Agency for Healthcare Research and Quality
Advancing Excellewnce in Health Care

AHRQ Health IT Grantee and Contractor Meeting

Friday June 4, 2010

Agency for Healthcare Research and Quality
Advancing Excellewnce in Health Care

Boston University School of Medicine / Northeastern University

Emerging Technologies
Demonstrations of the Virtual Patient Advocate

Annual Health IT Conference
Agency for Health Research and Quality
Washington, DC
June 26, 2010

Northeastern University

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BOSTON UNIVERSITY SCHOOL of Medicine

PLANAR
Northeastern
RED
RED

Motivation: Rapid Acceptance

Natural, intuitive modality provides rapid acceptance

Emulate human face-to-face conversation

Focus on nonverbal communicative behavior

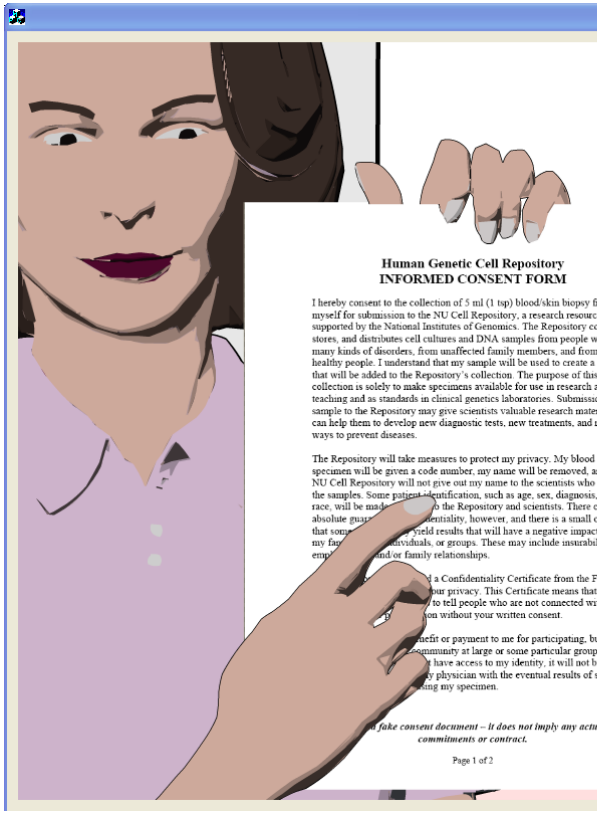
gaze, posture,

gesture, etc.

Motivation: Patients with Low Health Literacy

Face-to-face communication, in conjunction with written instructions, is best

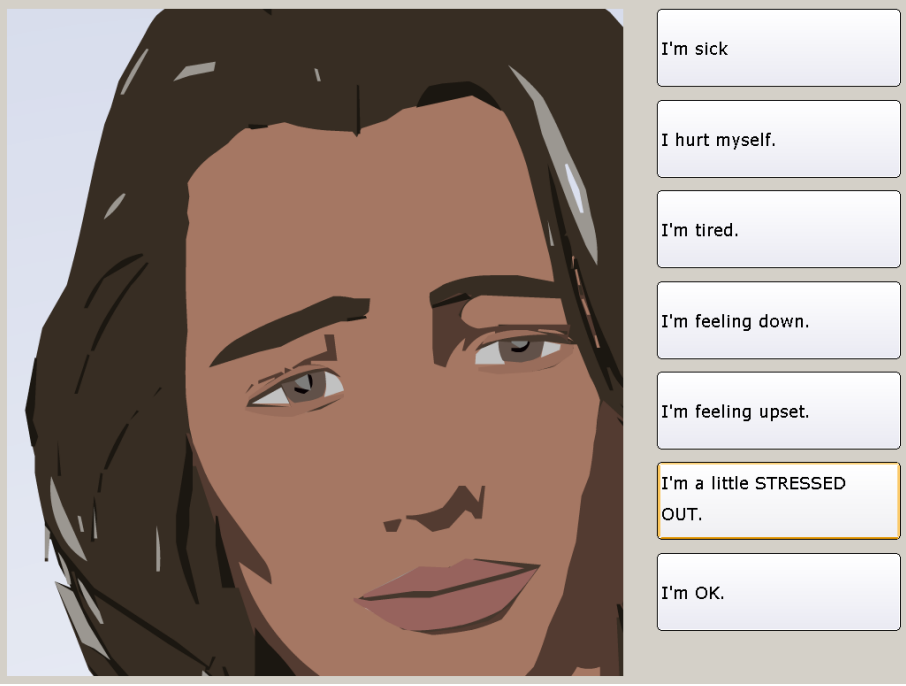
However, most health professionals have extremely limited time to spend with a patient



Motivation: Therapeutic Alliance

Maintaining engagement is a pre-requisite for longitudinal interventions.

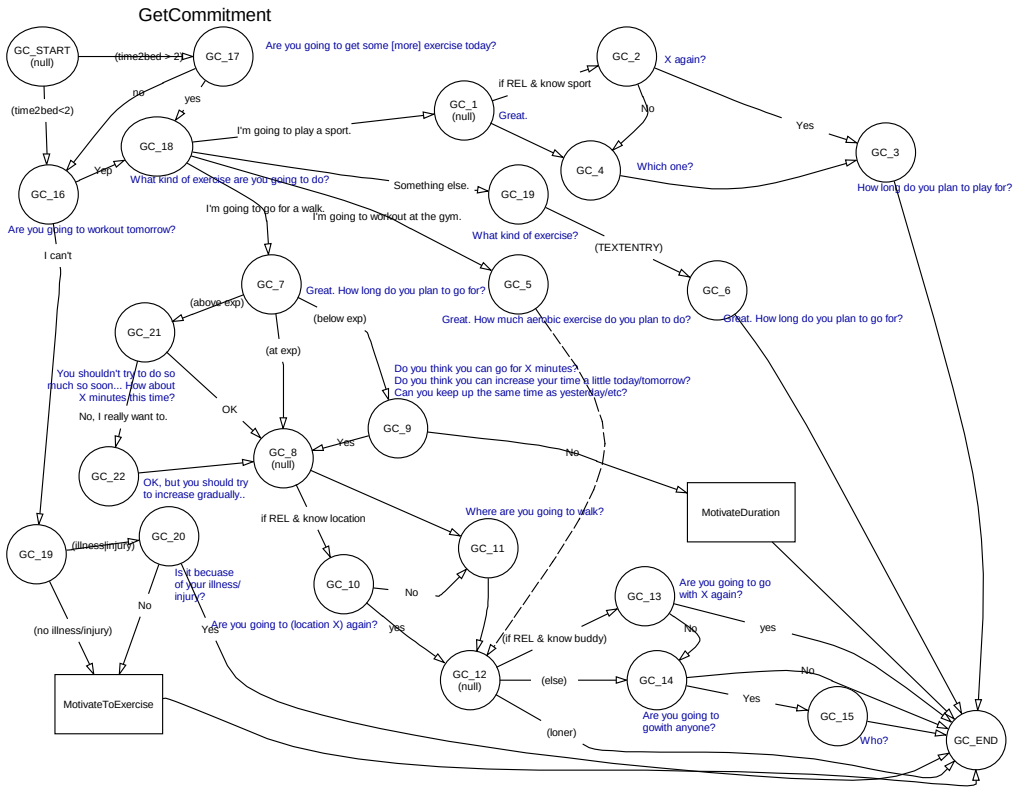
Agents can emulate human relationship-building behavior to build and maintain trusting, therapeutic alliance.



Technology Overview

Agent Architecture: Dialogue Representation

Hierarchical Transition Networks

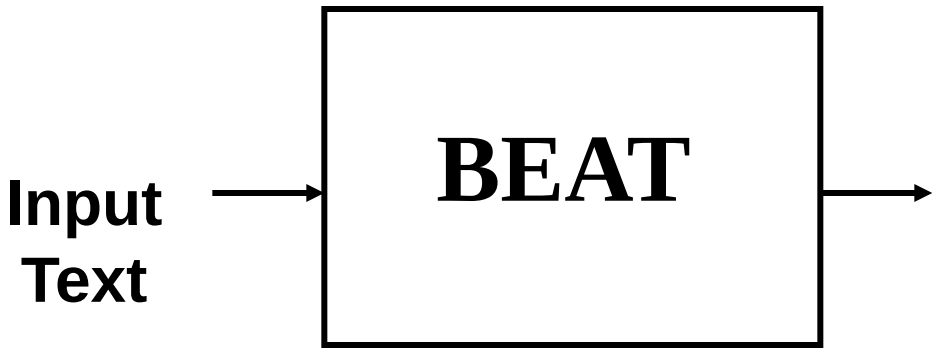


Agent Architecture
Dialogue Representation

Agent utterances represented by words plus XML annotations for synchronized nonverbal behavior

```
<UTTERANCE>It is for your
  <HEADNOD/><BEAT>blood
  pressure.</BEAT></UTTERANCE>
```

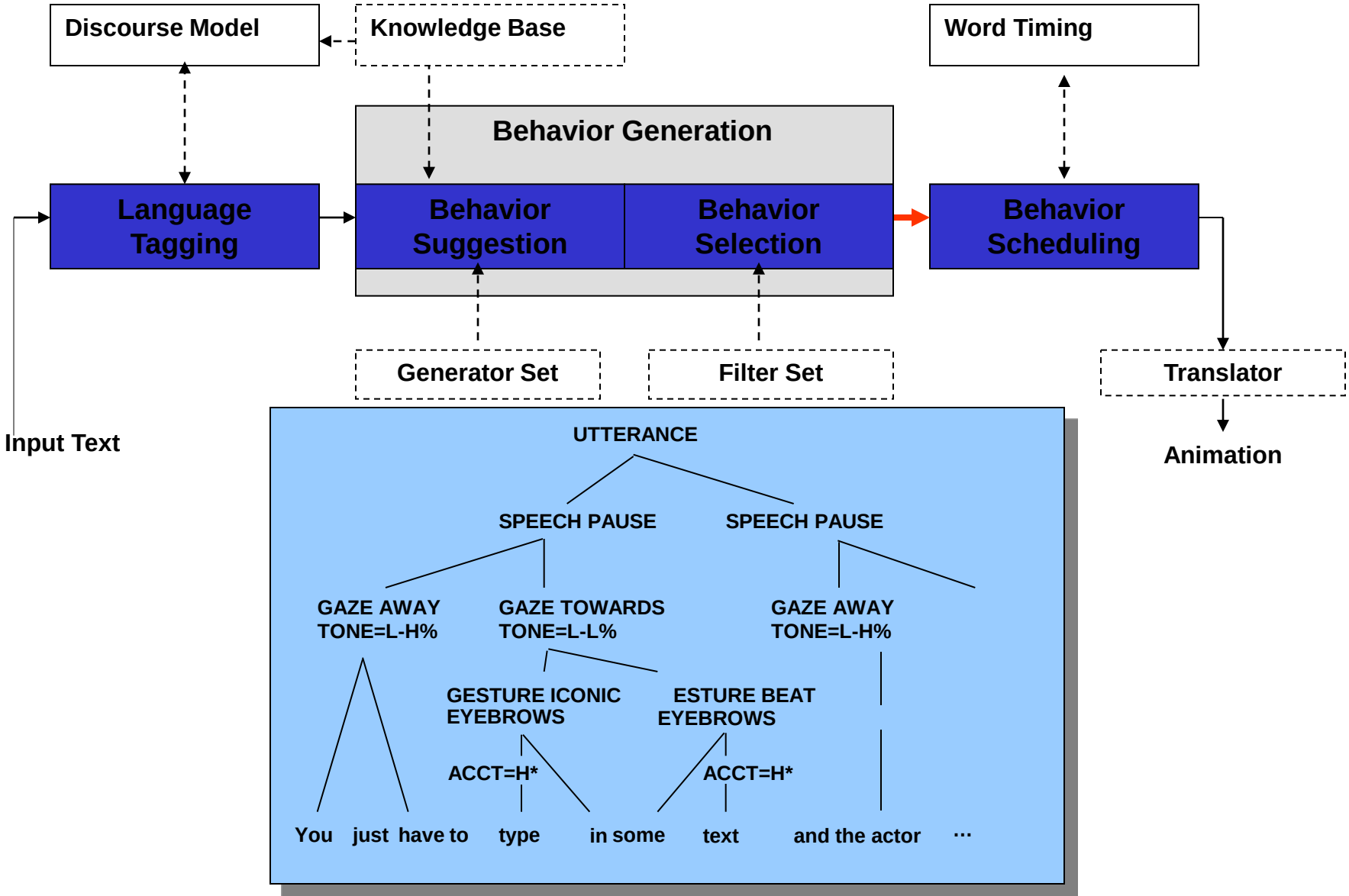
BEAT



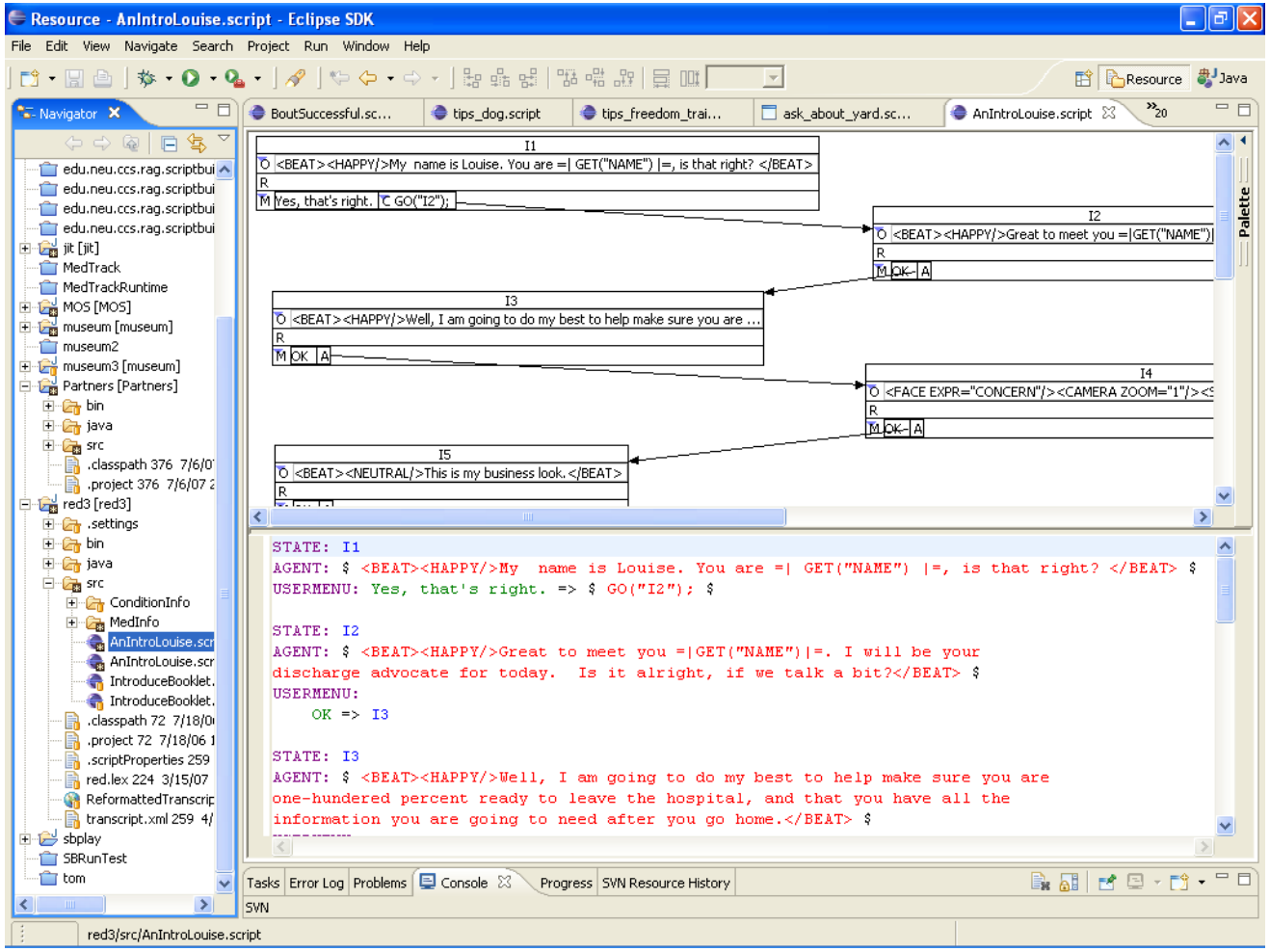
- Speech
- Intonation
- Hand Gesture
- Gaze
- Posture
- Eyebrow
- etc.

Animation

XML Trees Passed Among Modules

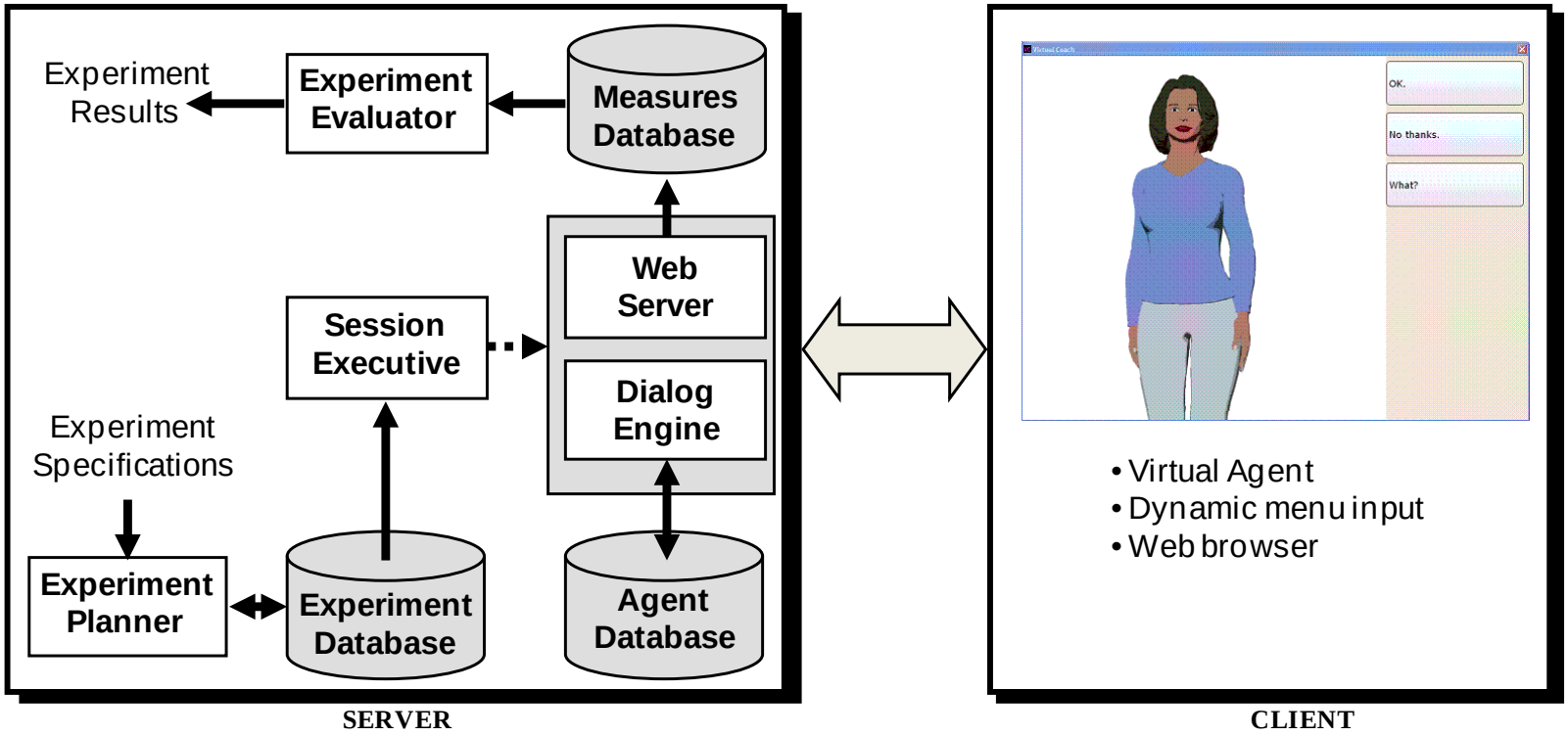


Agent Architecture Development Tools



- Custom, Eclipse-based IDE
- Integrated debug and test
- BEAT

Run Time Architecture



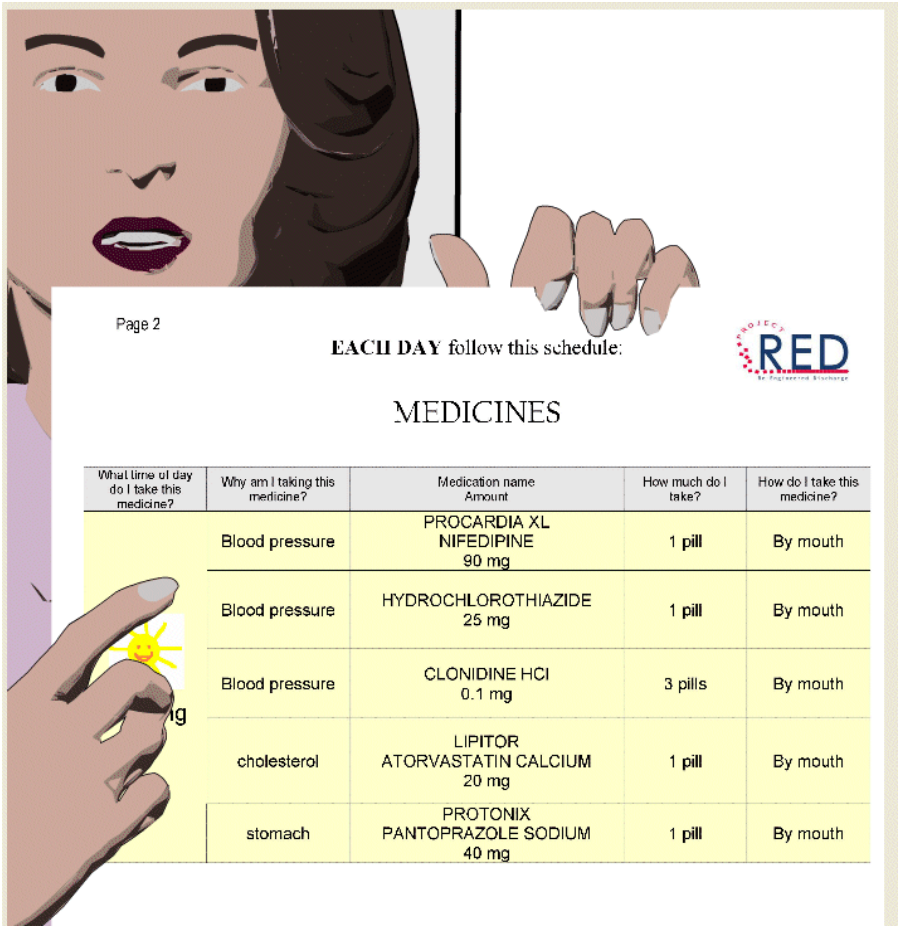
Platforms

PLANAR
What if I miss a dose?
No thanks
Could you repeat that please?

Okay , tomorrow night at 06:20 PM it is ! Talk to you then .
Ok

Development Methodology

Studies of Nurse-Patient Interaction



Page 2

EACH DAY follow this schedule:

PROJECT RED

MEDICINES

What time of day do I take this medicine?	Why am I taking this medicine?	Medication name Amount	How much do I take?	How do I take this medicine?
	Blood pressure	PROCARDIA XL NIFEDIPINE 90 mg	1 pill	By mouth
	Blood pressure	HYDROCHLOROTHIAZIDE 25 mg	1 pill	By mouth
	Blood pressure	CLONIDINE HCl 0.1 mg	3 pills	By mouth
	cholesterol	LIPITOR ATORVASTATIN CALCIUM 20 mg	1 pill	By mouth
	stomach	PROTONIX PANTOPRAZOLE SODIUM 40 mg	1 pill	By mouth

Resulting model of Gesture Stroke

New Topic Level	Gesture		
	NONE	POINT	REGION
No Change	80.8%	13.1%	6.1%
PAGE	63.6%	13.6%	22.7%
SECTION	48.3%	32.8%	19.0%
ITEM	31.2%	65.9%	2.9%

Interdisciplinary Collaboration

Doctors, Nurses, Pharmacologists,

Computer Scientists, Animators

3 Year Development

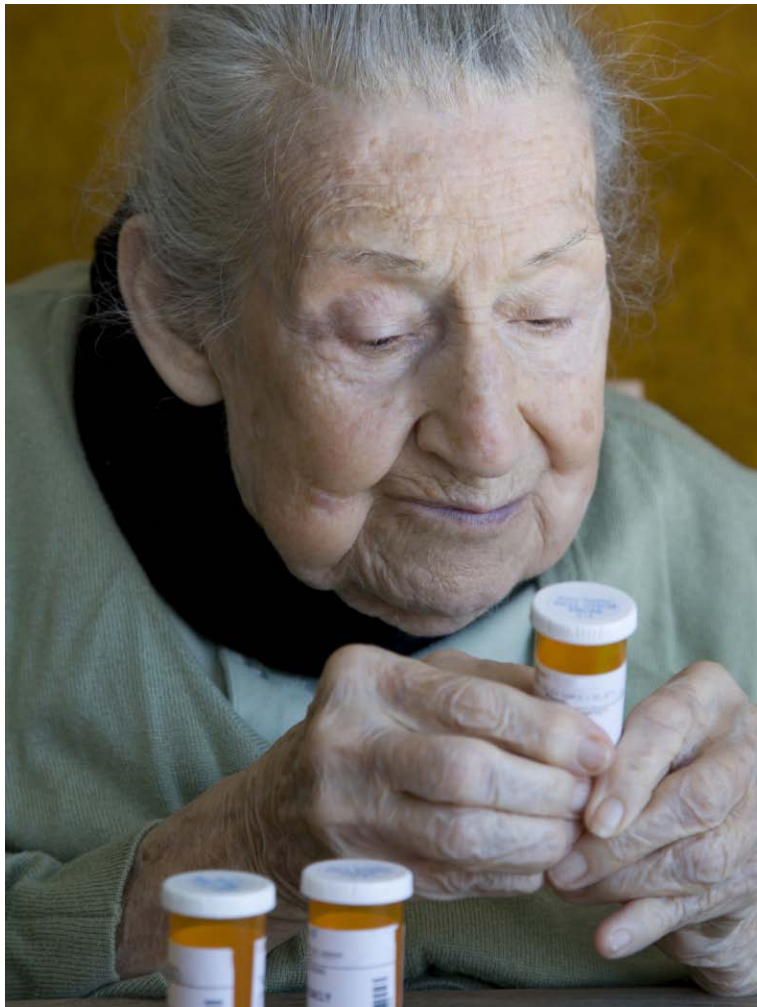
2,254 medications

48 diagnoses

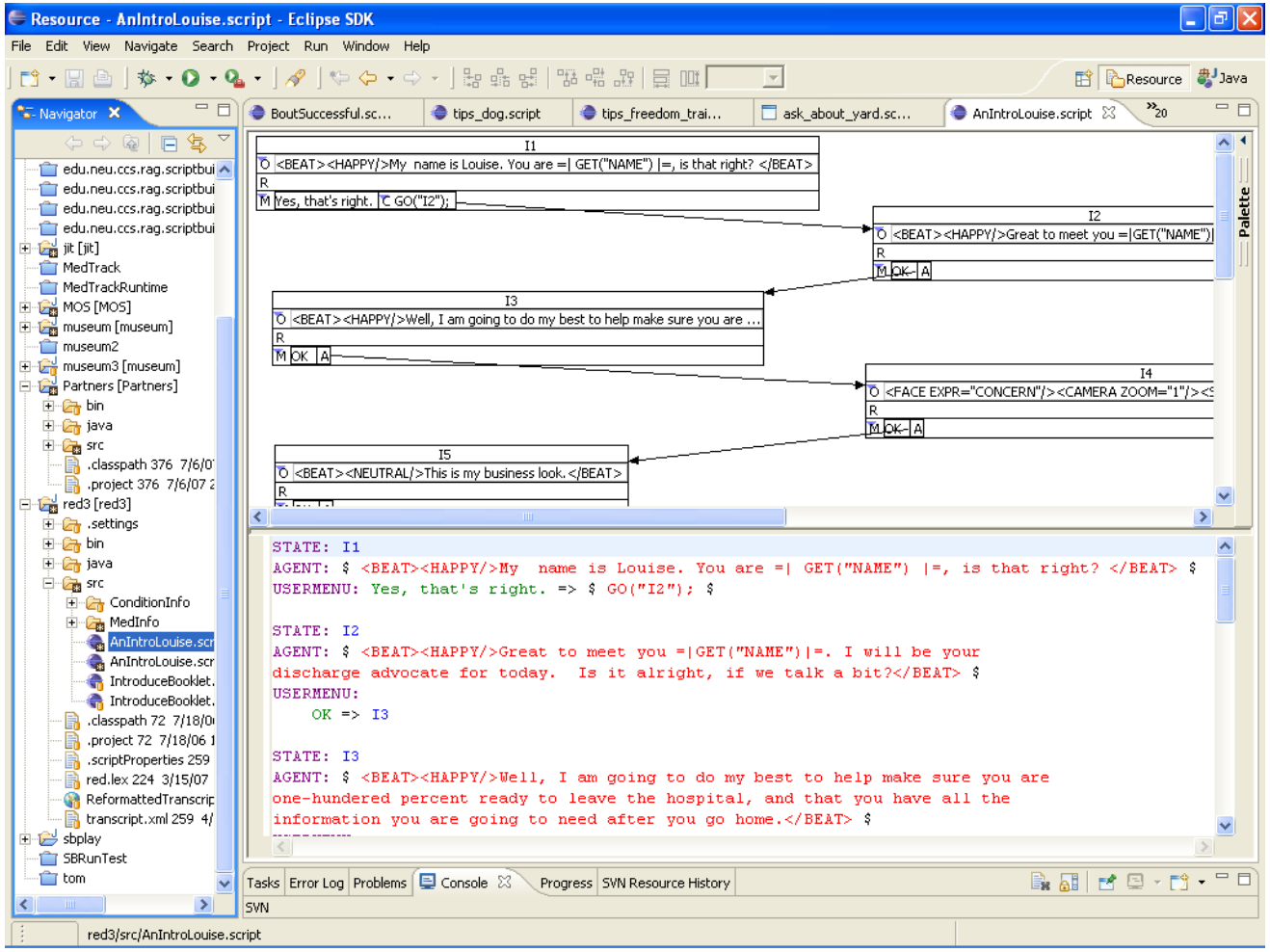
32,000 lines of dialogue script

Designing for Patients with Low Health Literacy

- Simple language
- Pictographs
- Face-to-face explanation by provider
- Scaffold
- Teach back & Comprehension checks



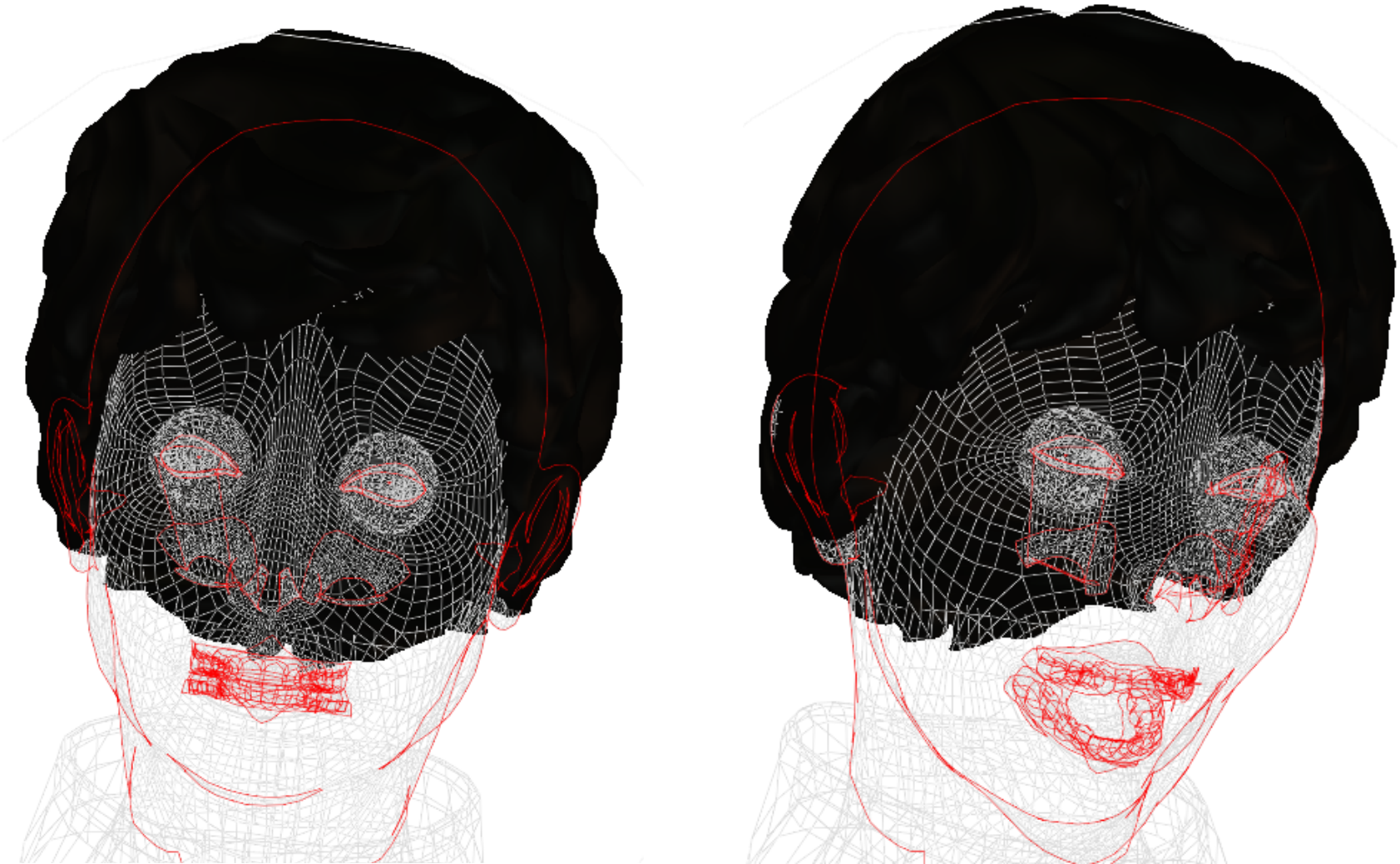
Agent Architecture Development Tools



- Custom, Eclipse-based IDE
- Integrated debug and test
- BEAT

Character and Art Development

Animation



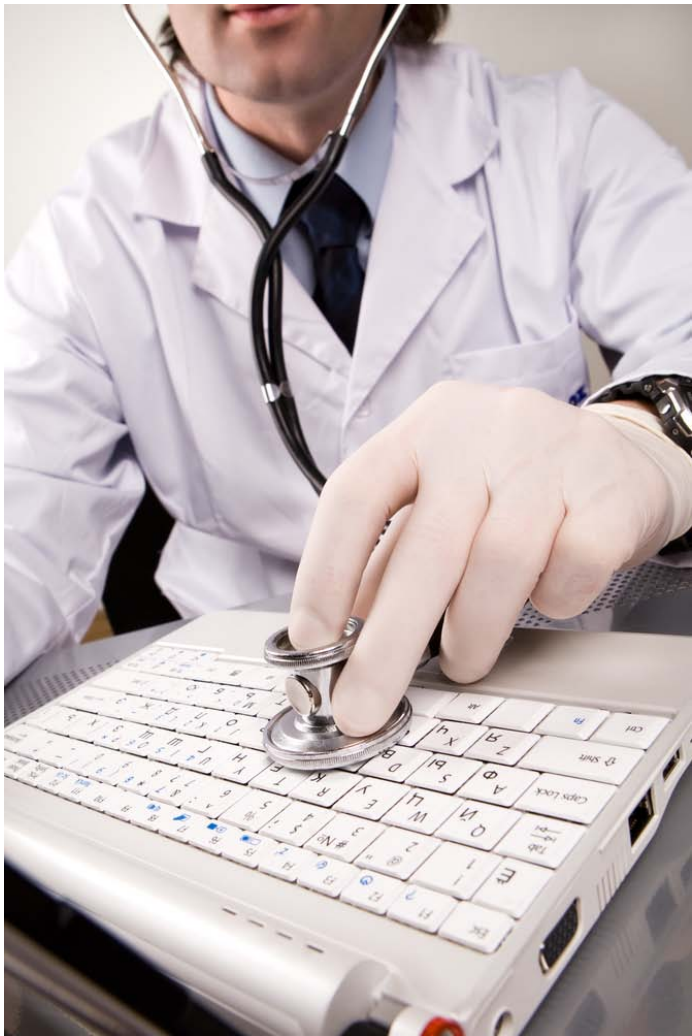
Evaluation

HCI Lab Studies

Pilot studies with non-patients

Pilot studies with patients

Clinical trials



Clinical Applications of Conversational Agents

- Project 1: ReEngineered Discharge – design “Louise” to complete an evidence-based comprehensive hospital discharge (PIPs)
- Project 2: Post Discharge Online Ambulatory “Louise” (Ambulatory Safety and Quality)
- Project 3: Improve Health of Young African American Women (RFTO-3 Communication Focused Technologies)

RED Checklist

PROJECT RED
Re-Engineered Discharge

Eleven mutually reinforcing components:

1. Medication reconciliation
2. Reconcile dc plan with National Guidelines
3. Follow-up appointments
4. Outstanding tests
5. Post-discharge services
6. Written discharge plan
7. What to do if problem arises
8. Patient education
9. Assess patient understanding
10. Dc summary to PCP
11. Telephone Reinforcement

Adopted by
National Quality Forum
as one of 30
"Safe Practices" (SP-11)

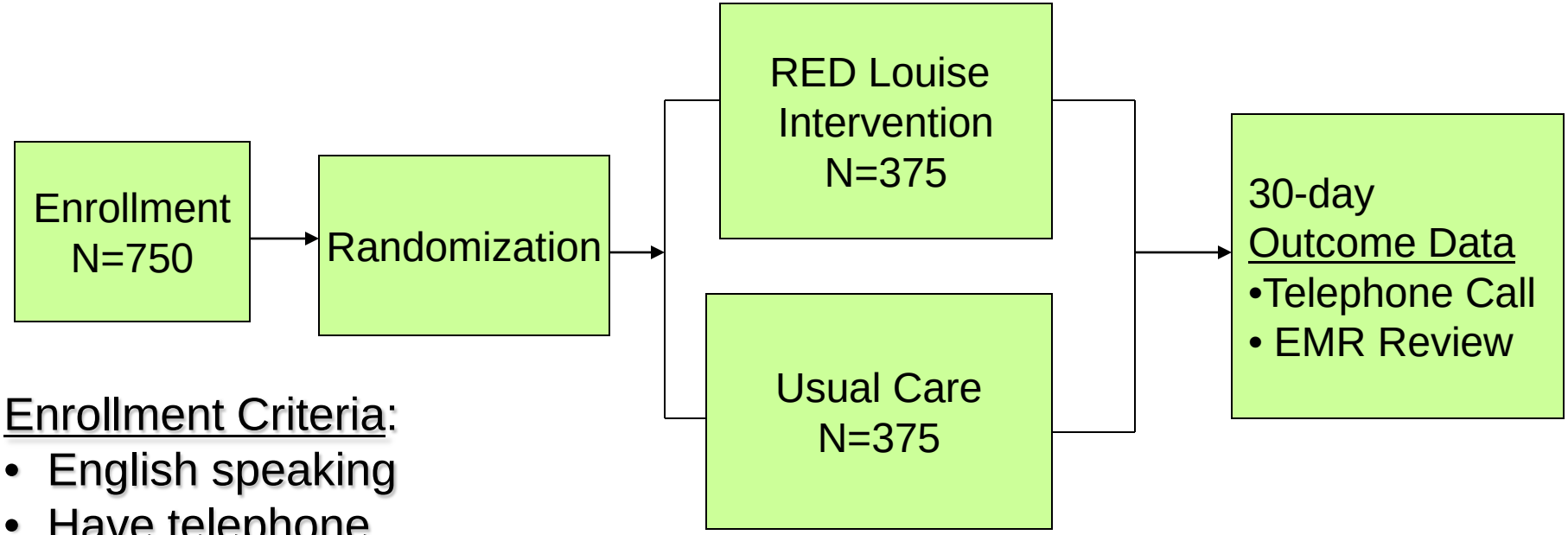
Project 1
Using Agents for Comprehensive Discharge

Conversational Agents

- Programmed to teach an evidence-based comprehensive hospital discharge (RED)
- Determine competency
- Can drill down
- High Risk Meds
  - Lovenox
  - Insulin
  - Prednisone taper
- Print a report

Characters: Louise (L) and Elizabeth (R)

RCT of ECA Teaching Hospital Discharge



Enrollment Criteria:

- English speaking
- Have telephone
- Able to independently consent
- Not admitted from institutionalized setting
- Adult medical patients admitted to Boston Medical Center (urban academic safety-net hospital)

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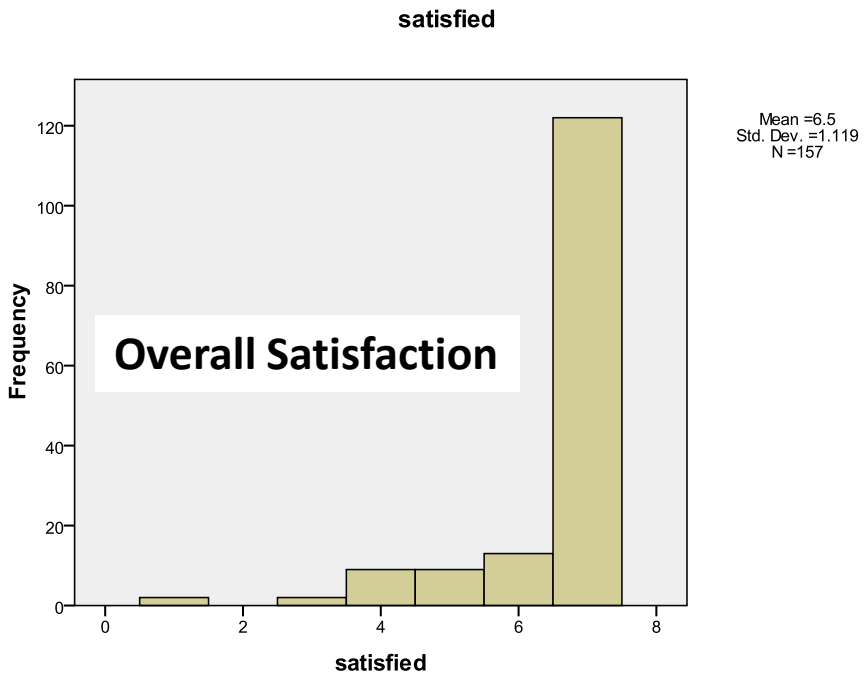
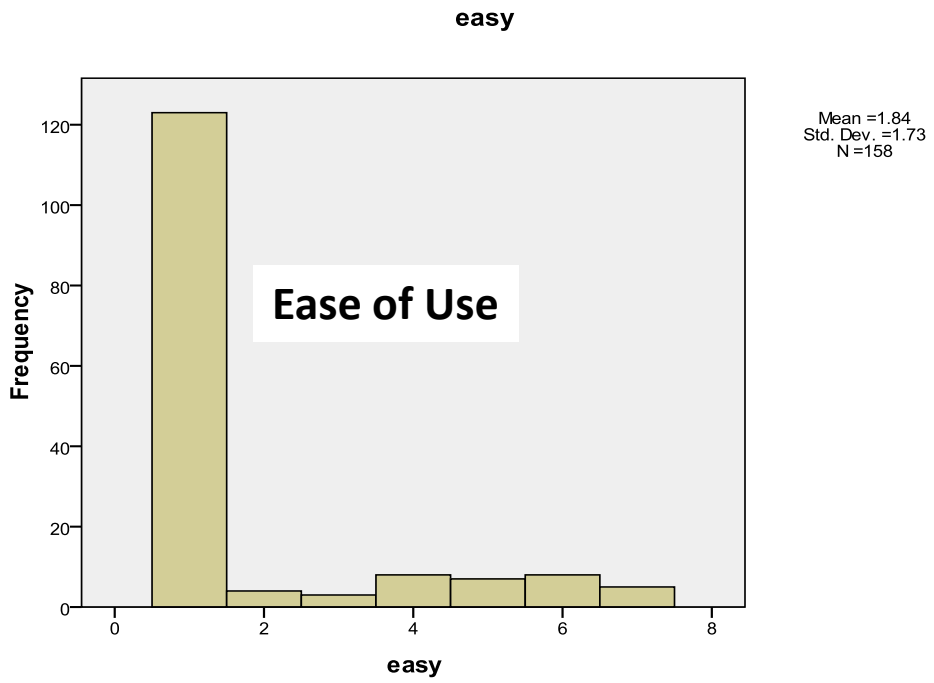
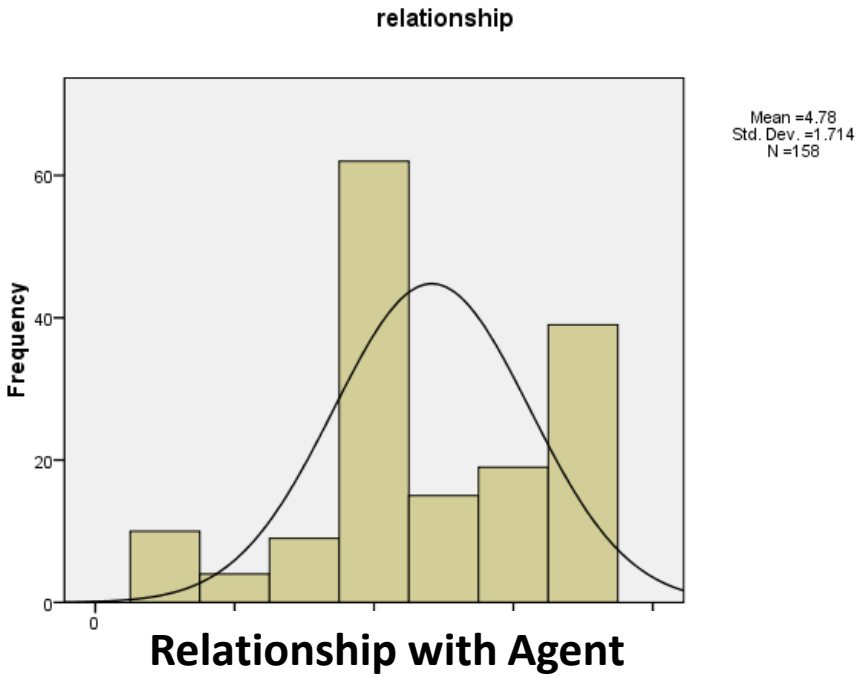
RED

Overall Usability



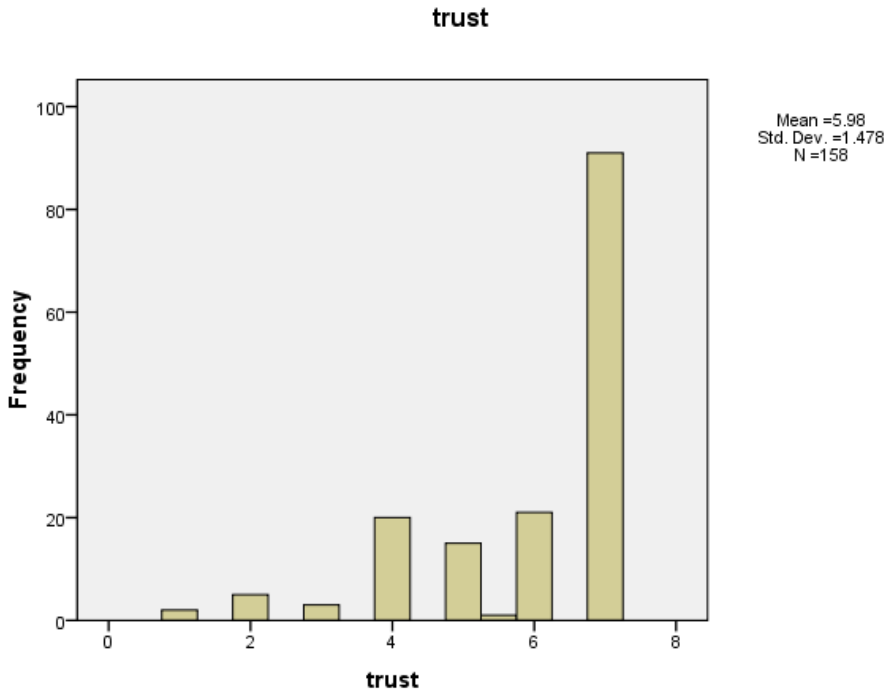


Overall Attitudes



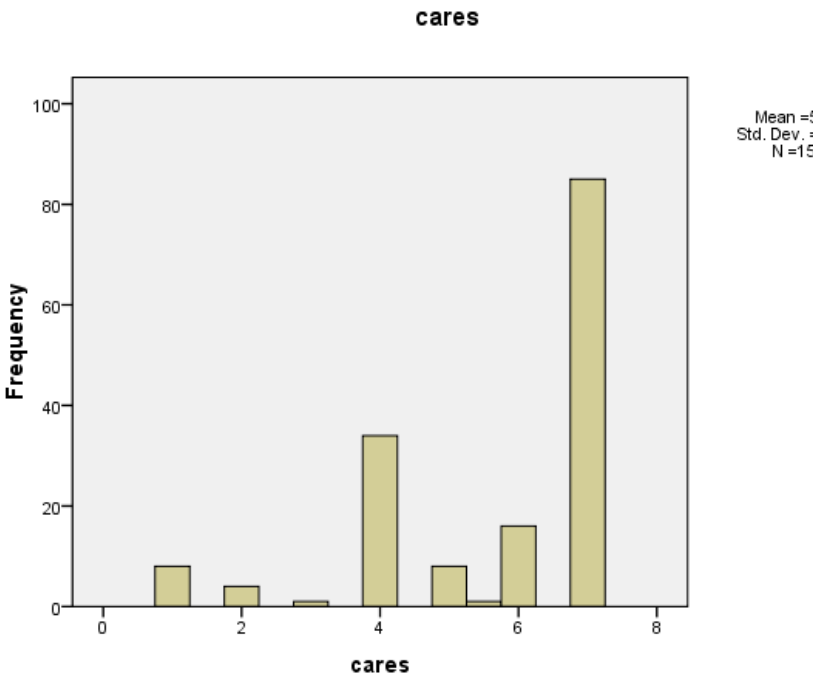
Relationship with Agent

1=stranger, 4=neutral, 7=close friend



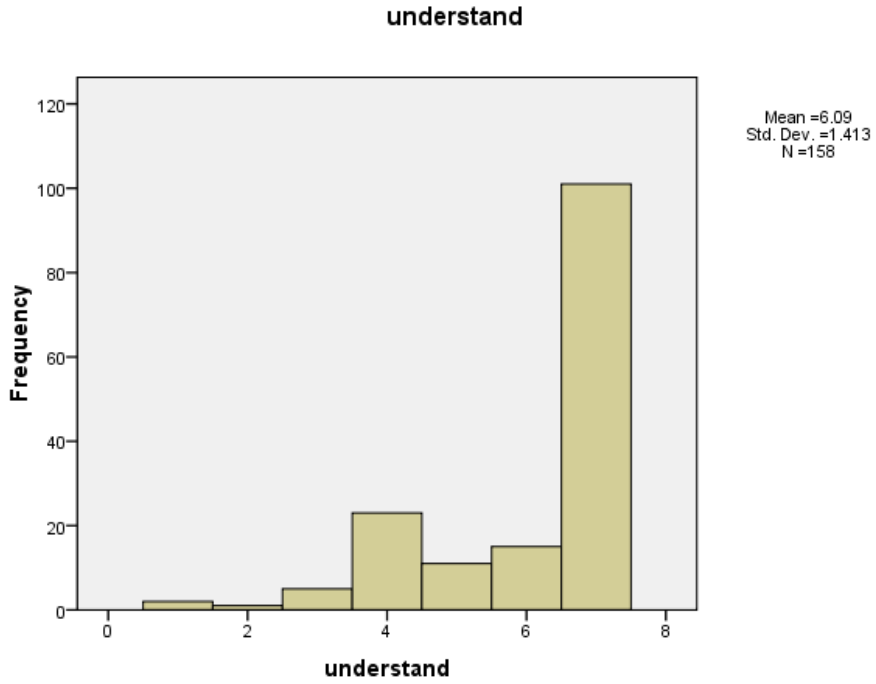
Trust in Agent

Overall Attitudes



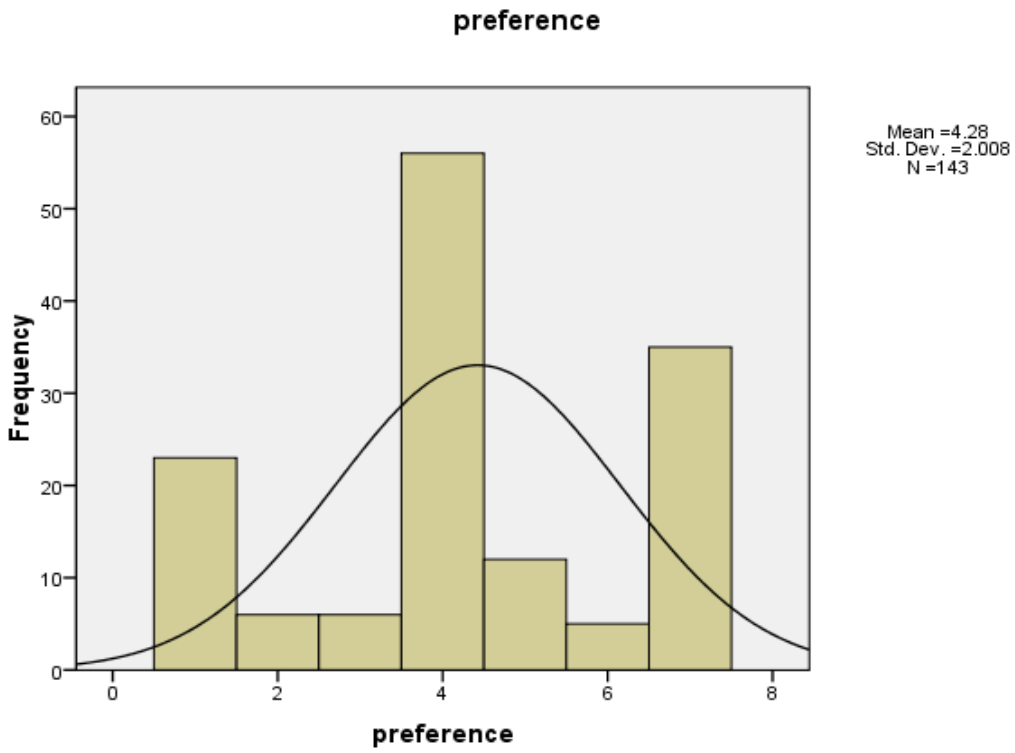
How much do you feel that Elizabeth cares about you?

1=not at all, 7= very much



How much do you feel that you and Elizabeth understand each other?

Who Would You Rather Receive Discharge Instructions From?



36% prefer agent
48% neutral
16% prefer doc or nurse

"I prefer Louise, she's better than a doctor, she explains more, and doctors are always in a hurry."

"It was just like a nurse, actually better, because sometimes a nurse just gives you the paper and says 'Here you go.' Elizabeth explains everything."

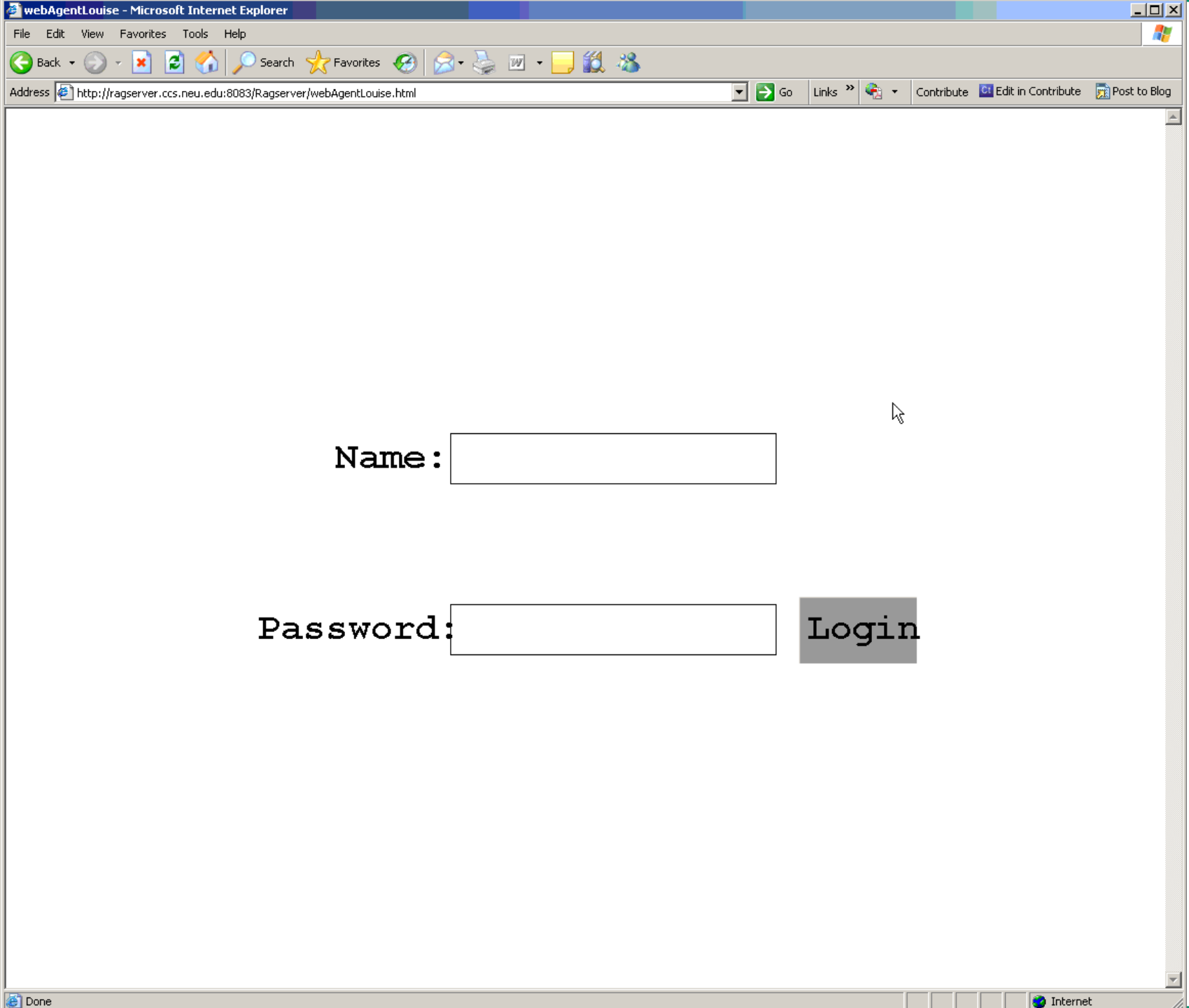
1=definitely prefer doc, 4=neutral, 7=definitely prefer agent

Project 2
Post Hospital Discharge Web-based "Louise"

- Post-discharge web-based system designed to emulate the post-hospital phone call
  - Promote Medication Adherence
  - Promote Appointment Adherence
  - Adverse Event Screening
- Posts "alerts" to nurse who follow-up each morning
- Tracks patient status over time

Online “Louise” Status

- Development and pilot testing complete next month.
- Test of Concept trial with 80 patients to begin July 1, 2010
- Outcomes:
  - 30-day Readmissions
  - ED visits
  - # AEs detected
  - Time to detect AEs*
  - Medication & Appointment Adherence
  - Satisfaction


webAgentLouise - Microsoft Internet Explorer
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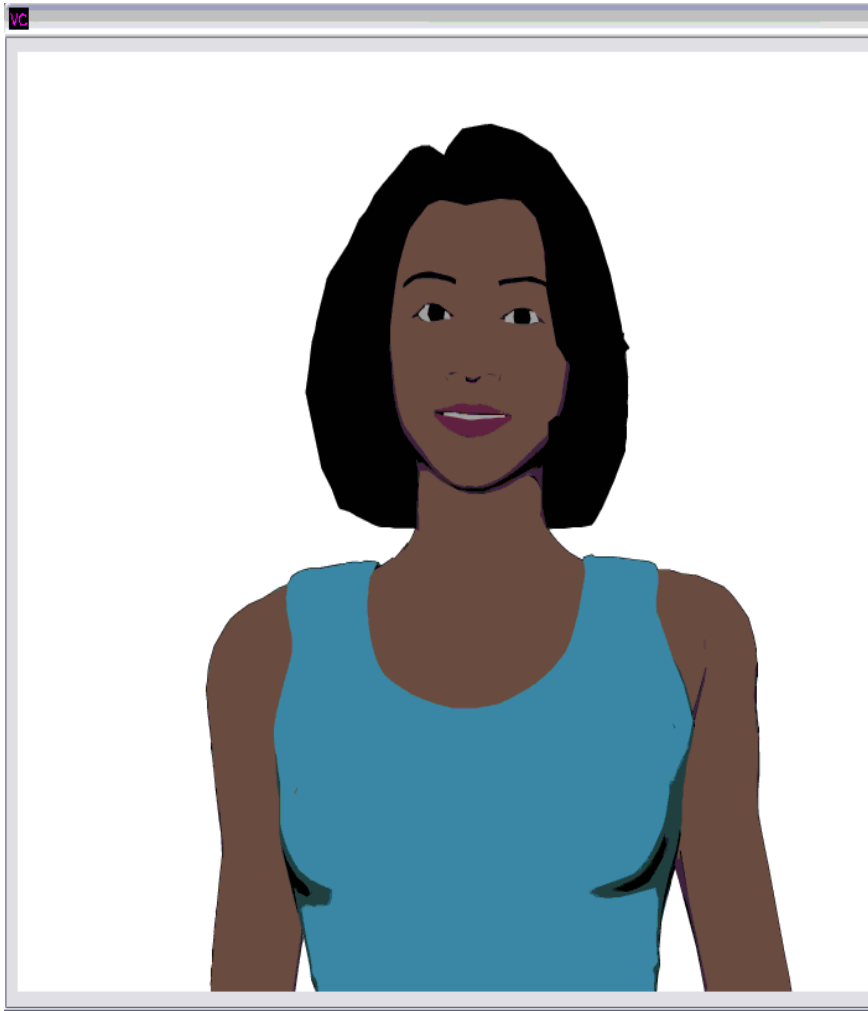
Address http://ragserver.ccs.neu.edu:8083/Ragserver/webAgentLouise.html
Go Links Contribute Edit in Contribute Post to Blog
Name:
Password:
Login
Done
Internet

Project 3: Social Networking to Improve Health of Young African American Women

Goal – to address disparities in IM and LBW

- Assess 54 Reproductive Risks in 12 Health Domains
- Assess Readiness for change in each risk area
- Provides information
- Provides “story” appropriate for readiness level (personal change narratives)
- Opportunity to leave your story behind
- Encourages “referral” to your friends
- Pilot study with 50 women in Fall, 2010



Conclusions

Conversational Agents:

- Deliver a variety of health messages
- Improve fidelity of health messages
- Well accepted by patients
- Usable with wide range of computer and health literacy
- Provide time and cost savings
- Can be ‘scaled’ for far reaching impact
- Relevant in the context of the PCMH
    - chronic disease
    - heath promotion / disease prevention
    - health education
    - could serve as a primary care “coach”

Thank you!

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Tim Bickmore bickmore@ccs.neu.edu

Project RED Website
http://www.bu.edu/fammed/projectred/

Workflow Toolkit and Lessons in User Centered Design

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Ben-Tzion (Bentzi) Karsh, PhD
Industrial & Systems Engineering
Center for Quality and Productivity Improvement
University of Wisconsin

Goals of the toolkit

- Help small and medium sized practices to
  - Analyze their workflows in preparation health IT implementation
  - Improves workflows during and post implementation
  - Use health IT to further improve workflows

Support activities

- Technical expert panel
- Request for Information
- Literature Review
- Environmental Scan
- *User centered design?*

Lessons in user centered design

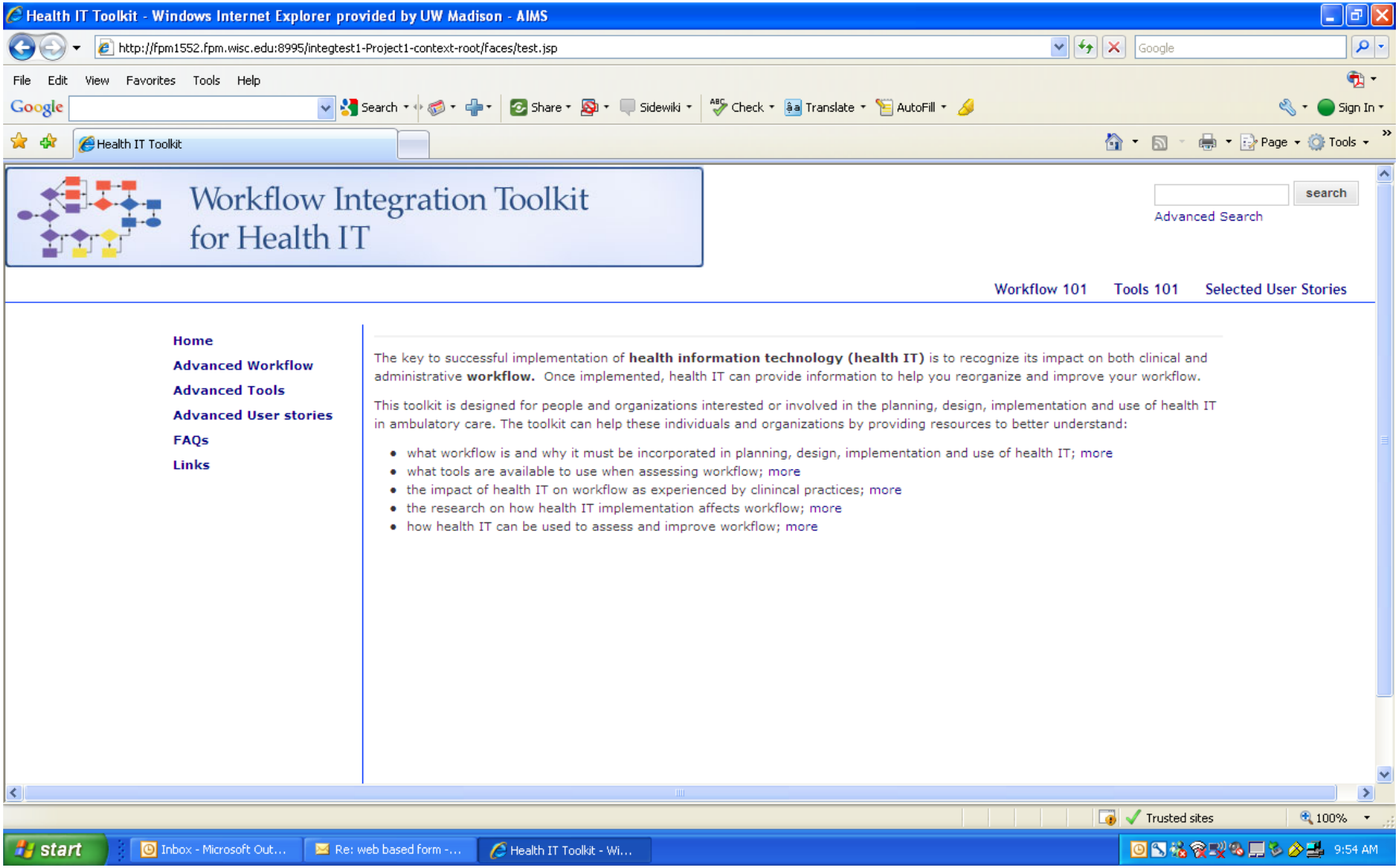
- A lot of talk about usability
- All of us are designing *tools*, for some *users*, to accomplish *goals*
- So all of us *should be* using user centered design processes

Designs are hypotheses about how artifacts affect cognition

David Woods

Who are the users?

- Small and medium sized practices
  - Physician champions
  - Practice managers
- Regional Extension Centers
- Two levels of expertise
  - Beginners
  - Advanced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Health IT Toolkit
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search
Advanced Search
Workflow 101
Tools 101
Selected User Stories
Home
Advanced Workflow
Advanced Tools
Advanced User stories
FAQs
Links
The key to successful implementation of health information technology (health IT) is to recognize its impact on both clinical and administrative workflow. Once implemented, health IT can provide information to help you reorganize and improve your workflow.
This toolkit is designed for people and organizations interested or involved in the planning, design, implementation and use of health IT in ambulatory care. The toolkit can help these individuals and organizations by providing resources to better understand:
what workflow is and why it must be incorporated in planning, design, implementation and use of health IT; more
what tools are available to use when assessing workflow; more
the impact of health IT on workflow as experienced by clinincal practices; more
the research on how health IT implementation affects workflow; more
how health IT can be used to assess and improve workflow; more
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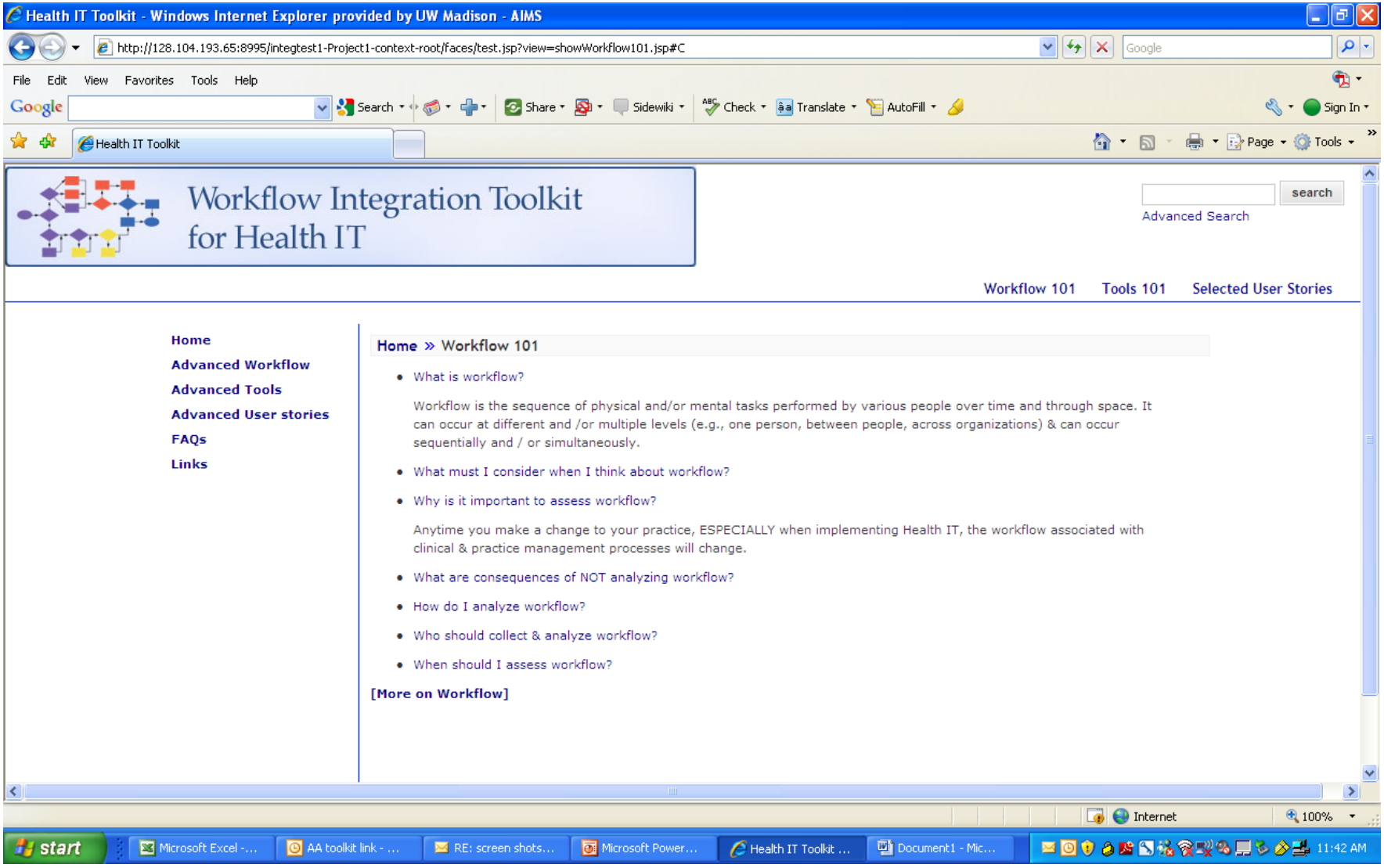
Users?

- REC staff did not exist at the time -so who are they and what do they know?
- What is “advanced” and what is “beginner”?
  - In implementation experience?
  - In stage of implementation?
  - Years of using health IT?
  - In workflow analysis?
  - Can they self-select?
- What about other users?
  - Vendors?
  - Curriculum developers?

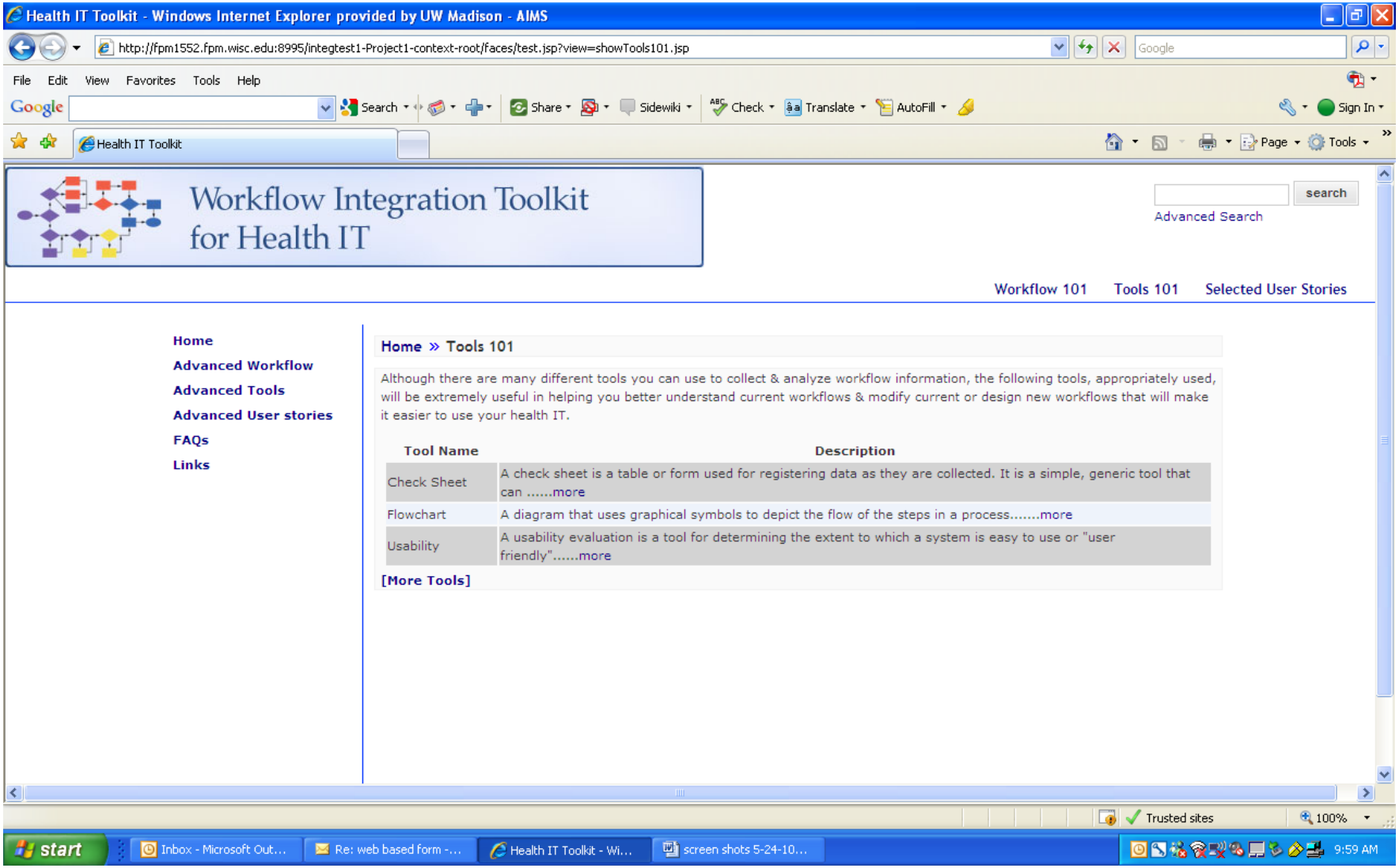
User goals

- Learn about workflow and its importance
- Learn how to analyze workflows
- Learn state of evidence regarding workflow and health IT success

Learn about workflow and importance



Learn about ways to analyze workflow

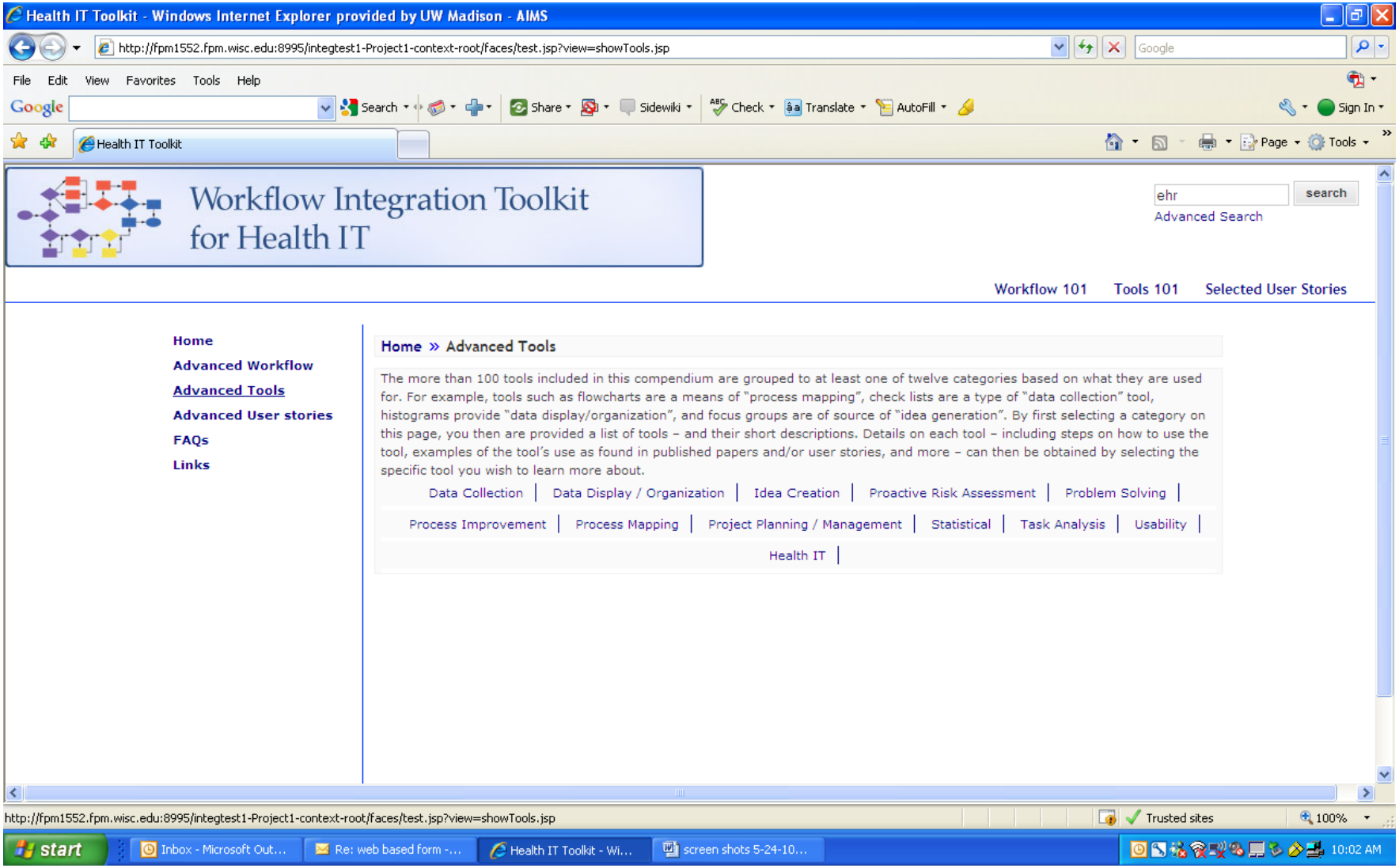


User goals?

- What users thought *workflow* meant, and therefore expected to learn about was all over the map.
- Our simple *tools* embedded our own assumptions – users still would not know what to use the tools for or how

Users' needs to achieve goals

- Need to know what tools are available
- How they have been used by others
- Where to learn how to use them
- Strengths and weaknesses of the tools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Workflow Integration Toolkit for Health IT
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Tools 101
Selected User Stories
Home
Advanced Workflow
Advanced Tools
Advanced User stories
FAQs
Links
Home » Advanced Tools
The more than 100 tools included in this compendium are grouped to at least one of twelve categories based on what they are used for. For example, tools such as flowcharts are a means of "process mapping", check lists are a type of "data collection" tool, histograms provide "data display/organization", and focus groups are of source of "idea generation". By first selecting a category on this page, you then are provided a list of tools – and their short descriptions. Details on each tool – including steps on how to use the tool, examples of the tool's use as found in published papers and/or user stories, and more – can then be obtained by selecting the specific tool you wish to learn more about.
Data Collection | Data Display / Organization | Idea Creation | Proactive Risk Assessment | Problem Solving |
Process Improvement | Process Mapping | Project Planning / Management | Statistical | Task Analysis | Usability |
Health IT |
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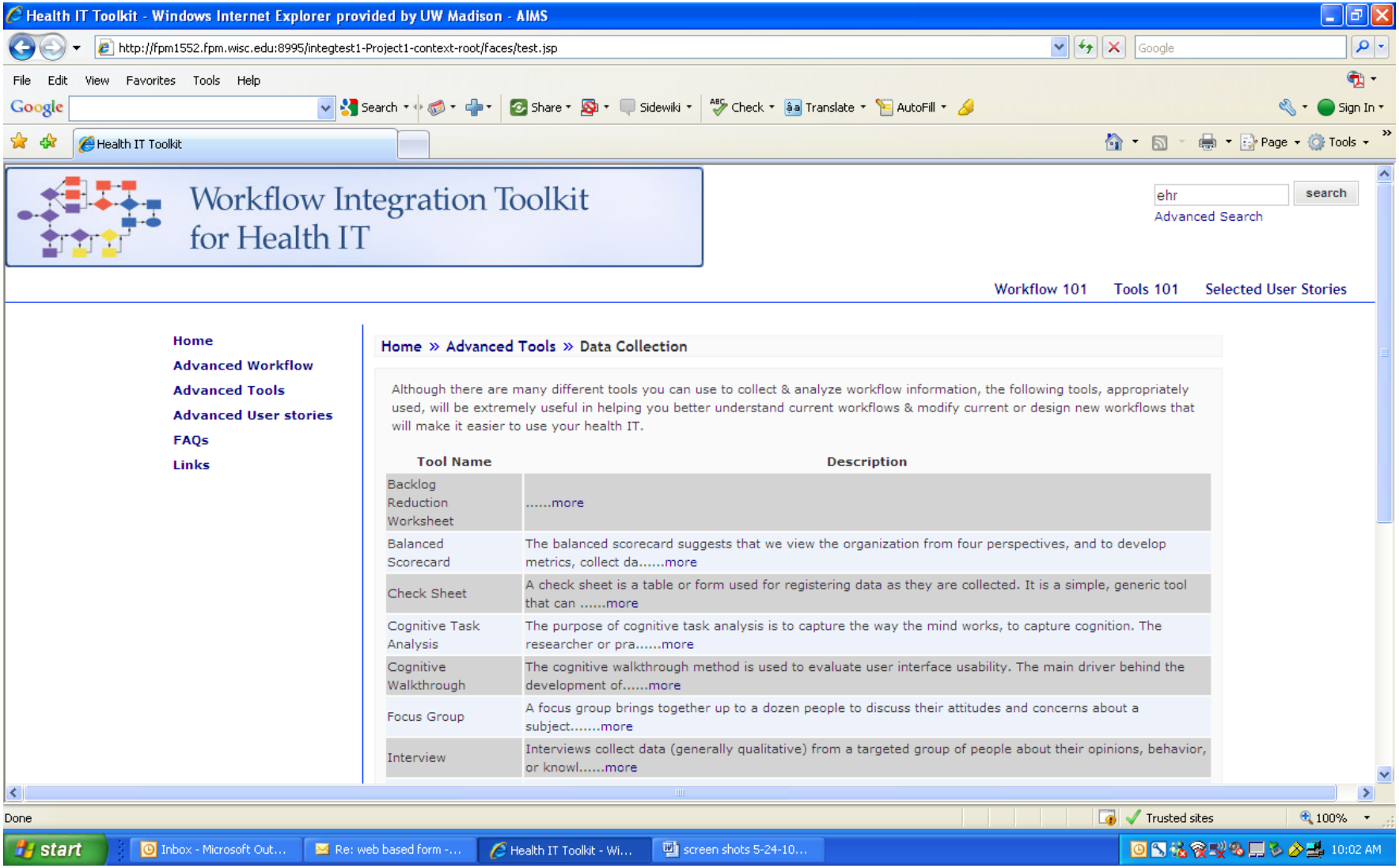
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Tools 101
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Advanced Tools
Advanced User stories
FAQs
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Home » Advanced Tools » Data Collection
Although there are many different tools you can use to collect & analyze workflow information, the following tools, appropriately used, will be extremely useful in helping you better understand current workflows & modify current or design new workflows that will make it easier to use your health IT.
Tool Name
Description
Backlog Reduction Worksheet
.....more
Balanced Scorecard
The balanced scorecard suggests that we view the organization from four perspectives, and to develop metrics, collect da.....more
Check Sheet
A check sheet is a table or form used for registering data as they are collected. It is a simple, generic tool that can .....more
Cognitive Task Analysis
The purpose of cognitive task analysis is to capture the way the mind works, to capture cognition. The researcher or pra.....more
Cognitive Walkthrough
The cognitive walkthrough method is used to evaluate user interface usability. The main driver behind the development of.....more
Focus Group
A focus group brings together up to a dozen people to discuss their attitudes and concerns about a subject.....more
Interview
Interviews collect data (generally qualitative) from a targeted group of people about their opinions, behavior, or knowl.....more
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Tools 101
Selected User Stories
Home
Advanced Workflow
Advanced Tools
Advanced User stories
FAQs
Links
Home » Advanced Tools » Data Collection » Details
REFERENCES
Brownbridge, G., A. Evans, M. Fitter and M. Platts (1986). "An interactive computerized protocol for the management of hypertension: effects on the general practitioner's clinical behaviour." Journal of the Royal College of General Practitioners 36(286): 198-202.
ABSTRACT
This paper reports an experimental study of general practitioners' use of an interactive computerized protocol for the management of hypertension, focussing particularly on the protocol's effects on doctors' clinical behaviour. Prior to its computerization a paper-based version of the protocol was used enabling a comparison of the alternative forms. Doctors' delivery of care was assessed from video recordings of 89 consultations and from the records made during these consultations. Comparisons were made of consultations conducted under control and experimental conditions. Use of paper and computer protocolsresulted in significant improvements in the doctors' delivery of care, in terms of the range of verbal and physical examinations conducted and recorded. The protocol's effects were most marked when the computerized version was used. However, use of the computer protocol resulted in the recording of information on the non-occurrence of certain events which had not been explicitly elicited during the verbal examination; features of the design which were intended to encourage adherence to the protocol resulted in the recording of unsubstantiated information. It is concluded that the detail of the verbal examination suggested by the protocol may have been inappropriate to the realities of a general practice consultation. The findings provide some useful insights for the design of future computerized protocols for the management of chronic conditions.
OBJECTIVE
To report an experimental study of general practitioners' use of an interactive computerized protocol for the management of
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User needs?

- Our initial design allowed a user to *learn about.* New design will let them *learn how.*
- It did not take into account potential time constraints of user in actual practice
- Small and medium sized practices may not have the resources to invest in this kind of learning

User centered design – devil is in the details

- User centered design is *NOT* asking users what they want and giving it to them
- User centered design is *NOT* designing something, showing it to users and asking "so does this make sense?" / "do you like it?"
- User centered design is *NOT* usability
- Knowledge about performance and skill to execute UCD is critical

UCD from Mockup to Real Use

- Rapid cycle of user feedback, evaluation, and redesign
- Differences between simulated use and actual use
- Updates
  - Development vs. maintenance
  - User involvement
  - Changing users and user needs

Next hypothesis

- Redesign website to be action oriented, right from the homepage
  - Click here to start analyzing your workflow
  - Click here to learn how to improve you existing workflows
- Make materials readily available
  - Click here to get workflow training materials
  - Click here for workflow curriculum presentations

Larger Challenge

- Users *need to know* a *whole.* Each of our toolkits gives a *part.* [sound like clinical needs and health IT?]
- Bigger question for all of the toolkits is *how do we help users to integrate* over all of the toolkits to get something useful?

Thank you
cqpi.engr.wisc.edu/withit_home

THE UNIVERSITY OF WISCONSIN–MADISON

July 26-30, 2010
Pyle Center, University of Wisconsin-Madison

Systems Engineering Initiative for Patient Safety (SEIPS)

SEIPS Short Course on Human Factors Engineering and Patient Safety Part I and Part II on Health IT

This two-part, five-day course for professionals presents nationally recognized speakers discussing a variety of Patient Safety topics and Human Factors Engineering (HFE) including:

Part I: The Basics of HFE & Patient Safety

- Human Factors Engineering
- Sociotechnical Systems and Macroergonomics
- Design of the Physical Environment and Ergonomics
- Cognitive ergonomics
- And more...

Part II: HFE & Health Information Technology

- Usability of Health IT
- Impact of Health IT on Patient Care Processes
- Human Factors of Implementing Health IT
- And more...

For short course schedule and registration information go to: http://cqpi.engr.wisc.edu/shortcourse_home

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Agency for Healthcare Research and Quality
Advancing Excellewnce in Health Care

AHRQ Health IT Grantee and Contractor Meeting

Friday June 4, 2010