# User Interfaces and Usability

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# The User Interface

- The user interface is the system that helps users **communicate** with the computer system and/or the application system
- System users often judge a system by its interface rather than its functionality
- A poorly designed interface can cause a user to make catastrophic errors
- Poor user interface design is the reason why so many software systems are never used
- Most users of business systems interact with these systems through graphical user interfaces (GUIs)

# The User Interface

- To design a better user interface, use the following objectives:
  - Match the user interface to the **task**
  - Make the user interface **efficient**
  - Provide appropriate **feedback** to users
  - Generate usable queries
  - Improve productivity of knowledge workers

# Dialog

- Dialog is the **communication** between a person and the computer
- Three key points to be considered are:
  - Meaningful communication
  - Minimal user action
  - Standard operation and consistency

# Communication

- Communication means that the user understands the information that is being presented
- Users with less skills require a greater amount of communication
- Provide easy to use help screens
- Often these contain hyperlinks to other related help topics

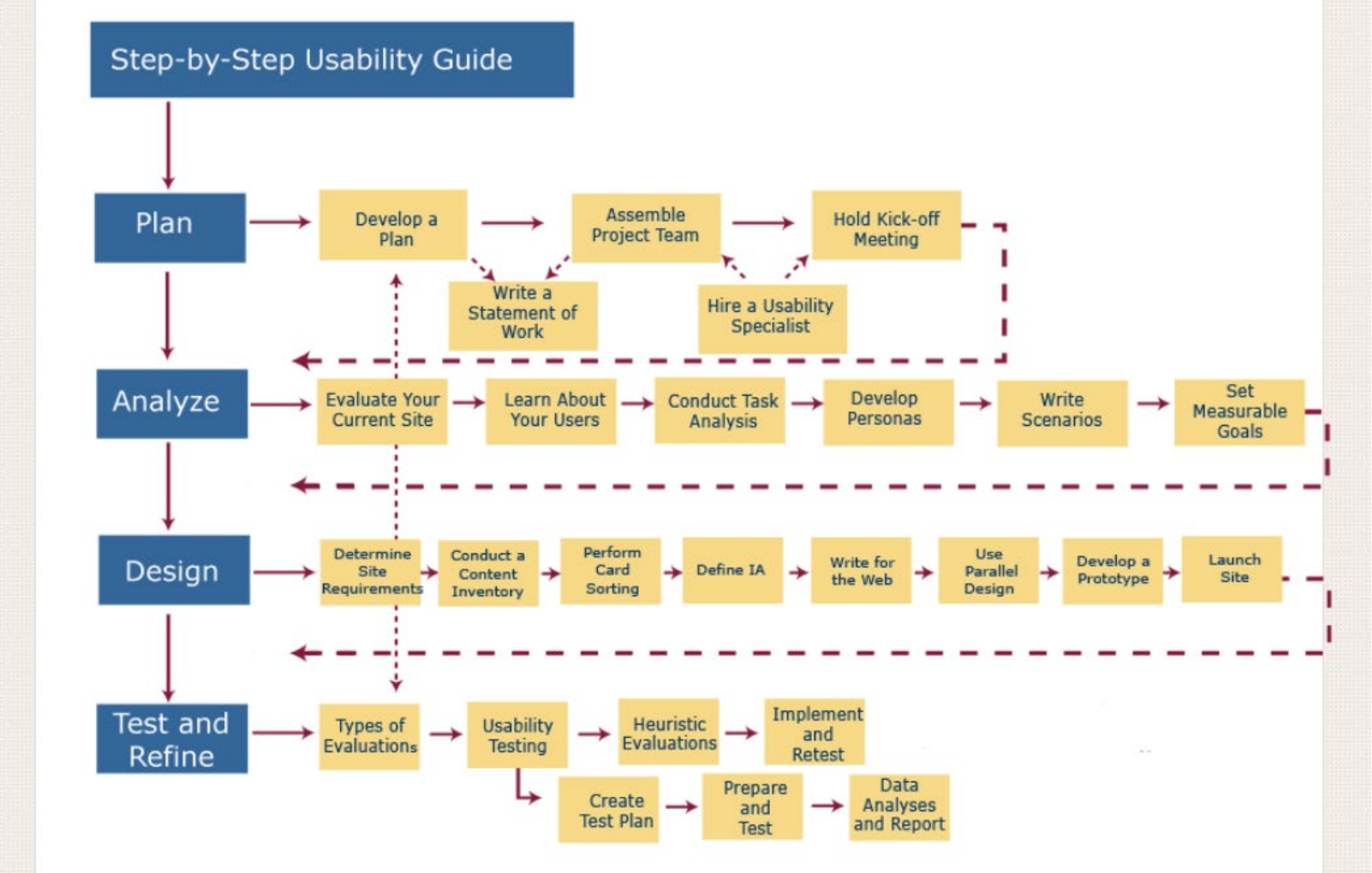
# Minimal User Action

- Minimal user action is achieved by:
  - Entering codes instead of code meanings
  - Enter only data that are not stored on files
  - Not requiring users to enter editing characters
  - Supplying default values on entry screens
  - Providing inquiry, change, or delete programs with short entry fields
  - Providing keystrokes for selecting menu options that are normally selected using a mouse
  - Selecting codes from a pull-down menu on a GUI screen

# Standard Operation

- Standard operation is achieved by:
  - Keeping header and footer information in the same locations for all screens
  - Using the same keystrokes to exit a program
  - Using the same keystroke to cancel a transaction
  - Using a standard key for obtaining help
  - Standardized use of icons when using graphical user interface screens
  - Consistent use of terminology within a screen or Web site
  - Providing a consistent way to navigate through the dialog
  - Consistent font alignment, size, and color on a Web page

# User Interface design process




https://www.usability.gov/how-to-and-tools/resources/ucd-map.html

# User Interface design principles

- Defined by Schneiderman (there are many others)
  - Book: Designing the User Interface, 6th edition (2016)
- User familiarity
  - The interface should be based on user-oriented terms and concepts rather than computer concepts
  - E.g., an office system should use concepts such as documents, folders,... rather than directories, file identifiers,...
- Minimal surprise
  - If a command operates in a known way, the user should be able to predict the operation of comparable commands

# User Interface design principles

- Consistency
  - The system should display an appropriate level of consistency
  - Commands and menus should have the same format, command punctuation should be similar, etc.
  - Also on the used terms:

| Consistent | Inconsistent A | Inconsistent B |
|---|---|---|
| delete/insert table | delete/insert table | delete/insert table |
| delete/insert column | remove/add column | remove/insert column |
| delete/insert row | destroy/create row | delete/insert row |
| delete/insert border | erase/draw border | delete/insert border |

Example from: “Designing the User Interface: strategies for effective Human-Computer Interaction”, B. Shneiderman et al.

# User Interface design principles

- Recoverability
  - The system should provide some resilience to user errors and allow the user to recover from errors
  - This might include an undo facility, confirmation of destructive actions, 'soft' deletes, etc.
- User guidance
  - Some user guidance such as help systems, on-line manuals, etc. should be supplied

# User Interface design principles

- User diversity
  - Interaction facilities for different types of user should be supported
  - Cultural and international diversity
  - Users with disabilities
  - Older users and childrens
  - Accommodate to hardware and software diversity
  - E.g., some users have seeing difficulties and so larger text should be available

# Components of the User Interface

- The user interface has two main components:
  - **Presentation language**, which is the computer-to-human part of the transaction
  - **Action language** that characterizes the human-to-computer portion
- Two problems must be addressed in interactive systems design
  - How should information from the user be provided to the computer system?
  - How should information from the computer system be presented to the user?

# Types of User Interfaces

- There are several types of user interfaces:
  - **Direct manipulation**
  - **Menu** selection
  - **Form fill-in** interfaces
  - **Command language** interfaces
  - **Natural-language** interfaces

# Direct manipulation

- The designer has to create a visual representation of the world of action, usually through metaphors
- ***Principle of virtuality***: a representation of reality that can be manipulated
- Feeling of involvement directly with a world of objects rather than communicating with and intermediary
- Physical, spatial, and visual representations appear to be easier to retain and manipulate than textual or numeric ones
- Examples: desktop metaphor, word processor, drawing tools,...

# Direct manipulation

- The designer have to create a visual representation of the world of action, usually through metaphors

| Advantages | Disadvantages |
|---|---|
| Visually represents task concepts | May require graphics display and pointing devices |
| Allows easy learning | May be hard to program |
| Allows easy retention | |
| Allows errors to be avoided | |
| Encourages exploration | |
| Affords high subjective satisfaction | |

from: "Designing the User Interface: strategies for effective Human-Computer Interaction", B. Shneiderman et al.

# Menu selection

- Provides the user with an onscreen list of available selections
- Typologies
  - Pull-down
  - Pop-up
  - Toolbar
  - Ribbon
- Appropriate for novice and intermittent users
- Keyboard shortcuts are essential for expert users

# Menu selection

- Provides the user with an onscreen list of available selections

| Advantages | Disadvantages |
|---|---|
| Shortens learning | Presents danger of many menus |
| Reduces keystrokes | May slow frequent users |
| Structures decision making | Consumes screen space |
| Permits use of dialog-management tools | Requires rapid display rate |
| Allows easy support of error handling | |

from: "Designing the User Interface: strategies for effective Human-Computer Interaction", B. Shneiderman et al.

# Menu selection Guidelines

- GUI menus guidelines:
  - The main menu is always on the screen
  - The main menu uses single words
  - The main menu should have secondary menus grouped into similar features
  - Prefer broad-shallow to narrow-deep
  - The secondary drop-down menus often consist of more than one word
  - Secondary options perform actions or display additional menu options
  - Menu items in grey are unavailable for the current activity

# Form fill-in interfaces

- Form-fill interfaces are onscreen forms displaying fields containing data items or parameters that need to be communicated to the user
- Users must understand the field labels

| Advantages | Disadvantages |
|---|---|
| Simplifies data entry | Consumes screen space |
| Requires modest training | |
| Gives convenient assistance | |
| Permits use of form-management tools | |

from: "Designing the User Interface: strategies for effective Human-Computer Interaction", B. Shneiderman et al.

# Form fill-in design guidelines

- Meaningful title
- Comprehensible instructions
- Logical grouping and sequencing of fields
- Visually appealing layout of the form
- Familiar field labels
- Consistent terminology and abbreviations
- Convenient cursor movement
- Error prevention where possible
- Marking of required fields
- Explanatory messages for fields
- Completion signal

# Dialogue Boxes

- Many tasks are interrupted to request users to select option, perform limited data entry, or review error messages
- **Dialog boxes** are a feature of GUI design
- They should have logically grouped functions
- Each dialog box should have OK, Cancel or Apply, and perhaps Help buttons
- When tasks are complex. multiple dialog boxes may de needed, leading to use a tabbed dialog box

# Command language interfaces

- Allow the user to control the application with a series of keystrokes, commands, phrases, or some sequence of these
- Require memorization of syntax rules
- May be an obstacle for inexperienced users

| Advantages | Disadvantages |
|---|---|
| Flexible | Poor error handling |
| Appeals to "power" users | Requires substantial training and memorization |
| Supports user initiative | |
| Allows convenient creation of user-defined macros | |

from: "Designing the User Interface: strategies for effective Human-Computer Interaction", B. Shneiderman et al.

# Natural-language interfaces

- **Natural-language** interfaces permit users to interact with the computer in their everyday or "natural" language
- Active area of research

| Advantages | Disadvantages |
|---|---|
| Relieves burden of learning syntax | Requires clarification dialog |
| "Natural" interface | May not show context |
| | May require more keystrokes |
| | Unpredictable |

from: "Designing the User Interface: strategies for effective Human-Computer Interaction", B. Shneiderman et al.

# Voice or Speech Recognition

- Voice or speech recognition systems are developing rapidly
- There are two different types of voice recognition:
  - Continuous speech systems, allowing for dictation
  - Speaker independence, so people can enter commands or words at a given workstation or device
- Some new tools such as Siri, Alexa, Cortana,…

# Feedback

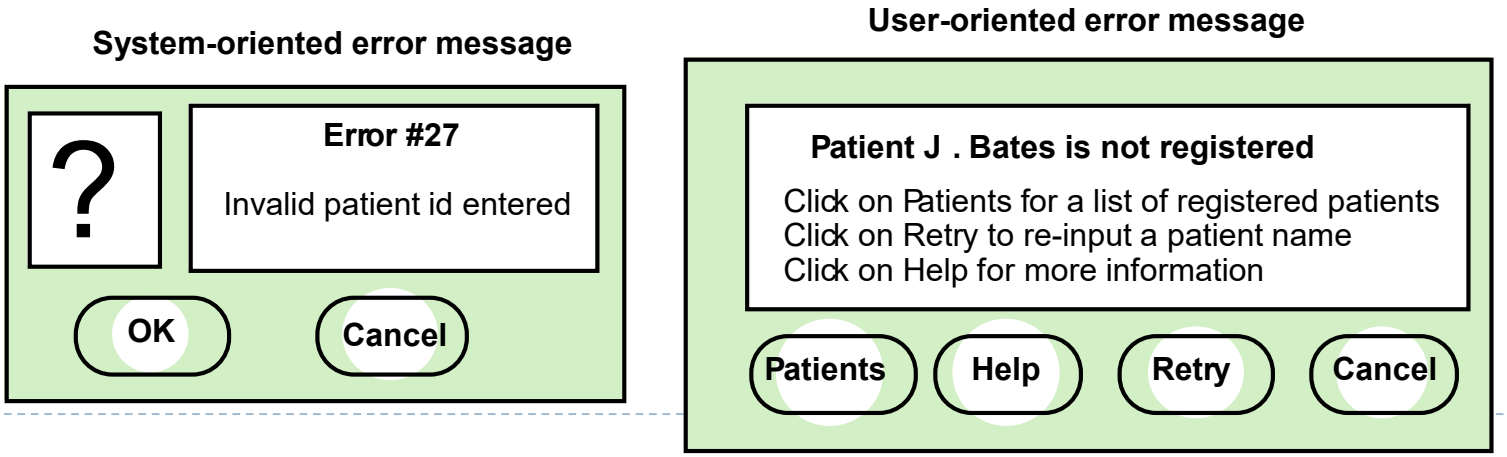
- All systems require feedback in order to monitor and change behavior by:
  - Comparing current behavior with predetermined goals
  - Giving back information describing the gap between actual and intended performance

# Types of Feedback

- Feedback to the user is necessary in seven distinct situations:
  - The computer has accepted the input
  - The input is in the correct form
  - The input is not in the correct form
  - There will be a delay in processing
  - The request has been completed
  - The computer cannot complete the request
  - More detailed feedback is available

# Error messages

- Error message design is critically important
- Poor error messages can mean that a user rejects rather than accepts a system
- Messages should be polite, concise, consistent and constructive
- The background and experience of users should be the determining factor in message design



# Program Help

- Program help comes in a variety of ways:
  - Pressing a function key, such as F1
  - A GUI pull-down menu
  - Context-sensitive help, specific for the operation being performed
  - Iconic help, obtained when a cursor is left over an icon for a few seconds (e.g., a tooltip)
  - Wizards, which provide a series of questions and answers when trying to perform an operation
  - Software forums

# Usability Tips for Websites

- There are several resources where you can find tips on how to design websites:
  - https://xd.adobe.com/ideas/
  - https://99designs.es/blog/web-digital/top-web-design-tips/
  - https://www.format.com/magazine/resources/design/website-design-tips
  - https://medium.com/quick-code/coolest-25-web-design-trends-in-2021-thatll-rock-the-world-388eb1144b7e

# Usability Tips for Websites

- **Global navigation**
  - **Simplicity.** Your navigation should help visitors understand how to get around on your site with the fewest clicks possible.
  - **Clarity.** There shouldn't be any guessing about what each navigation option means.
  - **Consistency.** The navigation system should be the same for all pages on the website.



https://xd.adobe.com/ideas/principles/web-design/web-page-design/

# Usability Tips for Websites

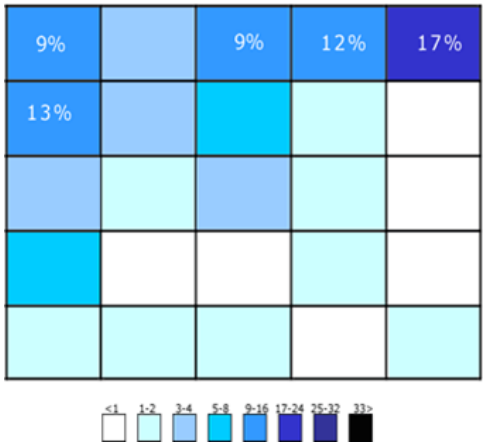
- **Visual and functional design of web links**
  - **Recognize the difference between internal and external links.** Users expect different behavior for internal and external links. All internal links should open in the same tab so that visitors can use the “back” button.
  - **Change the color of visited links.** When visited links don’t change color, users could unintentionally revisit the same pages multiple times.
  - **Double-check all links.** It’s frustrating to arrive at a 404-error page. Use tools like Dead Link Checker to find any broken links on your website.
  - **Use breadcrumbs as a secondary navigation scheme**



https://xd.adobe.com/ideas/principles/web-design/web-page-design/

# Usability Tips for Websites

- **Search tool**
  - **Put the search box where users expect to find it.** The chart below, based on a study by A. Dawn Shaikh and Keisi Lenz, shows the expected location of the search field
  - **Use a magnifying glass icon to draw attention to the area**. The magnifying glass icon has a universal meaning—most users are familiar with it
  - **Size the input box appropriately.** Making the input field too short is a common mistake
  - **Put the search box on every page**



# Usability Tips for Websites

- **Content strategy**
  - **Prevent information overload.** Too much information on a page can easily overwhelm visitors
  - **Avoid jargon and industry-specific terms.** Each unknown term or phrase that appears on the page will make it that much harder for visitors to understand the information
  - **Minimize long sentences.** Write in small, scannable segments
  - **Avoid capitalizing all letters.** All-caps text is fine for acronyms and logos. But it's best to avoid all caps for paragraphs, form labels, errors, and notifications



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# Usability Tips for Websites

- **Page structure**
  - **Make it predictable.** Look at your competitors' websites, identify common design patterns, and align with user expectations by using design patterns that are familiar to your target audience
  - **Use a layout grid.** A layout grid divides a page into major regions and defines the relationships between elements in terms of size and position
  - **Use a low-fidelity wireframe to privatize essential elements**. Before building the page, create a wireframe, analyze it, and remove anything that isn't absolutely necessary



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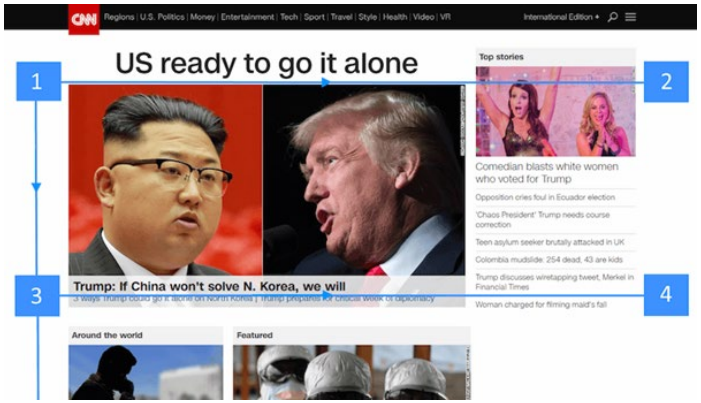
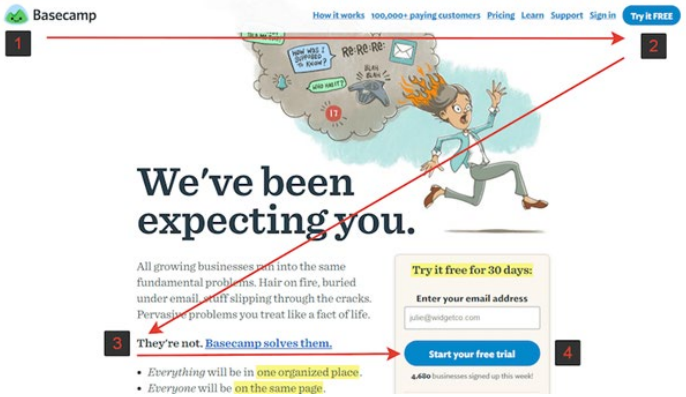
# Usability Tips for Websites

- **Visual hierarchy**
  - **Use natural scanning patterns.** The F-shaped pattern (for text-heavy pages) and the Z-shaped pattern ( for non-text-oriented ones) are two natural scanning patterns that can help you to set the right path for the visitor's eyes



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  - **Visually prioritize important elements.** Make important elements, such as key content or your primary call-to-action buttons, the focal points so that visitors see them right away
  - **Create mockups to clarify the visual hierarchy.** Rearranging elements in a mockup is much easier than doing it with code



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# Usability Tips for Websites

- **Scrolling behavior**
  - **Encourage users to scroll.** When you create lengthy pages, keep in mind that visitors still require a sense of orientation (of their current location) and a sense of navigation (other possible paths)
  - **Put your most compelling content at the top**. An excellent introduction sets the context for the content and answers the visitor's question, "What's this page all about?". Use engaging imagery
  - **Provide visual feedback when loading new content.** This is especially important for web pages where content loads dynamically, such as news feeds
  - **Avoid horizontal scrolling**



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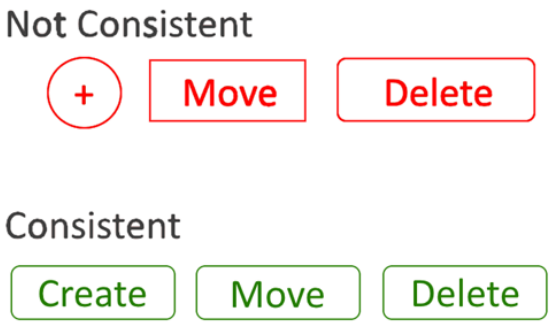
# Usability Tips for Websites

- **Buttons**
  - **Ensure that clickable elements actually look clickable**
  - **Label buttons according to what they do.** The label on any actionable interface element should always tie back to what it will do for the user
  - **Design buttons consistently.** When browsing a website, they'll associate an element's shape with button functionality



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# Usability Tips for Websites

- **Imagery**
  - **Make sure images are relevant.** Select images that are clear and support your product goals
  - **Use high-quality assets with no distortion**
  - **Avoid generic photos of people.** When visitors see faces of other humans it makes them think that there are real humans behind the product or organization



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# Usability Tips for Websites

- **Videos**
  - **Set audio to “off” by default, with the option to turn it on**
  - **Keep promo videos as short as possible.** Short videos are more appealing to the majority of users. Keep business videos in the range of **two** to **three** minutes.
  - **Provide an alternative way to access content**



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# Usability Tips for Websites

- **Animation**
  - **Visual feedback on user action.** Good interaction design provides feedback
  - **Navigational transitions.** Functional animation creates a connection between the two pages and smoothly transports users between them
  - **Branding**. Well-crafted animation establishes an emotional connection with visitors
  - **Parallax effects.** Parallax is a popular technique in web design in which the background moves at a different speed than the foreground content while scrolling



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# Usability Tips for Websites

- **Web forms**
  - **Ask only what's required.** The more you ask, the less motivated users will be to provide the data
  - **Order the form logically**
  - **Group related fields together**



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# Usability Tips for Websites

- **Mobile considerations**
  - **Aim for a single-column layout**
  - **Use the "Priority+" pattern to prioritize navigation across breakpoints.** The most important elements are exposed and less important items are hidden behind a "more" button
  - **Size images appropriately** for displays and platforms
  - **Properly sized touch targets** (such as links, buttons, and menus)
  - **Stronger visual signifiers of interactivity.** On mobile, there is no hover state to provide additional visual feedback



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# Testing and Checking

- Usability measures
- Fluid UX Walkthroughs
  - Heuristic Evaluation
  - Cognitive Walkthrough

# Usability measures

- ***Time to learn***: How long does it take for typical user to learn how to use the actions relevant to a set of tasks?
- ***Speed of performance***: How long it take to carry out the benchmark tasks?
- ***Rate of errors by users***: How many and what kinds of errors do people make in carrying out the benchmark tasks?
- ***Retention over time***: How well do users maintain their knowledge after an hour, a day, or a week?
- ***Subjective satisfaction***: How much did users like using various aspects of the interface?

# Fluid UX Walkthroughs

- Easy ways to assess usability and accessibility
- Combination **heuristic evaluation**, **cognitive walkthrough** and **accessibility markup review**
- Translated: a checklist with scenarios
- Anyone can do one

http://wiki.fluidproject.org/display/fluid/User+Experience+Walkthroughs

# Heuristic Evaluation

- Experts engage in systematic inspections of the user interface with the goal of identifying usability and accessibility problems
  - https://wiki.fluidproject.org/display/fluid/Heuristic+Evaluation
- Simple Usability Evaluation:

1. Try changing your font size, window size and resolution
2. Look critically at the page's layout, structure & content
3. Use the Tab key to navigate through all controls
4. Check for alternatives to images, sound, and video

# Screen Enlargement

- When you make things bigger or resize...
  - Is all the text visible?
  - Does it overlap or break up in any way?
  - Are headers and labels still correctly associated?
  - Do columns shift or realign unexpectedly?

# Layout and Structure

- Is the page structured into logical sections?
- Are the sections clearly labeled?
- Are there sufficient non-visual cues for site structure?
- Are there sufficient visual cues?
- Is the most important information prominent?
- Is navigation consistent from page to page?

# Keyboard Navigation

- Many different types of users use the keyboard
- You probably do, too!
- Keyboard access is one-dimensional: forward & back
- **Aim**: *Everything that works with the mouse, works with the keyboard*

# Keyboard Navigation Checklist

- Do all links, buttons, and form controls receive focus?
- Can all controls be activated with Enter or Spacebar?
- Are there any areas you get stuck or need the mouse?
- Do calendar pickers and other rich widgets work?

# What About Shortcuts?

- Accessibility guidelines use to suggest “access keys”
- Keyboard shortcuts bound to the **alt** key
- A huge source of controversy
- Bottom line: *don’t add new keyboard shortcuts*

# Cognitive Walkthrough

- It is a step-by-step exploration of a service to see how well a particular type of user
- How to Perform a Cognitive Walkthrough
  1. Choose a user (depending on what knowledge the user have and his/her needs, preferences, and limitations)
  2. Define the goal & tasks
  3. Perform the tasks
- The user can be a persona

# Cognitive Walkthrough

- From how the user perform the task, the expert can analyze the usability
- Similar walkthroughs can be done to analyze the accessibility, when the user has certain disability (low vision, blindness, impaired hearing, ...)

- https://wiki.fluidproject.org/display/fluid/Cognitive+Walkthrough