SWE - 632 Design & Development of User Interfaces

Fall 2020

George Mason University

Dr. Kevin Moran

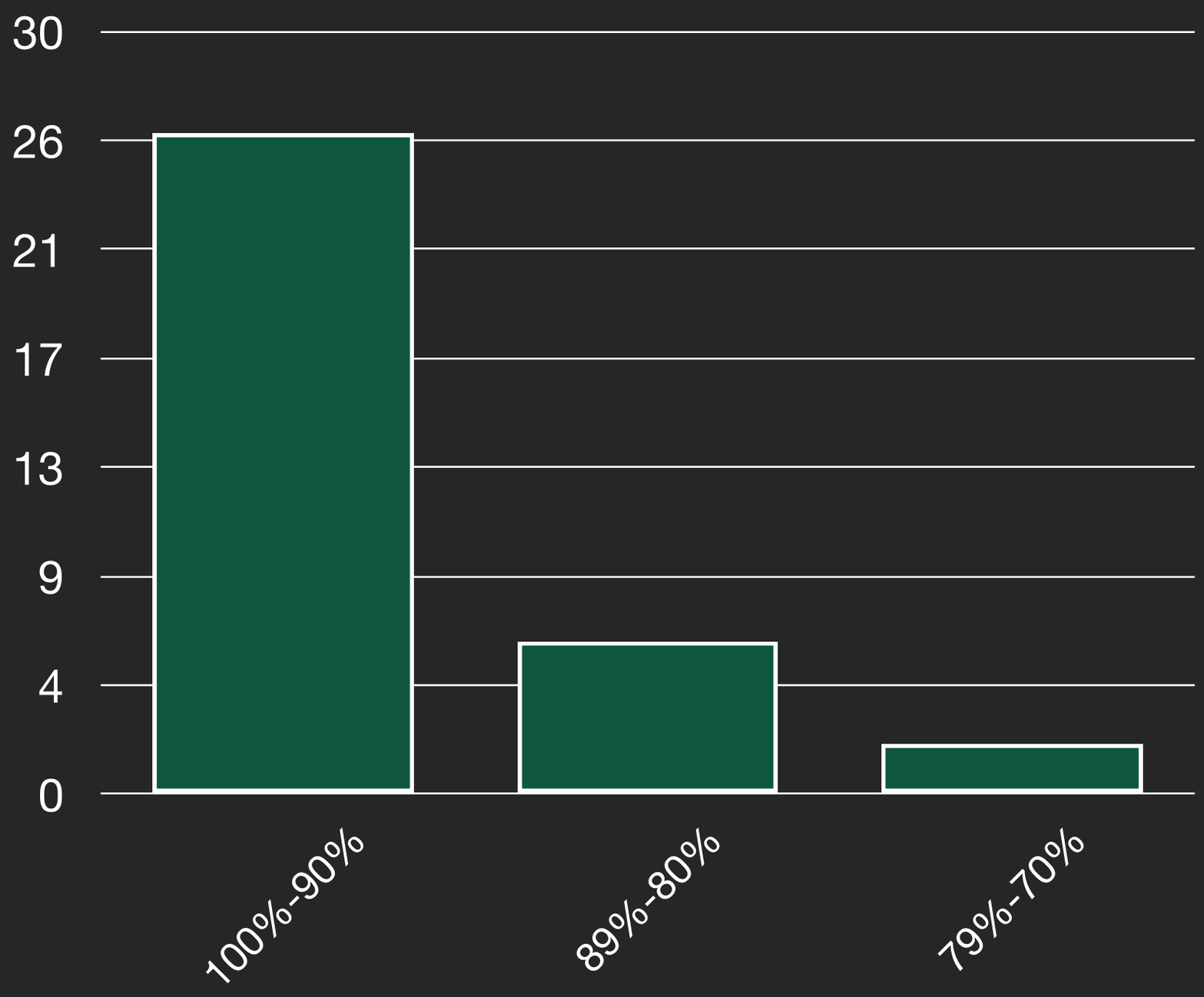
Week 9:

Interaction Techniques

Administrivia

- Midterm Exam Grades Returned (*Great Work!*)
- Project Checkpoint 4 due today
- Project Checkpoint 5 out now, due April 7th (two weeks)
- Discussion Question 9 - Posted after class
- Midterm Course Evaluation- Posted to Piazza Thurs

Midterm Exam: Grade Breakdown



Project Checkpoint 5:Think Aloud Usability Evaluation

Description

In this Project Checkpoint, your project group will conduct a usability evaluation study of your revised web app from Project Checkpoint 3 to identify 5 usability issues. The usability study will

1. Involve 4 participants, who may be friends, family, coworkers, or students in this class but may not be members of your project group
2. Consist of a single task that should last 10 - 20 minutes and must be at least 5 minutes long. Your task should have an overall objective but might enumerate several inter-related objectives (e.g., plan a home remodeling project, including listing materials you need to purchase and the steps you will take)
3. Collect think-aloud data and a screencast (w/ audio) of each participant. You are free to use whatever screen recorder you would like to use. For ease of use, you can conduct these studies over Zoom and record the screen using Zoom's built in tools.
4. Identify and report critical incidents that occur during the tasks
5. Collect subjective reactions from participants through a brief open-ended post-task interview conducted immediately following each task.
6. Analyze critical incidents and participant reactions to identify at least 5 usability issues.

Project Checkpoint 5: Think Aloud Usability Evaluation

Designing the Study

You should first design your study taking into consideration the following:

1. Design a task that exercises one or (ideally) more of your web app's use cases. Your task should describe a concrete, fictional scenario and a specific objective for the participant to accomplish within this scenario. A task might involve interacting with software other than your web app (e.g., searching the web, and using your app to record notes) to understand how your app fits into a larger context, particularly if your use cases can be accomplished very quickly. For example, if you app is a todo app, you might have the user use your app to brainstorm a plan.
2. Prepare a one or two paragraph description of your scenario and task.
3. Conduct a pilot test to ensure the task is understandable and of the right length and difficulty, revise your task, and repeat (as needed).

Project Checkpoint 5: Think Aloud Usability Evaluation

Conducting the Study

Next, conduct your study with 4 participants. For each participant, ensure that you

1. Introduce the experimenter(s) and the purpose of the study
2. Answer any questions the participant has about the purpose of the study.
3. Begin the task
    a. Give participant the task description
    b. Prompt participant to think-aloud
    c. Start the screen recorder
4. Observe the participant as they work
    a. Take notes on participant behavior
    b. Prompt participant to continue to think-aloud, when necessary
    c. Note critical incidents as they occur, jotting down both the time and the context of what occurred
5. Conduct a post-task interview
    a. When unclear, ask participants clarification questions about what they did and why they did it
    b. Ask open-ended questions such as what they liked best, what they found most challenging, and what they think might be improved.
6. Wrap up the study
    a. Thank the participants
    b. Stop the screen-recorder and reset the study setup for the next participant (if any)

Project Checkpoint 5: Think Aloud Usability Evaluation

Analyzing and Reporting Results

First, review your notes and the screencasts to identify and report critical incidents. For each critical incident, you should report:

1. A participant letter (A - D) and a critical incident number (1 - n) (e.g., A5)
2. Problem statement: summary of problem and effect on user (but not a solution!)
3. User goals: what was the larger goal that the user was working towards
4. Immediate intention: at the moment in time when problem occurred, what was user trying to do
5. Possible causes: speculate on what might have led the user to take the action they did.

Next, analyze the responses to the post-task interview questions. For each participant, build a short writeup summarizing responses to the interview questions.

Finally, from the critical incidents and interview responses from all of the participants, group common issues and try to find an underlying cause. For the 5 issues you believe to have the largest impact on the usability of your app, write a one to two paragraph description that summarizes the usability issue, citing all of the related critical incidents (e.g., A1, B5, C3, C6) and any related interview responses.

Note that we expect each team will find at least 5 usability issues from this exercise if the study is designed correctly. However, if you do find fewer than 5 issues, you should write a brief reflection on the study, discussing whether the design was adequate, and whether a different design may have led to the discovery of more issues. It is important to note that piloting the study is important here, because a study that is too simple may not uncover many usability issues. Therefore, it is important to pilot your study and revise the task/use cases to make sure that they are complex enough to discover potential usability issues. As noted above, a task might involve participants using other software (e.g., a search engine) in addition to your web app.

Midterm Course Evaluation

- Completely ***anonymous*** survey
- Opportunity to tell me:
  - The aspects of this course that you have enjoyed
  - The aspects of the course that you think could be improved
- Additional suggestions
- Posted to Piazza on Thurs, completely optional

Class Overview

1. *Overview of Interaction Design:* Thinking about User Actions

2. *Considering Physical Actions:* Designing to Ease Physical Constraints

3. *Mobile Design Considerations:* Designing for Mobile Interaction

4. *Universal Design:* Considering Accessibility

5. *7 Minute Break*

6. *Group Activity:* Interaction Design Guidelines

7. *Tech Talk* - Tableau

Interaction Design Overview

Identifying Actions

Goals → Action Sequence

Signifiers

Is this a button?

Or a link?

- Goals
  - Show which UI elements can be manipulated
  - Show how they can be manipulated
  - Help users get started
  - Guide data entry
  - Suggest default choices
  - Support error recovery

Hinting

- Indicate which UI elements can be interacted with
- Possible visual indicators
  - ***Static hinting*** - distinctive look & feel
  - ***Dynamic hinting*** - rollover highlights
  - ***Response hinting*** - change visual design with click
  - ***Cursor hinting*** - change cursor display

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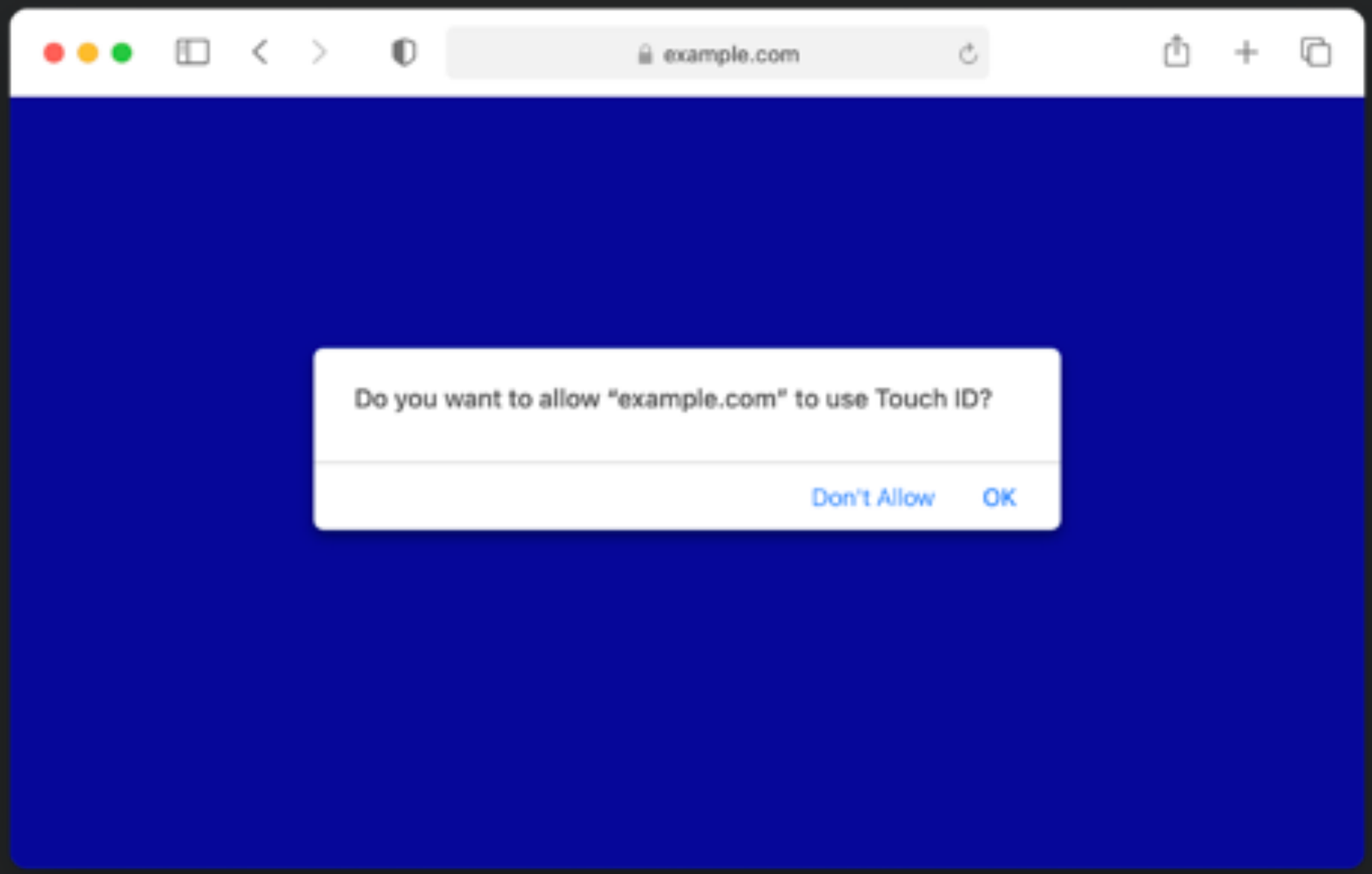
Help Users Predict Outcome of Actions

- What does this do?
- Should I click it?

Clarity of Wording (Bad Example)

- Design for clarity & precision



Clarity of Wording

- Choose words carefully
- Speak the user's language
- Avoid vague, ambiguous terms
- Be as specific as possible
- Clearly represent domain concepts

Likely & Useful Defaults

- Default text, if relevant (e.g., date)
- Default cursor position
- Avoid requirements to retype & re-enter data

Modes

- Vary the effect of a command based on state of system
- Examples
  - caps lock
  - insert / overtype mode
  - vi / emacs command modes
  - keyboard entry used for controlling game and chatting

Challenges with Modes

- Modes create inconsistent mapping
  - E.g., control S sometimes saves, sometimes sends email
  - Especially dangerous for frequent interactions that become highly automatic System 1 actions

- Avoid when possible
- Clearly distinguish if necessary
  - Make clear to user which mode they are in and how to change

Command Interactions

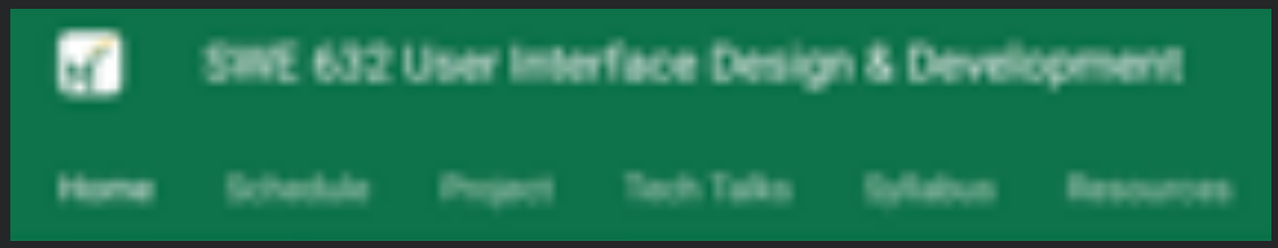
- How can a user invoke a command?
- Common examples
  - Menus
  - Buttons
  - Toolbar
  - Dialog box
  - Keyboard shortcut
  - Gesture
- What are some advantages and disadvantages of each approach?

Physical Actions

Avoid Physical Awkwardness

- Switching between input devices takes time
- Avoid forcing user to constantly switch between input devices (e.g., keyboard & mouse)
  - e.g., Effective tab order between fields
- Avoid awkward keyboard combinations

Moving the Mouse



- After a user has (1) realized that a region is interactable, (2) decided that it will cause the desired action to be invoked
- How long does it take for a user to move the cursor to click on it?
- What factors might influence this time?

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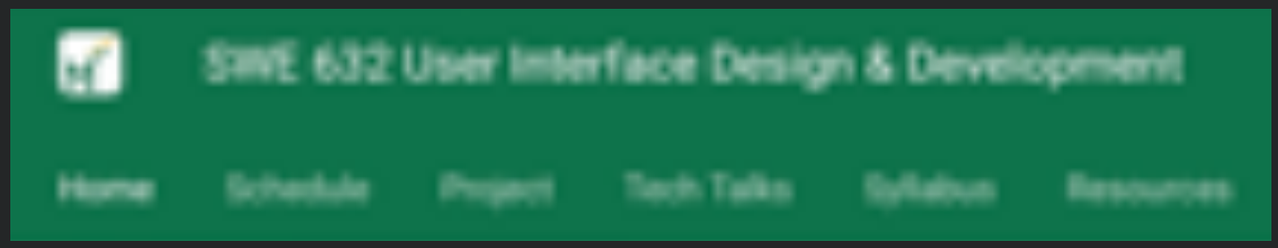

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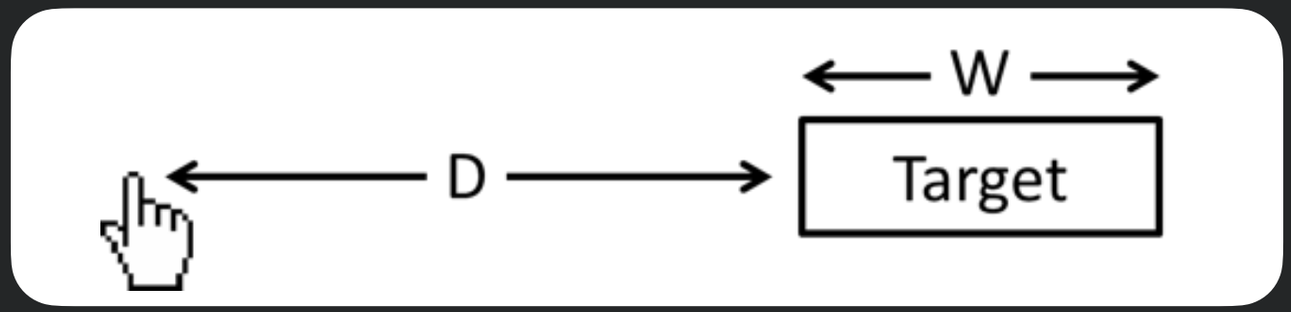
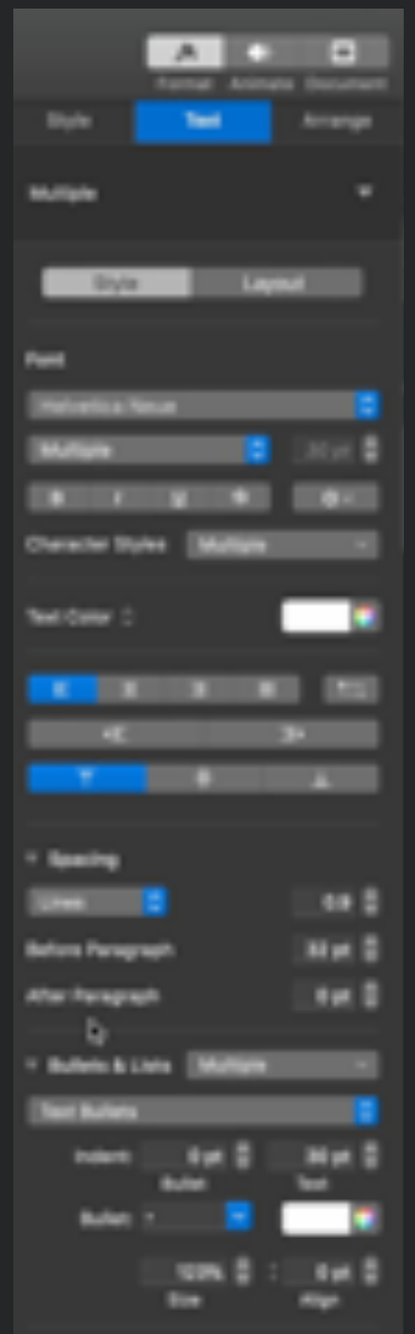
Fitt's Law



- Time required to move to a target ***decreases*** with target ***size*** & ***increases*** with ***distance*** to the target
- Movements typical consist of
  - one large quick movement to target (***ballistic*** movement)
  - fine-adjustment movement (***homing*** movements)
- Homing movements generally responsible for most of movement time & errors
- Applies to rapid pointing movements, not slow continuous movements



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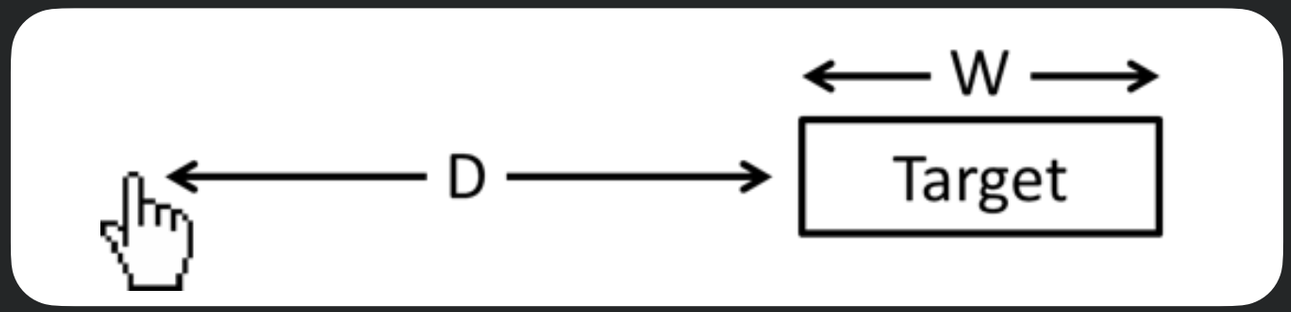

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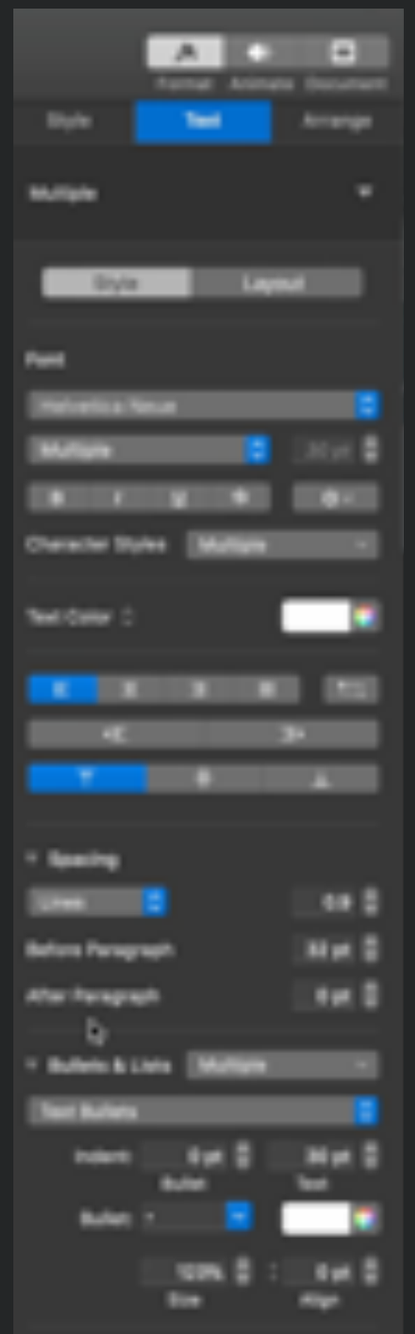

Design Implications of Fitt's Law

- ***Constraining*** movement to one dimension dramatically increases speed of actions
  - e.g., scroll bars are 1D

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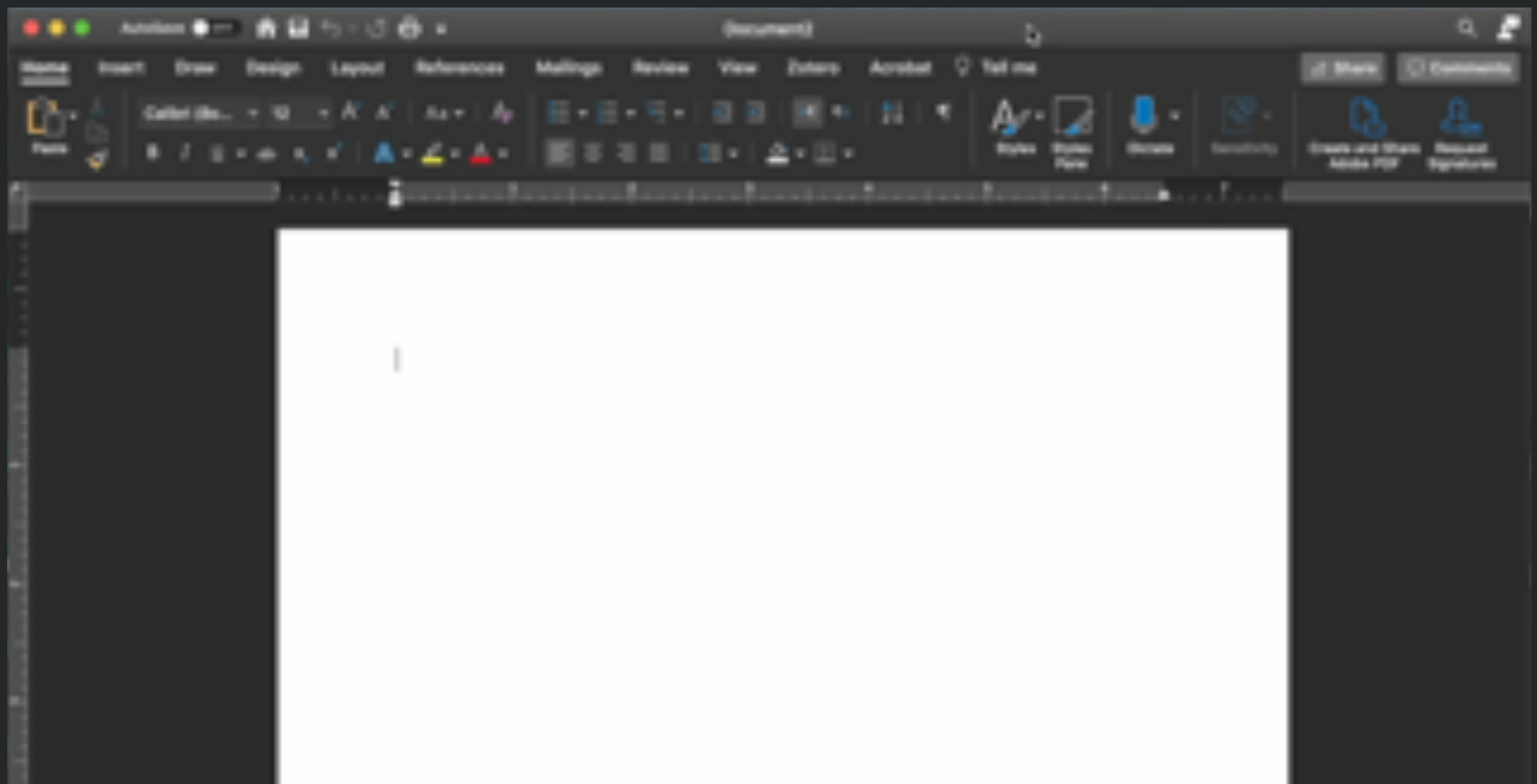

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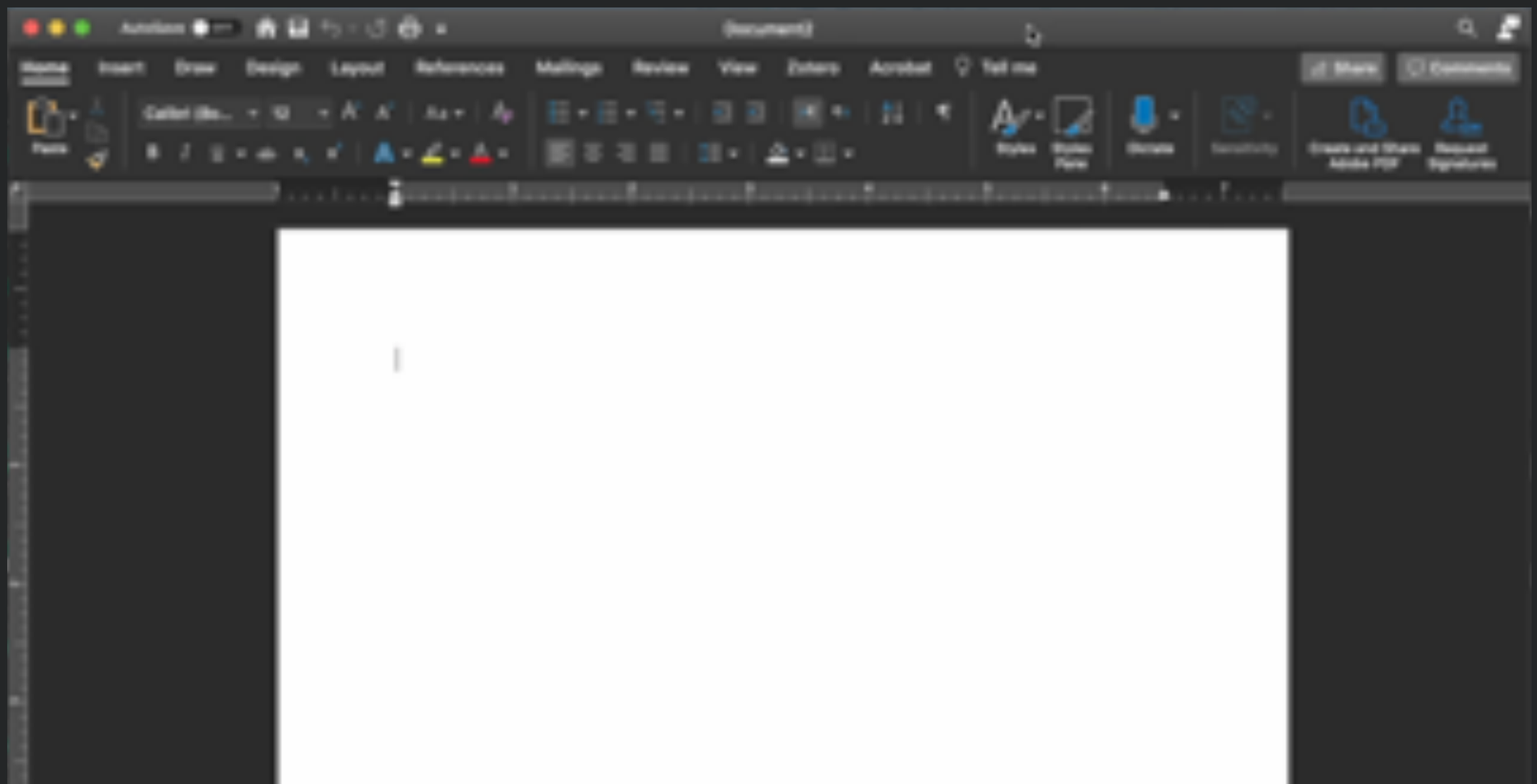

Mobile Design

Responsive Design

- Mobile devices often have smaller form factor than desktop / laptop OS
- Can design a separate UI
- Or may build a ***fluid*** UI that rescales for different display sizes

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Where's the Cursor?

- No cursor on many mobile devices
- Cannot use dynamic hinting to determine which elements can be interacted with
  - May require more use of static hinting
- Fitt's law still applies
  - Fingers are less sensitive, hard to select small buttons, occlude elements

Alternative Inputs

- Modern mobile devices often have a wide range of sensors which can be used for input
  - Camera
  - Microphone
  - Accelerometer
  - Three-axis gyro
  - GPS
  - Barometer
  - Proximity sensor
  - Ambient light sensor
- Enables new interaction techniques

Augmented Reality

- Overlaying generated content on top of view of the real world

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Alternative Inputs + Augmented Reality

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Universal Design

A Personal Subject for Me…

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A Personal Subject for Me…

+

Supporting Users with Disabilities

- **Perception** - visual & auditory impairments
  - Blindness or visual impairments
  - Color blindness
  - Deafness & hearing limitations
- **Motion** - muscle control impairments
  - Difficulties with fine muscle control
  - Weakness & fatigue
- **Cognition** - difficulties with mental processes
  - Difficulties remembering
  - Difficulties with conceptualizing, planning, sequencing actions

Blindness and Visual Impairments

- Users use screenreader to listen to screen elements
- Reads all of the text on the page
  - Through practice, learn to listen to text at 400+ words per minute
- Important to have ***alt-text***
  - Images should have labels that explain them
- Important to have ***hierarchy***
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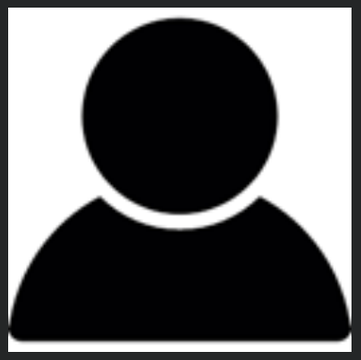
Universal Design

- How can users with physical disabilities be supported in user interactions?
- Good: ***assistive design*** - offering equivalent actions for disabled users that cannot take normal actions
- Better: ***universal design*** - designing interactions so broadest set of users across age, ability, status in life can use normal actions



Example - Curb cut

- Initially designed for ***accessibility*** - support for disabled & wheel chairs
- But potentially benefits ***all users*** of public spaces - people w/ suitcases, hand carts, roller blades, bikes, …

7 Principles of Universal Design

- ***Equitable use:*** The design is useful and marketable to people with diverse abilities
- ***Flexibility in use:*** The design accommodates a wide range of individual preferences and abilities
- ***Simple and intuitive:*** Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level
- ***Perceptible information:*** The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities
- ***Tolerance for error:*** The design minimizes hazards and the adverse consequences of accidental or unintended actions
- ***Low physical effort:*** The design can be used efficiently and comfortably and with a minimum of fatigue
- ***Size and space for approach and use:*** Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility

http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/

In-Class Activity

In-Class Activity: Interaction Design Guidelines

- Envision a fictional app (e.g., a mobile AR tour-guide app for visiting Antartica)
- Build a list of alternative interaction techniques for your category
  - Identify examples from desktop / web / mobile apps
- Describe pros and cons of each for your design context
- Describe how you will support mobile and universal design

- ***(1) Navigating lists of items***
  - Examples: grids, lists, pages of results, infinite scrolling, filtering
- ***(2) Invoking commands on content***
  - Examples: toolbar, floating toolbar, cards, context menu, sidebar pane
- ***(3) Invoking top level commands***
  - Examples: drawers, toolbar, menus, dialog
- ***(4) Entering formatted text***
  - Examples: toolbar commands, Markdown, HTML
- ***(5) Panning and zooming***
  - Example: zoom slider, scrollbars, pinch to zoom, drag to pan
- ***(6) Accelerometer-based control***
  - Examples: shake to undo, rotate to pan, roll / pitch / yaw game control
- ***(7) Chat bots***

Tech Talk

Tech Talk

1. *Tech Talk* - Tableau

Acknowledgements

- Slides adapted from Dr. Thomas Latoza's SWE 632 course