

# SWE 632 - Design & Development of User Interfaces

Spring 2021

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George Mason  
University

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Dr. Kevin Moran

*Week 1:*  
Course Overview  
&  
Heuristic Evaluation





# Welcome to SWE 632!

- Initial Logistics:
  - Welcome to the Lecture!
  - This Lecture is being recorded
  - During Lectures please *keep your microphone muted*, you can unmute in breakout sessions
  - You can keep your video on during lectures. If no video, please have a picture
  - Feel free to ask questions in the chat! Xu and I will monitor and respond

# Introductions



***Instructor:*** Kevin Moran

***Education:*** Ph.D. from William & Mary - 2018

***Research Interests:*** Software Engineering ,  
UI Analysis, Machine Learning

***Office Hours:*** TBD, please fill out poll!



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IEEE TRANSACTIONS ON SOFTWARE ENGINEERING, VOL. 4, NO. 4, 2018  
**Machine Learning-Based Prototyping of Graphical User Interfaces for Mobile Apps**  
Kevin Moran, Member, IEEE, Carlos Bernal-Cárdenas, Student Member, IEEE, Michael Curcio, Student Member, IEEE, Richard Bonett, Student Member, IEEE, and Denys Poshyvanyk, Member, IEEE

**Translating Video Recordings of Mobile App Usages into Replayable Scenarios**

Carlos Bernal-Cárdenas  
William & Mary  
Williamsburg, Virginia, USA  
cbernal@cs.wm.edu

Nathan Cooper  
William & Mary  
Williamsburg, Virginia, USA  
nacooper01@email.wm.edu

Kevin Moran  
William & Mary  
Williamsburg, Virginia, USA  
kmoran@cs.wm.edu

# Introductions

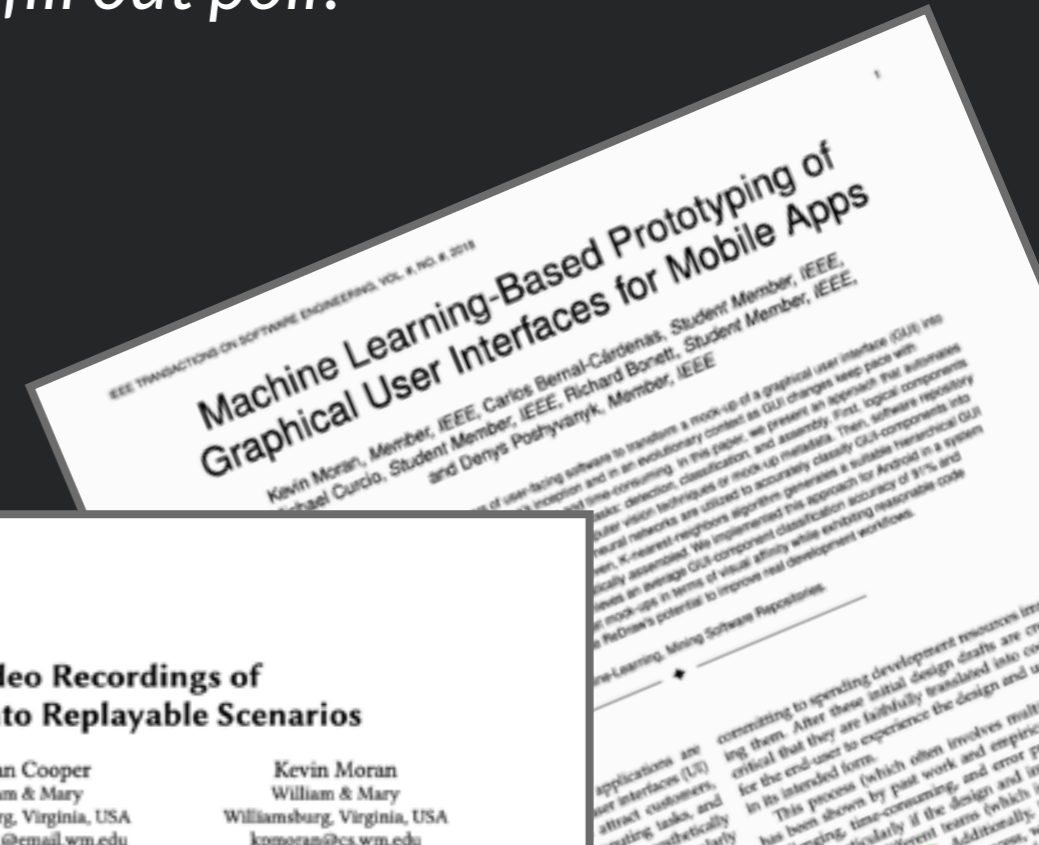


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## Translating Video Recordings of Mobile App Usages into Replayable Scenarios

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applications are committing to spending development resources into user interfaces (UI) ing them. After these initial design drafts are critical that they are faithfully translated into code for the end-user to experience the design and u in its intended form.  
This process (which often involves multiple iterations) is time-consuming, and error-prone. This has been shown by past work and empirically. We implemented this approach for Android in a system that has been shown by past work and empirically to have an average GUI-component classification accuracy of 91% and a potential to improve test development workflows. Additionally, we are currently working on extending this approach to iOS and other mobile platforms.



# Introductions



***Teaching Assistant:*** Xu Han

***Education:*** Current Ph.D. Student at GMU in ITS

***Office Hours:*** TBA





# Today's Agenda

1. Provide an overview of the Course Logistics - (15-20 mins)
2. Discuss the Philosophy & Purpose of the Course -(20 mins)
3. Discuss Heuristic Evaluations of User Interfaces - (20 mins)
4. Group Activity applying Heuristic Evaluations - (20 mins)
5. Firebase Tech Talk - (15mins)

# Course Logistics







# Course Resources

- Course Website: Syllabus, Schedule, Assignments, Lecture slides/recordings
- Piazza: Announcements, Discussions
- Blackboard (MyMason): Grades, Assignments
- Zoom: Class Meetings & Office Hours



# CourseWebsite

The screenshot shows a web browser window displaying the course website for SWE 632 User Interface Design & Development. The website has a dark green header with a navigation menu (Home, Schedule, Project, Tech Talks, Syllabus, Resources) and a search bar. The main content area is divided into sections: Home, Course Description, General Course Information, and Course Meeting Times. A table of contents is visible on the right side. The General Course Information section features a table with two columns: Faculty and Teaching Assistant. Each column lists a person's name, office location, email, and virtual office hours, along with a button to join office hours.

**SWE 632 User Interface Design & Development**

Home Schedule Project Tech Talks Syllabus Resources



Search

## Home

### Course Description

This course will provide a comprehensive introduction to human-computer interaction and the design and development of user interfaces, covering basic human cognition, methods for need-finding and prototyping, user-centered design, empirical and analytical methods for conducting usability evaluations, and principles for visual, information, interaction, and community design.

### General Course Information

Faculty	Teaching Assistant
 <ul style="list-style-type: none"><li>• Instructor: Dr. Kevin Moran</li><li>• Office: Nguyen Engineering Building 444</li><li>• Email: kmoran@ugm.edu</li><li>• (Virtual) Office Hours: TBA</li><li>• <a href="#">Click Here to Join Office Hours</a></li></ul>	 <ul style="list-style-type: none"><li>• Instructor: Xu Han</li><li>• Office: Nguyen Engineering Building TBA</li><li>• Email: xhan21@ugm.edu</li><li>• (Virtual) Office Hours: TBA</li><li>• <a href="#">Click Here to Join Office Hours</a></li></ul>

### Course Meeting Times

Office Hours: 10:00am - 4:00pm, 3:15pm

**Table of contents**

- Course Description
- General Course Information
- Course Meeting Times
- Virtual Course Spaces
- A Note to Students during COVID-19
- Course Philosophy
- Learning Outcomes



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# Grading Breakdown

- Participation & Discussion - (10%)
- Tech Talk - (10%)
- Project Checkpoints & Presentation - (40%)
- Mid-Term Exam - (20%)
- Final Exam - (20%)



# Participation & Discussion

- Weekly discussion questions assigned after class
- You must post your response by Monday @ *Midnight*
- You can either create your own response, or reply to another students
  - If you respond to another student, you must advance the conversation
- We expect these response to be *1 or 2 paragraphs*



# In-Class Activities

- Work together in small groups to gain experience trying out methods and concepts with examples
- No grades (*pandemic*), but very important, as you will learn a lot from your classmates during these exercises



# Tech Talks

- 15 minute overview of a front-end web technology
- Groups of 3 (collaborate w/ Zoom, Slack, etc...)
- Use piazza to find a partner, reserve topics
  - Dedicated thread will be posted after class
- Only 1 group can cover a technology
- *Signup by start of class next Weds. (Feb 3rd)*





# Course Project

- Build a (*really simple*) web app
- Use usability concepts and methods to identify usability issues
- Iteratively improve your app to address usability issues
- There will be 8 “Project Checkpoints” throughout the semester - culminating in a project presentation



# Project Checkpoint 0

- Due next Weds. before class (Feb 3rd)
- Form a group of 1, 2, or 3
- Pick an app to build
- Describe what you propose to build in ~1 page



# Policy on Code Reuse

- Can borrow code from online sources as much or as little as you'd like
- ***You must document instances of code that you reuse***



# Late Policy - Project Checkpoints

- HWs will often involve *peer evaluations*
- Can submit up to:
  - 24 hours late, lose 10%
  - 48 hours late, lose 20%
- HW submissions more than 48 hrs late will receive a 0
- ***These are difficult times, if you have unforeseen problems, please contact me & Xu before the deadline!***



# Exams

- Midterm & Comprehensive Final Exam
- Includes both in class lectures and material from assigned readings
- Synthesis-style, short essay questions
- Open Everything - *but must cite sources*
- Exams will be released on Piazza, you will have 1-2 days to complete

# Course Philosophy & Purpose





# Software is Ubiquitous



# Software is Ubiquitous





“Good Design” is incredibly  
important

“Good Design” is incredibly  
important

... and is centered on *usability*



# What is Usability?



# What is Usability?

Ease of Use

Productivity

Learnability

Efficiency

Retainability

User Satisfaction

Effectiveness

# Usable or Unusable?

A Teapot







# Usable or Unusable?

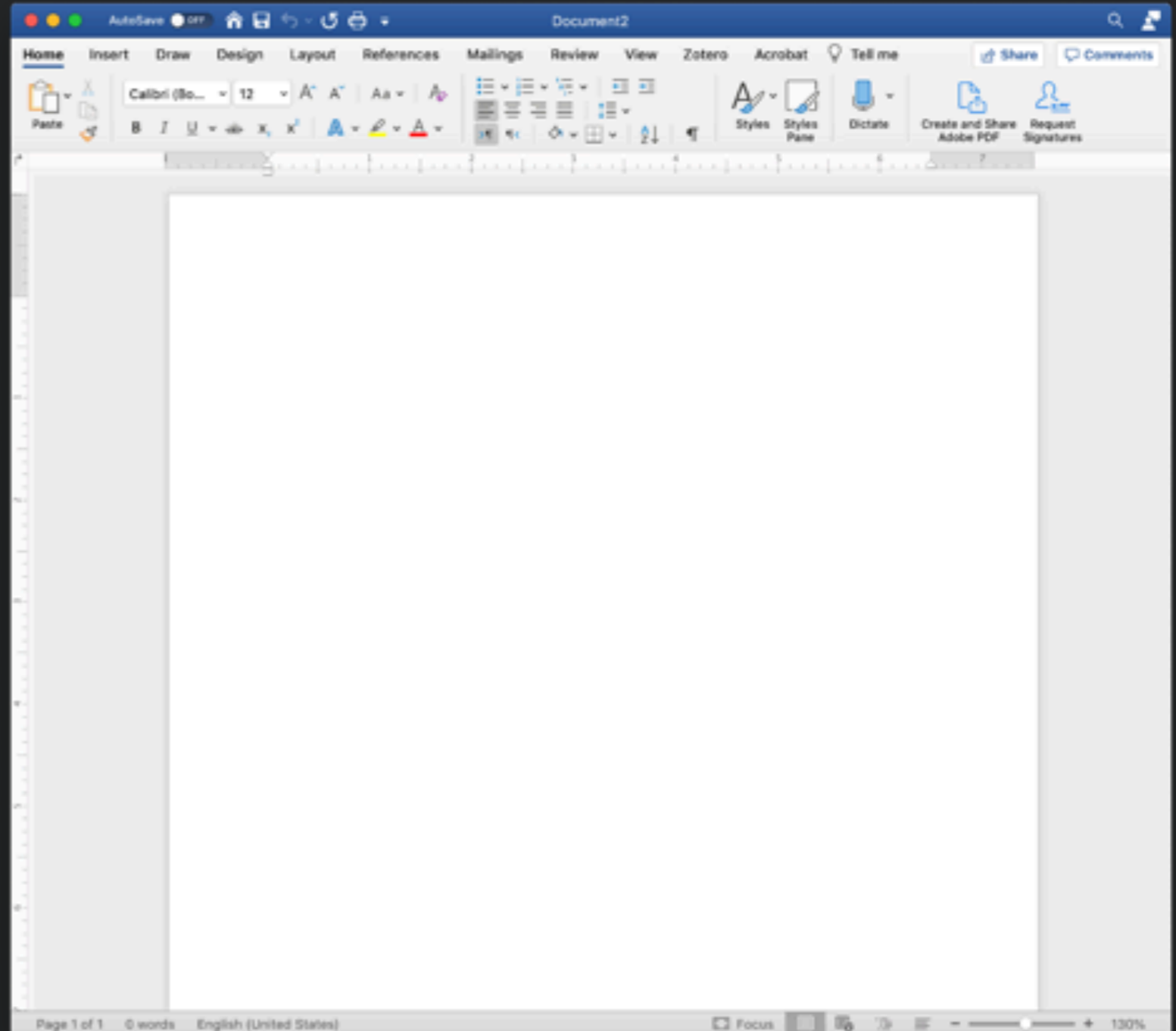
A Door





# Usable or Unusable?

## A Word Processor



# Usability

- A property of the relationship between
  - humans with goal-driven tasks
  - an artifact
- The speed and success with which the goals can be accomplished (task *performance*)



# Needfinding

- Given an existing artifact and humans doing a set of tasks, determine goals and identify usability issues that decrease task performance

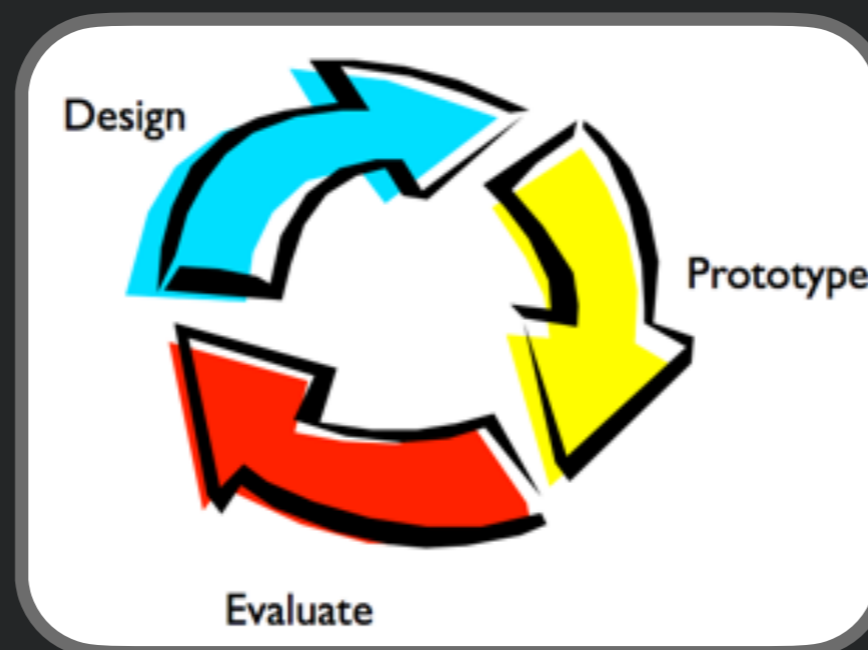


# User-Centered Design

- Given humans with goals and tasks, design an ***artifact*** that helps to accomplish these tasks

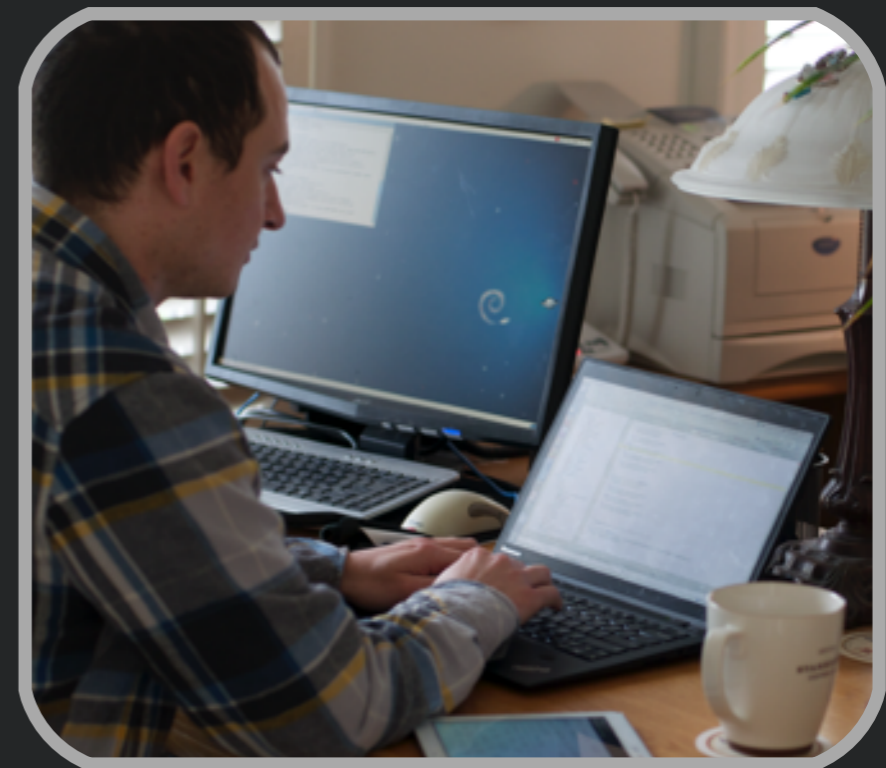
# Iterative User-Centered Design

- Given humans with goals and tasks, redesign an existing artifact that helps to accomplish these tasks faster and more successfully



# Empirical: Usability Study

- Given humans with goals and tasks an artifact, *observe humans* to identify usability issues that decrease task performance
- *“Ground Truth”*



# Analytical: Usability Principles



- Given humans with goals and tasks and an artifact, *assess for conformance to UI principles* to identify usability issues that decrease task performance
- *Approximation of “ground truth”*





# What Usability is NOT

- Not “dummy proofing”
- Not being “user friendly”
- Not just “usability testing”
- Not just making software pretty



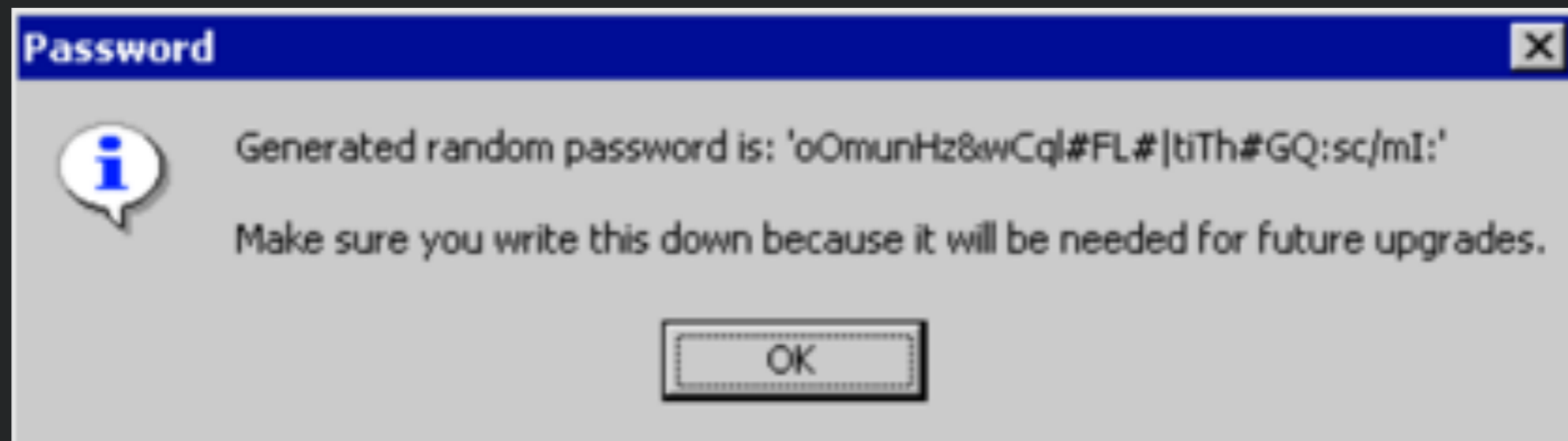
# Why Study Usability?

*“The results show that in today’s applications, an average of **48% of the code** is devoted to the user interface portion.”*

*“The average time spent on the user interface portion is 45% during the design phase, 50% during the implementation phase, and 37% during the maintenance phase.”*

– Myers & Rosson, CHI’92

# Why Study Usability?



Adapted from Maneesh Agrawala & Bjoern Hartmann

# Why Study Usability?

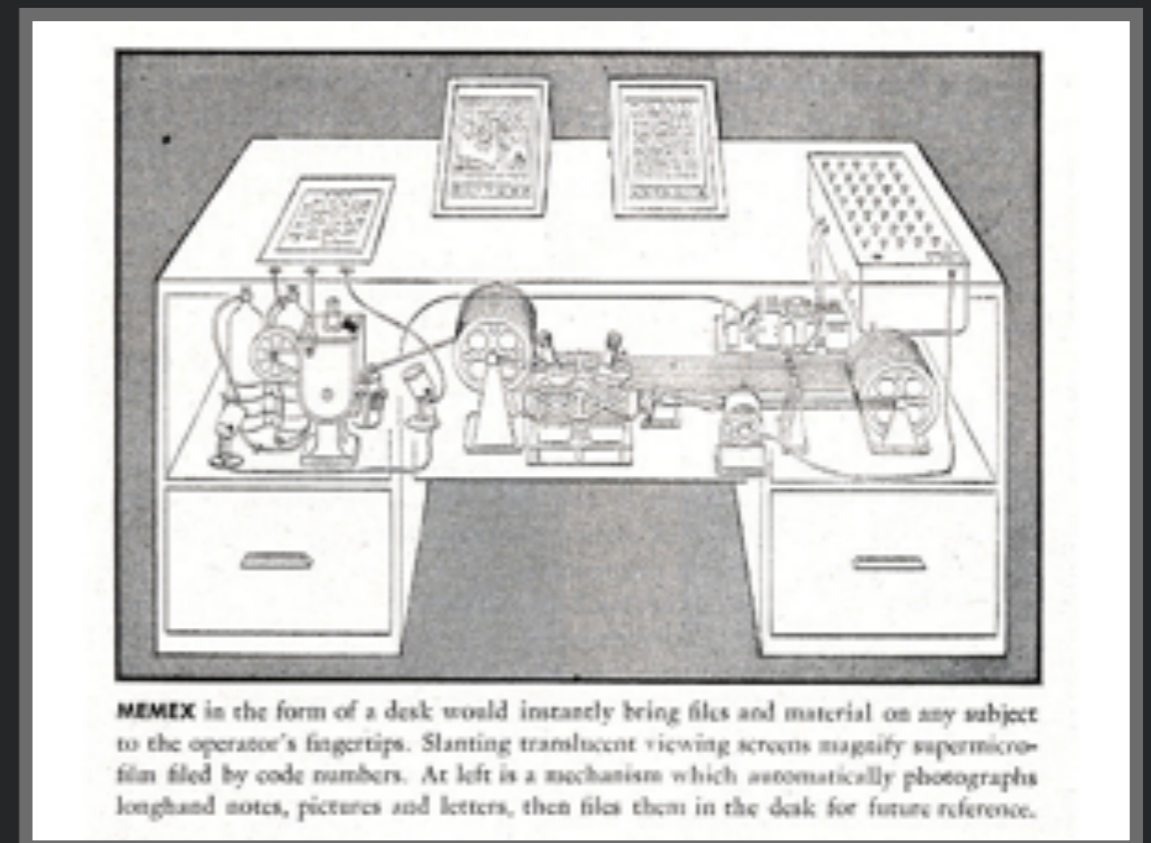
## Life-Threatening Errors

- 1995 American Airlines jet crashed into canyon wall, killing all aboard
- On approach to Rozo airport in Colombia
- Pilot skipped some of the approach procedures
- Pilot typed in “R” and system completed full name of airport to Romeo
- Guidance system executed turn at low altitude to head for Romeo airport
- 9 seconds later plane struck canyon wall
- Is the pilot to blame?
- [http://en.wikipedia.org/wiki/American\\_Airlines\\_Flight\\_965](http://en.wikipedia.org/wiki/American_Airlines_Flight_965)



# The Promise of Tech

- Vannevar Bush, *The Atlantic*, July 1945
- Described the Memex and predicted hypertext, personal computers, the Internet, the WWW, speech recognition, online encyclopedias



# Human-Computer Interaction

*“A discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.”*

- ACM SIGCHI Curriculum Development Group  
Report, 1992





# This Course

- Comprehensive introduction to usability and human-computer interaction (HCI)
- Basic cognition, user-centered design, usability evaluations, principles for UI design

# Iterative Model of User-Centered Design

## Observation

(Re)Define the Problem  
Understand User Needs

## Test

Evaluate what  
you have built



## Idea Generation

Brainstorm  
what to build

## Prototype/ Implementation

Build



# Heuristic Evaluation





# Heuristic Evaluation

- “*Discount* usability engineering methods” - Jakob Nielsen
- Involves a small team of evaluators to evaluate an interface based on recognized usability principles
- Heuristics – “rules of thumb”

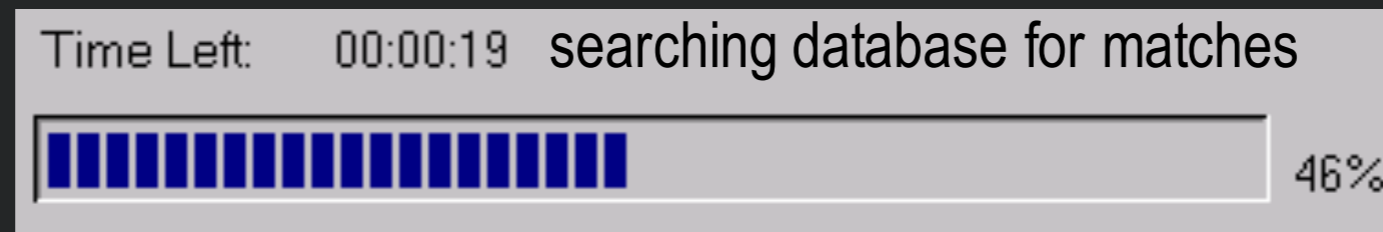
Adapted from slides by Bonnie John and Jennifer Mankoff



# Heuristic Evaluation

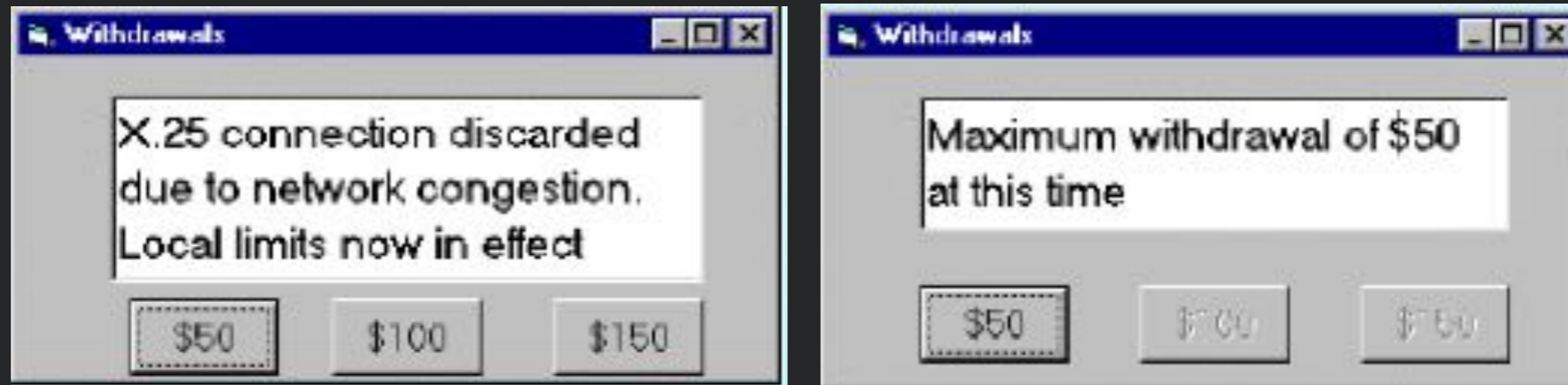
1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition vs. recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose, and recover from errors
10. Help and documentation

# H1: Visibility of System Status



- ***What input has been received*** - Does the interface above say what the search input was?
- ***What processing it is currently doing*** - Does it say what it is currently doing?
- ***What the results of processing are*** - Does it give descriptive results?
- Feedback allows user to monitor progress towards solution of their task, allows the closure of tasks and reduces user anxiety (*Lavery et al*)

# H2: Match Between System & Real World

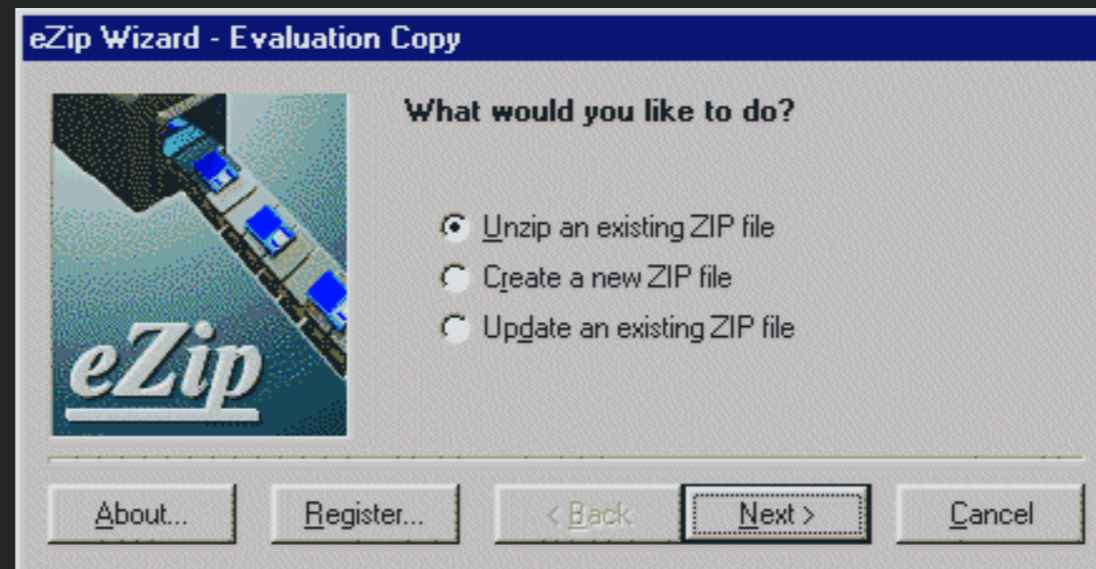


- Speak the users' language
- Follow real world conventions

# H2: Match Between System & Real World

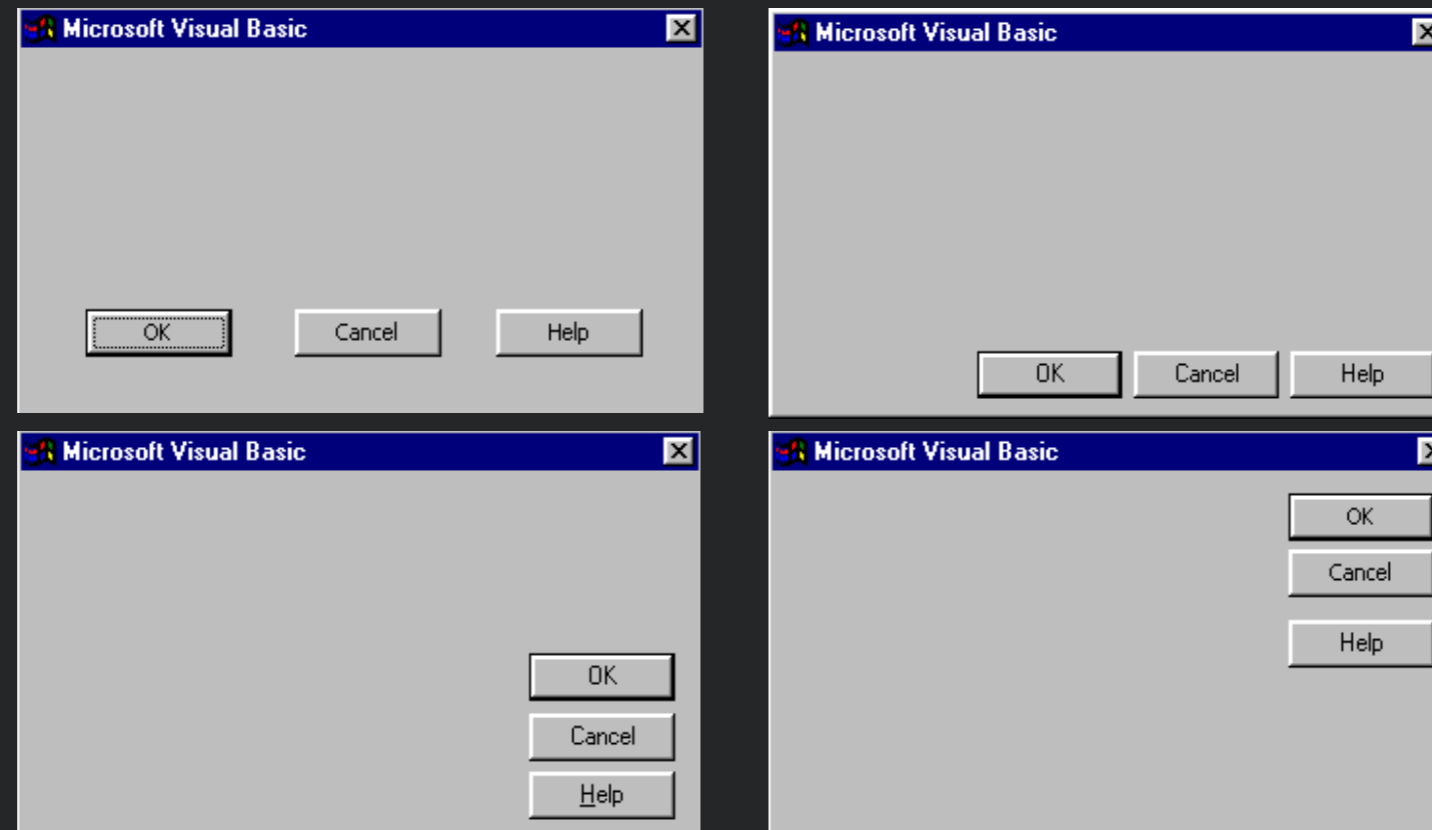


# H3: User Control & Freedom



- “Exits” for mistaken choices, undo, redo
- Don’t force down fixed paths

# H4: Consistency & Standards



- Same words, situations, actions, should mean the same thing in *similar* situations; same things look the same, be located in the same place.
- Different things should be different





# H4: Consistency & Standards



# H5: Error Prevention

Form1

Date:

Month Day Year

May 22 1997

Month Day Year

May 22 1997

Appointment

General | Attendees | Notes | Planner

When

Start: 8:30 AM Wed 5 /14 /97

End: 4:30 PM Wed 5 /14 /97

All day

Description

Smart Technology Sem

May 1997

S	M	T	W	T	F	S
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

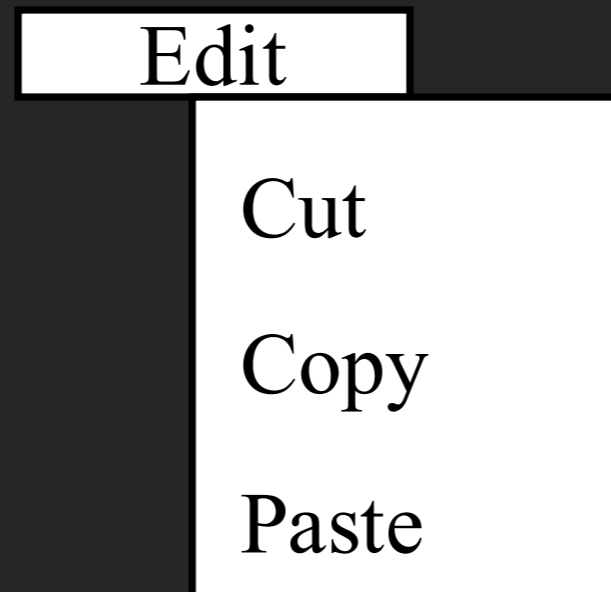
- Careful design which prevents a problem from occurring in the first place

# H6: Recognition Not Recall



- Make objects, actions and options visible or easily retrievable

# H7: Flexibility & Efficiency of Use



- Accelerators for experts (e.g., gestures, kb shortcuts)
- Allow users to tailor frequent actions (e.g., macros)

# H8: Aesthetic & Minimalist Design

Form Title – (appears above URL in most browsers and is used by WWW search)		Background Color:
Q&D Software Development Order Desk		FFFBF0
Form Heading – (appears at top of Web page in bold type)		Text Color:
Q&D Software Development Order Desk <input checked="" type="checkbox"/> Center		000080
E-Mail responses to (will not appear on)	Alternate (for mailto forms only)	Background Graphic
dversch@q-d.com		
Text to appear in Submit button	Text to appear in Reset button	<input type="radio"/> Mailto
Send Order	Clear Form	<input checked="" type="radio"/> CGI
Scrolling Status Bar Message (max length = 200 characters)		
***WebMania 1.5b with Image Map Wizard is here!***		
<input type="button" value=" &lt;&lt; Prev Tab"/>		<input type="button" value=" Next Tab &gt;&gt;"/>

- Interfaces should not contain irrelevant or rarely needed information

# H9: RDR from Errors

Help Users *Recognize*, *Diagnose*, and *Recover* from Errors



- Error messages in language user will understand
- Precisely indicate the problem
- Constructively suggest a solution

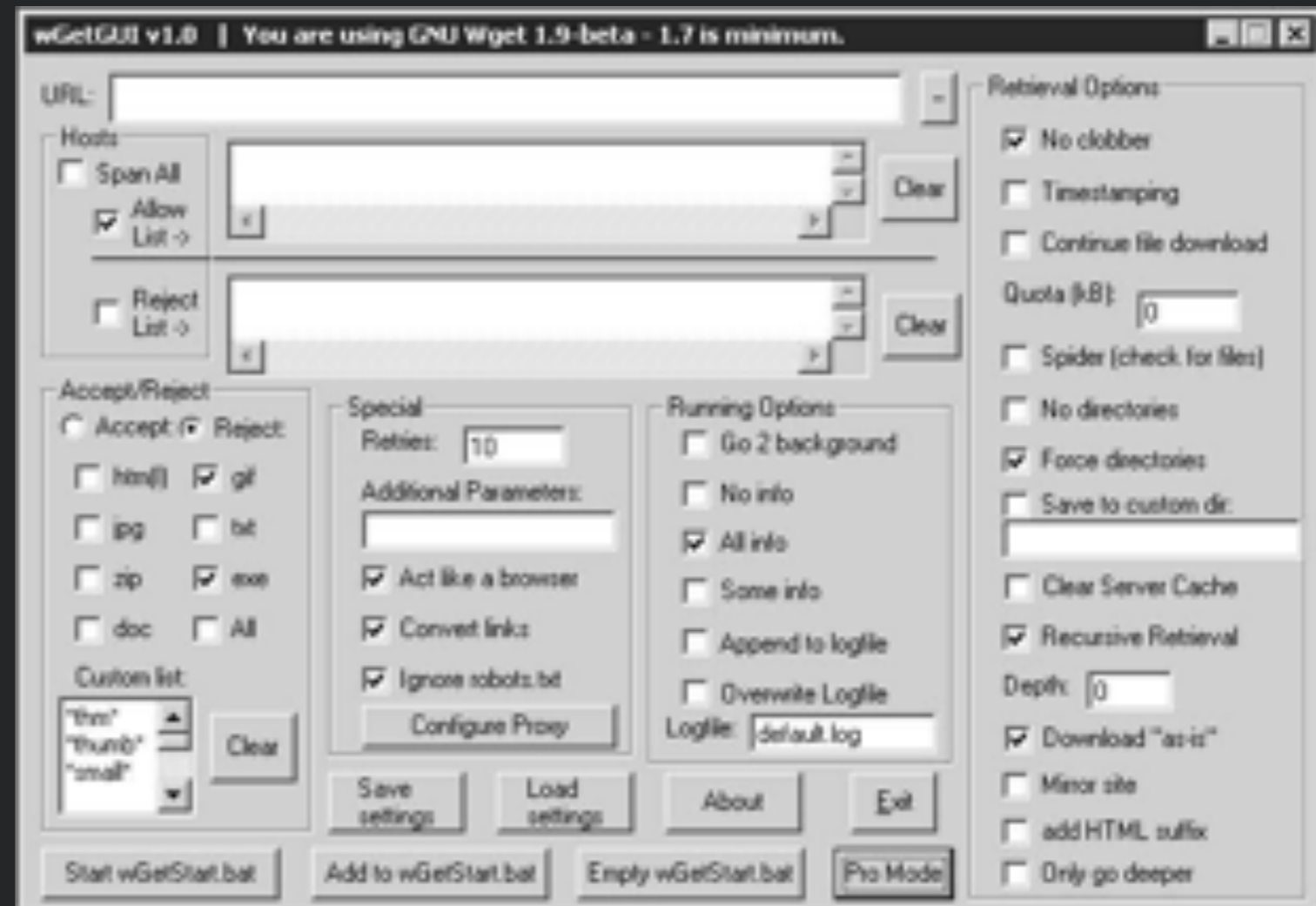
# H10: Help & Documentation

- Easy to search
- Focused on the user's task
- List concrete steps to carry out
- Always available



# Example

1. Visibility of system status
2. Match between system and the real world
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# Advantages of Heuristic Evaluation

- “Discount usability engineering” - Intimidation low
- Don't need to identify tasks, activities
- Can identify some fairly obvious fixes
- Can expose problems user testing doesn't expose
- Provides a language for justifying usability recommendations



# Disadvantages of Heuristic Evaluation

- Un-validated
- Do not employ real users
- Can be error prone
- Better to use usability experts
- Problems unconnected with tasks
- Heuristics may be hard to apply to new technology



# Using Heuristic Evaluation

- Can be used informally to identify issues in a website
- Can be used as a more formal usability inspection method
- Evaluators each first separately identify issues
- Issues then combined from each evaluator



# Ways to Use Heuristic Evaluation

- Early in design process to catch major issues
- When time or resources are not available for empirical usability evaluation



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# 7 Minute Break



# SWVE 632 - Design & Development of User Interfaces

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Class will start in:

07:01

Class will begin soon

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# In-Class Activity

- Breakout Rooms with 3-4 students
- Together select an application or website (e.g., Word, Twitter)
- Work individually to identify at least 1 usability issue
- For each issue, identify the heuristic, identify the functionality in the application, and summarize how the heuristic is violated in a few sentences
- Use Online Word Documents shared in Zoom chat