CSE 390B, Winter 2022

Building Academic Success Through Bottom-Up Computing

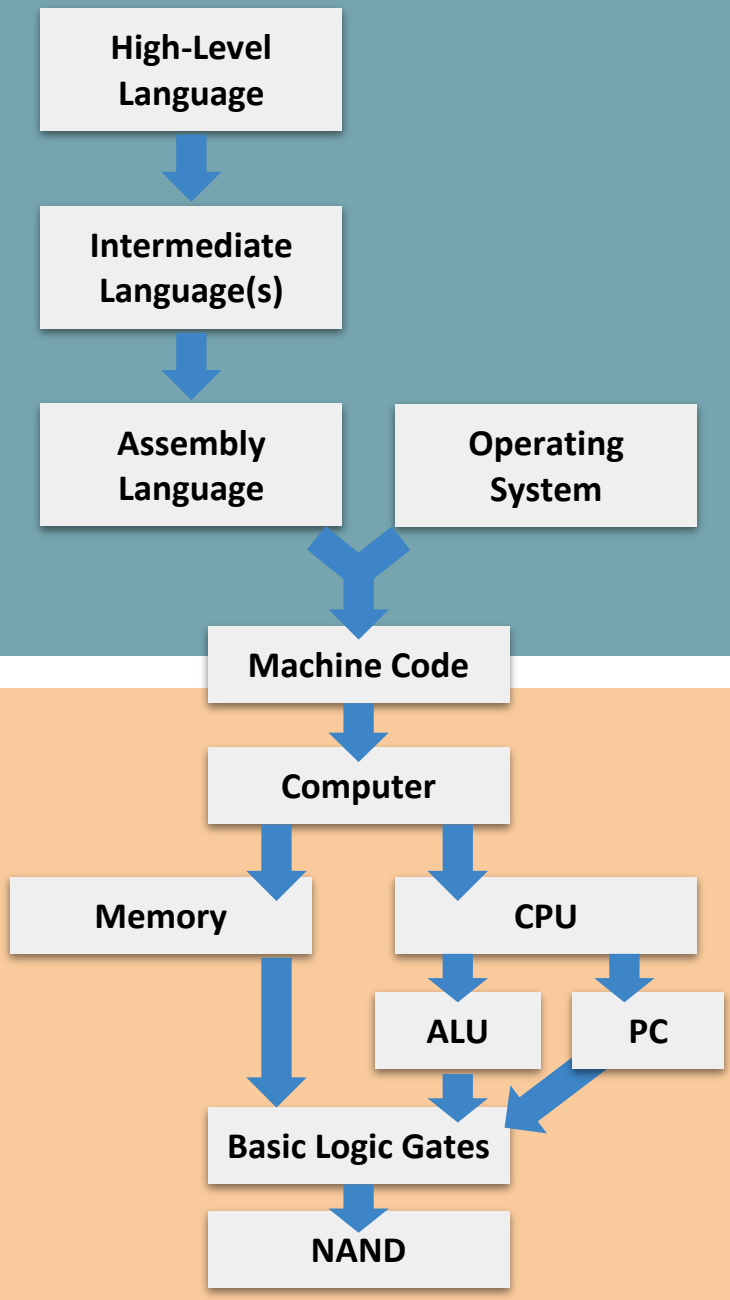
Two-Tier Compilation, Inclusive Design

Two-Tier Compilation, Inclusive Design, CSE 390B Final Project Overview

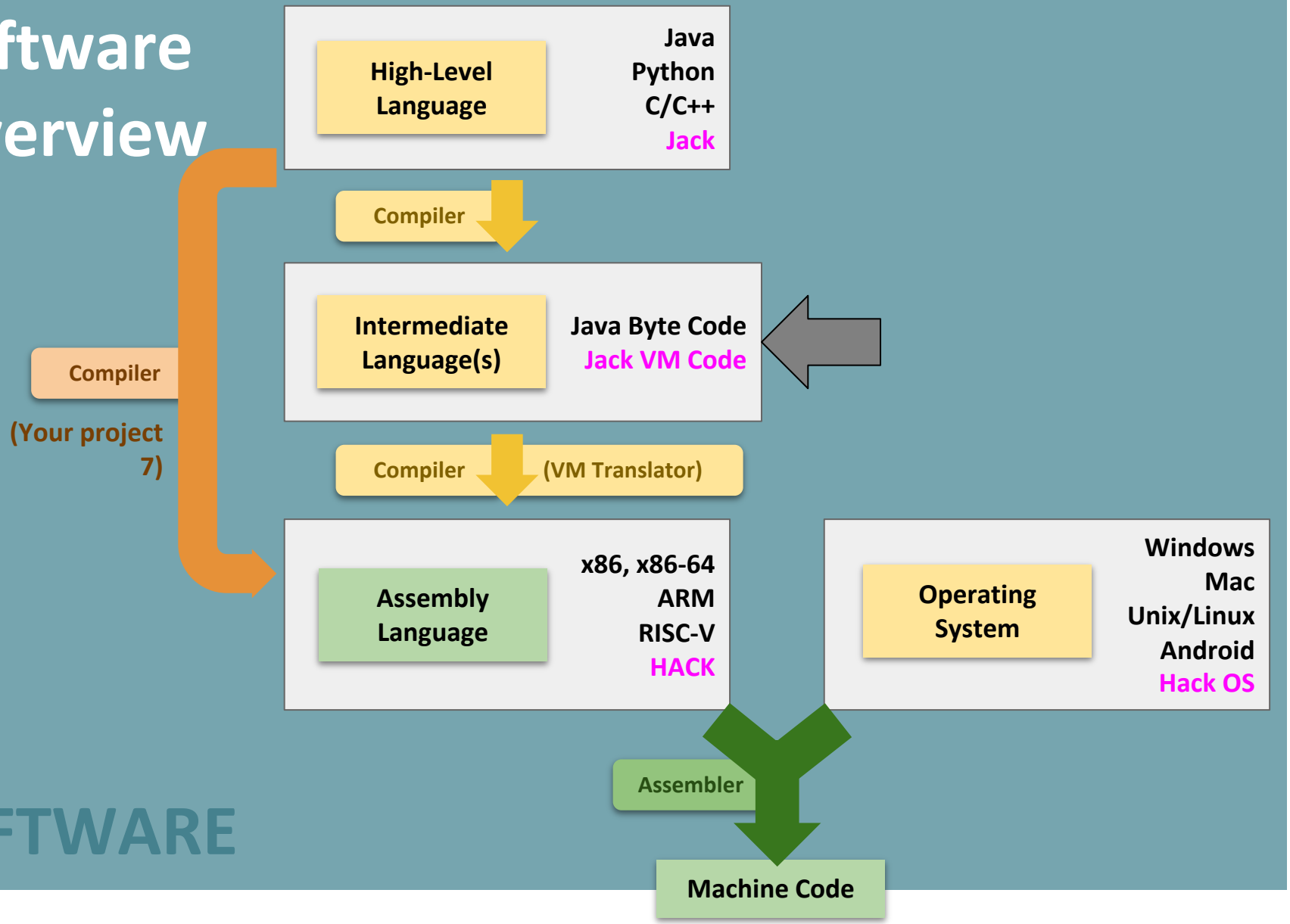
Lecture Outline

- **Two-Tier Compilation**
  - **The Java Virtual Machine (JVM)**
- Inclusive Design
  - What is Design?
  - Design Decisions in Computing
- Final Project Overview

Roadmap

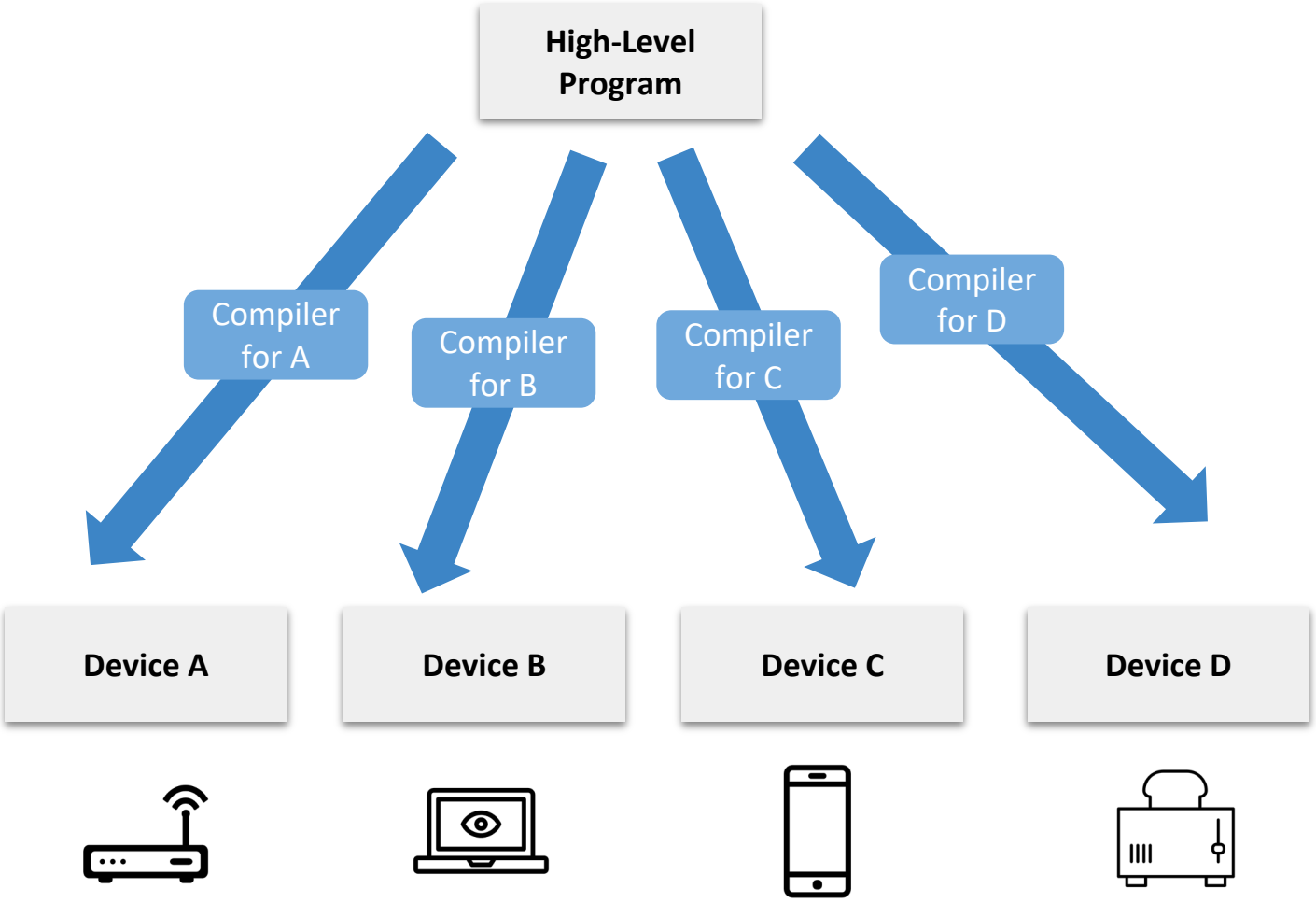

High-Level Language
Intermediate Language(s)
Assembly Language
Operating System
SOFTWARE
Machine Code
HARDWARE
Computer
Memory
CPU
ALU
PC
Basic Logic Gates
NAND

Software Overview

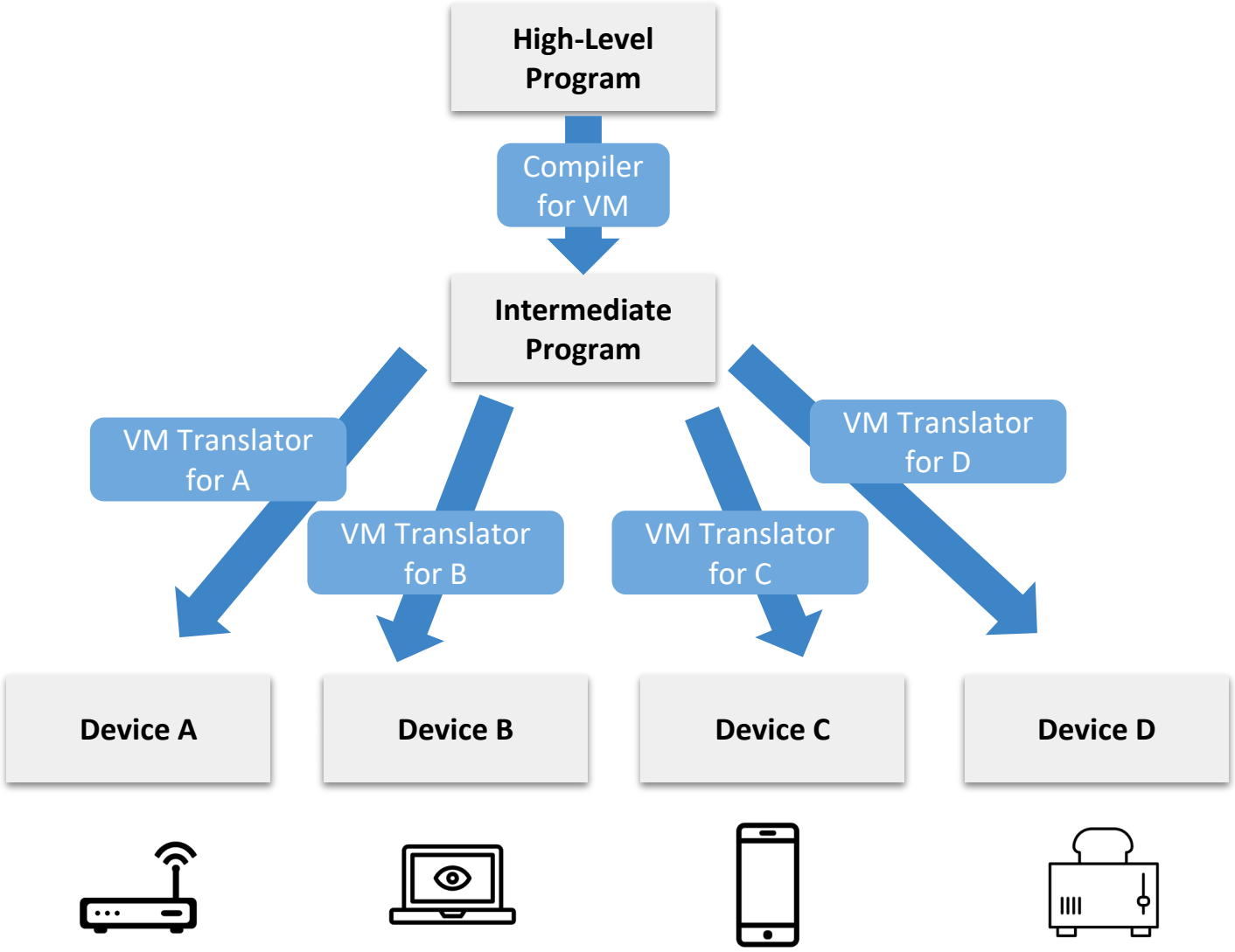


KEY: "Real-World" Examples
Our Computer

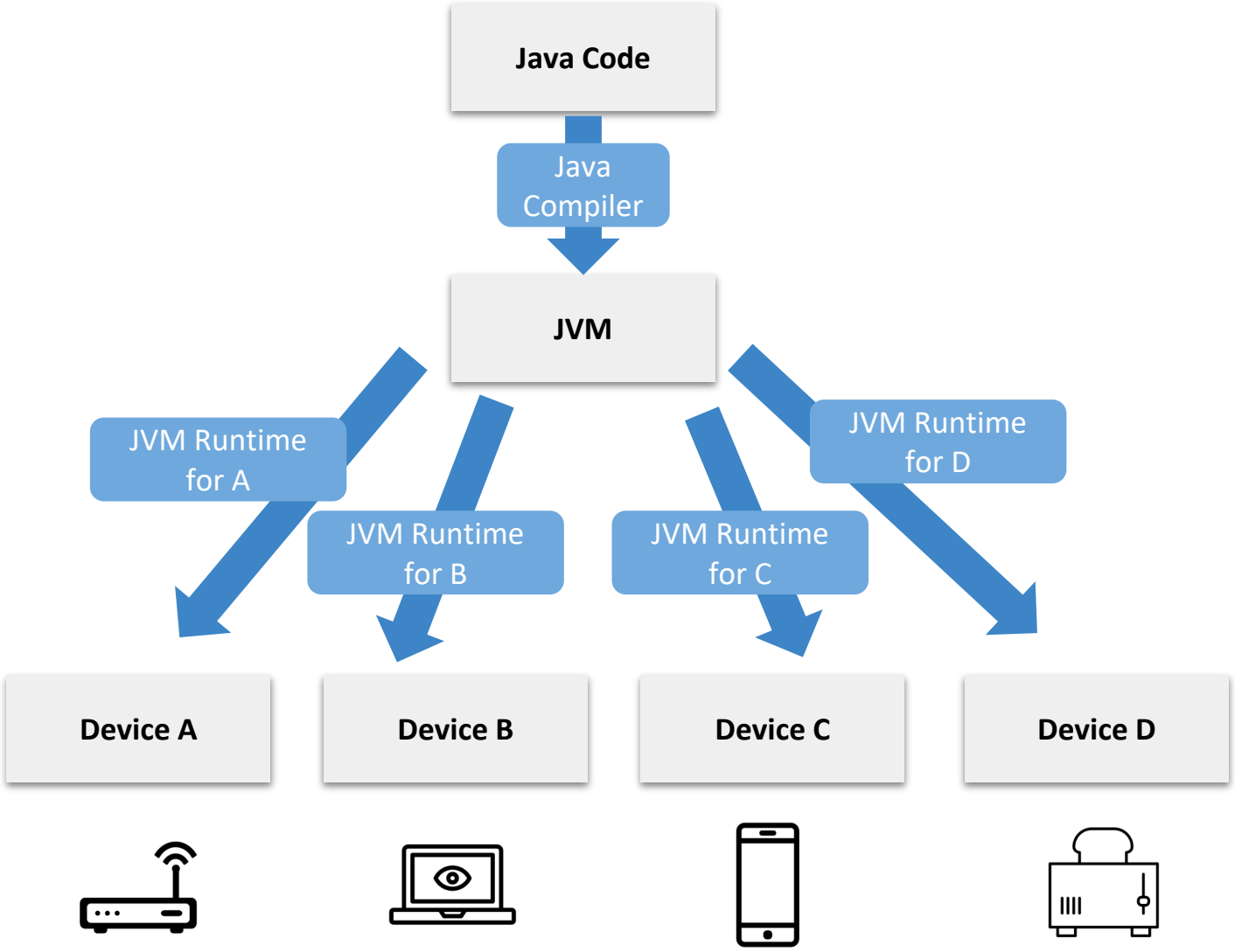
Compiling Code: Single Tier



Compiling Code: Two Tier



The Java Virtual Machine (JVM)



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- **Which of the following is NOT a benefit of the JVM two tier model?**

A. The same compiled JVM bytecode can be reused across devices
B. The same compiler (from Java to JVM bytecode) can be reused across devices
C. Programmers don't need to factor in differences between machine languages
D. Java programs can run on a new device immediately after it is released
E. We're lost…

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- **Inclusive Design**
  - **What is Design?**
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What is Design?

- The way something works, including how someone uses it
  - Almost always includes some element of interaction
- Design could have different definitions, goals, and interpretations in different contexts
  - It's also not always about the end-user of a product
  - For example, you might design a codebase that's easier to maintain
- Another idea: Everything we create has design, but there is a range to how intentional the design of something is
  - Could be completely forgotten
  - Could be focused on throughout the creation of something

Why Talk About Design?

- If design is "the way something works, including how someone uses it" then it dictates the interactions between us and, well, everything!

- Those interactions have a range of consequences
  - Positive: When you go to a website and you are easily able to find all the information you need
  - Unideal but fairly harmless: If a person can't easily drink from a certain cup
  - Harmful: If a person can't easily use emergency equipment

Why Talk About Design?

- Seemingly harmless interactions can have real impact on people, especially if repeated
  - E.g., Unable to use any door you see will make you feel unwelcome
- How can we design to create more positive reactions for more people while mitigating negative interactions?
  - Tough question in a world with so many diverse people!
- What accountability should there be for more harmful interactions caused by the design of something?
  - A big question with a muddy web of answers

An Aside: Bias

- Biases are the beliefs we have, often formed by our experiences
  - Can be **explicit**: We consciously have a belief about something and it may intentionally impact us
  - Can be **implicit**: Unconscious or impact us unintentionally
- We all have bias, and it is not inherently "good" or "bad"
  - Both potentially beneficial and potentially harmful consequences
- Eliminating bias is not a realistic goal
  - Attempting to mitigate negative consequences that come from bias is more realistic

Designer's Bias

- People often think of the "typical user" as someone who is similar to them or those they are close to
  - An example of the influence of their biases
- Even if we try to think beyond what is familiar to us, it is unlikely we will remove bias from the design process
  - Opinions about what something "should" do are inherently biased
- Ideally, we would develop processes that mitigate the negative effects of biases as much as possible
  - Recall biases can be both known (explicit) and unknown (implicit)

Bias and Design

- Following slides include some ideas and frameworks people have come up with related to bias and design

- Not meant to be the "most important" ideas
  - Think of it more as a few reference points that you can read/learn more about beyond this lecture
  - Discussions about bias and design are very nuanced and constantly evolving!

- None "solve" these issues
  - But they can be used to think about them and build better practices

Universal Design

- Big idea: Design things that can be used by as many people as easily as possible
- Designing things that work well for a wide range of people includes those who might usually be excluded
  - For example: Video captioning
- The process of "including everyone" leads us to better design

Inclusive Design

- Including as diverse a range of perspectives when designing something as possible
  - Similar to universal design, but you may offer different solutions for different types of people (rather than one solution for all)
  - "Including" a diverse perspective does not just mean having a diverse team of people
  - It means valuing a diversity of opinions and experiences

- If we prioritize diverse perspectives, especially those that have been typically excluded, it will lead to things that benefit more people

Affordance Theory

- Way of thinking about things around us
- Things provide different affordances to people
  - A way of defining what the capabilities of something are
- Can group these affordances into different categories:
  - What affordances does someone think/perceive something provides them?
  - What affordances does something actually provide someone?

Affordance Types

- Four "types" of affordances (in reality it's more of a spectrum)
  - Perceptible affordance - something does what someone thinks it can
  - Hidden affordance - something does what someone thinks it can't
  - False affordance - something doesn't do what someone thinks it can
  - Correct rejection - something doesn't do what someone thinks it can't

Design Principles In Practice

- In groups, discuss the following questions:
  - Observations of design in the real world
  - Experiences you have had with technology that has privileged or discriminated against you
  - How might you design these technologies differently to be more inclusive?

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Design in Computing

- Design discussions are relevant to computing
  - Many were developed with design in mind
- Technology can be biased
  - Design is part of almost everything in computing
  - Our biases influence the design of things
- The computer science field has a lack of diversity
  - This lack of diversity has led to many harmful designs

Design in Computing: Accessibility

- There is a large community in CSE focused on making technology more accessible for people
  - E.g., making web pages easily navigable for people who are blind
  - E.g., expanding internet access to remote populations

- Connection: Elements of both universal design and inclusive design
  - Universal design: Designing products that work for as many people as possible
  - Inclusive design: Including more perspectives in the design process, and potentially developing specific solutions aimed at including different groups of people

Design in Computing: Algorithmic Bias

- Research related to bias in AI/ML algorithms
  - E.g., Facial recognition technology not working as well on people of color (trained on primarily white datasets)
  - E.g., Racial bias in crime prediction algorithms (reflects the bias of our criminal justice system)

- These results biases reflect biased design decisions throughout development
  - Picking datasets biased towards certain communities
  - Testing applications in biased environments
  - Bias in what is prioritized within an algorithm

Moving Towards Inclusive Design

- Design is often categorized as being separate from other parts of the development process
  - In reality, happens in almost every stage of developing something
- You can voice feedback and concerns in design
  - You are ultimately contributing to the design of it
  - What conversations already occur, then ask how we can do better
- Different vision of how to approach building technology
  - Slogan offered by Animikii: “Move slow and empower people”

Next Steps

- Brief overview of design that only scratches the surface

- Entire fields and majors related to design and computing
  - Human Computer Interaction (HCI)
  - User Experience (UX/UI)
  - Human Centered Design and Engineering (HCDE, major at UW)

- Related courses:
  - CSE 340: Interactive computing
  - CSE 440: Intro to HCI
  - SOC 225: Data and society
  - HCDE department has some courses too!

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Final Project E-Portfolio Overview

- You will create an E-Portfolio that is geared toward a new Allen School student

- At its heart, the course is grounded in metacognition. Your E-Portfolio is a culminating project in having you reflect on the metacognitive skills you've learned and providing advice you wish you'd had when you first started in the program

- At our final class, you will give an 8-10 minute presentation on your E-Portfolio

Final Project Part I: Project Outline

Post-Lecture 17 Reminders

- Project 6 Part II: Professor Meeting Report due on Thursday (3/3) at 11:59pm PST
- Project 7 due next Tuesday (3/8) at 11:59pm PST
  - Please start if you haven't already!
- Project 5 grades released
- Pre-reading for Thursday's lecture includes Episode 2 of podcast (40 min)