Week 9-2
Designing for Broad Usage

SFWRENG 4HC3/6HC3 Human Computer Interfaces

** Slides adapted from previous instructors of COMPSCI/SFWRENG 4HC3/6HC3 and the COMPSCI 5115 course from University of Minnesota*

McMaster University

Challenges in Design

Designing for **various abilities**

- **Sensory Impairments**
  - Vision / Hearing
- **Cognitive Impairments**
  - Attention Deficit Hyperactivity Disorder / Learning Disabilities
- **Physical Limitations**
  - Mobility Impairments / Chronic Health Conditions

Designing for **broad usage**

- **Older Adults**
  - Physical and Cognitive Changes / Technology Comfort Issues
- **Children**
  - Literacy and Vocabulary / Physical Manipulation
- **Socio-Economic Differences**
  - Vast Differences in Technology Usage

Recap: Designing for Various Abilities

Universal Design: Creating accessible interfaces benefits ALL users

Sensory Impairments

- Visual: Alt text, screen readers, magnification, redundant coding
- Auditory: Captions, transcripts, visual alerts

Cognitive Impairments

- ADHD/Learning: Simplify, reduce density, clear grouping, persistent status
- Benefits: Less attention needed, easier to resume

Physical/Motor Limitations

- Motor: Large targets, keyboard navigation, proximity grouping, no timeouts
- Benefits: Works in motion, supports power users, handles device failure

Key Takeaway: Accessibility features (closed captions, keyboard shortcuts, voice control) improve usability for everyone in various contexts

Activity: Accessibility Settings (~5-7 mins)

Pair up with another classmate:

Pick a device (iPhone, Android Phone, Windows, MacOS, iPad) and go through **device accessibility settings:**

- Try activate different accessibility settings and see what the experience is like
- You can also compare settings between platforms
- Anything particular that you notice?

Share 1-2 sentences (on Avenue for this week's check-in) about what you discovered while exploring accessibility settings on your device. What was most interesting, surprising, or useful that you found?

Week 9 Overview

- ~~Monday~~
  - ~~Designing for Various Abilities~~
- **Wednesday**
  - **Designing for Various Populations**
- Friday
  - Intro to Design and Prototyping

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Design for: Older Adults

- **Physical and Cognitive Changes**
  - Mobility and Potential Physical Limitations
  - Cognitive Changes (e.g., Dementia)

- **Technology Comfort Issues**
  - Technology Preferences
  - New Technology Adoptions

Older Adults: Design Considerations

Designing for older adults needs to accommodate:

- Different **motor** abilities
- Different **cognitive** abilities
- Different **learning** curves towards technology

Example: Online Blogging

- **Background:** older adults considered more as consumers rather than creators
  - What are older adults' needs as content creators?
- Support meaningful work and engagement
  - Activity (social activity) valued by older adults
  - **Implication:** Make audience information transparent, easy to understand, and useful for self-reflection

"Tell It Like It Really Is": A Case of Online Content Creation and Sharing Among Older Adult Bloggers: https://dl.acm.org/doi/abs/10.1145/2858036.2858379

Design for: Children

Needs differ based on different ages:

- **Cognitive development** directly associated with age
  - Jean Piaget's four critical stages of development
- **Motor skills** differ among ages
- **Education, knowledge, practical skills** develop with age

Additional **individual difference** as well.

Design for: Children

Cognitive Development Stages:

- **Sensorimotor Stage:** < 3 years old
  - Learn by sensing the world
- **Preoperational Stage:** 3-6 years old
  - Struggle with logic & perspective thinking
- **Concrete Operational Stage:** 7-11 years old
  - Logical, but rigid
- **Formal Operational Stage:** > 11 years old
  - Close to adults in various motor and literacy skills

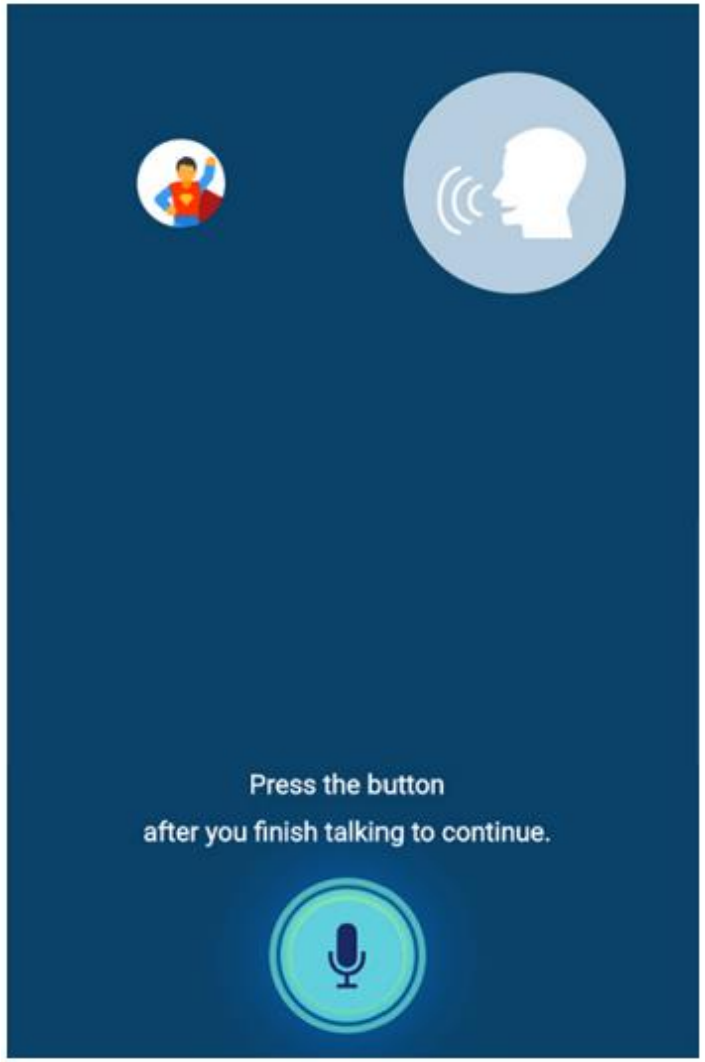
Children: Design Considerations

Designing for children needs to accommodate:

- Limited **literacy**
- Limited **motor** abilities
- Limited **cognitive** abilities
- Limited **knowledge**
- NEED for **FUN!**

Example: Voice Agent

- Challenges for children to **use regular interface and input** (keyboard, typing), conversational and voice input can lower the barriers
- Skills can be learned when interacting with **conservational agent**
- **Example:** App that lets children learn socioemotional strategy “self-talk” from a conversational agent



Self-Talk with Superhero Zip: Supporting Children’s Socioemotional Learning with Conversational Agents: https://dl.acm.org/doi/10.1145/3585088.3589376

Design for: SES Differences

- **SES –** Socioeconomic Status
- Socioeconomic status usually refers to people's "**education, income and occupation**"
- Sometimes refers to related factors like whether one lives in **a rural, urban or suburban area**.
- The world is (sadly) full of tremendous SES differences.

Design for: SES Differences

Table 1: Individual market income for select years

Year	Low-income cut-off line*	Percentile				
		25th	50th	75th	95th	99.95th
			Level in 2019 dollars			
1982	12,417	13,476	40,091	76,140	138,803	880,023
1993	19,361	6,698	29,386	68,495	136,775	1,201,808
2019	30,760	10,660	42,206	86,142	183,231	1,643,321
			Cumulative change (%)			
1982–1993	55.9	-50.3	-26.7	-10.0	-1.5	36.5
1993–2019	58.9	59.1	43.6	25.8	34.0	36.7
1982–2019	147.7	-20.9	5.3	13.1	32.0	86.7

*The low-income cut-off line is total income before tax for a one-person household in a mid-size city with a population of 30,000 to 99,999.

Source: Statistics Canada Table 11-10-0055-01 and Table 11-10-0241-01

Large disparity in individual income

Design for: SES Differences

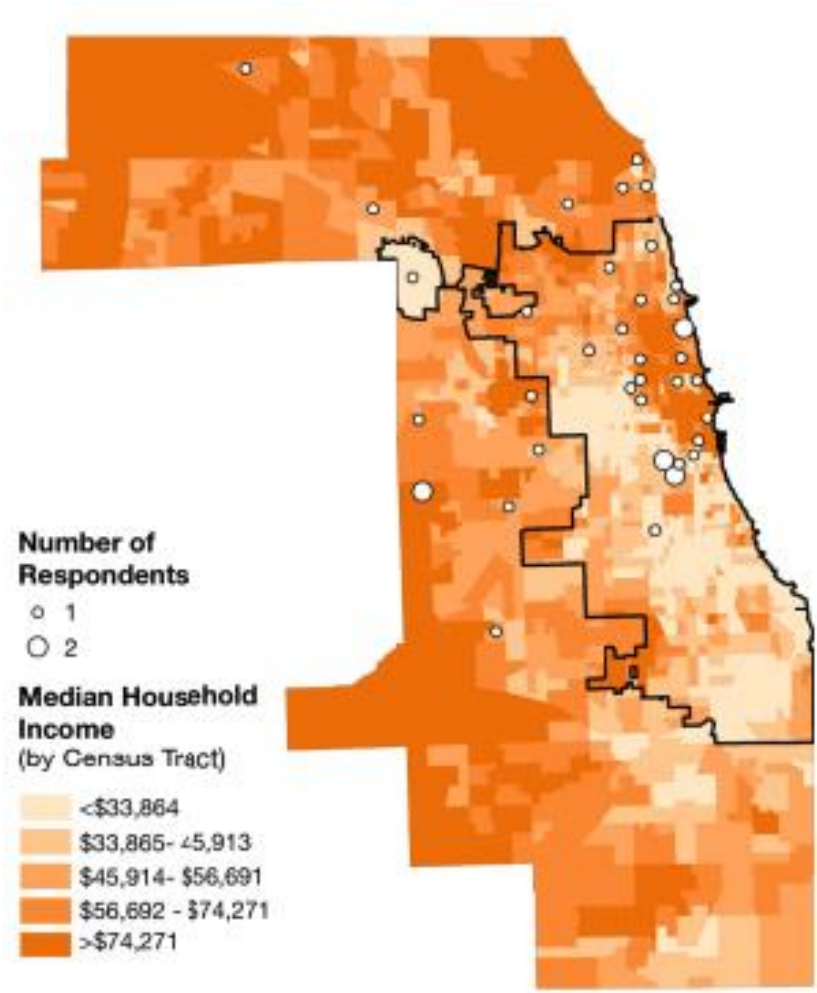
- SES is tremendously important to consider **when designing technologies**
- Very few existing products adequately account for SES in their design
- This is widely recognized in the computer science literature and by major tech companies
- Designing for diverse SES backgrounds is complex and nuanced and must often be done on a case-by-case basis.

SES Differences: Design Considerations

- Consider **ALL technological contexts**
  - Low-end/old devices
  - Small screens
  - Limited/intermittent access
- **Geography** matters
  - SES usually defines where people live
  - Can have significant effect on technology effectiveness
- Consider **correlates**
  - Example like different spending pattern

Example: Crowdsourcing Markets

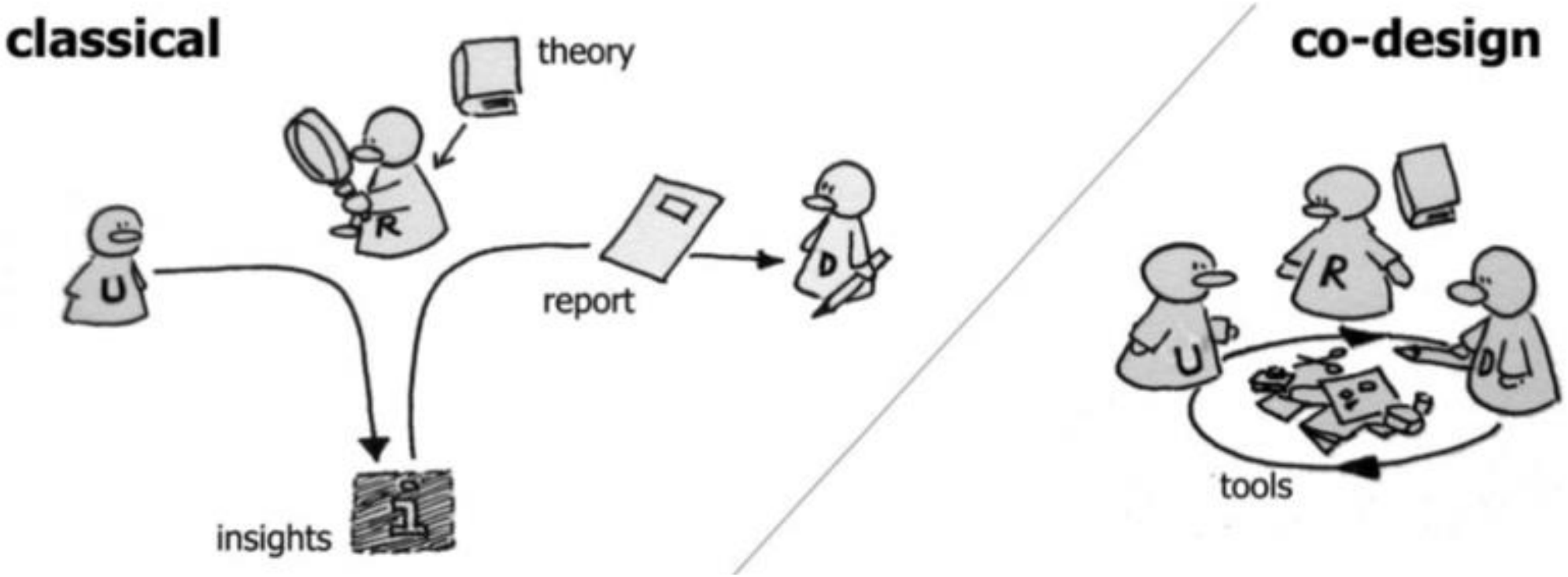
- **Crowdsourcing:** breaking up a big job
  - The geographic nature of these mobile crowdsourcing tasks (e.g., TaskRabbit) distinguishes them from online crowdsourcing markets
- **Example:** task respondents cluster around the high-income portion of the area:
  - Low-income resident would have to pay more for mobile crowdsourcing services and likely to have a harder time finding the service



Avoiding the South Side and the Suburbs: The Geography of Mobile Crowdsourcing Markets: https://dl.acm.org/doi/10.1145/2675133.2675278

Participatory Design Approach

Involve users **directly** in the design process as design partners



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