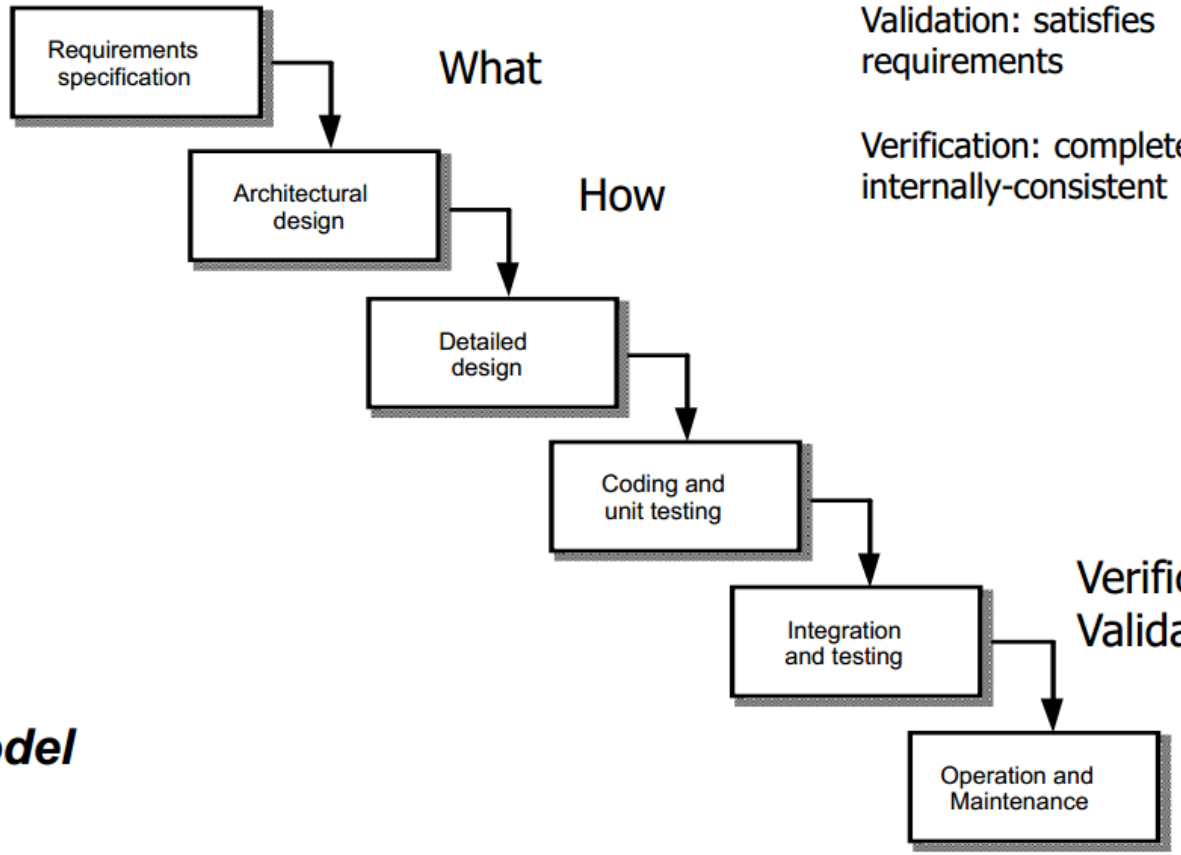
CS 315 – Intro to Human Computer Interaction (HCI)

User centered design

Software Lifecycle

Customer vs. user



What

How

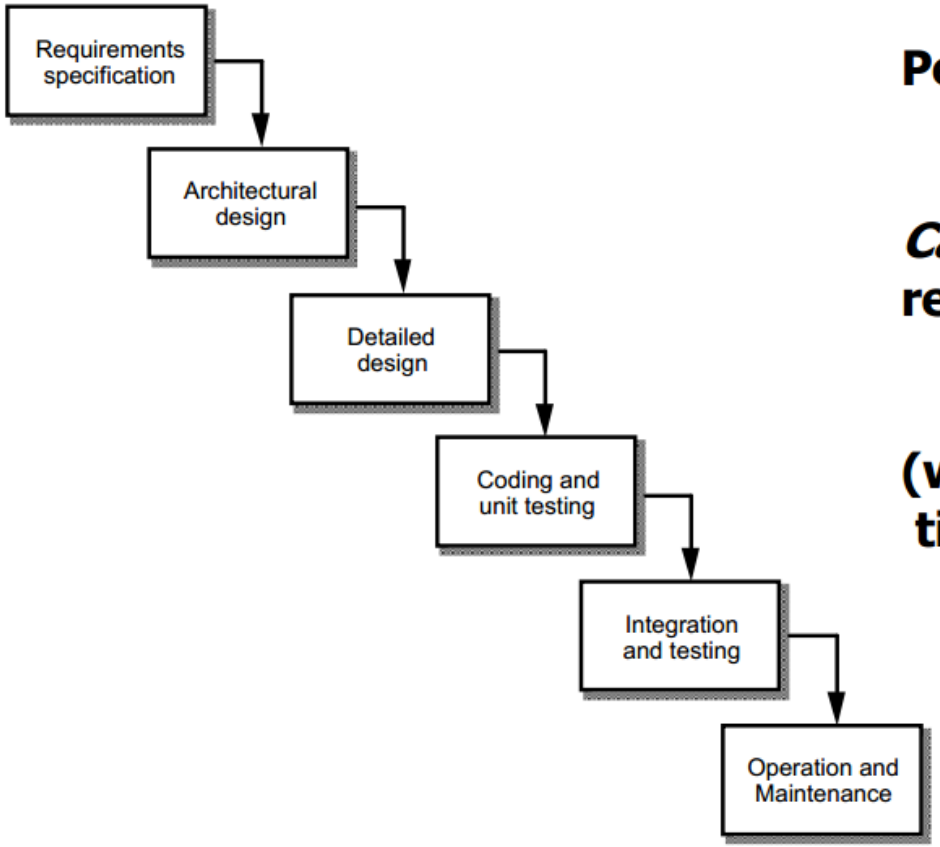
Validation: satisfies requirements

Verification: complete and internally-consistent

Verification v
Validation

The waterfall model

Why doesn't this work for UIs?

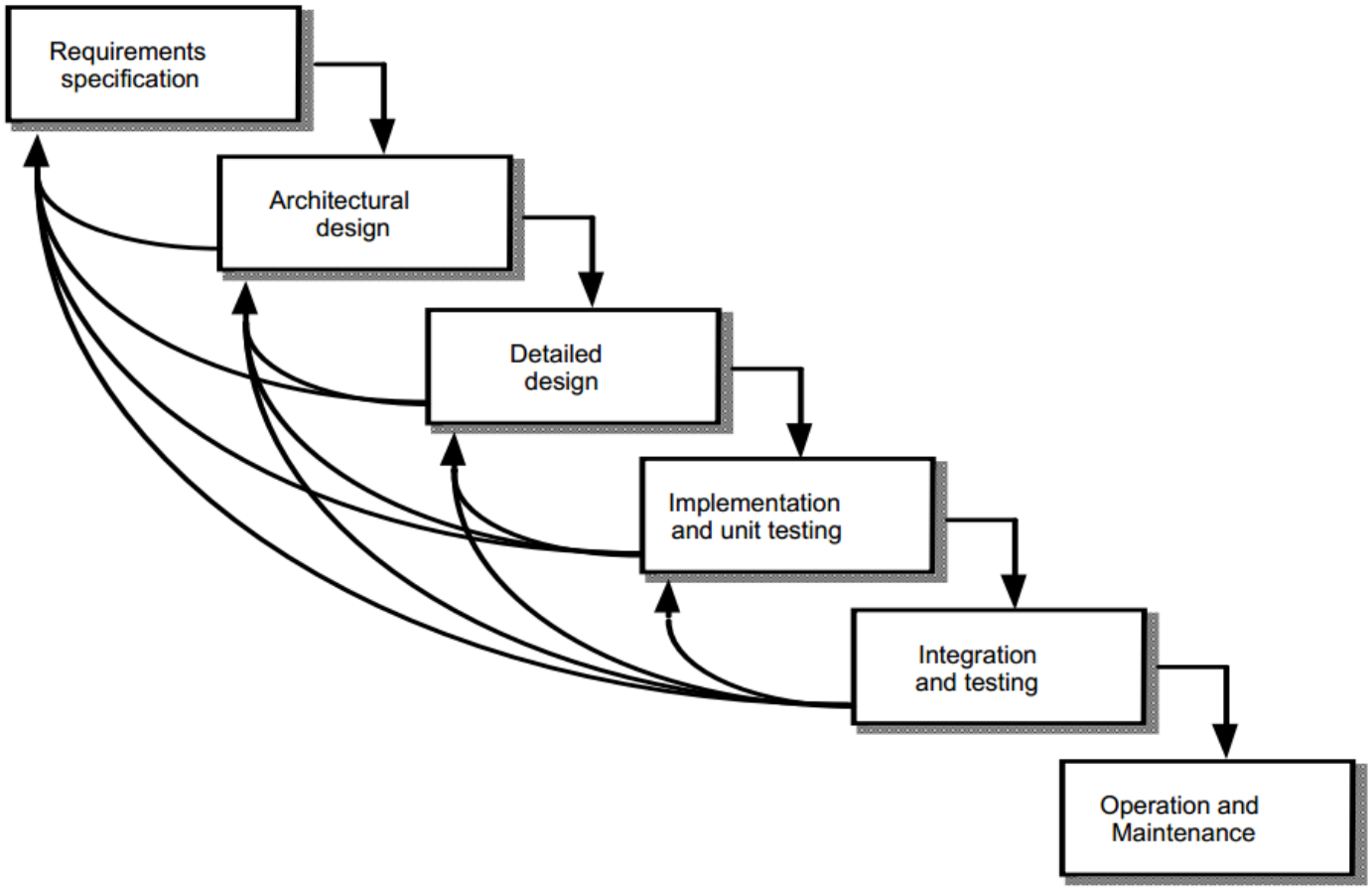


People are insanely complicated.

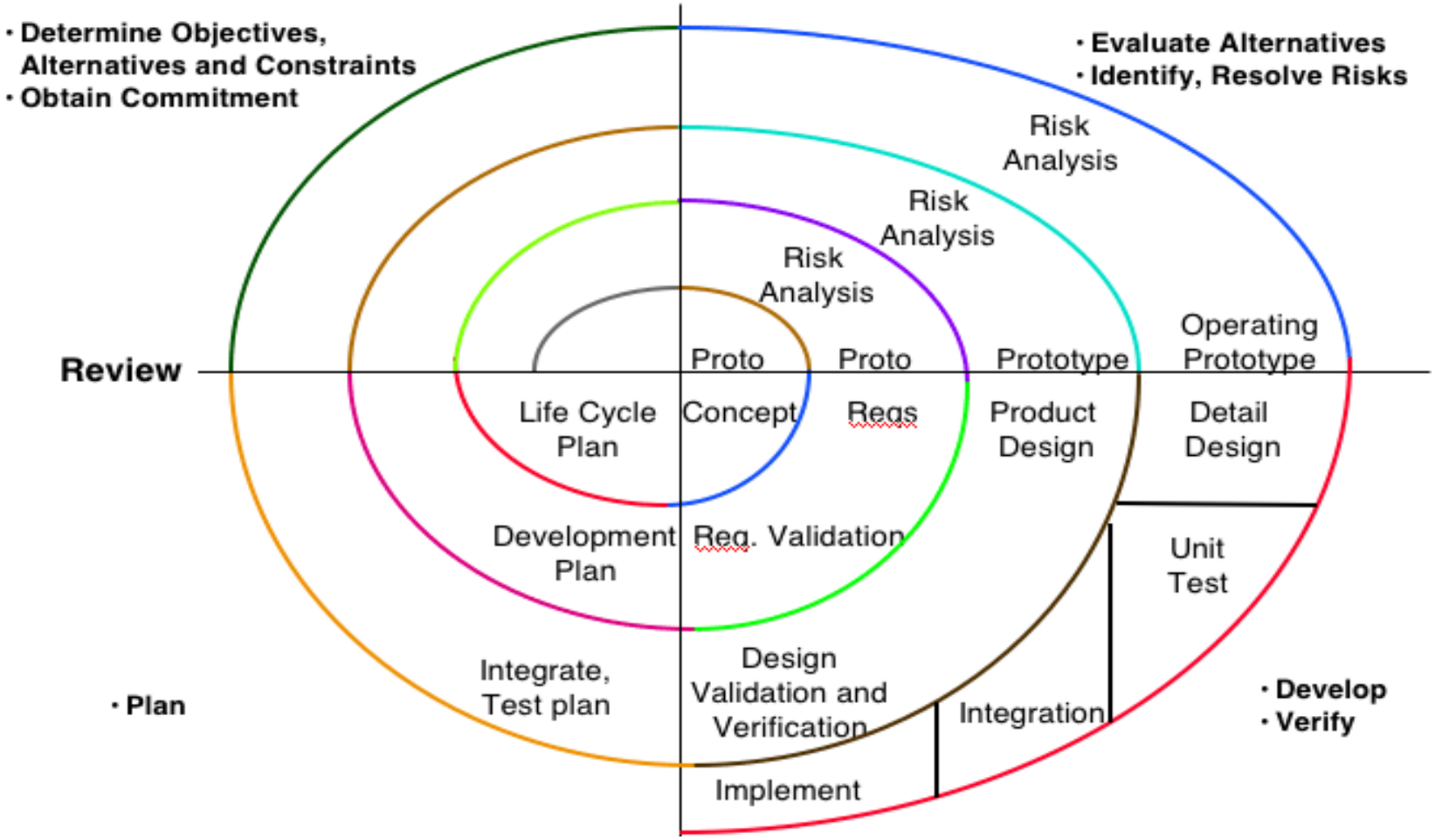
***Cannot* determine all requirements from the start**

(which results in 50% designer's time spent on code for UI)

Lifecycle for UIs



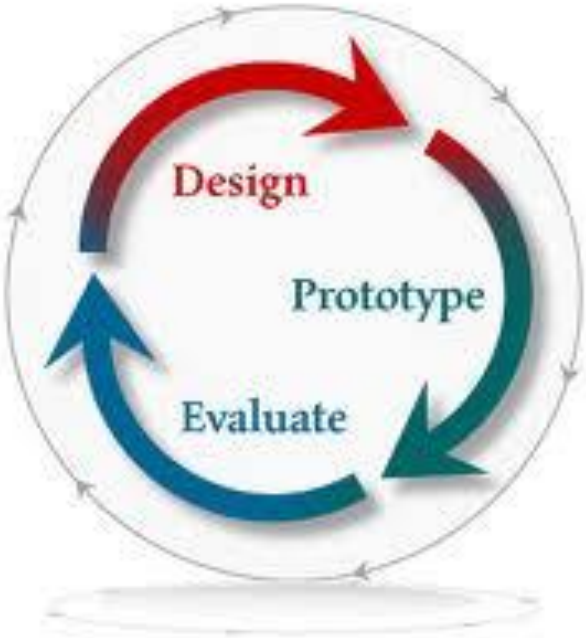
Spiral Model



Spiral Model

- Each cycle around the spiral can be like a phase
- Each cycle has four stages
  1. Determine objectives, constraints (i.e. plan!)
  2. Identify and manage risks. Explore alternatives as part of risk management
  3. Develop and verify next stage or level of the product
     - Depending on the spiral, “Product” might be a requirements document, a high-level design, code, etc.
  4. Review results and plan for next stage
     - May include getting client/customer feedback

Iterative Design



Iterative design

- Beware of ...
  - Early commitment ... Design inertia may make it difficult to recover, even in the face of overwhelming evidence
  - Understand reasons for problems, not just detecting symptoms (and patching)

Iterative Design the Wrong Way

- Every iteration corresponds to a release
  - Evaluation (complaints) feeds back into next version's design
- Using your paying customers to evaluate your usability
  - They won't like it
  - They won't buy version 2

User-Centered Design UCD

- Try lots of stuff. See how it plays with the users.
- Involve representative users in all stages of the development process.
- Minimize the cost of and commitment to prototypes.
- Users often can’t tell you which alternative is “better” – have to test and measure.

UCD

- First steps of user-centered design
  - User analysis: who is the user?
  - Task analysis: what does the user need to do?

Know thy user

- Know thy user
  - Knowledge about people in general (human factors)
  - Very, very specific knowledge about users and work environment (ethnography)
- Difference between user and customer

How To Do User Analysis

- Techniques
  - Questionnaires
  - Interviews
  - Observation
- Obstacles
  - Developers and users may be systematically isolated from each other
    - Tech support shields developers from users
    - Marketing shields users from developers
  - Some users are expensive to talk to
    - Doctors, executives, union members

Example: Self-Service Grocery Checkout

- Who are the users?
- Major user classes

Task analysis

- Identify the individual tasks the program might solve
- Each task is a goal (what, not how)
- Often helps to start with overall goal of the system and then decompose it hierarchically into tasks

Essential Parts of Task Analysis

- What needs to be done?
  - Goal
- What must be done first to make it possible?
  - Preconditions
    - Tasks on which this task depends
    - Information that must be known to the user
- What steps are involved in doing the task?
  - Subtasks
  - Subtasks may be decomposed recursively

Other questions to ask about the task

- Where is the task performed?
- How often is the task performed?
- What are its time or resource constraints?
- How is the task learned?
- What can go wrong? (Exceptions, errors, emergencies)
- Who else is involved in the task?

How to Do a Task Analysis

- Interviews with users
- Direct observation of users performing tasks

Dangers of Task Analysis

- Duplicating a bad existing procedure in software
- Failing to capture good aspects of existing procedure

Hints for Better User & Task Analysis

- Questions to ask
  - Why do you do this? (goal)
  - How do you do it? (subtasks)
- Look for weaknesses in current situation
  - Goal failures, wasted time, user irritation
- Contextual inquiry
- Participatory design

Contextual Inquiry

- Observe users doing real work in the real work environment
- Be concrete
- Establish a master-apprentice relationship
  - User shows how and talks about it
  - Interviewer watches and asks questions
- Challenge assumptions and probe surprises

Participatory Design

- Include representative users directly in the design team

Data Gathering

- Five Key Issues:
  - Setting goals
  - Identifying participants
  - Relationship with participants
  - Triangulation
  - Pilot Studies

Setting Goals

- Example:
  - Want to understand how technology fits into normal family life
  - Identify which of two icons is easier to use

Identifying Participants

- Population: the kind of people you want to gather data from
- Sampling: the particular participants that you choose
- Saturated Sampling: when you have access to all of the members of your target population
- Sampling:
  - Random sampling (probability)
  - Stratified sampling (non-probability)
  - Convenience sampling

Relationships with Participants

- Relationship needs to be clear and professional
- Participants should sign informed consent forms
- Incentives might be necessary

Triangulation

- Triangulation: investigating a phenomenon from two or more perspectives
  - Data: drawn from different sources, places, or people
  - Investigator: different researchers are used to collect the data
  - Method: different data gathering techniques are used

Pilot Studies

- Small trial before the main study
- Distributing 500 questionnaires and then realizing that a question is confusing is an expensive error

Data, Information, Conclusions

- Raw Data
- Information
- Conclusions

Data gathering for requirements

- Interviews:
  - Forum for talking to people
  - Structured, unstructured, semi-structured, groups
  - Props, e.g. sample scenarios of use, prototypes, can be used in interviews
  - Good for exploring issues
  - But are time consuming and may be infeasible to visit everyone

Interviews

- Unstructured - are not directed by a script. Rich but not replicable.
- Structured - are tightly scripted, often like a questionnaire. Replicable but may lack richness.
- Semi-structured - guided by a script but interesting issues can be explored in more depth. Can provide a good balance between richness and replicability.

Interview questions

- Two types:
  - ‘closed questions’ have a predetermined answer format, e.g., ‘yes’ or ‘no’
  - ‘open questions’ do not have a predetermined format
- Closed questions are easier to analyze
- Avoid:
  - Long questions
  - Compound sentences - split them into two
  - Jargon and language that the interviewee may not understand
  - Leading questions that make assumptions e.g., why do you like …?
  - Unconscious biases e.g., gender stereotypes

Running the interview

- Introduction – introduce yourself, explain the goals of the interview, reassure about the ethical issues, ask to record, present any informed consent form.
- Warm-up – make first questions easy and non-threatening.
- Main body – present questions in a logical order
- A cool-off period – include a few easy questions to defuse tension at the end
- Closure – thank interviewee, signal the end, e.g, switch recorder off.

Enriching the interview process

- Props - devices for prompting interviewee, e.g., a prototype, scenario

Data gathering for requirements

- Questionnaires:
  - A series of questions designed to elicit specific information
  - Questions may require different kinds of answers:
    - YES/NO, choice of pre-supplied answers, comment
  - Often used in conjunction with other techniques
  - Can give quantitative or qualitative data
  - Good for answering specific questions from a large, dispersed group of people

Questionnaires

- Questions can be closed or open
- Closed questions are easier to analyze, and may be done by computer
- Can be administered to large populations
- Paper, email and the web used for dissemination
- Sampling can be a problem when the size of a population is unknown as is common online

Questionnaire design

- The impact of a question can be influenced by question order.
- Do you need different versions of the questionnaire for different populations?
- Provide clear instructions on how to complete the questionnaire.
- Strike a balance between using white space and keeping the questionnaire compact.
- Decide on whether phrases will all be positive, all negative or mixed.

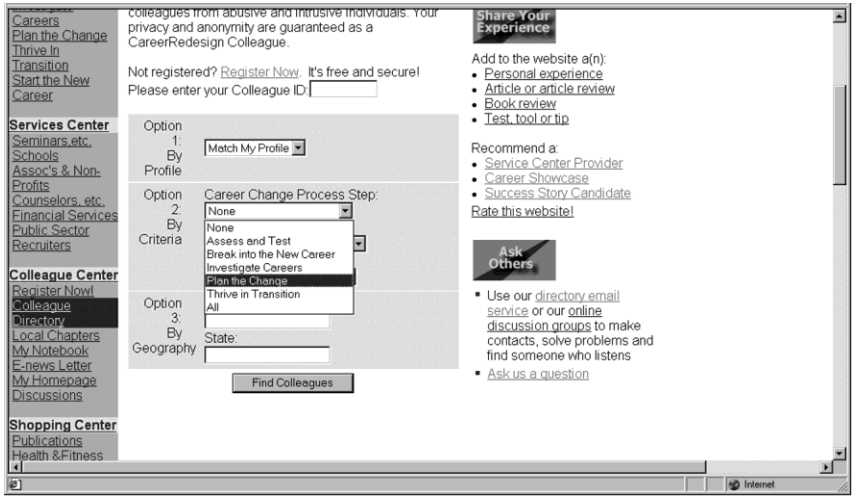
Question and response format

- ‘Yes’ and ‘No’ checkboxes
- Checkboxes that offer many options
- Rating scales
  - Likert scales
  - semantic scales
  - 3, 5, 7 or more points?
- Open-ended responses

Encouraging a good response

- Make sure purpose of study is clear
- Promise anonymity
- Ensure questionnaire is well designed
- Offer a short version for those who do not have time to complete a long questionnaire
- If mailed, include a stamped addressed envelope
- Follow-up with emails, phone calls, letters
- Provide an incentive
- 40% response rate is high, 20% is often acceptable

Advantages of online questionnaires



- Responses are usually received quickly
- No copying and postage costs
- Data can be collected in database for analysis
- Time required for data analysis is reduced
- Errors can be corrected easily

Spot four poorly designed features

2. State your age in years ☐

3. How long have you used the Internet? (*check one only*)
   - ☐ <1 year
   - ☐ 1–3 years
   - ☐ 3–5 years
   - ☐ >5 years

4. Do you use the Web to:
   - purchase goods ☐
   - send e-mail ☐
   - visit chatrooms ☐
   - use bulletin boards ☐
   - find information ☐
   - read the news ☐

5. How useful is the Internet to you?

_____

_____

Problems with online questionnaires

- Sampling is problematic if population size is unknown
- Preventing individuals from responding more than once
- Individuals have also been known to change questions in email questionnaires