CSE 390 B Spring 2021

Midterm Reflection, Compiler Wrap up, Design, & Final Project

Midterm Redo Reflection, Two-Tier Compilation, Design and Computing, Final Project Overview

Agenda

- Midterm Redo Discussion
- Two tier compilation
- Design
  - What is design?
  - Design in computing
- Final Project Overview

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Midterm Preparation Recap

Provided through CSE 390B

- Project 5: Paired Timed Mock Exam Problem
- In-Class Mock Exam
- In-Class Review Session
- Additional Office Hours

What preparation did you do outside of what was done in CSE 390B?

Midterm Redo Reflection Discussion

- What did you learn from doing the midterm redo? What are some big takeaways for you?
- What would you do the same or differently for how you approached your **preparation for the midterm?**
- What would you do the same or differently for the **test-taking strategies** you used during the midterm?

Try to be be specific. Think about the resources, tools, materials, and practices engaged in (or would have liked to engage in).

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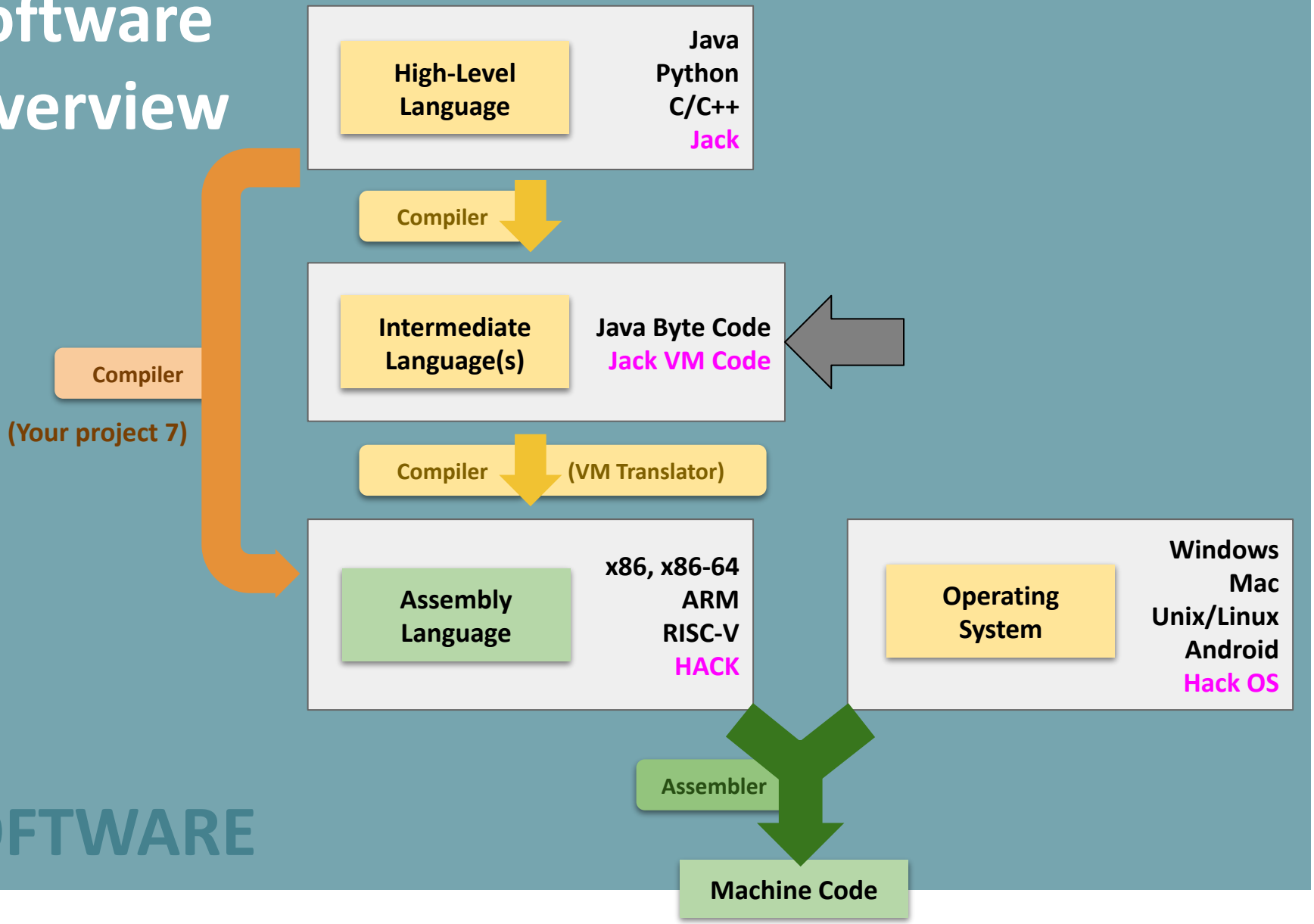
Software Overview

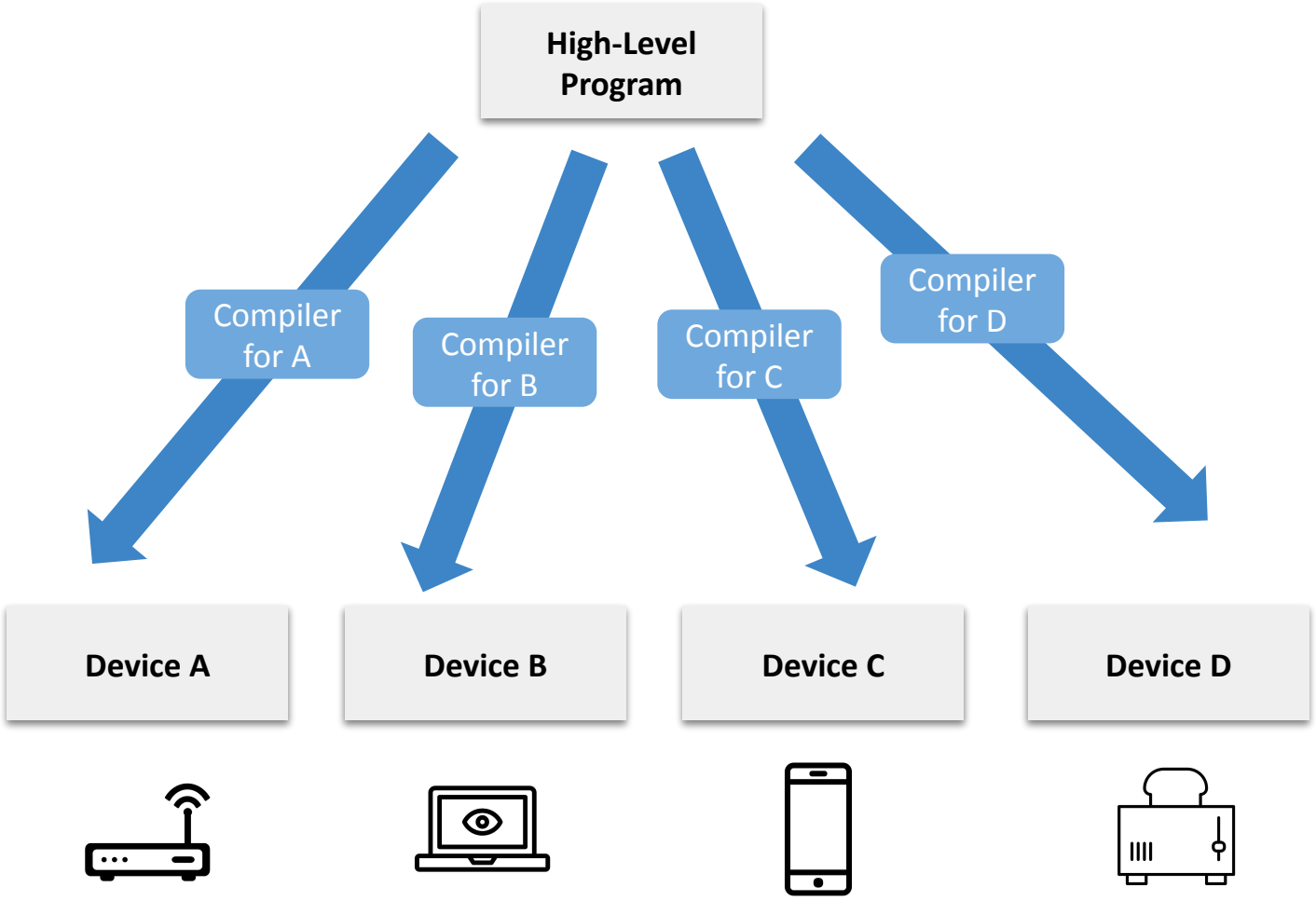


KEY: "Real-World" Examples
Our Computer

Compiling Code: Single Tier

- Compiler's job is to directly translate high-level language (e.g. Java) to machine specific instructions (e.g. x86-64 assembly)
- If a new machine architecture needs to be supported, have to reimplement entire compiler for that machine
- Programmer has to deal with any machine/system specific differences in their code

Compiling Code: Single Tier



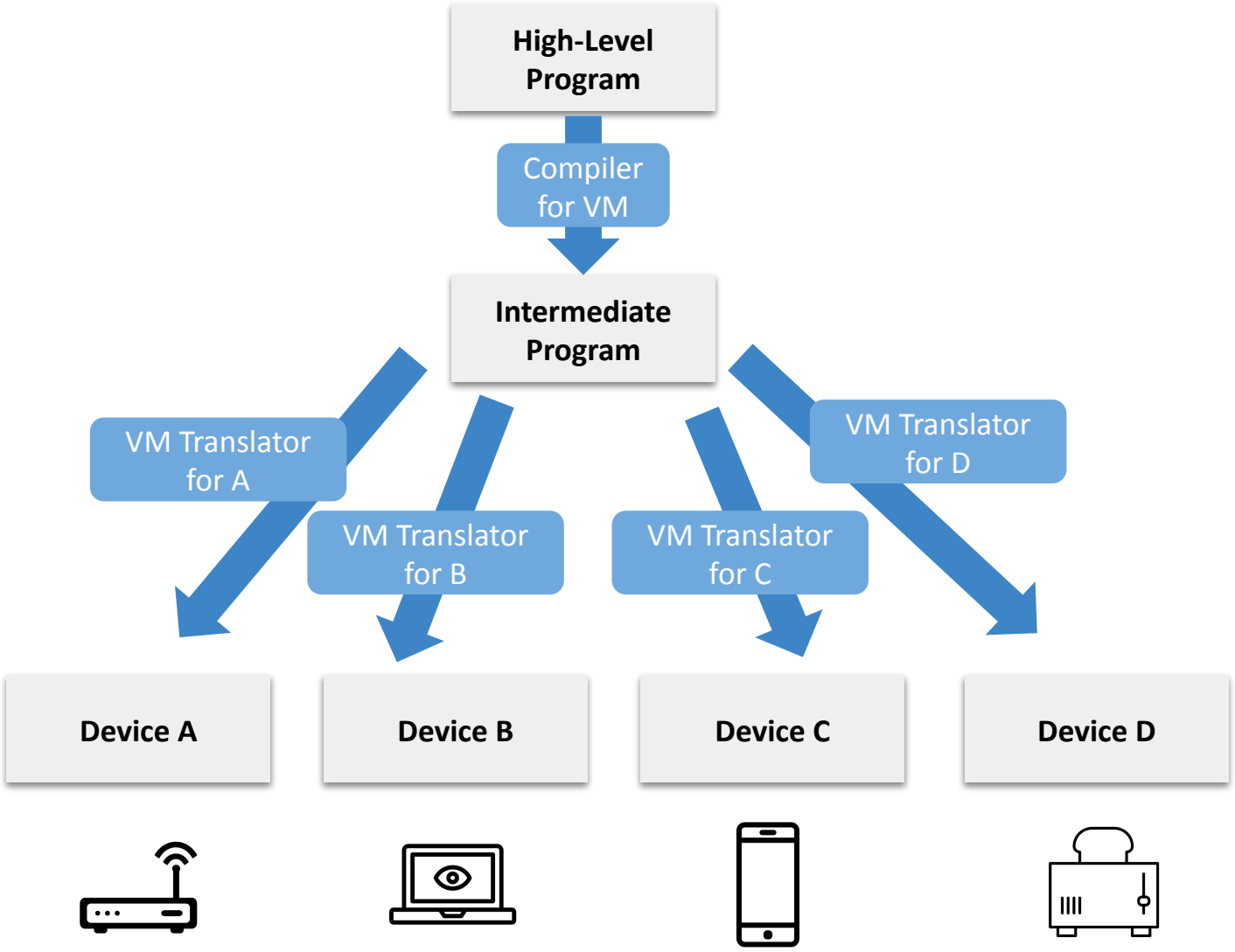
Compiling Code: Two tier

- Compiler's job is to translate high-level language (e.g. Java) to an intermediate language (e.g. JVM byte code) which is then run on a virtual machine

- If a new machine architecture needs to be supported, have to reimplement the virtual machine to run on the new hardware

- From the programmer's perspective, nothing changes at all between different architectures

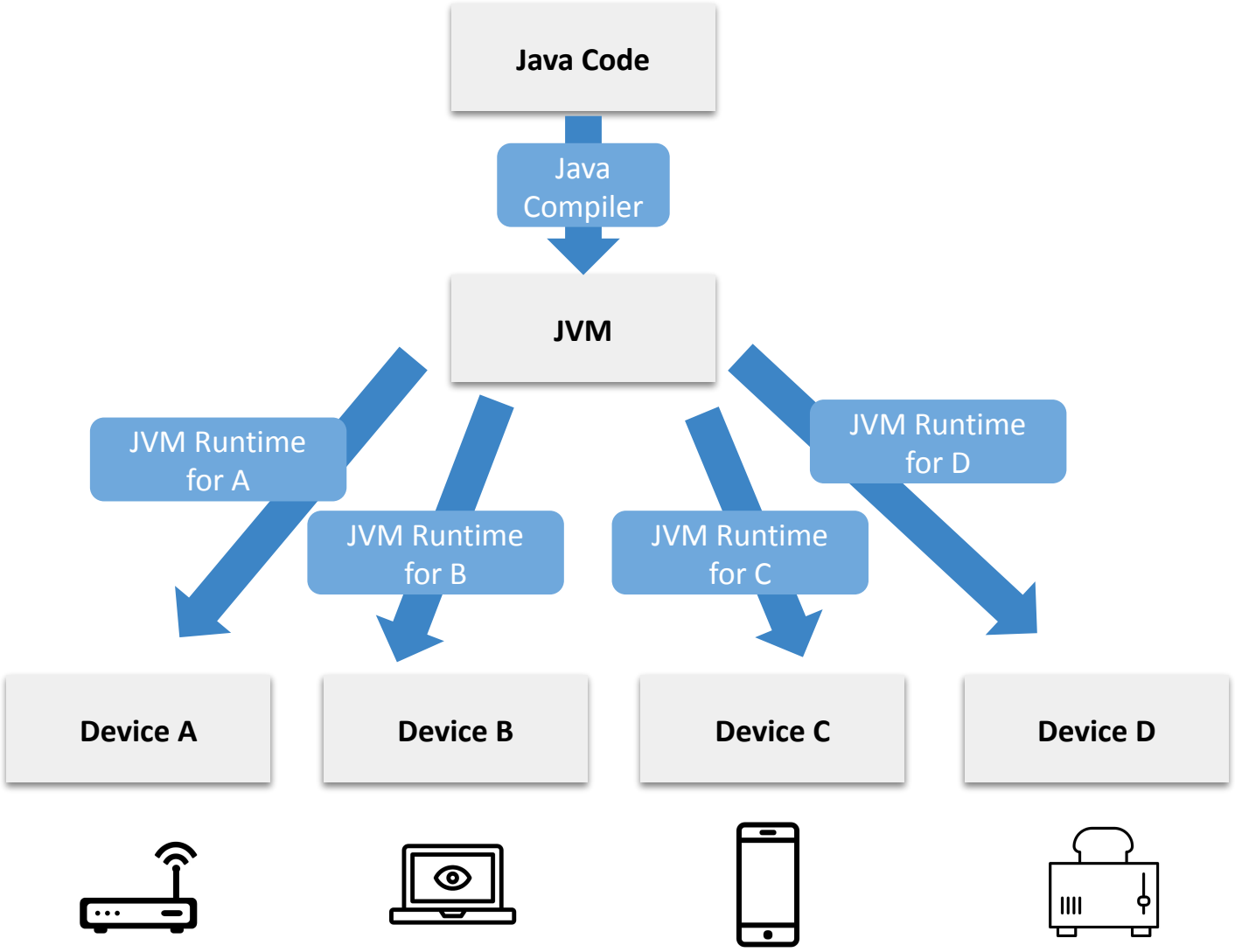
Compiling Code: Two Tier



JVM: Java virtual machine

- Since it is a "virtual" machine, it isn't actually the hardware on your laptop
  - There is further translation that happens between the JVM and your hardware
- Runs JVM Byte Code, an intermediate assembly-like set of instructions that Java is compiled into
- A "stack" machine, meaning operations/data revolve around heavy use of a stack
  - This is a bit different concept than our hardware's organization, which focuses on the use of registers
  - Read up on it if you are interested!! A different way of thinking about hardware

The JVM


Java Code
Java Compiler
JVM
JVM Runtime for A
JVM Runtime for B
JVM Runtime for C
JVM Runtime for D
Device A
Device B
Device C
Device D

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What is design?

- Could come up with thousands of different definitions!

- In breakout rooms, let's talk about what we think "design" is (not necessarily specific to computing)
  - Can come up with multiple different definitions
  - Draw from your personal experiences: what do you associate the word design with?
  - Try to pick out broad themes from specific thoughts!
  - It's ok if your broad themes aren't perfect or don't fit all situations, that would probably be an impossible task
  - Write these down so you can remember them when you share out!

What is design? Some thoughts

- One possible definition: the way something works, including how someone uses it
  - Almost always includes some element of interaction!
- Design could have different definitions/goals/interpretations in different contexts
  - It's also not always about the end-user of a product; for example, you might design a codebase so that it'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
  - Some can be super positive: when you go to a website and you are easily able to find all the information you need
  - Some can be not ideal but fairly harmless: if a person can't easily drink from a certain cup
  - Some can be really harmful: if a person can't easily use emergency equipment

Why talk about design

- Even less than ideal but seemingly harmless interactions can have real impact on people, especially if repeated
  - Not being able to use one door might be annoying for that moment/day
  - Not being able to use almost any door you see is going to make you feel really unwelcome in society

- How can things be designed to create more positive reactions for more people while mitigating negative interactions?
  - Tough question in a world with so many different/diverse people!

- What accountability should there be for more harmful interactions caused by the design of something?
  - A big question w/a messy web of answers in our society

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**: beliefs that are unconscious or impact us unintentionally
- We all have bias, and it is not inherently "good" or "bad"
  - Can have 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

- Things are usually designed for a "typical user"
- 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*
  - This often happens subconsciously!
- Even if we try to think beyond what is comfortable/familiar to us, it is unlike 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
  - Remember that biases can be both known (explicit) and unknown (implicit)

A few ideas related to 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, but it also has the potential to benefit everyone
  - For example, some people might need captions to watch a video, others might not. Including captions with a video has the potential to benefit both groups!
- End goal of including "everyone" is nearly impossible, but it's the process that is produced by this goal that leads to better designed things
- One slide does not do this topic justice!

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 everyone)
  - "Including" a diverse perspective does not just mean having a diverse team of people. It means seriously acknowledging/valuing a diversity of opinions and experiences

- Idea is that if you prioritize diverse perspectives, especially those that have been typically excluded, it will lead to things that benefit more people

- One slide does not do this topic justice!

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?
- 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
- One slide does not do this topic justice!

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Design in Computing

- All of these discussions of design are relevant to computing and technology!
  - In fact, some of them were developed specifically thinking about design in computing
- Even though some think that technology is unbiased, there are a lot of examples that show otherwise
  - Design is part of almost everything in computing
  - Our biases influence the design of things!
- CSE has suffered from a lack of diversity, and from not valuing opinions outside of the status quo
  - This lack of diversity has led to many designs with harmful negative consequences!
  - Remember: not just about having a diverse group of people: also about valuing the thoughts and opinions of a diverse group of people

Design in Computing: Accessibility

- There is a large community in CSE focused on making technology more accessible for people
  - Example: making web pages easily navigable for people who are blind
  - Example: 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

- One slide does not do this topic justice!

Design in Computing: Bias in algorithms

- There has been a ton of research related to bias in AI/ML algorithms
  - Example: facial recognition technology not working as well on people of color (trained on primarily white datasets)
  - Example: racial bias in crime prediction algorithms (reflects the bias of our criminal justice system)

- These end result biases are a reflection of biased design decisions throughout development
  - Picking particular datasets that are biased towards certain groups of people
  - Testing applications in biased environments
  - Bias in what is prioritized within an algorithm

- One slide does not do this topic justice!

Design in Computing Activity

- In breakout rooms, create a short mini-presentation on the design of something related to computing
  - Could pick a technology or product and look at it from the perspective of design
  - Could pick an issue/article/event and look at it from the perspective of design

- Edit one of the following slides to have the information
  - Include a brief overview of what you are talking about
  - Include a section on how it relates to design (include as many things as you can think of!)
  - Include lingering questions or thoughts you all had as a group

- We'll give you 15 minutes! It's ok if what you come up with is a work in progress

Group/Topic 1: <Insert Topic Here>

- Summary of topic
- Ways in which it relates to design
- Lingering questions or thoughts you have

Ok so what can we do?

- Design is often categorized as being separate from other parts of the development process
  - In reality, it happens in almost every stage of developing something

- Even if you don't feel like your "job" is the design of something, you can still voice feedback and concerns with how something is being designed
  - You're working on a project, so you are ultimately contributing to the design of it
  - Start by figuring out what conversations/processes related to design are already occurring, then ask how can we do better?

- It may seem like a lot of "extra" work, but in reality it is a different vision of how to approach building technology
  - No longer "move fast and break things"
  - Alternative slogan offered by Animikii: "move slow and empower people"

Wrap up

- This was meant to be a brief overview of a few things related to design in computing
  - But it really only scratched the surface

- There are whole 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)

- If you want to learn more, take a class, google, watch videos, etc.
  - CSE 340: Interactive computing
  - CSE 440: Intro to HCI
  - SOC 225: Data and society
  - HCDE department has some courses too!

Sources used that are worth checking out!

- Black People Have Always Been UX Designers: Space-making is an iterative design process
- Fundamentals of Inclusive HCI Design
- Kat Holmes: Rethink what inclusive design means
- Move Slow and Empower People: Animikii's Approach to Indigenous Technology
- CSE's inclusive community workshop
- The Theory of Affordances
- What is Universal Design? National Disability Authority
- Web Accessibility Initiative
- UNESCO report on world internet connectivity
- Racial Discrimintation in Face Recognition Technology
- Predictive policing algorithms are racist

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CSE 390B Final Project Overview

- At its heart, our course is grounded in metacognition
  - For your final project, we want you to reflect on your experience as an Allen School student so far
- You will prepare a 8-10 minute presentation geared toward a new Allen School student and giving them the advice you wish you'd had when you first started
  - Your presentation should focus on lessons from your own experience
- You should make visuals (e.g. slides) and practice, but the most important part is the quality of your reflection

Final Project Breakout Rooms
Part I: Project Outline

Reminders

- Professor Meeting Report due **Thursday 5/27**
- Project 7 due next **Tuesday 6/1**
  - Please start if you haven't already!
- Project 5 Grades released
- Note pre-reading for Thursday's lecture includes Episode 2 of podcast (40 min)