 62366-2007

Regulatory bodies recognize the importance of usability engineering methodology to produce safe and effective medical devices.

FDA

- FDA Increased Expectations for Human Factors



Draft Guidance for Industry and Food and Drug Administration Staff

Applying Human Factors and Usability Engineering to Optimize Medical Device Design

DRAFT GUIDANCE

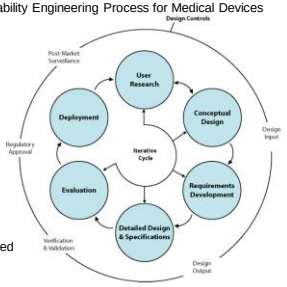
This guidance document is being distributed for comment purposes only.

Document issued on: June 22, 2011

U.S. Department of Health and Human Services
Food and Drug Administration
Center for Devices and Radiological Health
Office of Device Evaluation

IEC 62366 | Recognized by FDA

Steps in Usability Engineering Process for Medical Devices



"Input from USERS is typically obtained at nearly every stage in the cycle"

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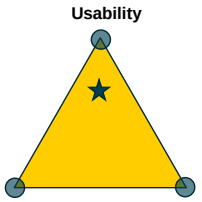
Balancing Needs



Business needs
(cost, revenue, time to market)

Technical constraints
(configuration, maintainability, reliability)

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Collaboration with Vendors

1. Join one of the ROSSI working groups
2. Contact vendor representatives
   - Let the vendors know of uncovered usability strengths and weaknesses.
   - Make use of the vendor's channels to get customer input:
     - Online forums and product feedback forms
     - Users meetings
     - Trade shows
   - Don't give up. Need concerted effort.

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"EVEN IF YOU ARE ON THE RIGHT LANE YOU WILL BE RUN OVER IF YOU JUST SIT THERE."

- Will Rogers

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QUESTIONS ?

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