IN4MATX 133: User Interface Software

Lecture 18: Augmenting Reality & Conversation

Professor Daniel A. Epstein
TA Goda Addanki
TA Seolha Lee

Announcements

Feb 27	Feb 28 **Ionic Demo (Seolha)** 2:00-2:50 | Zoom 3:00-3:50 | Zoom 4:00-4:50 | Zoom Recording	Mar 1 **Small & Large Displays** 2:00-3:20 | HH 178 & Zoom Recording **Professor Epstein Office Hours** 3:45-5:00 | Zoom	Mar 2 **Goda Office Hours** 2:00-3:00 | Zoom	Mar 3 **Augmenting Reality & Conversation** 2:00-3:20 | HH 178 & Zoom	Mar 4 **Seolha Office Hours** 11:00-12:00 | Zoom	Mar 5
Mar 6 **A4 Due** Sleep Tracker in Ionic	Mar 7 **Professor Epstein Office Hours** 2:00-4:00 | Zoom	Mar 8 **Interaction and Society** 2:00-3:20 | HH 178 & Zoom **Goda Office Hours** 10:00-11:00 | Zoom	Mar 9 **Goda Office Hours** 2:00-3:00 | Zoom	Mar 10 **Wrap-up** 2:00-3:20 | HH 178 & Zoom	Mar 11 **Seolha Office Hours** 11:00-12:00 | Zoom	Mar 12
Mar 13	Mar 14 **Seolha Office Hours** 1:00-2:00 | Zoom	Mar 15 **Professor Epstein Office Hours** 3:45-5:00 | Zoom	Mar 16 **A5 Due** Beyond Web & Mobile	Mar 17	Mar 18	Mar 19

Today’s goals

By the end of today, you should be able to…

- Describe some of the history of AR and VR and and conversational interfaces
- Differentiate augmented and virtual reality
- Explain key principles for designing a good AR experience
- Articulate some principles for designing conversational experiences

What is augmented reality?
What is virtual reality?
How do they differ?

Augmented reality vs. Virtual reality

- Virtual reality aims to transport a person to an entirely new place by blocking out the real world as much as possible
  - Ideally a full sensory experience

Augmented reality vs. Virtual reality

- Augmented reality layers digital enhancements on top of a view of the real world
  - Digital content is interactive
  - Digital content is viewable in 3D (or projected 3D)

Mixed reality (hybrid reality)

- Physical objects in the real world can be interacted with in the digital world
  - Kind of a hybrid of AR and VR
- By comparison, VR seeks to immerse a person in a completely artificial environment
- While AR just overlays objects in the real world

Virtual, Augmented, and Mixed reality

- Virtual reality
  - HTC Vive, Oculus rift
- Augmented reality
  - Apple ARKit, SnapChat lenses, Pokemon Go
- Mixed reality
  - Microsoft HoloLens

CAVE (1992)

https://www.youtube.com/watch?v=-Sf6bJjwSCE

Carolina Cruz-Neira, Daniel J. Sandin, Thomas A. DeFanti, Robert V. Kenyon, and John C. Hart.
The CAVE: audio visual experience automatic virtual environment. *Communications of the ACM* 35, 6 (June 1992)

CAVE (1992)

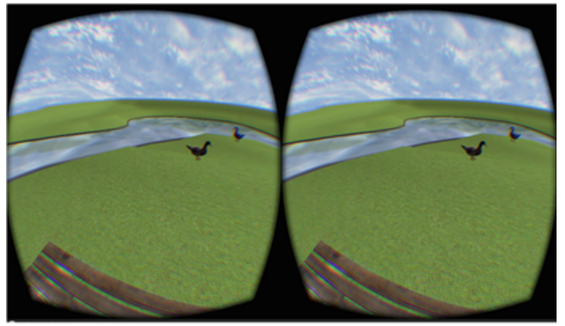
- Viewing headset
  (though it used projection walls)
- Sensors to detect a person's
  position and orientation
  in the space
- Audio feedback
- Motion controller

CAVE (1992)

- Necessitated a specialized setup
  - Large room
  - Four projection walls
  - Expensive wearable displays
- Technology could never be adopted by consumers
  - Who has that kind of space to devote to VR, never mind money?

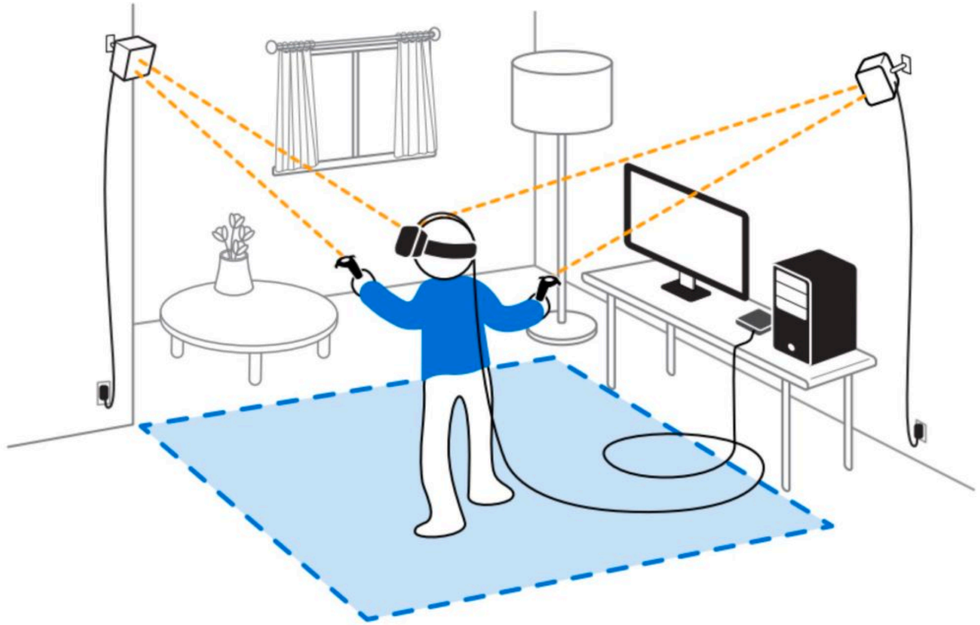
Google Cardboard (2014)

- Explicitly *not* a fully immersive experience
- Uses a phone to generate a screen for each eye
- Uses accelerometer and gyroscope for positioning



Oculus Rift & HTC Vive (2016)

- Clear out a play space
- Position sensors around the environment
- Motion controls
- An overlay headset



Microsoft HoloLens (2016)

Microsoft HoloLens (2016)

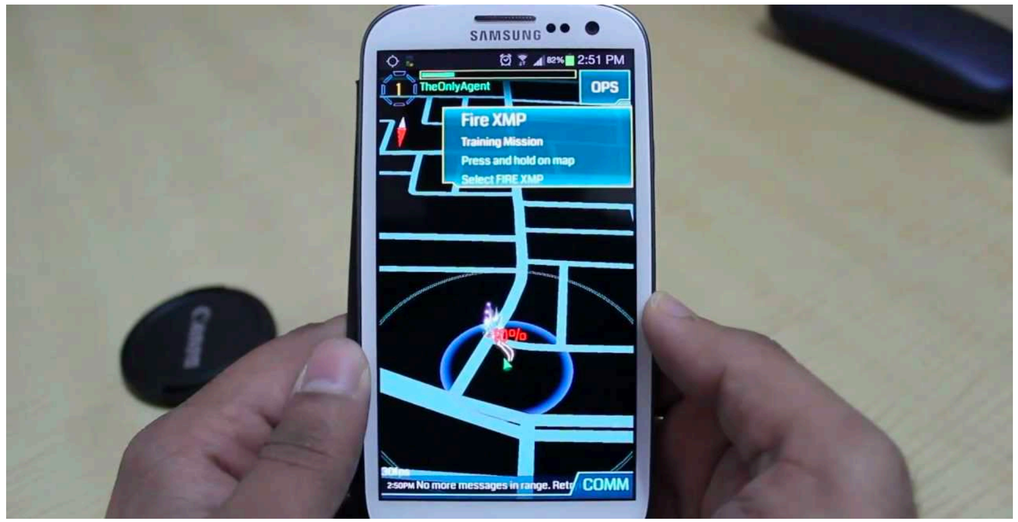
- Mixed reality system
  - Like AR, adds layers to the real world
  - Some physical objects can be interacted with
- Focused on commercial uses
  - Pricing: $3000/unit
- Though there are other videos which demonstrate entertainment applications

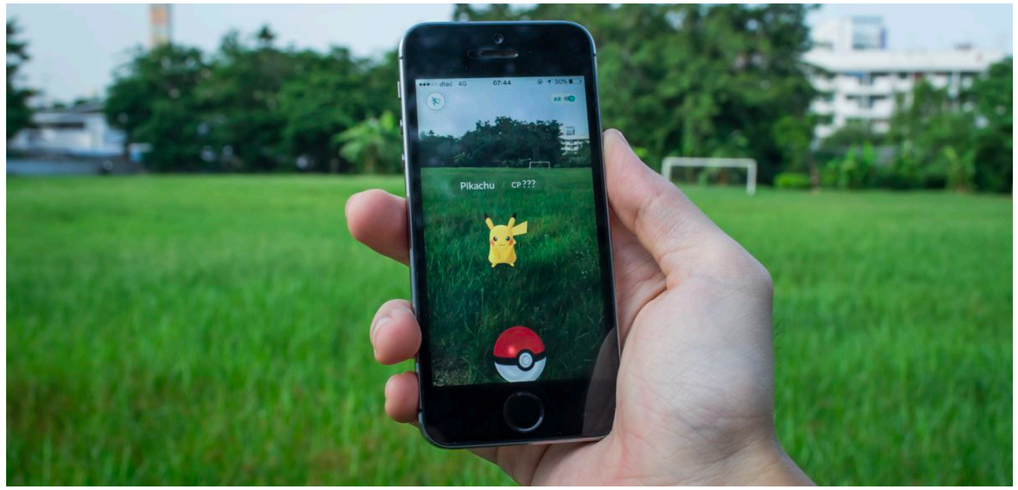
Snapchat (2011)

- A key component is augmenting the environment in fun ways
  - Mostly known for facial filters (I think? You tell me)
- A “camera company”, not a “social media company”
  - Core product is currently the social network

Ingress (2012) and Pokemon Go (2016)

- Popular games
  with millions of users (even today)
- AR aims to augment the real world
  - A layer over the camera
    is just one sense (vision)
  - Location-based PokeStops, Gyms, etc.
    add others
- Location-based gameplay leads to
  social interactions between players





Question

arvr

Augmented or virtual reality?

A. Both are AR

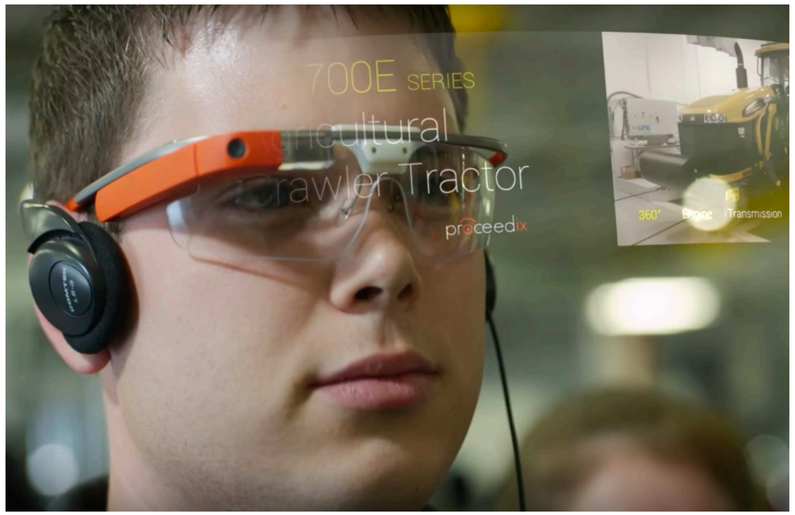
B. Cardboard is AR, Glass is VR

C. Both are VR

D. Cardboard is VR, Glass is AR

E. Both are neither AR nor VR

Google Cardboard



Google Glass

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arvr

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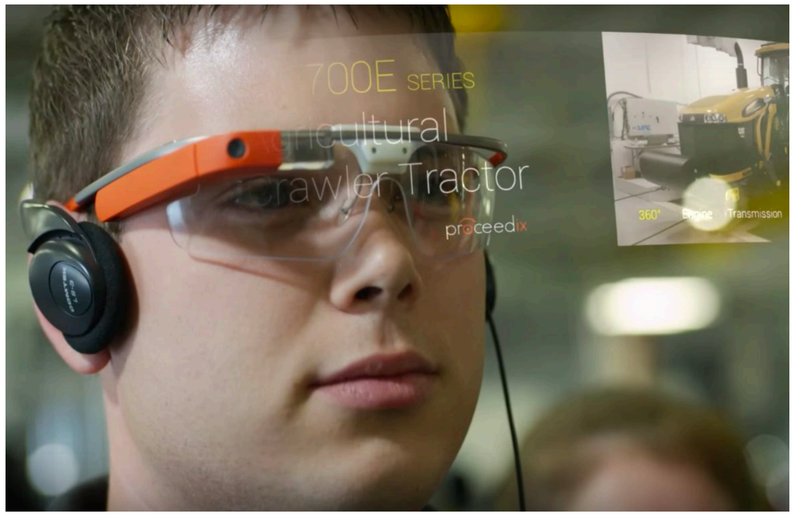


Google Glass

VR applications

- Games
- Flight simulators
- Sophisticated testing (car prototypes, etc.)
- Training (military, medical, industry, etc.)
- Recreation (nature hikes, exploring)

VR challenges remain consistent

- Creating a truly immersive experience is difficult
  - Need to replicate touch, sight, hearing… smell and taste?
- Most people do not have a physical space
  which can be taken over by a virtual environment
- Requires instrumenting the body, the environment, or both
  - Heavy, bulky, expensive, etc.
- Most practical uses are for enterprises rather than consumers

AR and Mixed reality avoid some problems

- The experience does not need to be fully immersive
- The physical space is literally part of the environment, and maybe even part of the experience
- Halfway-decent AR is pretty cheap computationally
  - It can run on your phone!
  - Other sensors like Gyroscope, etc. add to the experience
- Low cost makes AR practical for entertainment, etc.
  - Mixed reality is still very expensive

Implementing Augmented and Virtual Reality

VR Implementation

- Many common 3D development environments can be used
  - VR changes the rendering and the input
- Unity VR (and AR)
  - https://unity3d.com/learn/tutorials/s/xr
- Unreal VR (and AR)
  - https://www.unrealengine.com/en-US/vr
- Google cardboard
  - https://developers.google.com/vr/develop/unity/get-started-android

AR Implementation

Hybrid Development

- React 360
  - https://github.com/facebook/react-360
- Argon JS
  - https://github.com/argonjs/argon
- AFrame
  - https://aframe.io/

AR Implementation

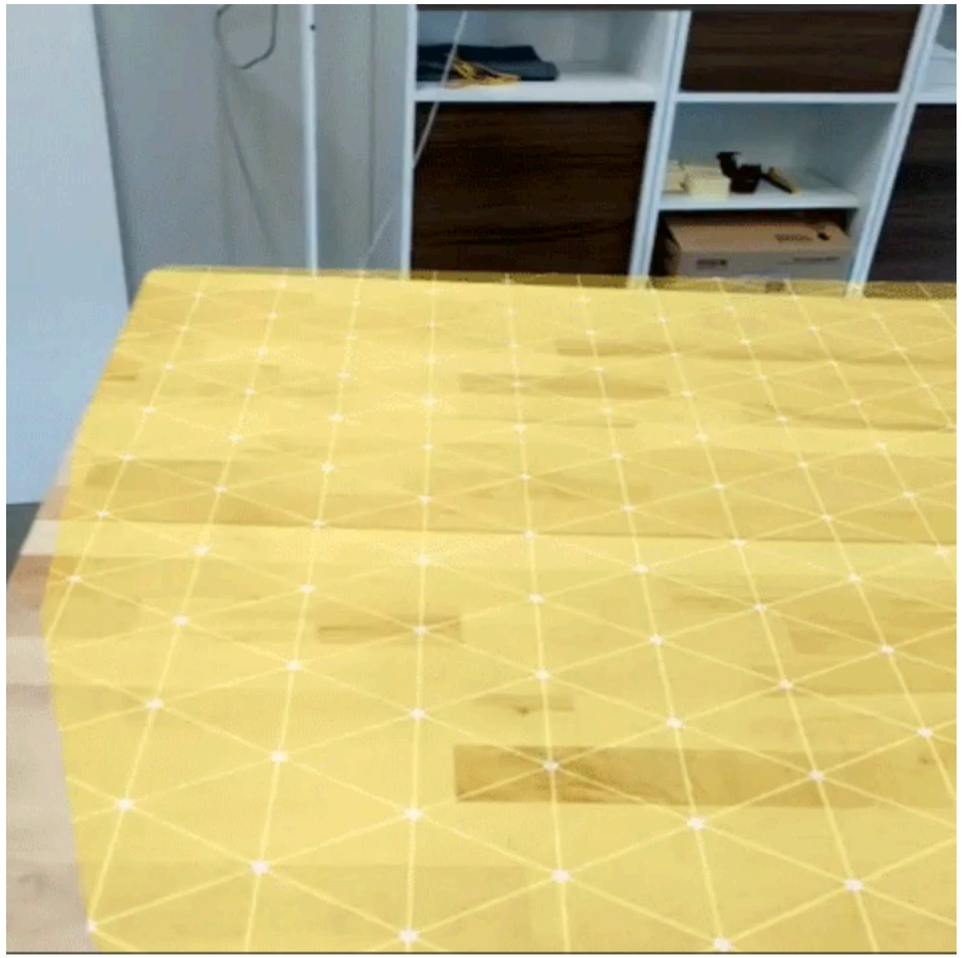
Native Development

- Google ARCore
  - https://developers.google.com/ar/
- Apple ARKit
  - https://developer.apple.com/arkit/

A few AR design recommendations

Label surfaces during set-up phase

- Highlight surfaces where objects can be placed
  - No visual cues can create confusion when a person goes to place an object
- Differentiate multiple surfaces
  - Update surfaces as a person moves their phone around



https://designguidelines.withgoogle.com/ar-design/

Provide guidance on interactions

- There gestures and interactions in AR are not standardized
  - Standards will come as the platform matures
- Use a combination of visual cues and text explanations to guide interactions
  - Dismiss hints when they have been performed successfully

https://designguidelines.withgoogle.com/ar-design/

Anticipate space limitations

- Do not require a user to walk backward or make quick sweeping motions
- Give a clear idea of the amount of space needed for an interaction
- Avoid putting large objects close to the user on the on the screen
  - They will instinctively back up

https://designguidelines.withgoogle.com/ar-design/

Trying to make computers conversational

IBM Shoebox

- 1961
- About the size of a shoebox
- One of the early examples of natural language processing

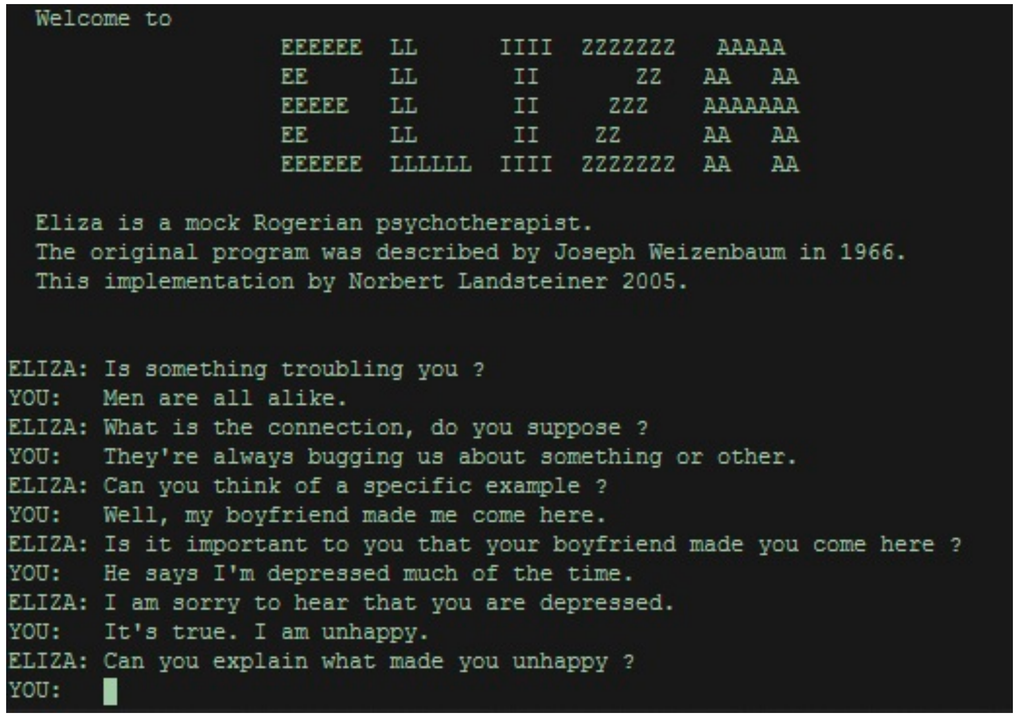
https://www.ibm.com/ibm/history/exhibits/specialprod1/specialprod1_7.html

IBM Shoebox

https://www.youtube.com/watch?v=rQco1sa9AwU

Conversational assistants

- ELIZA, 1964
  - Used pattern matching to have a conversation
  - Not that “smart”, would just reflect back what a person said
  - But “smart enough” to potentially pass a Turing Test



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

Conversational assistants

- People expect to converse with computers differently from how they converse with people
  - When talking to computers, people tend to exhibit commands
  - When talking to people, people tend to be more polite

Appendix B: Example dialogue

Computer partner, sentence responses

System: Is anyone there?
User:
System: hello
User: hello
System: what do you want to know?
User: igor's degree
System: Igor's degree is a BA, in fine arts
User: igor's school
System: Igor's school was the Sorbonne
User: igor house
System: Igor's house is a commune
User: igor marry

Appendix C: Example dialogue

Human partner, short responses

Partner: Is anyone there?
=>
Partner: hello
=> howdy, are you ready
Partner: what do you want to know?
=> ok, i'm not too sure what you've got there, but what i have here is a list of people and i'm going to start by asking you: what do you know about Igor?
Partner: what do you want to know?
=> what does Igor have a degree in?
Partner: BA, in fine arts

https://link.springer.com/article/10.1007/BF00158952

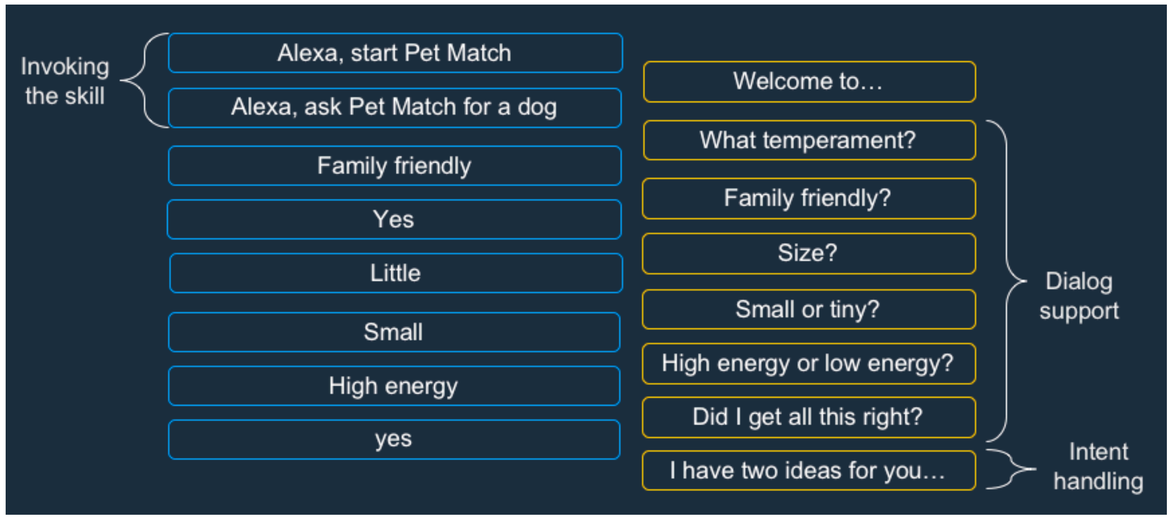
Conversational assistants

- Once Natural Language Processing (NLP) got good enough, conversational assistants started being ubiquitous
  - Siri (Apple) launched in 2011
  - Alexa (Amazon) launched in 2014
- Present on both on dedicated devices and part of apps
  - Chatbots are becoming widespread
  - Both in text and in speech

Conversational design recommendations

Multi-turn dialogs

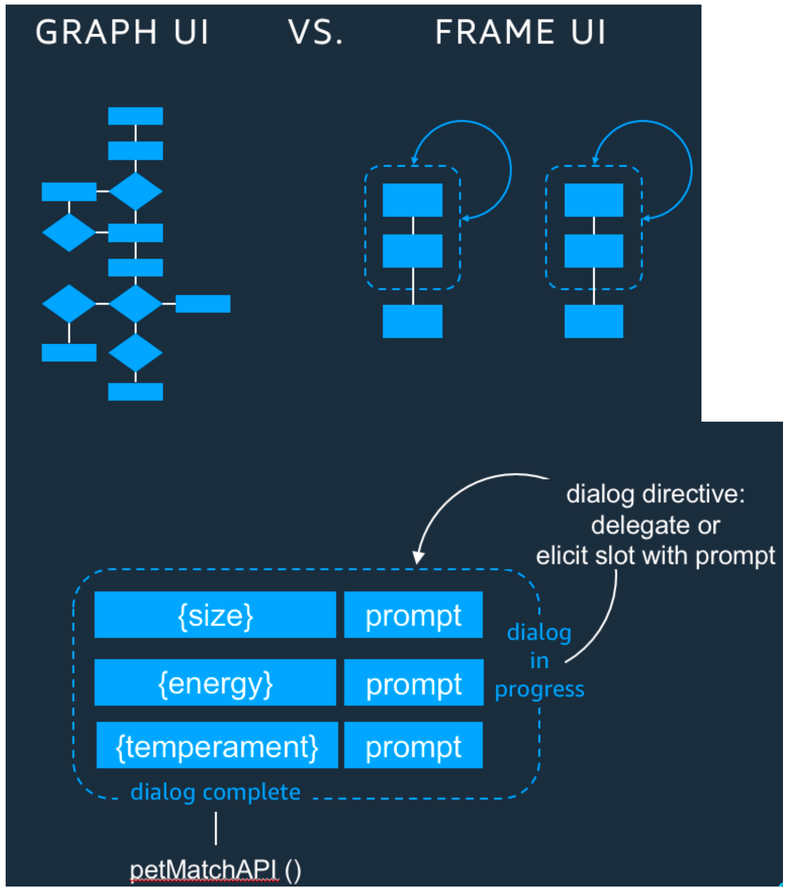
- When you have a conversation with someone, you typically ask them questions
- Voice assistants can do the same to fill up “slots” with all information
- On the web, these could be instantiated as labeled fields, but a person might be confused or turned off if the assistant just said the name of the field



https://developer.amazon.com/blogs/alexa/post/57d0bb9c-19a6-4c51-bfa2-fc6753d14b68/4-principles-of-conversational-voice-design

Optimize conversations

- Treat these question-answers as “frames” for updating information, rather than a graph of dialog options to traverse
  - A person might fill multiple slots at once
  - “I want a small, family-friendly dog”



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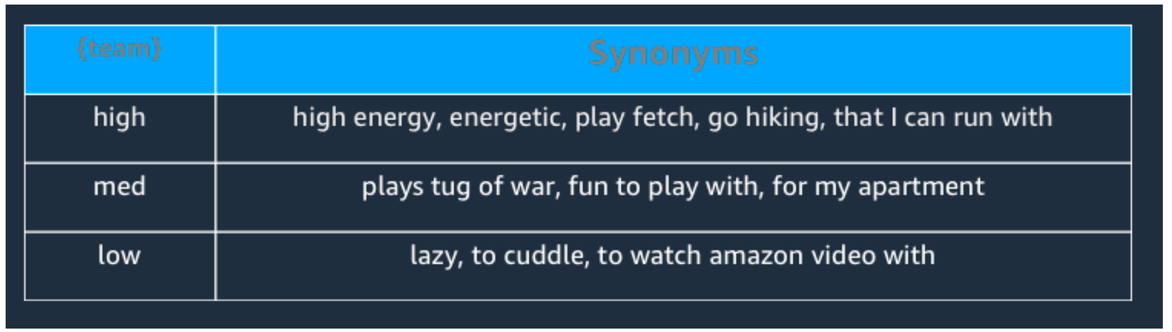
Diversify understanding

- Where you can, think through different ways a person might respond
  - Try to map those responses to your core concepts
  - If the dog should be low, medium, or high-energy
- Think of any descriptions you give as “training data” to the assistant’s model



{team}	Synonyms
high	high energy, energetic, play fetch, go hiking, that I can run with
med	plays tug of war, fun to play with, for my apartment
low	lazy, to cuddle, to watch amazon video with

https://developer.amazon.com/blogs/alexa/post/57d0bb9c-19a6-4c51-bfa2-fc6753d14b68/4-principles-of-conversational-voice-design

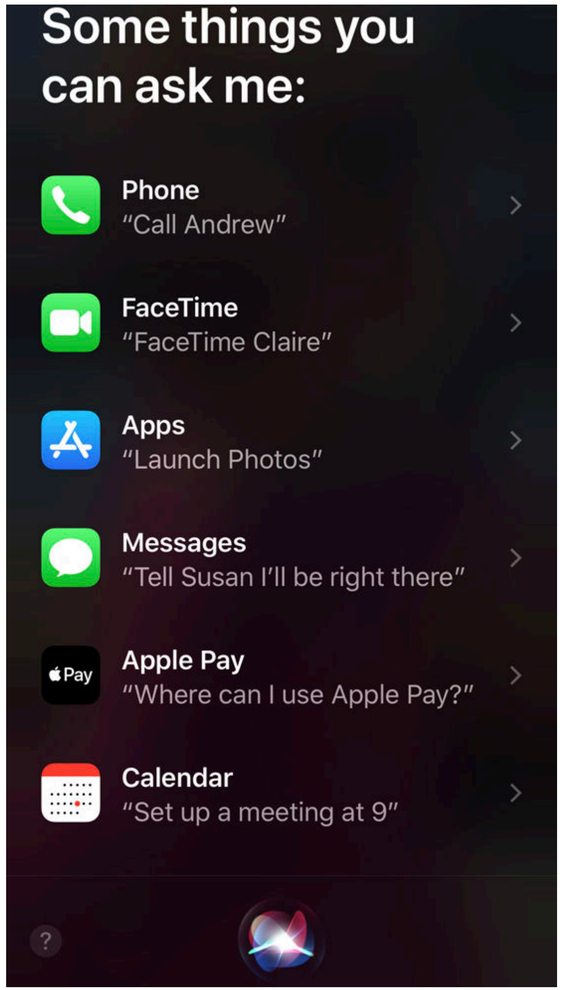
Include variance and memory

- Design your agent not to say exactly the same thing every time
  - Repetition sounds robotic
- If a person returns to a conversation, recall that as another person would
  - “Welcome back, Professor Epstein! Last we chatted, you seemed interested in a small, low-energy dog. Is that still the case?”
  - Can also sound corny, so be careful…

https://developer.amazon.com/blogs/alexa/post/57d0bb9c-19a6-4c51-bfa2-fc6753d14b68/4-principles-of-conversational-voice-design

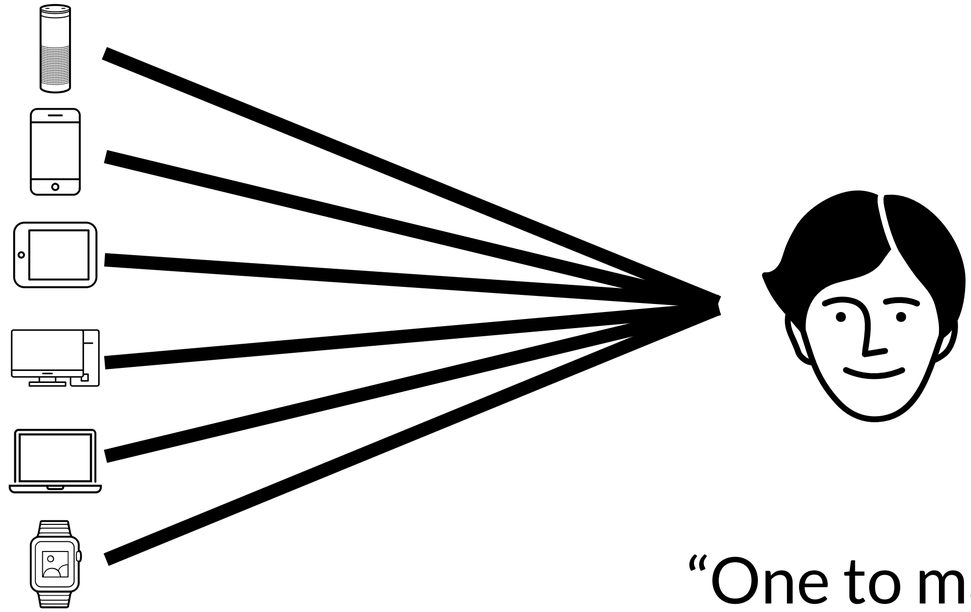
Overall advice on conversations

- Discoverability is **hard**!
  - People can't "see" what conversational options (commands) are available to them
  - We can show people a list of options, but they're likely to forget
  - They're likely to not notice if new functionality is added



Reflections on beyond web and mobile

- Devices offer different interaction affordances and are used in different contexts
- Web and mobile are often sufficient
  - Not every app needs an Alexa skill, Watch app, or TV app
- As we've moved to the "one to many" Ubiquitous Computing era, we're more often separating computation from interaction



"One to many"

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