Usability in design of Radio Therapy Software

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Usability Specialist

Human Care Makes the Future Possible
Agenda

Goal:

• Insight in the radio therapy area
• Insight in how it is to work with usability in this area
• Questions

Outline

• Nucletron, Radio Therapy and Oncentra
• Usability and software development organisation
• QA and Regulatory
• User Involvement
• GUI and Usability Design
Background

• Undergraduate studies, Msc
  – Humans, Computers and Work
  – 50/50 Work science / Computer science

• Graduate studies, PhD
  – Human Computer Interaction (HCI)

• Consultant
  – Usability Designer
  – Projects within the health care area

• Nucletron / Elekta
  – June 2010
  – Usability Specialist
You?
Nucletron, Radio Therapy and Oncentra
Organisation

**Nucletron**
- Dutch company
- Nucletron ww ~700 pers.
- Uppsala R&D ~40 pers.

**Elekta (2011)**
- Swedish international company
- Elekta ww ~3200 pers.
- Build and sell medical cancer treatment equipment to hospitals
Ways to treat cancer

• Surgery
• Chemotherapy
• Radiotherapy
  – Brachytherapy
  – External Beam
Brachy Therapy – LDR
Brachytherapy - HDR
Brachytherapy - Afterloader
External Beam – The accelerator
External Beam – Patient positioning
External Beam – Gantry and beam
Workflow – High level

• Cancer is diagnosed

• Treatment type is decided
  – Surgery
  – Chemotherapy
  – Radiotherapy
    – Brachy therapy
    – External Beam

• Patient starts the treatment
Workflow model – Radio Therapy, External Beam

Images from CT Scanner

Treatment Planning

Accelerator

Images

Plan

fractions x n
Oncentra - Treatment planning software
User profiles

• **Physician**
  – Decide on treatment and dose
  – Locate target

• **Physicist**
  – Dose calculation algorithms
  – QA – controls

• **Dosimetrist**
  – Contouring
  – Plans

• **Technician**
  – Software
  – Network
  – OS
Treatment and treatment planning workflow

**Patient**
- Fixation
- Take CT images

- Receive treatment fraction x n

**Oncentra User**
- Creates treatment plan

  - Import CT images

  - **Draw organs (ROI)**
    - Target - to treat/radiate
    - OAR - to avoid

  - **Set up beams**

  - **Calculate dose**

  - Export to accelerator
Set up beams - Oncentra
Software development organisation and Usability
SCRUM - Development Process
Application Design Team

- Decide on new functionality
- Refine product backlog
- Plan the work on a high level
- Synchronize teams
Application Design Team

Product Owners

- Maria
- Kellie
- Camilla
- Nina

Support

- Technical advisor
- Usability

Research
Development Team

Camilla
Product Owner

Maria
Product Owner

Kellie
Product Owner

Nina
Research

Mats
Technical advisor

Niklas
Usability
• Redesign existing things
• Design new things
Legacy systems

Several components

• TPP
  – BM
  – EM
• Raysearch
  – OM
  – MBS
  – VMAT
• Tatramed
  – AM
  – PA
• Mimer
  – Database
• DICOM
  – toolkit

Several developing sites

- Slovakia (~7 persons)
- Holland (~10 persons)
- Sweden (~30 persons)
Usability – what is it?

• Provide the *right functionality*
  – Learn about user’s work context, needs, goals
  – Research – front edge

• Make the functionality *easy to use*
  – GUI design
  – Logic
  – Consistent
  – Recognizable
Improve usability – achieve:

• Recognition
  – User can reuse knowledge
    – Within Oncentra
    – From other Windows systems

• Minimal cognitive workload
  – Let the system do the ”thinking work” (calculations)
  – Present information
  – Let the user make the decisions

• Easier to ”navigate around the interface” to “new areas”
  – Easier to learn new functionality

• Quicker and easier training
  – Easier to learn for new personnel

• A system that is:
  – Less complex to use
  – Pleasurable to use (user understands, don’t feel lost)
Organisational effects of usability

• Increased productivity
• Increased “job satisfaction”
• Less employee turnover
• Less sick leave
• Lower cost for support (internal/external)
• Less need of documentation and manuals
• Shorter education
• Shorter learning time
• The user can learn other parts in the system without further education
Organisational effects of absent usability

- Frustration – user has to find workarounds
- Easier to make errors (Hazards!)
- Less trustworthy system
- Cognitive workload
- Physical problems
  - Tensions in neck
  - Stress (and related symptoms)
- High sick leave
- High staff turnover
Usability Efforts at Nucletron

• Usability Specialist

• Usability and GUI design activities integrated into the development process

• Compliant to ISO/IEC 62366

• Comply to FDA’s emerging requirements on Usability Evaluations

• Continuous usability training
Usability Specialist

• Dedicated position / role
  – Not a shared responsibility by interested but inexperienced staff

• Joins product owners in the Application Design Team
  – Usability aspects in high level usability decisions and strategy

• Supports developers
  – Low level usability decisions
  – GUI design details
My Usability Work

- Decide on new functionality
  - Application Design Team
- QA – Regulatory
  - Medical Device
  - Fulfill standards and regulations
- GUI Design
- User centered system development
The range of Usability

Design activity

Graphical design
GUI design
Interaction design
Look’n feel
Application design
Organisational development

Design item

Button
Window
Functions
Permissions, rights
Concept
Access

User focus

Icon
Form
Application
Individual
Organisational
QA and Regulatory
USA - FDA:

- **Class I**
  - Plastic gloves

- **Class II**
  - Planning software

- **Class III**
  - Pacemaker
  - Accelerator
• Show compliance to IEC/ISO standards
  – IEC/ISO 62366 “Application of usability engineering to medical devices”

Fulfills requirement from FDA
Fulfills European requirement
Show Compliance to Standards

• Describe how we work - in documents
  – Standard Operating Procedure (SOP)
  – Work Instructions
  – Procedures

• Work like that – in practice
  – Follow work instructions and procedures

• Prove that we have worked as we have described
  – Document…
User Involvement
Contact with end users

- Use
- Feedback
- Product
- Feedback
- Marketing
- Sales and service
- Application Specialists

Nucletron
Improving patient care

R&D
User input

• Gamma sites – Hospitals for formal validation testing
• Alfa sites – Hospitals for informal tests
• Collaborations sites:
  – Amsterdam - Academisch Medisch Centrum
  – Leeuvarden - Radiotherapeutisch Instituut Friesland
  – Regensburg - University Hospital Regensburg
  – New York - Stony Brook Downstate Medical Center
  – Philadelphia - Thomas Jefferson University Hospital
  – Utrecht - Universitair Medisch Centrum
  – Uppsala - Uppsala University Hospital
User Centered System Design at Nucletron

• Application Specialists
• User meetings
• Employed clinical staff
• User tests
  – Formal (Gamma sites)
  – Informal (Alpha sites)
  – Technical
• Field studies
  – Customer visits
  – Discussing early designs (prototyping)
  – Service
  – Education
User Input

Validations
Tests
Field studies
Product Specialists
User meetings
Informal hospital contacts
GUI and Usability Design
GUI Design

• Support
  – Be a resource for developers making GUIs

• Educate
  – Do right from the beginning

• Design in advance
  – Prototypes

• Evaluate
  – With users
  – According to guidelines and heuristics
GUI Design: Prototypes
Admin: ROI Catalog, All-tab

- “Templates”
- “Type”
- Right click
- All = same list

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Support developers in GUI design

• Frequently urged:
  – Support the user
    – Consider user’s work flow
  – Provide right information
    – Make users feel confident
  – Simplify, simplify simplify
  – Emphasize often used information and functionality
    – Hide what is seldom used
  – Follow standards
    – Windows standards
    – GUI Guidelines
    – Consistency!

• Prevent GUI flaws
GUI flaws?

- Which ROIs?
- Why are they not suitable?
- What will happen if I ”continue anyway”?
Follow basic standards!

What do I scroll with these scrollbars?

- Change background image
- Zoom
Be consistent in the design

Are these icons representing the same kind of objects?
Questions?
Thank you for your attention!

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