SI 388 Anthropometrics

WEEK 2-1 (MON 11 SEP) – USERS' BODIES AND BASIC CAPABILITIES

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Agenda for Today

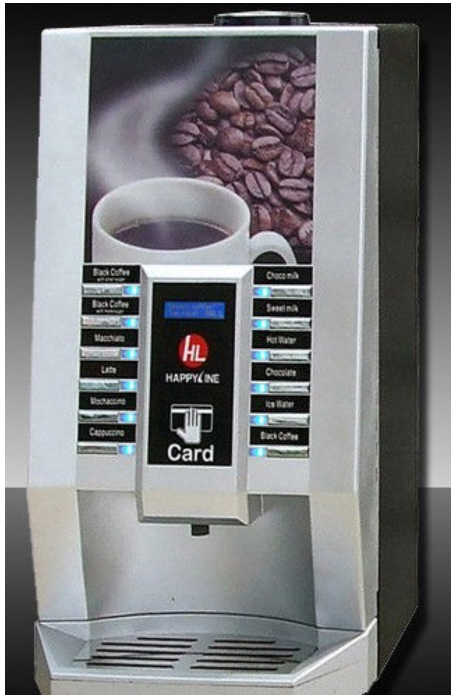
- ❑Visit from Michigan Data Science Team
- ❑**Reminder**: Teach-a-Chapter group book approval today
- ❑**Reminder**: Enroll in class if you have override
- ❑Short bios
- ❑**Lecture**: Anthropometrics (basic of bodies in UX)
- ❑Prep for in-class exercise for Wed

Learning Objectives

After today's lesson, students should be able to:

- ❑ Identify key ways human bodies are important in UX
- ❑ Explain various types of signals leading to intention
- ❑ Understand Fitts' Law and Steering Law
- ❑ Learn about Thumb Space

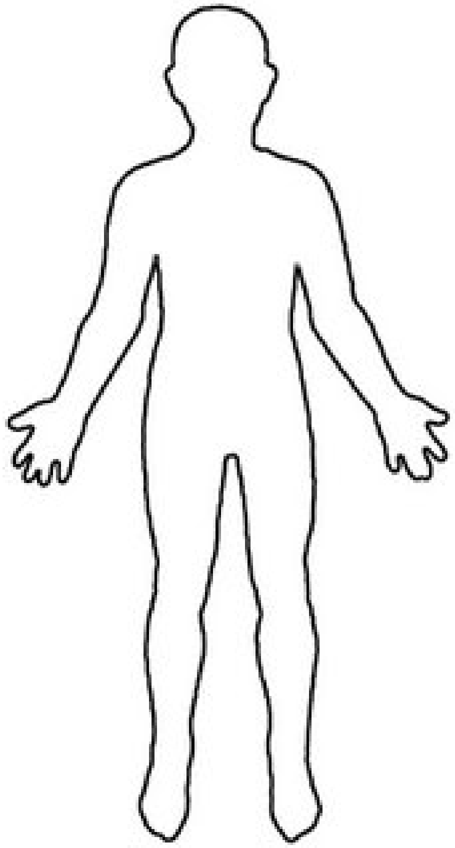
Why This Matters



Bodies Matter in UX Design

Some attributes of bodies

- Can manipulate objects
- Accept force-based feedback
- Accept tactile feedback
- Process varied sensory feedback
- Experience fatigue -> reduced capabilities



How Computers 'See' People

Touch Basics

- **Haptics** is an overall term for any form of interaction involving touch.

https://en.wikipedia.org/wiki/Haptics

- Touch screen
- Input gloves
- Keyboards
- Switches (toggles, slides, etc.)
- Vibration of smart phone
- Vibrating game controller

Touch Perception

- **Haptic perception (true) =** gets info from **both** skin and body positioning.
  - Bumpiness of a road surface
  - Feedback from a physical key being pressed
  - Pushing a doorhandle; feedback and texture

- **Tactile perception (cutaneous) =** skin stimulation only.
  - Heat of an electric stove's burner
  - Roughness of a wooden surface

- **Kinesthetic perception (proprioception) =** body positioning or movement.
  - Balance
  - Arm position
  - Posture

Diectic Reference

- **Diectic reference** = the user touches the elements *directly*, with no intermediary tool. E.g. no stylus.
  - Tablet screens
  - Physical buttons
  - Steering wheel
  - Finger painting!
  - Hand tools

Touch Inputs: Forming Intentions for Use

- ❑ Mouse
- ❑ Depressing keys/buttons
- ❑ Pointing w/finger on touchscreen
- ❑ Tapping with thumb
- ❑ Stylus

All these rely on **Affordances**

Physical affordance = how physical objects seem to *suggest* their own use

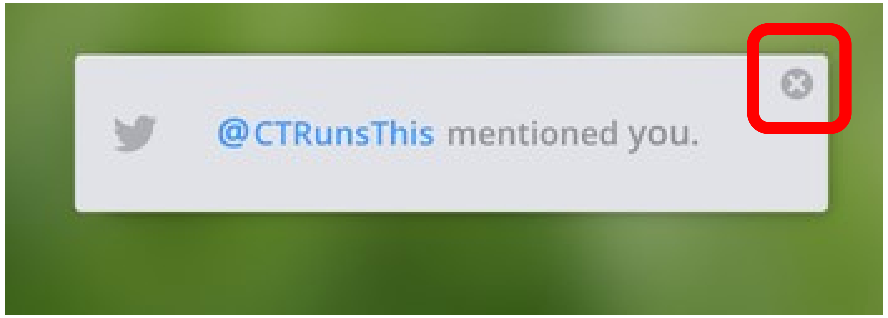
- ❑ Door handles
- ❑ (Sharpened) pencil
- ❑ Knifeblade
- ❑ Belt
- ❑ Shopping bag
- ❑ Computer mouse

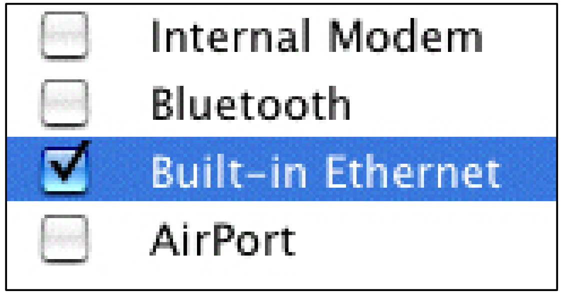
More Affordances & Related Ideas

- **Digital Affordance** = digital "items" (imagery) that suggests its proper use

- **Metaphor**

- **Strong convention**





Affordances

Skeumorphic vs. Flat design

https://www.nngroup.com/articles/flat-ui-less-attention-cause-uncertainty/

Motor Movement

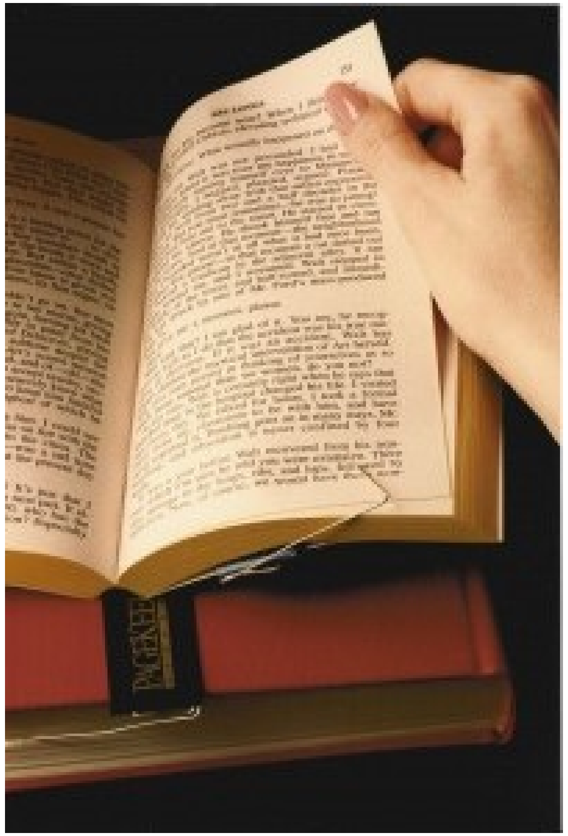
- Haptic perception + other senses (visual, hearing)
- Driven by **Intention**
- “Normal” movements
  - Slower, conscious
  - Controlled by continual feedback
- “Ballistic” movements
  - **Occur faster than feedback is received**
  - Require training and practice (“muscle memory”)
  - Examples: hitting a ball, walking, touch typing, running

Normal Motion

Example: Turn page of book

- **Form intention** … grip edge of book (consistent location)
- **Fire muscles** with slight force (normal movement)
- **Receive feedback** … haptic (tactile and kinesthetic) + audio + visual
- **Adjust movement** based on feedback during action

NEVER not under users' complete control



Ballistic Motion

Example: To get candy

- Form an intention … swing at piñata
- Fire muscles with force (ballistic movement)
- Received feedback … haptic (mostly kinesthetic) + audio (but no visual)
- Can’t adjust movement mid-swing

MOSTLY not under users’ complete control

‘HCI Laws’ for Motor Movement

Pointing and moving objects along paths follows measurable laws:

Fitts’ Law (1954)	Accot-Zhai Steering Law (1997)
• Pointing at targets, moving to them	• Directing a pointer along confined path

Fitts' Law

$$T = a + b \log_2 (1 + D/W)$$

Time to move to the target

a, b are **empirically determined constants** for a particular pointing technique

Distance to target

Width of target along the direction movement of the pointer

The farther you are moving and the smaller the target, the longer it takes to move the cursor or finger and point at target.

Fitts' Law: Visualized

Key point: It's not a linear relationship.

Why?

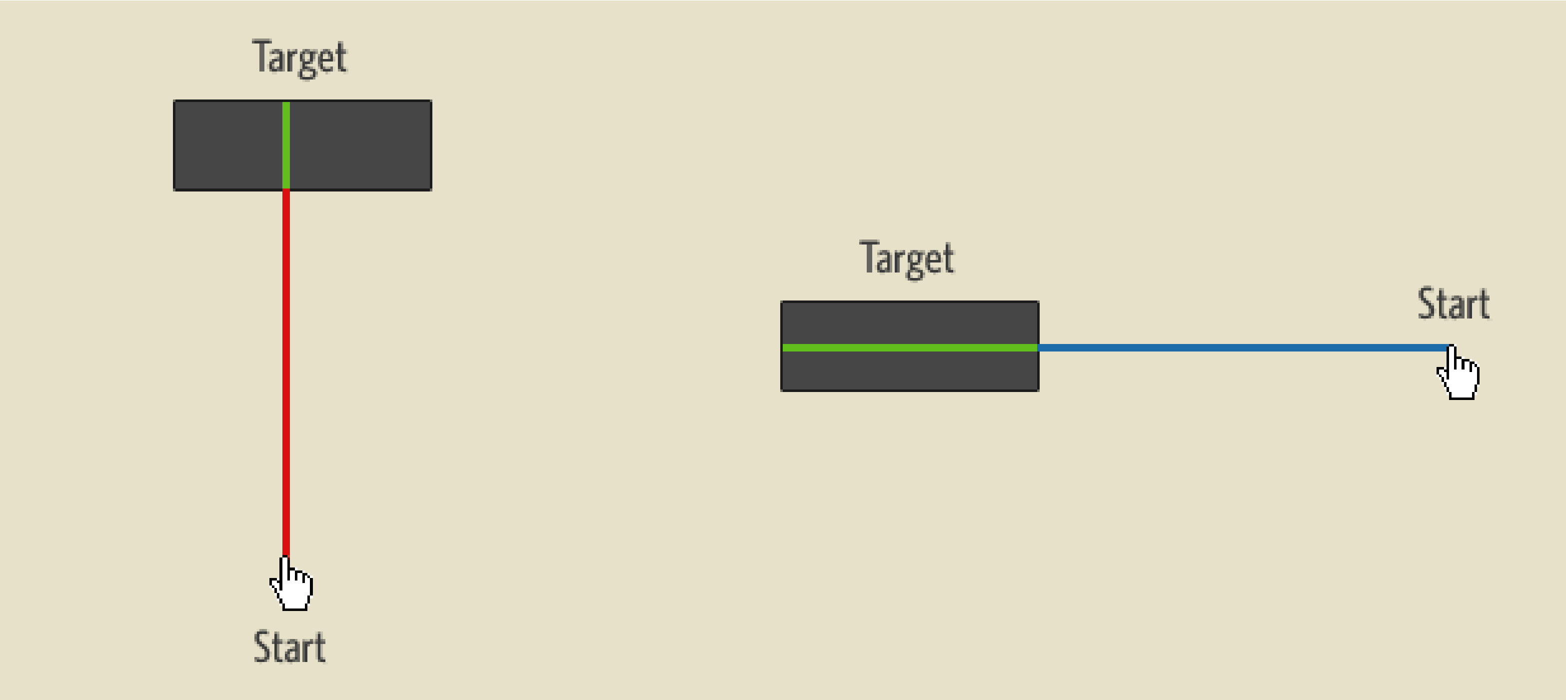
- Initial Movement is faster (ballistic)
- Final Movement is slower as corrections are made (normal)

http://particletree.com/features/visualizing-fittss-law/

Fitts' Law: Visualized

Target width in the direction of motion affects speed to target, so …

- A pointer will move to the target at right faster than the one at left.



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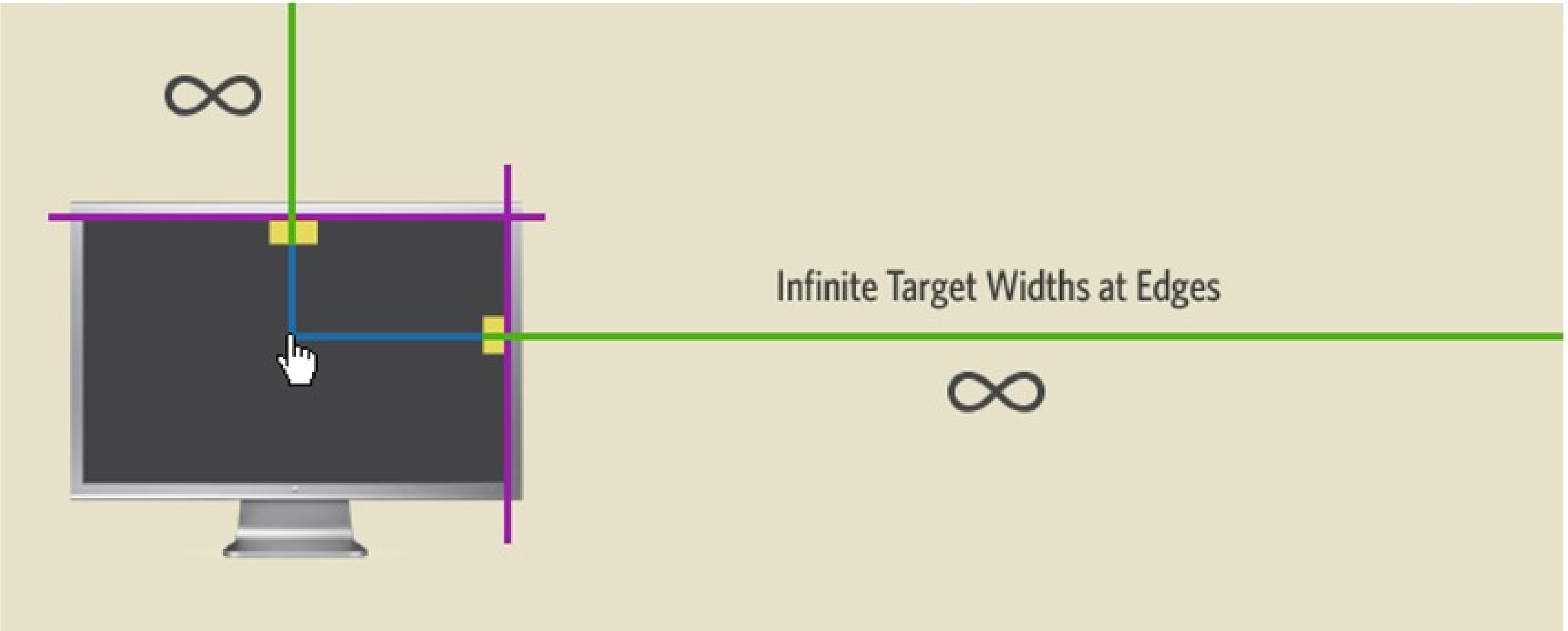
Fitts' Law: Visualized



http://particletree.com/features/visualizing-fittss-law/

Fitts' Law: Implications

- The larger the onscreen target and shorter distance to move to it, the faster you can point to it.
- Some not-so-obvious design implications:
  - Beyond a certain size, enlarging target → less speed improvement
  - Below a certain distance, decreasing distance → less speed improvement
  - Size of target matters only in relation to direction of movement
  - Targets at edge are easy to hit, as Width=infinite if pointer is halted

Fitts' Law: Design Implications

- ❑ Make click targets big
- ❑ Make the entire target clickable; consider making padding clickable
- ❑ Make labels next to input elements clickable
- ❑ Put important targets at the edge of the screen when possible
- ❑ Enough padding to separate tappable/clickable elements

Accot-Zhai Steering Law

- If user must keep pointer within confined path, a wider path allows faster movement
- Formula *derived* from Fitts' Law
- Common sense implication

$$\mathbf{T = a + b\ (D/W)}$$

Time to move to the target

a, b are empirically determined constants for a particular pointing technique

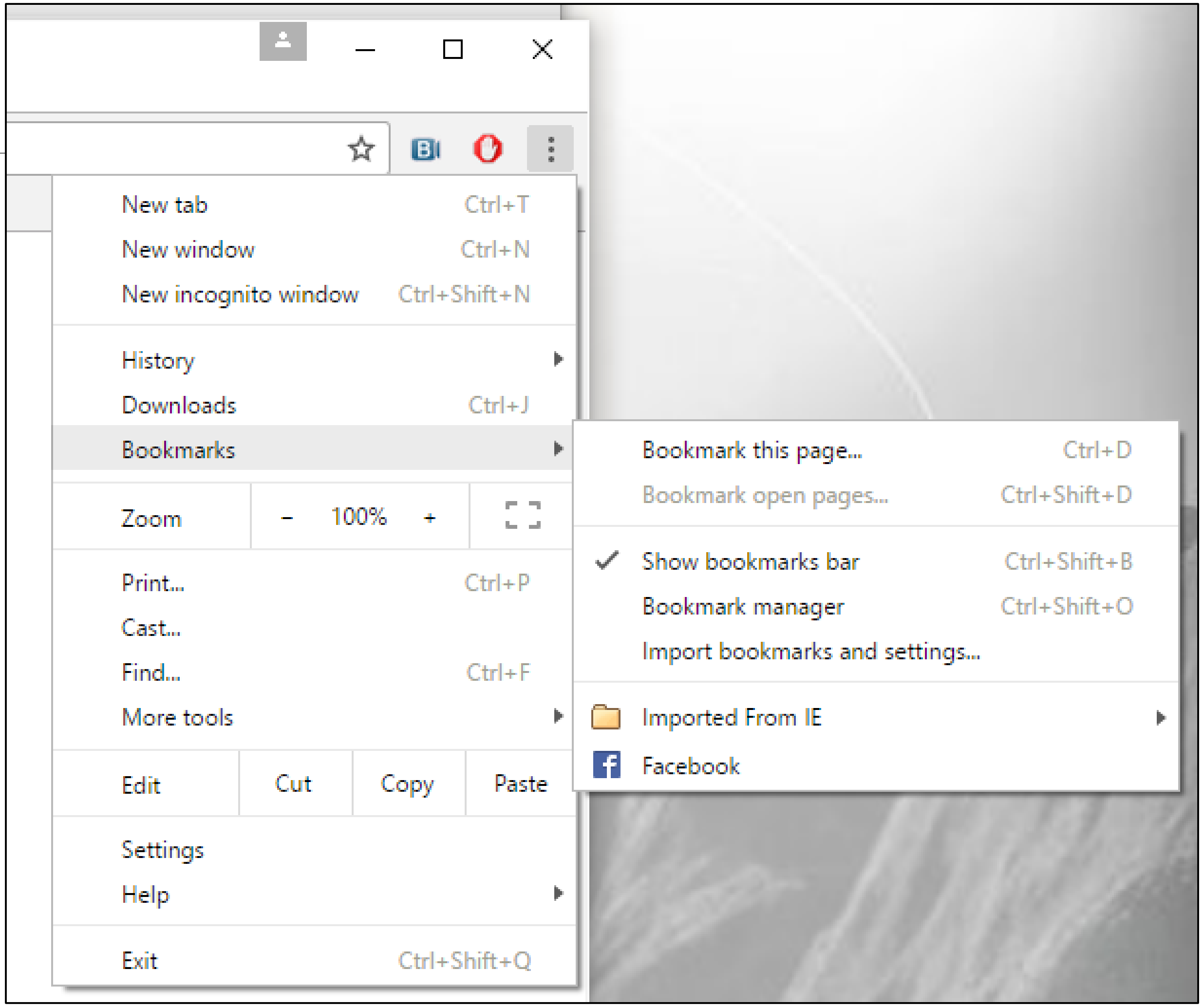
Distance to target

Width of the confined path

Steering Law: Example

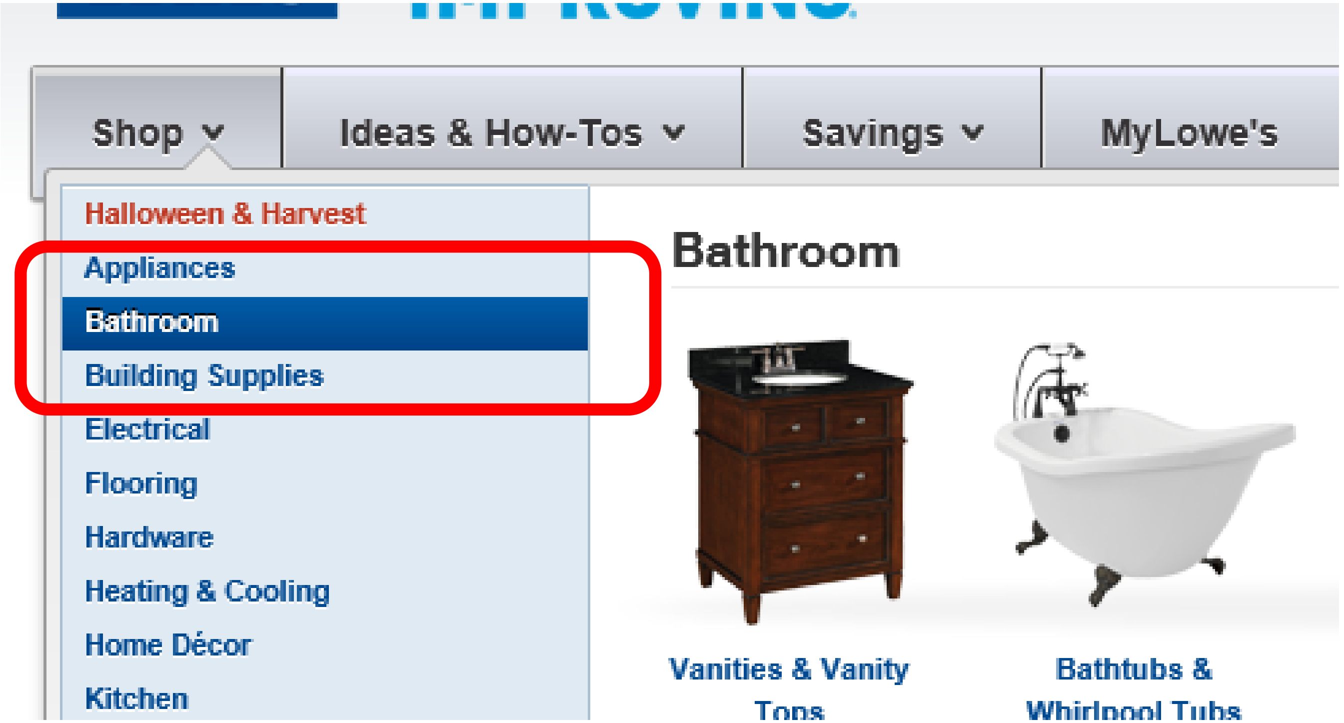
- Mouse pointer needs to move across narrow path to *nested* (walking) submenu
- Users must move pointer slowly as a result – or errors.

(Example from Chrome)



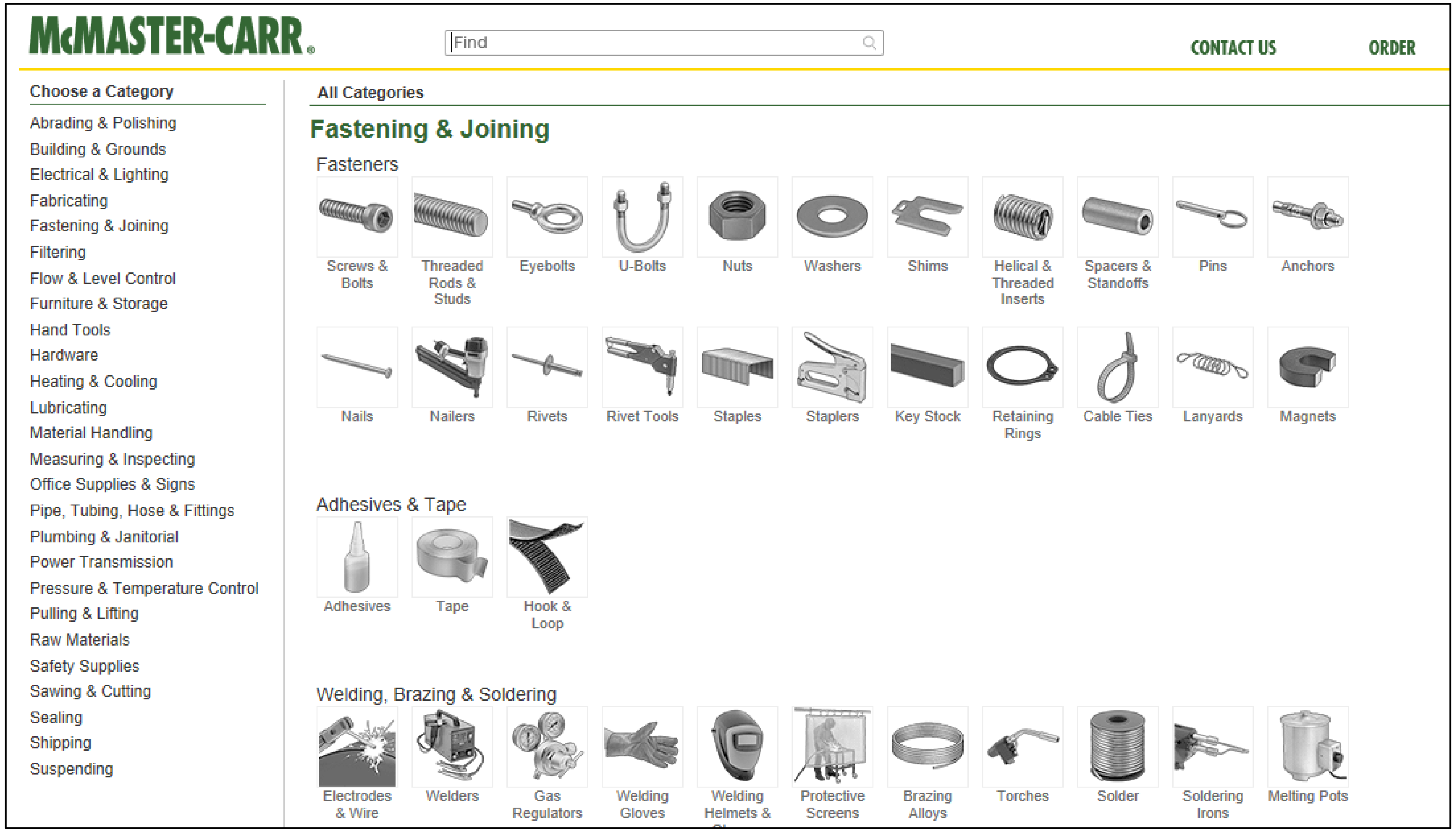
Steering Law: Design Implication

- Make nested menu items wide enough to be traversed easily
- If you use nested menus, build in 0.5 sec. delays so they don't close if user is moving very slowly



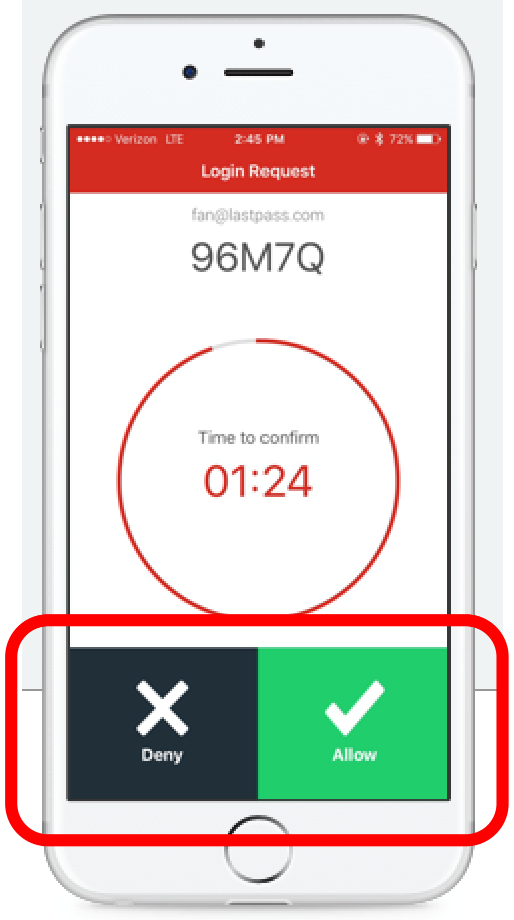
Anticipating Users' Movement

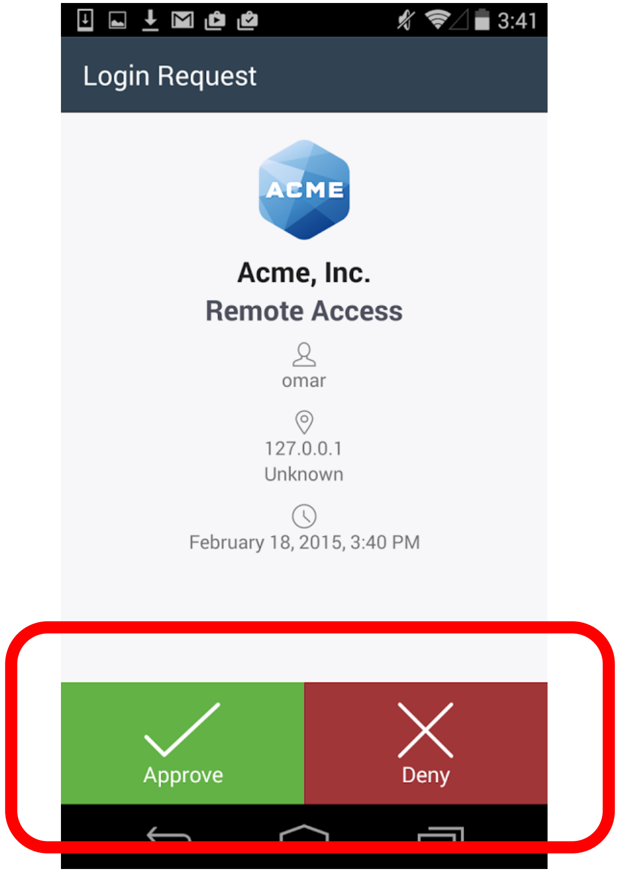
- "Focus" = selecting an element
- Quickest way to speed targeting is to anticipate intention, set focus



Mobile Phones

Why are the Deny and Allow located where they are?





Thumbs Matter

- "The Thumb Zone" = the most comfortable area for touch with one-handed use.
- 2013 study of how smartphones held:
  - One-handed—49%
    - Hold with right hand—67%
  - Cradled—36%
  - Two-handed—15%

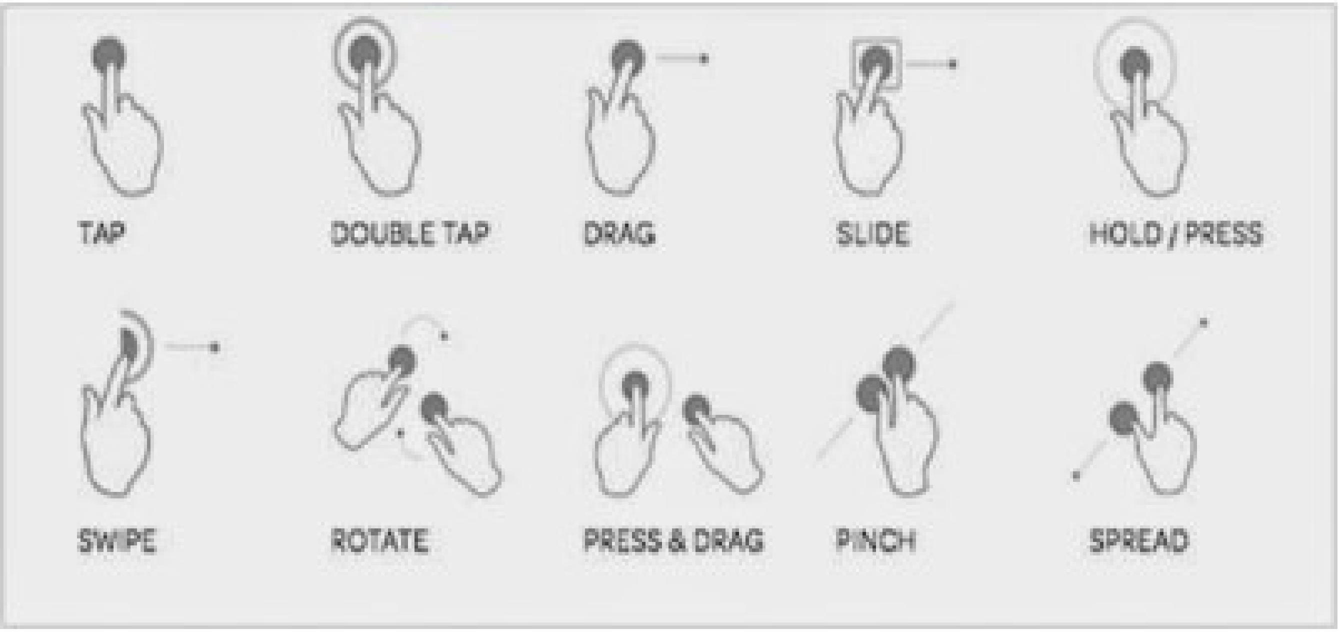
http://www.uxmatters.com/mt/archives/2013/02/how-do-users-really-hold-mobile-devices.php?

Hoober, S. (2011). Designing Mobile Interfaces.

Right-hand thumb zone

More on Touch Design

Gestures have become *conventions*

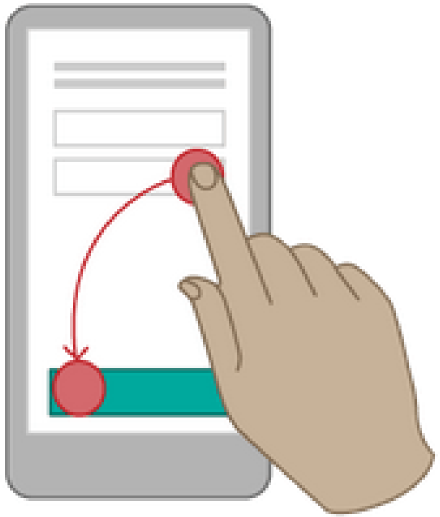


- Touch devices provide *limited* **tactile** feedback
- Finger-on-smooth glass is mostly **kinesthetic** feedback
- Touch screens (obviously) have richer kinesthetic than non-touch screens
- Natural deictic (direct) interaction, **very intuitive**:
  - Tap, hold/press to take hold
  - Slide and swipe to move
  - Pinch to reduce
  - ?? Expand pinch to enlarge?

Implications for UX Design

Touch and non-touch interfaces:

- ❑Use (effective) metaphors & follow strong conventions …
- ❑Ensure paths are wide enough for rapid movement
- ❑Keep common target size ~9-10mm (recommended)
- ❑Make sure there's enough padding between elements ~2mm
- ❑Place targets along edges when practical
- ❑Consider vibration as haptic feedback



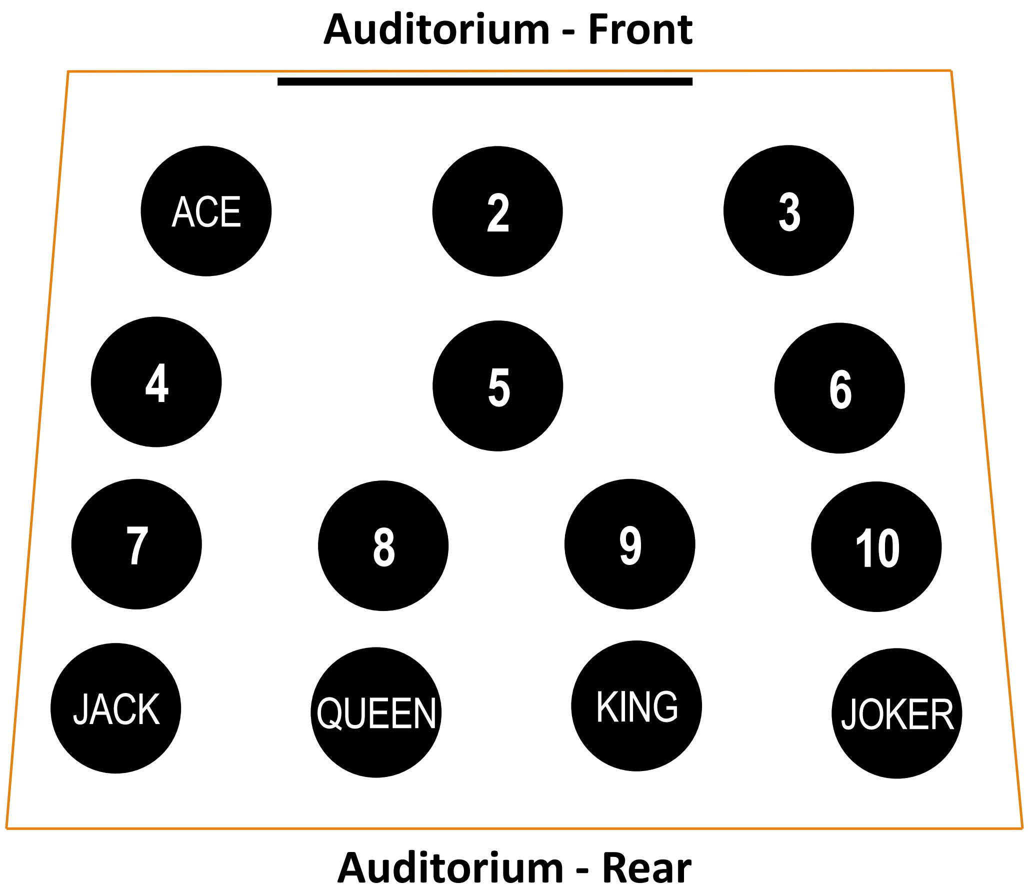
Lecture Summary

- Motor movement in most interaction
- Interfaces adding more haptic feedback
- Fitts' Law is a key principle of movement
- Steering Law less known, but super relevant
- Affordances help create *intention*, which leads to motor movement (and interaction)

Assignment: In-class group exercise - setup

1. You will be in groups of 5-6 students
   - Take a playing card, pass deck along
   - Gather with your same-numbers/symbol (7's, Jacks, etc.) as on the diagram (next screen)
2. Put all team members' names on a blank title sheet only
3. Put the group's playing card symbol on the **title sheet** and **deliverable**
4. *45 minutes:* Do the exercise on paper—sketching and hand-printed
5. Pick a speaker to verbally present the debrief
6. *20 minutes:* Speaker talks for 1 minute to describe your design and how it achieves the assignment
7. Make sure all names are on the paper
8. Instructor collects title sheets and deliverables

Group Locations



Finish design by 11 a.m.

Assignment: In-class design exercise

1. Imagine 10 years from now the technology is inexpensive to incorporate a high degree of touch input and haptic feedback. Think of a basic desktop program that today lacks haptic aspects (such as a word processor, spreadsheet, calendar, or email), and re-imagine it in the highly haptic world of 2027.
   - Describe what **touch controls** it would have. Be creative.
   - Describe **what haptic feedback** information it would provide the user (such as temperature, vibration, texture, etc.) and why these would be useful.
2. Identify *all relevant* concepts from lecture and clearly tell how they **are relevant to the features of your design**. (Mention even concepts that seem self evident!) *Hint: Part 2 is more important than Part 1.*

Some of today's concepts

- Tactile perception
- Haptic perception
- Diectic reference
- Physical affordance
- Digital affordance
- Metaphor
- Strong Convention
- Fitts' Law, Steering Law
- Thumb zone
- Gestures
- Target size
- Padding

(You also can use others from the course readings)

Grading Rubric

____ Design fully meets all the stated requirements (3)

____ *Several* concepts from lesson (and/or readings) are used (3)

____ Concepts are explicitly related to design elements (3)

____ Entire submission is clear, easy for grader to understand (1)

____ Total out of 10

All for Exercise 1

Wrapup for Today

Make sure all your names are on the paper

Turn in your paper to me before you leave

See you Monday