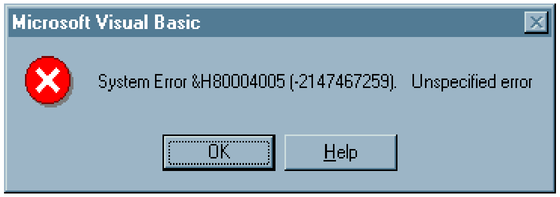
IFSM 303 Human Factors



"No matter where you go - there you are..."
- Buckaroo Banzi

Topics

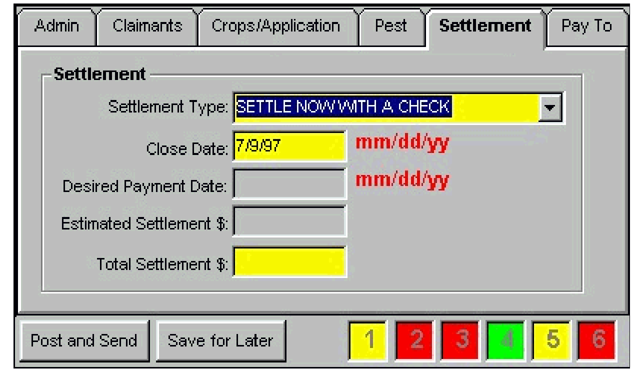
Results

Experiment

Quality of Service

Therac-25

What's Wrong with This?



HCI in the News

How do we organize and then find stuff?

'Tagging' helps unclutter data

Online search categorizes how humans label things

Tuesday, May 3, 2005 Posted: 11:23 AM EDT (1523 GMT)

NEW YORK (AP) -- Here's how we tend to organize our digital photos: We stick them into a folder on our computer and label it "Hawaii trip," or whatever.

Here's a new way: Forget folders or albums. Just "tag" the photos based on what's actually in each frame.

Now, extrapolate this concept to the ideas, images, videos -- and people -- you meet or wish to find online. If they're properly tagged, they're far easier to find.

That's "tagging", and it's currently all the rage among the digerati.

Tagging has the potential to change how we keep track of and discover things digital -- even whom we meet online. Several startups are banking their futures on it.

It could be our salvation as we attempt to sift through the growing clutter of data we're amassing on our hard drives and on that growing digital repository that is the Internet.

(AP PHOTO)

Noah Brier surfs the "flickr" site, looking for bookmarks tagged "lifehack."

"People are awash in an overwhelming sea of stuff," said Joshua Schachter, founder of del.icio.us, a service for tag-enabled online bookmarks. "Our ability to produce content far outstrips the ability to sort and consume it."

And with the growing production of photos, sound and video clips -- material not easily searchable -- tags become ever more important.

HCI Video - Softer Cars

How do we make cars safer for the people they hit?

CBS (2005)

Today's Experiment

Team 4

What do you have for us?

Group Activities

- Experiment
  - Research
  - Testing
  - Results
- Application
  - Compare individual Designs
  - Decide features / functions

Chapter 11

Quality of Service

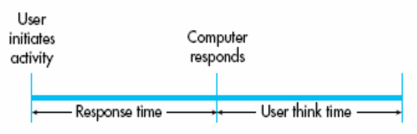
Time is precious

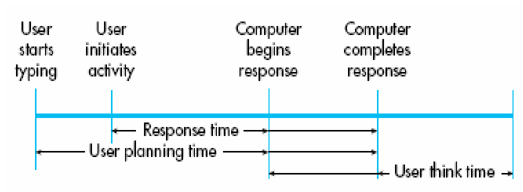
- Lengthy/unexpected response time
  - Frustration
  - Annoyance
  - Eventual anger
- Speedy/quickly done work result in
  - learning less
  - reading w/lower comprehension
  - making more bad decisions
  - committing more errors

Response Time

Time for computer to respond

User needs think time





Response Time Factors

Task Complexity
User Expectations
Speed of task
Error Rates
Time of Day
Fatigue
Familiarity with computers
Experience with task

Short Term Memory

7 +- 2

Familiarity Helps

Distractions

15 - 30 seconds

Chunking

Optimum problem solving

Longer response time
- 15+ seconds
- causes uneasiness
- penalty for error increases

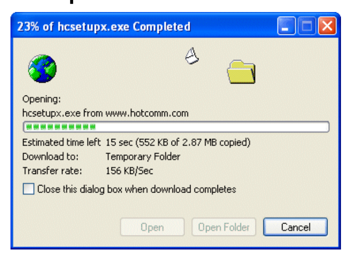
Shorter response time
- 1 second or less
- user fails to comprehend
- increase errors on complex tasks

Progress indicators

Shorten perceived elapsed time

Heighten satisfaction
- graphical indicators
- blinking messages
- seconds left for completion

Should be
accurate!



Satisfaction

Rapid task performance, low error rates, and high satisfaction:
- Users have adequate knowledge of the objects and actions
- Solution plan can be carries out without delays
- Distractions are eliminated
- User anxiety is low
- Feedback about progress

Optimum interaction speed

Novices prefer to work slower

With little penalty for an error, users prefer to work more quickly

Familiar task, rapid action preferred

Rapid performance previously, they will expect in future situations

Response-time choke

Allows a system to be slowed down when the load is light

Makes the response time more uniform over time and across users

Three things influence response-time

Previous experiences

Individual's tolerance for delays

Task complexity

Expectations and Attitudes

Varies with Task
  .01 seconds to 2 seconds

Stop Light - 30 seconds

Letter from US - 7 to 10 days

User detect 8% change

William's Study on Response Time

Response time +- STD
User can Press Attention Key

Seconds	Attention Key %
2	1.42
4	17.44
8	82.92

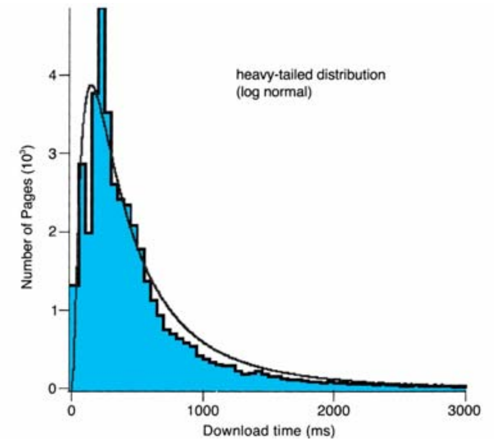
Netscape Developers

Two critical numbers

.2 seconds
  User expects something

8.5 seconds
  50% users give up

Web Page Response Times



Three Conjectures

People work faster with experience
  Problems: Therac-25 Disaster

Want response < 1 seconds

Dissatisfied with > 2 seconds

User Productivity

Repetitive tasks
  Long Response time slows task but can lead to higher accuracy

Problem Solving
  Workers adapt to response time
  Time to solution stayed same

Programming
  Increase response / user think

Variability

Consistency

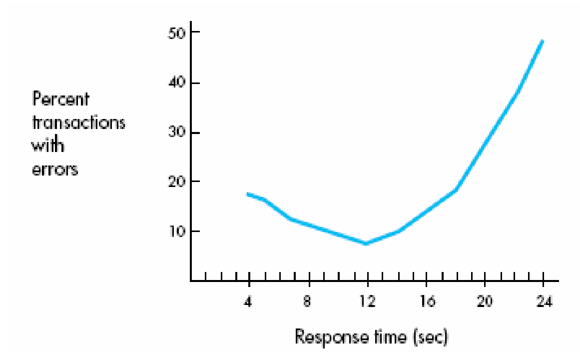
Different commands different RT

Response time variation +- 50% is OK

Possibly slow down fast responses

Completion Indicators

Error Rates vs. Response Time



Frustrating experiences

- 46% to 53% of users' time was seen as being wasted
- Recommendations include improving the QOS and changes by the user
- Poor QOS is more difficult in emerging markets and developing nations
- User training can help
- Email a common application, but also a common source of frustration
- Viruses also a problem

Summary

- Users prefer shorter response times.
- Longer response times (> 15 seconds) are disruptive.
- Users change usage profiles with response time.
- Shorter response time leads to shorter user think time.
- A faster pace may increase productivity, but it may also increase error rates.
- Error-recovery ease and time influence optimal response time.
- Response time should be appropriate to the task:
  - Typing, cursor motion, mouse selection: 50–150 milliseconds
  - Simple, frequent tasks: 1 second
  - Common tasks: 2–4 seconds
  - Complex tasks: 8–12 seconds
- Users should be advised of long delays.
- Strive to have rapid start-ups.
- Modest variability in response time is acceptable.
- Unexpected delays may be disruptive.
- Offer users a choice in the pace of interaction.
- Empirical tests can help to set suitable response times.

Case Study

Therac-25

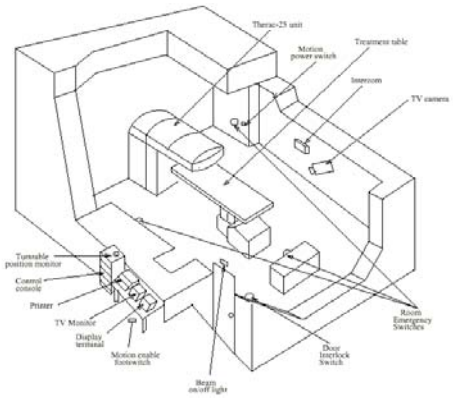
Case Study

March 21, 1986

East Texas Cancer Center

Ray Cox
- Tumor on Back
- Therapeutic Radiation Treatment
- 8 previous treatments

Therac-25



What happened

Placed in Therac-25

Suddenly a sharp jolt

Cox thrown off table

Staggers to lead door

Compounding Problems

Technician didn't see him
- Video Monitor disconnected
- Intercom not operational

Therac-25 shows error message

`Malfunction 54`

Patient suffered an over dosage

Trusting the Computer

Therac-25 shows under dosage

System checked out
- Problem not duplicated
- No electrical problems

Put back into service

Once Again

April 11, 1986

Same machine, same technician

Vernon Kidd
- Skin cancer, side of face

Intercom working

Something goes wrong

A loud pop is hear

Kidd is moaning for help

Three weeks later, Kidd is dead

Autopsy
- High dosage radiation damage
- Brain and brain stem

Downhill slide

Cox can not use his arm anymore

Radiation damage to spinal chord

Slowly becomes paralyzed

Dies in September

The investigation begins

Clinic Physicist Fritz Hager

Shuts down system

Contacts company
- Atomic Energy of Canada

The machine

Therac-25 Linear accelerator

Designed to fire a high energy beam of radiation deep into the body without damaging tissue

Can be used as either Electron Therapy or X Ray System

The difference

X Rays require high energy
- Penetrates body
- Exposed film

Electron Therapy
- Lower power
- Treat tumors near the skin

Three Setting

1 - X Rays - High Energy

2 - Electrons - Low Energy

3 - Visible Light - targeting on body

The computer

Tasks
- Monitoring the status
- Accepting input on treatment
- Preparing the beam
- Administering treatment

Problems?
- System would shutdown

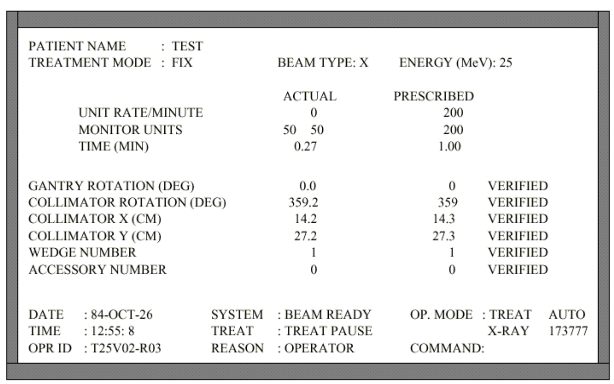
Recreation

After several days, Hager and the technian recreate the
`Malfunction 54`

90% of the time the system is used for X-Rays

If the technician typed quickly, might type X instead of E

The Screen



The error

Technician would correct mistake by hitting up key and hitting E

Would then continue with the setup

System would display
```
Input Verified
Beam Ready
```

What the machine was doing

Once the X was hit, the system started the generate the high power X-Ray Stream

When the E was hit, the beam was changed to Electrons

But the system stayed at high power level...

The Fix

The up key was removed

To correct a mistake, the Reset button was pressed, which changed the beam settings

Fallout

Texas was only 2 of 6 deaths worldwide

The other 4 happened a year before the discovery was made

AEC denied any problems until Texas

Final Death

January 17, 1987
Yakima Valley Memorial Hospital

Same machine, same problem, same result...

Realization

QA manager at AECL admitted “There are too many combinations of features to guarantee that the radiation beam won’t come out too intense.”

Final Comment

“A lesson to be learned is that focusing on particular software bugs is not the way to make a safe system.”

“The basic mistake here involved poor software engineering practices and building a machine that relies on software for safe operation.”

Fatal Design

“Furthermore, the particular coding error is not as important as the general unsafe design of the software overall.”

HCI Factors

What were some of the Human Computer Interaction Factors?

Next Time

Team 5 - what is your Experiment?