Assignment 2: Technology Selection

In this second assignment, your task is to recommend XR technology for a given scenario. This assignment consists of five (5) steps:

1. **Consider all scenarios below and pick one (1) of interest to you / create your own**
2. **Consider implementations along the Reality-Virtuality Continuum**
3. **Walk through the XR Technology Tree and collect options**
4. **Perform QOC analysis as systematically as possible**
5. **Optional: Pick another scenario, do the QOC analysis, and compare your selections**

Expected results

- Scenario-based approach to selecting XR technologies
- Better sense of what questions to ask when considering options
- More comprehensive list of criteria to aid decision making

Submission

Please submit the following information and supplementary materials (as PDF document or PNG image, optionally MP4 video) to the XR Technologies Gallery:

Title: Enter the name of the XR app you tried. *This text will appear as the title of the submission in the gallery.*

Category: Choose virtual reality (VR) or augmented reality (AR) to categorize the technology selection, or XR if it is a combination of both VR and AR.

Scenario: Choose the scenario for which you made a technology selection (see below). If it is your own scenario, please provide a visual depiction and brief description of the scenario.

Technology Selection using QOC Analysis:
You should perform the analysis in QOC representation (see below) and attach it as supporting materials. In the writing, state the questions, options, and criteria. Ask relevant questions about the key design issues for the scenario. Walk through the XR technology tree to collect options. Establish criteria that you should consider when weighing the options. Make your recommendation based on positive and negative assessments of the options.

Attachments:
- **QOC representation:** Submit an image of your QOC representation that clearly states the questions, options, and criteria. It should become clear which of the criteria you

assessed positively and negatively (draw dashed lines), and which of the options you picked (draw a rectangle around the selected option).
- **Other**: Feel free to submit any supporting materials such as sketches, screenshots, or photos that illustrate your options and make the selection criteria clear.

Scenarios

Below are the four (4) scenarios introduced in the lecture that you can work on. You could also describe your own scenario and then provide a technology selection for that scenario. You may also invite other learners to work on your scenario.

Scenario 1: Home Decoration

Adapted from "Place IKEA furniture in your home with augmented reality" by IKEA (YouTube 2014)

Scenario 1: Home Decoration—several family members use their handheld AR devices to collaboratively choose new home decoration for their living room.

Tip: In this scenario, we can see all AR displays are hand-held. So, you should explore possible AR tracking technologies, so center your questions and criteria around strong vs. weak AR, marker-based vs. marker-less AR, etc.

Scenario 2: Collaborative Game
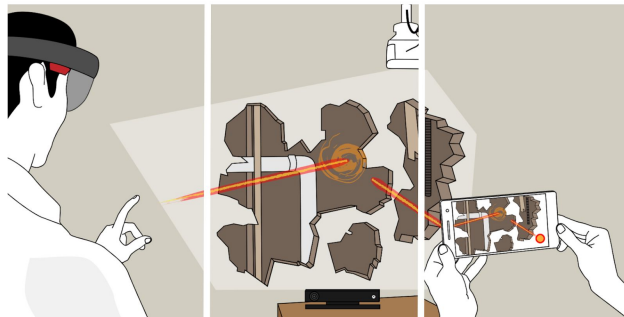
XR MOOC Specialization Course 1: Intro to AR/VR/MR/XR
Dr. Michael Nebeling

Scenario 2: Collaborative Game—three (3) friends play a shooter game together using various AR displays (headworn, projective, handheld). In a variation of this scenario, the friends are not co-located in the same place but play remotely from each of their homes.

Tip: In this scenario, you should explore possible AR technologies, so center your questions and criteria around strong vs. weak AR, marker-based vs. marker-less AR, etc.
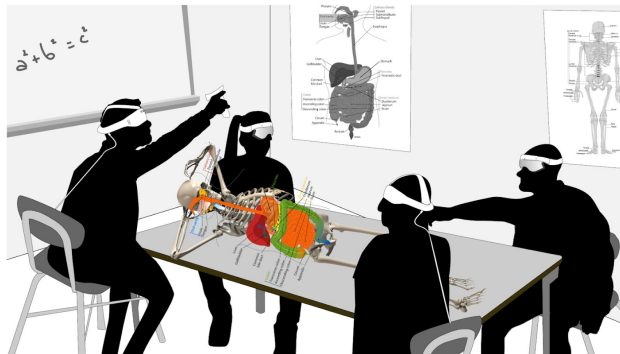
Scenario 3: Classroom Lecture
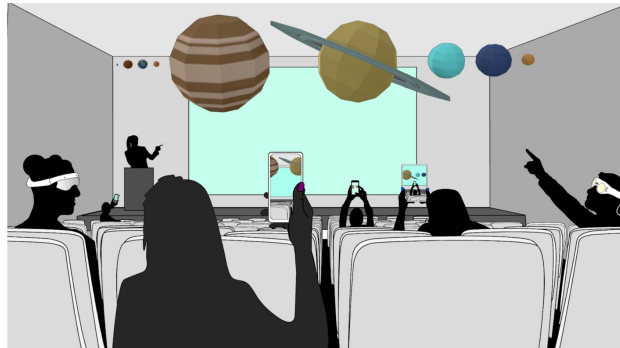
Scenario 3: Classroom Lecture—an instructor asks her students in class to take out their XR devices to look at the solar system and observe Kepler's laws of planetary motion.
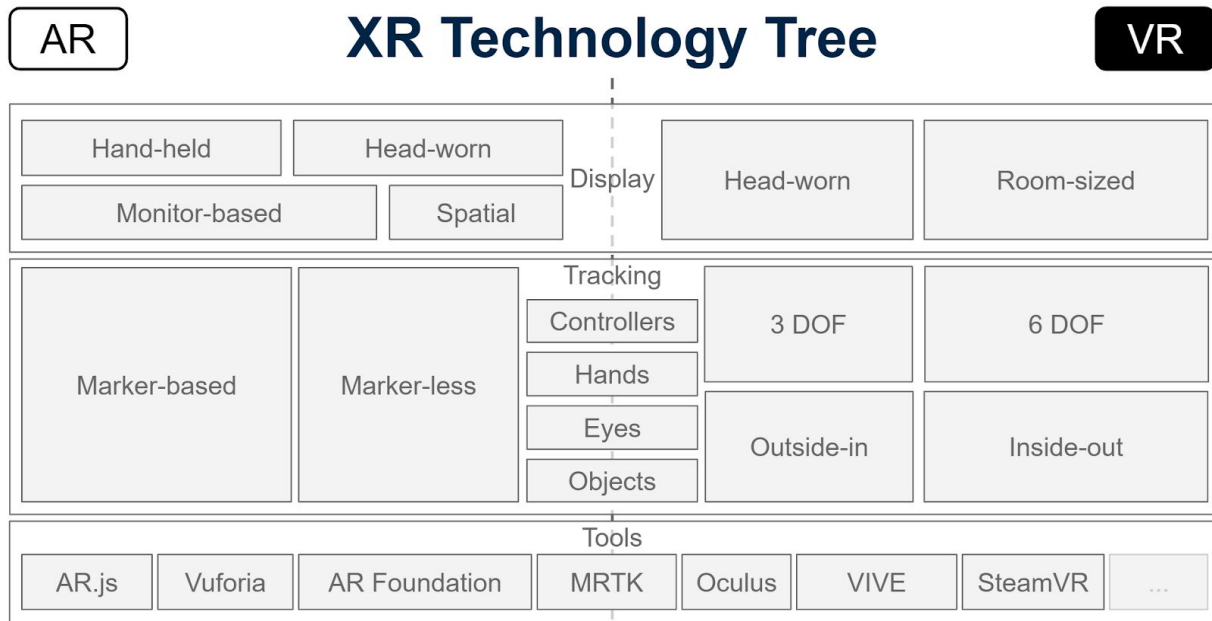
Scenario 4: Team Meeting

Scenario 4: Team Meeting—four students meet in a meeting room on campus to collaboratively work on their biology assignment on human anatomy using XR devices.

XR Technology Tree

For your reference, below is the technology tree presented in the lecture. Use it to generate options for key design issues. Focus primarily on display and tracking technologies and consider the benefits and trade-offs of each when formulating criteria—the mapping to platforms and tools is not the main focus of this course.

| AR | **XR Technology Tree** | VR |

Display
| Hand-held | Head-worn | Head-worn | Room-sized |
| Monitor-based | Spatial | | |

Tracking
Marker-based	Marker-less	Controllers	3 DOF	6 DOF
		Hands		
		Eyes	Outside-in	Inside-out
		Objects		

Tools
| AR.js | Vuforia | AR Foundation | MRTK | Oculus | VIVE | SteamVR | ... |

XR Technology Tree showing the main types of displays (hand-held, head-worn, monitor-based, spatial/projective, room-sized) and classes of tracking technologies (marker-based vs. marker-less, 3 DOF vs. 6 DOF, inside-out vs. outside-in, controllers, hand/eye tracking, object recognition) as well as software tools (not in the focus of this assignment) to create AR or VR applications.

QOC Analysis

As a reminder, here is an example of a QOC analysis from the original article by MacLean and colleagues (see full reference at the end).
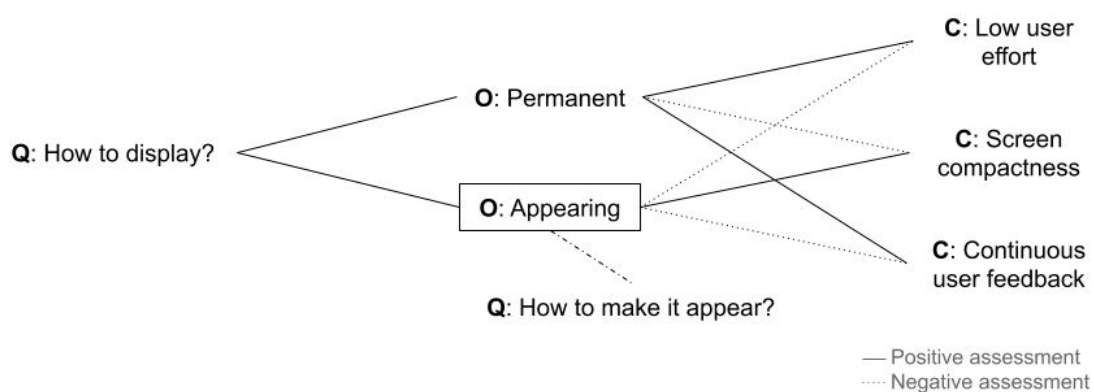
MacLean et al. (1991): Questions, Options, and Criteria: Elements of Design Space Analysis

In this QOC, the question is "How to display?" the content, the options are permanent or appearing, and the criteria are low user effort, screen compactness, or continuous user

feedback. The appearing option is positively assessed and leads to the follow-up question "How to make it appear?", which will in turn trigger its own QOC analysis.

Below are the tips I gave in the XR Decision Tree lecture where I put QOC analysis in the context of XR technology:

Ask questions about the design of specific elements, e.g.:
- How to display the selected furniture in the living room?
- How to track friends playing in the same room/different rooms?
- How to travel in the solar system?
- How to manipulate the planets?
- How to collaborate around the human skeleton?

List design alternatives, not just related options, e.g.:
- 2D vs. 360 vs. 3D content
- Hand-held vs. head-worn vs. projective/spatial vs. monitor-based display
- Marker-based vs. marker-less tracking

Establish criteria that can be objectively assessed and weighed, e.g.:
- Works on any device (only requires camera and marker but no additional sensor)
- No need for instrumentation (no need for placing a marker in the environment)
- Can move around (without paying attention to keeping the marker in view)

References

- Allan MacLean, Richard M. Young, Victoria Bellotti, Thomas P. Moran: ***Questions, Options, and Criteria: Elements of Design Space Analysis.*** HCI 6(3-4): 201-250 (1991)