

# Design Models + Usability, Contextual Inquiry cont'd

Lecture 2 – CS 5601

# Last Day and today

## Last Day

- Introduction into User Centred Design + Usability
- Understanding Users (intro to Contextual Inquiry)

## Today

- More on UCD and Usability
- Contextual Inquiry
- Into to Design

# Announcements

- Remember that Assignment 1 – paper summary is due on **Sunday May 28 at 11:00pm** (if you missed the first lab and haven't been in contact with your group, please see me during break today)

# Good Design and Usability



- We want to design good interfaces → but how do relate “good”
- We talk of “good, bad or poor” design in relation to **Usability**
- Usability: (as defined in Part II of the ISO9241 standard)
  - “the extend to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use”
  - **Effectiveness**: measures the accuracy and completion of goals
  - **Efficiency**: are the resources expended in relation to the accuracy and completion
  - **Satisfaction**: the comfort and acceptability by the users AND sometimes *enjoyment*

# Problems with Bad Designs

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1. User Frustration and Dissatisfaction
  - “Computer Rage”
    - First coined in 1999 by Market & Opinion Research International
    - Found in poll that workers are verbally and physically abusive towards the information technology



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# Problems with Bad Designs

2. Loss of productivity, efficiency and money, and can cause embarrassment to the company
  - Poor user interfaces can have a financial cost
3. Safety and User Interfaces
  - This is a very important issue for safety-critical systems
  - Consequences can be injury or worse, death
  - e.g., aircraft, power plants, medical devices, etc.



## Example of Bad Design: Safety

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- "Around 8:05 a.m., the Hawaii emergency employee initiated the internal test, according to a timeline released by the state. **From a drop-down menu on a computer program, he saw two options: "Test missile alert" and "Missile alert."** He was supposed to choose the former; as much of the world now knows, he chose the latter, an initiation of a real-life missile alert."

<http://www.cbc.ca/news/world/missile-alert-hawaii-panic-1.4486510>

## User Centered Design

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- An approach to UI development and system development.
- Focuses on understanding:
  - **Users**, and
  - Their goals and tasks, and
  - The environment (physical, organizational, social)
- Need to pay attention to these throughout development



# UI Design vs. Software Engineering

UI Designers →  
concerned with ways to  
designing usable products  
that encourage positive  
user experiences

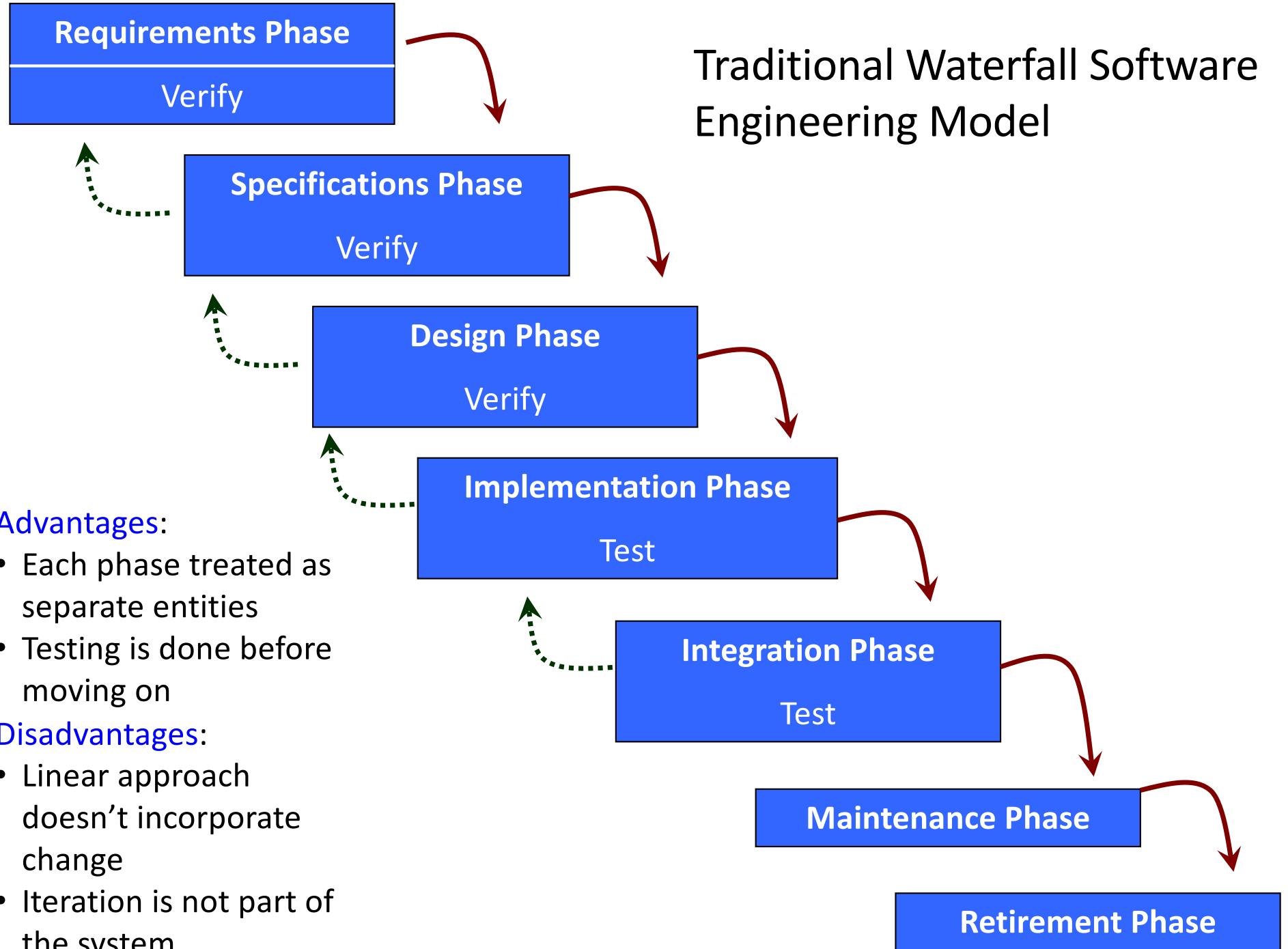
Software Engineers →  
concerned with  
engineering the software  
for products

# Example

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- The difference between a UI designer and software engineer can be compared to that of an architect and engineer

ARCHITECT	ENGINEER
Concerned with people How will people mix together Public vs. private spaces Will people live in a space as it was intended? etc.	Concerned with more practical Costs and durability of materials Structural, environmental aspects Construction methods, etc.



# User Centric Design

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This model is based on premise that:

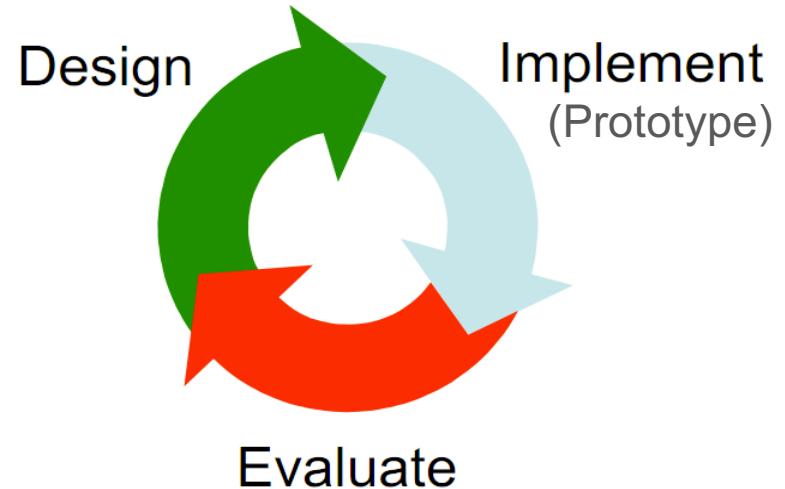
1. **Users** must be involved throughout the development process
2. The process should be highly iterative

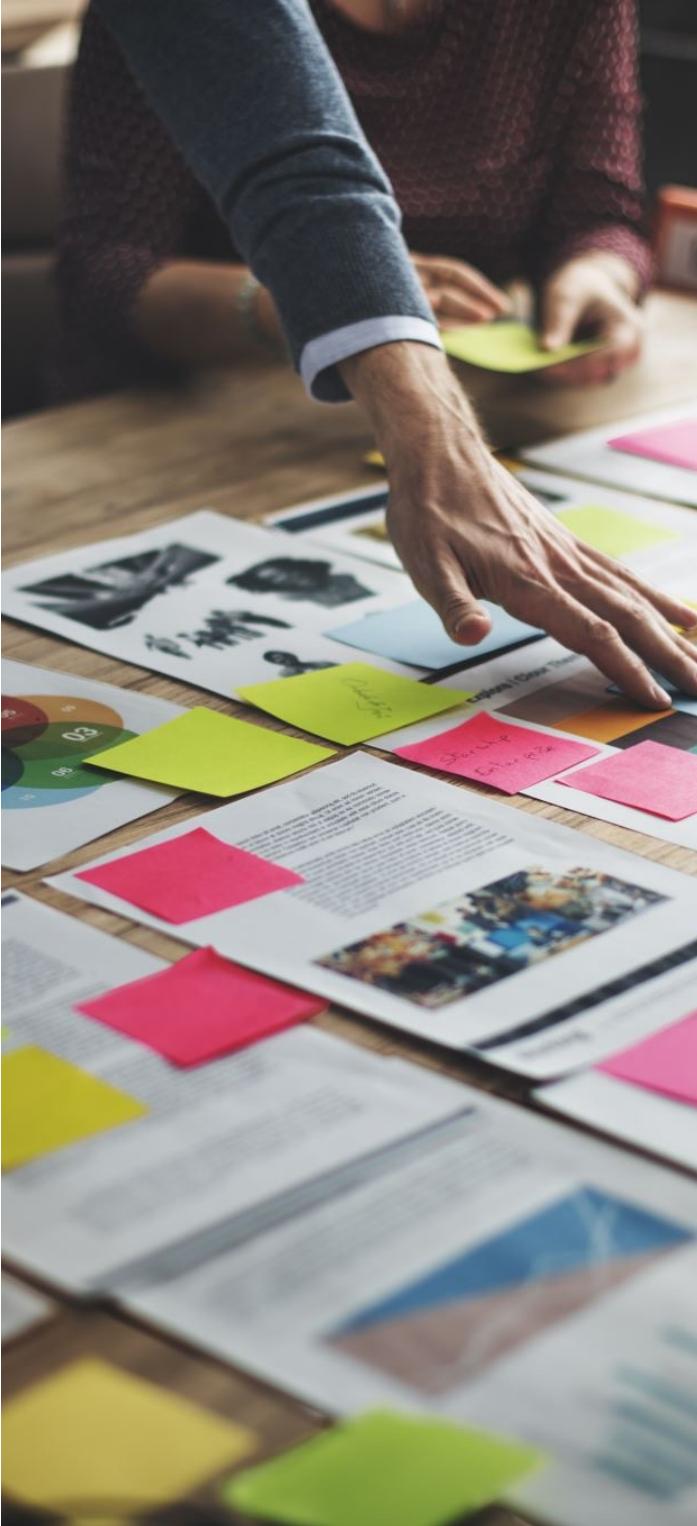
Focuses on:

Understanding *users* of a computer system under development

Understanding the *tasks* that *users* will perform and the environment (e.g., organizational, social, physical) in which they use the system

Focuses on *user experience*





# User Centric Design

## How to make the process iterative?

- We evaluate at *all stages* of development
  - *Early* in the design process
    - **Users** can help define requirements/specifications
    - Users can help test early mock-ups
  - During *implementation/prototyping*
    - Can evaluation versions to test design and functionality
    - Can give opinions and suggestions
  - During *training/after delivery* of product
    - Can give opinions for updates and detail any problems

# User Centric Design

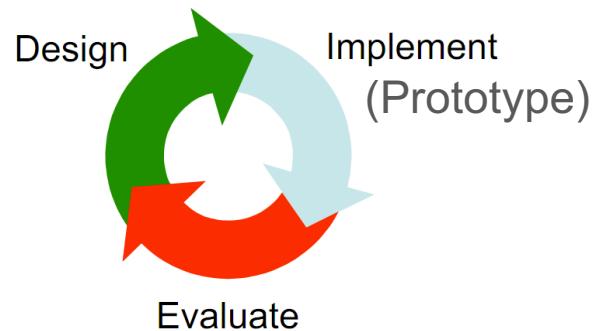
- **4 main principles of user centric design (ISO Standard)**

1. Active involvement of *users*
2. Appropriate allocation of functions between the *user* and the system
3. The *iteration* of design solutions
4. Multi-disciplinary design *teams*

- **4 essential user centric design activities (ISO Standard)**

1. Understand and specify the *context of use*
2. Specify the *user* and organizational requirements
3. Produce *design solutions* (prototypes)
4. *Evaluate* designs with users against requirements

- This contributes to the Usability of the system and the User Experience with the system



# The User Experience

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How a product behaves and is used by people in the real world

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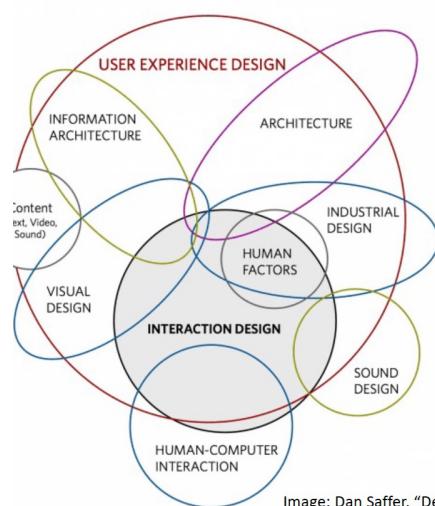
the way people feel about it and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it

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"every product that is used by someone has a user experience: newspapers, ketchup bottles, reclining armchairs, cardigan sweaters." (Garrett, 2003)

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Cannot design a user experience, only design for a user experience



RECALL...

**User Experience (UX):** the professional practice of understanding needs and generating useful designs through working with user populations, and considering the "whole system".

Image: Dan Saffer, "Designing for Interaction: Creating Innovative Applications and Devices"

# User Experience

- What aspects help contribute to a user experience:
  - **Usability**
  - Functionality
  - Aesthetics
  - Content
  - Look and feel
  - Emotional appeal
  - Perhaps: fun, health, social, cultural, status...



# User Experience Goals

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- With UI trying to provide for a positive user experience, means that like usability we should consider some *user experience goals* when designing and developing systems
- Usability goals are *objective* – they try to access how useful or productive a system is from its own perspective
- User experience goals are *subjective* – they reflect how a system *feels* to the user

# User Experience Goals



## Desirable Aspects:

satisfying, enjoyable, engaging, pleasurable, exciting, entertaining, helpful, motivating, challenging, enhancing sociability, supporting creativity, cognitively stimulating, fun, provocative, surprising, rewarding, emotionally fulfilling



## Undesirable Aspects:

boring, frustrating, making one feel guilty, annoying, childish, unpleasant, patronizing, making one feel stupid, cutesy, gimmicky

UI



UX



Usability?



From THE IMPORTANCE OF EVALUATING UX, Jeff Sauro



# Usability

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- A reminder:
- Usability
  - Systems should be easy to learn, effective to learn and enjoyable
  - Systems should enable people to do their activities at work, school and everyday life to achieve their goals
  - Is made up of several goals



## Usability Goals

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- For each type of user and task you can use measurable goals to help guide the design and development
1. Effective to use (effectiveness)
  2. Efficient to use (efficiency)
  3. User satisfaction (satisfaction)
  4. Safe to use (safety)
  5. Have good utility (utility)
  6. Easy to learn (learnability)
  7. Easy to remember how to use (memorability)
- ISO 9241 Standard



# Usability Goals

1. Effectiveness: measures the *accuracy* and *completion* of goals
2. Efficiency: are the resources *expended* in relation to the accuracy and completion
3. Satisfaction: the comfort and acceptability by the users AND sometimes enjoyment



# Usability Goals

4. Safety: involves protecting the user from dangerous conditions and undesirable aspects
  - can refer to external conditions (e.g., working environments – such as exposure to X-ray machines)
  - can refer to helping the user to avoid doing unwanted actions accidentally and errors unexpectedly
  - To create safe systems:
    - Prevent the user from making serious errors by reducing risk of wrong key/buttons from being hit (e.g., do not place quit or delete buttons next to save commands)
    - Provide users with the means for recovery from errors (e.g., the garbage in Microsoft and Macs or Undo or confirmation dialogues)



# Usability Goals

5. Utility: refers to the extent to which systems provide the right kind of functionality so that users can do what they need it to do
  - Can have high utility and low utility (depending on what the user wants to do)
    - e.g., for accountants they need a high utility system to do tax returns
    - e.g., weather people need a high utility system to let them analyze weather patterns to make accurate predictions
    - e.g., Notepad has low utility – it allows users to make notes but has limited formatting functionality



Sticky Note – example of non-digital low utility



# Usability Goals

6. Learnability: refers to how easy a system is to learn
  - Users do not want to spend a lot of time learning how a system works
  - They want to be able to start doing their tasks right away and continue until the task is completed (e.g., they don't want to have to interrupt their current task to figure something out)



# Usability Goals

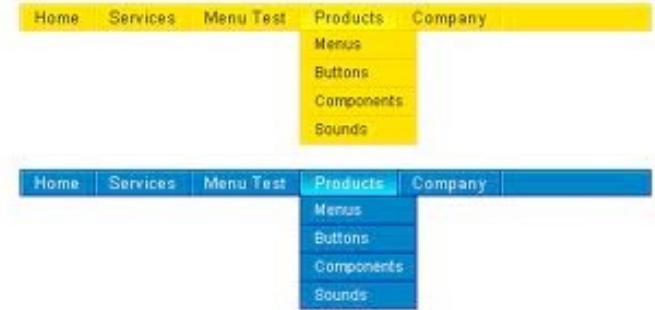
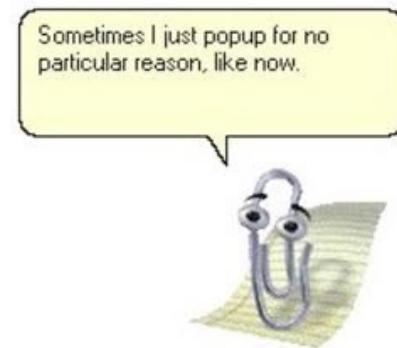


- When is **Designing for Learnability** very important (make something easy to learn)?
  - This is especially important for systems meant for everyday life (e.g., Smartphones, tablets, washing machines, etc.)
  - For more complex systems (e.g., flight simulators) people are willing to spend more time learning but it should still be understandable and intuitive

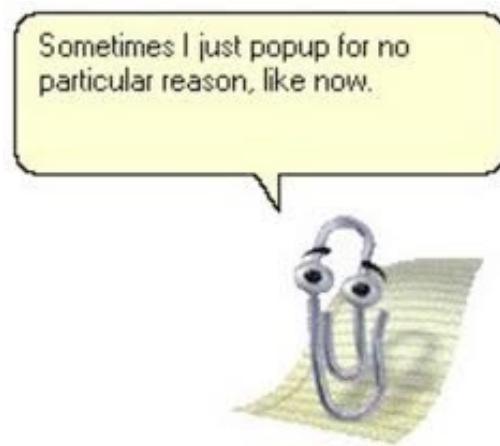


# Usability Goals

7. Memorability: refers to how easy a product is to remember how to use, once learned
  - If users haven't done an operation for a while, they should still be able to remember how to use or to re-learn/re-remember how to use it quickly (**RECALL**)



# Usability Goals



- Ways to design for Memorability (make it easy to remember how to use, once learned)?
  - Operations should be obvious and intuitive when they aren't it is hard to remember how to do them
  - You can help users by using meaningful icons, command names and menu options and grouping useful and related commands/options together
  - Provide useful help options that the user can initiate
  - Don't irritate the user (e.g., 'clippy')



# How to measure your usability goals?

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- This is not always easy
- What is a 'good' level? Maybe 'ok' is okay?
- What ones are most important? How do you determine the important ones?
- What are you going to use to measure these? Probably different for the different goals and products.
- E.g., how to measure effectiveness? Efficiency? Learnability?

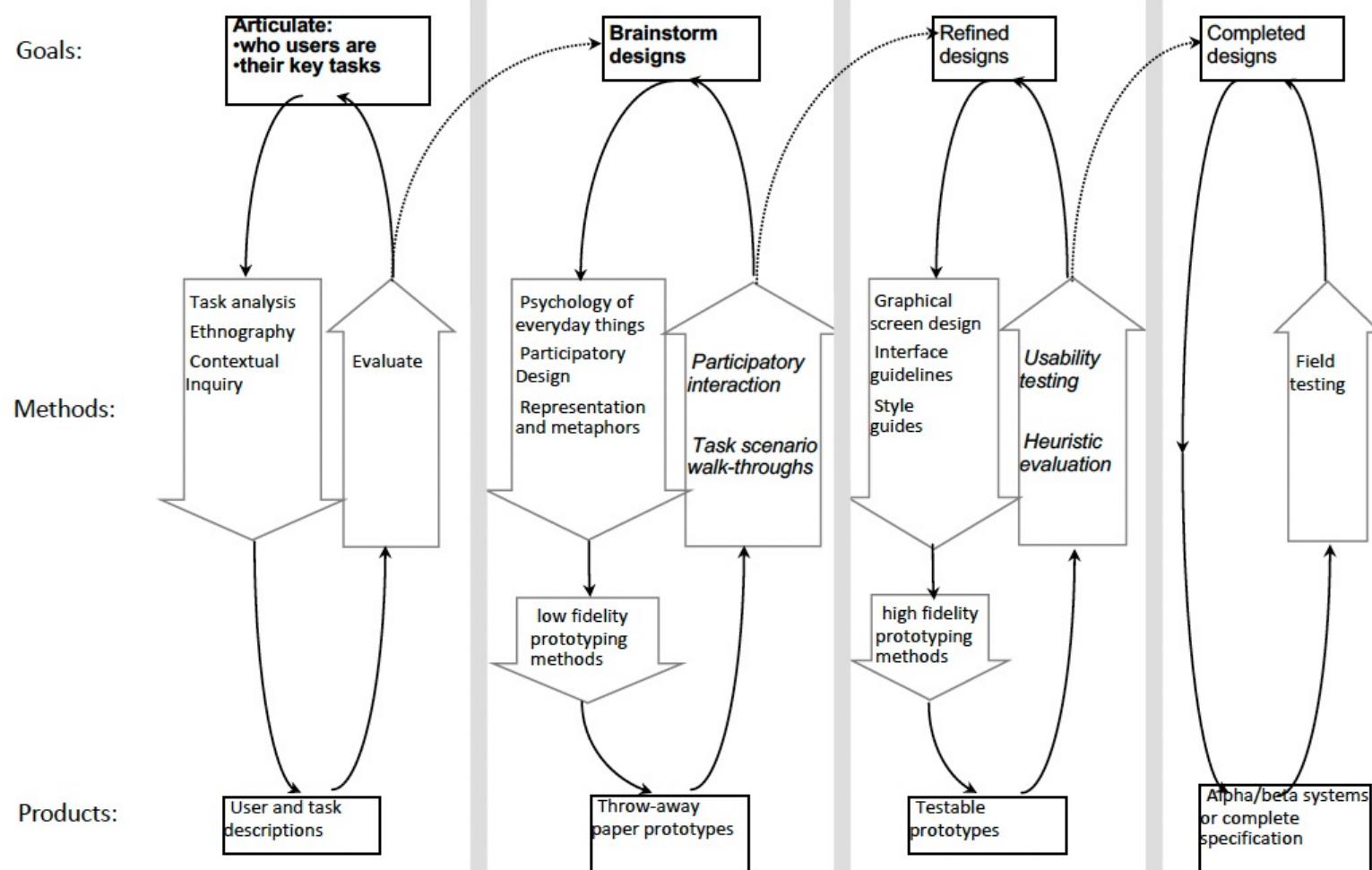
# Example

- You want to design a new web browser
  - The goal is to figure out the most basic functions from the browser and to figure out if users can use their previous browser experiences to learn a whole set of functions
- To simply ask the user "is the system easy to learn" is not very focused (it is not clear how to measure)
  - Instead, can word questions around measures:
  - "**How long** did it take a user to figure out how to use the most basic functions in the new web browser?"
  - "**How long did it take a user** to learn a whole set of functions?"
  - "**How many times** did the user need to "undo" an action?"
  - "**How many attempts** did the user need to complete a simple task?"
  - "**How many clicks** did it take to find the correct page?"
  - "**How long does it take** for a user to learn to use the most basic functions in the new browser to perform some benchmark tasks **compared** to their current browser?"
  - "**How did the user rate the ease** to learn x, y or z from 1 being easy to 5 being hard?"

# Design Process

## A Phased UCD Process Model

Process diagram by Saul Greenberg



UCD = user centered design

# Design Process in the Course Project

Roughly, a combination of the Phased UCD Process Model and the Iterative Design model

Phase == Milestones and Assignments

Phase 1: Understanding Users, Validating Design Concepts

Phase 2: Applying Design Principles, Design Walkthroughs

Phase 3: Contextualizing, Refining, and Evaluating Designs...

Phase 4 would likely involve a field trial ...



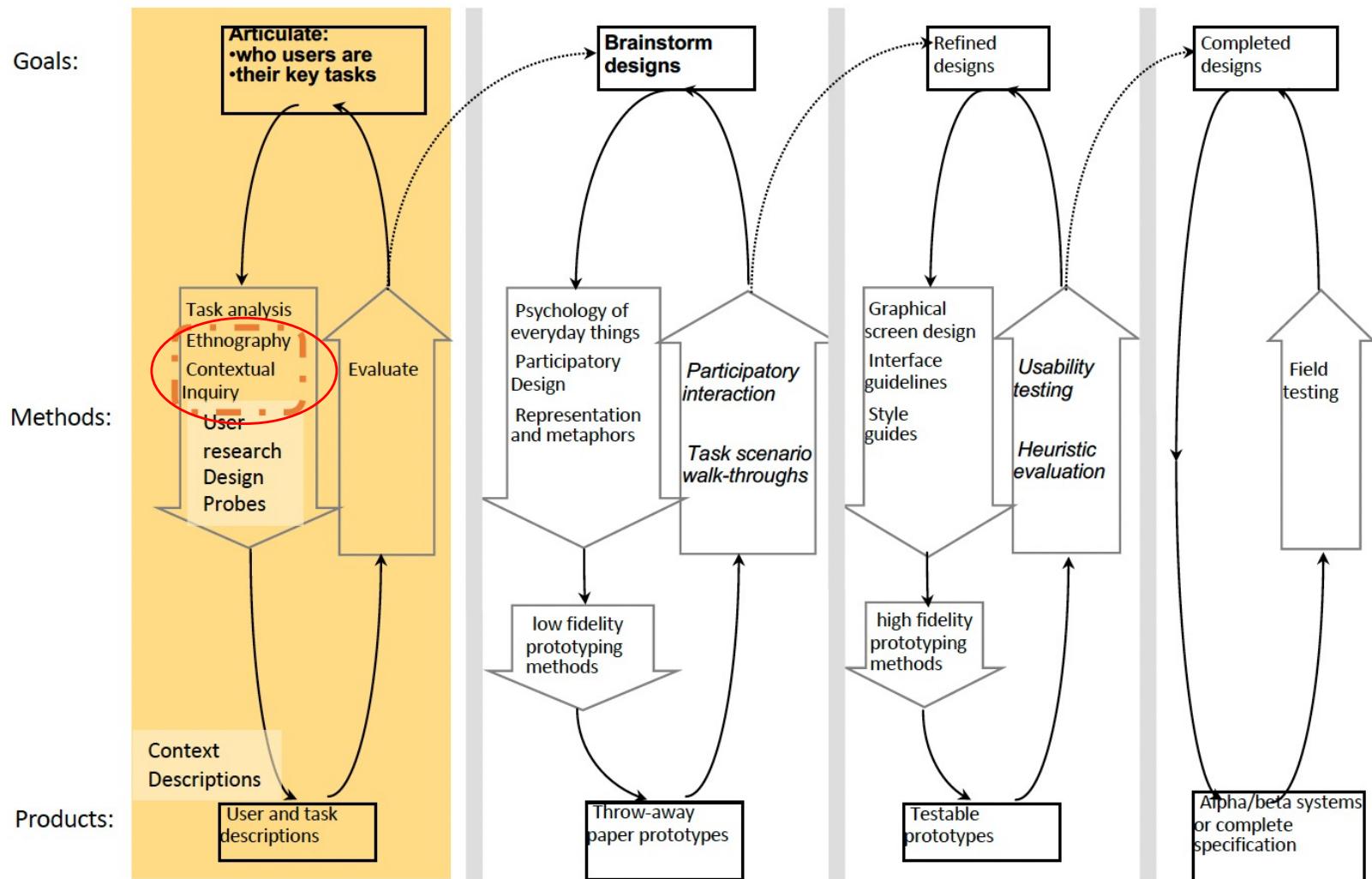
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# Understanding Users

Part I

# A Phased UCD Process Model

Process diagram by Saul Greenberg



# Topics



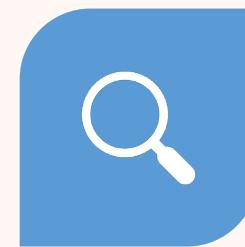
UNDERSTANDING  
USERS FOR THE  
COURSE PROJECT



USER RESEARCH



ETHNOGRAPHY



CONTEXTUAL  
INQUIRY

# Concept vs Reality



vs.



## **The User**

*a pretend person  
who will mould  
themselves to fit  
your system*

## **Mary**

*a real person with  
real constraints  
trying to get her job  
done*

# Concept vs Reality



VS.



## The Setting

*An idealized abstraction  
that lets you ignore  
inconvenient details*

## Yankee Stadium

*An actual location with  
its own policies, contracts,  
attendance, traditions, etc.*

## Understanding users in this course project

- You are trying to do a variant of user-centered design
- In user-centered design you actively engage actual or potential users of your system throughout the process
- In UCD understanding users includes:
  - Spending time with them at their place of work (or where the supported activity takes place)
  - Interviewing / surveying users
  - Defining their needs and tasks and verifying these with them.
- But in reality, you are using your classmates
- They are similar to you BUT can still offer a new or different perspective based on experience and background

# Conducting Research – use variety of resources

- **Online resources:** Academic articles, News, Blogs, Wikipedia, Photo essays, Videos, Data repositories
  - Note: If an online resource doesn't cite sources and clearly identify who created it, then it isn't a trustworthy resource also consider author motivation. Are they primarily sharing information or are they primarily trying to persuade? If the latter, be skeptical about the informational content.
- **Libraries:** Librarians do that By appointment E.g. <https://libraries.dal.ca/hourslocations/kellogg.html>
  - Use Dal library search to find academic articles and electronic books. This will give you access if Dalhousie has paid for it.
- **Citations:** Academic articles are peer reviewed to ensure the research methods, analysis, and argumentation are sound.
  - But not all publication venues are top-quality (e.g., can check their Impact Factor (IF), avg. number of citations an article they publish gets. Higher is generally better, but this biases popular topics.)
  - A paper with a lot of citations may have had a greater impact on the relevant research community, and so may be more useful. There is an echo chamber effect, however.
- **Snowball method:** If you find a highly relevant article: Look at their list of references, identify potentially relevant ones.
  - Look at the list of articles that cite this one, identify potentially relevant ones. ...and so on...  
Example: ACM Digital Library



# Ethnography

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- “...theory of cultural behaviour in a particular society” (Frake 1964:111-112)
- “It takes a very skilled person with a high degree of selfawareness to study a cultural scene he has already acquired” (Spradley and McCurdy 1972:32-34)



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# Ethnography

- People observed as they go about their normal activities
- Observers immersed in the environment and become a part of the normal activities
- Strong attempt to minimize the impact of having the observer present
- Important to NOT INFLUENCE normal activities
- Sometimes observers are more hidden while other times observers are fairly apparent (i.e. part of the experience) but are still careful to not influence activities or behaviours
- More of an experience than a data-collection exercise
- BUT experience must be analyzed, shared with others so it must be documented or captured somehow



# Ethnography

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- Reveals info that may be missed by other methods (i.e., real activities, context of work, implicit goals)
- Records behaviours, activities and context
  - Including what is normal or taken for granted
  - What people say/do
  - Documents notes, pictures, room layouts, video
- Don't plan what you are going to collect, just collect what happened
  - But do know how to collect



# Contextual Inquiry

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- A design methodology rooted in ethnography
  - Structured approach to gathering and interpreting data from fieldwork for the purpose of informing design
  - Typically involves 7 stages:
    1. Contextual Inquiry
    2. Work Modelling
    3. Consolidation
    4. Work Redesign (visioning and storyboarding)
    5. User Environment Design
    6. Mockup/Prototype and Test with Customers
    7. Refining Design
- We will focus on the first three steps

# Contextual Inquiry

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- One-on-one field interviews with customers/users in their workplace to discover what matters in the work
- Can gain reliable knowledge about what customers do and what they care about
- Identify appropriate people to meet, observe, and interview: customers, users, managers, etc.



## Contextual Inquiry

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- To efficiently gather information relevant to product development.
- To gather context sensitive information that is relevant and helpful to design.
- Taking users out of context separates them from familiar cues, tools, and environmental aspects of their normal work environment.
- When asked questions out of context, users tend to speak in generalities.

# Contextual Inquiry vs Ethnography

- CI is usually much shorter than ethnography
- Focused on design issues not on understanding “everything”
- Less concern with “blending in” to become participant observer
- Main goal is to design a system in traditional ethnography there is no pre-determined agenda to follow beyond understanding culture
- Contextual Inquiry example: student shopping
  - <https://www.youtube.com/watch?v=JV6br-npgfw>
- Ethnography (from a CS perspective) Example
- Eric Paulos and Tom Jenkins – the Jetsam An Urban Probe
  - <http://www.urban-atmospheres.net/UrbanProbes/Jetsam/index.htm>

Urban Probes: Encountering our Emerging Urban Atmospheres  
Eric Paulos and Tom Jenkins  
ACM SIGCHI, April 2005

Jetsam  
An Urban Probe

Eric Paulos  
Tom Jenkins

Intel Research

# Last Day we looked at Interviewing

Talking and **listening** to people

Verbally asking participants  
questions and hearing their point of  
view in their own words

Done face-to-face or over the phone  
or video

One to one (one interviewer and one  
interviewee)

# Today – focus more on Contextual Inquiry



## **Interviewing: What they say**

Get them to think aloud while working

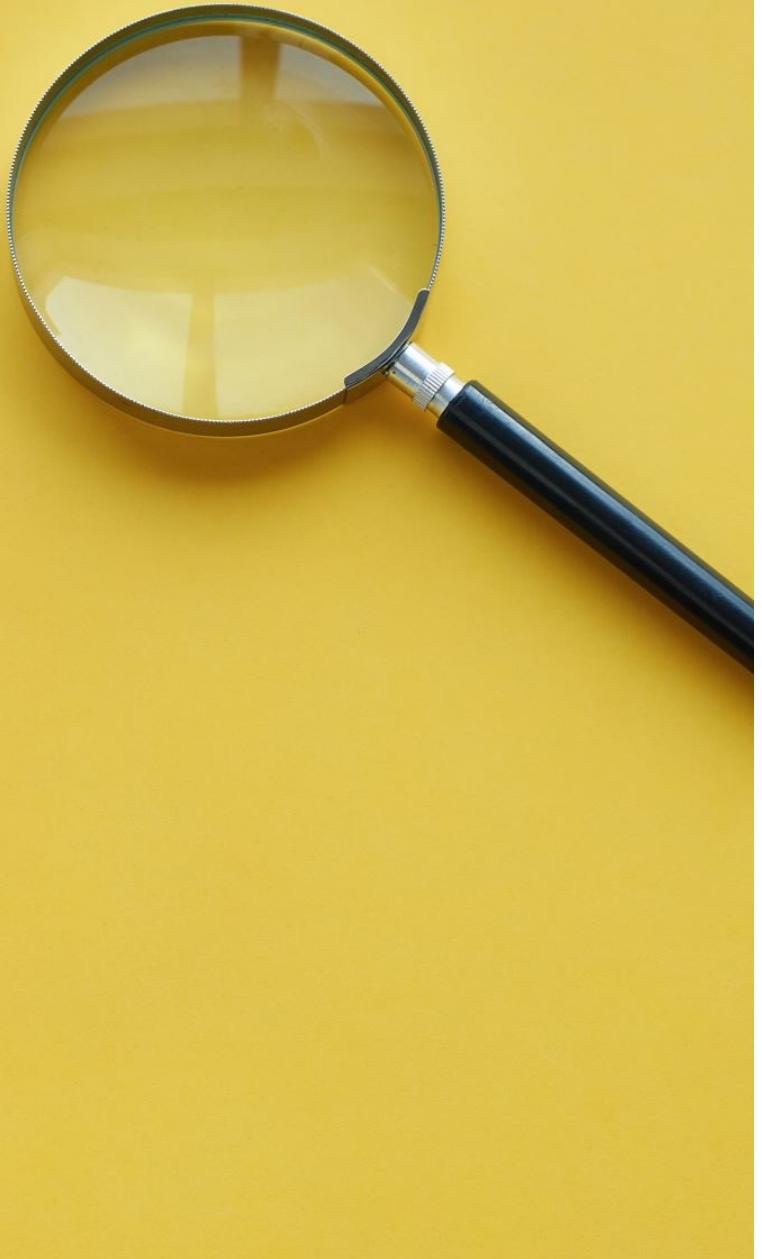
Narration can add “hidden” information

## **Observing: What they do**

See actual behavior, which often differs from what they say

### Contextual Inquiry:

Can be interviews alone (or with minimum observation) and can be a combination of Interviewing and/while Observation



## What is Observation?

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- Watching people, programs, events, tasks, communities, etc.
- Used to:
  - Provide information about real-life situations and circumstances
  - Assess what is happening
- Valuable because you cannot always rely on participants' willingness and ability to provide information



## When is observation useful?

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- When you want direct information
- When you are trying to understand an ongoing behaviour or process
- When there is physical evidence, products, or outcomes that can be readily seen
- When other data collection methods seem inappropriate

# Observations

## Advantages



Most direct measure of behavior



Provides direct information



Easy to complete



Saves time (?)



Can be used in natural or experimental settings

## Disadvantages

- May require training
- Observer's presence may create artificial situation
- Potential for bias
- Potential to overlook meaningful aspects
- Potential for misinterpretation
- Difficult to analyze

# (If unobtrusive...)



- Can see things in their natural context
- Can see things that may escape conscious awareness, things that are not seen by others
- Can discover things that may have been taken for granted
- Can learn about things that people might not be willing to talk about
- Low potential for generating observer effects

# Limitations

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- Potential for bias
  - Observer bias
  - Cultural bias (during observation and interpretation)
- Reliability
  - Ease of categorization
- Often used in combination with other methods to provide a more thorough account

# Types of observation



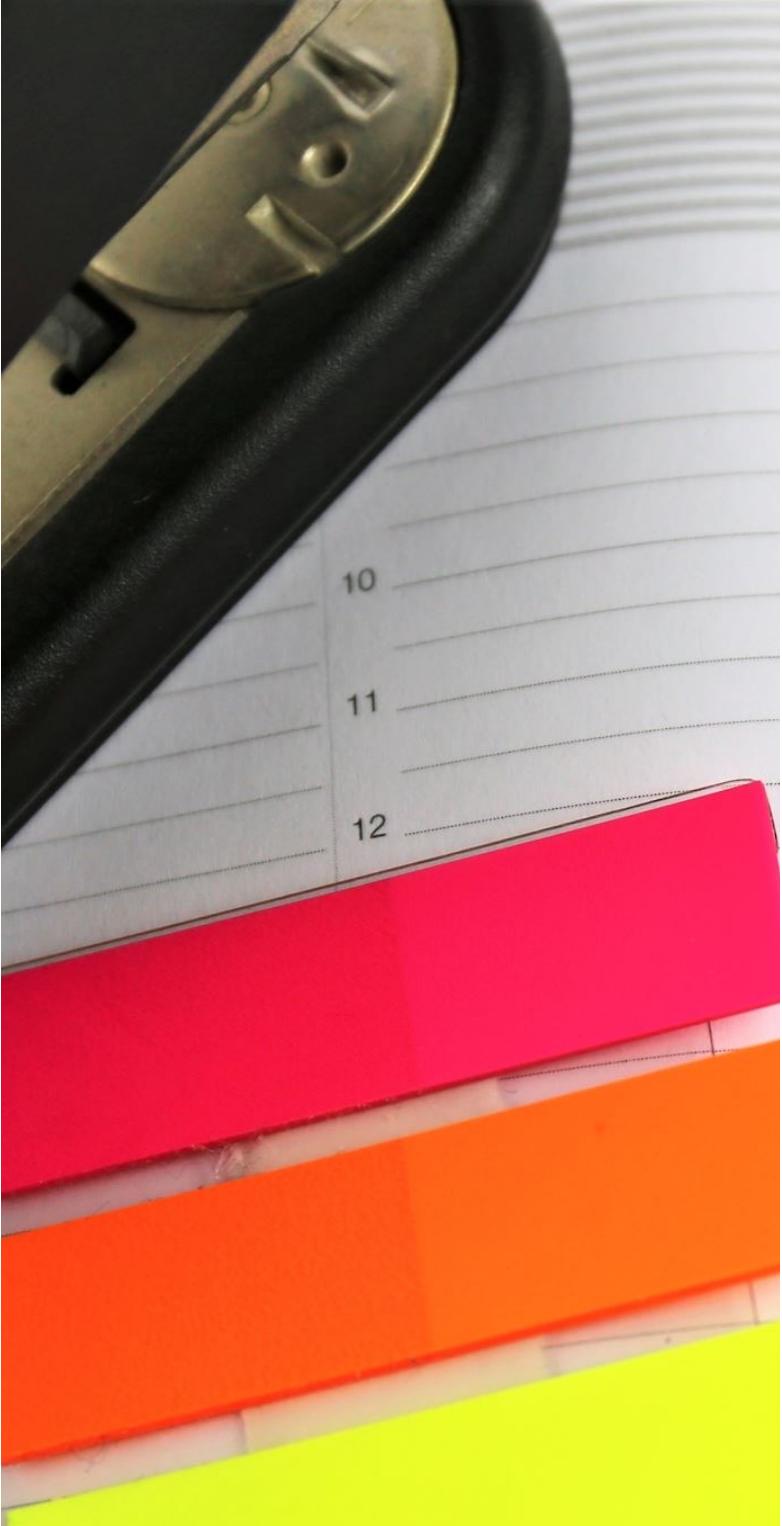
Structured  
(looking for)

For example: How often does the user search for information?

Unstructured  
(looking at)

For example: How does the user find information?

**\*\*Observing what does not happen may be as important as observing what does happen**



# Observations need to be credible

- Observation guide
- Recording sheet
- Checklist
- Field notes
- Pictures
- Video
- Some combination of the above

# Partnership for Contextual Inquiry

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- Get people to walk you through their work/tasks
  - If possible, you want to actually be there when they do real work
  - **May be impossible but you can get them to re-create what they do by walking through their tasks**
- When you see something, you don't understand, or a detail is missing, ask for clarification
  - This causes a break in the work so make sure you do this in a way to not interrupt too often
- Interviewees can become sensitized to their work/tasks (they think it obvious for example) → so again try to fill in the gaps
- Can ask them to do a talk aloud as well (ask them to describe out loud what they are doing) – this will ensure that you don't miss something
  - Easier to take notes as well

# Observations:

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- Interviews are more of a conversation (ask and listen and clarify if necessary)
- Contextual inquiries involve inquiries (questions about what is happening) mixed with observations with how someone does something (usually involving an artifact). Key: make sure you don't constantly interrupt a person (makes it more obvious that you are there so they may not act naturally). A talk aloud can help with this (let them describe what they are doing).
- You may do more of a strict observation (e.g., the grocery store one) where the person just gives updates of what they are doing, and the researcher asks clarifying questions.
- When it's difficult to do this 'in the wild' you can 'recreate' how the user may do something. For example, if you wanted to explore how a student registers online at Dal, you could set up the webpage on a laptop and give the user some tasks to complete (e.g., How would you register for the course Eng 1000). Often you can ask the user to do a talk aloud (say what they are doing while they are doing it). You record how they do things, if they get lost, any frustrations, what they like, as they are interacting, etc.
- In addition to the observations, you can also ask them some questions (sometimes better to leave to the end or after they have finished a task) about what they liked, disliked, why they do it this way, and for suggestions to help you better understand.

# An example of User Centered Design (and contextual inquiry)

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- How about if you were asked to design a new shopping cart?
  - How would you do it?
  - What approach would you take?
  - What do you think it would look like?
- Ideo video on youtube:
- <https://www.youtube.com/watch?v=M66ZU2PClzM>

# What are some characteristics of Ideo's Design Process?

- Capture domain knowledge from experts
- Identify specific breakdowns
- Brainstorm solutions to address those breakdowns
- Cross-pollinate ideas
- Pull what's good from different design sketches
- Design, prototype solutions, evaluate, and then try again OR was it evaluate, design, prototype, evaluate and redo? (iterative approach)  
OR was it to learn, evaluate, design, prototype, evaluate and redo OR  
??? what do you think?
- Develop a functional prototype and evaluate “in-the-wild”

Group Activity  
in lab

Group M1  
Indiv A3

Indiv A4



# Contextual Design – A Process

- Contextual Inquiry is part of Contextual Design:
  - An established process for analyzing tasks people do and designing technology to aid them in those tasks
  - An amalgamation of a set of best practices in interactive systems design
  - A tested methodology that has been applied many times
  - A step-by-step process to understand users

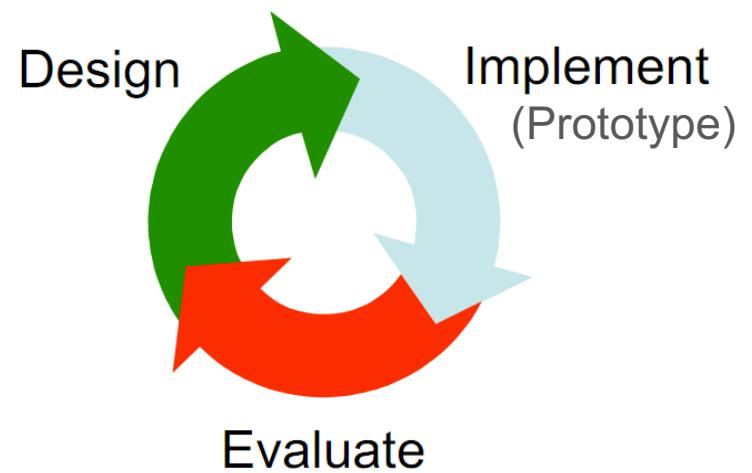
# Contextual Design

## – Steps

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This explicit process supports design of software:

1. Do contextual inquiry (information gathering, learn about your users)
2. Develop models of work for people you study
3. Consolidate these models to produce a single picture of your user
4. Redesign how user will work with your system as a component
5. Define the overall structure of your system to work with user's new work process
6. Mock-up (prototype) and test with users



# Design Exercise

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- Get into groups of 4-5 people (you can reuse the groups you did last time or expand on results from last time): (5 minutes)
- Two topics (highlight the one you did previously):
  1. How does the weather affect how people plan their day?
  2. How do people choose how to get to school/work each day?
- Using on the 2 themes and questions that came up with last time (10 minutes)
  - Come up with a task that you could ask a user to think about and to talk you through how they would do the task (you can ask them to show using their mobile phone/laptop as well if it relevant ie they would use it normally)
  - Then I'll assign a student to join the groups to go through the tasks
  - While they are going through the tasks, record (make notes) on what they do
  - You can ask them questions while they do it
  - Ask your set of questions from last class after they do each 'theme'
  - Post on Brightspace – make sure to add everyone's name and only one person needs to add (by 6:00 today)

Note: a theme would be a sub-area of interest related to the topic. For example, if your topic was "How do people navigate when walking to a destination"

- A theme might be "How people create routes"
- Questions might be:
  - How do you typically find out how to get to your destinations? Why do you use this/these methods? Is there one method that seems to work better? Why?

For a task/scenario relating to theme 1: you could say:

- "Imagine, you are meeting a friend for coffee after class today. Suppose your friend suggests the "Waterfront Coffee Bar and Eatery" on Lower Water St, Halifax. It's a nice day, so you decide to walk. How would you create your route to the coffee shop?"
- Can you describe all the steps that you would take (note, if you would use any technology or apps to help, you can show us how you would use these as you describe the steps you would take).

- Shneiderman, B., Plaisant, C. (2005). Designing the User Interface (4th Edition). US: Pearson-Addison Wesley.
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# Brainstorming Guidelines

1. Don't ban "silly stuff" – sometimes it is unconventional ideas that can turn into really useful or innovated ideas (remember to debate)
2. Build one idea on another (e.g., if you get stuck go back to a good idea and find alternatives)
3. \*Keep records\* capture all your ideas without censoring – write down, photos, videos, sketches, etc.
4. Keep the main problem in focus (easy to get off topic)
5. Have one person be the facilitator to help things stay on track

# CAVEATS

- You can conduct a great interview, but not achieve your research goals.
- Why?
  - Interviewing the wrong people
    - Omit a segment of the target population
    - Recruitment strategies could bias population
  - Asking the wrong questions
    - your interview questions don't adequately address the research questions
  - Incomplete data collection
  - Faulty analysis of data collected