Aalto University
School of Arts, Design
and Architecture

Coding Virtual Worlds

Intro

Prof. Sebastian J. Schlecht
Jan Vornhagen

Today's outline

- Administration
- Course Goals / Philosophy
- How to learn to code? (Sebastian)
- Git Introduction (Jan)
- Next Assignment (Jan)

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Administration

Course Structure
DOM-E5162 - Coding Virtual Worlds

3 ECTS

Period I, Autumn 2020

Compulsory course in *Building Virtual Worlds* minor studies

Course may not be retaken

Grades are 1 - 5

6 Weeks (7 Sep – 23 Oct 2020)

Mondays 13:15–15:00 (Lecture)

Wednesdays 15:15–17:00 (Workshop)

Attendance in the course is compulsory (minimum 80%)

Round of Introductions

We are …

Sebastian J. Schlecht

Jan Vornhagen

Learning Outcomes

After the course, the students are able to …

- implement a VR scene with a game engine
- explain the infrastructure of VR software
- describe VR usage (UI) and experience (UX)
- perform basics of collaborative/pair coding
- implement basics of VR development concepts

Feedback / Communications

Weekly Questionnaires

- Course Feedback
- Assignment Feedback
- Submit questions

Official questions

- MyCourses Forum
- Email
  - Course related sebastian.schlecht@aalto.fi
  - Assignment related jan.vornhagen@aalto.fi

Unofficial Communication

  - Slack group buildingvirtualworlds.slack.com

Weekly Contact Sessions

Monday (2h) - Lecture
Discussion from DiscoverVR (30 min)
Feedback on last assignment (30 min)
Some Best Practices (30 min)
Prepare for the next assignment (30 min)

Wednesday (2h) - Workshop
Q&A for assignments & coding practices

Workload
Overview

Total 81 h for 3 ECTS

Contact session: 6 x (2 + 2) = 24h
Coding Assignment: 6 x 7 = 42h
DiscoverVR: 6 x 1 = 6h
Reflection: 9 h

Technical Infrastructure

Oculus Quests (in total 15)

XR Studio Otakaari 7 (5 workstations)

Immersive Sound Studio Otakaari 7

Computer rooms (remote desktop)

Takeout laptops (16 Aalto Dell Latitude 7490 Core i5 16GB 512GB SSD 14”)

Oculus Quest
Device

- Loan for the duration of the course
- Be responsible to yourself and others
  - Hygiene
  - Device Maintenance
  - Comfort
  - Be a good VR advocate

Oculus Quest

Why?

All-in-one VR Headset

No need for VR ready PC

Simple deliverables

Oculus Link

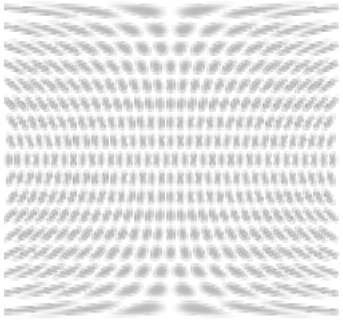
Other HMDs not usable

Oculus Quest
Allocation

- Priority
  - Attendance (now)
  - Building Virtual Worlds Students
  - Registration Order

- Make poll - https://doodle.com/poll/9f75ue7hquewg5p7
- Allocation done later today
- Pick-up at Väre/Studio Takeout

XR Encounter
Extracurricular



VIRTUAL CINEMA LAB

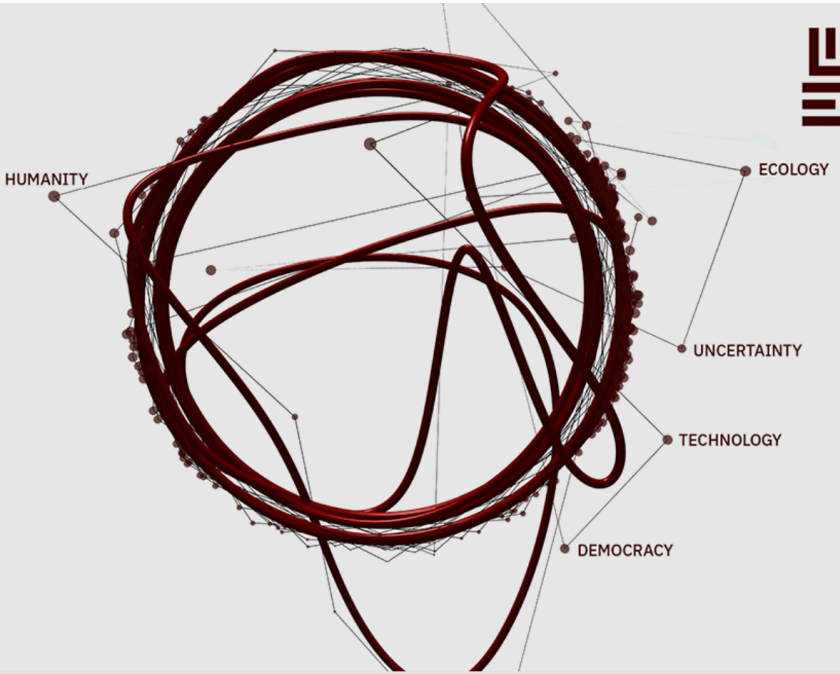
- Joint with Virtual Cinema Lab
- Meet-ups sessions in VR
  - Test Social VR apps
  - Play multiplayer games
  - Watch immersive movies jointly
  - Try out 3D scanning and motion capture
  - …

XR Encounter 1

Ars Electronica

Suitable date: Friday / Saturday afternoon or evening?

Poll - https://doodle.com/poll/p99kdvic7vfzyszn



ARS ELECTRONICA 2020

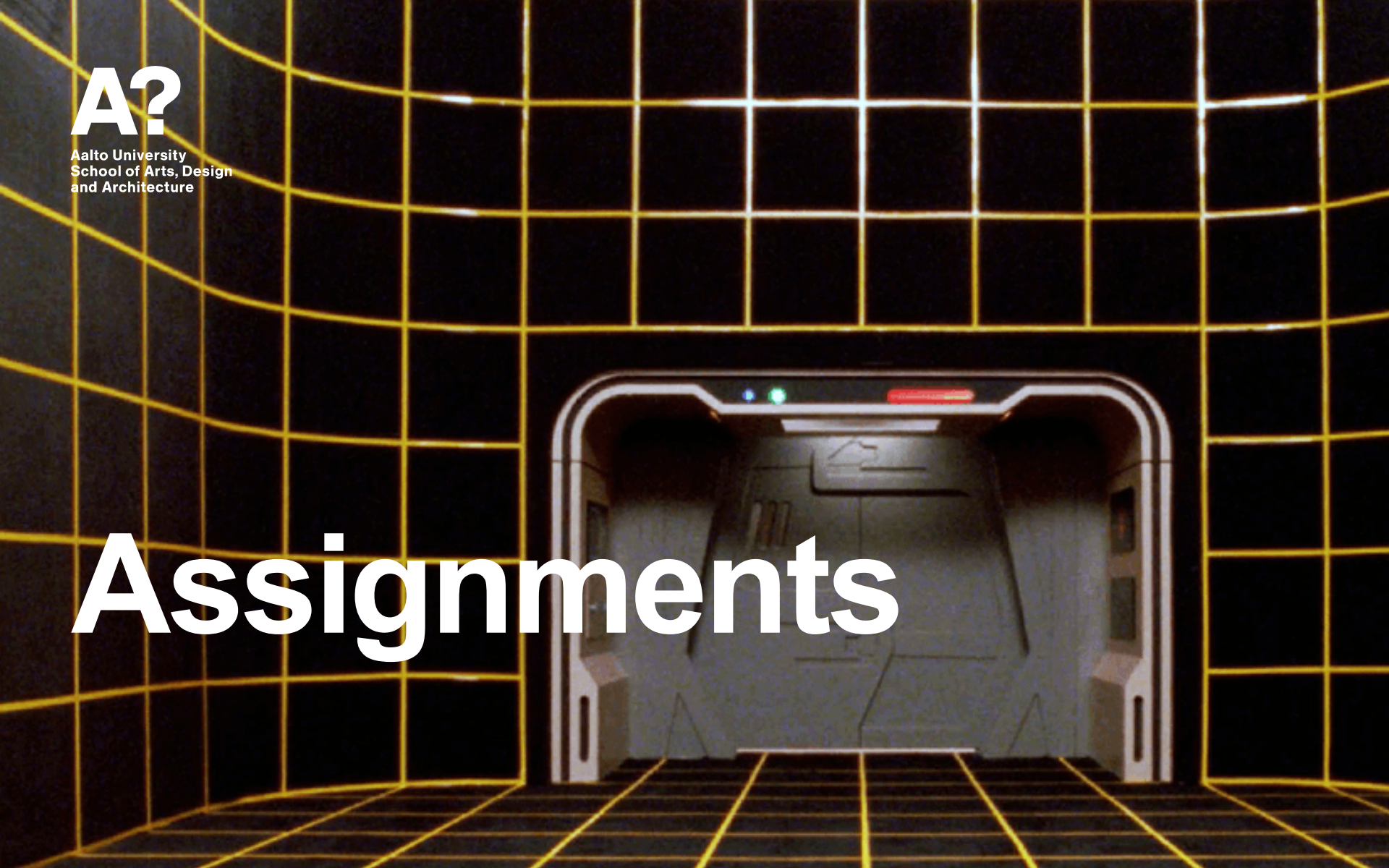
Festival for Art, Technology & Society

9.–13. Sept.

A global journey mapping the ‘new’ world

In Kepler’s Gardens

at JKU Campus, Linz
and 120 other locations worldwide



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Assignments

Assignment
Overview

All assignments are graded on 0-100 scale + 20 extra points

No exam

Final grade weighted average of all assignments

On a scale of 0-5 (0-49 = 0; >50 = 1; >60 = 2; >70 = 3; >80 = 4; >90 = 5)

Deliverable: .apk and Git

Assignment submission Sunday, 23:59

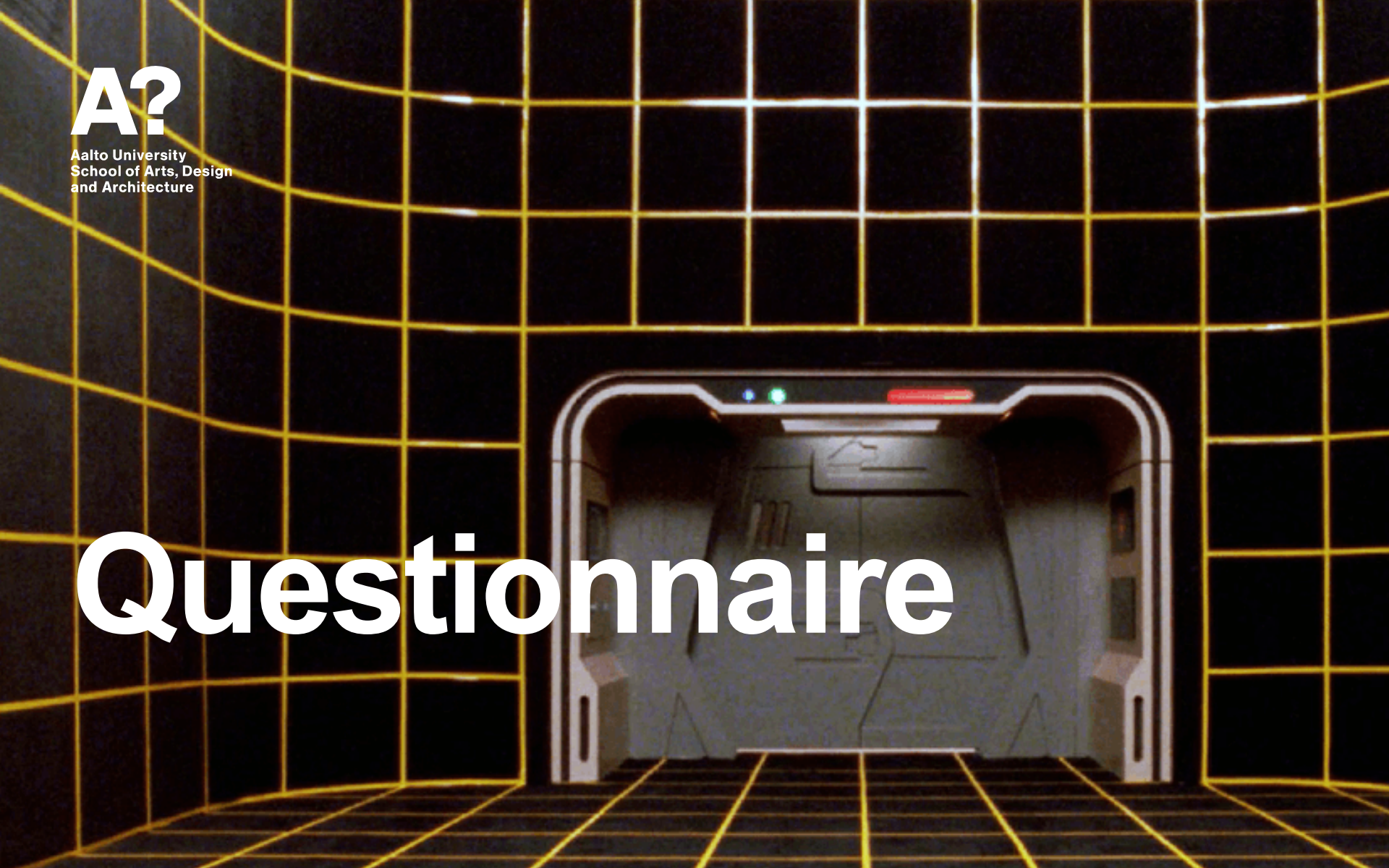
For every starting 24h, there are -10 points.

Course Journey
Assignments

Week	Content	Who
1	Create with Code in Unity	In rotating pairs
2	Introduction to VR in Unity	In rotating pairs
3	VR user interface in Unity	In rotating pairs
4	Designing VR assets	In rotating pairs
5	From Scratch	In groups
6	Final Project	In groups

Course Journey
Discover VR

Week	Experience
1	**Social** Altspace VR, Mozilla Hubs
2	**Game** Beat Saber Demo, Super Hot Demo
3	**Locomotion** Mission:ISS, National Geographic, The Under Presents
4	**Creation** Tilt Brush
5	**Storytelling** 360 Videos, Museum of Other Realities



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Questionnaire

From the Questionnaire
Coding Experience

Most of you …

- **Have some experience in programming (Java(script), Processing, C++, …)**
- **But little experience with C# and Unity except those with Game studies background**
- **No prior experience making VR experiences**

From the Questionnaire
Prior VR experience

- Playing VR games, watch 360 films, other VR experience
- Making cinematic VR
- Designing virtual exhibition
- VR Reading experience
- VR experience with the Oculus Quest

From the Questionnaire
Personal Machines

- Many MacBook Pros
- Unfortunately, Macs are generally quite terrible with VR
- Those > 2017 might be ok to work with
- Oculus Link requires NVIDIA graphics card
- The PC laptops seem good

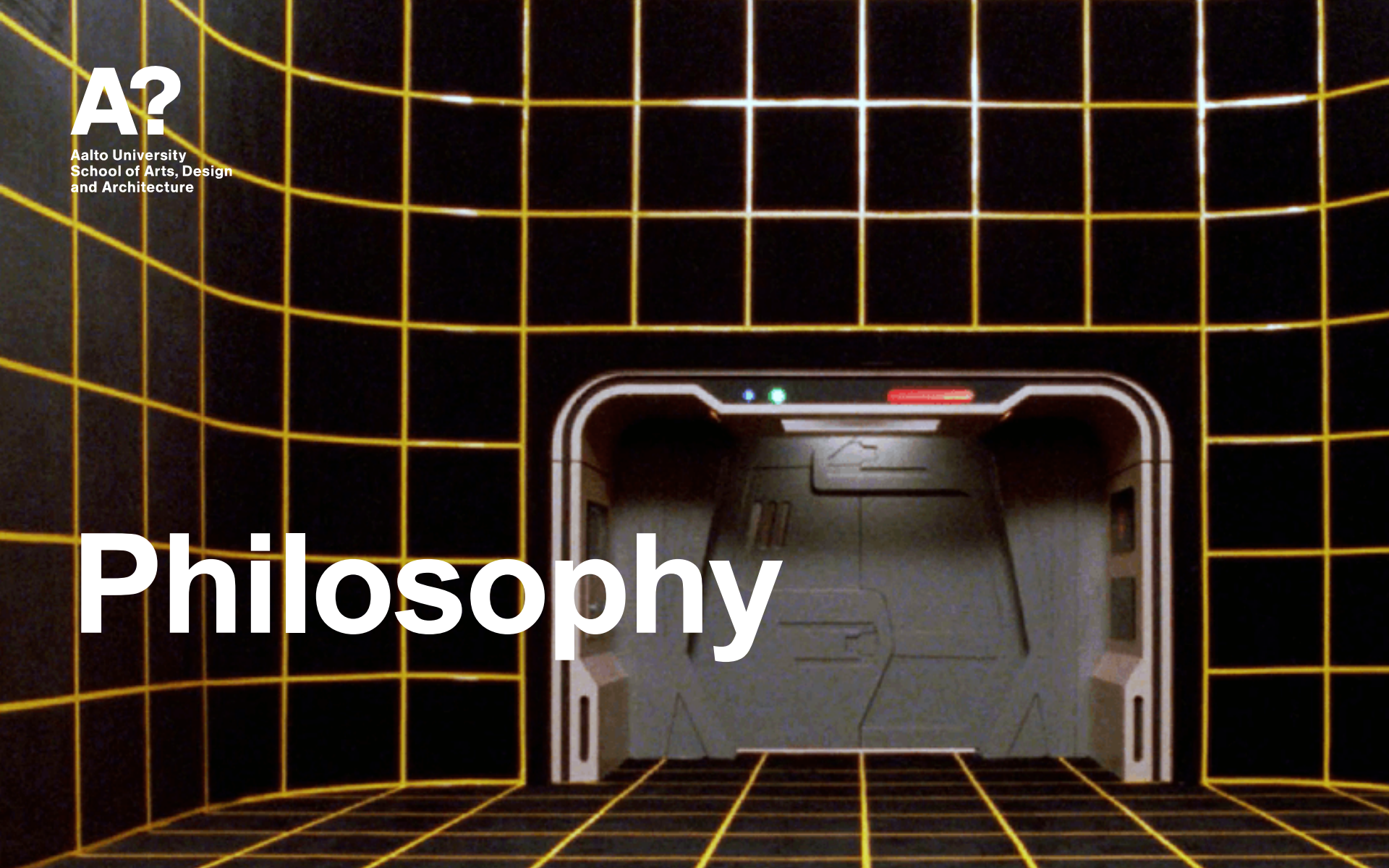
From the Questionnaire

Hope to learn

- Create a VR (or preferably AR) experience using unity
- Sometimes my design was ignored by the engineers because it was not efficient, so I hope to know what types make the program heavy and lead to more aesthetical [results].
- Improve my ability to utilize unity as a tool to make immersive environments
- This course will be the first step for me to step into the virtual world.
- Being fluent enough to prototype ideas quickly.

From the Questionnaire
Comments

- I'm hoping for a hands on class where we get things done in class. (Not a lot of homework)
- I hope assignments could be more flexible directed to graded students (high/medium/normal) who could have a huge difference from each other in understanding of the virtual world.
- I don't have coding or computer science background, so I hope that there are examples that show what can be done with coding in VR context
- Looking forward to the course!



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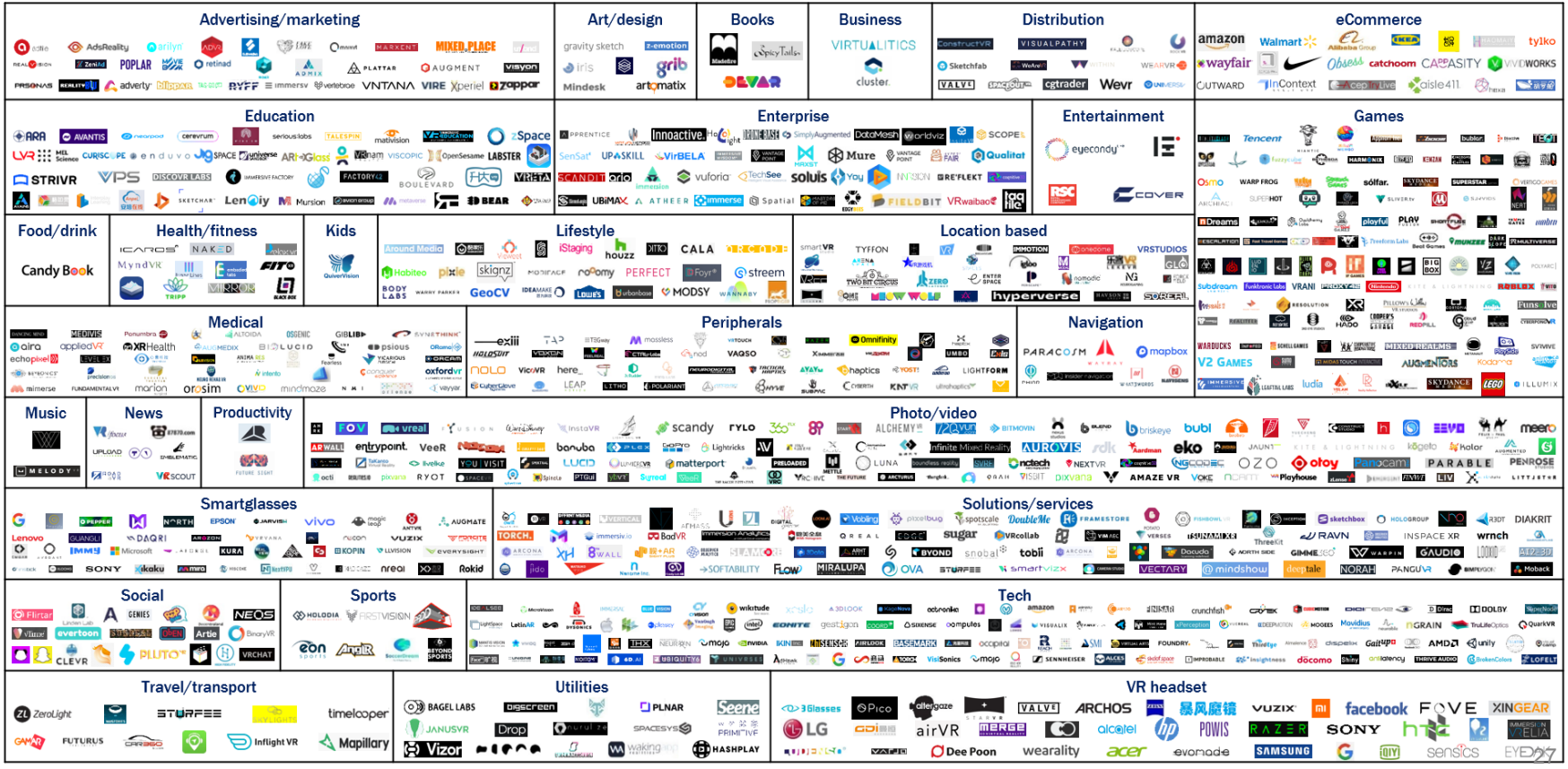
Philosophy

Why learn VR?

A new wave?

AR/VR Leaders*

** selected AR/VR companies that have raised funding or generated significant revenue, plus selected corporates (June 2019)*



Digi-Capital

Why VR and not AR?

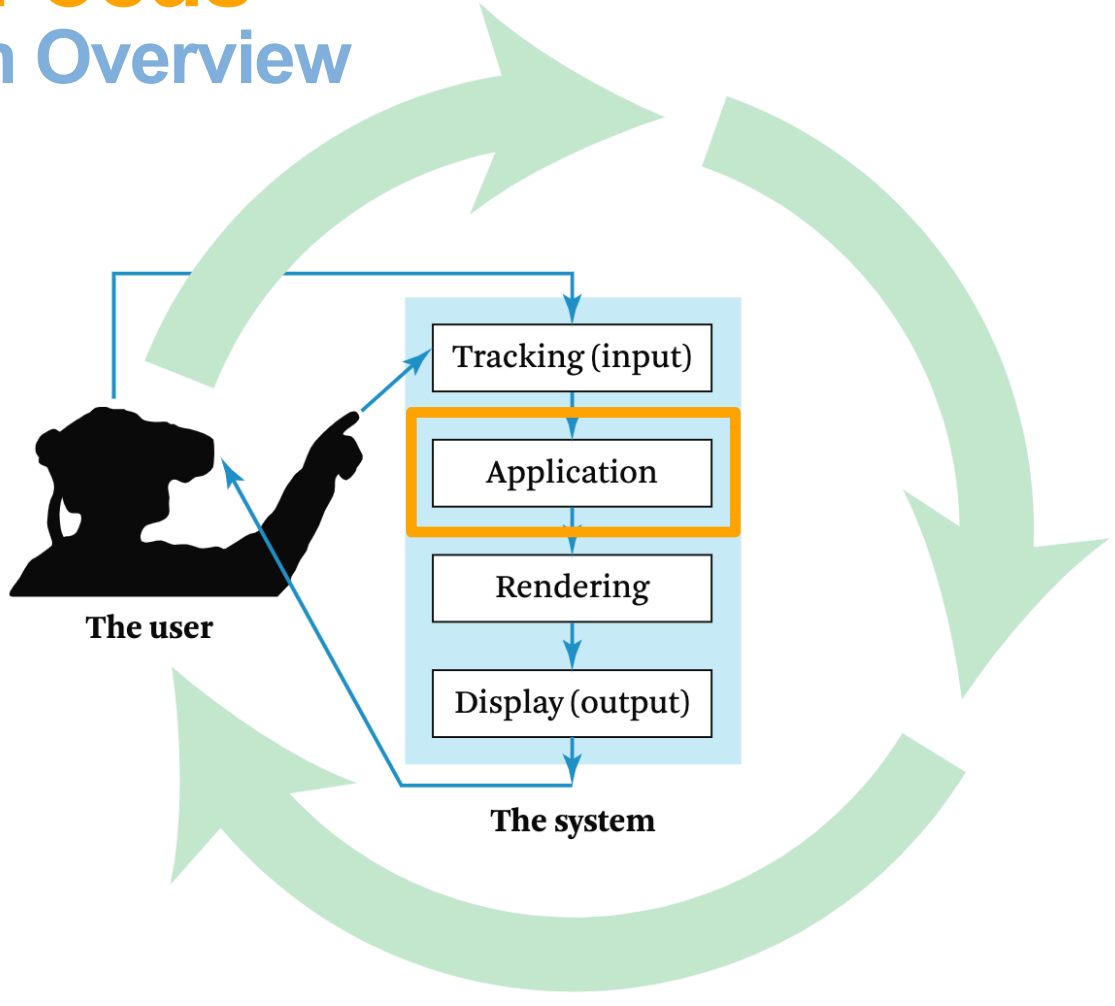
… although AR might be more relevant

VR fundamentals are simpler to learn

- **in-box system**
- **Simpler design and more control**
- **VR design is more mature**
- **VR devices are more mature**
- **AR relies on high-level black boxes**
    - **spatial computing**
    - **Object recognition**

… but many technical/design principles translate to AR

Course Focus
VR System Overview



Why Unity?

… there are plenty of alternatives

- Unreal Engine
- Web XR
- MaxMSP, Processing, etc.

Unity 3D offers

- Modern VR build-in integration
- Large developer community
- Fast iteration cycles

Course Philosophy
Introductory Course in Unity VR

Goal: Self-contained journey from start to first VR experience.

- **Unity + Oculus Quest**
- **Basic Coding**
- **Consistent set of tutorials**
- **Community of learners**

Why taking part in this course?
Make use of the community

All material can be self-taught; fantastic online material.

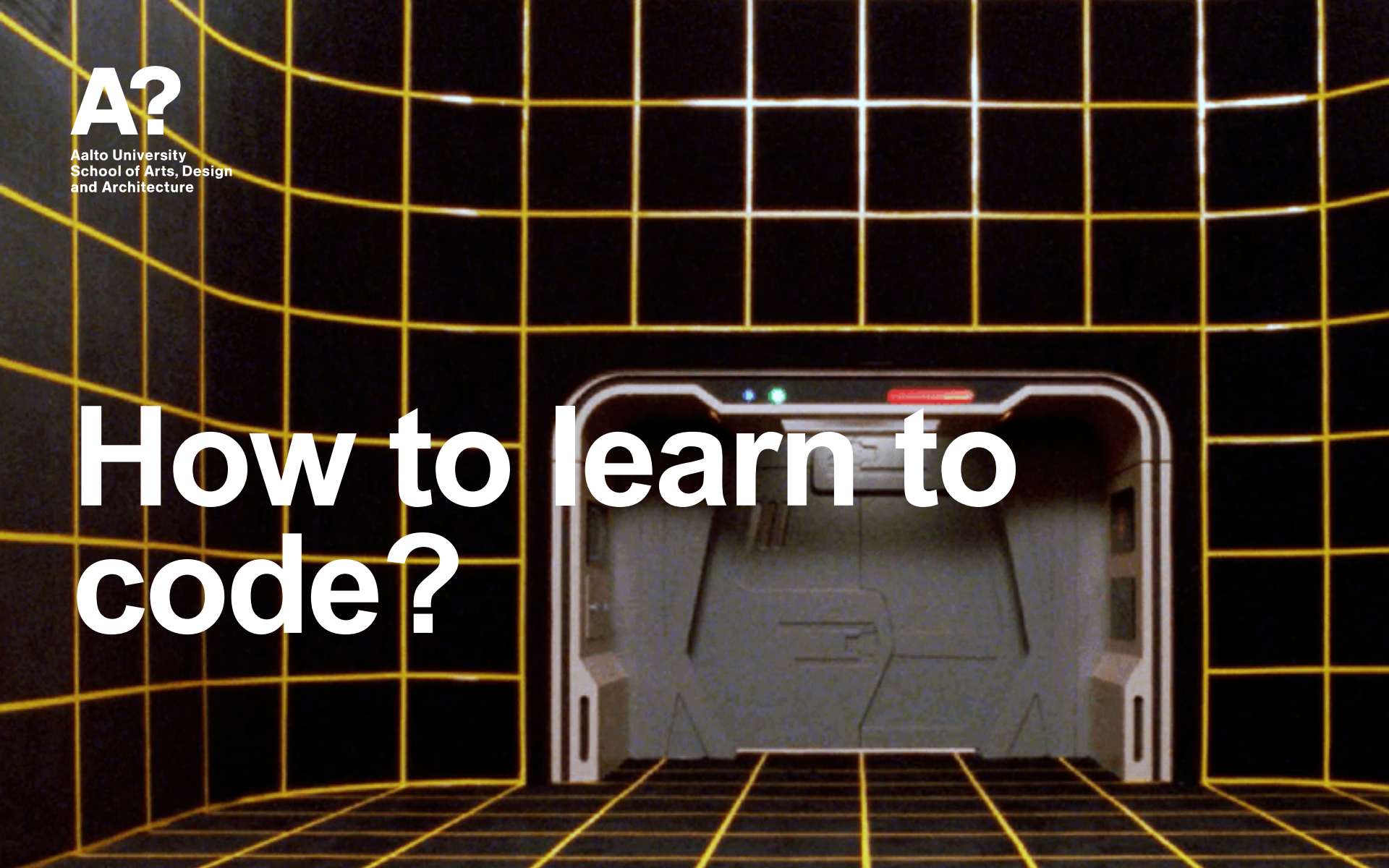
- **Unity Tutorials**
- **Youtube videos**
- **Forums**

Here we give structure and community

- **VR is highly technical and requires well-functioning teams**
- **Learn by teaching others and being taught**

This VR system sucks I want you use XY!

- **Don’t be a loner (if you still want to be then tell us)**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How to learn to
code?

Why learn programming?
Some motivation

Why you should invest in learning programming instead of, e.g., focusing on your other strengths (narrative design, 3d art etc.)

… at least it teaches you how the computer thinks.

Everybody in this country should learn to program a computer … because it teaches you how to think.
- Steve Jobs

How to learn code?
The Designer-Programmer

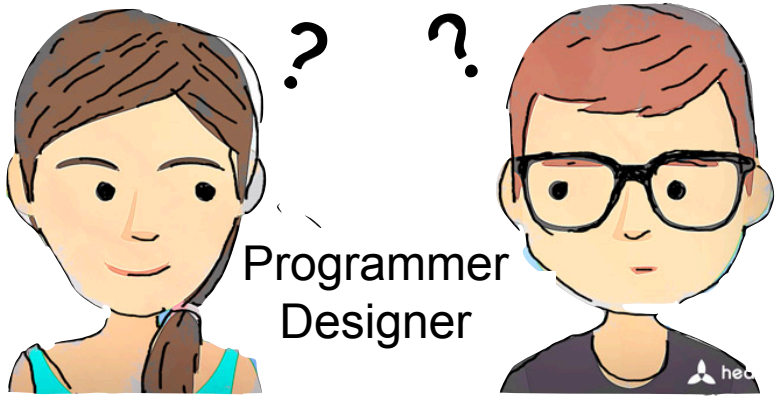
Declared dead in the golden age of AAA games

Resurrected thanks to indie-friendly publishing channels and more efficient development tools

Learning to code has never been this easy

Valuable in interdisciplinary teams and leadership positions

Prototyping is great for communication



How to learn code?

Code is not the solution to everything

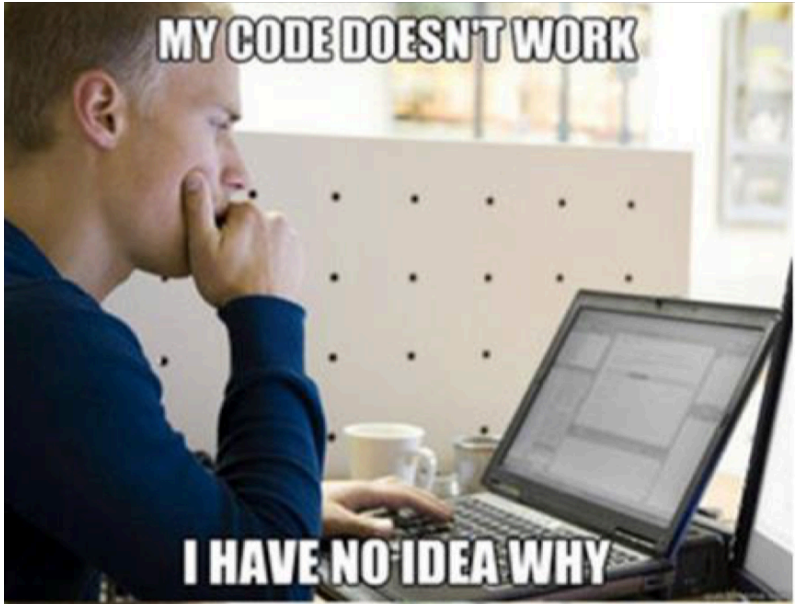
Unity offers powerful GUI and additional packages

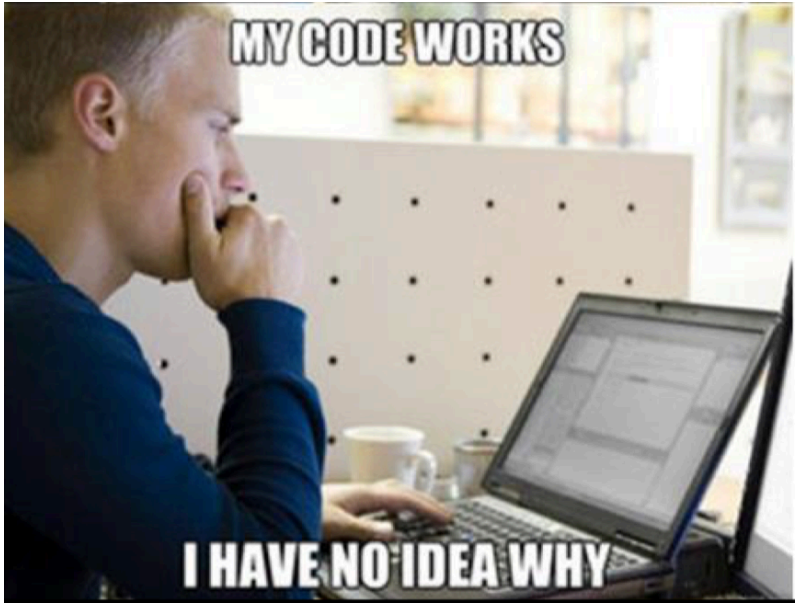
Choose the right tool for the right job

Code often very useful for *glueing* components.

How to learn code?

Programming can be frustrating.



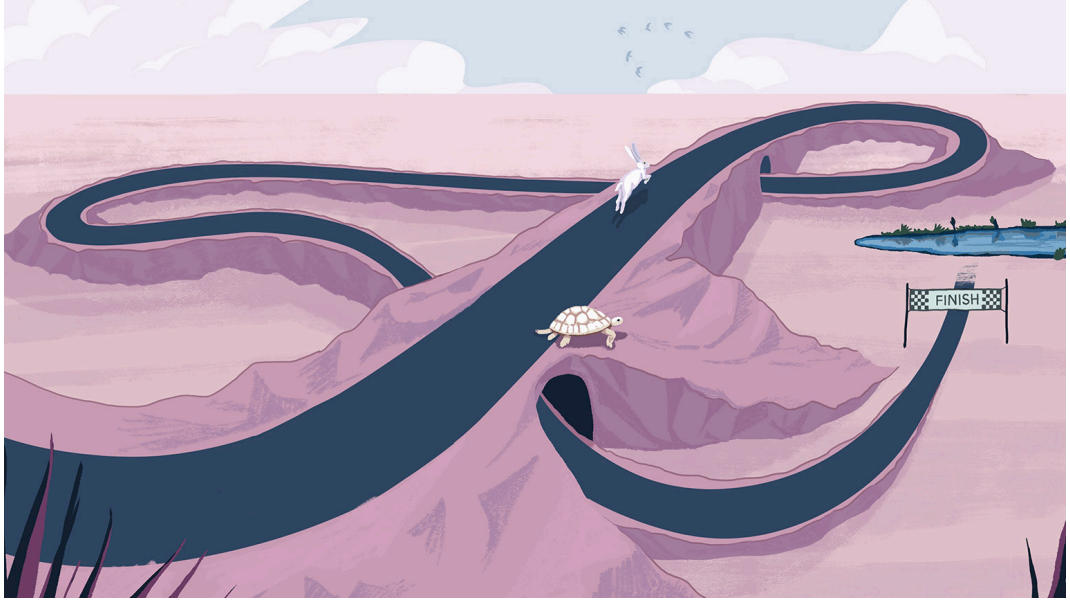


How to learn code?
No pain, no gain

Growth only happens when you're outside your comfort zone.

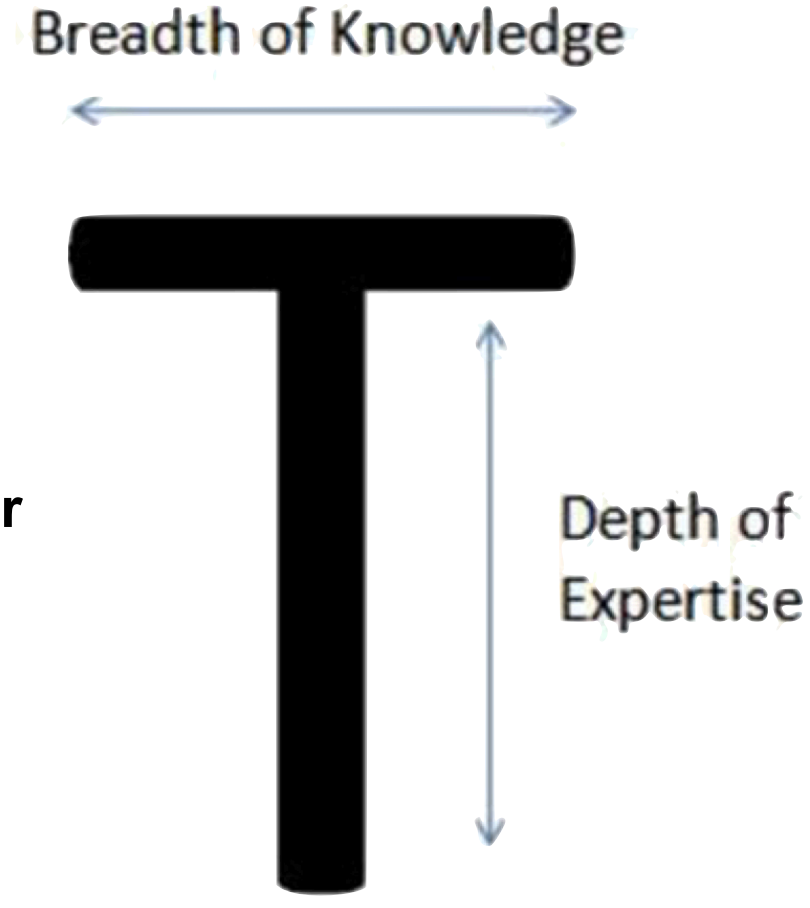
How to learn code?
Learning is an investment

Slowing down to speed up



https://www.mckinsey.com/business-functions/organization/our-insights/the-organization-blog/slowing-down-to-speed-up

T-shaped skills
Communication is key



This course focuses on vertical bar

Pair Programming
Possible Constellation

Driver:

develops code, has control of mouse and keyboard

Navigator:

watches for defects, thinks of alternatives, asks questions

Thinking and doing instead of just doing!

Programming pedagogy research shows clear benefits.

Pair Programming
Benefits

- Higher quality programs
- Decreased time to complete programs
- Greater understanding of the programming process
- Increased enjoyment of programming
- Decreased dependence on teaching staff
- Improved course completion rates
- Improved performance on exames

Pair Programming
Examples

Positive

- **Why are you using an integer type for that variable?**
- **Wouldn't a *for* loop be better for this than a *while* loop?**
- **I don't understand how that expression calculates the values that we are supposed to use.**

Negative

- **If you think that it is right, then it is OK with me.**
- **That is not going to work; you don't know what you're doing.**
- **I am completely lost.**

§

Assignment Carousel

Every week your project gets moved to another student.

Thus

- **You receive a project**
- **You hand over your project**

Therefore

- **You get to see different styles**
- **You need to communicate your choices**

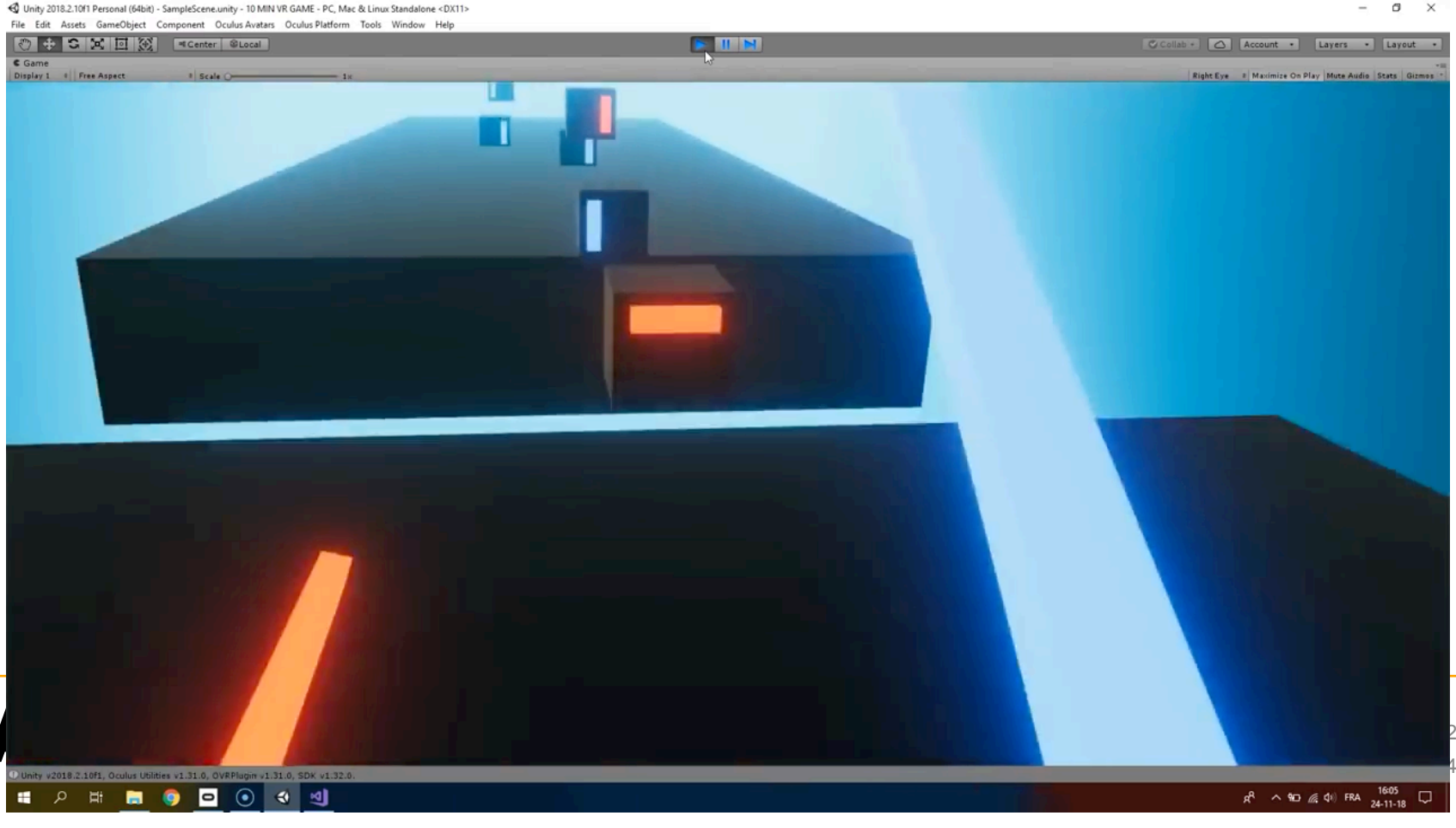
Teacher's Role

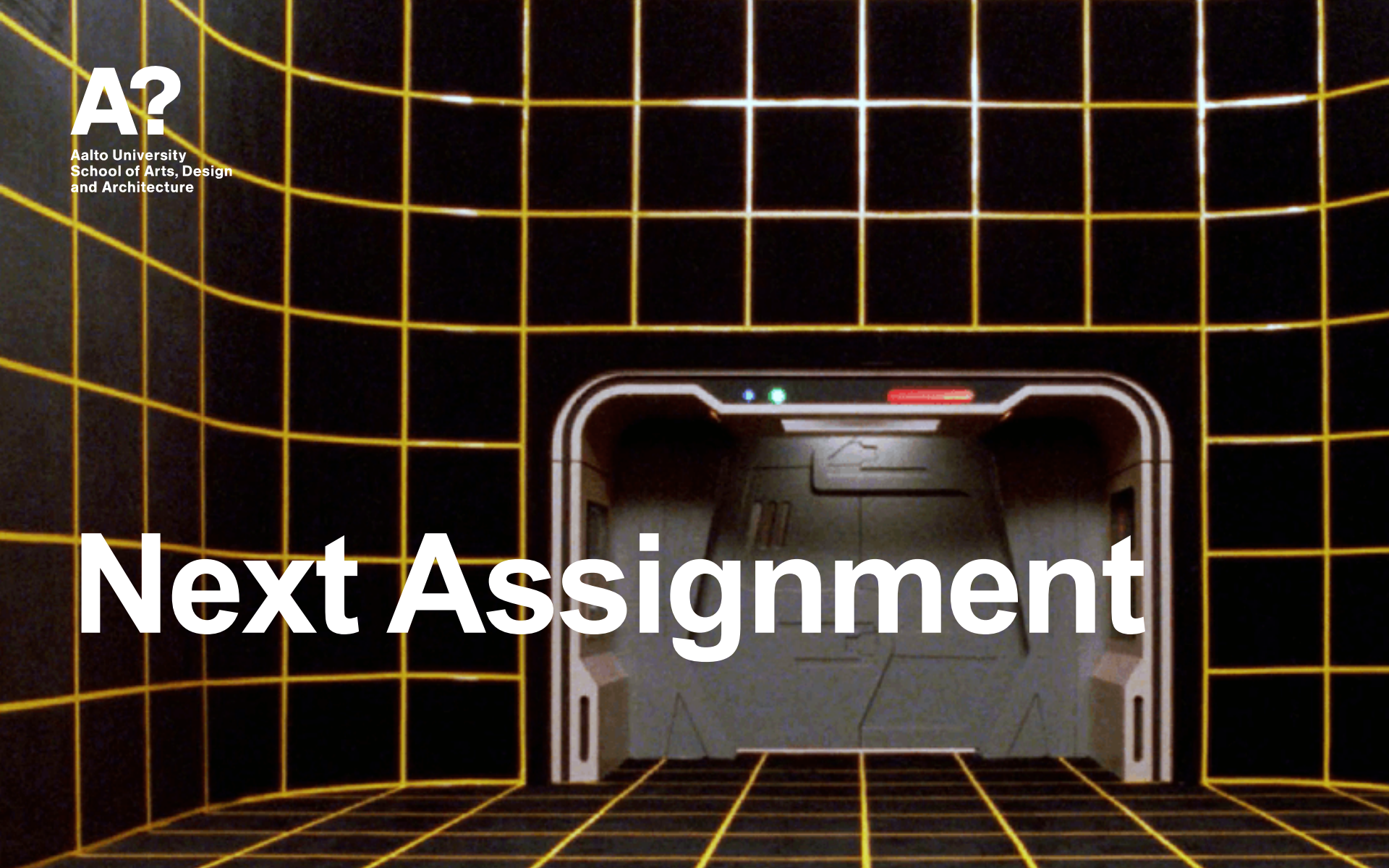
Role of teacher in scaffolding process (Wood et al., 1976).

Role	Description
Recruitment	Maintain the students' interest in the given task
Reduction in degrees of freedom	Making the task manageable
Direct maintenance	Keeping the students on task
Marking critical features	Highlighting feature that can help the students to accomplish the task
Frustration control	Motivate the students and provide timely guidance so that they would not feel frustrated and would like to give up
Demonstration	Role model the process required

At the end of the road

Example Final Project

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Next Assignment

First Assignment
Learning Goals

Learn to use version control (git)

Know your way around Unity (editor, Visual Studio, etc.)

Very basics of programming (loops etc)

Finding information and understanding the error messages (this is the most difficult part)

Next Assignment
Version Control

Next Assignment
Let’s start