CS 4750

Levi D. Smith CS4750 Human Computer Interface

Human-Computer Interface Design and Evaluation Design

CS 4750 Fall 2001

Quick access to class materials

- Jump to the syllabus of lecture topics, readings, and assignments.
- Captured lectures (Section A and Section B), courtesy of eClass.
- Overview of the class project.
- See this quarter's project groups page.
- Access on-line full-text search of the HCI textbook.
- Other useful HCI information, much of which will be discussed further in lectures.

General Information

- **Description:** (General online Course Catalog) Human computer interface is considered in terms of user-system compatibility.Concepts in human factors and interface design are covered in relation to capabilities of both humans and computers. Cross-listed with PSYC 4750.
- **Goals:**
  - To expose you to the significance of the usability of a computer system from the user's perspective.
  - To gain awareness of human capabilities and how that impacts interaction.
  - To gain expertise in applying various HCI evaluation and modeling techniques to improve the design and software development process.
  - To inform you of the wider field of HCI for further study.
- **Meeting Time:** MWF 10:05-10:55 am (Section A), MWF 11:05-11:55 am (Section B)
- **Meeting Place:** CCB 102

Textbooks

Required?	Title	Author	Publication information
Yes	***Human-Computer Interaction, 2nd Ed.*** *(DFAB)*	Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale	*Prentice-Hall, 1998*
Yes	***Design of Everyday Things*** *(DOET)*	Donald A. Norman	*Basic Books*

Exams

	date	weight
Exam 1	~~9/26~~	12.5%
Exam 2	11/5	12.5%
Final	12/13 (A) and 12/14 (B)	20%

October 1 (Monday)

Instructor

Dr. Gregory D. Abowd

- **Office:** 380 Centennial Research Building (CRB)
- **Phone:** 404-894-7512 (unreliable)
- **Email:** abowd@cc.gatech.edu
- **Office Hours:** Wednesday afternoons 380 CRB (or by appointment)

Teaching Assistants

Khai Truong

- **Office:** 386 Centennial Research Building (CRB)
- **Phone:** 404-385-0257
- **Email:** khai@cc.gatech.edu
- **Office Hours:** MWF 2:00-3:00pm

Heather Richter

- **Office:** 246a CRB
- **Phone:** 404-385-1101
- **Email:** hrichter@cc.gatech.edu
- **Office Hours:** Tuesday 10am - noon

Syllabus

Information in this syllabus may change as the term progresses. Recent changes will be marked in RED, to grab your attention.

Syllabus

Information in this syllabus may change as the term progresses. Recent changes will be marked in RED, to grab your attention.

The instructor will make every effort to have prepared lectures available in advance a day or two before the actual lecture. These prepared lectures will be in PowerPoint format.

Week	Date	Topic	Reading	Prepared lectures	Project	Supplemental Assignments
1	8/20	Introduction	Previous classes Class policies	slides		
Foundations						
	8/22	History of HCI	DFAB 4.1-4.2	slides		
	8/24	History of HCI	Dealers, Ch. 15	slides		
2	8/27	Project	Project overview	slides		
	8/29	Design of Everyday Things	DOET Chs. 1-4	slides		
	8/31	more Norman thoughts		slides	Part 0 due	
3	9/3	Labor Day		NO CLASS		
	9/5	Usability Principles	DFAB 4.3	slides		
Modeling						
	9/7	Humans Heather Richter	DFAB Ch. 1 Card, Moran & Newell, pp. 23-44	slides		
4	9/10	Project Part 1 discussion				
	9/12	Predictive models	DFAB 6.10 Fitts' Law	slides		
	9/14	CANCELLED				
5	9/17	Task Analysis Cognitive Models	DFAB 6.6-6.9 DFAB Ch. 7	slides		More on GOMS
Interaction Design						
	9/19	Interaction models	DFAB Ch. 3 DOET 45-53	slides		
		Part 1 poster				

	9/21	session			
6	9/24	Prototyping, Storyboards and Scenarios	DFAB 5.5	slides	
	9/26	Designing for errors	DOET Ch. 5	slides	
	9/28	exam review			Part 1 due
7	10/1	Exam 1			
	10/3	Language and Speech	DFAB 15.3	slides	
	10/5	Pen and Gesture	DFAB 15.5-15.6	slides	
8	10/8	Metaphors		slides	
	10/10	UI toolkits	DFAB Ch. 10	slides	
	10/12	Part 2 poster session		slides	
9	10/15	Mid-semester break		NO CLASS	
Evaluation					
	10/17	UI Development Environments		slides	
	10/19	Evaluation introduction Questionnaire design		slides	Part 2 due
10	10/22	Think aloud	DFAB Ch. 11	slides	
	10/24	Cognitive walkthrough	DFAB 11.4.1	slides	
	10/26	Heuristic evaluation	DFAB 11.4.2	slides	
11	10/29	Empirical evaluation	DFAB 11.5.1	slides	
	10/31	Understanding HCI Statistics			
	11/2	exam review			
12	11/5	Exam 2			
Advanced Topics					
	11/7	CSCW	DFAB Ch. 13-14	slides	
	11/9	CSCW			
		Designing for the			Part 3

	11/12	Web Albert Badre	DFAB 16		due
	11/14	Designing for the Web Albert Badre			
	11/16				
14	11/19				
	11/21				
	11/23	Holiday		NO CLASS	
15	11/26				
	11/28				
	11/30				Part 4 due
16	12/3	Final presentations			
	12/5	Final presentations			
	12/7	Final presentations			
Finals week	12/13 (Section A) 12/14 (Section B)				

Levi D. Smith
August 20, 2001
CS 4750

Introduction to Human Computer Interaction
Gregory D. Abowd

- Ubiquitous Computing - removing monitor and keyboard and putting computers into the environment

Khai Truong 386 CRB
Heather Richter 2nd floor CRB

Main textbook - 2nd edition. (Norman)

- Subject - CS 4750 for e-mail response typically by evening
- 5 deliverables for project. (4 for grades)
- 2 exams
- 5-10 quizzes
- 3 Us - Usability, Usefulness, Ubiquity
  - Usability → easy to learn
  - Usefulness → become more productive
  - Ubiquity → useful function to people.
- Projects will use novel technologies

August 22, 2001

Read Xerox article by Friday
Lecture Thursday at noon.

- Important to build more useful and usable systems
- Chapter 4

- Time sharing - servicing a number of users,
- Computers became interactie with time sharing
- Networks and time sharing
  - Licklider → ARPA net
- Sutherland - sketchpad system - started CG
- Engelburt - developed toolkits - mouse and additional input devices.
  - allowed others to build on top of his work
- Alan Kay - personal computers - "Dynabook"
- ~~we develop relation~~ relationships develop between people and their technologies
- Bit Blit - paint to independent portions of the screen
- Desktop Metaphor
- Direct manipulation interface - people can manipulate objects on the screen.
- agent based - software entity to do actions for you
// Apple → eagar system → noticed the actions
// that you have performed, and performs it on
// your behalf
- Vannevar Bush - Memex - desk computer - used photographs to keep track of documents

- Nelson - hypertext format instead of putting information linearly

CS 4750
August 24, 2001

- Lickbider - ARPANET
- Bob Taylor - Xerox CSL (Computer Science Lab)
- Personal Computer became a reality at Xerox park
- Xerox park gave us 1) Laser printer (Gary Starkweather)
  2) Ethernet (Bob Metcalfe)
  3) Personal Computer (Chuck Thacker) "The Alto"
- Alto vs. Polos
- "Augments" System - Engelbart (video in class)
- Alan Kay - University of Utah
  - Dynabooks - fit in pocket (his vision)

WYSIWYG - Flip Wilson
Bravo - text editing - difficult to use.
Daniel Ingalls - BitBlt

Xerox STAR
- last demonstration of STAR (video)

- Corded keyboard
- BitBlt - pop-up menus
- Alto - using mouse to perform action (Englebart only used it to position cursor)
- Predict the future and invent it.

Movie2: Apple
Movie3: Bill Gates - Condex

Lev: D. Smith
CS 4750

Waterfall Model:
Requirements - what you will build
Design - how to build it
Implementation & Test
Maintenance

- data processing - 60's & 70's
Batch Fallacy - don't know the requirements at the beginning

Incorporate evaluation → formative (before) //prototype
→ summative (after system has been deployed)

- Summative - evaluating existing systems

- Ways of prototyping
  - Story boards
    pictures & words
  - Limited function

Part 1. Understanding the Problem
  - who, what, where
    users, tasks, environment
Part 2. Design Alternatives
  - 3 solutions
Part 3. Prototype

- Informal Presentations

- Think off the desktop
  - Mobility, handheld, environmental (wearable)

August 29, 2001

Levi D. Smith

http://www.cc.gatech.edu/

Project Ideas

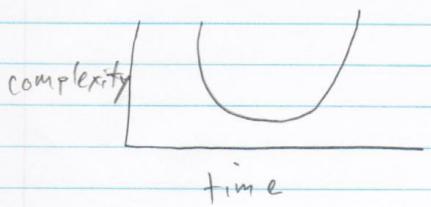
Aware Home
- Home automation
  - devices that control lighting, heat, etc.
  - Intercom
- Digital Photography
- Capture surfaces

- visibility - labels
- number of operations greater than functions then device becomes difficult
- feedback - electronic board-ink showing on screen
- natural mapping
  - natural: plausable explanation
  - mapping: realationship b/w physical operations & actions that get performed

Some examples of "natural" mappings
- affordance - steering wheel, door knob

Usability vs { Cost, Reliability, Time Market }

U - Curve



- people learn to use what you need

Readings

Dealers Ch 14

CMN - on website

Fitt's Law

- tech bias
- broad + narrow

- Convergent devices
  - // Accomplice - keyboard, color display, phone
  - // in one
  - // GSM phone
  - // GPS device

physical notebook + electronic notebook

Bluetooth // Mbps

- Huenistics

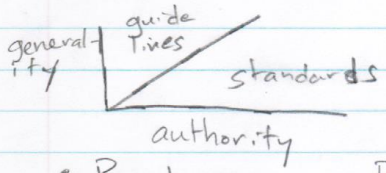
- perceived affordance - ex. might not look like a phone, but is supposed to be used as a phone,

- mental models // use a metaphor
- visibility // operations you want to // perform and feedback
- // cognitive walkthrough
- // hourglass (feedback)

l - psfgc
f - dmtsc
r - orrt

CS4750
September 5, 2001

- generality levels
  - low = concrete to high = many situations
- authority
  - high (law) to low (advice)
- standard Ex: IEEE
  (high in authority



- Paradigms vs. Principles
  - paradigms - example, copied behavior
  - principles - theories / explanations
- Principles of Usability
  - learnability
  - flexability
  - robustness - how are user's goals supported

Learnability
- novice → competent → expert

psfgc
things you already know

- desktop metaphor - familiarity from another domain
- Bravo - WYSIWYG
- Gypsy - cut, copy, & paste

dmtsc

- Robustness

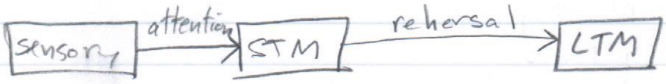
orrt

Levi D. Smith
August 7, 2001

- Reading for next class: Fitts Law
- eyes have fewer cones for blue light
- cocktail party effect
  - cues can change filtering - your name

- Sensory perceptual
  - short term
  - long term

- recognition - much easier task than recall



Processing
Recognize - act cycle
Norman: evaluate/execute
occurs without thought

Levi D. Smith
September 10, 2001

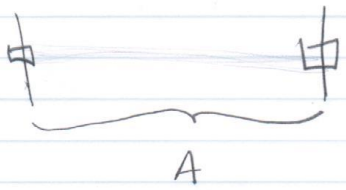
- 479 10th Street – Aware Home
  Corner of 10th and Center

- Template
  Who // the users are
  What // task
  Where // where do the perform these tasks

- KNOW THE USERS
- // Poster session September 21
- // characteristic – // undergraduate vs graduates
- // understand what the user does
- // larger system – library system
- // analysis of existing systems

CS4750 September 12, 2001

- Vistcon - VB for developing on CE
- Fitts' Law - developed by Shannon
- parameters have to be determined experimentally



1 degree Fitts Law

- Fitts Law doesnt apply ~~to~~ speaking commands.
- haptic interface - you can feel feedback
- doing processing - Fitts' Law doesn't apply
- KLM Keystroke-Level Model
  - **K**eyboard Press
  - **B**utton on Mouse Pressed
  - **H**ommy from KB to M
  - **P**ointing Task
  - **M**emory
  - **R**esponse

* Read Friday's Reading
  - 3 Major Classes
  - GOMS & Cognitive Complexo
- Unstand how cognitive model feeds

Tuesday @6:30 Library
September 17, 2001

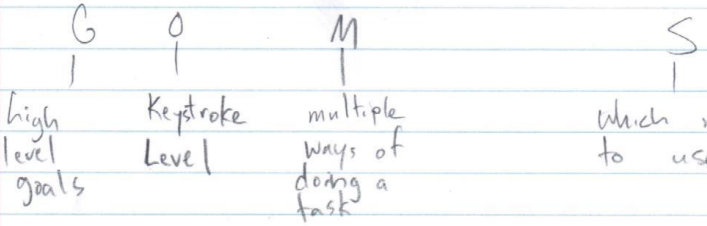
Poster
- Understand state of affairs
★ No screenshots ★
- Going
- Have artifacts - current methods
  - phone books, location websites
- One person always stationed at project

Task analysis
analyzing and documenting

HTA - heirarchical task analysis
plan - textual description on one level

TAKD - task analysis and knowledge decomposition
- Do one task analysis

Performance tends to be quantitative
- time
Competence
- legal and executable



Exam 1: Monday October 1, 2001
- Covers: Up to 26 and including 9/26 (lectures + reading)
50 - 50
objective - short answer / short essay

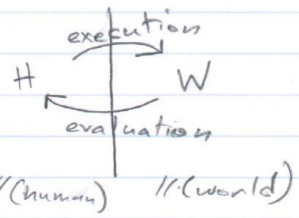
- Closure problem - can you close the loop on an interaction

Examples:

ATM - get cash and leave
- started making them beep so you know to get your card

e-mail attachments - people send messages without intended attachments

NORMAN
(DOET, pg. 46)
Simple idea



7 stages

goal formed

Example from HoS and determine the problem - (for exam)

CS4750

September 24, 2001

- Examples of version one.
  - Future Dining
- Show where our system will excel according to criteria (be concrete)
  Top 3-4 principles
  - Active Art

Task Analysis
- Deep understanding of artifacts and tasks
- Why do people have problems with the current system?
- Understand the problem at hand - do not propose solution or technology

TA - "what do we do" compared against what do we need
- Prototype needs to give authentic experience

- ~~Reaction to~~ Needs capability to respond to a defined set of tasks.

- Throw-away or incremental
- Least amount of effort to solve a problem
- Listen to reason why the interface has problems - what harms interactive experience?

September 26, 2001

- Scenario - fictional stories
  - characters: end users
  - products: artifacts
  - events: activities
- Before & after scenarios

- Errors are unavoidable
- Mistakes (avoidable)
- Slips (unavoidable

mistake { Goal / Intention

slip { Sequence / Perform

- capture - driving example
- discription - similar objects - orange juice in cereal
- associative activation - "Freudian slip"
- loss of activation
- Mode errors - like VI insert/edit modes - doing wrong task

- Recognize when errors occur
  - know categories of errors
    mistakes → novice
    slip → experts

CCT - cognitive complexity theory - include pieces of information that the user will need to complete next step in TA

motor - know how long user is willing to wait, - how long a user will do a repeated task
perceptual - related to stress of user
100 - 200 ms - can't tell if things are faster or slower - appears immediate.

- Avoid invisible modes
- Use constraints
  forcing functions: interlock - actions must be completed in correct order
  lockout - keep users from doing unwanted actions
  lock in - forcing people to do an action at a particular time
- avoid false understanding

- synthesizability - learn from what you have done,

Recovery from errors
- feed back
- comprehension - useful error messages / warning to signal right kind of info
- backward - undo
  forward - see current state of system

- Describe what problems might occur
- Examine errors in current systems

September 28, 2001

People Matching
Ex: – Douglas Engelbart b. inventor of the mouse

// not more than one description to a // person

Licklider – f. "founder" of Internet
// Proctor for exam
1 Page Cheat Sheet
8 1/2" X 11 Paper

Daneil Ingalls c. BitBlt

DFAB principles – learnability
– flexibility
– robustness

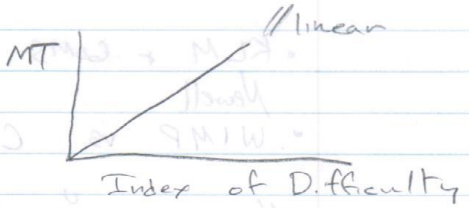
DOET Chs 1-4 – natural mapping
– good visibility
– mental model
– feedback

Standards & guidelines - levels of authority & generality

Fitts Law
movement task

$MT \propto \frac{D}{S} / \frac{A}{W}$

$MT = a + b \log_2 \left(\frac{A}{W} \right)$



Pie menus violate Fitts Law

- 5 Norman Chapters
- 1, 2, 3, 4, 5, 6, 7 Text } things emphasized in lectures
- Dealers Chapters -

echoic → working → LT

Baxton's 3 state model

- devices may be used under different conditions

KLM - descriptions of operations performed by users,

- performance measure

Use GOMS to break down tasks

GOMS - task analysis techniques

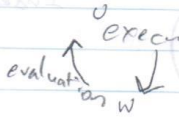
- lowest level → "0" operators

Method - sequence of operations

- bottom level on tree
- GOMS assumes sequential order
- HTA + GOMS breaks into goals + sub goals
- HTA - plan that describes logic
- GOMS - try to get into head of user
- HTA - 3rd party observance

- KLM + GOMS - Card, Moran, + Newell
- WIMP vs. CLI

Norman



September 28, 2001

Task Analysis
- activities
- artificats
- relations

- Every system is subject to slips

October 3, 2001

- Prosody - speak a sentence depending on the punctuation the sentence ends,
- 4 Kinds of Errors
  - substitution
  - rejection
  - insertion
  - deletion

October 5, 2001

- Project Part 1
- Exam - grade on a curve
- Over a 93 automatic A

12 - 90s
20 - 80s
20 - 70s
16 - 60s
3 < 50s

- Pen as an input technology
- View ink as data

stroke
sequence of points

touch-typist - type without looking at KB

- Meeting tomorrow @ 6:30 pm in library

October 8, 2001

- Poster session - October 19
- Part 2 Due - October 24

- Lecture transcription
- Applications (pen)
- Measure eyebrow movement as a frustration meter
- Part 2 of Project
  Design Space Exploration
  - variety
  - feedback from users

- Examples - Fall 99
  - Future Dining, Team Canada, Ictus for Design
    part2.html

Metaphors

Next Wed @ 3:30 ~~in the library~~

October 10, 2001

Metaphors
- Pen supported by desktop
- Stapler not supported

User Interface Software
- windows allow multi-tasking
- dialog between end user and system
- user to computer dialog
  - two ways of coding interaction
    - internal to application
    - external to application (UI builders)

Know the distinction between these two

1:10 pm tomorrow with Heather

- create dialog one might use to interact with voice recognition system
- think about design decisions for each different prototype

October 17, 2001

- Docs Part 3 criteria address issues presented in preceeding parts.
  - Predictive modeling - Fitts Law, KLM (to measure time to perform actions)

- Questionaires can be formative or summative
- Ask similar questions to ensure validity
- Can ask multiple questions to draw out more detailed answers for subjective questions

October 22, 2001

Important:
- Variety
- Assessment of Prototypes
  - against usability criteria

Observational Techniques
- Pros & Cons
  - Rich Record (usually poor if done by only one person)
  - More data to analyze if recorded
  - post hoc interpretation - people might not remember what they did, so they make-up an answer that sounds intelligent
- Think Aloud - encourage user to say what they are thinking
- Cooperative evaluation - designer speaks with user to ask questions.

Think aloud - Airline

October 24, 2001

- Post task interview to ask questions about think aloud
- Cognitive walkthrough
  - good for learnability

CW
- define inputs
- walk through action sequences
- believability

- Peripheral vision can detect movements more easily

Inputs - knowledge and experience from previous systems
Doing the walkthrough -
4 Questions -

- Is action perceivable?
- Is there feedback?

Inputs
  Goals
    make / receive call
    search for name
    send message
    set alarms
  Users
    routine / occasional
    experience / novice

Prototype

Nokia.com

6210 tutorial

1.) • Is user expecting to do that action?

2.) • Is action to perform task there?

3.) • Can user figure out how to do the task.

4.)

October 29, 2001

- know end user population
- 3 types of information from surveys - quantitative, qualitative, background info.
- size & availability of display
- how long it takes user to successfully perform task - number of errors per task.
- Hypothesis - controlled conditions impact measured observance.
- People's satisfaction - through observance ask them Likert scale.
- Treat computers as social actors

- Reveal influence of independent variables on the dependent variables.
- Eliminate possibility of chance relationship
- "null" hypothesis — no relationship in difference between control

- Each subject is exposed to only one prototype - between group
- Each subject is exposed to multiple prototypes - within group

- within - fewer people needed, but more time.
  - learn time might slow performance + errors

within - balance order
between - no learning effects
- careful selection needed

outlier - something went wrong
- Save data - to check results
- to do different analysis on data.
- Measuring techniques must be considered

October 31, 2001

$\bar{X}$ → sample mean
μ → population mean

Null Hypothesis $\leq$

Variance is the sum of each sample's distance from the mean

Std Dev → $\sqrt{\text{Variance}}$

67% in 1st Std Dev
95% in 2nd Std Dev

T-Test

P value → 0.00011178 → 99%
- Tails determine how different the things are on the ends of the curve.

- Negatively - one tail test

- Paired T-Test - need two data sets from the same test sample - Otherwise use regular T-test
- 95 - standard acceptance percentange
- Less than 95%, no proof to suggest hypothesis is true (with given data)

November 2, 2001

- Part 3 has changed
- Due date pushed back

Story board
Video Summary
Build Prototype
> 3 representations of same system

Required
- Physical Form desc
- Story board of overall functionality (screenshots)
- Build functional portion of prototype

- Project Description
  - Should borrow heavily from part one
- Physical Model
  - describe physical model
  - if commercially available, then show pictures of it.

- Exam 2
  - 40% Objective
    T/F fill-in-the-blank
  - 60% Short Answer
    4 Questions @ 15 pts each
  - 10/3 - 10/31 - lecture and reading material
  - 2% for putting name on exam

- No Annoying Match
- 1 8 1/2" x 11" Cheat Sheet

- Empirical study takes more time + money, but not always. (questionaires)
- 4 different kinds of tests used in different kinds of situations
- T-test vs. paired T-test
  - Same set of situations
  - Exam before + Exam After course for same set of people (paired TT)
  - Throw out people who didn't take both tests
  - Two different groups tested (Men vs. Women, studens with prereq vs. w/o)
    T-test or X^2 Test
  - X^2 Test for discrete values
  - P-Value - confidence level - happens outside of chance
  - P-value 0.05 or less (95%)
- Between groups vs. Within groups
  - Dependent Variable (measurable)
  - Controlled variable
- Development Environments
  - Build interface with components and tie them with functionality
  - Event based programming
  - App Forge External to Application
  - Internal - Read Eval loop
- Roles of Windowing System
  - device independence
  - Drivers allow you to use multiple devices without worrying about specific code

- Focus policies
- Look + Feel - determines the display of a system
- OO paradigm fits widgets
- Summative vs Formative
- Different between observational techniques
- Input techniques
  - Different ways to use pen-based input
  - Unistroke - from time down to pen time up

りびらドスミス

November 7, 2001

- Computer Supported Cooperative (Collaborative) Work
- CSCW - for groups of people
- sociology - study of groups of people
- anthropology
- work process
- competitive - games in general

- Knight Riders - multiple (to find other people)
  - UTC - support of bands + booker

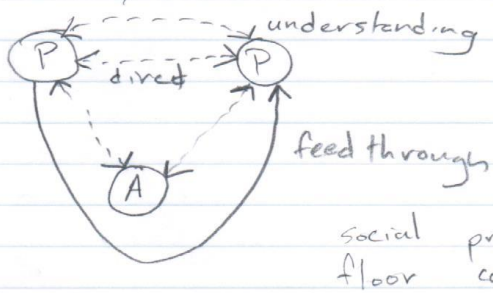
CS 4750

A K
3 2-4

November 9, 2001

Test Avg 81.6
90-100 - 26
80s - 13
70s - 16
60s - 8
below 60 - 4

- groupware - eclass for meetings,
- People / Artifact



social protocol
floor control - anyone can make slight changes

- critical mass - more people = more benefit (Napster)
- critical mass - level for enough people or enough use.
- Evaluation of groupware requires a group of people during testing

November 12, 2001

Web Usability

- Usability - Ease of learning
  - Ease of use
  - Less Effort
- Context -
  - Ex: supermarket - finding Folger's
  - Genre - News, shopping, entertainment, et cetera
  - Entertainment - Colorful + Animations as opposed to news sites
- Site Context supercedes genre context?
- What is the purpose of the site?
- Scenario - Who, What purpose, When, How?
- Ergonomic Issues
- Users differ - must take into consideration during design
- Can create different interfaces for each audience
- Create one interface that is communicated well

CS 4750
November 14, 2001

- News genre looks different from shopping and other genres
  Distinguishing Features
  - Content, Expression, Form
    - Form - relation of objects to each other on the page
    - Expression - how objects are presented (ex: font, pictures)

- No more than 50 kB for pictures
- 5 - 8 kB for pictures - for good response time
- Aesthetics
- Art should not interfere with site's ~~cont~~ goals + functionality.

November 16, 2001

Ubquitous Computing

Networks: Dial-Ups ≈ 56K vs. Cable Modem
(2 second rule)

- Qubiquity - augmenting the environment
- Capture experiences and return them when they need it,
- Context aware → do tasks automatically for user depending on what the user is doing
- Grudin's list - 8 challenges
- Abowd's Rule = Live it
- Comments:
  - Location Tracking
  - Ambient Display

Sat - Spc
- GT game
- W
- Fl vs, FSU

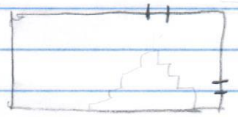
November 19, 2001

11/30 - Industry speakers

- Ubiquitous Computing - seamlessly integrated into environment
- Technical issues UBICOMP

Presen.

Lit - WG	- 5	VP - 5
RWL - (LM) - GT x2	- 5	World History - 5
Sociology (Many) - GT	- 5	
CG - GT	- 8	
C: Society (Debate) - GT	- 5	
IE - Y - 12	- 10	
Tech Comm (DVD) - GT	- 5	



November 21, 2001

- Evening when we're hungary
- Look at people familiar + unfamiliar w. the area

- ~~Cooperative Evaluation~~
- ~~Cognitive Walkthrough~~
- ~~Heuristic Evaluation~~

- Co-evolution
  - Ex: Electronic typewriter

- Professors using other professors captured lectures to prepare their own lectures → was only intended to allow students to refresh themselves.

November 26, 2007

- Part 4 + Contextual Inquiry
- Agenda - Question
  - Part 3 TA evals by Tuesday
  - Part 4 overview
  - Contextual Inquiry
- Part 4 - Written: due Nov. 30 75/100
  - Presentation 25/100
- Put evaluation artifacts in appendix section.
- What did you find out from doing evaluation? → should be included
- What we think are cause of problems

- Critique of Evaluation - problems in evaluation, redundancy in evaluation.
- No regrade for part 4
- Final presentation
  - Attendance is mandatory
  - Same as 3 Quizzes
- 8 or 9 projects
- 15 minutes per presentation
- Part should be questions + answer (5 minutes)
- Should be off of the cowet (HTML, Power Point 2000)
- 1 - 2 people for presentation
- Presentation
  - Overview (1)
  - Results from part 4 (5) - Results only - Usability bugs
  - Critique of Evaluation (2)
  - Future Directions (2)
  - General Discussion (5)

- Presentation Wednesday

Content

- Contextual Inquiry
  - Motivation
  - Sources of Info

// CS6455 - Evaluation techniques
// - grad HCI course
// - Contextual Design - book course
// based on
Chapter 3 - basis for today's lecture

- Gathering data about users
  - Ask users
  - Market Research // what will people // pay for - what will they buy
- 4 Principles
  1.) Context // understanding activity while observe
  2.) Partnership // designer + person observed
  3.) Interpretations
  4.) Focus // Pinpoint problems

1.) Context
- gathering real data about users + their activities
- avoid summary
- abstractions
- externalize people's knowledge about ordinary activities

2.) Partnership
- apprentice (you) / master (them)
  ↓
  humble, inquisitive, attentive to detail

interviewer / interviewee
// be open minded instead of dictating
expert / novice
guest / host
↳ // too polite - doesn't ask questions

3.) Interpretation
- go from observable facts to design ideas / inspiration

- Cooperative Evaluation
- Appendecies + Posting

- Heuristics - make comments → Fill out ourselves
- Cognative Walkthrough

November 28, 2001

- Ph. D. - Independent Research
  - Ph.D. needed to be a faculty member at major research university
  - Intel, PARC, HP - research jobs with independency - with Ph.D

Industry Panel

Troy Surdick - Siemens
- troy.surdick@siemens.com

John Morrow - NCR
- john.morrow@ncr.com

Tim King - Delta
- tim.king@delta.com

(Lawrence Najjar - lawrence-najjar@yahoo.com)

www.chia.org

90

CS 4750 Human-Computer Interface Design and Evaluation Fall 2001

Exam 1

Gregory Abowd October 1, 2001

Your name (please print): Levi D. Smith

True/False (10 points, 2 points per question)

T **1.** Fitts' Law is particularly well-suited to predict the movement time for tasks that involve the use of a scrollbar to browse through a long document.

T **2.** The "S" in GOMS refers to how a user selects between different methods to satisfy a common goal in various situations.

F **3.** When tracing the history of interactive computing, the paradigm shift represented by the introduction of time-sharing was one that accounted for the human ability to perform more than one task at a time. → multi-tasking

F **4.** A slip is an error that indicates the user has formulated the wrong intention for interacting with the world.

F **5.** A summative evaluation technique is one applied during the early stages of design and is expected to give quick feedback that will direct near-term iterations on the design.

Multiple Choice (8 points, 2 points per question)

1. A flat metal plate on one side of a door suggests to you by its very appearance that it can be pushed with the palm of your hand. This relationship between the physical characteristics of an object and the actions you can perform on that object is referred to as

a) a natural mapping.
b) appropriate feedback.
c) an affordance.
d) synthesizability

2. Many modern appliances have a control panel with physical buttons used to invoke certain features of the appliance. When the number of buttons is much less the number of possible functions that can be performed on the appliance, a single button is then assigned a number of potential functions, depending on the current mode of the appliance. Norman argues that this situation is a violation of what principle of good design?

a) good visibility.
b) a natural mapping.
c) an affordance.
d) buiding a good conceptual model.

3. Over a short period of time, we find it easier to remember the string of numbers "404 894 6743" as opposed to the sequence of numbers "4048946743" because

a) numbers are easier to remember than arbitrary characters.

b) the chunking of the numbers, as suggested by the spacing, is significant.

c) ten numbers is not that many to have to recall from working memory.

d) all of the above.

4. You pick up the phone to call a fellow student in your HCI class. After looking up their number and dialing the phone, the other student answers. You suddenly realize that you cannot remember why you were phoning this student in the first place! What category of slip best describes this situation.

a) Data-driven error

b) Loss of activation

c) Recognition over recall error

d) Capture error

Fill in the blank (26 points, 2 points per blank)

1. The three types of human memory are sensory, short term (working) and long term. These different memories are characterized by how much information they hold and how long that information can be retained.

2. Norman refers to the user's difficulty in formulating and articulating an intention as a series of actions on the physical world as a problem traversing the Gulf of Execution

24

3. In designing an interface, the choice to use visible menus and action buttons labelled with command names instead of a command line interface that users must commit to memory in order to use effectively is a concession to the heuristic of recognition over recall.

4. Three basic categories of usability principles are learnability, flexibility, and robustness.

5. A Wizard of Oz prototyping scheme, in which non-existent functionality is provided through human intervention, is a useful way to gain usability feedback in situations in which the technology to perform the task is not available.

Levi D. Smith

14

Matching (16 points, 2 points per person)

Match the name in the left column with the statements in the right column that apply to that person. There may be zero or more matches per person, and you must get all matches to get full credit. Not every statement in the right column need be matched to an individual in the left column.

H Vannevar Bush

K Alan Kay possibly A?

_____ Ted Nelson - hypertext

E Charles Simonyi

B, L Ivan Sutherland

I Gary Starkweather

G Douglas Engelbart A

J Daniel Ingalls

a) Early (ambiguous) champion of personal computing from work at Xerox PARC in learning technologies. - Bob Taylor

b) Developed SketchPad system to demonstrate interaction with a virtual world of objects.

c) Xerox PARC researcher who is acknowledged founding father of ubiquitous computing. Mark Weiser

d) Developed general theory of intelligence with Herb Simon at Carnegie Mellon and helped develop Model Human Processor.

e) Creator of the first WYSIWYG editor, Bravo.

f) Application of GOMS to Nynex case study saved company millions of dollars in operational costs. - CMN

g) Late 1960's demonstrator of two-handed input techniques, builder of toolkits to bootstrap programming.

h) Science advisor to the President during World War II, he described a specialized device, called the *memex*, that was a pre-cursor to a personalized hypertext retrieval system.

i) Inventor of the laser printer.

j) His invention of the BitBlt algorithm provided the Xerox Star with a responsive interface to manipulate menus and windows.

k) Worked at Xerox Palo Alto Research Center (PARC) on the development of the Smalltalk language.

l) Widely considered father of modern computer graphics.

Short Answer

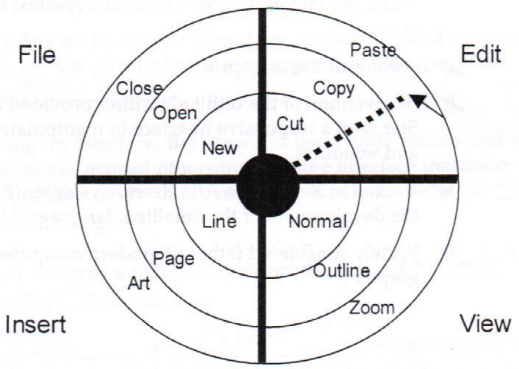
Provide written answers to the following questions. Your answers should be as complete as possible and contained within the space provided.

1. **(8 points)** What do we mean when we refer to the user's mental model of a system? How do principles of learnability (predictability, synthesizability, familiarity, generalizability and consistency) contribute to the development of the user's mental model.

(8)

A mental model is how the user creates theories to understand the casual behavior of systems. Learnability is composed of the principles that evaluate how well the system can move the user from a novice to expert user. Therefore, if the system supports the learnability principles well, then the user's mental model of the system becomes more accurate. Learnability principles: predictability - ability to predict operations on the interface; synthesizability - ability to build a model based on past interactions; familiarity - ability to use knowledge in other domains in system; generalizability - support for actions in similar applications; consistency - support in like behaviors in similar situations

2. **(10 points)** A *bullseye menu* is a particular kind of interaction object that can be used to replace a traditional top-of-screen menubar. The figure below provides a graphical view of the bullseye menu.



(Part a) This menu operates as a pop-up menu, meaning that it is invoked at the mouse cursor position when the right mouse button is clicked. It is visible on the screen until the next mouse click event is received. The user sees four different quadrants (labelled as File, Edit, View and Insert in the diagram) that represent different menu choices. Moving the mouse in the direction of a quadrant and clicking the left mouse button when the mouse cursor is over the desired segment (for example, over the Paste segment of the Edit menu in the diagram) invoke that menu action.

Lev. D. Smith

Can you explain using Fitts' Law how this bullseye menu compares to the traditional top-of-screen menubar that you see in most GUI applications?

This menu violates Fitt's Law since the size of a selection depends on the number of menu choices (similar to James Landy's DENIM interface). The time required to select one of the menu choices in the bullseye menu greatly increases with more menu choices compared to the time of a traditional menubar.

2

starting point differs

Fitt's Law: $a + b \log_2(\frac{D}{S} + 1)$ where D = distance to target, S = size of target, and a & b are constants depending on the device and on it is used

(Part b) This same bullseye menu can be used in a nonvisual manner to support use by visually impaired users through the use of sound. When used in this nonvisual mode, the user invokes the menu in the same way, by clicking on the right mouse button. The user still indicates the menu of choice by moving the mouse cursor in the direction of the correct quadrant. However, now to select a choice in the menu, the user listens to audible "pings" from the menu object to indicate passage from one segment to the next before selecting the menu option of choice. In the example above, to select the Paste segment of the Edit menu, the user would invoke the menu and would move the cursor in an upward-right motion. She would continue moving and listen for 3 "pings" from the interface, since the Paste option is in the third segment of the Edit wedge of the menu.

How can you apply Fitts' Law to predict movement time for this nonvisual mode of use of the bullseye menu?

It would be difficult to use Fitt's Law to predict movement time since sound cues violate Fitt's Law. There is no way to specify the constants or variables needed in the formula.

5

3. **(8 points)** What is the relationship between the Hierarchical Task Analysis (HTA), GOMS and Keystroke-Level Model (KLM) methods for analyzing interaction between a human and computer in performing some computer-assisted task?

GOMS is a form of a hierarchical task analysis, which tends to focus on user's action (what is going on in his/her head). KLM is a way to specify the Operations and their times in GOMS. HTA is a cognitive model which models tasks performed by a human by breaking tasks into subtasks.

8

KLM-
K-keyboard
B-button on mouse pressed
H-homing between devices
M-memory
R-responsiveness

4. **(8 points)** In the video watched in class celebrating the development of the Xerox Alto, the commercial cousin of the Star, one of the designers extolled the virtues of the keyboard design. He claimed that one of the HCI successes of the Alto was the use of special purpose buttons separated from the typical alphabetic keys. These special function keys allowed the user to invoke functions like "cut," "copy," and "paste" and apply that same function to a variety of objects in many different applications.

(a) Explain which principle of usability is being exploited by the use of these similar keys to invoke similar operations in different settings?

generalizability - supports the user's specific knowledge of an interaction in one application to similar situations in other applications.

3

consistency

(b) Use of the terms "cut," "copy," and "paste" represent an example of what paradigm of interactive computing? Why were these words adopted for use in the Gypsy desktop publishing system developed by Xerox PARC researchers?

These terms which were covered in the 'Dealers of Lightning' chapter were chosen since they represent real world actions which were mapped to the Gypsy system. (supported the familiarity usability principle)

2

-2

"metaphor"

Levi D. Smith

5. **(8 points)** Two principles that support the learnability of an interactive system are *predictability* and *synthesizability*. Using Norman's seven stages of interaction and the execution/evaluation cycle, explain the difference between these two principles.

Norman's seven stages:

evaluation
- Forming the goal
- Forming the intention
- Specifying an action

execution
- Executing the action
- Perceiving the state of the world
- Interpreting the state of the word
- Evaluating the outcome

Predictability supports the user to determine the effects of operations on the interface. It gives a greater ability to determine the effects of execution. (summative)

Synthesizability allows the user to assess the effects of past operations on current state (formative)

- Predictability allows better ways of interpreting the system before, while synthesizability gives better interpretation after.

4

Exam 2

Gregory D. Abowd November 5, 2001

Your name (please print): Levi D. Smith 79

True/False (20 points, 2 points per question)

✓ 1. A cognitive walkthrough is a good technique to evaluate expert use of an interface.

F 2. Summative evaluations collect only quantitative data while formative evaluations collect only qualitative data.

✓ 3. In a think-aloud evaluation, HCI experts (→ are they the users?) are asked to talk out loud while evaluating the usability of an interface so that the experimenter can efficiently record their observations.

✓ 4. One way to limit the vocabulary of a user in a natural language interface is to similarly restrict the output of the system.

T 5. In a controlled empirical evaluation, the independent variables are those factors that you hold constant while you measure the dependent variables.

T 6. The two main roles of a windowing system are to provide device independence and multiple application control. (multi-tasking)

T 7. The AppForge development environment for handhelds uses an event-based or external paradigm for defining the user-computer dialogue.

✓ 8. While conducting a heuristic evaluation, it is important to gather usability bugs from a large number of independent evaluators. ~50

T 9. A regression analysis can be used to test whether a significant trend exists for a collection of ordered observations of continuous data.

F 10. Dr. Abowd's middle name is Dumbledor.

12

Levi D. Smith

Fill in the blank (20 points, 4 points per question)

1. You are designing an on-line shopping system. To aid users with initial understanding of your system, you use the familiar notion of a shopping cart. The use of the shopping cart is an example of a metaphor .

2. "Click to select" and "Mouse over" are two examples of a focus policy (2 words), used in a windowing system to choose which window will become the target of subsequent user input.

3. Grafitti, Quikwrite and Cirrin are examples of unistroke recognizers, which interpret meaning from pen input consisting of information from a single pen-down/pen-up sequence.

4. A controlled experiment in which each subject is exposed to only one experimental condition is referred to as a between - group design.

5. A Ch: - Squared test can be used to detect a significant trend between two different subject populations when discrete data is collected.

20

Levi D. Smith

Short answer (60 points, 15 points per question)

1. In developing a "natural" interaction style, we try to mimic how humans communicate with other humans, typically through the use of input types such as speech (from a human voice) or ink (written with a pen). Describe what it means to use voice or pen input "as data." Give an example of how speech might be used "as data." Give an example of how ink might be used "as data."

as data = no translation

Input data can be raw (in the form it is created) or converted to a form understood by computers.

- Speech can be recorded by a computer, and then the recorded sound can be converted into text (ASCII characters), although there is no 100% efficient way of converting speech to text yet. Speech data can also be stored in a raw format allowing users to relisten, fast forward, rewind, and pause portions of the speech.
- Pen input can also be analyzed by a computer to convert strokes into letters and words. Pen data can also be stored as pen strokes (like the electronic whiteboard). Strokes within a specified period of time can be chunked together, so that the strokes can be stored as a word, allowing the word to be referenced as a point of time, link, or allow the word to be moved to another location (shopping list

using a technique such as Quickwrite, Cirrin or Graffiti;

7

2. What are the three categories of questions that define the content of a questionnaire? Which category of question would use a Likert scale? You administer the same questionnaire to two different groups of students asking their opinion about the effectiveness of a particular textbook used to teach HCI. What statistical test would you use to determine if there is a significant difference in the responses between those two groups for a variety of 5-point Likert scale questions?

- Background, Qualitative (subjective), and Quantitative (objective)
- Likert scale questions are in the quantitative category of questions.
- The comparison between the two different groups would use a T-test to determine significance in difference.

15

Levi D. Smith

3. What is the critical distinction between a think-aloud observational evaluation versus a cooperative evaluation? Give two reasons why would you choose a cooperative evaluation over a think aloud. In a post-task interview, why might you not trust the answers a subject gives while she is explaining the reasons for behavior you observed during a think aloud evaluation?

Think aloud is when the user describes his thought process, while in cooperative evaluation the observer participates in the evaluation with the user (possibly to explain things and ask questions). In Think aloud, the observer does not interact with the user.

(10)

where are 2 reasons? -5

The answers may not be trusted because the user may feel that they are required to give an answer so they make up something. The user may feel that they need to give an intelligent answer. Or the user may forget things after performing the tasks.

4. What usability property of a system is the main focus for a cognitive walkthrough evaluation method? What four questions make up the believability story for a cognitive walkthrough?

A cognitive walkthrough tests how easily a user can adapt to the user interface of a new system (learnability).

Four questions for believability of cognitive walkthrough:

1) will users be trying to produce whatever effect the action has?
2) Will users be able to notice that the correct action is available?
3) once users find the correct action at the interface, will they know that it is the right one for the effect they are trying to produce?
4) After the action is taken, will users understand the feedback they get?

15

4750 Project- Part 1- Rough Draft

Rationality Gone Awry: Anthony Gelsomini, Levi Smith, Russell Smith, Kristie Watson

Problem Description

An initial problem statement - an overview of what the system will do and why it is needed;

Many people decide to eat at restaurants since they are already out in the community, but there is no easy and efficient methodology for them to use to decide where they will eat. Currently there is no easy way to access information about restaurants while away from a home environment. Potential restaurant diners, in order to decide which restaurant to visit, need information about the menu options offered, the price of entrees, the location of the restaurant, and possibly even how long the wait time is. These are forms of information that we seek to provide in a system utilizing a PDA, so that this information can travel with the user.

User Profile

A description of the important characteristics of the users of the system;

Users of the system will be experienced in the use of PDA equipment and thus will be aware of how to utilize the various features of a PDA. It is assumed that since currently use of a PDA requires vision and coordinated movement of the hands, that our users will have these capabilities as well. They will be from a variety of age groups, from young adults to older adults.

TA - Can older adults effectively use this system

A task analysis, consisting of:

- **A description of the important characteristics of the tasks performed by users;**

  Tasks involve searching for options on the PDA interface, scrolling through menus to view restaurant options to select, and reading output on the PDA screen. Tasks also include being able to easily distinguish options of the program, potentially being able to connect directly to the restaurant to access wait time and order food, and

  This is more efficient than searching phonebooks or websites since the PDA is portable and can be used anywhere, eliminating the need for a PB or desktop.

TA Environment

- **A description of important characteristics of the task environment;**

  The task environment is any location in which a PDA can be used, which is essentially anywhere. Ideally, users would not use this system while driving, but it is a possibility and as such, mental demand required by this system should be as low as possible. The task environment also involves the interaction between other features on the PDA, which could interrupt the system.

- **A simple structured task analysis of the problem, in one of the forms described in the textbook.**

A description of the larger *system* , the technical or social organization, in which your product will participate;

The product will participate in the social organization of dining in a community. It will be interactive with the local restaurants to aid in such features as menu listings, restaurant locations, wait time for these restaurants as well as potentially being able to order food from the ~~product.~~ The ~~product~~ system will also participate in the technical community involving technological concepts like PDAs.

System

Assessment of current System

An analysis of the existing system, automated or manual, including its advantages and deficiencies;

The current system for locating and selecting restaurant options in a community is two-fold and both of these options have their own benefits and dawbacks. The first method is entirely manual and involves the concept of either locating restuarants in local newspapers~~of~~ in the yellow pages. Once they are located the user must depend upon the newspaper ad to provide information or they must call the restaurant to inquire about menus and other information. This system is advantageous in that it requires little of the user. There are few mental demands in placing a call and talking directly to the source of information, the restaurant. There is also an advantage of being able to ask for any information from the restaurant with no potential limitations. However, this current system is very limited in its scope. It cannot be easily performed when the user is not at either their home or office since this system requires contact information for the restaurant. Additionally it is very time consuming if several restaurants are being considered. There are also time constraints since the user is required to utilize this system during restaurant operating hours to be assisted. The second system currently in use involves using listings for restaurants on the Internet. One such system is "AccessAtlanta." These systems provide necessary information such as restaurant location and price range and type of cuisine offered. The Internet search of restaurants is advantageous in that it can be performed quickly, but it requires that the Internet is functioning properly and it still requires that the user be fairly immobile to perform the search. It would be difficult to discover information while driving in a vehicle and searching for a restaurant. It is also deficient in the scope of the information provided. There are not many menu listings and it is impossible to determine wait times without also utilizing the manual system previously disussed.

An initial list of usability criteria, or principles, that should be used in the eventual evaluation of your design;

This system should consider:

-working memory principles (place information in the world as opposed to in the user's head)
-sensation and perception principles (limitations of color vision and vision in particular, especially as aging occurs)
-Robustness (Mistakes should be easy to recover from and there should be such options as performing a new search on each screen)
-Learnability (System should model other search decices, possibly a search engine on the Internet, or should be constructed using restaurant metaphors)
-Flexibility (User should be able to modify the system to save favorite restaurants for easy access to their information, etc)

And a description and justification of how the above information was gathered, including references to existing literature and on-line material that was instrumental in helping you complete this stage of the project

-Access Atlanta website (www.AccessAtlanta.com)
-others (to be added soon)

Requirements Gathering Reflections.

- Interviews to gain information about the needs of the users.
- Observations - previous knowledge about the interactions in a restaurant
- Observed existing websites

Usability

(3 criteria required)

RGA Sample Interview Questions

Sample Interview Questions

When and where do you most often decide where you will dine for fast food?
(At home, at work, during commute...)

How many times a week do you usually eat fast food?

What kinds of fast food do you most frequently eat?
(burgers, pizza, chicken, Mexican...)

How long do you usually wait in line to order fast food?

How much time usually passes between the time you place an order and receiving your order?

How much extra would you be willing to pay to order your food before arriving at the restaurant?

What would be most helpful in finding a fast food restaurant in an unfamilar area?
(maps, directions, picture of the restaurant, distance...)

What percent of the time do you use the drive-through at fast food restaurants?

Link to this Page

- Rationality Gone Awry last edited on 17 September 2001 at 12:21:54 pm by newjersey-nt.cc.gatech.edu

RGA Poster Information

Who: Fast food customers on the go. Generally, teenagers and up, although special considerations should be taken for each age group.

What: Simplify the task of finding restaurants and ordering food. This task should be able to be performed anywhere using a device such as a Palm Pilot. The system should also indicate the distance and possibly directions to all local restaurants or those specified by the user. In later stages, the system will allow users to choose a restaurant and order their meal in advance to eliminate long line waits.

Where: Anywhere in the vicinity of a fast food restaurant.

Link to this Page

- Rationality Gone Awry last edited on 17 September 2001 at 12:21:54 pm by newjersey-nt.cc.gatech.edu

Group Project: Practical Interface Design

Outline

Quick access to the sections of this document:

Project Overview

This semester you will undertake a group project (teams of 4) to evaluate some computing-related task/problem, to develop interface design alternatives for the task/problem, to implement a prototype of your design, and to plan and execute the evaluation of your design. This project should provide you with hands-on experience with the tasks that interface designers face every day.

Each project group will be graded as a team, that is, each person receives the same grade. Team members, however, will be given the opportunity to indicate the level of work done by all members of the team. Your individual performance within the team will be reflected in your class participation grade. Within the team, you must negotiate on how much and what each person will contribute. Think carefully about your team members: Where do people live and what hours do they work? Where will you meet? What skills do the different individuals bring to the group (computing, programming, design, evaluation, statistics, etc.)? You are encouraged to form a heterogeneous team full of individuals with varying skills.

Project Report Book

Each part of the project will include a deliverable report. This report will be placed on the WWW and should be written in HTML. Each team should have a "home" page which includes: 1) a brief (paragraph) description of the problem/task; and 2) links to the reports for project parts 1-4. The deliverable for Part 0 is to set up this Web project notebook. The format of the reports for the individual parts is up to you, but it should be professionally prepared, expressive, grammatically sound, illustrative of your efforts and process, and easy to view and understand. A good design effort can easily be hampered by a poor communication of what was done. Web space will be set up under the class Web directory for you to place your notebook. You will **NOT** be allowed to host the project notebook anywhere else. We will also provide templates for various deliverables, to help those who might need HTML advice.

Part 0 - Identifying Team and Topic

Due August 31

Weight: 0%

This first part of the project is relatively simple. You must list the members of your team and identify the problem that you will be working on. You must also set up a Web project notebook that lists your project team members, the name of your team and will provide links to all other project deliverables. Work with the class TA to set up Web directory space for your project. A simple template for your project notebook is available for you to use. Or you can look to previous classes for ideas to copy.

Part 1 - Understanding the Problem

Due September 28
Weight: 12.5%

The key goal of this first substantive part of the project is to deeply understand that problem that you are addressing, its set of pertinent users, and the issues and constraints that are involved in the problem. You should include an assessment of the existing system currently or commonly used to accomplish these tasks. Most important is to identify important characteristics of the problem that will influence your subsequent design.

In class we will discuss different techniques for acquiring this kind of information. Feel free to utilize the techniques that you feel are most appropriate to the particular task you are examining. Your report and deliverable for this part should deeply examine the problem of study. Who are the potential users? What tasks do they seek to perform? What functionality should the system provide? Basically, you are setting up a set of constraints for your subsequent design. What criteria should be used to judge if your design is a success or not?

More specifically, you should develop the following items in this part, and you should communicate them through your report:

- an initial problem statement - an overview of what they system will do and why it is needed;
- a description of the important characteristics of the users of the system;
- a task analysis, consisting of:
    - a description of the important characteristics of the tasks performed by users;
    - a description of important characteristics of the task environment;
    - a simple structured task analysis of the problem, in one of the forms described in the textbook.
- a description of the larger *system* , the technical or social organization, in which your product will participate;
- an analysis of the existing system, automated or manual, including its advantages and deficiencies;
- an initial list of usability criteria, or principles, that should be used in the eventual evaluation of your design; and
- a description and justification of how the above information was gathered, including references to existing literature and on-line material that was instrumental in helping you complete this stage of the project.

You should turn in a report using this template as a guideline for preparing the report. We will utilize one full class day as a poster session at the end of this part of the project. Each group will post information of their project including material from part 1. Everyone will then circulate and interact with the designers. The idea here is that each group can use this opportunity to get feedback about their

design ideas and to iteratively refine their design as they head into part 2 of the project.

Part 2 - Design Alternatives

Due October 19
Weight: 12.5%

The key goal of part 2 of the project is to create multiple design alternatives for your product. The purpose of these design alternatives is for you to explore and illustrate the potential design space. Based on your experiences creating these designs, you should iterate on the requirements and usability criteria for your product.

In this part of the project you only need to provide mock-ups, scenarios, storyboards, and sketches of your interface designs. That is, you should provide pencil-and-paper or electronic images of the interface at various stages. You do not need to build a working prototype. However, your design sketches should be sufficiently detailed for a potential user to provide useful feedback about the design. Along with your design mock-ups, you should provide a brief narrative walk-through of how the system will work. You should also include your justifications for why design decisions were made, and what you consider to be the realtive strengths and weaknesses of your different designs.

Your project report should include all the explanatory material mentioned above as well as all the design sketches, drafts, storyboards, etc., that you generated. If some of your sketches are on paper, we will provide you with access to a scanner to scan in these images. Make sure that your report adequately reflects the design process that your group undertook.

More specifically, you should develop the following items in this part, and you should communicate them through your report:

- At least three interface designs (prototypes) illustrating some portion of your product. With each design you should include:
  - A rationale for this design choice.
  - Illustrations of the design (sketches, storyboards ...)
  - At least one scenario from an end-user's perspective.
  - An assessment of this design. This assessment should include feedback from potential
- An explanation for why you chose this set of designs to explore the potential designs.
- A summary of your modifications to your requirements specification and your usability criteria.

You should turn in a report using this template as a guideline for preparing the report.

As before, you will present your results in a poster session. In this session, you should aim to demonstrate the variety of the different storyboards that you explored and seek input from the gallery that will help you in determining how to narrow the design space for part 3.

Part 3 - System Prototype and Evaluation Plan

Due November 12
Weight: 12.5%

In part 3 of the project, your group will implement a detailed prototype of your product. In most cases you should use multiple presentations of this final prototype (storyboards, sketches, and functioning

computational artifacts) to illustrate your final design.

You should also write a detailed evaluation plan for your product utilizing multiple evaluation techniques that are tailored to evaluate your prototype against the requirements and usability criteria you earlier established.

You should include in your design description an assessment of your design that is substantially based on feedback from potential end-users. (Hint - one way to debug your evaluation plan is to test it on end-users). What aspects of your design "worked" and what failed to meet your specifications? If you had more time to work on the design, what would you now change and improve? Remember, no designer ever gets a system "just right." We will reward teams who honestly and carefully assess their design and who clearly provide a plan for its improvement.

More specifically, you should develop the following items in this part, and you should communicate them through your report:

- An overall description of your final design.
- Multiple prototypes illustrating various portions of your final design. With each prototype include:
  - Sufficient visual material to convey the prototype.
  - At least one scenario from an end-user's perspective.
  - An assessment of this aspect of your design. This assessment should include feedback from potential users.
- A detailed evaluation plan. You should indicate at least three separate evaluation exercises that will be performed on your final prototype, with a clear rationale for each exercise that explains which requirements and usabiility criteria that exercise is intended to validate.

You should turn in a report using this template as a guideline for preparing the report. As before, you will present your results in a poster session. Although your poster should focus your final design and evalaution, it should still tell a complete story.

Part 4 - Evaluation

Due November 30
Weight: 12.5%

In this final part of the project, you will provide a detailed evaluation of the prototype presented in part 3 and provide a summary of whether your prototype meets its design goals. You will conduct the evaluation planned in part 3 and report the results. No prototype will be perfect, so we will be looking for insights you gain in this stage that would feed into an improved design. More specifically, you should develop the following items in this part, your team must:

- Execute the three evaluation exercises proposed in the Part 3 deliverable Evaluation Plan for the project you have been assigned.
- Collect and analyze the results of your evaluations.
- Provide an overall assessment of your final design including areas for future work.
- Determine what changes to the new system are suggested by your evaluation.

Deliverable:

Use this template as a guideline for preparing the report.

Instead of having an informal poster session at this stage, we will have formal final presentations by each project during the final week of the semester. Here is an outline and description of what is expected in the final presentations.

Future Dining

Fall 1999
Project
Notebook

Design Alternatives

Contents

Project Description

Restaurant dining is a means for social interaction, relaxation, and nourishment. Besides providing a pleasant environment and good food, restaurants must make it easy for customers to order items that they will like in order to maximize the enjoyment of the dining experience. The goal of this project is to design a system that will improve users' dining experiences. Specifically, we want to make it easier for restaurant customers to make informed decisions about their selections, and secondarily the system should improve other aspects of the user's interaction including order accuracy and wait time. Because of international languages, religious constraints, health awareness and other needs, dining out can be a challenging experience. For these special needs, some customers require more information in order to make their dining experience more enjoyable. A new system which meets usability requirements and helps users accomplish the tasks currently performed in the existing system is necessary to achieve the goal of this project.

Requirements Summary

Through research of the existing system described in Part 1 of this project, the requirements for an alternate system were revealed. The main purpose of the system is accomplished by providing accurate and relevant information to the customer in a way that is easily accessible to him/her. system should provide a mechanism for multi-lingual support and internationally recognized symbols where possible. Most customers require item description and price. Beyond this basic information, the desired additional information varies widely. Consequently, only information that the customer is interested in should be visible so that the information does not overload the

customer. Additionally, it would be helpful to provide the information differently depending on the customer's preferences (e.g. nutrition, quantity, price, popularity, etc.). The new system should work with the existing system in order to make a smooth transition to the system possible. The system should reduce wait times or at least ensure fair wait times among all customers. Comment tracking with accurate order information should be possible which will be the source for menu information. The system should eliminate confusion of the customer's order. The system should provide a history of a customer's order and menu information preferences for his/her return visit. Although the project focus is on restaurant patrons, the system should also benefit restaurant staff, restaurant managers, and restaurant profits. There should be a decreased burden on wait staff to remember information. Also, users without certain skills may require assistance or an alternate interface.

Requirements Outline

1. Core requirements
    - A. Functional
        - i. Provide information about dining selections (name of item, price, description, picture, quantity, ingredients, nutrition information)
        - ii. Multilingual interface
        - iii. Allow ordering at any time during visit (drinks, appetizers, salad/soup, entrée, side orders, desert)
        - iv. Allow order changes
        - v. Allow special orders (standard selections (choice of bread), special selections (no onion))
    - B. Nonfunctional
        - i. Ease of use
            - a. intuitive interface
            - b. not cluttered (avoid information overload)
            - c. constrained actions - only allow actions that make sense
        - ii. Environment suitability
            - a. Aesthetics
            - b. Size/space requirements
            - c. Durability
            - d. Preservation of ambience (silent or relaxing sound)
        - iii. Performance
            - a. Fast response
            - b. Fast information retrieval
        - iv. Minimize communication errors and misunderstandings
        - v. Provide easy access to menu item information
2. Secondary requirements
    - A. Functional
        - i. Provide additional information about dining selections (popularity, preparation time, customer comments)
        - ii. Take Order
        - iii. Provide mechanism for choosing shared items, such as appetizers, that fit the tastes of multiple dining companions.
        - iv. Payment interface
        - v. Request feedback
        - vi. Allow customization of interface for personal taste
    - B. Nonfunctional
        - i. Ease of use (no instruction needed)
        - ii. Maintain traditional dining protocol
        - iii. Flexibility in uncommon situations
        - iv. Adaptability to unexpected situations

v. Multicultural interface
vi. Design for levels of familiarity with menu and jargon

Design Space

We feel it is important to remain as consistent as possible with the current protocol when introducing new technology into the dining environment. Our opinion is that the technology would not be accepted if the inconveniences associated with its adaptation did not outweigh the advantages it provided. Since many people we interviewed were satisfied with the current system, even small inconveniences without benefit associated with the introduction of a new technology may cause them to reject it.

We have considered varying several aspects of the design space, including the physical model, usage metaphor, and input/output methods. Natural language speech input, intelligent agents (both personalized and abstract), visual interfaces, and various combinations have all been considered.

INPUT

Natural Language input:

Natural language is the current method for ordering food and obtaining information in a restaurant environment. Thus, an ideal voice recognition system is appealing, since it does not change the way in which a customer makes queries and places orders. On the other hand, voice recognition is technically difficult and current implementations may not yet be accurate enough to be effective, particularly in a noisy environment such as a restaurant and with many unique users without system training. We feel that acceptable speech understanding in this domain may be possible in the near future, in large part because the set of words and phrases that the system would need to understand would be relatively small. The set of recognizable words and phrases would need only to include those associated with a specific restaurant, its menu items, and its available services.

Another reason for considering natural language speech recognition as an interface method is that the personal space at a traditional dining table is extremely limited and often cluttered with glasses, silverware, plates, and other items. A voice interface would not require any physical space, but may still be able to fulfill many of the design requirements.

Touch Screen/Pen-based input:

Touch screen or pen-based input is an attractive alternative for use in conjunction with a display. These input devices would not require any further space requirements other than, possibly, an electronic pen. The task of ordering food can be accomplished easily with this type of input device because the task has relatively few possible actions, such as choosing which item to order. All of these actions can be represented with display widgets such as buttons and menus. It would be possible to include common requests for specific information, such as nutritional and dietary information, in the set of actions afforded by the touch display. Uncommon and unusual requests would need to be handled by a waiter or waitress in the usual way.

Touch screen and pen-based displays require manual dexterity to use effectively. Therefore, the "clickable" objects must be large enough to successfully target with a low error rate. This will likely

increase the required size of the display. Touch screens and pen-based displays would also need to be cleaned with each use. In a restaurant environment, depending on the food being eaten, fingers and hands may become too dirty to make using a touch screen input device desirable.

Keyboard input:

A standard alphanumeric keyboard at a dining table would require a large portion of space. Alternative keyboards, such as chord and one-handed keyboards, are not common enough to assume the user is familiar with their use. Although standard keyboards afford making uncommon and unusual requests, we feel that requiring these requests to be explicitly typed is a significant inconvenience with respect to the current method. Furthermore, the technical problem of correctly interpreting these types of queries computationally still exists.

One possible implementation of a keyboard as an input device would be to design a special keyboard for the specific domain. The keyboard may have a button for each item that may be ordered, or type of information that may be requested. This approach would require additional physical space than the touch display. Additionally, keyboards suffer the same problem of becoming dirty as touch screen devices, but keyboards are much more difficult to clean.

OUTPUT

Visual Displays:

In the existing system, a visual display is used in the form of a paper menu to present information to a restaurant customer. We feel that a visual display is a necessary aspect for our design for several reasons. Primarily, it is a method for displaying the dynamic information that we wish to provide (i.e. menu items, cost, ingredients, etc.). Presenting this type of information in any other way would be either undesirable or impractical.

Presenting menu information entirely with audio is an alternative to using a visual display. The problem with this approach (and others such as smell, taste, or touch) is that it does not allow for the information to be easily preserved or remembered, and it does not allow easy simultaneous comparison. A menu normally provides more than the five to nine chunks of information that can be stored in short term memory, and we wish to add to the amount of available information. Therefore, the output interface must hold output as an aid to the user's short-term memory. A visual display does this nicely since information is permanent with respect to time, and a user can access information again simply by changing their focus of attention.

One problem with visual displays is that they require a relatively large amount of space. At a dining table in a restaurant, space is extremely limited. Therefore we have considered a number of unique ways to vary the physical model and position of the display. We have considered mounting the display within the table; below, next to, and behind the plate; and another in which the display moves out from the table in front of the user. We have also considered placing the display next to the user on a stand or embedded in a wall.

Portable displays have been considered as well. The ideal version of a portable display would be a handheld thin flat panel display with similar physical characteristics as a traditional menu. This display could easily replace a paper menu without a dramatic effect on the current environment. A portable display could be removed from the table to provide more room for the food when the customer is ready to eat. Unfortunately if the display is the only interface, the user is then left with no other method to request additional items or help after the display has been removed. Another alternative is to provide a place to store the portable display at the table.

Small displays, only a few inches diagonal, have been considered as well. These displays are not as useful for displaying general menu information. However, they could be used in conjunction with a traditional paper menu to display only supplemental information that results from a query or to represent an intelligent agent.

Audio/Speech Output:

Because the personal space at a traditional dining table is extremely limited and often cluttered with glasses, silverware, plates, and other items, we have seriously considered natural language speech as an interface method. It was previously mentioned that audio alone would not be able to meet our requirements for allowing information to be easily retrieved. However, audio, specifically speech, may be used as a supplemental form of output. Text to speech synthesis is easily implemented with current technology. A speech output device may be convenient when making simple queries, such as "Does this item come with a salad?" or "How spicy is the curried chicken?"

One problem, with audio output is that it must be loud enough to be clearly understood by the person making a query. This could become a problem if multiple requests are made simultaneously. A solution to this would be to limit the number of speech output devices to one per table. Another problem with speech output is that a response might interrupt a conversation that was taking place at the table.

DESIGN METAPHOR

Intelligent Agent

Intelligent agents are another variation of the design space. The concept of an agent provides a metaphor that easily maps to the concept of a waiter or waitress. In fact, an intelligent agent can directly replace the functionality of the waiter or waitress in a restaurant with the exception of bringing physical items to the table. The metaphor is most easily understood when the agent is personalized. This normally implies that the agent is given a face with various expressions. This concept would also be best used with a voice interface, although other interfaces such as text could be used.

One pitfall to using an agent as a design metaphor is that the metaphor suggests the agent is able to perform more actions than it actually can. Until artificial intelligence techniques and our understanding of cognitive processes improve dramatically, the set of actions that the computerized agent can perform is a subset of the set of actions that an actual human can perform. If the agent is unable to correctly respond to a query, users can become frustrated and begin to dislike the agent. Therefore, a design using the agent metaphor must either effectively communicate to the user the limitations of the agent's abilities and understanding, in order to prevent users from making bad requests, or restrict such requests from being made. Communicating the limitations of the agent to the users in our specified user profile would be exceedingly difficult since we have chosen to design for a user population with a wide range of technical abilities. Furthermore, restricting the users ability to make bad requests would not be possible with a natural language interface, as we cannot prevent the user from saying what they wish.

Web Store

One usage metaphor that can be used in conjunction with a visual display to model ordering food a restaurant is the idea of purchasing products online. This is a rather new metaphor, but more and more people are using the Internet for shopping and thus becoming familiar with the idea of

purchasing items through a visual display using menus and buttons. Online shopping commonly uses another metaphor of shopping in an actual store, where items are placed in a virtual shopping cart. We can modify this metaphor to better support the concept of ordering food in a restaurant substituting a plate, table, or cooking pan for the shopping cart.

Food Preparation

A variation of the web store metaphor is a cooking metaphor. Using this metaphor, customers can drag the items they wish to eat onto a virtual cooking pan or chopping block, as if they were assembling the ingredients to be prepared themselves. Although this method is unlike the traditional system, it provides a more natural interface for certain actions.

Interface Designs

In the next section three designs are described. The designs were chosen to reflect the viable options of the design space. Although the focus for each design is on the metaphor, the features and physical models can be interchanged for the most part, but they have been fixed in order to give a more concrete example of the design.

Interface Design A -- Food preparation metaphor

Description

This design focuses on giving the user the ability to specify what he/she wants, how he/she wants it. In this design, the user builds his/her meal in a virtual workspace. The meal is then prepared and delivered by restaurant staff. The physical device is a flat screen display unit with pen input. The display is driven by a networked computer, which would be running a web browser type application.

In its fullest degree, the user would be able to select raw ingredients from a vast virtual market. The user would then drag ingredients onto preparation surfaces and specify preparation details. Implementation is limited by the ability of the kitchen to produce custom meals in a short period of time, so realistically, the user would select a menu item and be able to work with a limited set of ingredients relative to that item. For some items the user will be able to specify how it is cooked in both degree and type (fried, baked, boiled, well-done, dark, light, etc.). An easy example is selecting pizza toppings by dragging them onto a virtual pizza. Another example is a pasta restaurant featuring a create-your-own pasta dish allowing different pastas, sauces, meats, and cheeses. For this design illustration, a create-your-own stir-fry example will be used.

Rationale

In this design users are empowered to use their imagination and try their own creations. A traditional menu limits the user's ability to alter selections. Rather than immitate the existing system, this design exploits the functionality that is possible with a computer interface. In this case the human computer interaction can provide more information than telling a waiter/waitress a few words about what is desired.

The desired information is displayed on the screen. The interface remains at the table, and it is always available for more information and additional ordering. Since this design focuses on giving the user the ability to specify exactly what they want, special orders are certainly accommodated. Although a computer literate user would be able to use the system with little or no assistance, a non-technical user would require some assistance. This interface gives the user both the ability to give a detailed specification, and it gives the user feedback about what the result will look like, how it will taste (spiciness, sweetness, ...), and how nutritious it will be.

Design Illustrations

Although the physical interface could be any graphical display system with a pointing device, a table mounted device with a pen input was chosen for this design (see Fig. A.1). The device uses a flat video display that slides out from underneath the table and then tilts up to a 30 degree angle with the table. In this design additional table space is not required. An attached pen serves as the pointing device. It also replaces keyboard input using handwriting recognition.

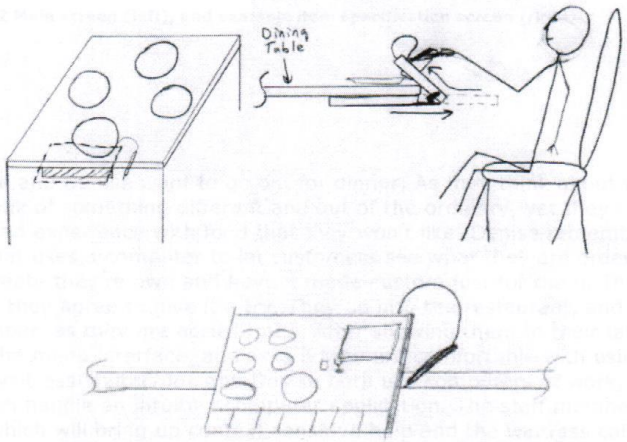


Figure A.1. The physical design.

The visual user interface is graphical, with a toolbar at bottom of the screen (always visible and functional, unless modal dialog is active which must be answered). Users begin with a table workspace with empty dishes as placeholders or icons with which to make selections (Fig. A.2). The user selects items on the table in order to explore options. The user then makes a selection from a submenu. For selections labeled "Create-Your-Own," the user is able to modify the selection in a food development environment (Fig A.2). The development environment allows the user to work with a limited set of ingredients relative to that item. For some items the user can specify how it is cooked in both degree and type (fried, baked, boiled, well-done, dark, light, etc.).

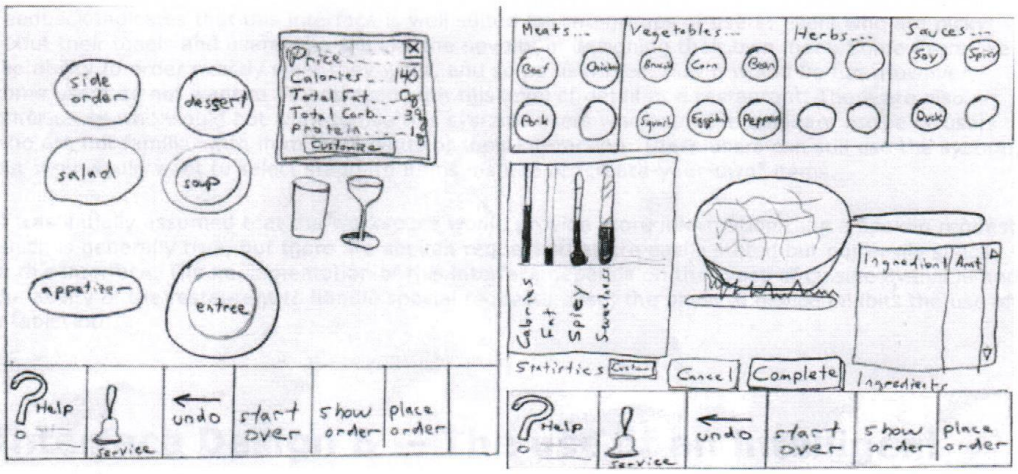


Figure A.2 Main screen (left), and example item specification screen (right).

Design Scenario

It's a Friday night, and Joe and Denise want to go out for dinner. As they think about where they want to go, they try to think of something different and out of the ordinary, yet they want to be cautious about having a bad experience with food that they won't like. Denise remembers hearing about a new restaurant that uses a computer to let customers see what they are ordering and even give them the ability to create they're own and have it made custom just for them. This sounds both exciting and safe, so they agree to give it a try. They go into the restaurant, and are seated by a restaurant staff member, as they are accustomed. After showing them to their table, the staff member directs them to the menu interface, and asks if they are comfortable with using the device or if they would prefer a waitress/waiter. Joe and Denise both use computers at work, and they feel confident that they can handle an intuitive computer application. The staff member directs them to the help button which will bring up context sensitive help and the waitress call button. They look at the display and make their selections. Denise, who knows what she wants in her meal, selects the create-your-own stir-fry. She is asked if she would like to start with the standard recipe and then modify it. She chooses to work from scratch. An empty wok appears with ingredient bins surrounding the wok. She likes lots of baby corn and water chestnuts in her stir-fry, and she is able to get everything just the way she wants it. Joe, who is not familiar with what ingredients he wants, picks the standard items and never leaves the main ordering screen.

Potential problems

The power and flexibility of this interface come at the cost of complexity. With many features it becomes more difficult to make all of them intuitive. The complications involved in designing the item might require the user to experiment or ask for assistance. If the user is not familiar with GUI's, unlike Joe and Denise, then the user may become frustrated with the system.

Design Assessment

Feedback indicates that this interface is well suited for two groups of users: users who are picky about their meals and users who will like the novelty of designing their own meal. Some users like the ability to order exactly what they want, and some users feel that it would be fun. However, some users do not want to be bothered with this level of detail at a restaurant. There are also other users who would not want to use this system: users who want the standard recipe or users who are not familiar with item ingredients or their interaction. These users can still use the system, but they would want to select standard items instead of "create-your-own" items.

It was initially assumed that the workspace would provide more information than a spoken request, which is generally true, but there are spoken requests that are easily stated but not easily specify in this interface. The implementation of this interface depends on the types of cuisine available and the ability of the restaurant to handle special requests. Also, the physical device inhibits the use of a tablecloth.

Interface Design B — The use of an intelligent agent

Description

This system entails the use of an intelligent agent to help with the ordering process. This system doesn't totally eliminate certain aspects of the traditional setting; the customer can still order when ready, the paper-based menu is still used, and the waiter/waitress still brings the order. Along with those aspects, this particular system adds an additional feature. It provides an intelligent waitress who is at the table at all times!

The purpose of the intelligent waitress is to supplement customers with readily available help. This system is automated through automatic speech recognition, allowing customers to ask the intelligent waitress questions, and she provides a response to their inquiries. When the customer is ready, she/he can place the order via the intelligent waitress. The agent's response may be audible or inaudible because the user is provided with a mute option. Once this option is selected, the responses to each query are in a textual form.

The interface for this intelligent waitress consists of a very small, unobtrusive display which can sit in the center of the table or on the end of the table. A visual representation of the waitress is present on the display, and there are only four buttons: activate, mute, help, volume up and volume down (one button). Pressing activate while the system is off activates the system, while pressing activate while the system is on turns the system off. When the system is off, the agent cannot hear the customer. The agent can only hear the customer while the system is in the activated or on state. The text screen is always on and is used to display advertisements when the system is off. Mute, volume up and volume down control the volume level of the system — none, higher, or lower. The main purpose of the mute button is to minimize the number of interruptions when customers are conversing. The agent can still hear the customer's query when mute is selected and respond. (See Figure 1.)

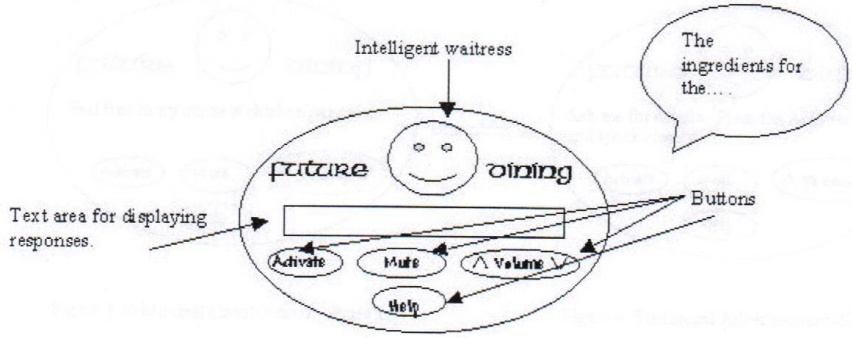


Figure 1: The 'intelligent waitress'

While the system is deactivated, continuous messages appear on the screen. These messages provide visual cues to the customers. For example, a message will be used as a signal to the customer to make inquiries by pressing activate (See Figure 2). Other messages can be used as advertisements for the restaurant. (See Figure 3 and Figure 4). Status messages will also be included. Pressing the mute button produces the status message in Figure 5 and pressing volume up or volume down produces a status message in the form of status bars — the more status bars, the higher the volume. (See Figure 6) Other messages may include error messages. If an invalid query is made or if the person's query is inaudible an error message may be similar to Figure 7.

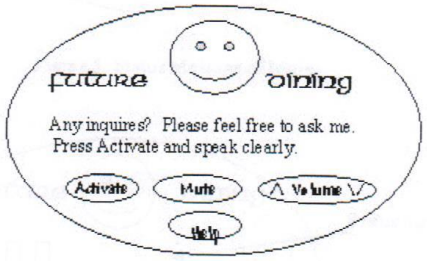


Figure 2: Visual cue to make an inquiry

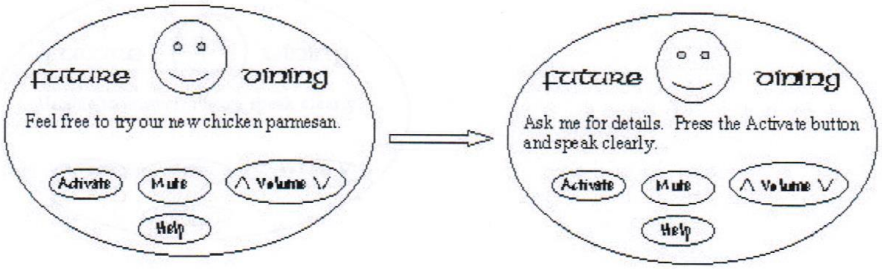


Figure 3: Subliminal advertisement – Screen 1

Figure 4: Subliminal Advertisement -Screen 2

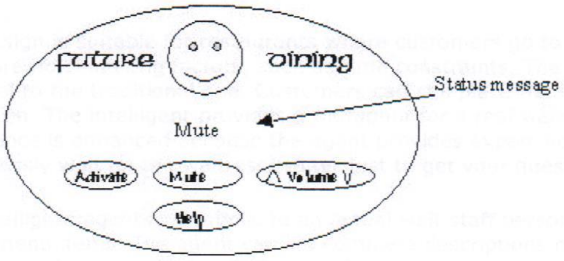


Figure 5: Status Message of Mute

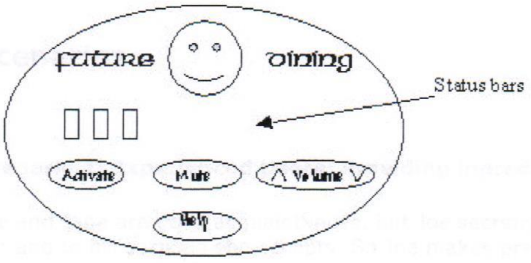


Figure 6: Status Bars for Volume Buttons

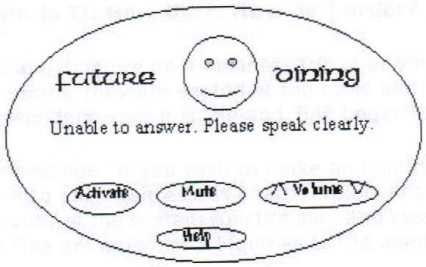


Figure 7: Error message

Rationale

This design is suitable for restaurants where customers go to enjoy the dining experience or where there are no delimiting factors, such as time constraints. The dining experience will be almost identical to the traditional one. Customers can still place the order when ready and they are still waited on. The intelligent provides a metaphor for a real waitress/waiter. Overall, the dining experience is enhanced because the agent provides expert help on menu dishes. There is no need to endlessly wait on the waitress/waiter just to get your questions answered.

The intelligent agent is symbolic to an actual wait staff person. The agent is very knowledgeable about menu items. The agent can list complete descriptions of ingredients and nutritional information for menu items of interest. The agent can also list the prices of items and specials of the day. The person has the option to mute the agent or turn it off. This option allows answers to appear in a textual format and is useful for minimizing interruptions of conversations.

Scenarios

Scenario 1: Experienced Users: Providing ingredients and nutritional information

Joe and Jane are good acquaintances, but Joe secretly has a crush on Jane. He decides to ask her out and to his surprise she accepts. So Joe makes preparation to take Jane to a restaurant that they both frequent. This will be a great opportunity for them to become acquainted.

Joe and Jane are somewhat picky eaters. Joe is allergic to any product with peanuts in it, and Jane is on a diet, so she is avoiding food containing high levels of cholesterol and sugar. They begin to browse through the menu. Joe has to make inquiries about items of interest, to make sure that they don't contain any byproduct of peanuts. Since they are familiar with the system, they know exactly what questions that the system is capable of answering. Therefore, he asks the agent for a list of ingredients. Now he is able to make a decision.

Jane makes a decision. Joe is aware of her diet and warns her that the item has little fat, but a lot of sugar. She doesn't really want to rely on his word alone. Therefore, she makes an inquiry to the intelligent waitress. The agent then provides her with the nutritional information on the specified menu item.

Scenario II: New User: How do I order?

Fred and Tina are on a business trip in another city from which they live. When they arrive at the restaurant, they are seated at the table and handed a menu. Fred notices this display on the table and wonders what it is. He and Tina began to analyze the display.

The message "If you wish to make an inquiry or if you wish to place your order, press activate and speak to your waitress" is heard. Fred is hesitant, so he presses help. The help option gives a brief overview of the system functionality and clearly specifies all the actions that he can make. Now he and Tina are able direct inquiries to the agent and place their order.

Assessment

This design proposes some advantages as well as disadvantages. This interface provides an intelligent waitress who is a metaphorical model of a human one. The agent and customer carry on normal interactions found in a traditional restaurant setting. The agent has vast knowledge on menu items, takes orders for customers, and answers other various questions. Since this design provides a dining experience that is very similar to the traditional one, the user may be more susceptible to it.

In addition, this design is compact, taking up minimal space on the table. This design should be very easy to use. There are only four buttons on this tool, which are self-explanatory. The visual cues and status messages will also assist customers when using the system.

Since the given technology is not fully developed, this design also poses some major disadvantages. First of all, ASR is hard to do given things like speech impediments and unrecognized sounds or words. Secondly, there is always the issue about whether the users are going to be comfortable with this technology or not. The set of recognizable words and phrases would need only to include those associated with a specific restaurant, its menu items, and its available services. However, limited vocabulary and context would not provide a rich communication.

Another problem that arises is related to language constraints. The language used in a system of this sort system is usually limited to promote precision. The issue of handling bad input arises. The wording of queries may be ambiguous and the agent may not be able to respond. The user could then try to rephrase the inquiry, but what is the correct way to phrase it? How is that determined? This factor differs from culture to culture. If the customers do not know how to word the query so that the system can understand, the user may get very frustrated and may not wish to use the system. Lastly, in keeping with functional requirements, it is too difficult to encode different languages and to customize it to every environment. Within every language there are different dialects that would have to be considered.

Another point to consider when using this technology, is how will the agent know when it is being spoken to? What degree of intelligence would be sufficient for the agent in a restaurant setting? Will the agent be able to make jokes and carry on regular conversations with the customers? If so, what level of interaction is sufficient? Too much interaction may annoy the customers, while too little interaction may yield a feeling of neglect and non-hospitality amongst customers.

Lastly, as with all of our design options, this system will be expensive to implement. Also to a lot of people the waiter/waitress is indispensable. Some are not ready to replace the waitress/waiter.

Interface Design C — Handheld Electronic Menu

Description:

Physical:

This interface uses a flat-screen hand held device as a display unit and a pen-like input device to interact with the screen. The device is in color and of the size of a palm pilot or a digital diary. It is light in weight and easily manageable. There is one set of display and screen per person on the table. The device is necessarily of dimensions and weight so that it can be held and operated in the hand. It can be put away when not in use.

There is a slot for scanning the credit card.

Technology:

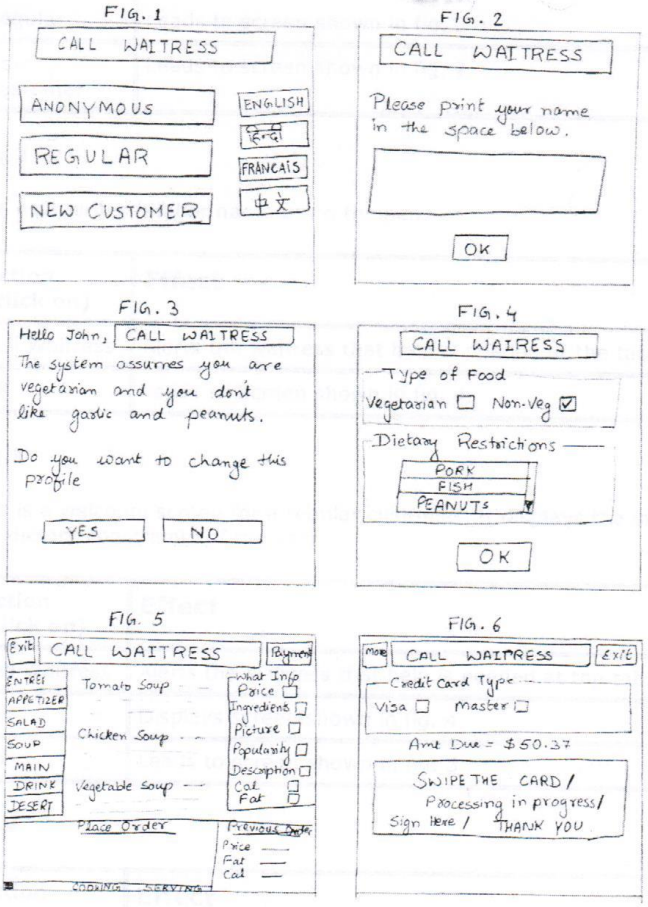
It makes use of direct manipulation principle for interaction. The objects on the screen can be manipulated using the pen and its effect is instantaneously visible to the user.

User can navigate through series of screens using pen as a pointing device. The pen can also be used to write. Pen also supports pick and drop technology i.e. objects can be picked from the screen and dropped somewhere on the screen.

It supports the following functionalities:

1. Displays desired information like price, ingredients, nutritional value etc. about the menu items.
2. Allows the user to place orders.
3. Allows the users to modify orders up to certain period of time i.e. till the order is being worked upon by the cook.
4. Shows the status of their order i.e. is cooking, or is being served etc.
5. Keeps history regarding dietary constraints of the users if desired.
6. Allows the users to call waiter/waitress.
7. Allows making payments using the credit card.

Design Illustrations and Functional Overview:



The first screen that is displayed on the device is shown in fig.1.

Fig.1

Action (click on)	**Effect**
Call Waitress	Alerts the waitress that help is needed at the table.
Any of the language buttons (eg. French)	Change the font of current and subsequent screen to the font of the button clicked on. (eg. The font is changed to French characters)
Anonymous	Displays screen shown in fig. 4

Regular	Leads to screen shown in fig. 3
New Customer	Leads to screen shown in fig. 2

Fig.2

The user writes his/her name using the pen.

Action (click on)	Effect
Call Waitress	Alerts the waitress that help is needed at the table.
OK	Leads to Screen shown in fig. 4.

Fig.3

This is a welcome screen for a regular customer. It displays the information that is stored about the dietary constraints of the user.

Action (click on)	Effect
Call Waitress	Alerts the waitress that help is needed at the table.
Yes	Displays screen shown in fig. 4
No	Leads to screen shown in fig. 5

Fig.4

Action (click on)	Effect
Call Waitress	Alerts the waitress that help is needed at the table.
Vegetarian check box	Only display food in subsequent menu list that is vegetarian and shows dishes in a gray colour that can be made vegetarian by replacing/removing an ingredient.
Non-Veg check box	Displays all the menu items vegetarian as well as non vegetarian.
Items in Dietary Restrictions combo box	Only displays food that does not contain the selected items in the combo box and shows dishes in a gray colour that can be made without that ingredient if desired.
OK	Leads to screen shown in fig. 5

Fig.5

Action (click on)	Effect
Call Waitress	Alerts the waitress that help is needed at the table.
Entrée, Appetizer, Desert etc.	Only display food in menu list that belongs to the chosen category.
Price, ingredient, nutrition etc.	Displays only the desired information about the items.
Ingredients	This will bring a drop down list of items that the ingredient can be replaced with, user can choose from that list. In case of ingredients like salt and pepper, a slider appears to select how spicy dish the user desires.
Make Payments	Leads to screen shown in fig.6

Other activities that can be performed on this screen are:

To **place an order**, click on the item name and drop it in the place order window.

The grayed out items can also be chosen and will be made according to the dietary constraints.

To **cancel the order**, pick the item from place order window.

Fig.6

Action (click on)	Effect
Call Waitress	Alerts the waitress that help is needed at the table.
Credit card type check boxes	System assumes that user is using that credit card to make payments. It asks user to swipe the card through the slot in the device.
Swipe the credit card	Prompts to sign on the screen using the pen.
Sign on the screen	If transaction is done, displays THANKS else displays the problem and promts to redo the procedure of payment.

Rationale

The design is best suited for regular customers as their records are stored in the system. The items displayed are according to their desire, and it makes the dining experience hassle free. The design suits the environment as it allows the users to interact easily with very little navigation. It supports

all of the core requirements. Because there is no audio interaction, it does not interfere with the normal conversation between the restaurant customers. It is also flexible, when not in use the waiter/waitress can take it away, and other customers can use it. This reduces the number of devices that are required in a restaurant. It also allows the users to view the status of their order and can let them edit their menu if the cook has not yet started working on it (if device left at the table). It also allows the users to customize the dishes as they desire by choosing the ingredients and spice level. It allows the users to make payments using credit cards, which is faster and safer than the current method. The time of payment is also a perfect opportunity to request feedback.

Design Scenario

Scenario I

A computer literate Chinese person goes to the restaurant for the first time:

Hao goes to the restaurant, after being seated he sees the wonderful looking interface on the table. He is not very comfortable with English. He sees a button labeled "Chinese" in Chinese. He is happy to see this, and he clicks on it. The whole screen is now converted to Chinese.

He goes through the labels on the interface and gets an idea of what to do with it. He clicks on the OK button; the next screen comes up with all the items. He is interested in knowing a detailed description, a picture and the nutritional value of each item besides the price and name. He checks the corresponding check boxes and gets the desired information. He picks the items he wants to order and drops them on the order window. He now waits for the food; the status of his order is visible in the time line at the top. After eating, he goes to the payment screen, makes payment with his credit card and leaves the restaurant after a pleasant dining experience.

Scenario II

A regular customer of the restaurant:

John is a regular customer of the restaurant. He is a vegetarian and is allergic to garlic. He hates peanuts and does not like Soya sauce on his food. He has this information already in the system. After being seated, he presses the button "Regular Customer," and the system only displays vegetarian items not having garlic, peanuts and Soya sauce. He picks the items to order and drops them in the order window. After having his food, as he wants to make payment by cash, he presses the button "CALL WAITRESS". The waitress comes; he makes the payment and leaves the restaurant.

Scenario III

Mary, a middle aged woman, goes to the restaurant for the first time:

She is not very comfortable with the technology. She sees the screen and does not know what to do with it. She sees the button labeled "Call Waitress". She selects it, and the waitress comes and helps her with placing the order.

Design Assessment:

Limitations:

1. It requires some familiarity with technology. Initial learning may require some time.
2. As the device needs to be hand held, the display screen needs to be small, hence only small

number of items can be visible at a time on the screen. Further, it requires a fair amount of concentration to work with the device.
3. If the waitress takes away the device, she needs to be called and asked for the device to place further orders. This can be overcome by keeping the device with the customer till he/she is done with it.
4. If something is spilled or dropped on the screen or the screen is touched with greasy hands, the hardware must be robust enough to work.

Feedback:

1. The ideas of keeping records and instantaneous payment were appreciated.
2. The display of nutritional information and popularity of dishes were liked by most of the people.
3. People were hesitant about the abrupt change in the restaurant dining experience and suggested that there should be a smooth transition, meaning allowing both options of waiter/waitress and the display.
4. Some people thought that it could still be a supplement of traditional paper menu as for the person with no dietary constraint; he would prefer to see all the items at a glance, which is limited by the size of the screen.
5. People also suggested that instead of asking people about their being vegetarian or non-vegetarian, another option could be to ask their cultural background and frame further questions accordingly.

Changes to requirements and usability criteria

We did not find new requirements, but the challenges involved with meeting the requirements are more apparent. Providing a multilingual interface is not as difficult as designing a multicultural interface. A multicultural design entails much more than translation and string substitution.

For usability criteria, the key concerns have been narrowed down to aspects of learnability and robustness. Specifically, for learnability the system must provide promote *visibility* through clearly visible controls to promote system functionality. Each control function must be easily identifiable. The system must provide visual cues, reminders, lists of choices, detailed descriptions, and other aid, either automatically or on request. This will help to eliminate the opportunity for user error and confusion. These cues will aid the user in recognizing the system upon arrival to the restaurant. Specifically, for robustness the current state and the possible action for that state should be straightforward. The system must anticipate and recognize user goals, and assistance should be provided if needed. The system must be *responsive:* user requests must be fulfilled. The system must help the user correct "slips."

RGA Project Part 3

Project Description

Dining away from home is a common experience in this age of convenience and many people make the decision to eat at a restaurant when they are already out in the community. These people are in what we define as a mobile environment, in transit and away from their home, office, and any personally established location. They are in a unique situation in terms of dining in a restaurant because there is currently not a well-designed system available to find a restaurant while in a mobile environment. We seek to support the tasks of finding a restaurant in terms of gaining information based on certain criteria, selecting a restaurant based on this information, identifying additional information about the restaurant (for example menu items), establishing the directions to this restaurant from the present mobile location, and actually physically finding the restaurant. This system will be aimed at a user population which is of a variety of ages, but which is familiar with the concept of finding a restaurant in both novel and familiar environments. More specifically, it will focus on a population with vision and mobile capabilities, who are experienced with the use of a PDA, and who are most likely college students or business professionals.

Design Summary

The design space for our potential interfaces is all somewhat similar in that they are all mobile. The nature of our problem demands the solutions be mobile ones. Our problem is to find an effective manner for users to search for restaurants in a familiar and possible unfamiliar mobile environment. The design space of our interfaces could be a user walking down the street, a user driving in an unfamiliar or familiar area, or in any number of situations where the user finds himself away from conventional computer-based or paper-based methods of finding a restaurant.

Based on a number of observations we arrived at a final design that centered around a mobile platform, specifically utilizing a PDA. In the previous part of this project, we proposed three separate prototypes. One was a voice-activated system that allowed the user hands-free access to a limited amount of information. This small amount of information was needed to keep the mental demands on the user to a minimum. We also proposed a system that would work solely with groups. This system would attempt to find a agreement point for a disagreeing group in a restaurant finding situation. The problems with these systems are listed in detail in section two of this project.

Thus, we decided to use most of our third proposed prototype, which was a restaurant finder interface on a PDA. In the end, we chose to use a large majority of the pieces of the PDA prototype because of its ease of use, ease of production, and most importantly its vast mobility. Additionally, upon examination, this prototype best adhered to the usability principles that we considered to be of import- familiarity, recoverability, and customizability. The PDA prototype was the one that allowed us the greatest ease in accomplishing these goals. It is clearly mobile, it draws from experience using PDA interfaces and Internet restaurant search pages, and thus, is familiar to users, based on the design allows for ease of recovery with back buttons, and is customizable as well.

epresentation A - Physical Model

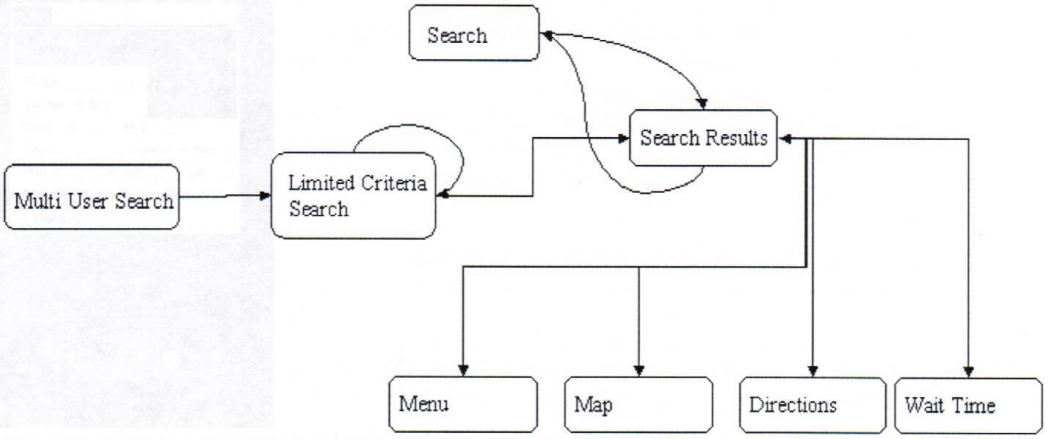
The physical model for this project is a handheld device. For practical purposes it makes sense to use a device that the user would already have instead of making a dedicated device. Our user group was decided to be that of college students and business people, these two groups are already users of PDA's and so the learning curve will not be too great. The basic device will consist of a PalmOS based handheld:

This device may be expanded for additional functionality to be provided. The two options for expansion are GPS locator and/or a wireless internet connection. Examples of these two are below:

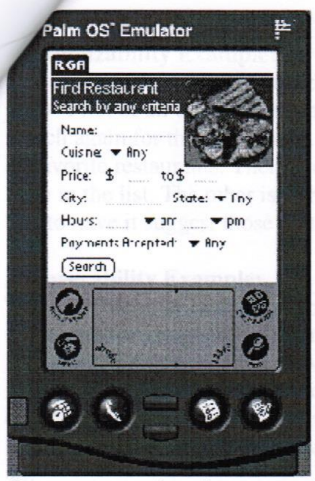
These examples show what the system will look like and it is most practical on a general purpose device. For this reason, the choices are limited to Palm or WinCE devices and we choose the Palm for ease of use and compact form factor.

Representation B - Storyboard of Overall Functionality

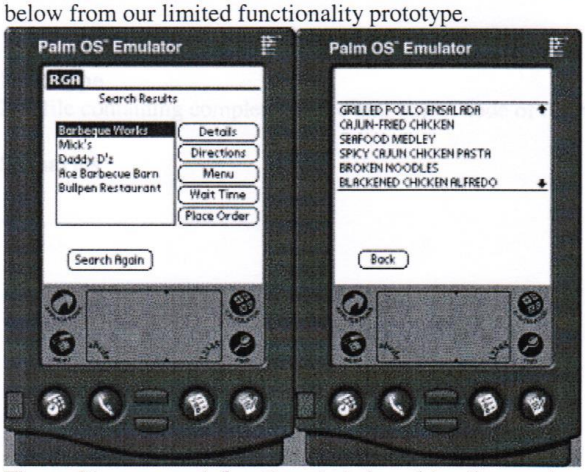
Explanation of State Diagram:



The basic flow of control for the Restaurant Finder is described in the state diagram displayed above. It has two main start states, one for the single user (or at least the mode where the system assumes a single user) and the multiuser mode. The single user mode goes to a search screen that allows the user to specify search criteria for a restaurant. These criteria are cuisine type, name, price, location, hours, and payments accepted. The location field allows two options for specifying the location, one which is based upon your current location and is determined via GPS or wireless internet connection. The other option is to specify a destination location if where the user wishes to eat is not the same as where they currently are.



Once a user makes the appropriate selections the system consults its database of restaurants and presents a list of the top choices that meet the selection criteria. This list has a group of buttons to its right, these buttons present the following options that the user can perform on any restaurant. These include getting menu options, directions to the restaurant, a map to the restaurant, and wait times for the restaurant. To view these details the user selects the appropriate restaurant and the selects the option which they wish to see. In each of these submenus there will be appropriate options for both going to the next restaurant detail screen and to also go to the next restaurant. This will allow the user to go the menu choices and quickly scan through a group of restaurant choices. This functionality for ease of switching between restaurants is not shown in the screenshots below from our limited functionality prototype.



The multi user search function starts by asking the user how many users wish to give recommendations for the restaurant and what the location to search is. The location field can be filled out as above, either by the current location or by the destination. The multi user screen then goes to the search criteria screen for the first user. This search screen is much simpler than that of the single user search, which is to make the possible choices a bit more limited to assist in making an accurate choice. All the user is allowed to select are first and second choices for cuisines. The user then presses next and hands it to the next user. Once all the users have entered their options the system goes to the same search results screen as the single user mode.

At every point in this system the user can go to the state directly previous to the one it is at to allow it to recover from mistakes.

Customizability Example:
The user is allowed to customize the application to suite their personal needs. This is accomplished in several ways. First of all the application can remember the most recent searches assuming that the user may wish to search again for the same thing. The other way in which the user can customize the interface is through the list of favorite restaurants. There are two ways to populate this list, one is by selecting restaurants that you wish to have in the list. The other is to have the system to make some guesses by the types of searches you perform and to have it suggest those that it believes the user will like the most.

Recoverability Example:
The recoverability of the system is very important since in a mobile environment the user is forced to use more awkward methods of input and so getting the input right and not having to reenter information is very important. This application provides for recoverability through the use of back buttons throughout the interface. This allows the user to easily move around the menu system and not to have to start from scratch each and every time. This is particularly useful in the search results screen, where if you press back it will return you to the search screen with your current criteria filled in so that you can refine it without reentering it all.

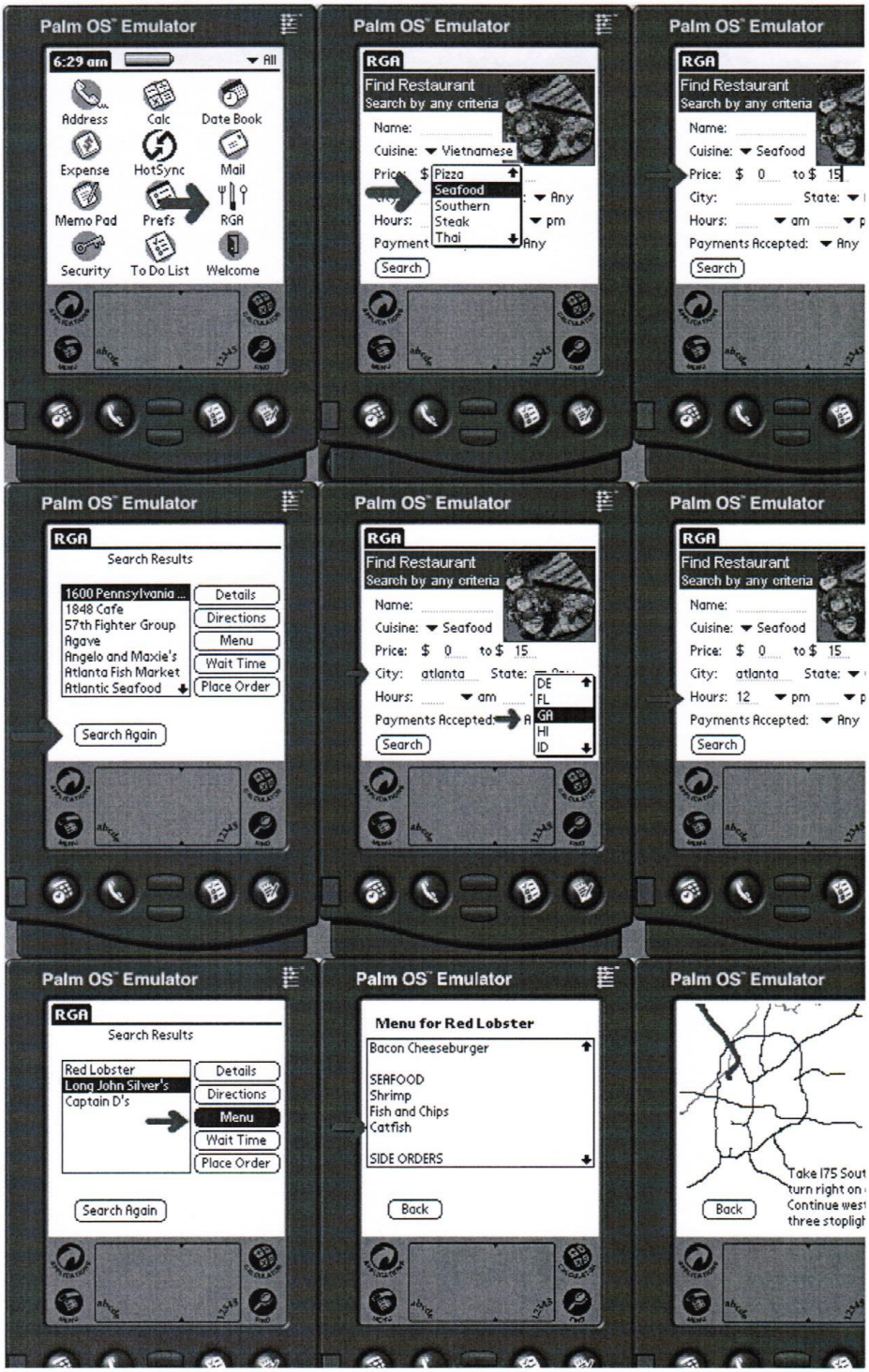
Familiarity Example:
The main search interface is modeled after the web based form structure that is the basis for most of the web based restaurant guides. It provides a group of fields that you can enter any combination of inputs to produce a search.

Representation C - Limited Scope Functional Prototype

Prototype
ZIP file containing complete source and object code of the restaurant finder application: RGA_dev.zip

Scenarios

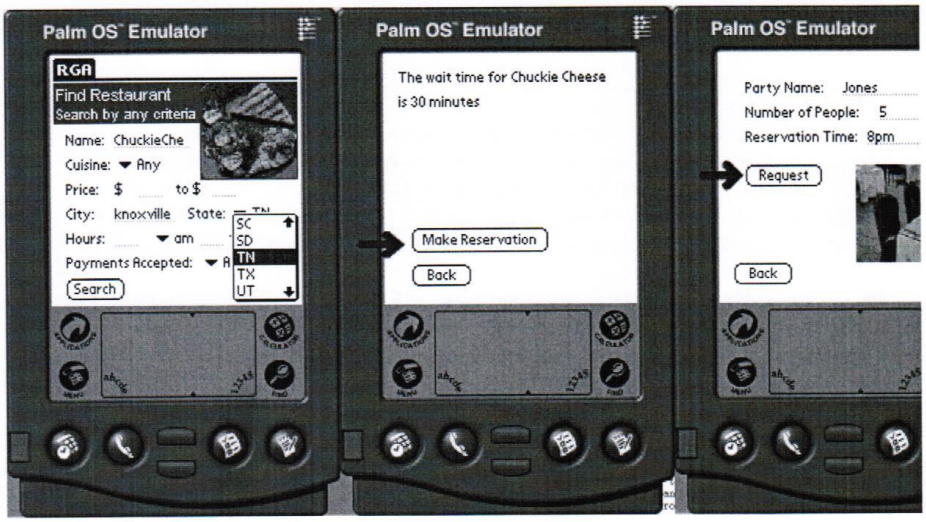
Mr. Smith decides that he wants seafood for lunch, but does not want to spend too much money, since he is saving his money to buy his family very nice Christmas presents. Therefore, Mr. Smith selects "Seafood" from the drop-down list of cuisines. Then he clicks on the first field in Price and enters "0" and clicks on the second field and enters "15." Mr. Smith clicks on the "Search" button, and the restaurant finder application brings back a list of 100 results. Having no time to scroll through all these results, Mr. Smith presses "Search Again," which takes him back to the search screen. Mr. Smith's original search criteria are preserved, so



clicks on the city text field and enters "Atlanta" and selects "GA" from the state drop-down list. Mr. Smith also realizes that it is only noon, and many of the seafood restaurants in the area do not open until 5pm. After realizing this fact, Mr. Smith clicks on the first text field of hours and enters "12" and selects "pm" from the pop-up box adjacent to it. Mr. Smith clicks "Search", and the application brings back three results: Long John Silver's, Captain D's, and Red Lobster. Mr. Smith feels like he is really in the mood for catfish, so he wants to make sure that it is available at the restaurant that he selects. He selects Long

n Silver's from the list, and clicks the "Menu" button the right. Mr. Smith browses through the menu, but catfish is not listed. He clicks "Back", selects Red Lobster, and clicks "Menu". This time Mr. Smith finds catfish on the menu. He clicks "Wait Time" to view the current waiting time, which is 30 minutes. Mr. Smith knows that he will never be able to make it back to work in time if he has to wait that long, so he clicks "Back", selects Captain D's, and finds catfish on the menu. He proceeds to click the "Directions" button to get driving directions to the restaurant. The application displays the map, and Mr. Smith jots down the textual driving

rections. Mr. Smith then closes the application and his Palm device, and drives to Captain D's.



Mr. Jones and his wife has decided to throw a birthday party at Chuckie Cheese for their son's tenth birthday one night. The parents know that the restaurant is usually busy on Saturday night, so Mrs. Jones starts the restaurant finder application on her Palm device. On the search screen, she enters "Chuckie Cheese" in the name field and enters "Knoxville" as the city and selects "TN" from the state drop-down list. She then clicks "Search" and the application returns the expected restaurant for the birthday party. She clicks on

Wait Time" and sees that there is a one hour wait. They want to have the party at 8pm, so Mrs. Jones clicks "Make Reservations." Mrs. Jones enters 8pm as the reservation time, and enters 5 for the number of people, since she knows that her sons wants to invite two of his friends to his party. Mrs. Jones then exits the restaurant finder application, and the parents are assured that their child's birthday will not be ruined due to long wait times.

Detailed evaluation plan

Evaluation A - Cooperative Evaluation

Usability Criteria Addressed

Performing a cooperative evaluation on the Limited Scope Functional Prototype will address the usability criteria of familiarity, recoverability, and potentially customizability. Since it is an observational technique, in which an end-user performs a task typical for the system, it will be possible for them to comment on how easy it is to learn the system based on similarities to existing systems (familiarity), to observe unintended actions and the ease with which they can be corrected (recoverability), and it will be possible to question the user about potential shortcuts that could be developed for experienced users (customizability). However, to

form this technique several inputs are necessary.

Inputs Required
To perform a cooperative evaluation it is necessary to identify the task that is to be performed by end-users. In this case, the task will be to search for a restaurant using the criteria of cuisine, price, and city, and to locate directions and make a reservation for the restaurant that they choose. We will indicate that since the prototype is limited in functionality, it does not contain a large number of restaurants and they must choose a restaurant from the list provided. We will instruct them to perform the task and voice what and why they are performing certain actions and we will indicate that they should ask any questions or voice any concerns that they develop.

Resources Required
The cooperative evaluation will be performed using the limited scope functional prototype. Thus, it will involve the use of a PDA. The individuals using the PDA and performing the assigned task will be a sample of the user population, which is outlined in part one of this project, but in brief, they should be experienced with a PDA, have vision and motor capabilities, and be either a college student or business professional. We would like to target at least five of these individuals to participate in the cooperative evaluation.

Two members of the design team will observe this task. They will both record what the user says on a form indicating the user's demographic information such as name, age, and amount of experience with a PDA. This form will have areas to record each action and then comments that the user makes about each action. It will have a separate section for questions and comments that the user makes. One member of the design team will also ask the user questions when he or she is not clearly indicating why a particular action is being performed. The other member of the design team will assist in the recording to ensure that all comments are recorded. He will not ask questions, since two members questioning the user could be intimidating to them. The two members of the design team will switch roles for each different user, to eliminate evaluator bias.

Evaluation B - Heuristic Evaluation

Usability Criteria Addressed
We will be able to evaluate all three of our usability criteria with this evaluation. The three that will be addressed will be Familiarity, Recoverability and Customizability.

Inputs Required
A Heuristic Evaluation will be performed on the storyboard representation of our design. We will have a number of different evaluators run through the storyboard as if they were using the system itself and address a number of heuristics that will be laid out. The following ten heuristics, which will be used as guidelines for the evaluation, are drawn from Dix, Finlay, Abowd, & Beale (1998). These guidelines will allow the evaluators to focus their attention on certain aspects of the design. Following these guidelines also allows for coverage of all of the above mention usability criteria. The heuristics to be used for the evaluation are as follows:

1. *Visibility of the system:* It is important for the user to be able to see what is happening within the system and to receive the appropriate information and the appropriate times from the system.

2. *Match between system in the real world:* Especially in our design, it is important for the user to be able to leverage off of some experience they have had in the past. This will allow for faster learnability of the system

3. *User control and freedom:* To have an effective system, the user must be able to move freely within the system without running into any unexpected roadblocks. Also, the user should be able to easily reverse course

hey find themselves somewhere they do not wish to be within the system.

4. *Consistency and standards:* Throughout the system it is very important that the system remain consistent in how it acts and how it feels to the user.

5. *Error Prevention:* To reduce confusion and other problems with the system, the design must take into account actions that would cause errors.

6. *Recognition rather than recall:* The system should place as little mental load on the user as feasibly possible. Therefore, presenting information to be recognized would be preferable to relying on information the user has to recall from memory himself.

7. *Flexibility and efficiency of use:* There should be present in the system that would allow an expert user to speed up the interaction but are not noticeable to the novice user

8. *Aesthetic and minimalist design:* The system need only present information that is relevant to the completion of the task. All other information has the possibility of hindering the completion of the task

9. *Help users recognize, diagnose and recover from errors:* Make errors messages in language the user can understand and have easy and recognizable methods available to correct these problems

10. *Help and documentation:* Any necessary documentation the user needs to operate the system for effectively should be easy to access and easy to search and browse through.

Resources Required
This evaluation will require several evaluators to go over the system and address the heuristics mentioned above. Four to five evaluators will be needed to capture the most usability problems while saving on resources. These evaluators will be students in the HCI class. They will be walked through the storyboard representation by a member of our team and then each student will independently evaluate the system based on the above heuristics. Each student will be provided with a form listing the heuristics, and with appropriate space to make comments about each heuristic. After each evaluator has performed their evaluation, our design team will meet with them to discuss problems with the system and violations of usability principles and heuristics. We will assign a severity rating to each of these problems based on frequency, impact, and persistence.

Evaluation C - Cognitive Walkthrough

Usability Criteria Addressed
The cognitive walkthrough will centrally address the criteria of familiarity, since it is designed to explore learnability though exploration. Peripherally, however, it may also address recoverability, since the user will be performing a task sequence and could potentially make errors.

Inputs required
Prototype Description: This input is supplied in the previous section, in which the prototype is clearly described. However, this evaluation will be performed on the limited function representation, and since it actually has functionality, it will be more than adequate for a description.

Task description: The task being examined is to search for a restaurant using the criteria of cuisine and price and then to find the restaurant's menu options and directions to the restaurant. This task is representative of one that most users would perform on this system, and in addition it utilizes two forms of input method,

ecting a choice from a pull-down menu and entering information using pen-recognition such as Graffiti.

Action Sequence:

A1. Fill in criteria of price using pen to write price.
R1. Screen displays acceptable price range.

A2. Select a cuisine type from a pull-down menu.
R2. Screen displays selected cuisine type.

A3. Use pen to select search icon.
R3. Search results are listed, along with several options on the right portion of the screen, including details, menu, directions, wait time, and order.

A4. Select restaurant of choice.
R4. Restaurant of choice is highlighted.

A5. Select menu.
R5. The restaurant's menu is displayed.

A6. Select "back."
R6. The restaurant list is again displayed, along with the above mentioned options.

A7. Select "directions."
R7. The screen shows a map, along with text directions to the restaurant.

Resources required
The cognitive walkthrough will be performed on the limited scope functional prototype. It will not require end-users to perform this technique, but instead it should be performed using "HCI experts." These experts will be five of our CS4750 classmates. These classmates are required to have experience with a PDA and searching for a restaurant. In addition, they will have knowledge of evaluation techniques and usability principles. They will be provided with a set of standard forms to use for the completion of this evaluation technique. Specifically, they will be given a form that asks their name, the date, and the time of the evaluation. This form will then provide them with the four questions that must be answered in a cognitive walkthrough, along with sufficient space to answer these questions. The questions are as follows:

1) Will the users be trying to produce whatever effect the action has?
2) Will users be able to notice that the correct action is available?
3) Once users find the correct action at the interface, will they know that it is the right one for the effect they are trying to produce?
4) After the action is taken, will users understand the feedback they get?

In addition to the form providing space for the answers to these questions, an additional form will be provided for each question, so that the evaluators can address any negative answers that they make on the original form, in answering the four questions. The form for comments on negative answers will prompt the evaluators for a detailed description of the usability problem, an estimation of how frequently the evaluators think the problem will occur, and how serious the problem will be for the end-users.

nk to this Page

- Rationality Gone Awry last edited on 15 November 2001 at 2:30:07 pm by kansas-nt.cc.gatech.edu

11/21/01 12:32 PM

Current Methods for finding restaurant information:

- Access Atlanta
- Search Engines (ex: Yahoo)
- Telephone books
- Television advertisements
- Newspaper advertisements
- Roadside billboards

- Vindigo

ivol: (Xerox PARC) — Free Form Ink
lass (GT)
atLand (Xerox PARC) — electronic whiteboard

ynomite (FX-PAL)
e Audio Notebook (MIT) — Personal

ft Keyboard → Virtual Keyboard

9 (Tegic Communications) → Phone Layout

ickwrite (Perlin) - unistroke 

..rrin (Mankoff) - word level unistroke

raffiti - unistroke

<u>sture Recognition</u>
functional information
scope
target information

mpirical Study -

d Evaluation Loop - Internal to Application

tification based - Control loop does not reside in app

IMS - user interface management system

<u>tules of evaluation</u>
Laboratory Studies
Field Studies

<u>Evaluating Design</u>

Cognitive Walkthrough
- Will users be trying to produce whatever effect the action has?
- Will users be able to notice that the correct action is available?
- Once users find the correct action at the interface, will they know that it is the right one for the effect they are trying to produce?
- After the action is taken, will users understand the feedback they get?

- Heuristic Evaluation
  - Simple & natural dialog
  - Speak the user's language
  - Minimize user memory load
  - Be consistent
  - Provide feedback
  - Provide clearly marked exits
  - Provide short cuts
  - Good error messages
  - Prevent errors

Review-based Evaluation

Model-based Evaluation

- Evaluating Implementation
  - Empirical Method
    - Subjects
    - Variables
    - Hypotheses
    - Experimental design
    - Statistical Measures
  - Observational Techniques - Think Aloud
  - Query Techniques - Cooperative Evaluation
    - Interviews
    - Questionnaires

- Choosing an evaluation method
  - Design vs. Implementation
  - Laboratory vs. Field Studies
  - Subjective vs. Objective
  - Qualitative vs. Quantitative measures
  - Immediacy of Response
  - Intrusiveness
  - Resources

- Prosody - speak sentence according to punctuation at the end

- Questionaires - can be formative or summative
- Ask similar questions to ensure validity of questions

- Each subject is exposed to only one prototype - between group
- Each subject is exposed to multiple prototypes - within groups

Restaurant Search Questionnaire

How do you get information about restaurants where you might be interested in eating?

How do you determine where you will eat when you are already away from home?

What criteria do you base your search on?
(Cost, cuisine, location, payment types accepted, parking, valet, etc)

Would it be helpful to have access to information about restaurants while away from home?

How do you search for restaurants when you are not in your hometown?

Do you often look up restaurants you have already been to for their phone number or address?

Do you call restaurants for information?

If so, what kinds of questions do you ask?

Do you usually get satisfactory answers?

How often do you get to a restaurant only to find that the line is longer than you are willing to wait?

Do you use Internet-based search pages to find information about restaurants?
If so...

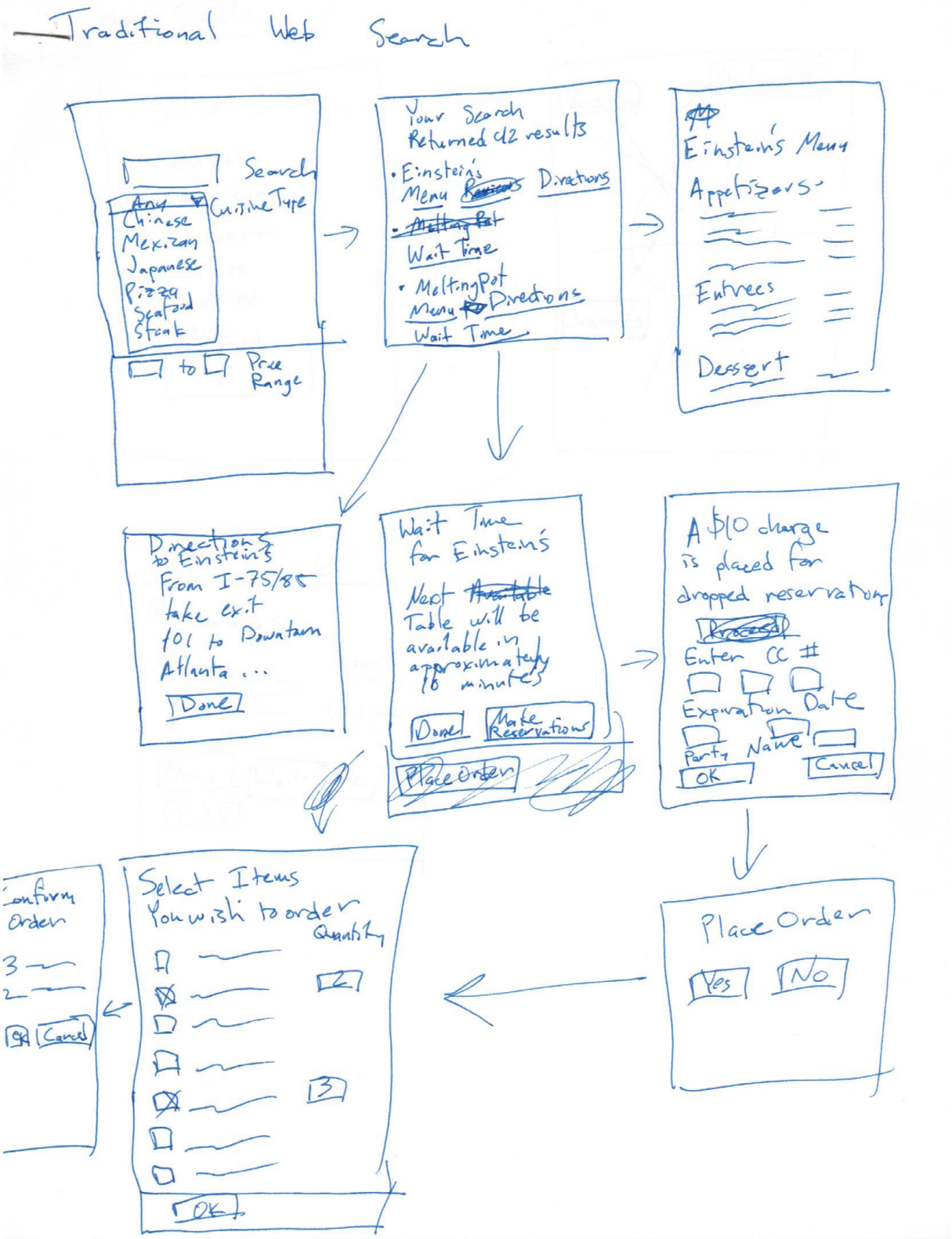
a. How often do you use Internet-based restaurant search pages?
b. What criteria do you base your search on?
(Cost, cuisine, location, payment types accepted, parking, valet, etc)
c. Is a grouping of similar restaurants useful?
-By which criteria would you prefer to group the restaurants?
d. Do you trust the information that you find on the Internet about restaurants?
e. Do you have a preferred Website for searching for restaurant information?
f. What features set this site apart?
g. Are there features that are not there that you wish you could have?
h. Would being able to make reservations (when appropriate) be useful?

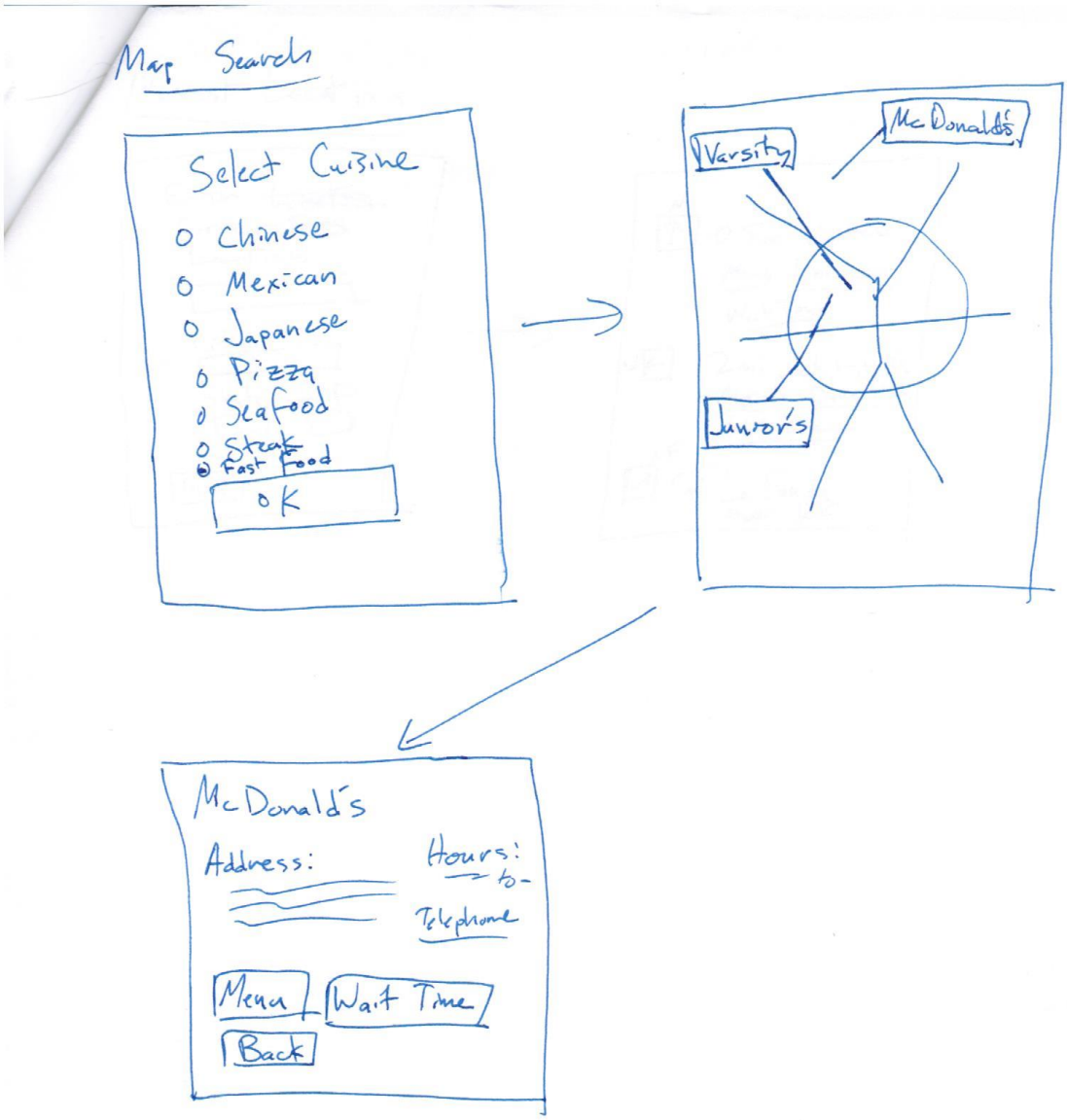
Do you own or have access to a PDA (Personal Digital Assistant)?
If so...

a. What do you use your PDA for?
b. Are you skilled at using your PDA and writing to it with the stylus
c. Do you access the Internet from your PDA?
d. How often do you carry your PDA?

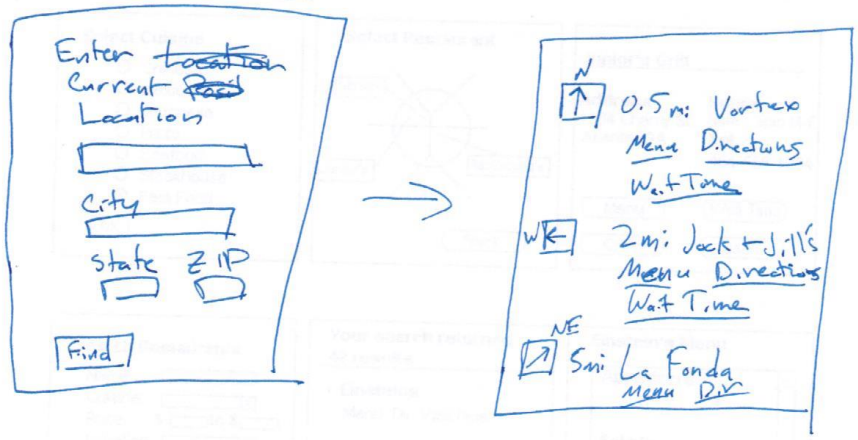
command

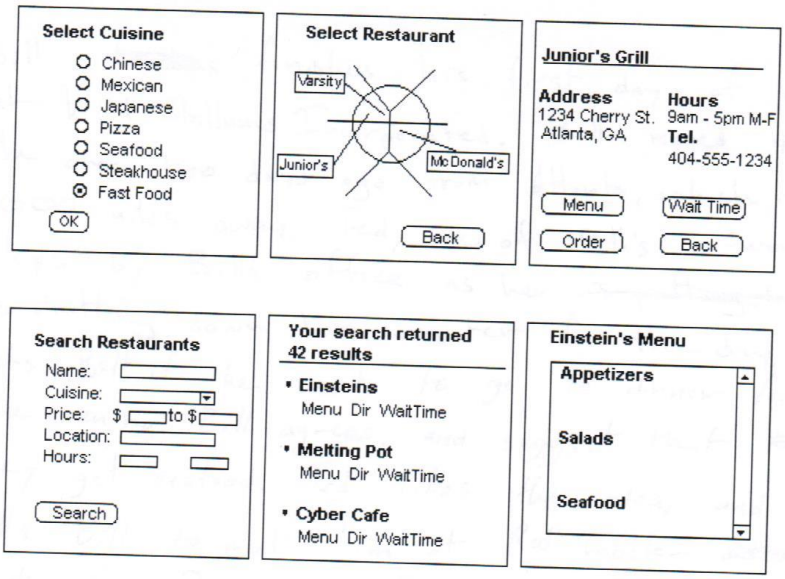
- If a GPS device is attached to the portable device, then the user's location will be computed using the GPS's coordinates. Otherwise, the user must specify a city and state, separated by a comma.
- The ~~prego~~ application is superior to those already available, since it gives increased search capabilites. Also gives complete menu listings, wait times, and ordering capabilitres for participating restaurants.
- The user may specify one or many search criteria to find a desired dining establishment.


Traditional Web Search
Search
Any
Chinese
Mexican
Japanese
Pizza
Seafood
Steak
Cuisine Type
to
Price Range
Your Search Returned 12 results
• Einstein's Menu Directions
Wait Time
• MeltingPot
Menu Directions
Wait Time
Einstein's Menu
Appetizers
Entrees
Dessert
Directions to Einstein's
From I-75/85 take exit 101 to Downtown Atlanta ...
Done
Wait Time for Einstein's
Next Table will be available in approximately 10 minutes
Done
Make Reservations
Place Order
A $10 charge is placed for dropped reservation
Enter CC #
Expiration Date
Party Name
OK
Cancel
Place Order
Yes
No
Select Items You wish to order
Quantity
2
3
OK
Confirm Order
3
2
OK
Cancel


Map Search
Select Cuisine
Chinese
Mexican
Japanese
Pizza
Seafood
Steak
Fast Food
OK
Varsity
McDonald's
Junior's
McDonald's
Address:
Hours:
to
Telephone
Menu
Wait Time
Back

Nearest Location




Select Cuisine
Chinese
Mexican
Japanese
Pizza
Seafood
Steakhouse
Fast Food
OK
Select Restaurant
Varsity
Junior's
McDonald's
Back
Junior's Grill
Address
1234 Cherry St.
Atlanta, GA
Hours
9am - 5pm M-F
Tel.
404-555-1234
Menu
Wait Time
Order
Back
Search Restaurants
Name:
Cuisine:
Price: $ to $
Location:
Hours:
Search
Your search returned 42 results
Einsteins
Menu Dir WaitTime
Melting Pot
Menu Dir WaitTime
Cyber Cafe
Menu Dir WaitTime
Einstein's Menu
Appetizers
Salads
Seafood

Bill finishes his first day of work at Wild Stallions Incorporated. Bill moved to the area two days ago from Atlanta, which is 1000 miles away. Ted, one of Bill's co-workers, stops by Bill's office as he is shutting down his computer for the day. Ted asks Bill if he wants to go to dinner for the evening. Bill agrees, and suggest that they get seafood. Ted likes the idea, and tells Bill to meet him at Red Lobster in San Dimas at 8pm.

Around 7:30pm Bill realizes that he has no idea where the restaurant that Ted suggest was located, so Bill turns on his trusty portable Palm device. Bill starts the restaurant finder application, and enters "Red Lobster" in the search screen, and specifies "San Dimas" as the city. The search returns the correct result. Bill selects "Map" to give him a visual idea of which streets to take there. Then he exports the textual directions to his desktop computer to be printed. Before shutting off his PDA, Bill selects "Wait Time" for the Red Lobster restaurant, and notices that there will be at least a 1 hour wait. Bill calls Ted on the phone and notifies him of the lengthy wait time. The two then decide that they will meet at RL at 8:30 pm. Bill takes his printout and heads to RL.

This ~~devices~~ design is more practical than others, since the technology to support is beginning to become widely accepted. Palm devices are being used by X number of people in the United States, People are becoming familiar with Palm applications, therefore this design will be more easily accepted than one contained in an entirely new device. The ability to use the application alongside other Palm applications allows simple access.

Rationale

- The PDA allows users to access restaurant information easily while at work or while traveling. The program can be easily accessed using the same device that one might use to organize dates, memos, and other information. The interface design capitalizes on familiarity since it uses layouts that the user will be familar with in convential searches for restaurants. A search page will be provided that will resemble a tradiation web search interface. The user will have the ability to search by restaurant name, cuisine, price range, operating hours, payments accepted, and location. For users unfamilar withe the area, the application will have the ability to show a map to a selected restaurant and give proper ~~direction as to~~ driving directions to the restaurant. Users will easily be able to interpet a visual map, especially moreso than textual directions, ~~adding to the~~ therefore reducing complexity.

OK

- Empirical study takes more time and money, but not always (questionaires)
- 4 different kinds of tests used in different kinds of situations
- T test vs. paired T-test
- same set of situations
- exam before and after course for same set of people (paired TT)
- Throw out people who didn't take both tests
- Two different groups tested (men vs. women, students with prereq vs. w/o) (TT or X2 Test)
- X2 test for discrete values
- P value is the confidence level - happens outside of chance
- P value should be 0.05 or less (95%)
- Between groups vs. within groups
- dependent vairable (measurable)
- controlled variable
- Development environments
- Build interface with components and tie them with functionality
- Event based programming
- AppForge was external to application
- Internal -> Read Eval loop
- Rules of windowing system
- device independence
- drivers allow you to use multiple devices without worrying about specific code
- Focus policies
- Look and feel - determines the display of a system
- OO paradigm fits widgets
- Summative vs. formative
- Difference between observational techniques
- Input techniques
- Different ways to use pen based input
- Unistroke - from time down to pen time up
- Free form ink: Tivoli: (Xerox PARC), eClass (GT), FlatLand (Xerox PARC) - electronic whiteboard
Dynomite (FX-PAL), the Audio-Notebook (MIT) -> Personal
- Soft keyboard -> virtual keyboard
- T9 (Tegic Communications) -> Phone layout
- Quickwrite (Perlin) ->Unistroke (to corners)
- Cirrin (Mankoff) -> word level unistroke (letter wheel)
- Graffiti - word level unistroke
- Gesture Recognition: functional information, scope, target information
-Empirical Study
- Read Evaluation Loop - Internal to applicaiton
- Notification Based - control loop does not reside in the application
UIMS - user interface management system
- Styles of Evaluation: Laboratory studies, field studies
- Evaluation of design:
- Cognitive Walkthrough - will users be trying to produce whatever effect the action has?
- will users be able to notice that the correct action is available?
- once users find the correct aciton at the interface, will they know that it is the right one for the effect they are trying to produce?
- after the action is taken, will users understand the feedback they get?
- Heuristic Evaluation
-Simple and natural dialog
- Speak the user's language
- Minimize user memory load
- Be consistent
- Provide feedback
- Provide clearly marked exits
- Prvide shortcuts
- Good error messages
- Prevent errors
- Review-based evaluation - use lit reviews
- Model-based evaluation - GOMS, KLM
- Evaluating Implementation
- Empirical Method
- subjects - select size (10)
- variables - independent - manipulated to produce different results - ex: chemicals
- hypotheses - prediction of dependent - measured - ex: temp
- experimental design - Between / within
- statistical measures - outcome
- Observational Techniques
- Outliners - clearly wrong data
- Think Aloud
- Cooperative evaluation
- Query Techniques
- Interviews
- Questionaires
- Choosing an evaluation method
- Design vs Implementation
- Laboratory vs. Field studies
- subjective vs. objective
- qualitative vs. quantitative measures
- Immediacy of response
- intrusiveness
- resources
- Prosody - speak sentence according to punctuation at the end
- Questionaires - can be formative or summative
- Ask similar questions to ensure validity of questions
- Each subject is exposed to only one prototype -> between group
- Each subject is exposed to multiple prototypes -> within groups
- heuristic - guideline or general principle or rule of thumb that can guide a design decision or be used to critique a decision that has already been made
- Save Data for proof / redo experiment / for others (statistical measures)
- Discrete vs. continuous variables
↳ R, G, B ↳ Height
- Distribution - continuous data
- Parametric tests
- Std Dev = $\sqrt{\text{Variance}}$
- Dichotomus - Yes / No Question
- Null Hypothesis - the independent variables do not influence the dependent variables
- Regression Analysis - for continuous data
- Variance - the sum of each sample's distance from the mean
- 67% 1st Std Dev, 95% 2nd Std Dev
- CW - define inputs, walk through action sequence, believability
- Protocol Analysis - to record user in observation - paper and pencil, and a recording, video recording, computer logging), user notebooks
- Questionnaire questions: general, open-ended, scalar, m/c, Ranked
- MVC vs. PAC
↓
-Groups Input + Output together
- Component to ensure abstraction + presentation are consistent
are consistent
- components of UIMS - less Impl dependent
presentation - appearance of interface
dialog control - communication between presentation + application
application interface -

Observation Evaluation Techniques

	Think Aloud	Protocol Analysis	Post-Task WT
Stage	Implementation	Impl.	Impl.
Style	Lab/Field	L/F	L/F
Objective	No	No	No
Measure	Qualitative	Qual	Qual
formation	High/Low Level	H/L	H/L
mediacy	Yes	Yes	No
trusive	Yes	Yes	No
me	High	High	Medium
quipment	Low	High	Low
xpertise	Medium	High	Medium

Analytic Evaluation Techniques

	CW	Heuristic Evaluation	Review Based	Model Based
S	T	Throughout	Design	D
S	Laboratory	L	L	L
O	No	N	As source	N
M	Qualitative	Ql	"	Ql
I	Low Level	High Level	"	LL
I	N/A	N/A	"	N/A
I	No	N	N	N
T	Med	Low	L-M	M
E	Low	Low	Low	Low
E	High	Med	Low	H

Query Eval. Techniques

	Experiment	Interviews	Questionnaire
S	T	T	T
S	Lab	Lab/Field	L/F
O	Y	N	N
M	Quantitative	Ql/Qn	Ql/QN
I	L/H	H	H
I	Y	N	N
I	Y	N	N
T	H	L	L
E	M	L	L
E	M	L	L