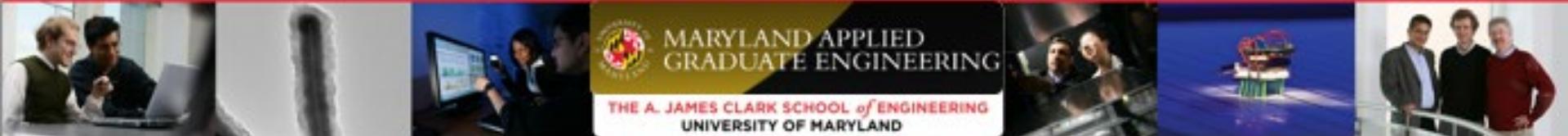


ENPM 613 – Software Design and Implementation

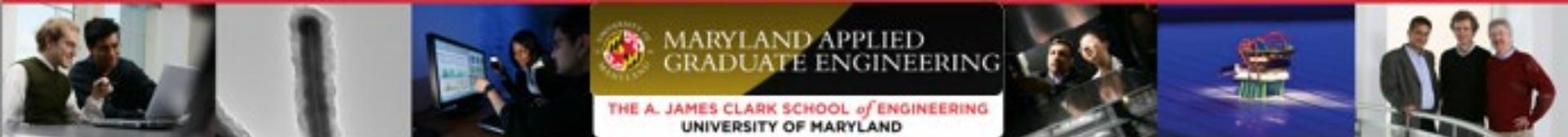
USER CENTERED DESIGN

Dr. Tony D. Barber / Prof. Sahana Kini
Fall, 2022



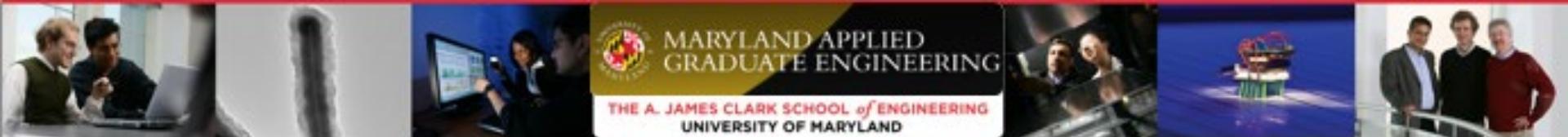
TODAY'S CLASS OBJECTIVES AND OUTCOME

- Define and explain the importance of the user centered design in software development
- Define user centered design concepts
- Explain user centered design process and relation with engineering design
- List interaction design principles
- Model users using personas
- Model tasks and user interaction using task hierarchy and storyboards
- Develop user interface sketches, wireframes, and prototypes
- Explain aspects of web pages/applications structural design and detailed design
- Identify usability attributes and measures
- List techniques for user interface evaluation



OUTLINE

- Lecture
 - Usability definition and importance
 - User centered design concepts, process, and techniques
 - User Centered Analysis
 - User Profiles and Personas
 - Task and Scenario Analysis
 - Setting usability criteria
 - UI Structural Design
 - Information Architecture
 - Navigation Design
 - Layout
 - UI Detailed Design
 - Presentation
 - Content
 - Interaction
 - Usability evaluation
- Assignment – User Centered Design



RESOURCES

▪ Books

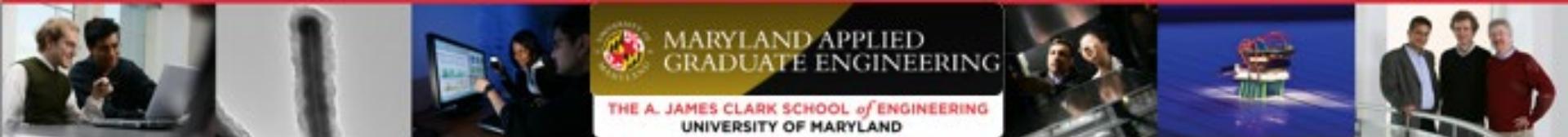
- *Software Engineering*, Ian Sommerville, [Ch 29 Interaction Design](#)
- *Sketching Users Experiences*, Bill Buxton
- *Designing the User Interface*, Ben Shneiderman
- *The Elements of User Experience*, by Jesse James Garrett
- *Voice User Interface Design*, by James P. Giangola, Jennifer Balogh
- *Designing Voice User Interfaces*, by Cathy Pearl
- *The Design of Everyday Things*, by Don Norman
- *The Thoughtless Design of Everyday Things*, by Karl Wiegers

▪ Standard

- [ISO 9241-210 Part 210](#): Human-centered design for interactive systems

▪ Paper

- [The User as a personality](#), by Stefan Blomkvist



MORE RESOURCES

- User centered design, user experience

- <https://www.usability.gov>
- <http://www.usabilityfirst.com>
- [UX Magazine](#)
- [Nielsen Norman Group](#)

- The elements of user experience

- <https://www.slideshare.net/openjournalism/elements-of-user-experience-by-jesse-james-garrett>
- <http://www.jjg.net/elements/pdf/elements.pdf>
- <https://www.slideshare.net/openjournalism/elements-of-user-experience-by-jesse-james-garrett>
- <https://www.slideshare.net/willsansbury/user-centered-design-1787667>

- Wireframes: <https://www.slideshare.net/nickf/wireframes-for-the-wicked>

- Usability vs. User Experience: What's the difference?

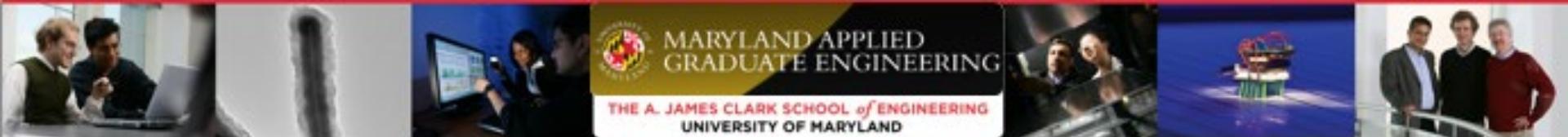
https://www.slideshare.net/domain7/ux-vs-usability?qid=9e05b214-570c-44f1-97ba-7995ab840e40&v=&b=&from_search=3

- 10 Usability Heuristics explained <https://www.slideshare.net/crafted/10-usability-heuristics-explained>

- User Centered Design Overview <https://www.slideshare.net/hursman/user-centered-design-overview>

- Free UX tools (freeware and/or trial software)

- [Project tools](#) | [Prototyping tools](#) | [Design tools](#) | [User research tools](#) | [User testing tools](#) | [Survey tools](#) | [Annotation tools](#) | [Card sorting tools](#) | [Screen grab tools](#) | [Sitemapping tools](#) | [Analytics tools](#) | [Accessibility tools](#)



OUTLINE

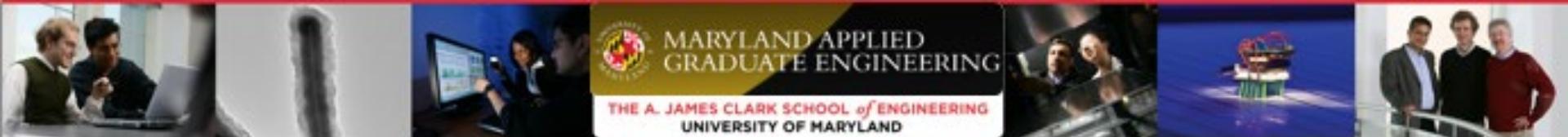
- Lecture

We are here

- Usability definition and importance

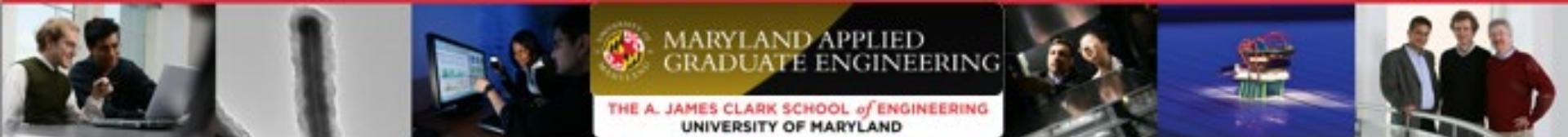
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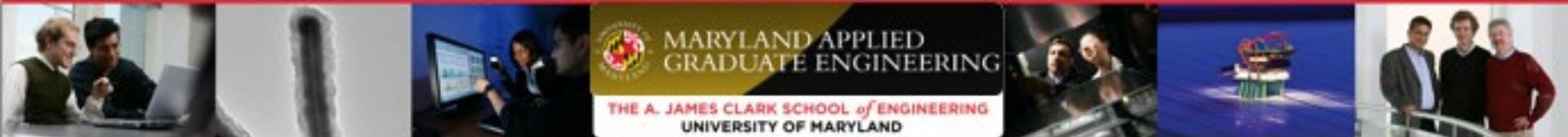
ISO 9241 USABILITY DEFINITION

- **Usability:** The extent 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:* the accuracy and completeness with which users achieve specified goals
 - *Efficiency:* the resources expended in relation to the accuracy and completeness with which users achieve goals
 - *Satisfaction:* freedom from discomfort, and positive attitude to the use of the product
 - *Context of use:* characteristics of the users, tasks and the organizational and physical environments



PROPERTIES OF A USABLE PRODUCT

- Is easy to learn
- Is hard to forget
- Minimizes burden
- Reduces workload
- Encourages and rewards experimentation
- Anticipates and forgives mistakes
- Does what the user wants when the user wants it
- Always provides feedback
- Satisfying and, possibly, fun to use



USABILITY ATTRIBUTES AND MEASURES

Usability is the measure of the quality of a user's experience when interacting with a product or system

Relate these measures/quantitative Usability attributes to the “Response measure” in the SEI Quality Scenarios for Usability

Usability attributes

Attribute	Description
Learnability	How long does it take a new user to become productive with the system?
Speed of operation	How well does the system response match the user's work practice?
Robustness	How tolerant is the system of user error?
Recoverability	How good is the system at recovering from user errors?
Adaptability	How closely is the system tied to a single model of work?
Easy to remember	How long does it take the user to perform the same task again?

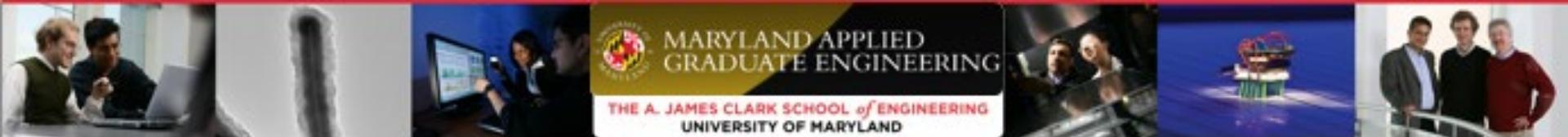
[From Software Engineering, Ian Sommerville, Ch29 and J. Nielsen <http://www.webnauts.net/usability.html>]



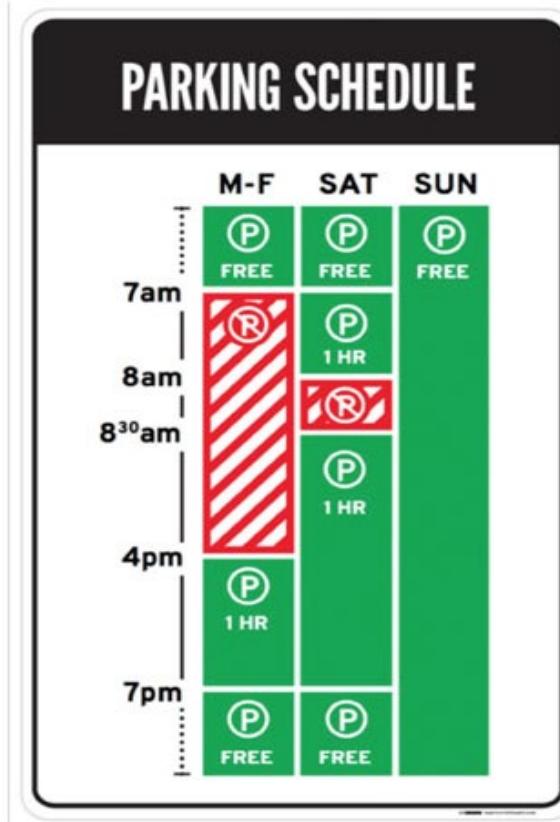
WHY AND TO WHOM IS USABILITY IMPORTANT?

- To the user
 - It makes a significant difference
 - Perform a task accurately and completely or not
 - Enjoy the process or be frustrated
- To the developer
 - It can mean the difference between the success or failure of a system
- To management
 - Poor usability can cost time and effort and can greatly determine the success or failure of a system

Given a choice, people tend to buy systems that are more user-friendly



COMPARE THE USABILITY OF THE TWO REPRESENTATIONS OF THE SAME INFORMATION



<https://www.interaction-design.org/literature/article/bad-design-vs-good-design-5-examples-we-can-learn-frombad-design-vs-good-design-5-examples-we-can-learn-from-130706>



OUTLINE

- Lecture

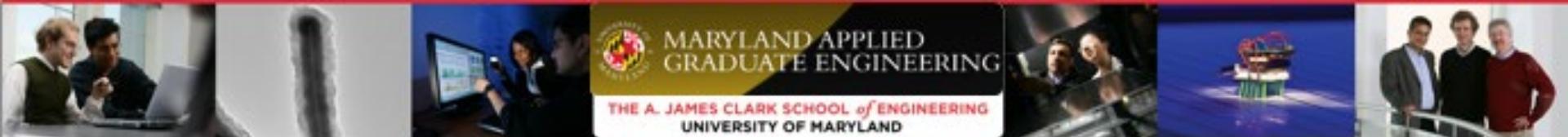
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We are here

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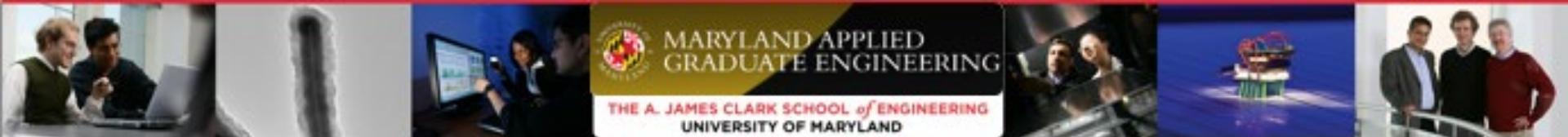
MORE DEFINITIONS

- *Human computer Interaction (HCI)*
 - The study of how people interact with computers and to what extent computers are developed for successful interaction with human beings
- *User centered design (UCD)*
 - A design philosophy for interactive systems
 - Involve the user in the design and development process
 - Puts the user (rather than the system) at the center of the design
 - Design a system to support its intended users' existing beliefs, attitudes, and behaviors as they relate to the tasks the system must support
- *User experience (UX) design (UxD)*
 - Conducting user research with intended users of a system, to reveal users' needs and preferences



DEFINITIONS

- *Interaction design (ID)*
 - An iterative process where users interact with designers and interface prototypes to decide on the features, organization and ‘look and feel’ of the system user interface
- *User interface (UI) design*
 - Design of the human computer interface (typically visual/graphical GUI)
- *Usability*
 - A measure of the interactive user experience associated with a user interface
- *User experience* is sometimes used interchangeably with *Interaction experience*
- User experience = usability **and** other user related “ilities”

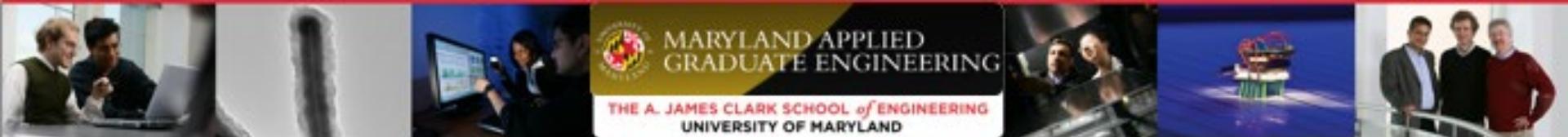


“WHY” USER CENTERED DESIGN (UCD)?

- As a result of applying UCD, the product achieves usability that leads to user satisfaction

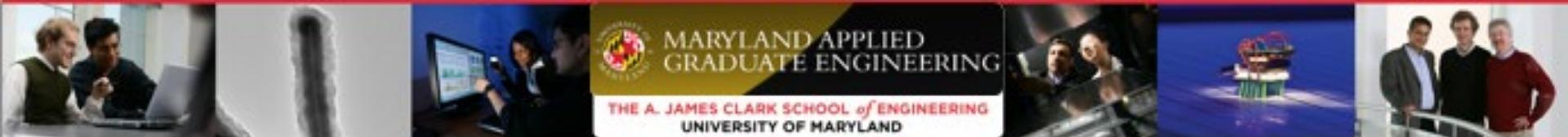


- User is (one of the) main software stakeholders
 - Is this true for all software?
 - Is user the most important stakeholder?

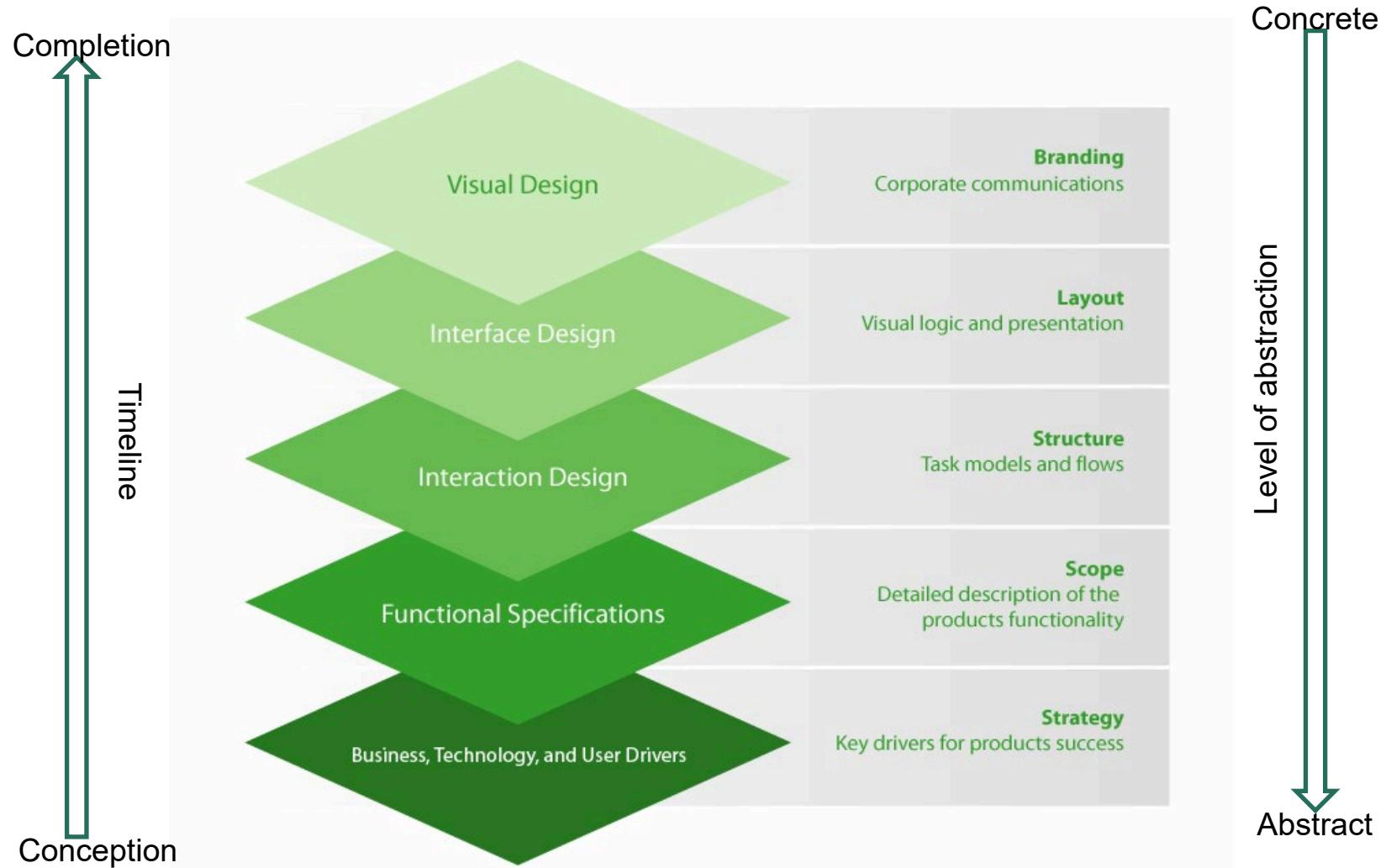


UCD ASPECTS

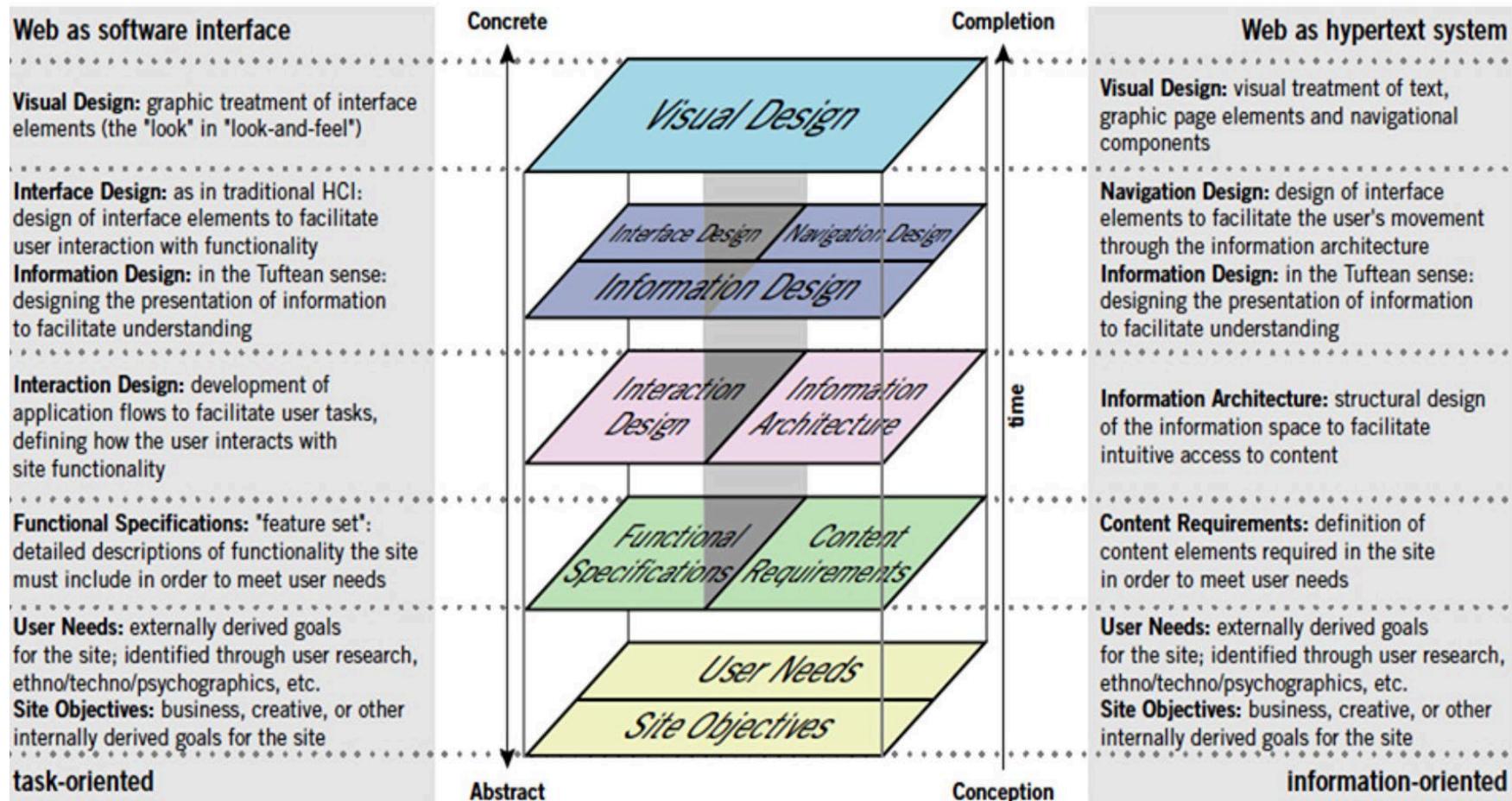
- Strategic design (identify the “what”)
 - Business requirements
 - Technological constraints and opportunities
 - User goals
- Tactical design (identify the “how”)
 - Principles
 - Process
 - Methods, techniques, tools



LAYERS OF UX DESIGN



LAYERS OF UXD – MORE DETAIL

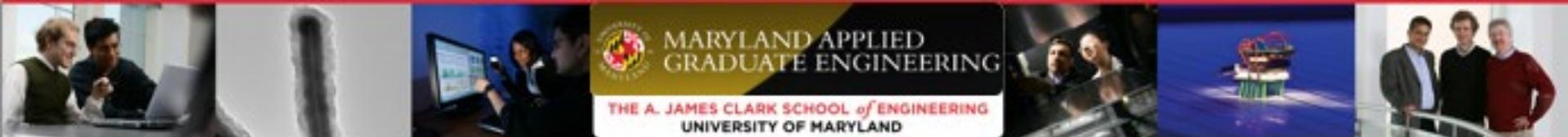


[From Jesse James Garrett <http://www.jjg.net/elements/pdf/elements.pdf>]



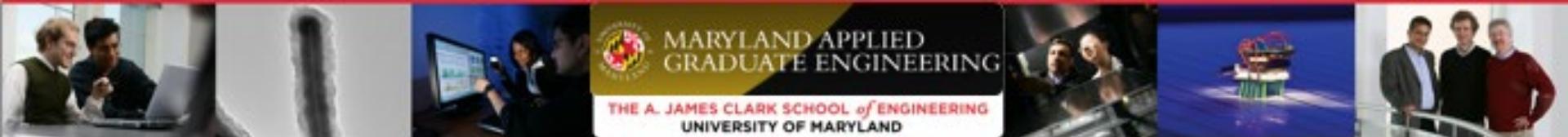
USER CENTERED DESIGN AND ENGINEERING DESIGN

- ***User centered design*** – focused on the interaction between the user(s) and the system
 - Includes aspects related to other disciplines (psychology, graphics, linguistics)
- ***Engineering design*** – focused on the product that provides the functionality and quality needed by the user(s)
- User centered design in relation to engineering design:
 - First develop and test low fidelity prototypes
 - Then:
 - Interface is separately prototyped in parallel with other software engineering activities
 - The interaction design proceeds incrementally as the software is developed

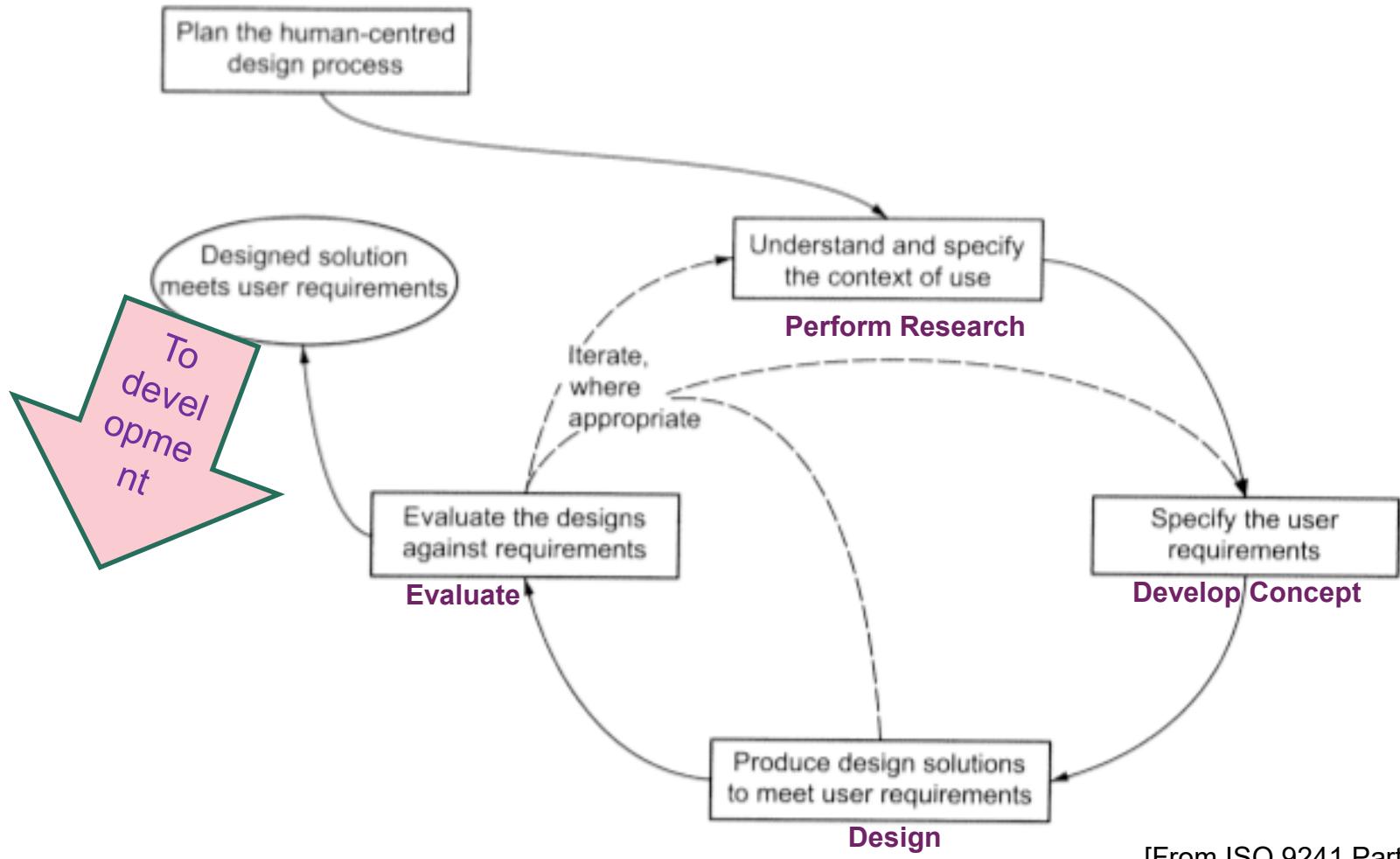


ELEMENTS OF UCD

- Active involvement of users
- Clear understanding of user requirements
- Allocation of function between users and technology
- Iteration of design solutions
- Multi-disciplinary design
- Addresses the whole user experience



USER CENTERED DESIGN (UCD) PROCESS



21

[From ISO 9241 Part 210]



UCD MAIN ACTIVITIES

User-centered Analysis

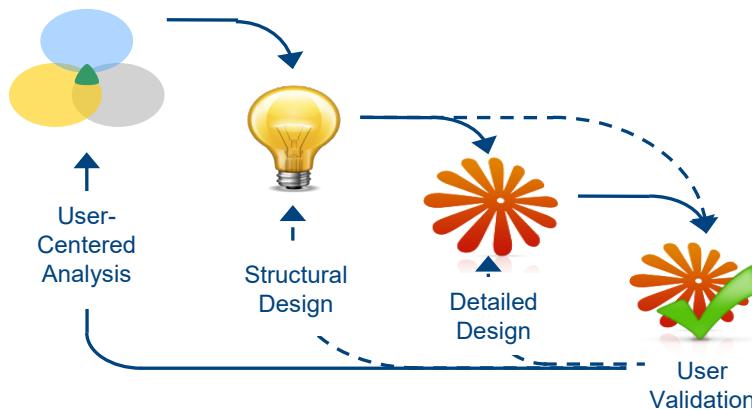
- User Profiles and Personas
- Task and Scenario Analysis
- Set usability Criteria

Structural Design

- Information Architecture
- Navigation Design
- Layout

Detailed Design

- Presentation
- Content
- Interaction



User Validation

- Usability Testing
- Types of Usability Test
- Other Validation Techniques

From *Essentials of Usability* course by Human Factors International (HFI), Inc.



USER CENTERED DESIGN PROCESS

- Iterative process, consisting of the following types of activities:
 - Perform research
 - Develop concept
 - Design
 - Evaluate

Activity	Techniques
Perform Research	Inquiry, Interviews, Surveys, Focus groups, Workshops, Brainstorming, Task analysis, Content analysis, Affinity diagramming, Mental modeling, User profiles/personas , User scenarios, Competitor evaluation
Develop Concept	Storyboards, Sketching , Card sorting, Wireframes , Participatory design, Page layout, Navigation modeling, Metadata design, Taxonomy design
Design	Graphic design, Icon design, Screen mockups, Interaction diagrams, Low/high fidelity prototyping , Functional prototyping
Evaluate	Usability evaluation, Usability testing, Usability lab testing, Web analytics



WHEN TO USE VARIOUS UCD TECHNIQUES

Technique	Purpose	Stage of the Design Cycle
User Interviews and Indirect Data Gathering	Collecting data on user's needs and expectations *NOT focus groups, except for brainstorming.	At the beginning 
Contextual Inquiry	Collecting information on user's environment and typical behavior	Early 
Usability Testing (Lo-fi prototype)	Collecting qualitative on user's interaction and quantitative data on measurable usability criteria	Early; mid-point 
Usability Testing (Advanced prototype)		Final stage 
Satisfaction Surveys	Collecting qualitative data on user preference and satisfaction	Mid-point; final stage 

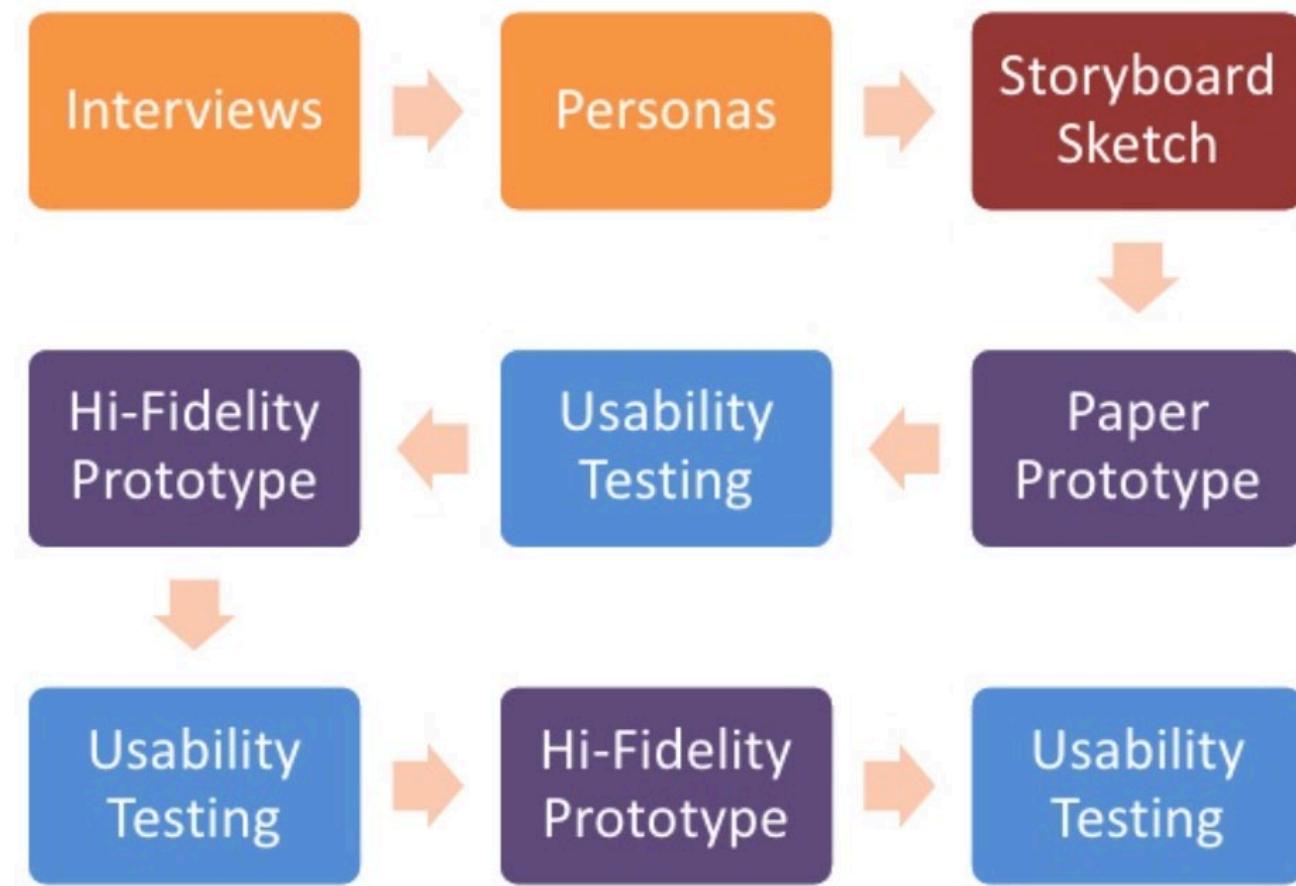
24

From *Essentials of Usability* course by Human Factors International (HFI), Inc.

MORE ON UXD TECHNIQUES ...

- A collection of UxD techniques: <https://methods.18f.gov/>
- Example UxD documents and deliverables
<http://www.uxforthemasses.com/resources/example-ux-docs/>

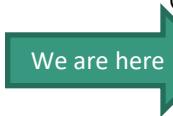
EXAMPLE UCD TECHNIQUES COMBINATION IN A PROJECT

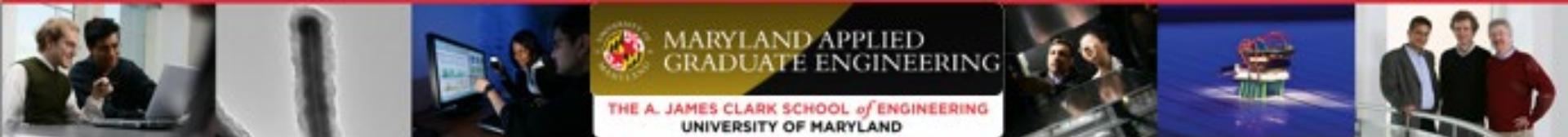


[From A. Hursman, [User Centered Design Overview](#)]



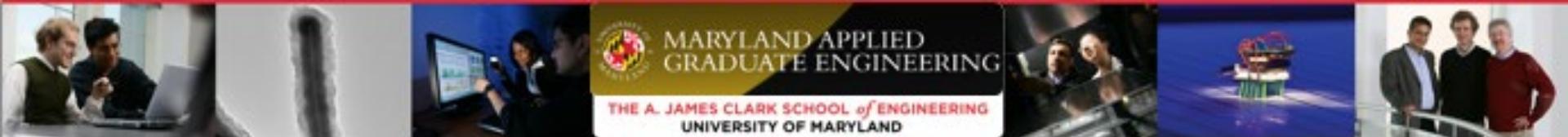
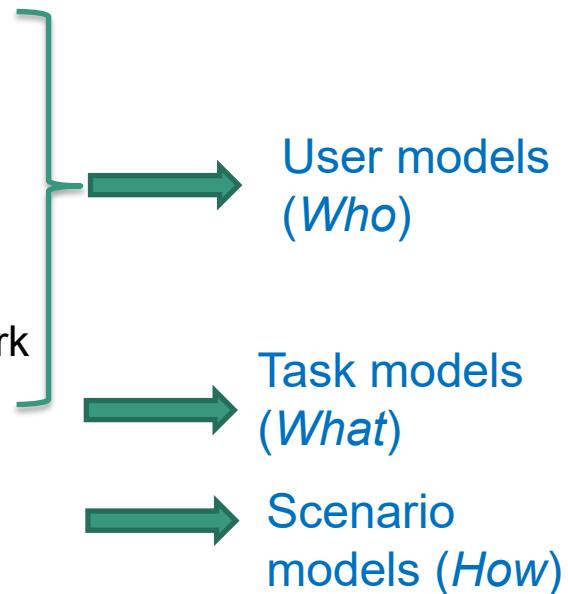
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-  **User Centered Analysis**
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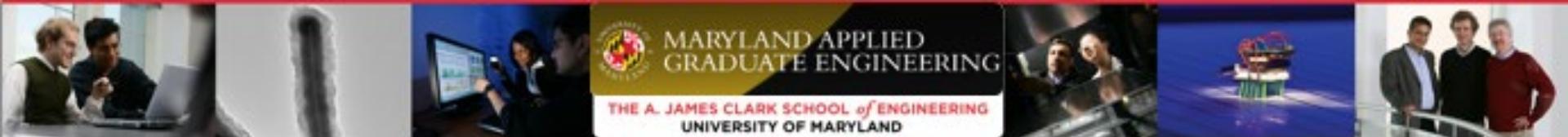
USER AND TASK ANALYSIS

- Users + Goals + Tasks => Flows
- User analysis - develop an understanding of:
 - The *users*
 - *Users' goals and tasks*
 - Their working environment
 - Other systems that they use
 - How they interact with other people in their work
- Task analysis
- Scenario analysis



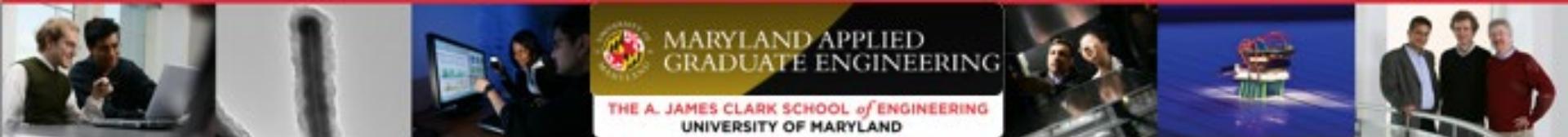
USER PERSPECTIVE

- Determined by:
 - Needs and wants
 - Goals, motivation, triggers
 - Obstacles and limitations
 - Tasks, activities, behaviors
 - Geography, language, culture
 - Environment, gear
 - Work life and experience
 - Mental models
 - Do not always match reality
 - Set expectations, which drive and shape behavior
- Different user types have different characteristics



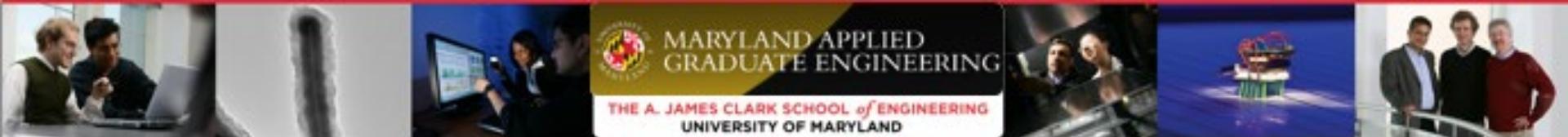
KNOW YOUR USERS!

- Who are they?
- What are their work environments like?
- How experienced are they with the technologies?
- What are their mental models and vocabulary?
- What are their personal characteristics?
- What are their cultural differences?
- What are their motivational differences?



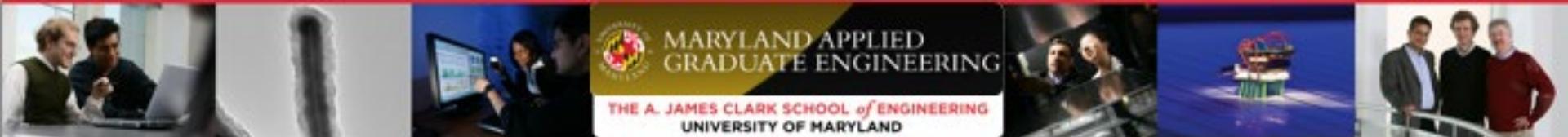
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USER MODELING - PROFILES/PERSONAS TECHNIQUE

- Personas **represent** the **various user types** that are expected as the intended users of a system
- Personas are **not** real people
- Are not “made up” but discovered
 - Need to conduct research to come up with personas
 - There is no “recipe”; no definitive process, only guidelines
 - See [How To Create UX Personas](#)
- Personas are **goal-directed**
 - A precise description of our user and what s/he wants to accomplish
 - Personas are only useful in a purposeful context
 - Goals are not tasks; it is not about what the user wants to do, it is about **what s/he wants to achieve**
- Keep stakeholders and developers focused on the intended users, as they make design decisions



USER MODELING - PROFILES/PERSONAS TECHNIQUE

▪ Elements of a persona

○ Name

- Usually a real name, like “Bob” or “Lisa,” and may include the role of the individual as well. Roles should communicate something about the user’s perspective or motives. Examples of roles are, “Early Adopter,” “Conservative Shopper,” “Worrier,” “Care-giver,” “Parent,” and so on. Include a photograph that represents the individual’s general character to create a more vivid and realistic example for project stakeholders.

○ Goals - Motivations, Needs, and Preferences

- Based on user research, each persona’s motivations, needs, and preferences should be expressed in a concise statement, such as, “John wants to compare mobile phones and calling plans to sign up for new cellular service. He is particularly interested in finding a phone that will support worldwide travel, without expensive roaming fees.”

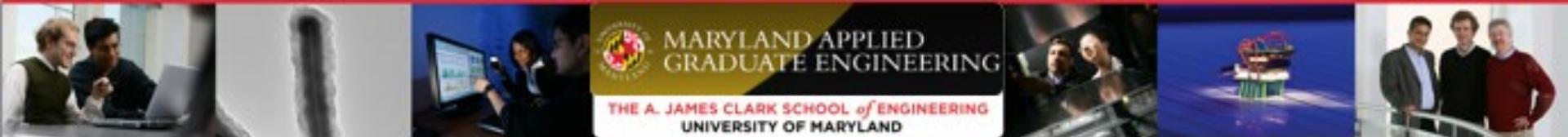
○ Scenarios

- Personas help project members better understand the personalities of a system’s intended users by describing a potential task or goal that the system will support in terms of how a person will react to it. For instance, a “Worrier” may be hesitant to complete a shopping purchase, fearing that his credit card information will not be secure. A parent may wish to control the experience of her young child while he explores a video gaming website that advertises violent games.



HEURISTICS AND TECHNIQUES FOR DEFINING PERSONAS

- Be goal-directed; make sure the goals and objectives of the persona are clear
- *Ethnography* – “observe in their habitat”
- *Contextual inquiry* – like ethnography but more active; e.g. designer may collaborate with the end user on a task
- A persona is specific to the design problem at hand, and they do not overlap
- Start with 3-12 personas
 - Primary, secondary, supplemental, and negative
 - At least one primary, but not too many either



PROTO-PERSONAS

- Proto-personas - very similar to traditional personas just without the extensive background research that goes into them
- Help achieve a few key things for the project we cannot get any other way:
 - Gives stakeholders, team leads, developers and the UX team members a common language when discussing features or functionality.
 - Helps all parties empathize with the users as human beings, and not some sort of 'abstract user'. This empathy CANNOT be understated.

Better Personas One Simple Change to Help Mitigate Bias by James Thompson

<https://medium.com/headspring-ux-team/better-personas-one-simple-change-to-help-mitigate-bias-2611d291a1a4>

PERSONA EXAMPLE1

[From Calde, S., Goodwin, K., & Reimann, R. (2002). *SHS Orcas: The first integrated information system for long-term healthcare facility management*]



Figure 1: The team created detailed descriptions of each persona, including a stock photo and a biography. The text to the right represents a summary of Rhonda's persona description (each description was about a full page in the actual deliverable).

Persona Example: Rhonda Wilson, RN Nurse Unit Coordinator

Rhonda is a 36-year-old RN who has worked at several skilled nursing facilities. She started out in acute care but moved to long-term care so she could have more autonomy. Rhonda was promoted to Unit Coordinator four years ago because she is very competent and generally well organized.

Rhonda is entirely overwhelmed and is drowning in paper, even more so than the average nurse. She often misses eating dinner with her boyfriend because she has to work late, filling out forms and reports.

Rhonda's goals are to:

- **Spend time on patient care and staff supervision, not paperwork.**
- **Be proactive.** Rhonda needs to understand trends in order to solve problems before they happen, instead of just reacting to crises.
- **Know that things are being done right.** Rhonda supervises the unit because she's good at what she does. If nurses aren't following procedure or documenting things, she wants to know right away.

26

Can you identify characteristics of this persona that drive the interaction design, and how?



PERSONA EXAMPLE2

Kitty K.

Name them

Have photos of them

Keep it concise

Identify key behaviors and motivations

Motivations
Uniqueness, The Hunt. She loves to find and possess unique or unusual items such as certain other countries' or antique jewelry.

Behaviors
Showing and telling. She loves to display her collections on in her home and on her body and loves it when this precipitates conversations with others.

Most valuable items are catalogued and valued. She has had professional insurance representatives catalogue her most valuable items. She regularly has some of these items re-inspected.

Formal groups. She joins formal knitting and quilting groups as a means to learn how to do it and to have a place to make friends and share stories.

Relationships. She likes to contribute a good deal of time and money to a local textile museum in order to help educate the public about the items she loves and to help preserve them.

Computer Experience
Ebay, Amazon, Word, Excel

**Age: 55
Location: San Francisco, CA
JobClass: Affluent (Architect)**

Obstacles
Lack of familiarity/no payoff. Won't use a system that isn't easy and familiar (e.g. "like Excel or Word"). She also has reservations in any system that doesn't offer a clear advantage over paper logs like Excel.

Current systems works fine. Kitty has a system for keeping track of and caring for her collections that is working well for her.

Situation

Preserving memories. For Kitty, the value of a thing is in its intrinsic beauty but also in the people or situations of those things. She has a number of quilts that belonged to her mother or other family members. While beautiful, she sees their real value as sentimental or symbolic. At some point, she would really like to have a catalogue of other collections that would allow her to record and preserve the stories and associations each of the objects represents for her.

Let them speak or tell their story

Be wary of 'typing' or stereotyping them

Include project specific considerations (i.e. obstacles, triggers, etc.)

CREDIT: ADAPTIVE PATH

The “bubbles” are heuristics for developing a persona (user model)

[From A. Hursman,
[User Centered Design Overview](#)]



CLASS EXERCISE - PERSONA

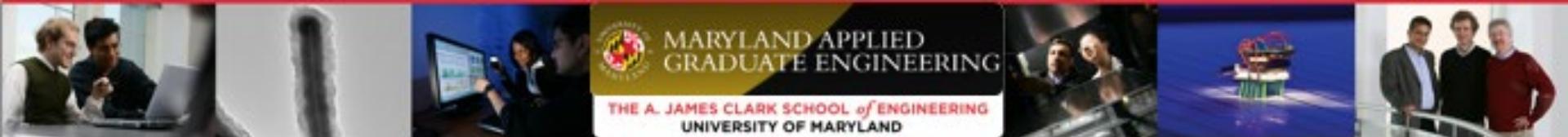
- For your class project software, develop a persona for the primary/typical user
 - Teamwork
 - Present it to the class



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- Assignment – User Centered Design

We are here



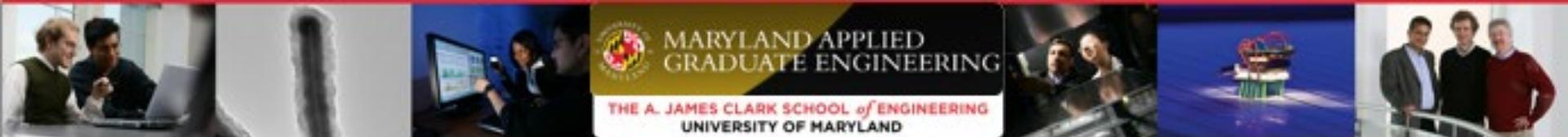
PURPOSE OF TASK ANALYSIS

Identify tasks and individual steps of the user's interaction with the system and their relationship(s)

- Sequence
- Dependencies, contingencies
- Repetition within tasks
- Information needed

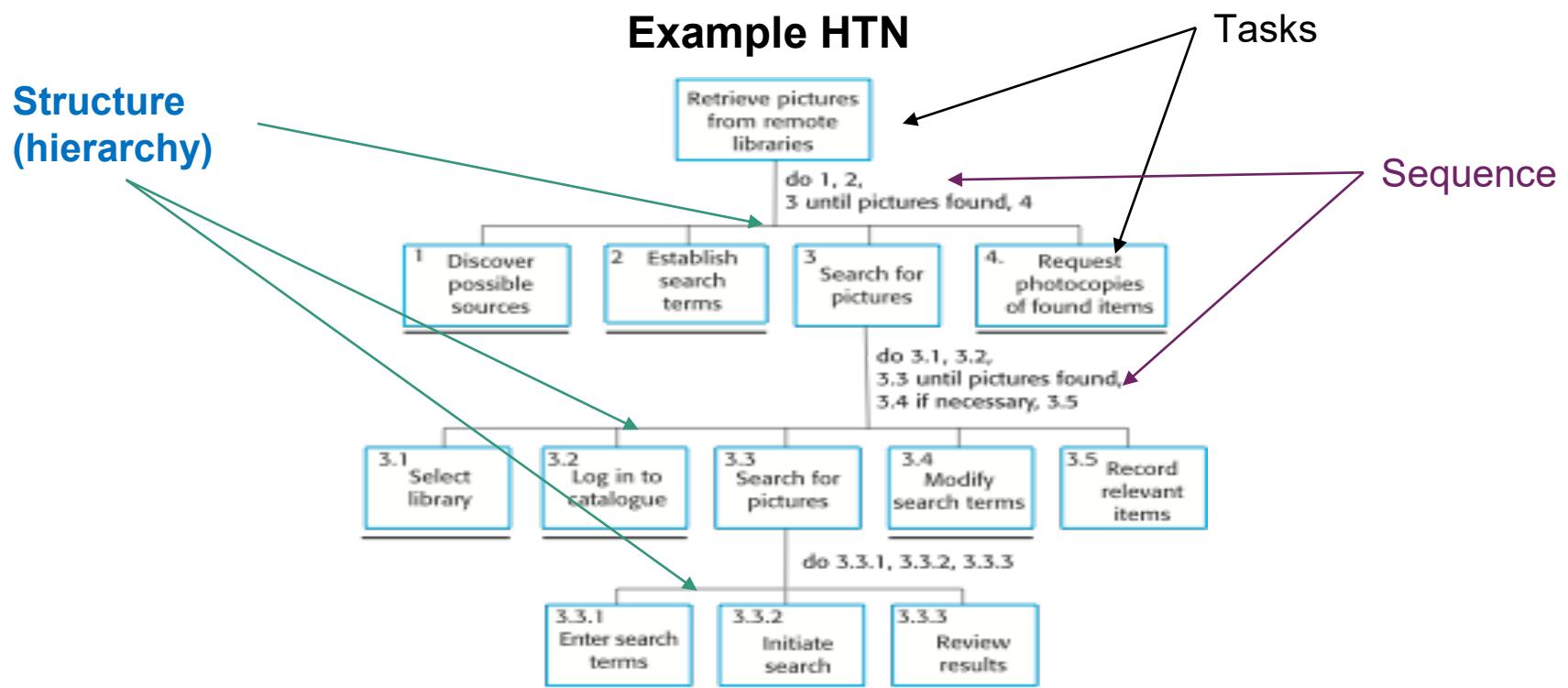
Detect problems

- Unnecessary steps
- Unnecessary complexity
- Redundant activities
- Bottlenecks
- Poor function allocation
- Poor distribution of skills
- Poor job enrichment



USER'S TASK MODELING – USING HIERARCHICAL TASK NETWORK NOTATION

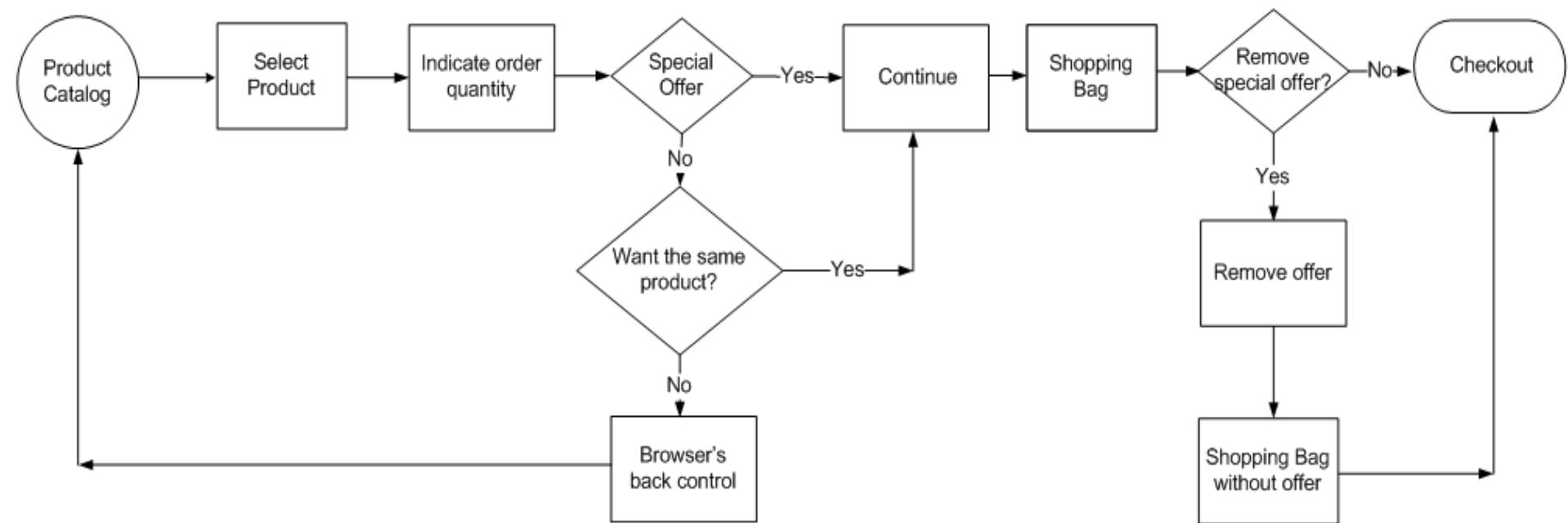
- Hierarchical Task Networks (HTNs) notation can be used to represent
 - A task decomposition structure and
 - A sequence of tasks



USER'S TASK MODELING – USING ACTIVITY DIAGRAM NOTATION

For an online shopping system

Task-Flow - Select product and proceed to checkout

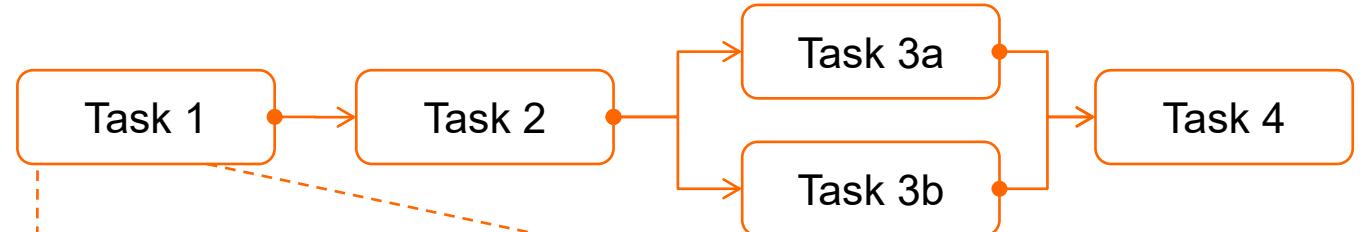


FROM TASK FLOW TO SCREEN DESIGN

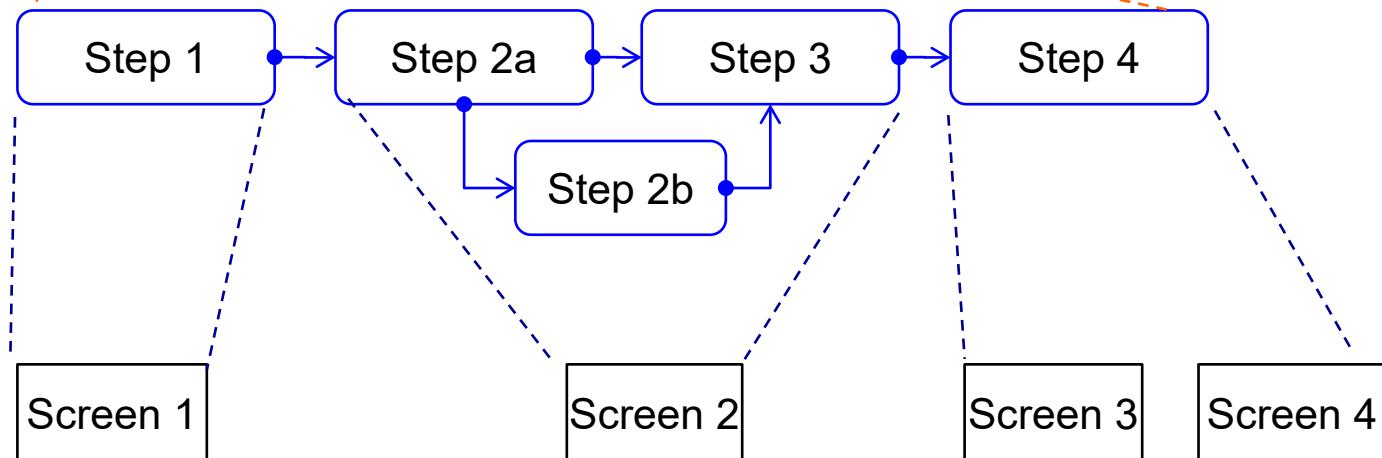


High level tasks -> tasks' steps -> page/screen flow

Identify how tasks fit together in the user's mental model.



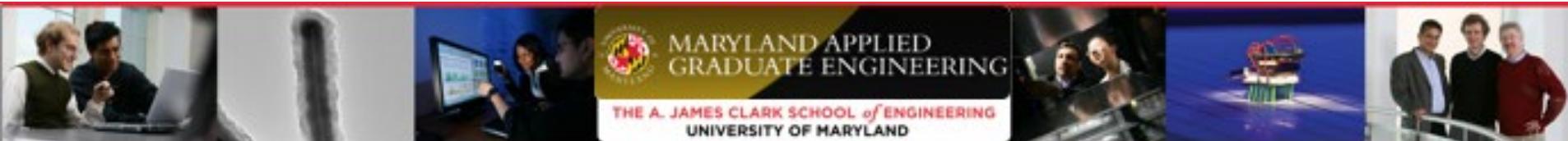
Identify the flow of steps for each task.



A screen may enable a single step or multiple steps (a step may even require multiple screens).

43

From *Essentials of Usability* course by Human Factors International (HFI), Inc.



USER INTERFACE FLOW DIAGRAMS

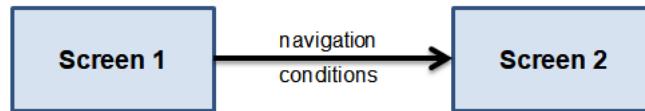
- Also called *interface-flow diagrams*, *windows navigation diagrams*, *context-navigation maps*, *dialog maps*
- Show a high-level overview of the user interface for the application
 - Flow of windows/pages/screens (“user journey”)
- Support an understanding of how the system is expected to behave relative to its users
- Model the interactions that users have with software, as defined in a single scenario
 - A scenario can refer to several screens and provides insight into how they are used
- Help validate the overall flow of the application's user interface
- Can be used to determine if the user interface will be usable
 - Too many boxes and many connections may be an indicator that the system is too large for people to learn and understand
- Not directly supported by UML
 - Sometimes UML state machine diagrams are used for representing this information: *states* represent screens/windows and *transitions* represent user actions

<http://agilemodeling.com/artifacts/uiFlowDiagram.htm>

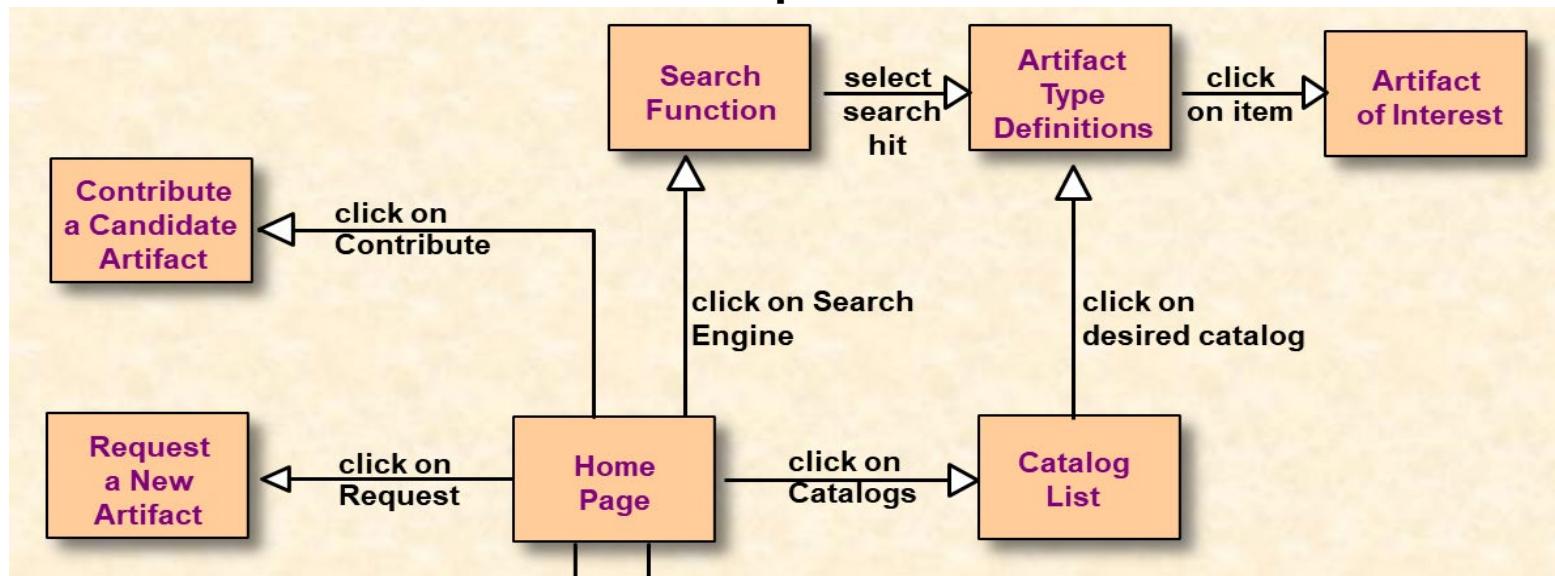


USER INTERFACE DIALOG MAPS

- A *dialog map* illustrates the architecture of a user interface design. It depicts the dialog elements in the system and navigation links among them, but it doesn't show detailed screen layouts



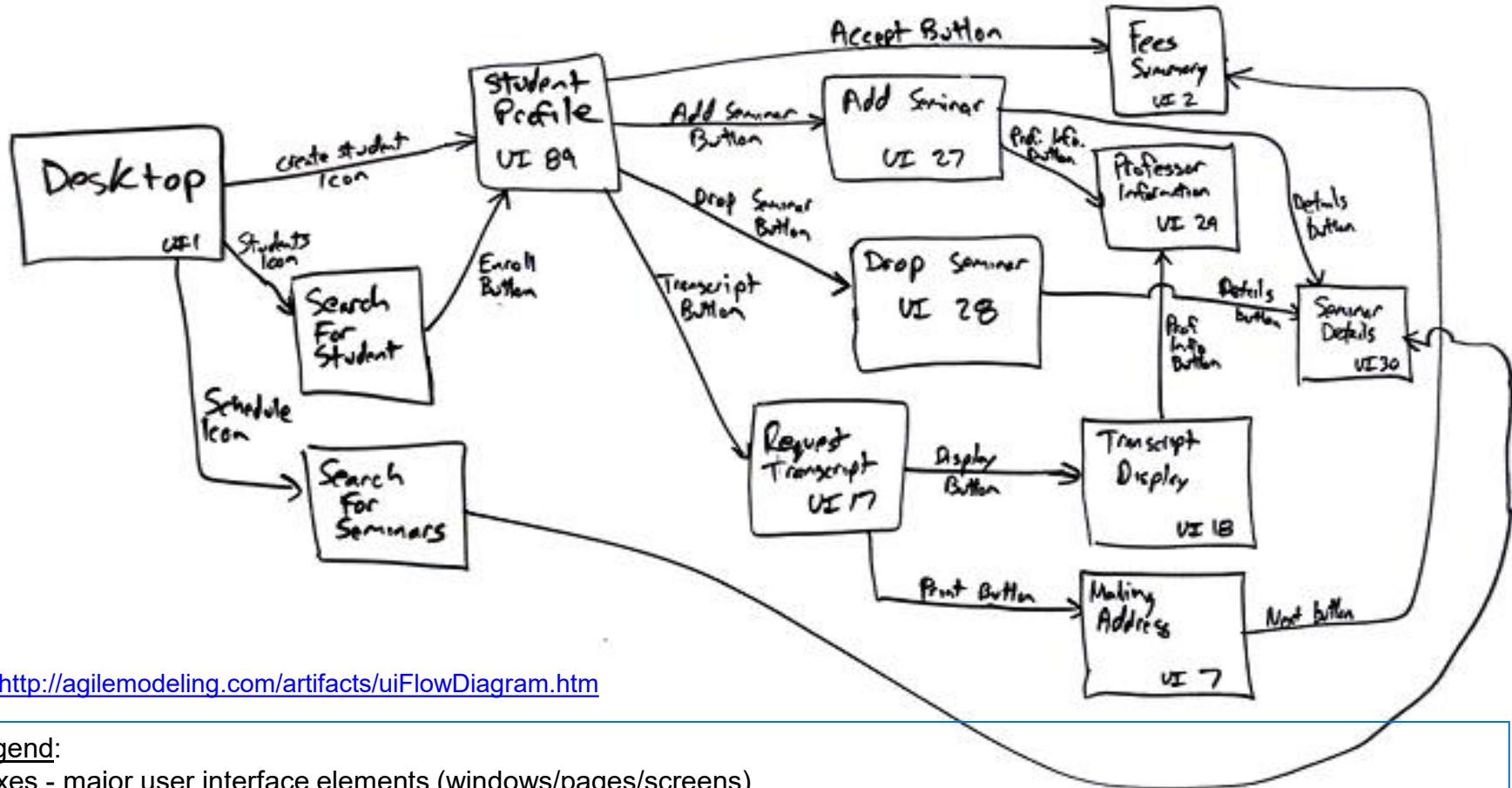
Example



[K. Wiegers, [Improve the User Experience with Dialog Maps](#)]



USER INTERFACE FLOW DIAGRAMS - A UNIVERSITY SYSTEM EXAMPLE

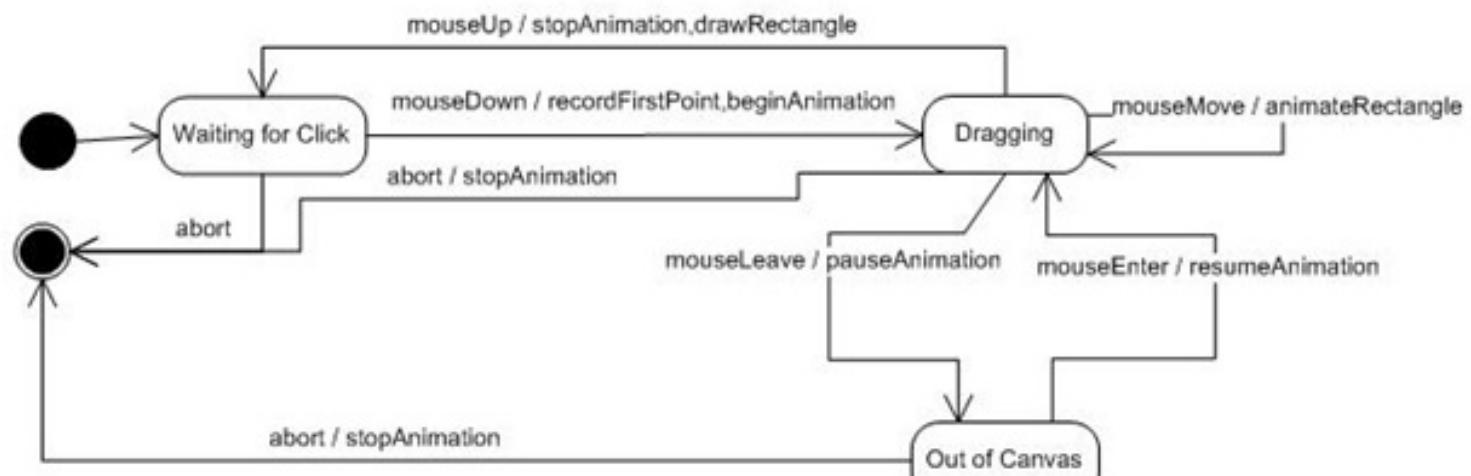


<http://agilemodeling.com/artifacts/uiFlowDiagram.htm>



STATE MACHINE FOR REPRESENTING UI FLOW MODEL (1)

- States usually correspond to screens between which a user can navigate
- Transitions correspond to user events that will cause the UI to move between different screens (states)



[Statecharts Based GUI Design](#), by Chenliang Sun
[State Machines and GUI interaction](#), by C. Lassala

STATE MACHINE FOR REPRESENTING UI FLOW MODEL (2)

UI flow diagram

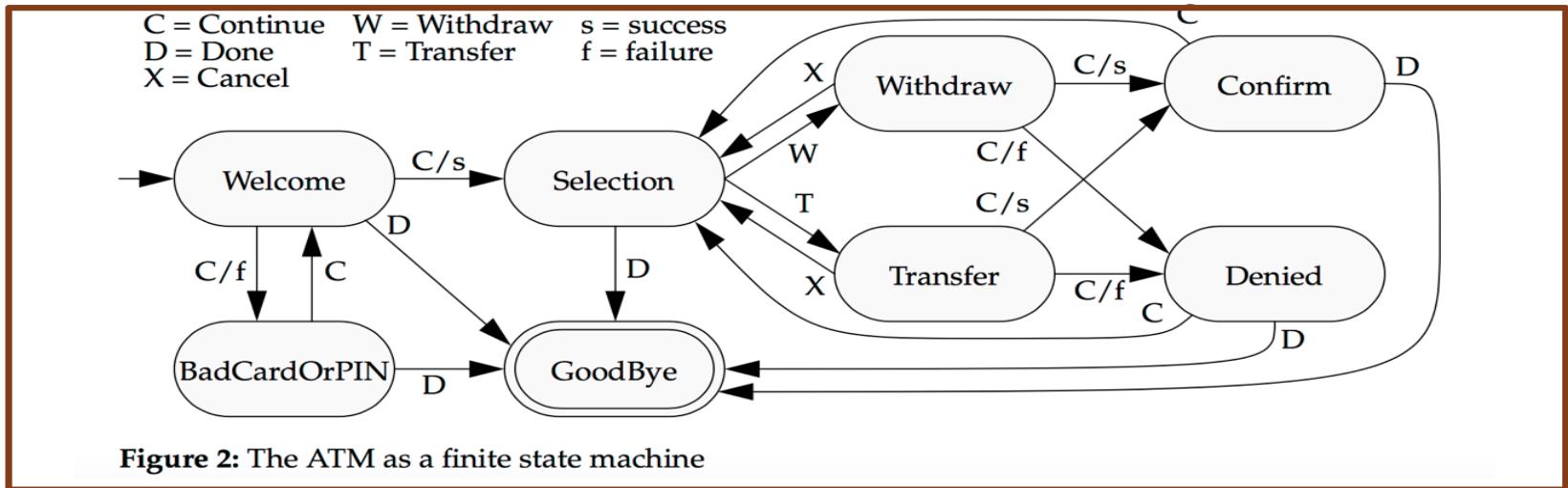


Figure 2: The ATM as a finite state machine

User Interface

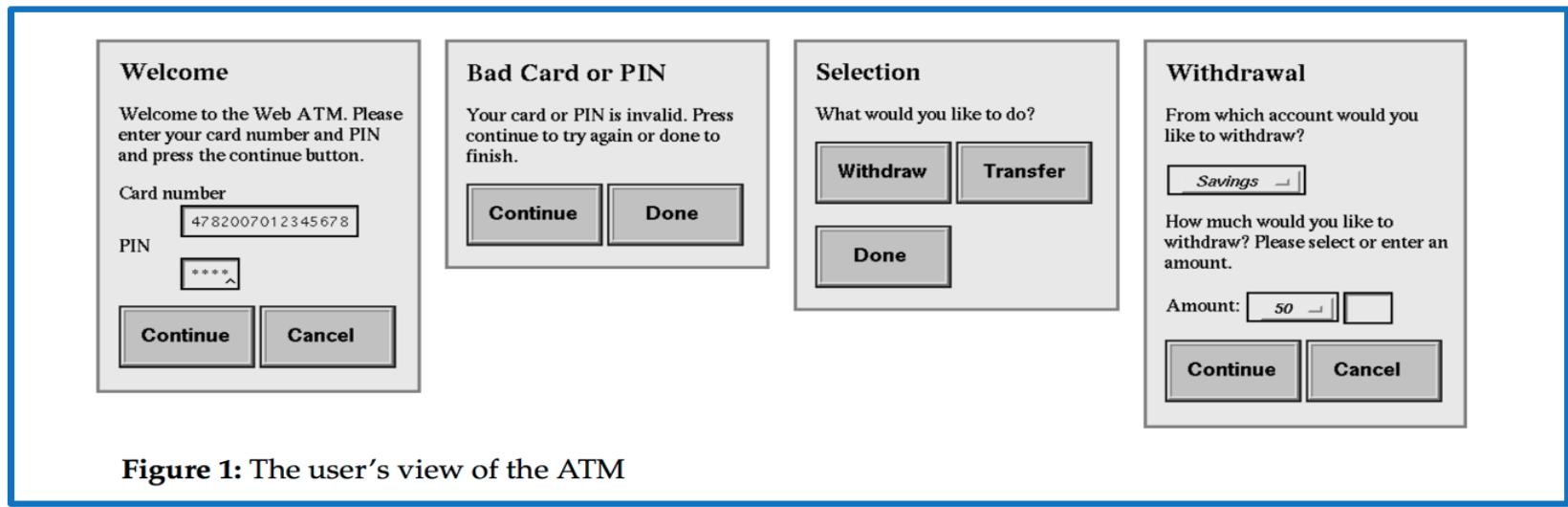


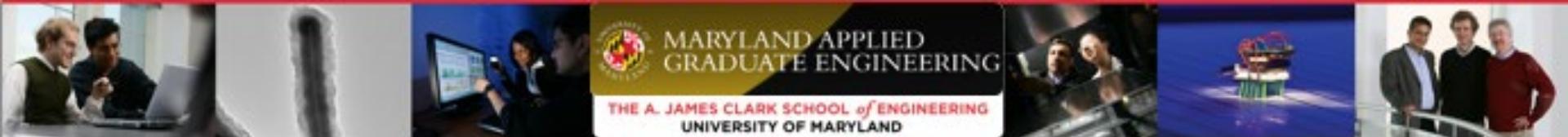
Figure 1: The user's view of the ATM

From: [Interactive Web Applications Based on Finite State Machines](#), by K. Läufer

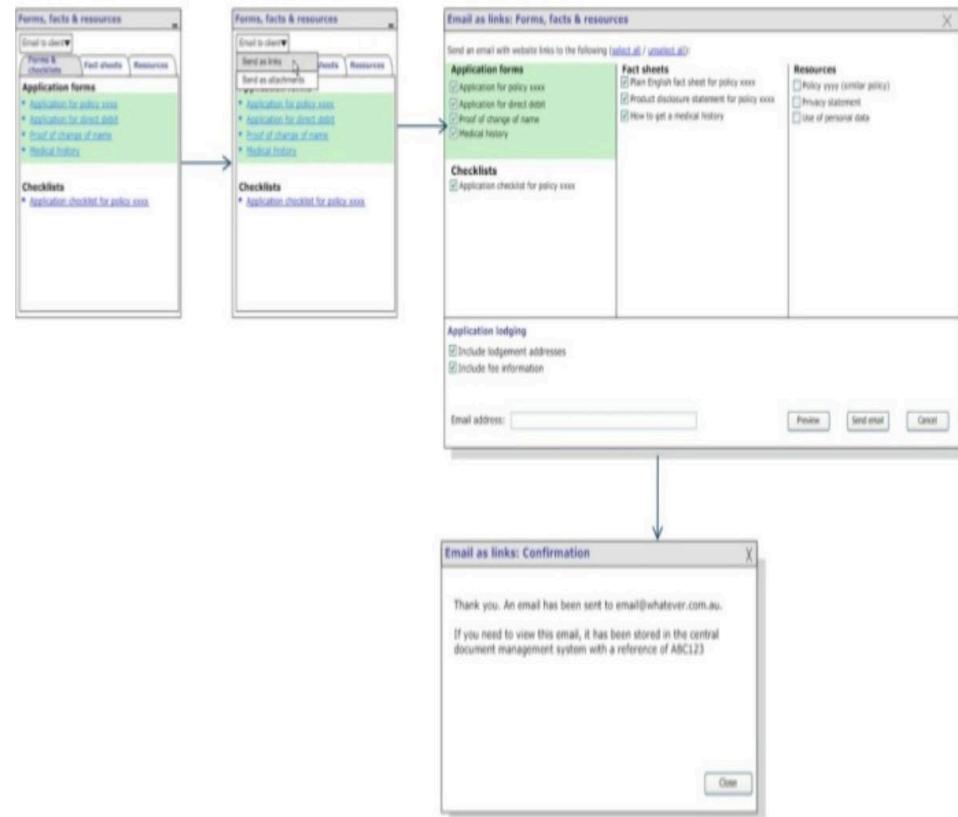
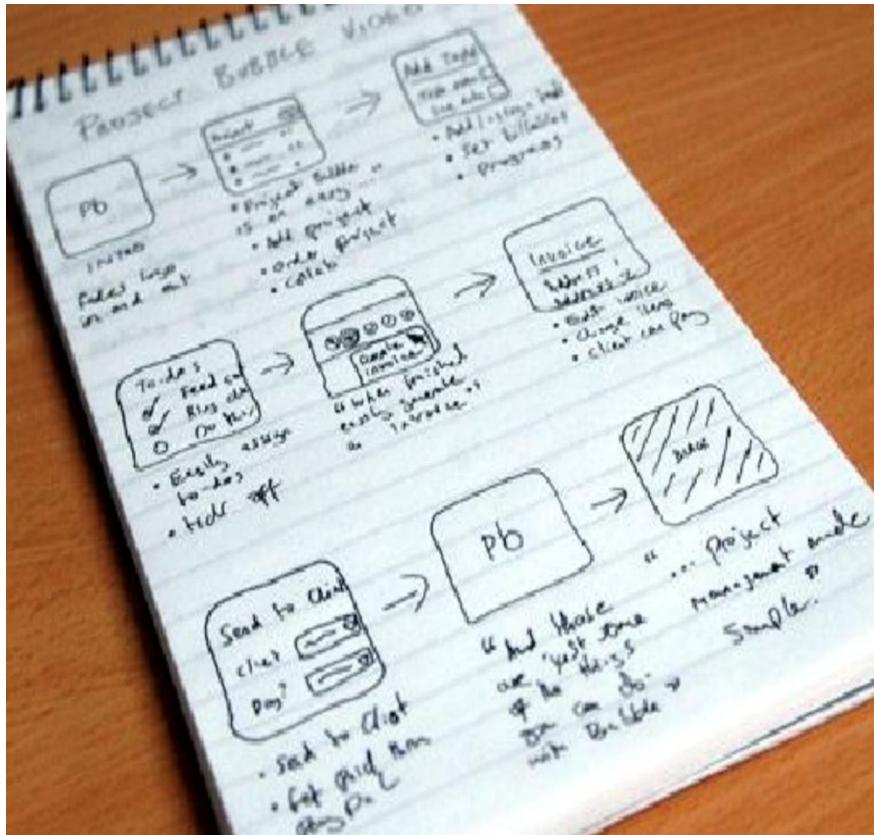


SCENARIO MODELING – STORYBOARDS

- A storyboard represent a scenario composed of multiple screens, in sequence
- Show how a user experiences a workflow
- Represent a task or scenario end-to-end
- Thinking about the software as if it was a movie, in terms of how people would use it
- Communicates ideas
- Screens can be represented as sketches, wireframes, or prototypes

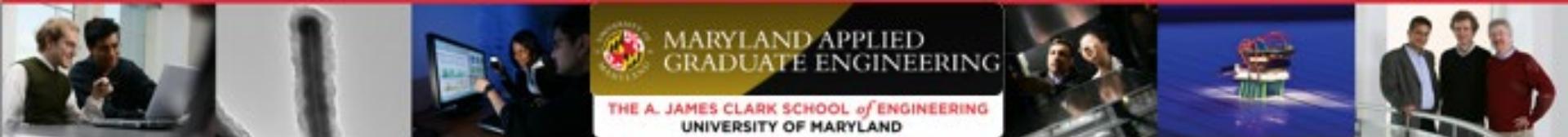


EXAMPLE STORYBOARDS



SKETCHES, WIREFRAMES, PROTOTYPES

- Abstract representations of the user interaction/interface, used during UCD
- Sketch
 - A rapid, freehand drawing, with no intention of becoming a finished product
 - Is only a foundation upon which we can overlay actual design work
- Wireframe
 - A basic visual guide
 - Used to suggest the structure of an interface, and relations between screens
 - Purpose: to communicate and explore the concepts that come out of sketching
- Prototype
 - A communication tool and artifact
 - Represents a more defined set of ideas



EXAMPLE SKETCHES

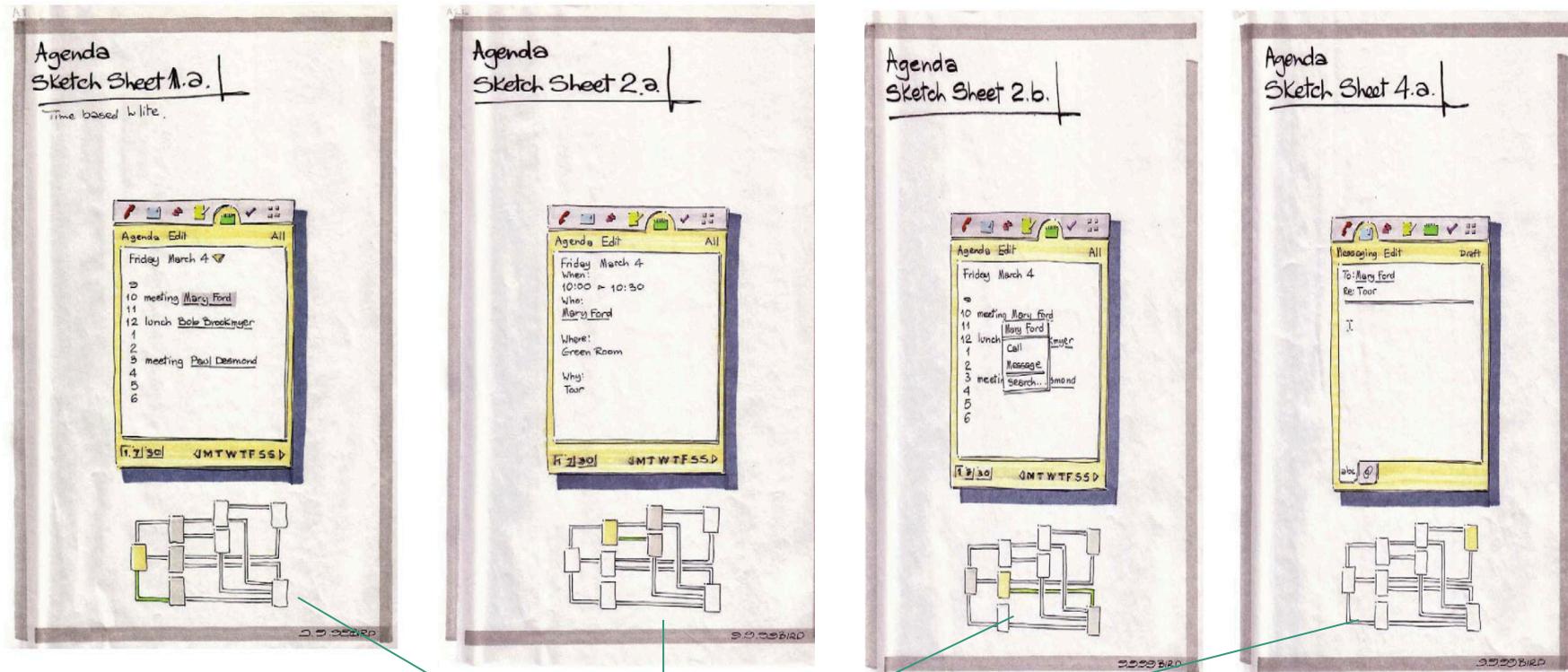


Figure 99: Sketches of PDA Agenda Screens

The sequence of images sketches out a potential design for interacting with a PDA-based agenda. Each image is like a key frame in an animation. Notice the **state transition** diagram at the bottom of each image, which shows its context relative to the others, as well as the overall page hierarchy.

Images: Ron Bird

interface
flow diagram

[From *Sketching Users Experiences*, Bill Buxton]



EXAMPLE WIREFRAMES

Reference zones



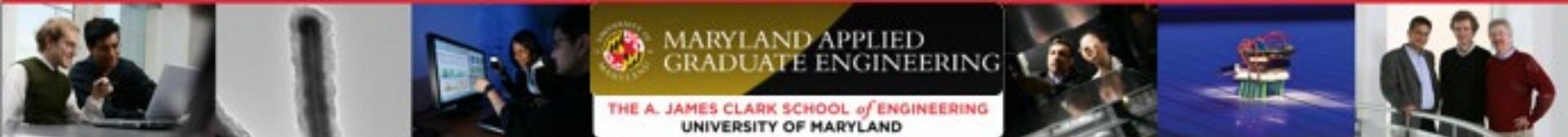
High fidelity wireframes

From [Wireframes for the Wicked](#)

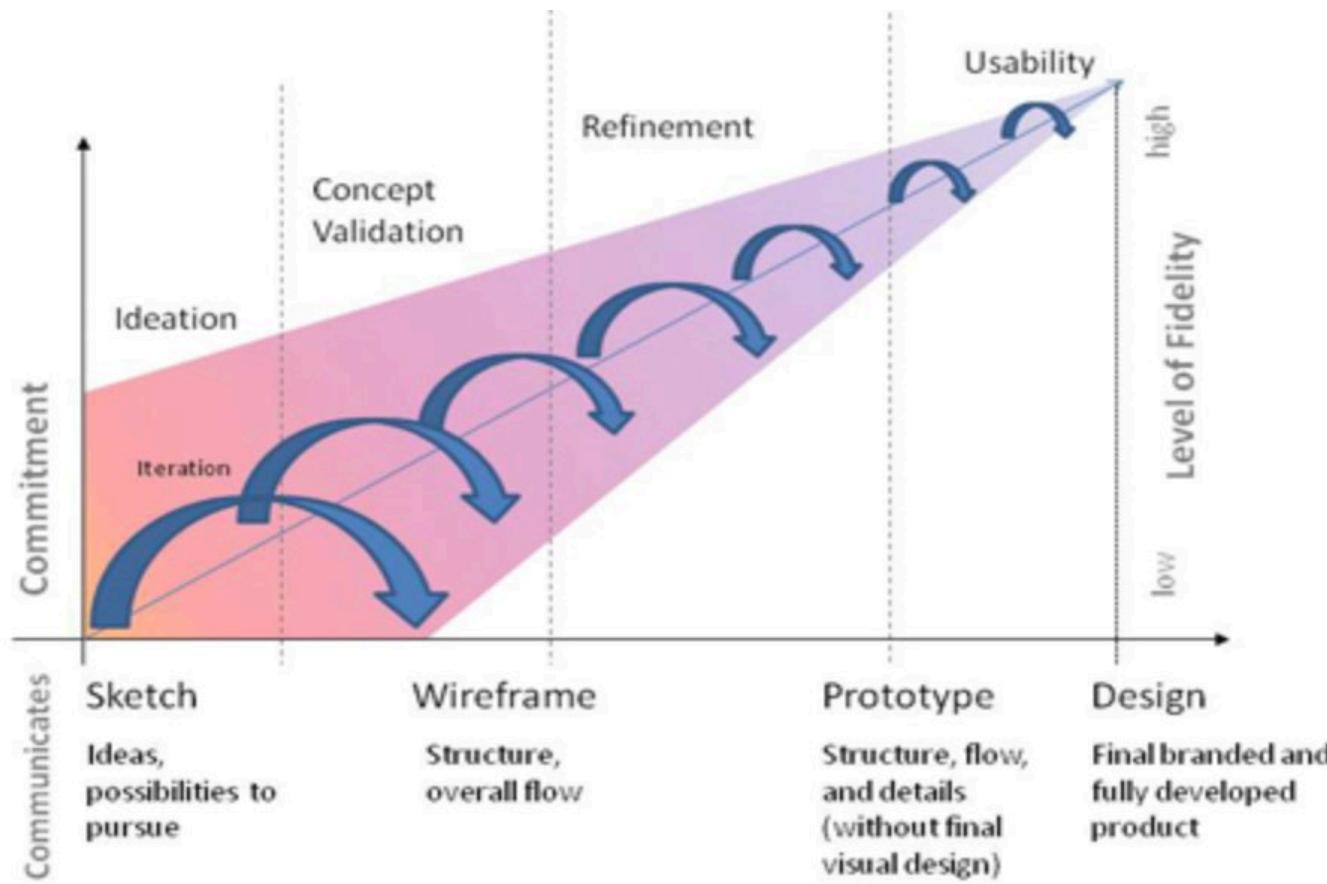


PROTOTYPES

- **Low-fidelity** prototypes - often paper-based and do not allow user interactions
- **High-fidelity** prototypes - computer-based, and usually allow realistic (mouse-keyboard) user interactions
- Pros:
 - Make the solution “visible” -> precise means of agreeing on things with the user
 - Facilitates design and test cases
- Cons:
 - Cost to develop
 - May pigeon-hole users or developers into early requirements commitments
 - Throw-away solution becomes “the real thing” - a Big Ball Of Mud (BBOM)
- Example tools for prototyping: [Pencil](#), [Balsamiq](#), [axure](#)



ARTIFACT AND ABSTRACTION PROGRESSION

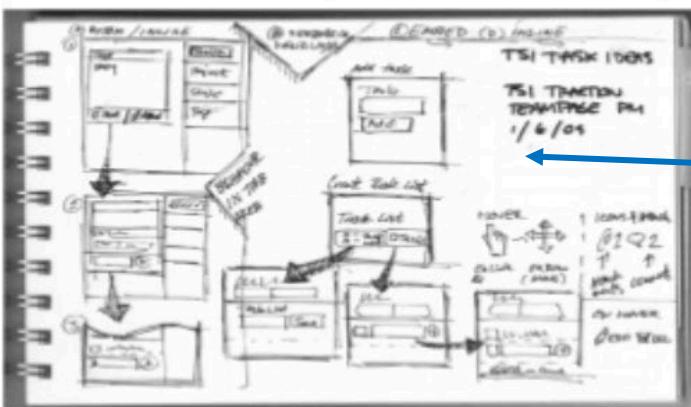


No clear separation line between these artifacts

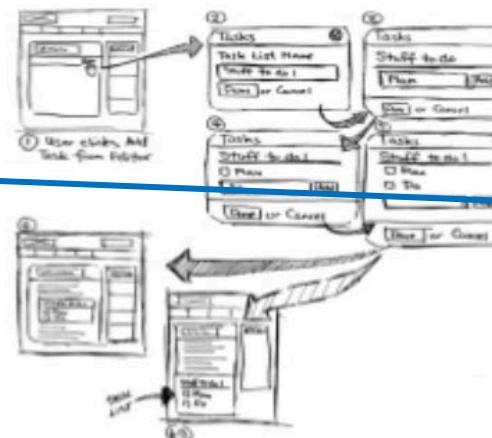
From [Sketches and Wireframes and Prototypes!](#) by T. Lepore



EXAMPLE SKETCH, WIREFRAME, PROTOTYPE



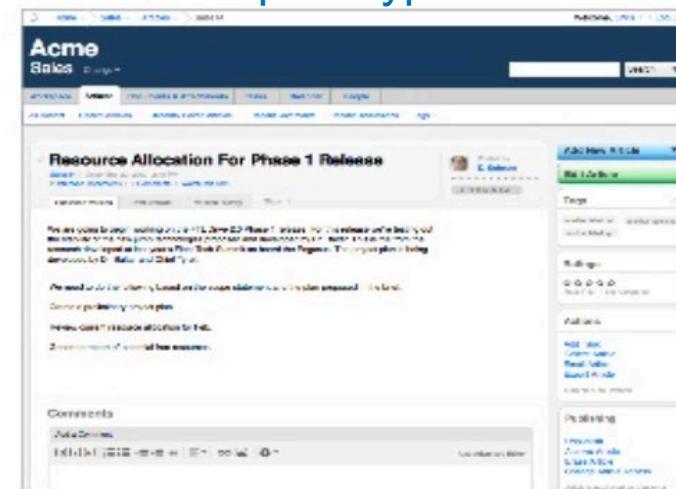
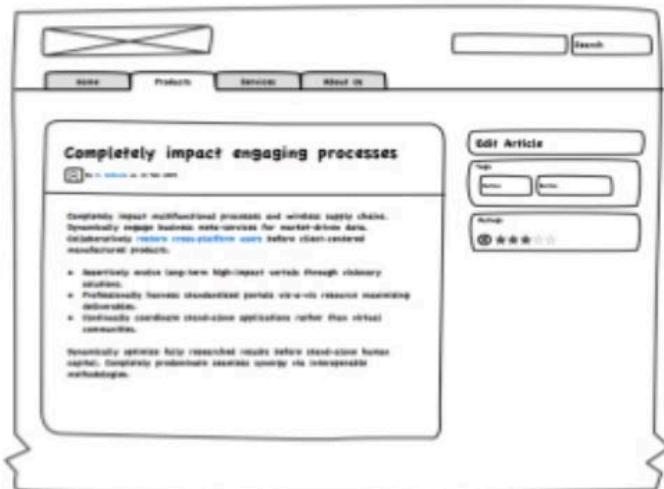
wireframe



sketches

- 1. Start Task Creation
- 2. Task Editor opens. User creates Task List
- 3. After Saving Task List Name, User can Create First Task.
- 4. Task creation is successful. In the Task List input, it is displayed.
- 5. If user clicks 'Add Task from Editor'
- 6. If user clicks 'Edit Task'
- 7. If user clicks 'Delete Task'
- 8. After clicking 'View', the list is reloaded in the article.
- 9. Alternatively, viewing ID is published below the editor.

prototype



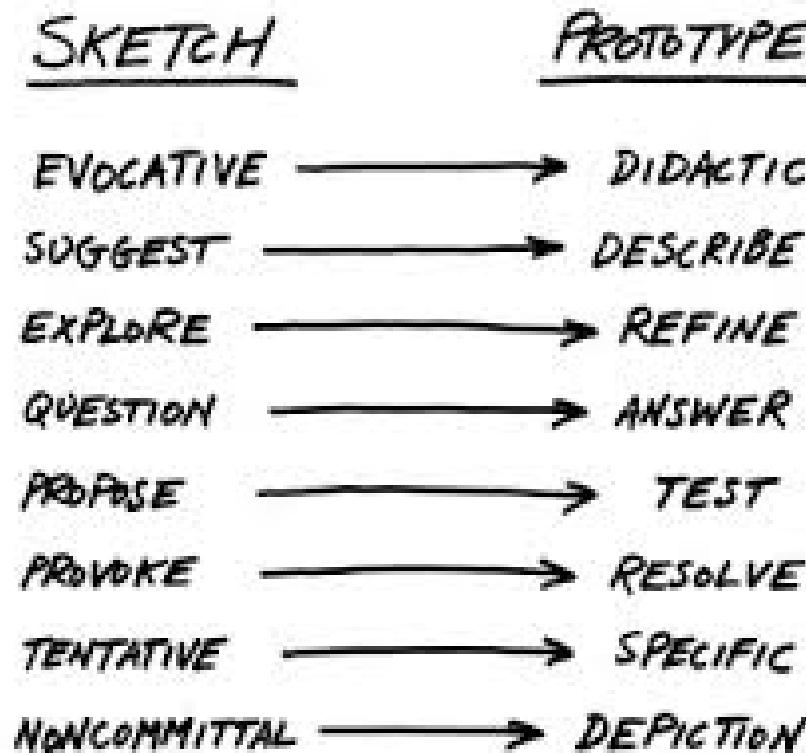
From [Wireframes for the Wicked](#)

56



SKETCHING AND PROTOTYPING

Used early, for concept development and validation/ ideation



Used progressively for design

Sketching User Experiences

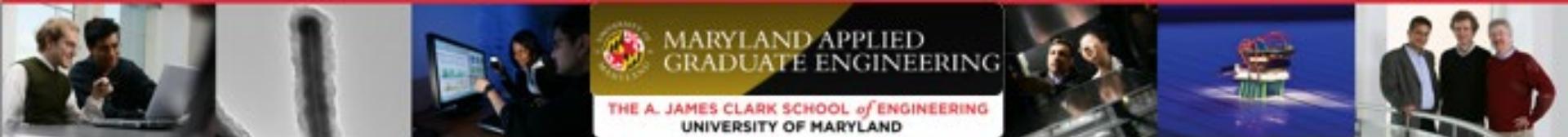
[From *Sketching Users Experiences*, Bill Buxton]



OUTLINE

- Lecture
 - Usability definition and importance
 - User centered design concepts, process, and techniques
 - User Centered Analysis
 - User Profiles and Personas
 - Task and Scenario Analysis
 - Setting usability criteria
 - UI Structural Design
 - Information Architecture
 - Navigation Design
 - Layout
 - UI Detailed Design
 - Presentation
 - Content
 - Interaction
 - Usability evaluation
- Assignment – User Centered Design

We are here



SETTING USABILITY CRITERIA AND MEASURES

Time Progression

- Usability criteria are the pass/fail **measures of the level of usability** the interface requirements are intended to produce
- During UCD strategy definition, usability criteria are identified
 - Goals - in terms of expected user performance
 - Specific, measurable
 - Provide concrete examples (e.g., scenarios) associated with each metric
- During the project, usability criteria **focus the design** direction and trade-offs
- At the end of the design stage, usability criteria provide **benchmarks for usability testing**
- At the end of the project, **usability criteria allow the team to measure how well they have achieved the performance targets that are the entire purpose of the usability effort**

SETTING USABILITY CRITERIA AND MEASURES (CONTINUED)

- Learnability:
 - How long should it take the user to learn the interface?
 - Time measures
 - Efficiency/speed of operation:
 - How well should the interface perform?
 - Time measures
 - Accuracy measures
 - User success ratio
 - Memorability (easy to remember):
 - How hard is it for the user to get back up to speed to use the system after time away?
 - Time measures
 - Recoverability (error reduction):
 - Does the interface minimize error likelihood, particularly for critical errors?
 - Error rate
 - Satisfaction:
 - Is the interface transparent? Fun to use? Easy?
 - User assessment
- These criteria and measures are related to the *Response Time* for **Usability** scenarios (in the Quality Attributes scenarios)



CLASS EXERCISE 2 – STORY BOARD

- For your class project software, develop a storyboard with low-fi paper prototype (sketches)
- Teamwork
- Present it to class for "user representative" feedback



61



OUTLINE

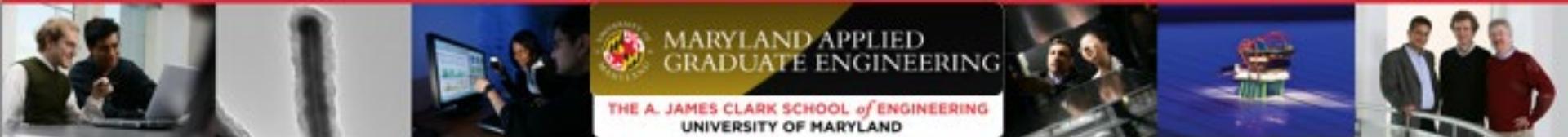
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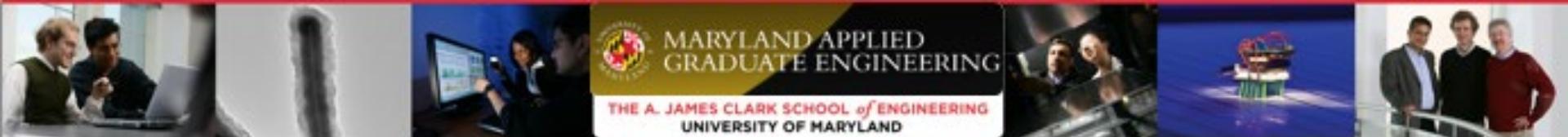
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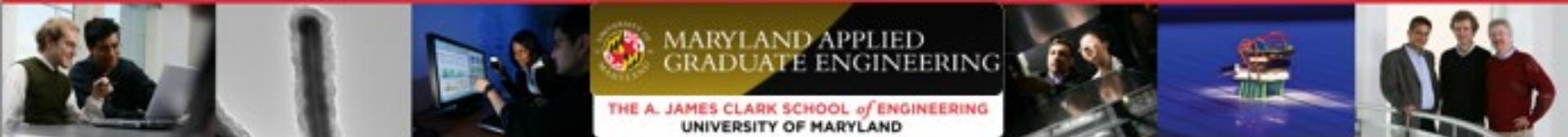
WHY IS THE USER INTERFACE IMPORTANT?

- *Interaction* between user and computer takes place through the *interface*
- The interface enables or prevents access to software features
- The interface determines software/system usability
- In this class we will address **graphical/visual user interfaces (GUI)**
- Other types of user interfaces
 - Voice user interface (VUI)
 - Virtual Reality/Augmented Reality (VR/AR)
 - See Supplemental Material



HUMAN ASPECTS TO BE CONSIDERED

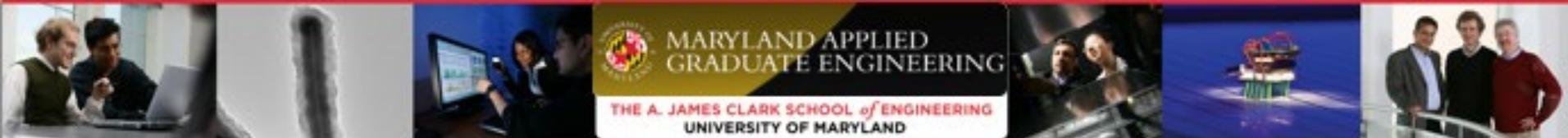
- People
 - Have a limited short-term memory
 - Make mistakes
 - Have diverse range of physical capabilities
 - Have different interaction preferences
- These matters must be addressed when designing human-computer interaction – see definition of principles on the next slide
 - User familiarity
 - Consistency
 - Minimal surprise
 - Recoverability
 - User guidance
 - User diversity (accessibility)



PRINCIPLES OF INTERACTION DESIGN

Principle	Description
User familiarity	The interaction should be based on terms and concepts drawn from the experience of the people who will make most use of the system.
Consistency	The interface should be consistent in that, wherever possible, comparable operations should be activated in the same way.
Minimal surprise	Users should never be surprised by the behaviour of a system.
Recoverability	The interface should include mechanisms to allow users to recover from errors.
User guidance	The interface should provide meaningful feedback when errors occur and provide context-sensitive user help facilities.
User diversity (Accessibility)	There should be appropriate interaction facilities for different types of system users.

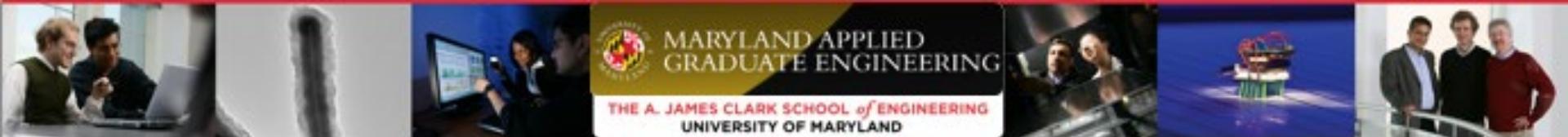
[Based on *Software Engineering*, Ian Sommerville, Ch29]



DESIGN PROPERTIES

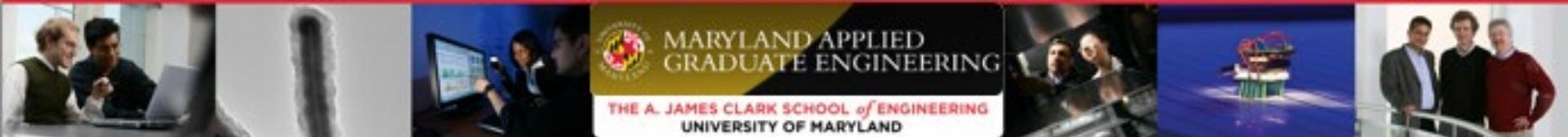
- Design, by its very nature, should:
 - Make it easy to determine what actions are possible at any moment;
 - Make things visible, including the conceptual model of the system, the alternative actions, and the results of the actions;
 - Make it easy to evaluate the current state of the system;
 - Follow natural mappings between intentions and the required actions, between actions and the resulting effect, and between the information that is visible and the interpretation of the system state.

(Don Norman, 1988)



USER INTERACTION/UX/UI HEURISTICS

- These heuristics/principles/rules help create a well-designed User Interface and improve the usability of the system
- There are multiple sets of heuristics, some rules are similar in different sets
- For example:
 - J. Nielsen's [10 Usability heuristics](#)
 - Shneiderman's [Eight Golden Rules of Interface Design](#)



NIELSEN'S 10 USABILITY HEURISTICS

More at

<https://www.nngroup.com/articles/ten-usability-heuristics/>

1 Visibility of System Status

Designs should *keep users informed* about what is going on, through appropriate, timely feedback.



Interactive mall maps have to show people where they currently are, to help them understand where to go next.

2 Match between System and the Real World

The design should *speak the users' language*. Use words, phrases, and concepts *familiar to the user*, rather than internal jargon.



Users can quickly understand which stovetop control maps to each heating element.

5 Error Prevention

Good error messages are important, but the best designs carefully *prevent problems* from occurring in the first place.



Guard rails on curvy mountain roads prevent drivers from falling off cliffs.

8 Aesthetic and Minimalist Design

Interfaces should not contain information which is irrelevant. Every extra unit of information in an interface *competes* with the relevant units of information.



A minimalist three-legged stool is still a place to sit.

NN/g

Nielsen Norman Group

Jakob's Ten Usability Heuristics

3 User Control and Freedom

Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action.



Just like physical spaces, digital spaces need quick "emergency" exits too.

6 Recognition Rather Than Recall

Minimize the user's memory load by making elements, actions, and options visible. Avoid making users remember information.



People are likely to correctly answer "Is Lisbon the capital of Portugal?".

9 Recognize, Diagnose, and Recover from Errors

Error messages should be expressed in plain language (no error codes), precisely indicate the problem, and constructively suggest a solution.



Wrong-way signs on the road remind drivers that they are heading in the wrong direction.

4 Consistency and Standards

Users should not have to wonder whether different words, situations, or actions mean the same thing. *Follow platform conventions*.



Check-in counters are usually located at the front of hotels, which meets expectations.

7 Flexibility and Efficiency of Use

Shortcuts — hidden from novice users — may speed up the interaction for the expert user.



Regular routes are listed on maps, but locals with more knowledge of the area can take shortcuts.

10 Help and Documentation

It's best if the design doesn't need any additional explanation. However, it may be necessary to provide documentation to help users complete their tasks.



Information kiosks at airports are easily recognizable and solve customers' problems in context and immediately.

www.nngroup.com/articles/ten-usability-heuristics/



SHNEIDERMAN'S *EIGHT GOLDEN RULES OF INTERFACE DESIGN*

1. Strive for consistency

Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus, and help screens; and consistent commands should be employed throughout.

2. Enable frequent users to use shortcuts

As the frequency of use increases, so do the user's desires to reduce the number of interactions and to increase the pace of interaction. Abbreviations, function keys, hidden commands, and macro facilities are very helpful to an expert user.

3. Offer informative feedback

For every operator action, there should be some system feedback. For frequent and minor actions, the response can be modest, while for infrequent and major actions, the response should be more substantial.

4. Design dialog to yield closure

Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives the operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and options from their minds, and an indication that the way is clear to prepare for the next group of actions.

5. Offer simple error handling

As much as possible, design the system so the user cannot make a serious error. If an error is made, the system should be able to detect the error and offer simple, comprehensible mechanisms for handling the error.

6. Permit easy reversal of actions

This feature relieves anxiety, since the user knows that errors can be undone; it thus encourages exploration of unfamiliar options. The units of reversibility may be a single action, a data entry, or a complete group of actions.

7. Support internal locus of control

Experienced operators strongly desire the sense that they are in charge of the system and that the system responds to their actions. Design the system to make users the initiators of actions rather than the responders.

8. Reduce short-term memory load

The limitation of human information processing in short-term memory requires that displays be kept simple, multiple page displays be consolidated, window-motion frequency be reduced, and sufficient training time be allotted for codes, mnemonics, and sequences of actions.



ERROR PREVENTION/HANDLING

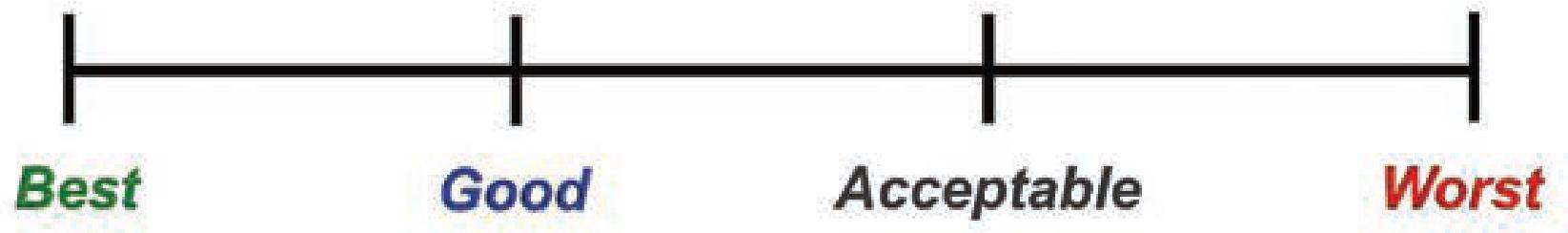
Different ways to handle user and system errors, some more desirable than others

make it impossible
for the user to
make a mistake

make it difficult
for the user to
make a mistake

make it easy
to recover
from an error

just let it
happen

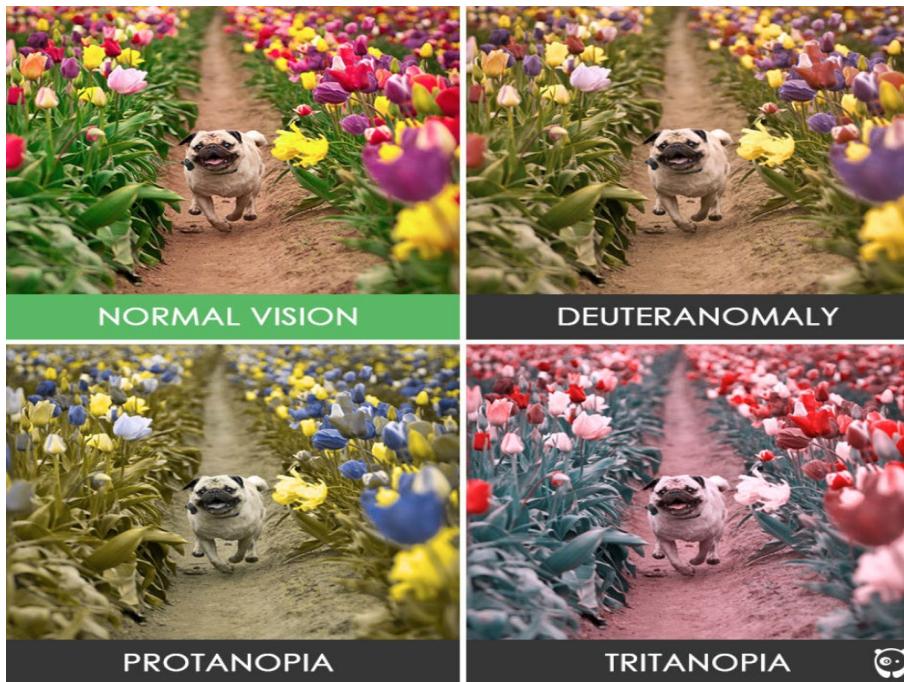


From: K. Wiegers, *The Thoughtless Design of Everyday Things*

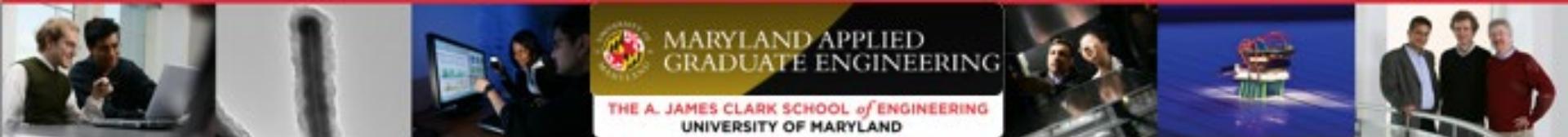


ACCESSIBILITY

- “Universal Design” (UD)
- [GSA Section 508 Accessibility Program](#)
- [Tools for accessibility checking](#)
 - Example of what things look like to someone who is “color blind”

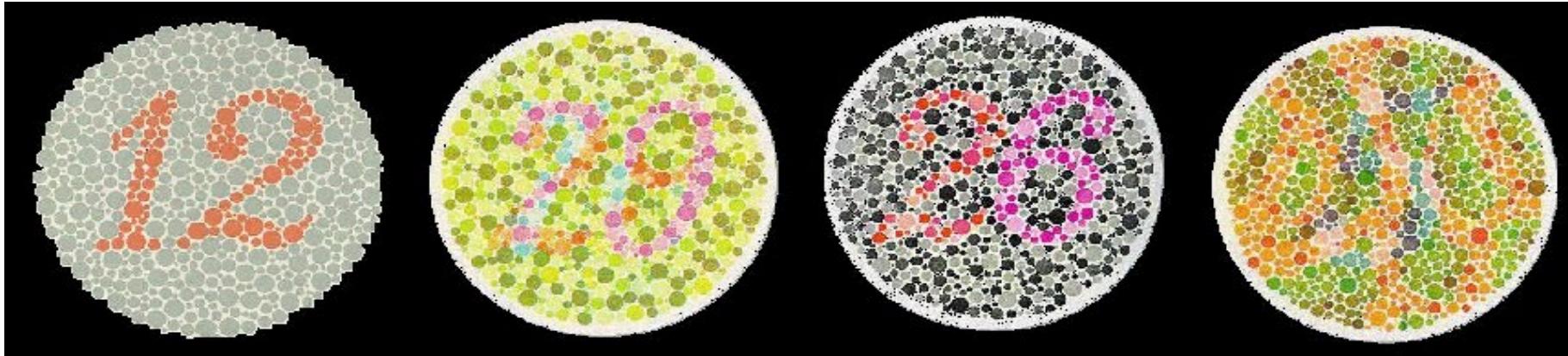


Take a look at: [How EnChroma's Glasses Correct Color-Blindness](#)



WHAT NUMBERS DO YOU SEE?

[Ishihara test](#)

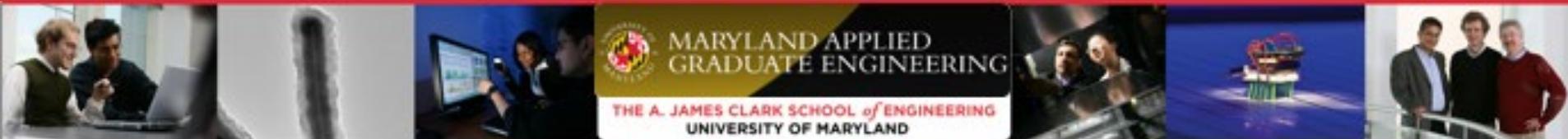


Everyone should see a 12.

Normal visioned people should see 29. Colorblind people should see 70.

Normal visioned people will see 26. If you are red-blind, you should only clearly see the 6. If you are green-blind, you should only see the 2. A totally colorblind person will not see any number in this plate.

Normal visioned people will not readily see any number, but colorblind people will easily see a number 5.



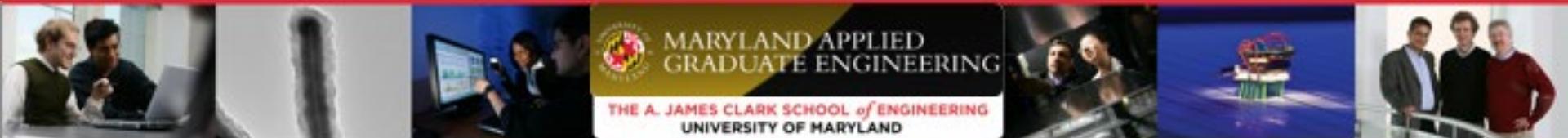
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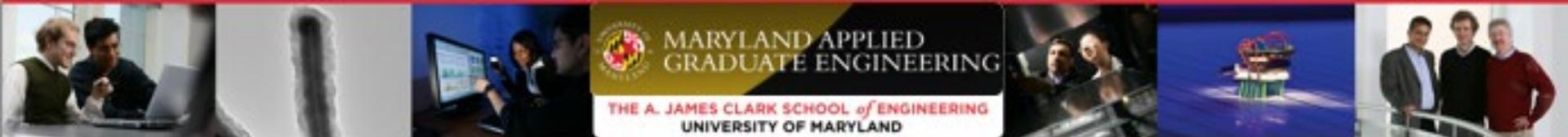
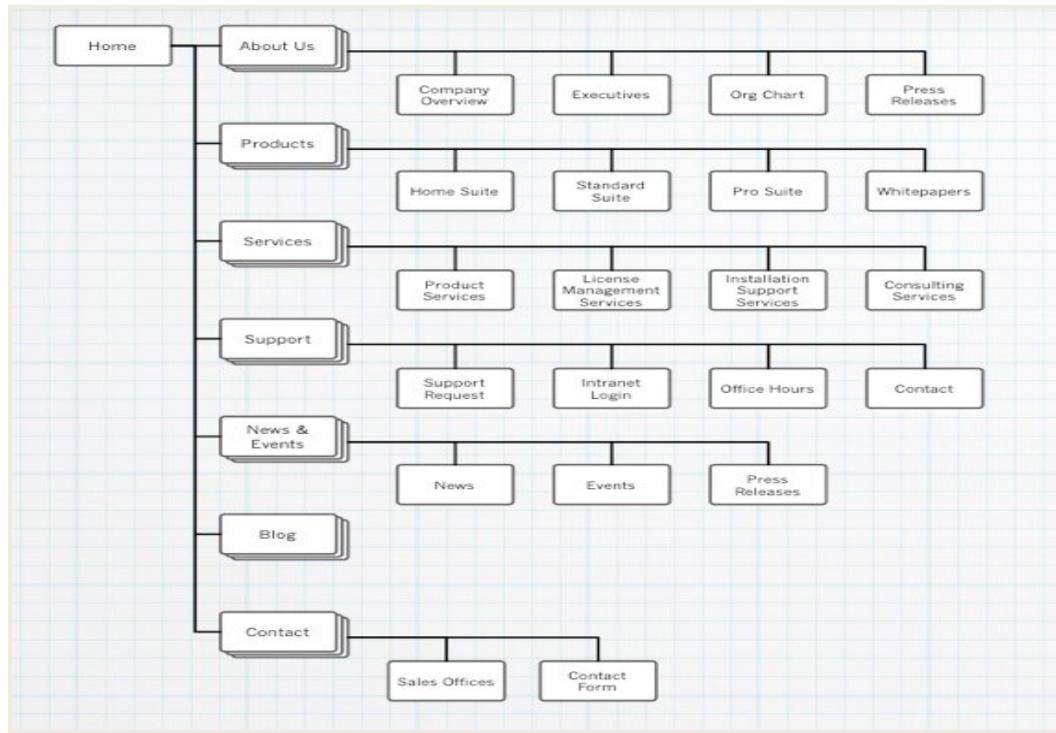
We are here

■ Assignment – User Centered Design



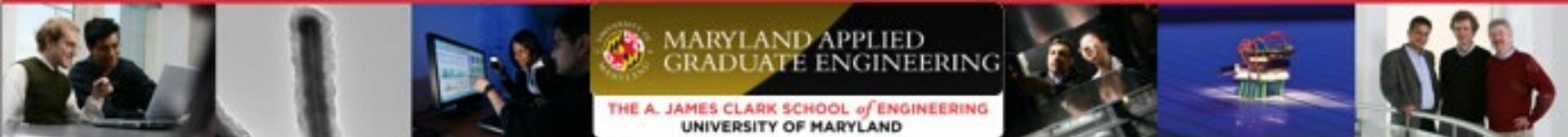
INFORMATION ARCHITECTURE

- Structuring the information/content
 - so that users can easily find and work with it
 - according to *users' mental models and task flows*



DIFFERENT WAYS TO ORGANIZE A SITE...

- Exact schemes (e.g., Alphabetical, Chronological)
 - work best if you know exactly what you are looking for
- Categorical Schemes (By Topic, User, etc.)
 - encourage exploration and browsing
 - but may not be mutually exclusive
 - the degree of ambiguity depends on how carefully you've organized your categories
- Good labels are important
 - *Card Sort Technique* can be used to create meaningful group labels

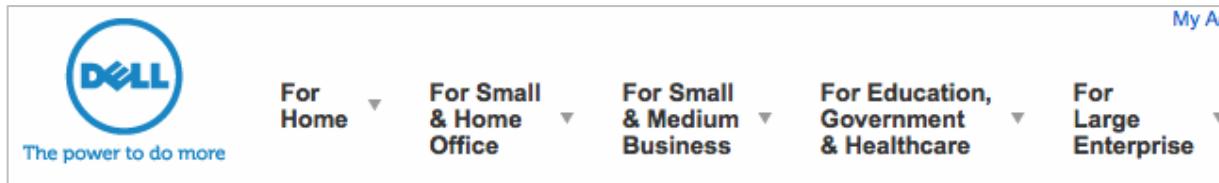


EXAMPLES OF CONTENT ORGANIZATION

By Topic



By User



By Product or Service



By Task

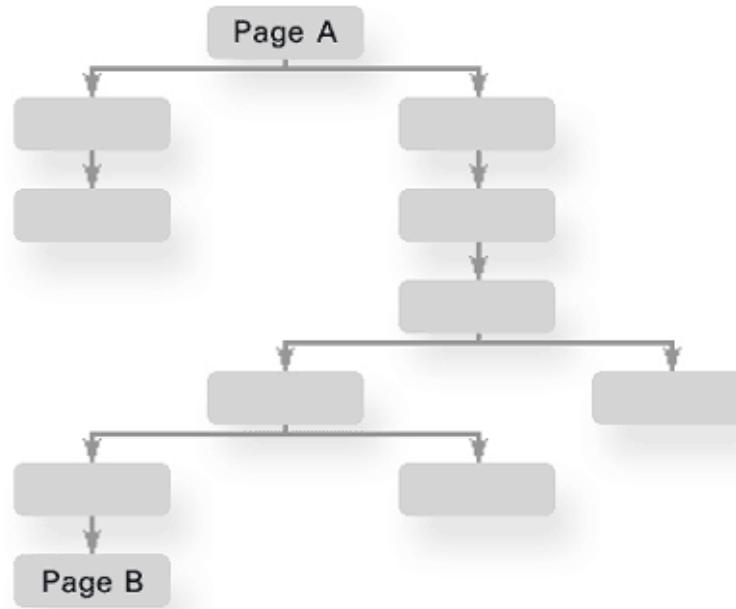


By Store or Department

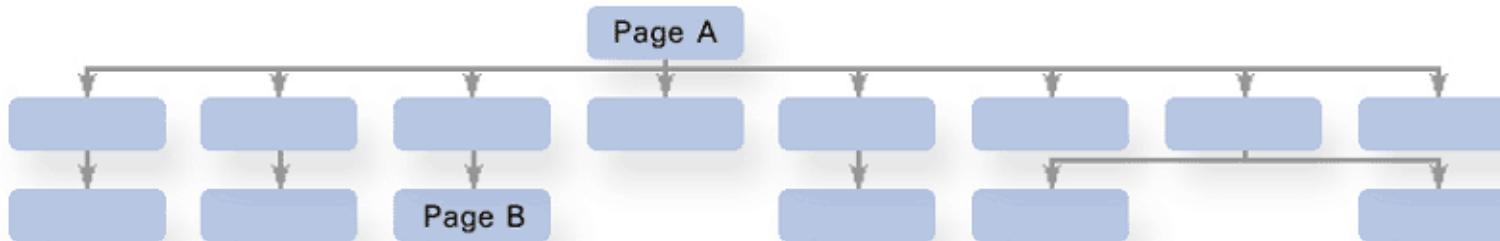


From *Essentials of Usability* course by Human Factors International (HFI), Inc.

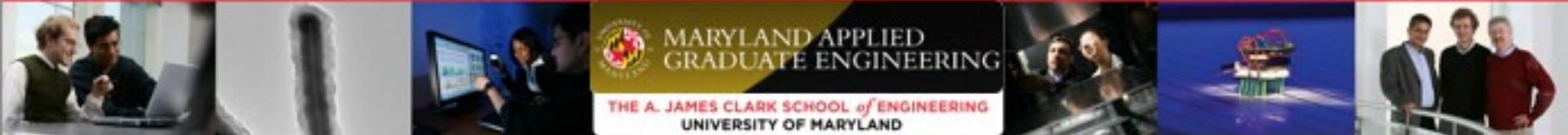
BALANCE OF BREADTH VS. DEPTH



6 clicks



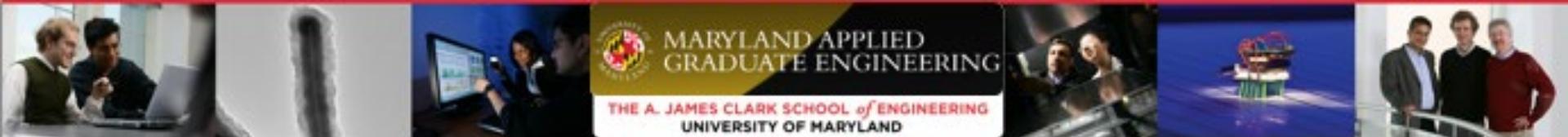
2 clicks



OUTLINE

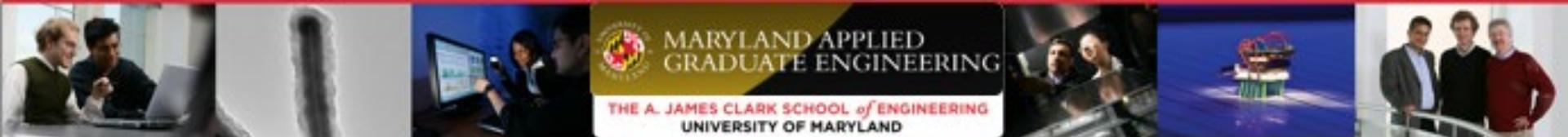
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We are here



NAVIGATION

- A collection of user interface components
 - Include global navigation, local navigation, utility navigation, breadcrumbs, filters, facets, related links, footers, fat footers
- Goal:
 - Help users find information and functionality
 - Encourage users to take desirable actions
- Shows users
 - Where they are
 - Where they can go
 - How to get there
 - How to get back
- Good navigation:
 - Is obvious
 - Matches user's mental model
 - Provides users with alternatives



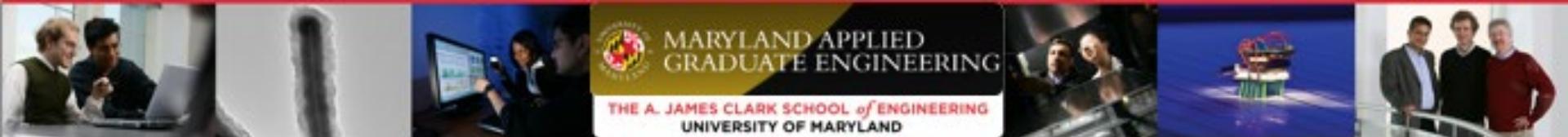
DIFFERENCE BETWEEN INFORMATION ARCHITECTURE (IA) AND NAVIGATION

- IA is the information backbone of the site
- IA is not part of the on-screen user interface (UI), rather, **IA informs UI**
 - IA itself is not visible in the UI, but it impacts the User Experience (UX)
- The IA is documented in spreadsheets and diagrams, not in wireframes, comprehensive layouts (known as comps), or prototypes
- Navigation refers to those elements in the UI that allow users to reach specific information on the site
- More information: [The Difference Between Information Architecture \(IA\) and Navigation](#)



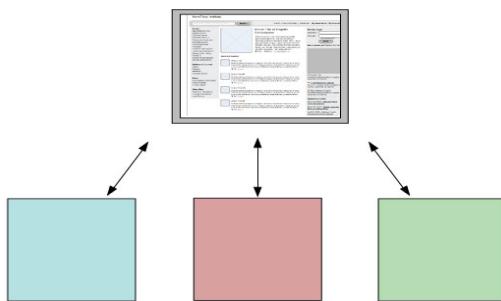
NAVIGATION PATTERNS (*MODELS*)

- What is a navigation pattern?
 - A general, repeatable solution to a commonly-occurring usability problem in interaction design
- User Interaction task flow patterns – define how users move between different screens of an application



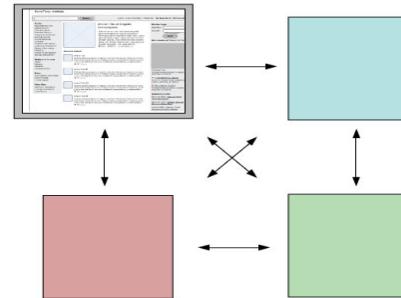
TYPES (PATTERNS) OF NAVIGATION

Hierarchical



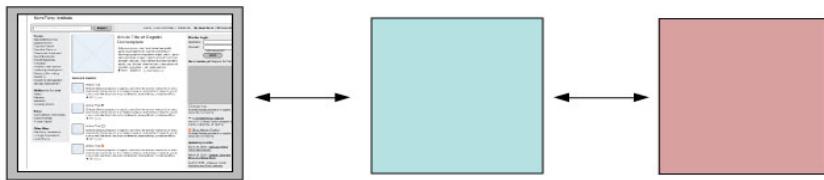
When individual tasks must be completed or terminated before others can begin

Persistent



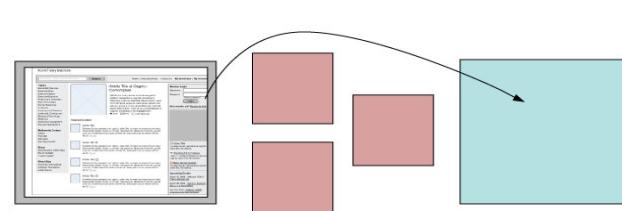
When users tend to jump between related tasks or content or there are a manageable number of choices or menu items

Sequential



When the task flow is well-defined, predictable, and procedural; all steps within the process must be addressed or completed; accuracy is important

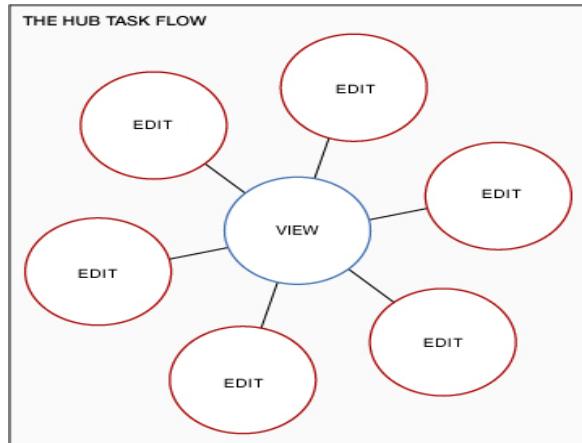
Search



When direct access to a results set based on criteria entered is needed



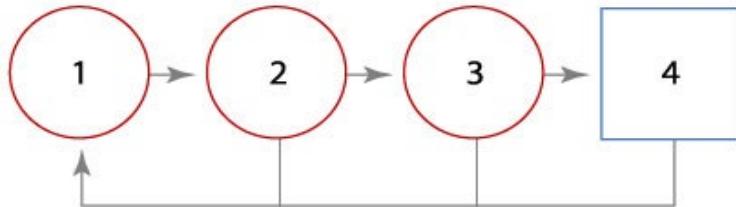
MORE NAVIGATION PATTERNS



Hub

For situations that use multiple, discreet, single-page forms

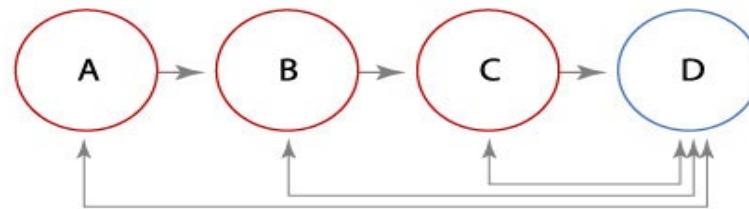
THE WIZARD TASK FLOW



Wizard

For multi-page procedures or operations that must be completed in a prescribed order

THE GUIDE TASK FLOW

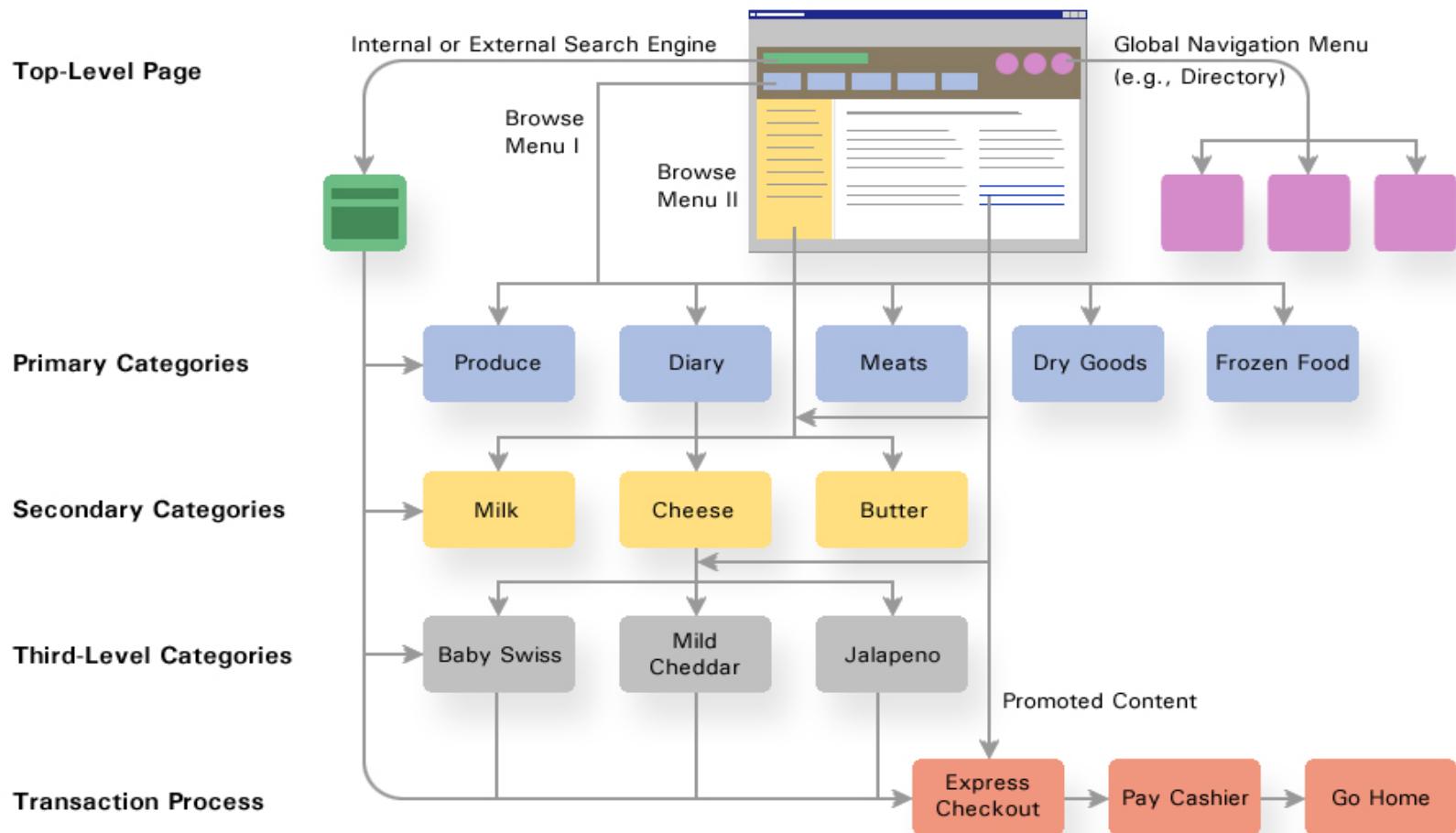


Guide

For complex, multi-part sequences that seek to combine the navigational guidance of a wizard with the navigational flexibility of a hub



COMBINING NAVIGATION MODELS

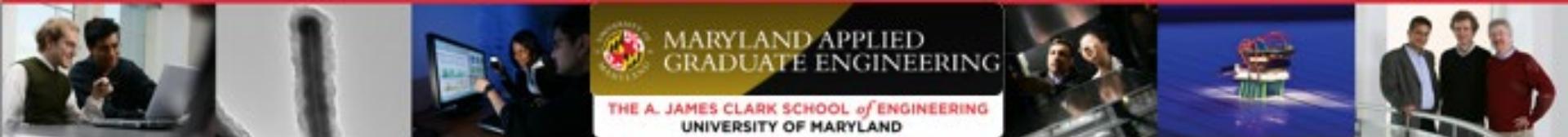


From *Essentials of Usability* course by Human Factors International (HFI), Inc.

OUTLINE

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 - Usability definition and importance
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We are here



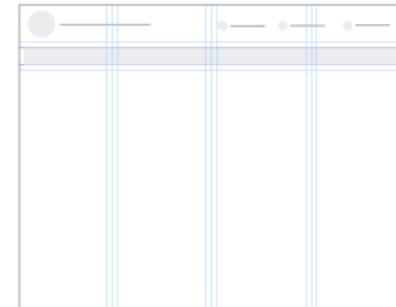
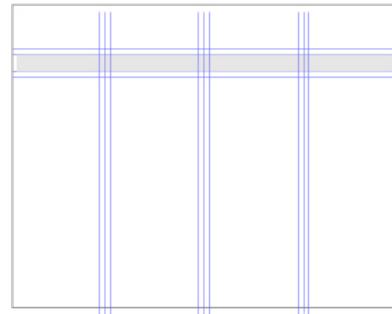
PAGE LAYOUT

- The arrangement of text, images, and other objects on a page
- Layout directs users' visual attention
- A grid system helps organize layout and reduce clutter

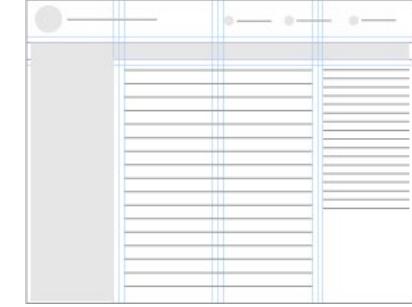
Columnar grid showing gutters:



Simple shapes represent the navigation and banner areas:



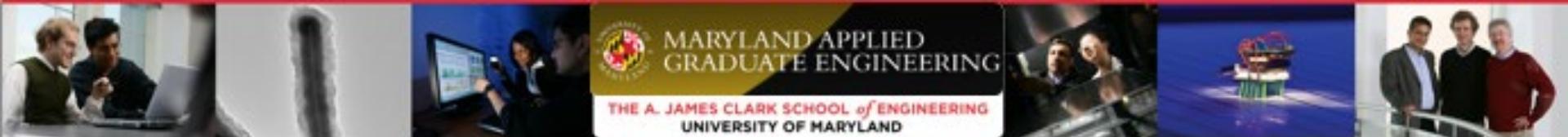
All elements are represented as points, lines, and planes:



OUTLINE

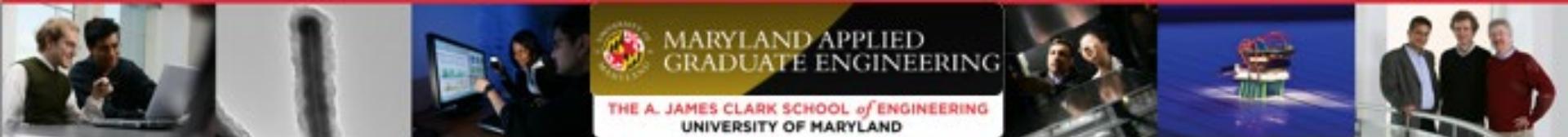
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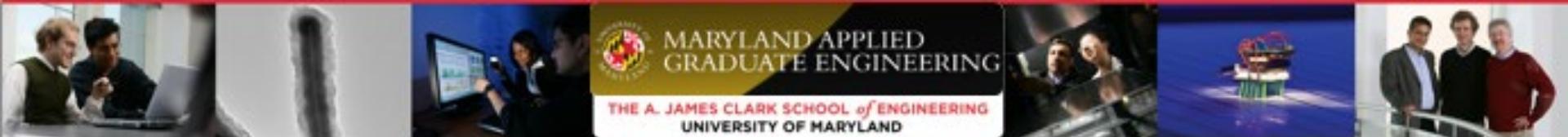
UI DETAILED DESIGN

- Detailed design aims to decrease the load on the user
- A single mistake in detailed design won't necessarily cause a system to fail
 - **But many mistakes can!**
- Concerns of UI detailed design:
 - Presentation
 - Content
 - Interaction



INFORMATION PRESENTATION

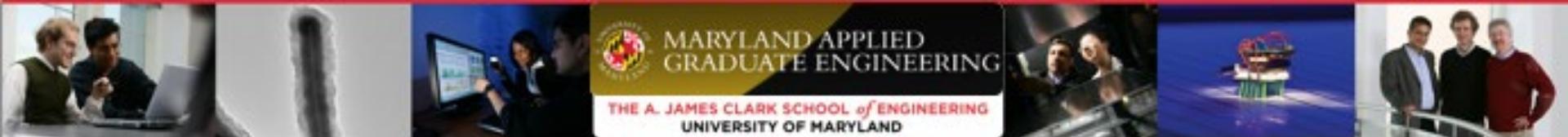
- Size, shape, shade, color
- Typography (fonts)
- Layout



USE OF COLOR - HEURISTICS

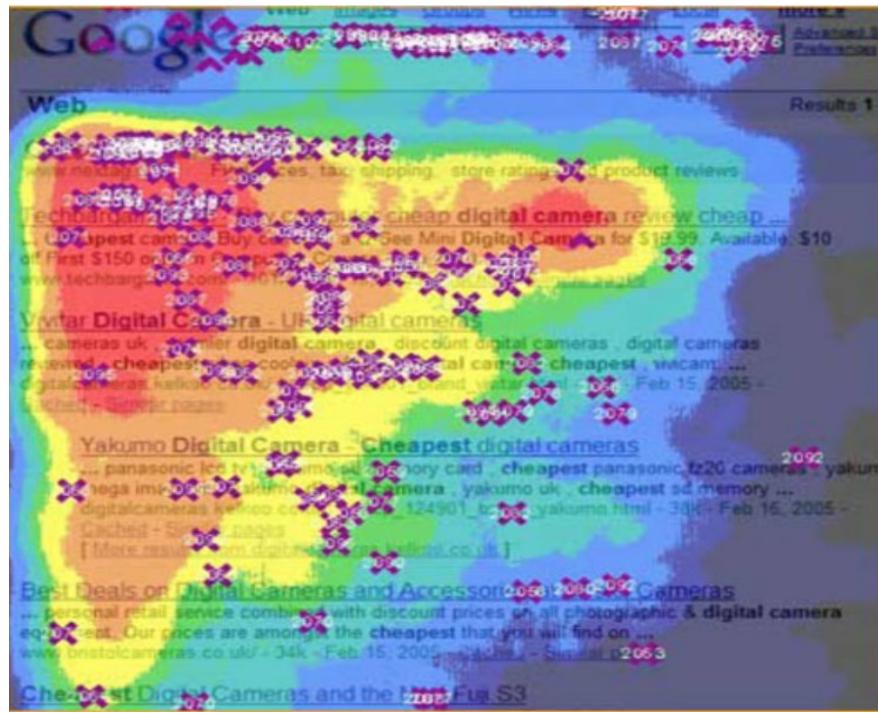
- Limit the number of colors and be conservative how they are used
 - No more than four or five separate colors in a window and no more than seven in a system interface
 - Too many colors make visual search harder
- Use color change to show a change in system status
- Use color coding to support users' task
- Use color coding in a thoughtful and consistent way
- Be careful about color pairings/combinations
- Be aware that not all users can perceive colors the same way
- Keep in mind that colors are associated with feelings/emotions
 - <https://www.smashingmagazine.com/2010/01/color-theory-for-designers-part-1-the-meaning-of-color/>
 - <https://www.wordpress-web-designer-raleigh.com/2015/04/16/color-in-web-design-color-symbolism/>
 - <https://thenextweb.com/dd/2017/11/08/psychology-web-design/>

[From *Designing the User Interface*, Shneiderman]



PRESENTATION

- Heatmaps show that typically people scan sites in an “F” shape, from top left to right and down the left-hand side
- Keep this in mind when you decide where to place elements on your layout



HOW CAN THE USER INTERACT WITH THE SYSTEM – INPUT FROM THE USER

Interaction style	Main advantages	Main disadvantages	Application examples
Direct manipulation	Fast and intuitive interaction Easy to learn	May be hard to implement Only suitable where there is a visual metaphor for tasks and objects	Video games CAD systems
Menu selection	Avoids user error Little typing required	Slow for experienced users Can become complex if many menu options	Most general-purpose systems
Form fill-in	Simple data entry Easy to learn Checkable	Takes up a lot of screen space Causes problems where user options do not match the form fields	Stock control Personal loan processing
Command language	Powerful and flexible	Hard to learn Poor error management	Operating systems Command and control systems
Natural language	Accessible to casual users Easily extended	Requires more typing Natural language understanding systems are unreliable	Information retrieval systems

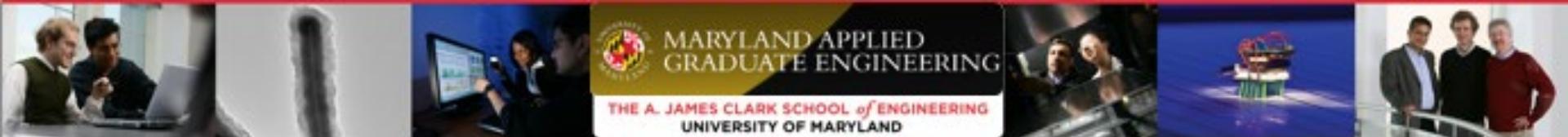
[From *Software Engineering*, Ian Sommerville, Ch29]



INFORMATION PRESENTATION - OUTPUT TO THE USER

- Format: text and/or graphic, depending on:
 - Is the user interested in precise information or in the relationships between data values?
 - How quickly do the information values change? Should the change in a value be indicated immediately to the user?
 - Must the user take some action in response to a change in information?
 - Does the user need to interact with the displayed information via a direct manipulation interface?
 - Is the information to be displayed textual or numeric? Are relative values of information items important?
- Guidance:
 - Graphical information display - trends and approximate values
 - Digital display - when precision is required

[From *Software Engineering*, Ian Sommerville, Ch29]



INFORMATION PRESENTATION - MESSAGE WORDING

Factor	Description
Context	Wherever possible, the messages generated by the system should reflect the current user context. As far as is possible, the system should be aware of what the user is doing and should generate messages that are relevant to their current activity.
Experience	As users become familiar with a system they become irritated by long, 'meaningful' messages. However, beginners find it difficult to understand short, terse statements of a problem. You should provide both types of message and allow the user to control message conciseness.
Skill level	Messages should be tailored to the users' skills as well as their experience. Messages for the different classes of users may be expressed in different ways depending on the terminology that is familiar to the reader.
Style	Messages should be positive rather than negative. They should use the active rather than the passive mode of address. They should never be insulting or try to be funny.
Culture	Wherever possible, the designer of messages should be familiar with the culture of the country where the system is sold. There are distinct cultural differences between Europe, Asia and America. A suitable message for one culture might be unacceptable in another.

[From *Software Engineering*, Ian Sommerville, Ch29]

94



OUTLINE

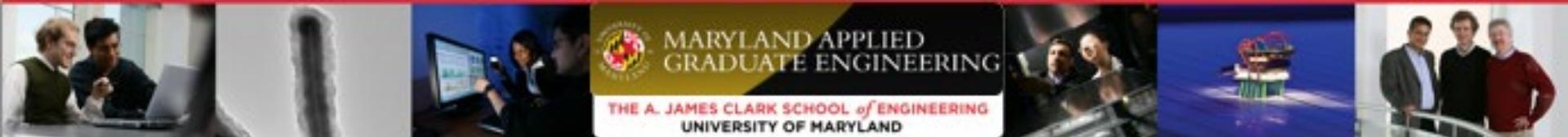
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Usability evaluation

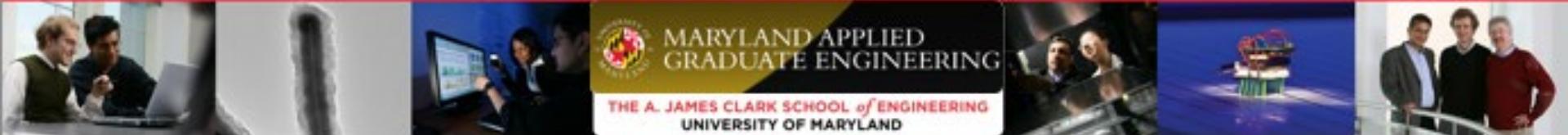
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DESIGN VS ACTUAL UX

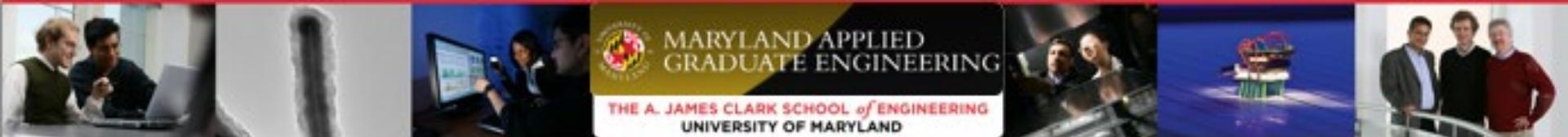


96



USER INTERFACE EVALUATION

- It means assessing the usability of an interface and checking that it meets user requirements
 - Part of the normal software verification and validation process
Perform alpha and beta interface evaluation/testing
- Techniques:
 - Questionnaires -collect information about what users thought of the interface
 - Observation of users at work with the system and ‘thinking aloud’ about how they are trying to use the system to accomplish some task
 - Video ‘snapshots’ of typical system use
 - Inclusion in the software of code which collects information about the most-used facilities and the most common errors



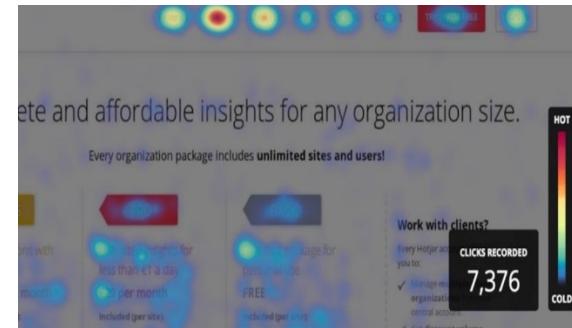
USER INTERFACE EVALUATION EXAMPLE TOOLS

▪ UX Recorder

- Capture the user's face (via the camera), their audio (through the mic) and their on-screen gestures such as taps, swipes and scrolling behavior.

▪ Heatmaps tools

- visualize how visitors use a website
- hotjar, crazyegg, Mouseflow



▪ More tools at: invision



SUMMARY

- Usability (like any other quality attribute) needs to built-in the software from the beginning and throughout the development life cycle
 - UCD supports this
- Usability definition and importance
- Definition of user centered design concepts
- User centered design process and techniques
- User centered analysis
- UI structural and detailed design
- Usability evaluation

OUTLINE

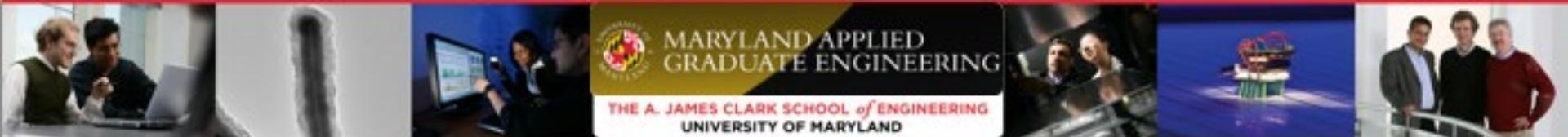
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Assignment – User Centered Design

USER CENTERED DESIGN QUIZ

- User centered design concepts
- Online
- Individual submission



SOFTWARE DEVELOPMENT PROJECT ASSIGNMENT

- Tasks:

- Model your users (as personas), user interaction flow, and a low-level prototype of the user interaction with the system

- Team assignment

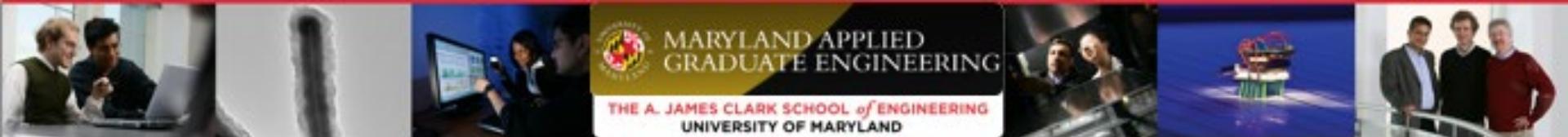
- Online submission – **only one team member needs to submit**

- Personas description and user interaction flow – in a Word or pdf file
 - HTML/pdf ... files for the Pencil/Balsamiq/... prototype (**make sure navigation/links between screens work**)

- Update the *Project Management* workbook

- *Individual contribution* to the activity

- **Detailed!**



SOFTWARE DEVELOPMENT PROJECT ASSIGNMENT (CONTINUED)

- Perform *team-to-team* reviews and provide feedback on the **personas**, **user interface flow model**, and **wireframe/story boards navigable prototype** artifacts
- **Team-to-team review procedure: (this applies to all phases of the project)**
 - Each member of a *Reviewer team* must review the *Author team's* artifact(s) and record comments
 - The *Reviewer team* must discuss and merge all members' comments and then the lead for this phase must provide the team's collective feedback online, through ELMS.

PROJECT PRESENTATION NEXT CLASS ...

- Each team will present:
 - Your specific LMS (name, domain, brief description, target users/customers, main features and a list of high priority quality attributes/scenarios)
 - LMS user model (personas), User Interface Flow Diagram, and user interface prototype (wireframes storyboards **with navigation**)
 - Two most important lessons learned in this activity
- Each team: presentation (**TIMED!**), plus questions and answers/ discussion
 - **Reviewer team must review the submission before class; in class ask questions and provide feedback**
 - Everyone else is encouraged to ask/provide comments
 - There may be questions related to the Requirements Analysis assignment

All team members must be present, and everyone must show their part of the work

104



"The Comfort Zone"

by @thewealthhike



TWH

www.thewealthhike.com



What are we afraid of?

Posted by Scott Roberts

231 Views

**DISCOMFORT
JUDGEMENT
UNPREPARED
REJECTION
FAILURE
VULNERABLE
EMBARRASSMENT
OURSELVES**

Posted by Scott Roberts

231 Views

With practice...

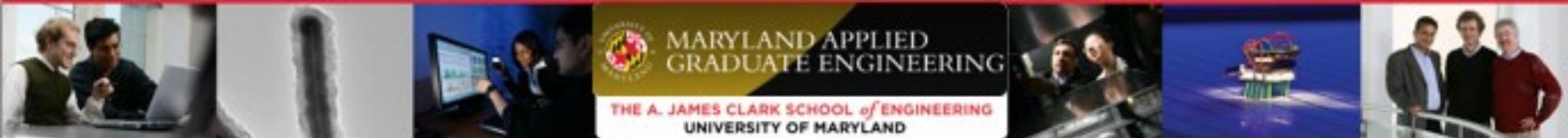
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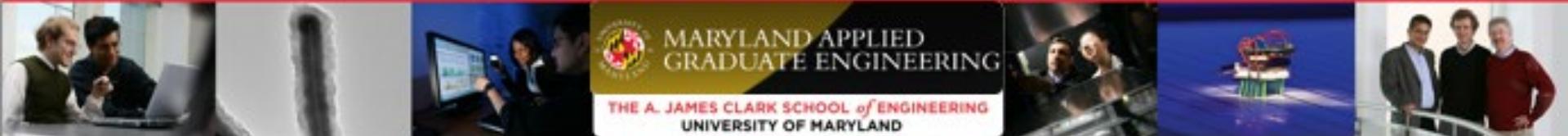


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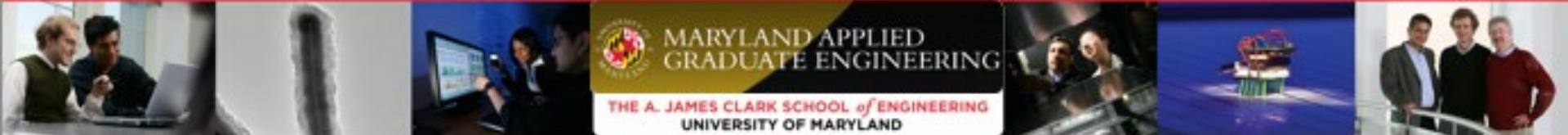
107



SUPPLEMENTAL MATERIAL

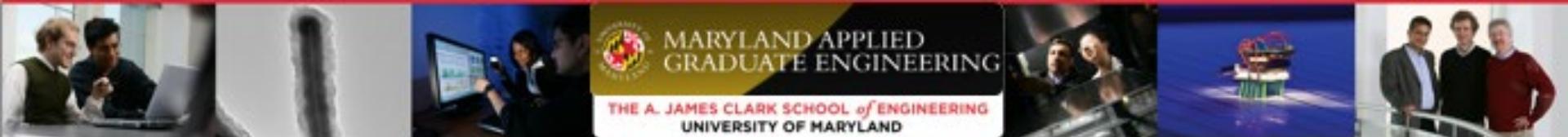


STATE MACHINES



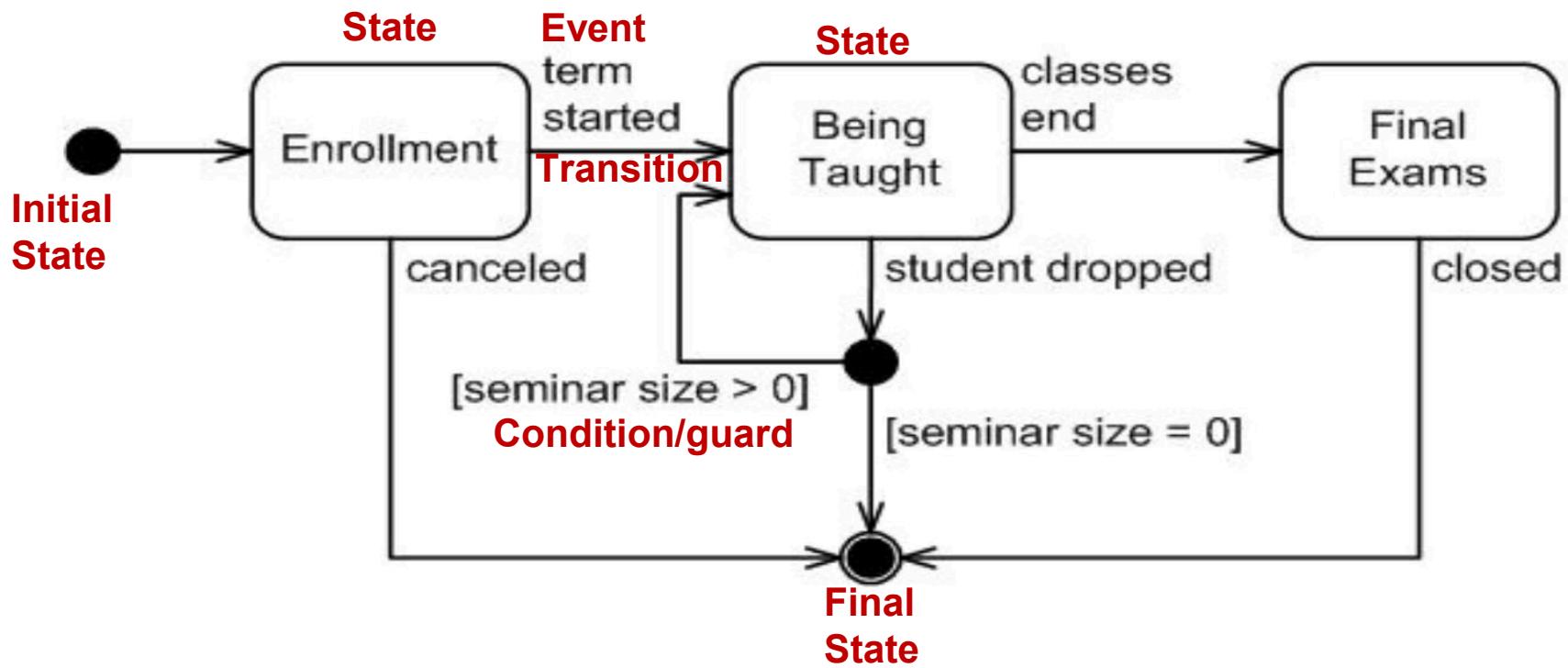
STATE MACHINES - DEFINITIONS

- A **state** is a *mode or condition of being* of an entity
 - Characterized by a set of values for the entity attributes/variables or a set of responsibilities/actions
- A **transition** is a change from one state to another
- An **event** is a noteworthy occurrence at a particular time
- A guard is a condition that must be true when the event occurs, for the transition to take place
- State machine - a dynamic/behavioral model
 - Documents states, transitions, and events
 - Used to model behavior of complex objects, particularly those that act in different manners depending on their state
 - Represented using *UML state machine diagrams* (used to be called state chart diagrams in UML 1.x)



UML STATE MACHINE DIAGRAM EXAMPLE 1

Model of the lifecycle of a *seminar* taught at a university

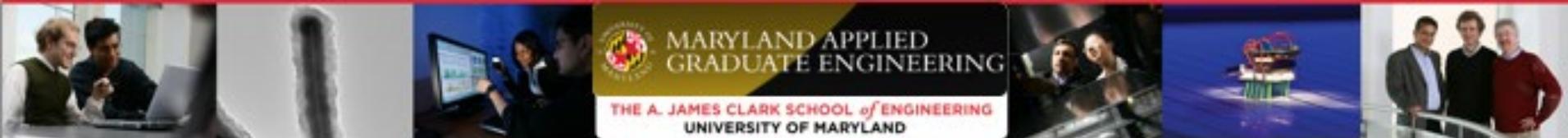
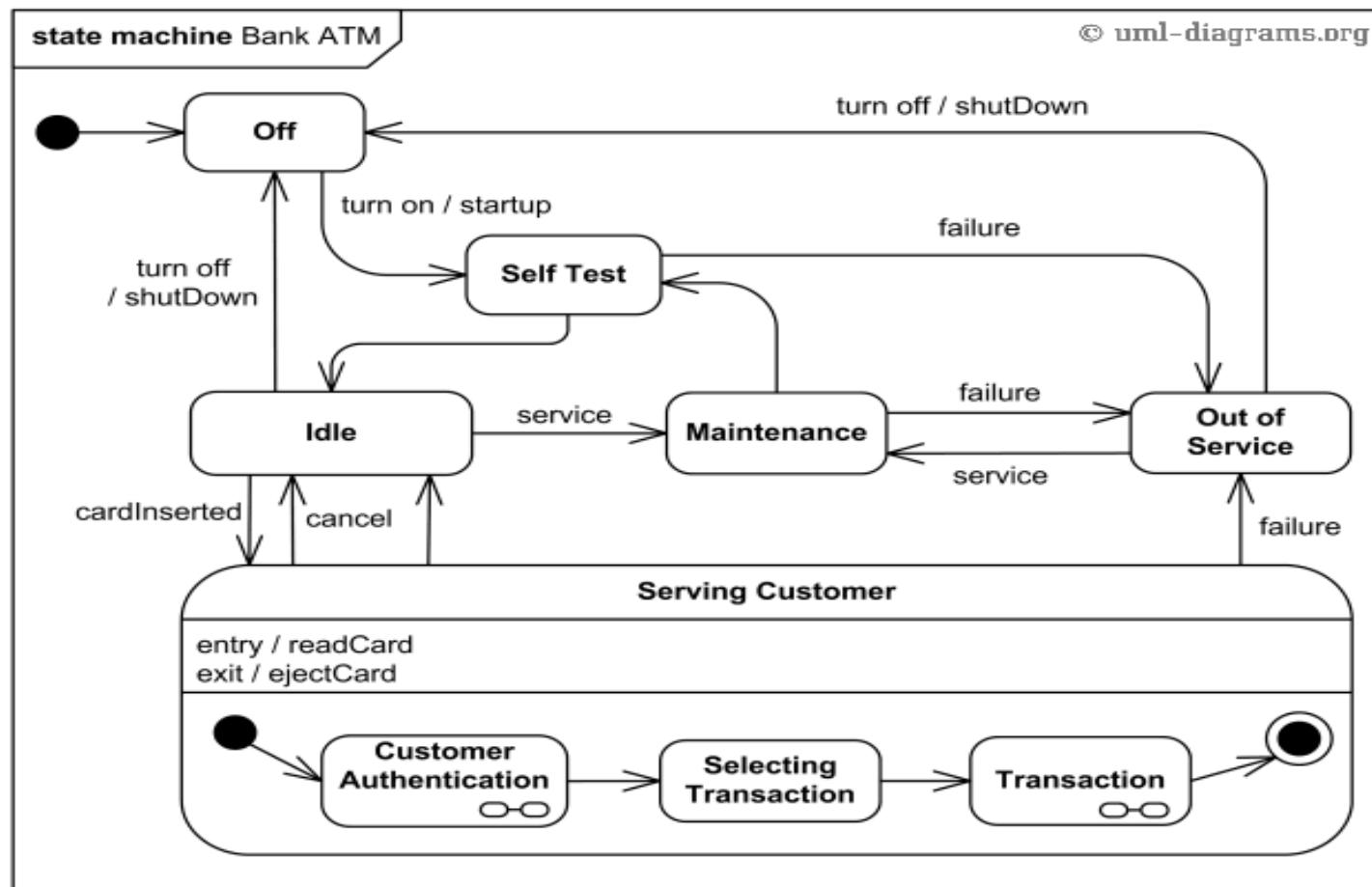


From: <http://www.agilemodeling.com/artifacts/stateMachineDiagram.htm#sthash.31fagTvc.dpuf>

111



UML STATE MACHINE DIAGRAM EXAMPLE 2



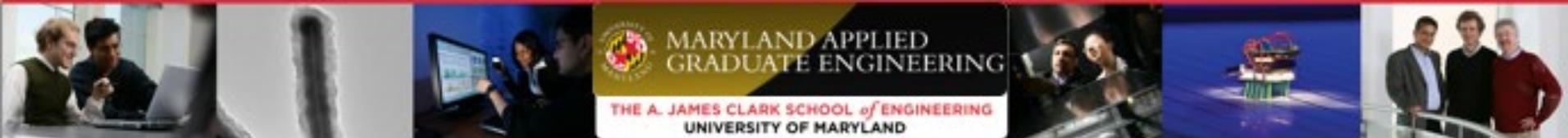
COMPARISON AND WHEN TO USE?

Activity diagram

- You are interested in processes and the flow of events
- The steps involved in performing an activity are important
- You have many related functions that affect each other
- You need to model concurrent processes

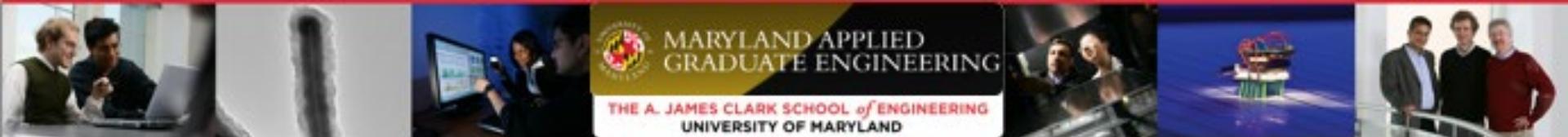
State machine diagrams

- You are interested in understanding how an object changes over time
- A crucial business object goes through many changes
- The state of different pieces of data greatly impacts the functionality of the system



MORE ON UML STATE MACHINE DIAGRAM

- C. Fox Textbook, chapter 13
- Slides at:
<https://users.cs.jmu.edu/foxcj/Public/ISED/index.htm>
Ch13A, Ch13B, Ch13C



VOICE USER INTERFACES (VUI)

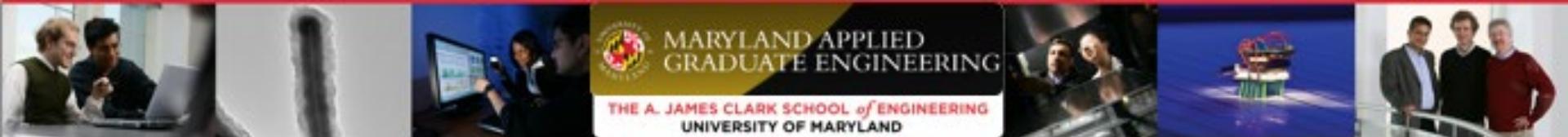


115

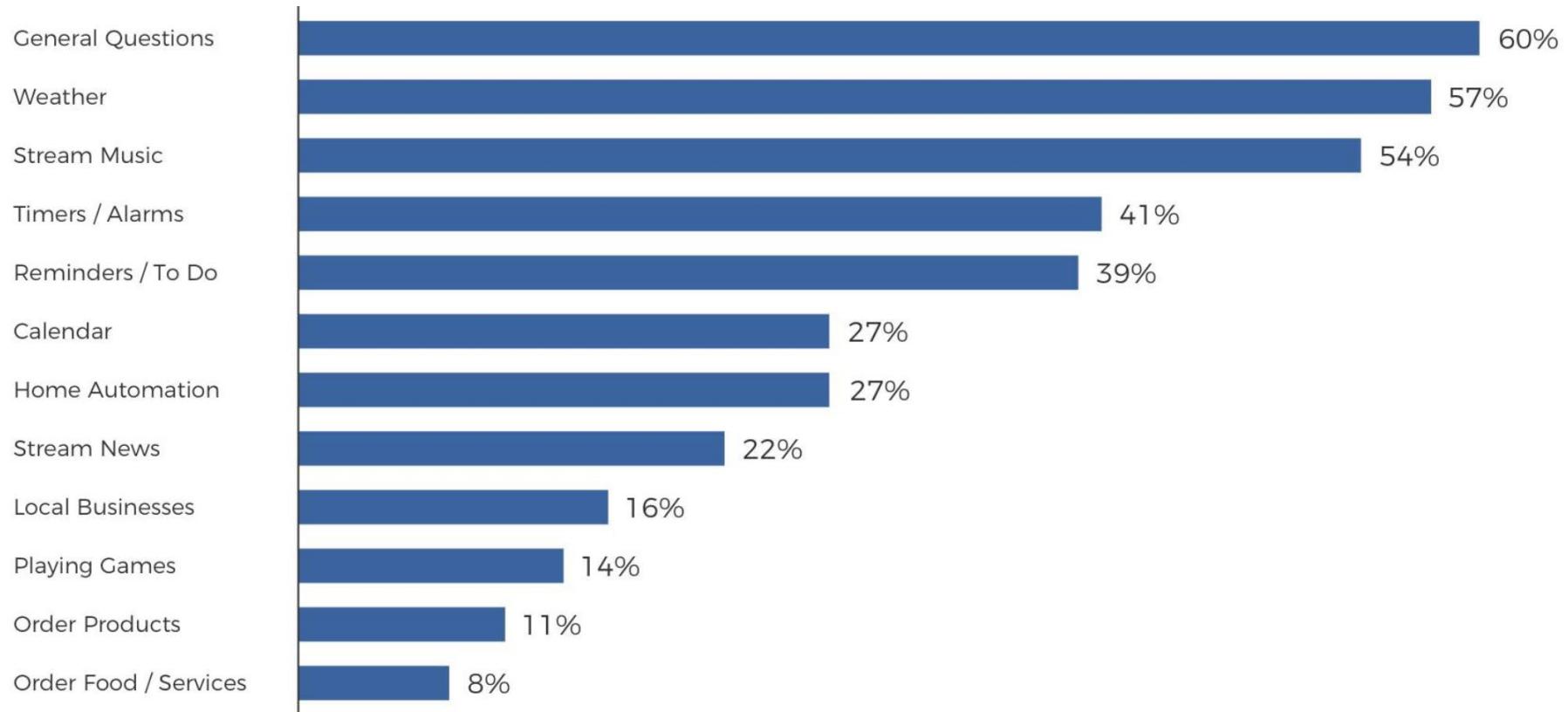


VOICE INTERFACE

- Use voice/speech interaction to control computers and devices
- Invisible interface
- Requires voice recognition and voice synthesis
- Services
 - Alexa (on Amazon Echo)
 - Tens of thousands voice experiences (apps) with the Alexa Skills Kit (ASK).
 - Apple
 - Siri (iPhone)
 - HomePod
 - Google Home
- Designing a good VUI requires interdisciplinary science
 - Computer science
 - Linguistics
 - Human factors psychology

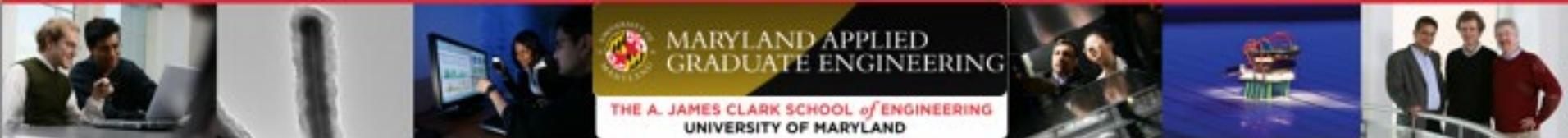


USE CASES FOR VUI



From: F. Goossens, [Designing a VUI—Voice User Interface](#)

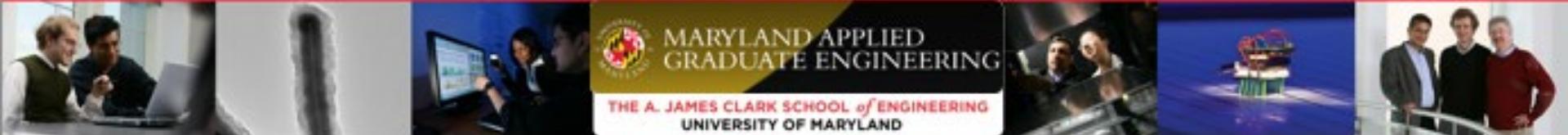
117



WHERE VUI IS SUITABLE

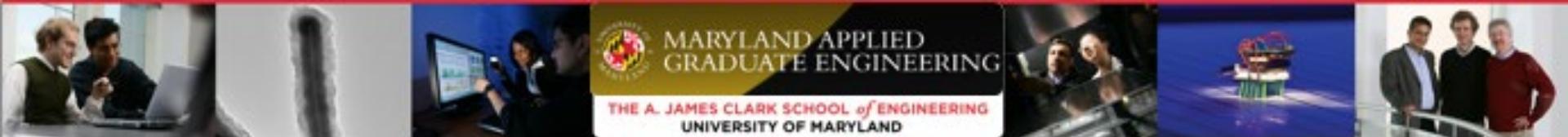
- Good for:
 - Search
 - Command and control: one-shot interactions
 - Quick answers; ‘off the top off your head’
 - Shallow interactions
 - Hands-free contexts
 - Shortcuts
 - Engagement / fun
 - Deeper, longer flows: multi-turn interactions
 - Noisy, social environments
 - Productivity / work
-
- Not so good for:
 - Choice

Voice recognition gone wrong 😊



VUI CHALLENGES

- Ambiguity of input
- Memory-dependent
- Time constrained
- Sounding natural

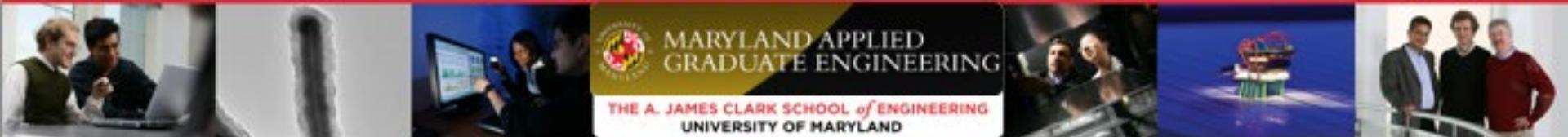


VUI PRINCIPLES

- Keep the communication brief
- Progressive disclosure
- Be co-operative
- Considerate confirmation when a task has been completed
- Fail gracefully (create a strong error strategy)
- Manage expectations
- Add an extra layer of security

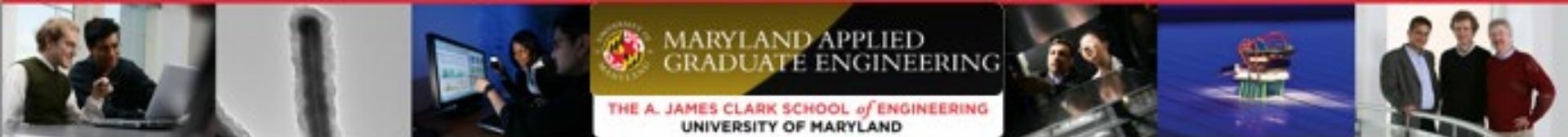
More principles and resources at <https://voiceprinciples.com>

120



VUI DESIGN PROCESS

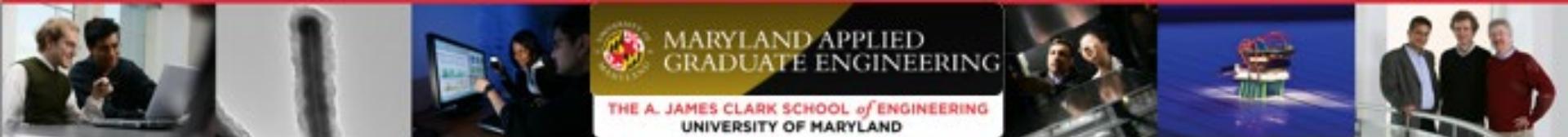
- Find your use case(s)
- Define your persona
- Sample dialogue
- Wizard of Oz testing
- Develop dialogue flow(s)
- Build, test, launch



THE ELEMENTS OF A VOICE COMMAND

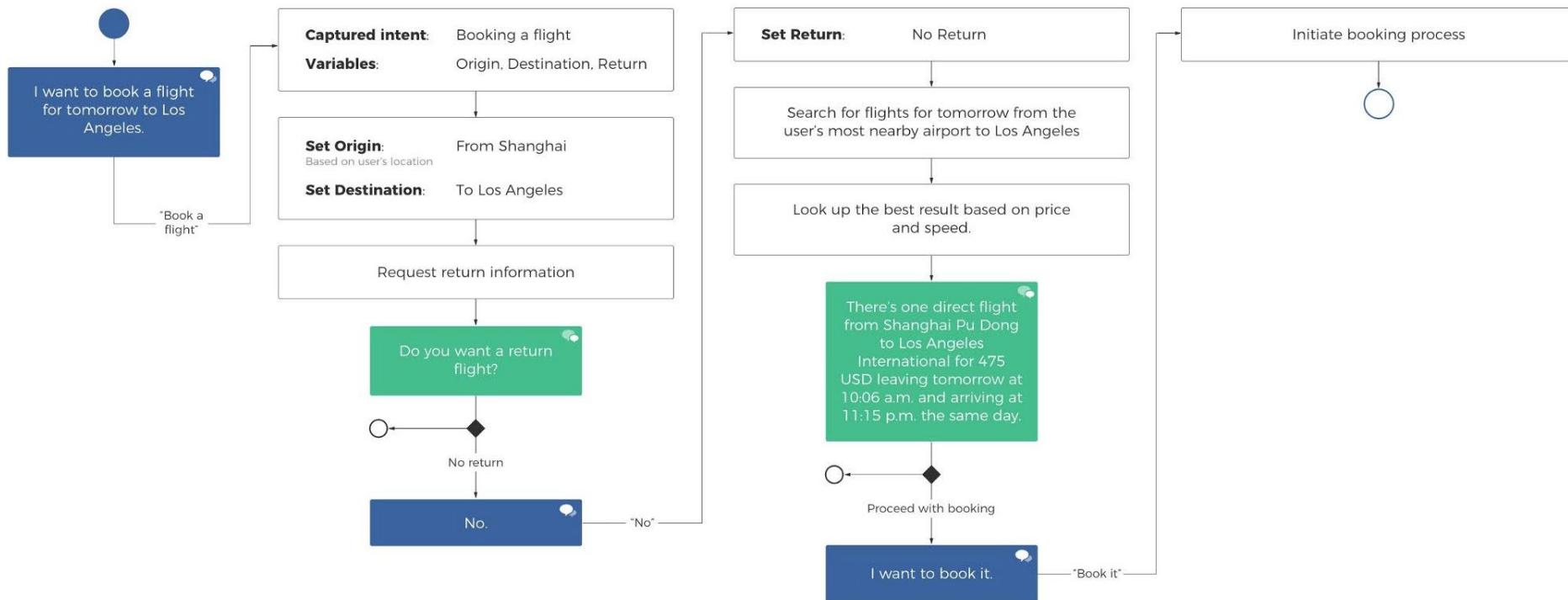
- **Utterance:** What the user said during their turn
- **Intent:** What action did they intend
- **Prompt:** What the system says in response
- **Slot / variable:** Information required for intent

- **Example:**
 - **Utterance:** “What time is Game of Thrones on TV tonight?” OR “When is Game of Thrones on today?”
 - Same **intent** for multiple utterances
 - **Prompt:** Game of Thrones is on at 9:00pm today
 - **Slot:** “Today” = date; “Time zone” = EDT; “Game of Thrones ” = show



VUI PROTOTYPE TECHNIQUES – DIALOG FLOW

Sample Dialog Flow



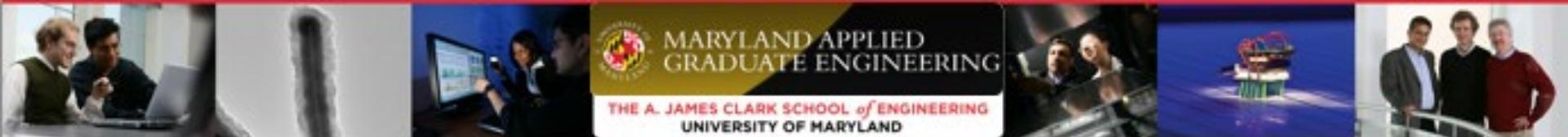
From: F. Goossens, [Designing a VUI—Voice User Interface](#)

123

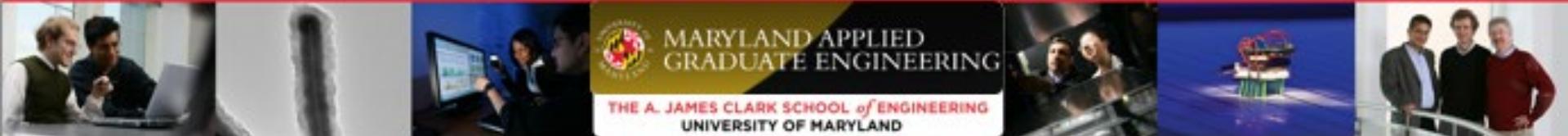


APPS FOR PROTOTYPING VUIS

- [Sayspring](#) - create a **working** prototype for voice-enabled Amazon and Google apps
- Amazon - [Alexa Skill Builder](#)
 - Makes it easy for designers to create new Alexa Skills.
- Google offers an SDK

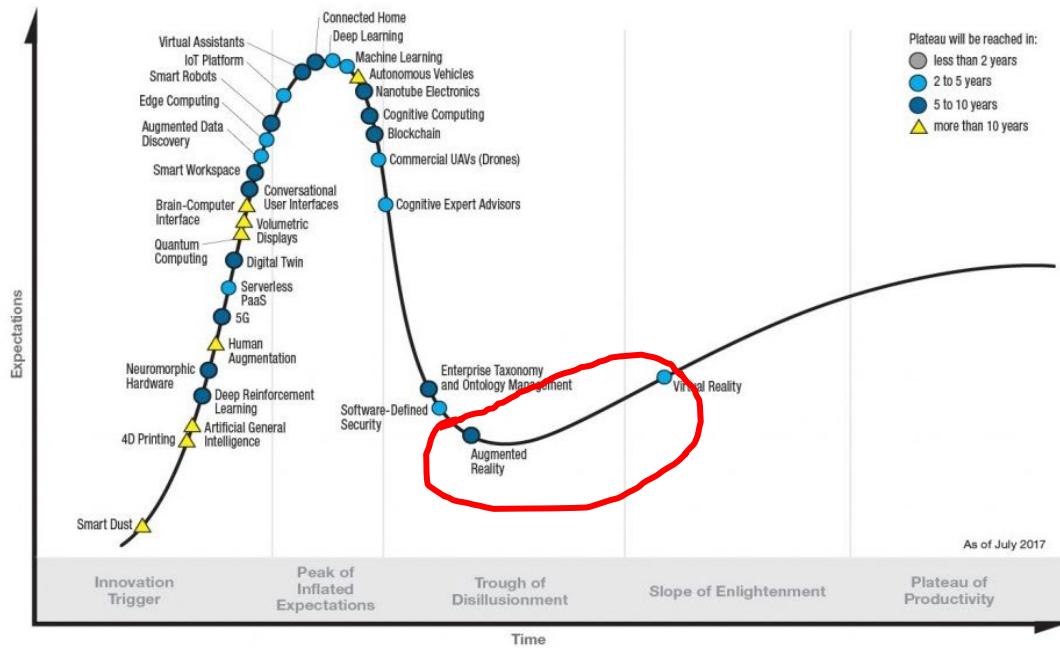


VIRTUAL REALITY (VR)/ AUGMENTED REALITY (AR)



VIRTUAL REALITY (VR)/ AUGMENTED REALITY (AR)

Gartner Hype Cycle for Emerging Technologies, 2017



Sutherland, 1968

gartner.com/SmarterWithGartner

Source: Gartner (July 2017)
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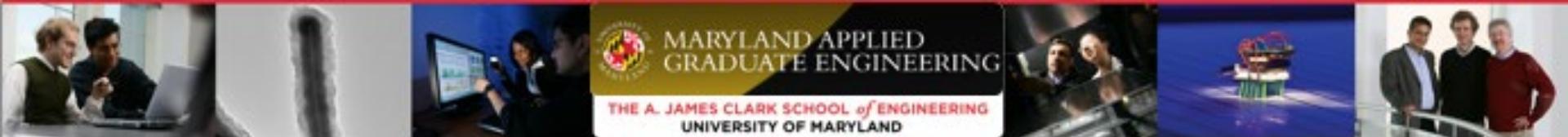
Gartner

126



VR/AR DEFINITIONS

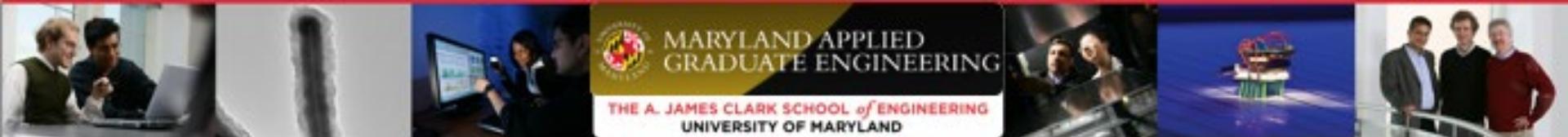
- Virtual environment (VE):
 - A synthetic, three-dimensional world seen from a first-person POV, where the view is under real-time user control
- (Immersive) Virtual reality (VR):
 - An approach using advanced technologies to immerse the user in a VE
- Augmented reality (AR):
 - An approach using technologies to enhance the user's view of a real-world environment with synthetic objects or information
- Mixed reality (MR):
 - Any technological approach that blends sensory information from the real world with synthetic objects or information
- Extended reality or Cross reality (XR):
 - Anything in the VR/AR/MR family of technologies and systems
 - Anything on the reality-virtuality continuum



VR/AR CHARACTERISTICS

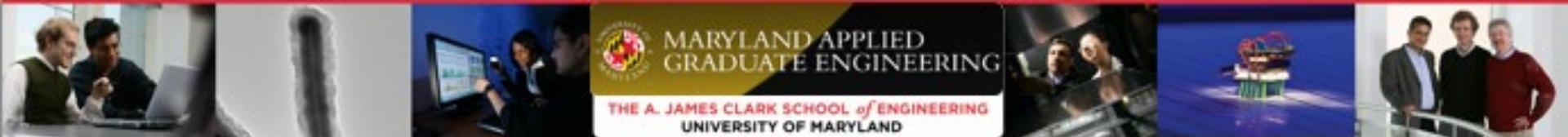
- Not viewing, but experiencing
- Not on a screen, but everywhere
- Basic navigation is completely natural, “non-mediated”
- Realistic physiological and psychological reactions
- Sense of presence

Visual, audio, and other sensory experience and communication means



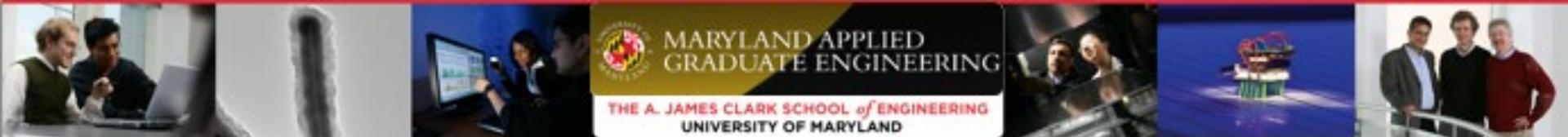
VR APPLICATION DOMAINS

- Games/entertainment
- Training
- Education
- Therapy
- Design
- Visual data analysis
- ...



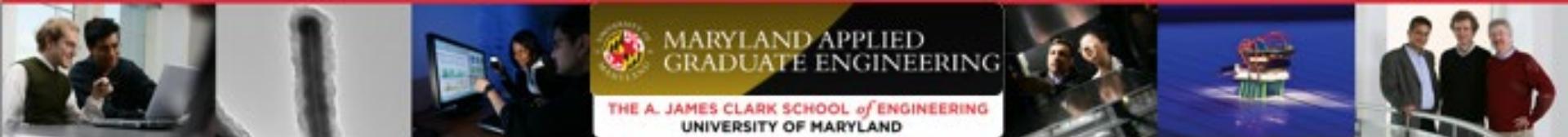
UX GOALS FOR VR

- **Usability:** the system is designed to help users achieve their goals smoothly and effortlessly
 - Task efficiency
 - Task accuracy
 - **Comfort**
 - Satisfaction
 - Lack of frustration
 - Lack of errors
 - **Low mental/physical workload**
 - Ease of use
 - Learnability
 - Productivity
- **Usefulness:** the system provides features that allow users to accomplish goals that are important to them (of work or play)



UX GOALS FOR VR (CONTINUED)

- **Emotional impact:** the system produces positive psychological effects and minimizes negative ones
 - *Fun, Coolness*
 - Elegance
 - Joy
 - Flow
 - Pleasantness
 - *Presence*



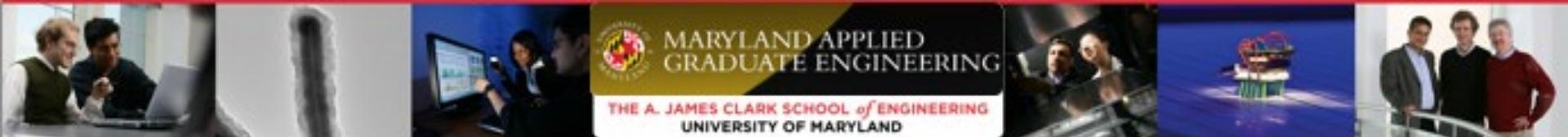
VR/AP UX DESIGN

Specifics

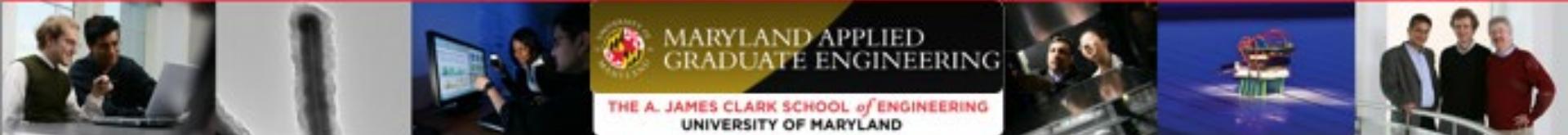
- Challenges, e.g. cybersickness, perception, motor abilities
- Devices, technologies
- Techniques, Algorithms
- Design principles: Affordance, Ergonomics, Constraints, Natural mappings

- Design process
- Design principles
 - Consistency
 - Simplicity
 - Structure
 - Visibility
 - Error prevention
 - Error recovery
 - Automation / control
 - Feedback
 - Accessibility
 - Vocabulary
 - Recognition over recall

Similarities



ORGANIZING A UX TEAM



STRUCTURING AND ORGANIZING A UX TEAM

- Most Ux teams will include some of the Ux roles below:

- Visual Designer

- Similar to a Graphic Designer, the Visual Designer focuses on the big picture – the concept of graphics, typography, iconography and the colour schemes. Visual Designers attend to the aesthetics and rarely enter into the technical

- UX Designer

- Deals with how the user is going to interact with the product. The primary responsibility of the UX Designer is to ensure that the product has a logical flow so that the user can move from step to step without getting lost.

- UI Designer

- Concerned with the form and distribution of graphic elements in an interface. While the UX Designer makes a design usable, the UI Designer makes it pleasant to use.

- Interaction Designer

- Understands how a user interacts with an app and builds interaction and animation into the design so that it reacts to the user's touch/instruction.

[From: <https://usabilitygeek.com/how-to-build-in-house-ux-team>]

134



STRUCTURING AND ORGANIZING A UX TEAM (CONTINUED)

➤ Information Architect

- Organizes the design elements so that they make sense. The Information Architect deals with the structure of a website, app or any other interactive product.

➤ Usability Expert/UX Researcher

- Deals with the user's needs. The aim of the research is to answer two questions: who are our users? And: what do our users want and need? This profile usually conducts interviews with users and does research about market data.

➤ Metrics Analyst

- Gathers and analyses financial and operational information for an organization. The person performing this role may also be responsible for the analysis of costs and effectiveness of staffing practices and training programs.

➤ Enterprise Architect

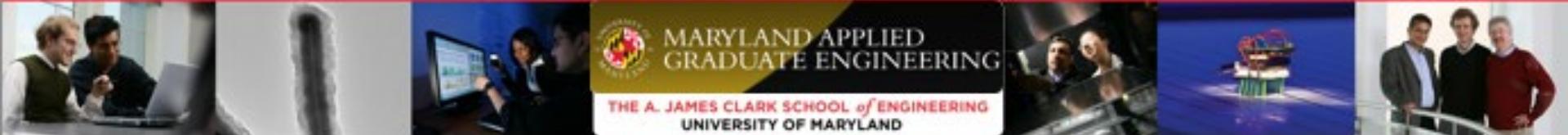
- Works with stakeholders to create a holistic view of the organization's strategy, processes, information, and information technology. The enterprise architect uses this knowledge to ensure that the business and IT are in alignment.

[From: <https://usabilitygeek.com/how-to-build-in-house-ux-team>]

135



UX IN AGILE DEVELOPMENT



AGILE USER CENTERED DESIGN AND ENGINEERING DESIGN

- In an agile development project:
 - Agile teams are made up of *generalizing specialists* with the ability to work on a wide range of things, instead of narrowly focused specialists typically found on traditional teams
 - **At the beginning of the agile project** - perform high-level, very broad modeling to address the majority usability and UI issues facing the team
 - Don't need a detailed answer, the details can come later on a just in time (JIT) basis during development, but
 - **You do need a strategy**
 - **During development** usability practitioners should be embedded within the development team, working on UX tasks when needed but also working with their teammates on non-UX activities
 - **User testing, including usability testing, is done throughout the lifecycle**, it isn't left to the end of the project where it is invariably too late to act.

<http://agilemodeling.com/essays/agileUsability.htm>

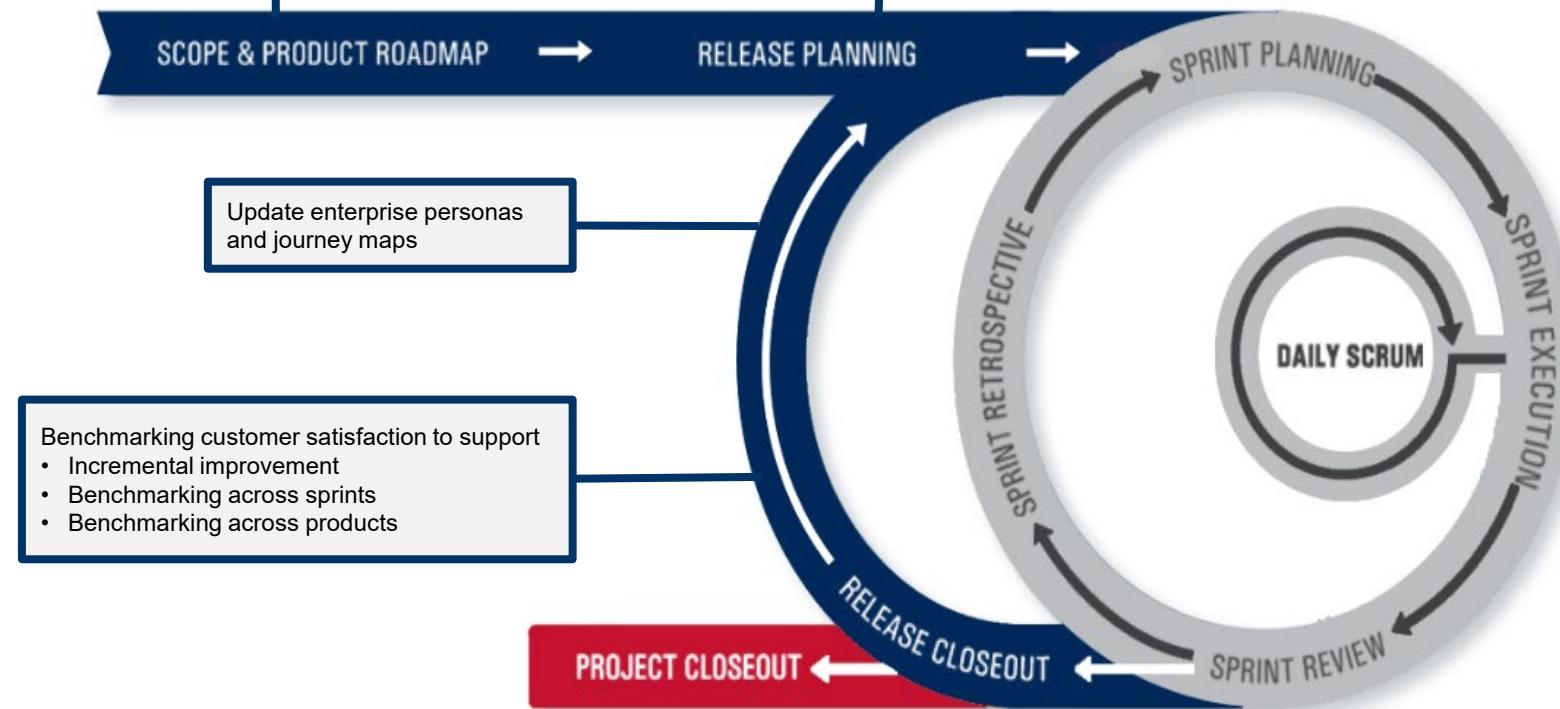
137



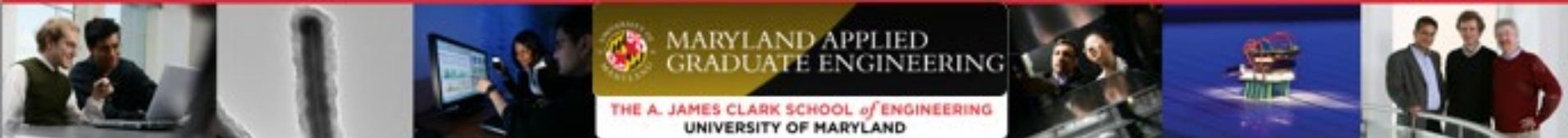
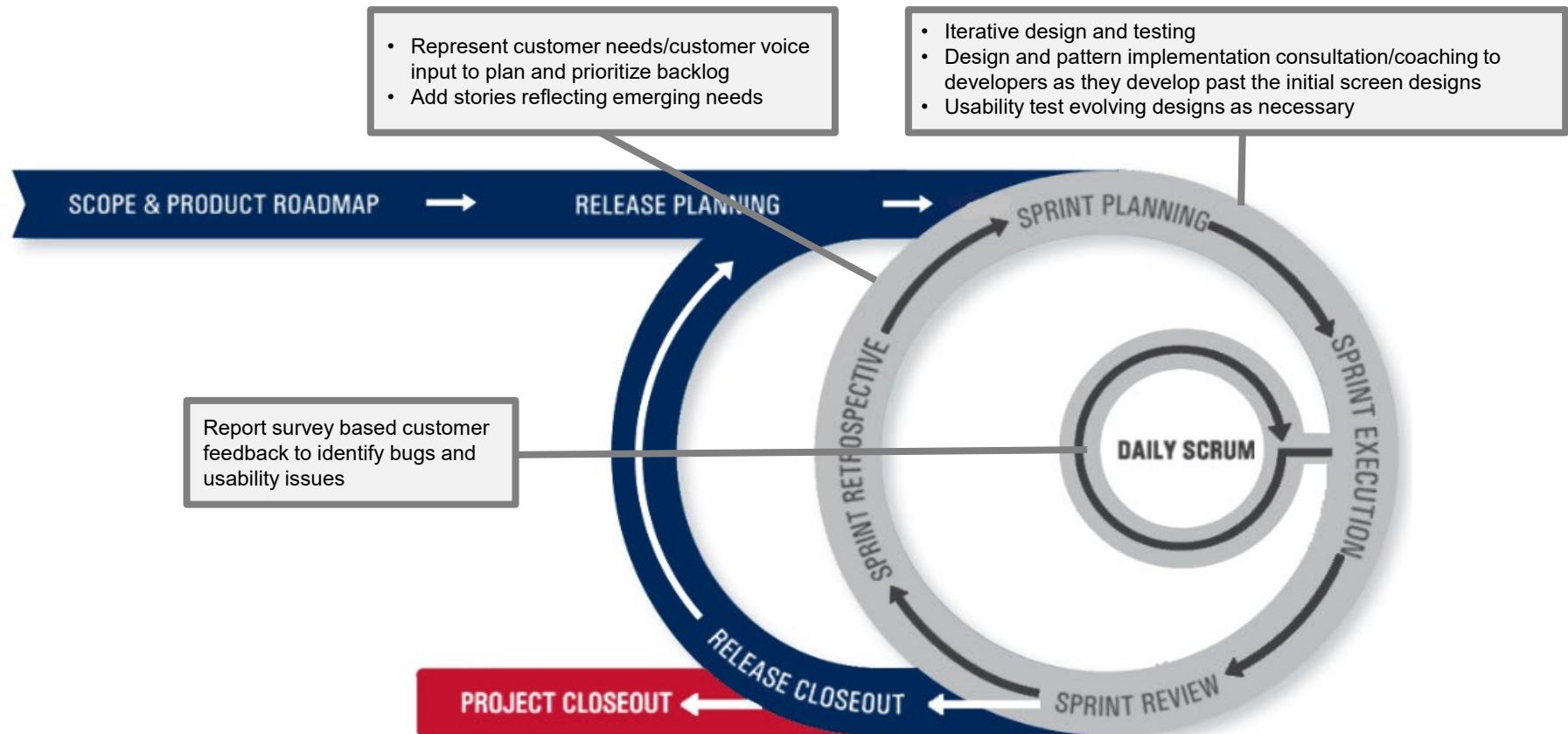
UX IN AGILE SOFTWARE DEVELOPMENT: PLANNING

- Initiate discussions with project sponsor and project manager
- Participate in business process reviews and analysis.
- Draw on existing research / conduct gap research to develop user journey and needs and task analysis
- Conduct additional research as needed

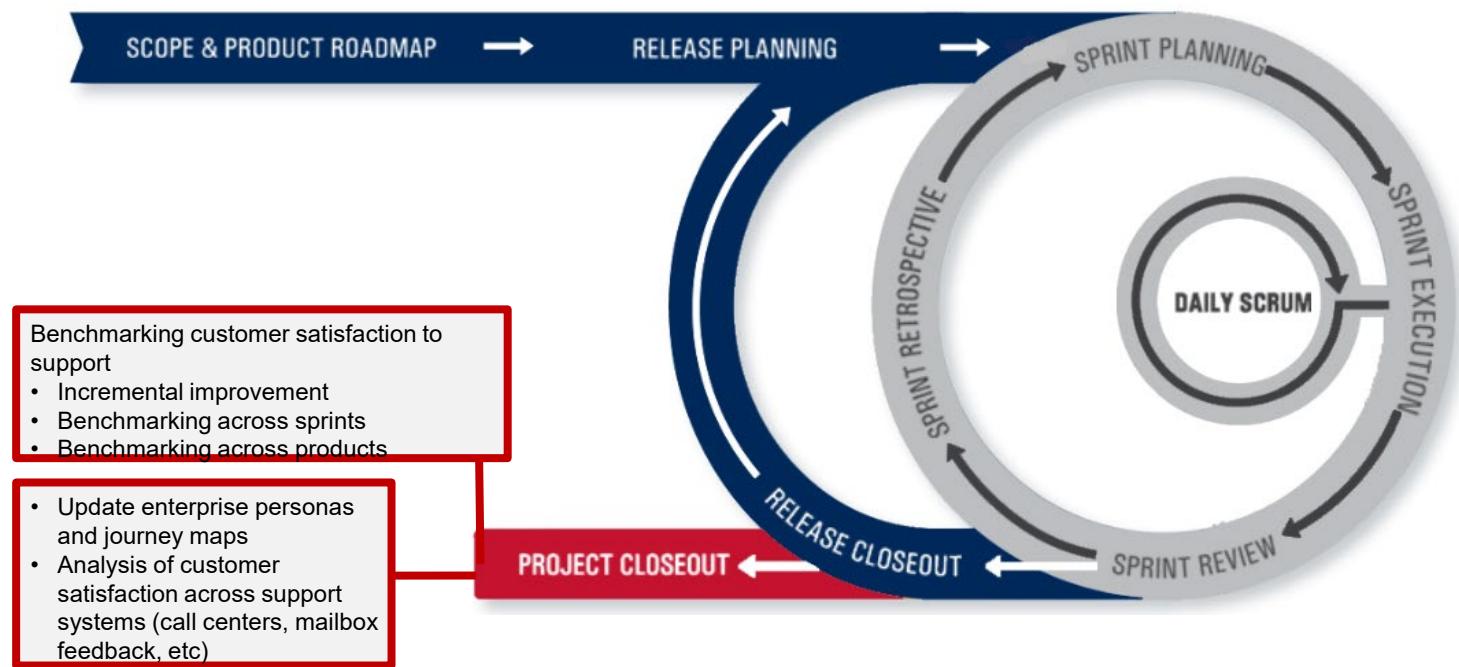
- Draw on existing research / conduct gap research to develop user journey and needs and task analysis.
- Work with project sponsor and project manager to define success criteria and map to measurable UX Key Performance Indicators, including measures of learnability, efficiency, and customer satisfaction.



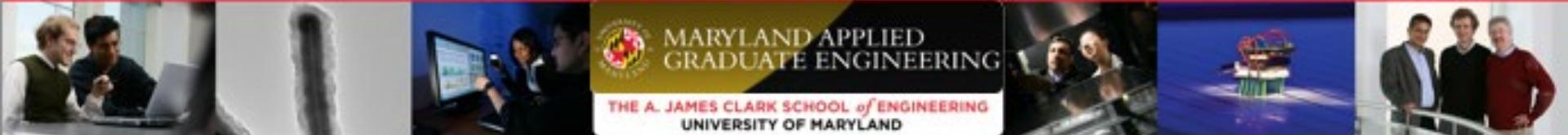
UX IN AGILE SOFTWARE DEVELOPMENT: SPRINTS



UX IN AGILE SOFTWARE DEVELOPMENT: CLOSEOUT

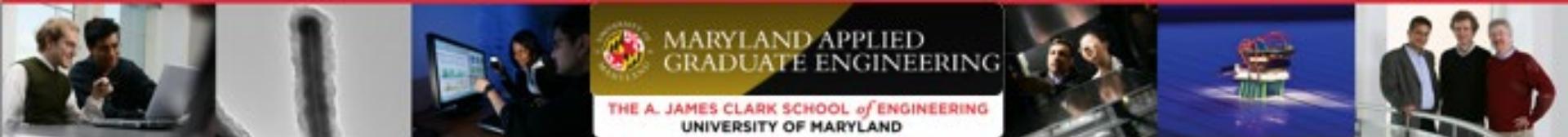


ADDITIONAL UX/UI RESOURCES

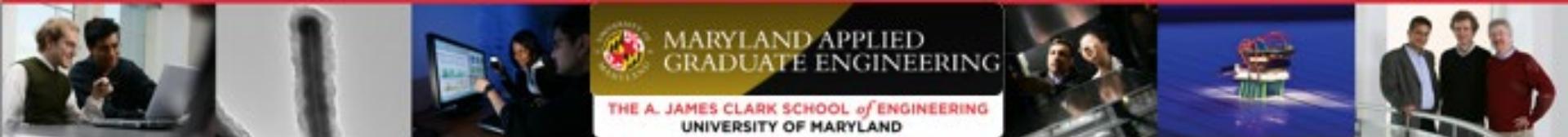


MORE UX/UI RESOURCES

- [Integrating UX Design methodologies into software development](#),
Neil O'Donoghue
- [Example UX docs and deliverables](#)
- [The Cost of UX Design](#)
- [Why Your Total Project Costs Are Actually Higher Without UX](#)).
 - A scaled down [UX strategy](#) in terms of budget, is better than none at all.
- Science of a good UI (Mark Miller)
 - <http://www.sgui.com/>



SIX THINKING HATS TECHNIQUE FOR GROUP DISCUSSION



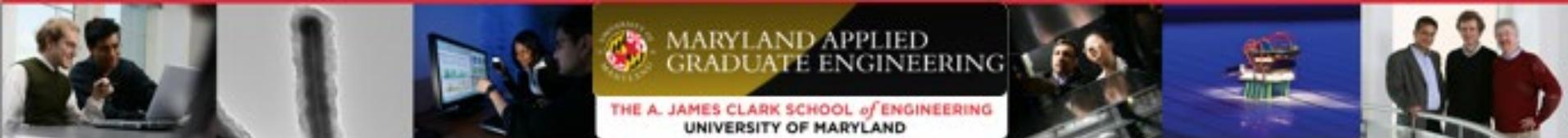
CONSIDER SIX THINKING HATS FOR YOUR PROJECT

- A technique for group discussion and individual thinking, involving six human characteristics
- A system designed by [Edward de Bono](#) which describes a technique for group discussion and individual thinking
- Provides a means for groups to plan thinking processes in a detailed and cohesive way, and in doing so to think together more effectively.



These are Edward de Bono's "Six Thinking Hats".

While most of us put on just one thinking hat, de Bono says we need six: Green is for creativity - being provocative to see where thoughts will lead us. (Provocation in this sense is the testing of even wild concepts). Blue is management, in which we ask - what is the goal? Yellow is an optimistic response, seeing the sunny side. White is information with the question - what are the facts? Black is discernment which requires that we be practical. And red is for emotions, activating our gut reactions. (Illustration credit: Nelly Ghazaryan)



SIX THINKING HATS (CONTINUED)

- Six distinct directions are identified and assigned a color. The six directions are:
 - **Managing** Blue – what is the subject? what are we thinking about? what is the goal? Can look at the big picture.
 - **Information** White – considering purely what information is available, what are the facts?
 - **Emotions** Red – intuitive or instinctive gut reactions or statements of emotional feeling (but not any justification).
 - **Discernment** Black – logic applied to identifying reasons to be cautious and conservative. Practical, realistic.
 - **Optimistic response** Yellow – logic applied to identifying benefits, seeking harmony. Sees the brighter, sunny side of situations.
 - **Creativity** Green – statements of provocation and investigation, seeing where a thought goes. Thinks creatively, outside the box.

