Sensing Virtual Reality:
Practical Seminar on Dynamic Passive Haptics

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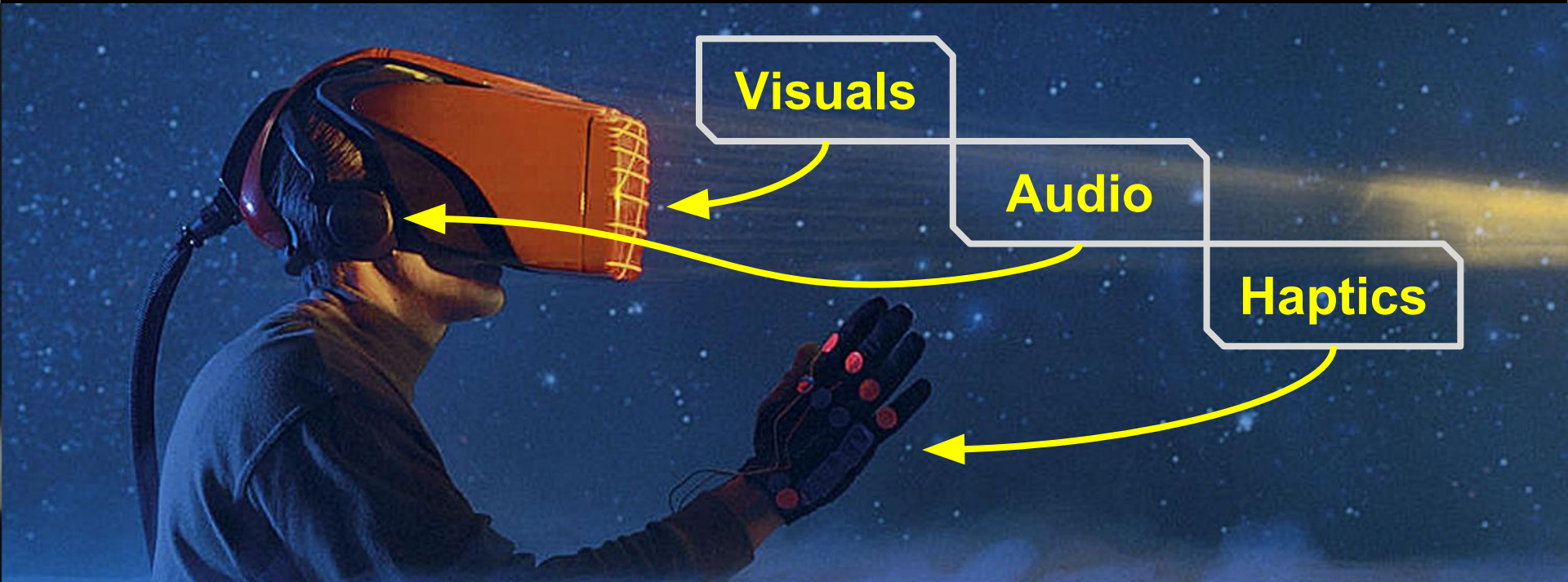
Seminar Kick-Off

29.10.2018

30 JAHRE DFKI

UNIVERSITÄT DES SAARLANDES

Breaking down a Virtual Reality experience ...



Virtual Reality Interaction Today

Build your own haptic VR controller!

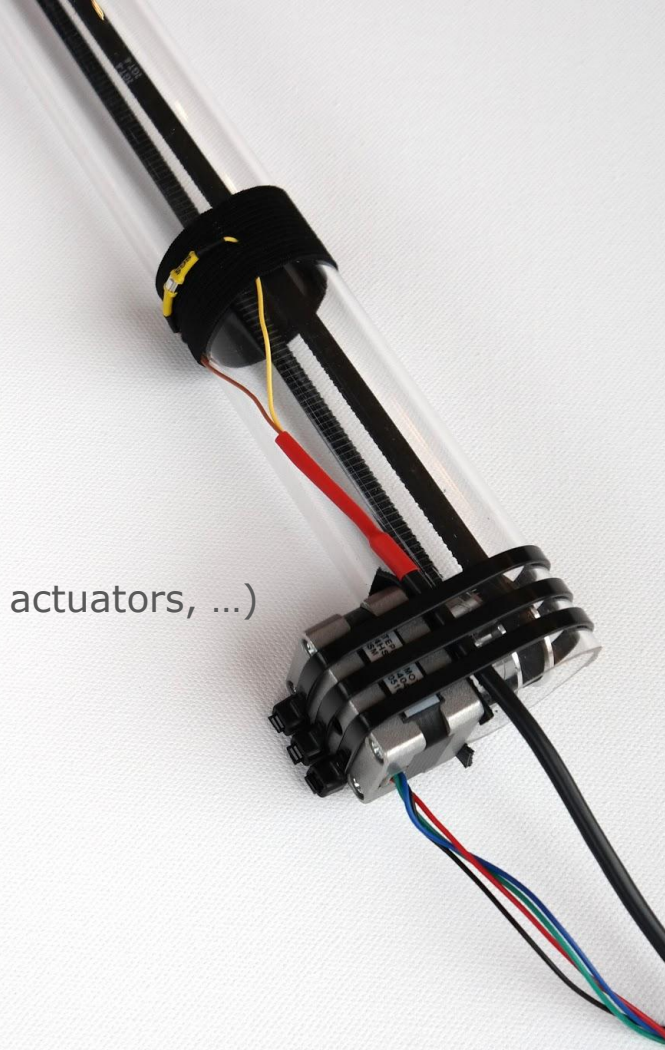
… using dynamic passive haptics;
… in groups;
… from initial concept to working prototype!

Learning Objectives

- understanding the **design process** of dynamic passive haptic devices

- gain **hands-on** experience in
  - creating a haptic VR controller
  - embedded systems development (Arduino, sensors, actuators, …)
  - digital fabrication (3D printing, laser cutting, ...)

- **integration** of low-level (Arduino) with high-level (Unity 3D engine) systems

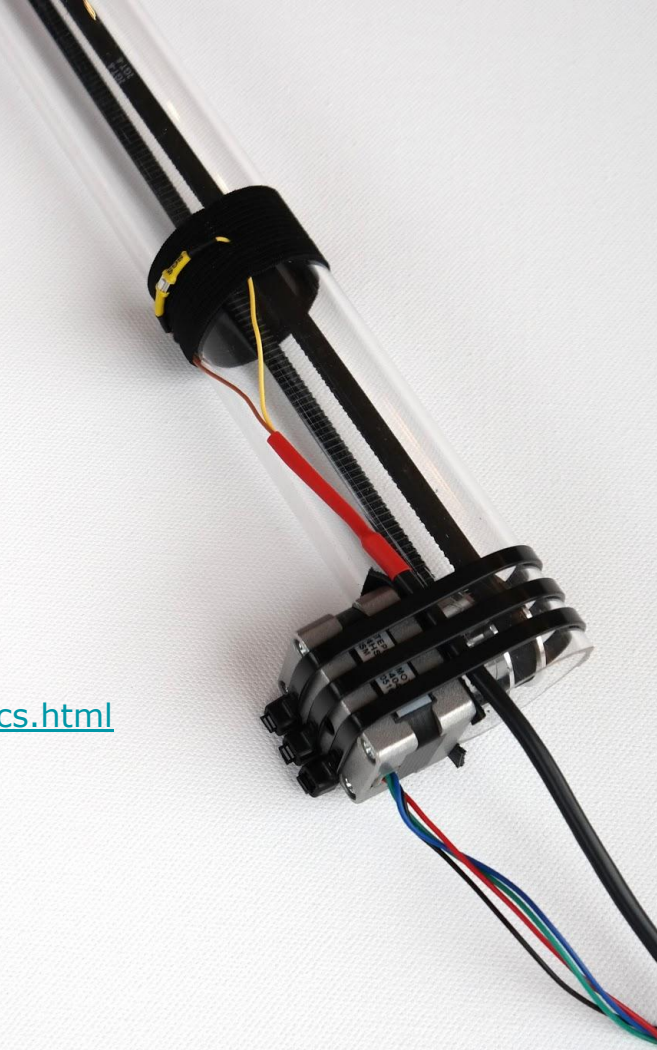


Seminar Structure

- Team:
  - André Zenner — Andre.Zenner@dfki.de
  - Donald Degraen — Donald.Degraen@dfki.de
  - Felix Kosmalla — Felix.Kosmalla@dfki.de
  - Dr. Florian Daiber — Florian.Daiber@dfki.de

- Schedule & details online:
  http://umtl.cs.uni-saarland.de/teaching/winter-2018-2019/sensing-virtual-reality-practical-seminar-on-dynamic-passive-haptics.html

- Piazza:
  we'll enroll you → please check your emails!



Seminar Schedule

- **29.10.2018** Kick-Off & Intro to DPHF

1 week

- **05.11.2018** Pitch of Ideas & Tech Background

1 week

- **12.11.2018** Announcement of Topics
  … @ 23:59 ***Deadline:*** Vote for Preferences
- **13.11.2018** Announcement of Group Assignments

Seminar Schedule

1 week

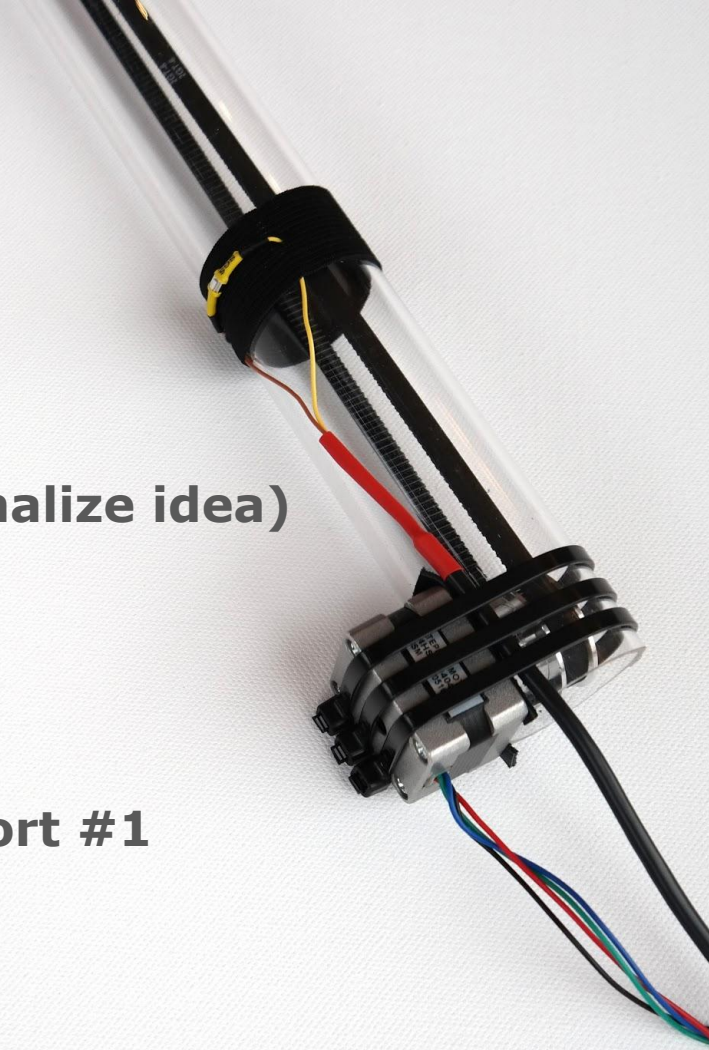
- **19.11.2018** **Concept Presentations**

2 weeks **(meet with advisor & finalize idea)**

- **01.12.2018** **Start Work**

2 weeks

- **17.12.2018** ***Deadline:*** **Progress Report #1**



Seminar Schedule

4 weeks

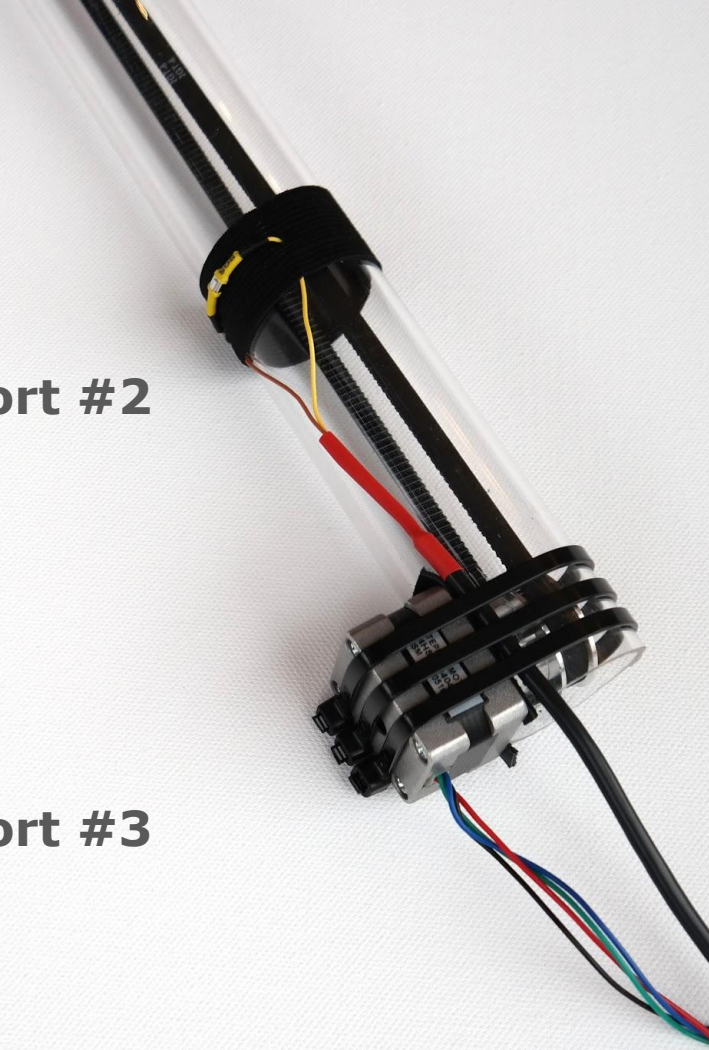
- **14.01.2019** **Deadline: Progress Report #2**

2 weeks

- **28.01.2019** **Mid-Term Presentations**

2 weeks

- **11.02.2019** ***Deadline:*** **Progress Report #3**



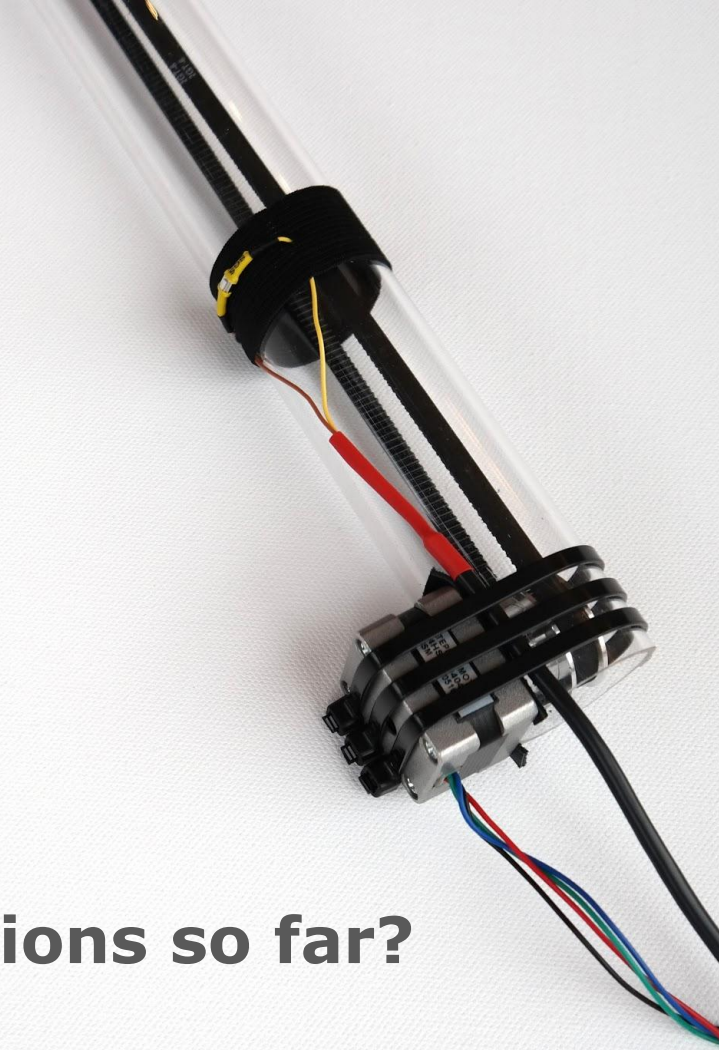
Seminar Schedule

2 weeks

- **25.02.2019** **Final Presentations**

1 week

- **04.03.2019** ***Deadline:*** **Final Report**



Any organizational questions so far?

Grading

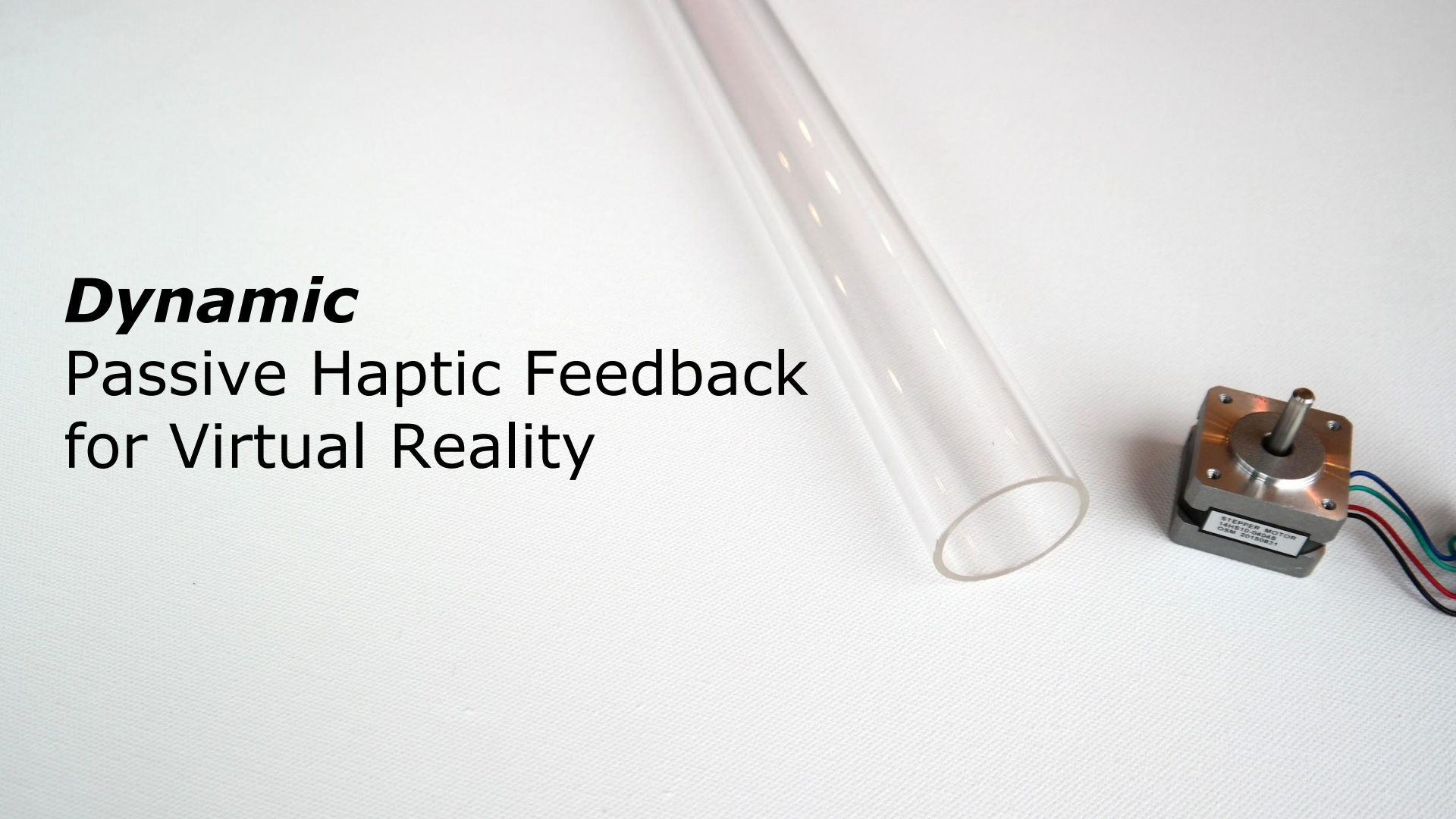
• 17.12.2018	Progress Report #1	10%
• 14.01.2019	Progress Report #2	10%
• 11.02.2019	Progress Report #3	10%
• 25.02.2019	Final Presentations	40%
• 04.03.2019	Final Report	30%
	Total	100%

→ All deadlines are hard deadlines and mandatory!

→ The attendance to all scheduled meetings is mandatory!

→ Pitch of Ideas & Mid-term Presentations are not graded

Dynamic
Passive Haptic Feedback for Virtual Reality



Haptic Feedback

tactile

surface and touch details

receptors in the skin

e.g. pressure, vibration, texture, …

kinesthetic

greater forces, body angles

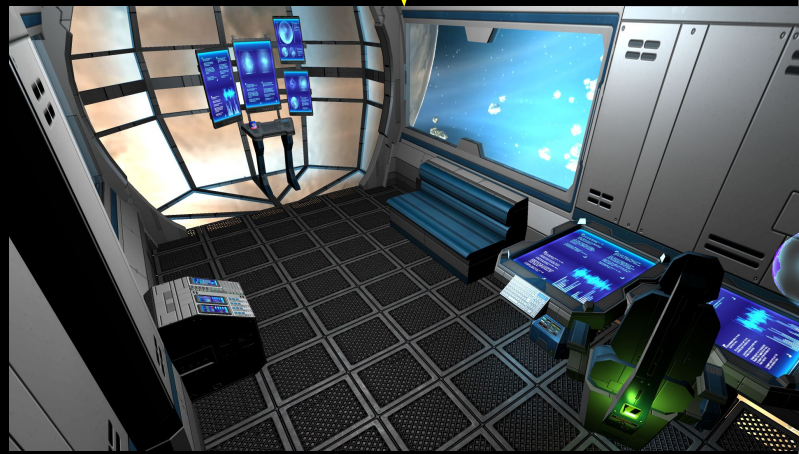
receptors in joints, tendons, muscles

e.g. size, weight, shape, …

The Haptic Feedback Continuum

Passive Haptics Significantly Enhances Virtual Environments [Insko – 2001 – PhD Dissertation]

Substitutional Reality
[Simeone et al. - CHI 2015]



[The VOID - 2015 - https://youtu.be/cML814JD09g]
see 0:49 and 1:37

The Haptic Feedback Continuum

Passive Haptics — **Mixed Haptics** — **Active Haptics**

Dynamic Passive Haptics

- **physical** objects represent **virtual** objects
- users **feel the real object** when interacting with the virtual object in VR
- physical object called ***prop*** or ***proxy***

- **Pros:** realistic haptics & low-complexity
- **Cons:** inflexible (user needs to switch props)

The Haptic Feedback Continuum

Passive Haptics

Active Haptics

Mixed Haptics

Dynamic Passive Haptics

standard VR controllers offer vibrotactile feedback (here: HTC Vive)

Grounded Active Haptic Interface
[Massie et al., 1994, PHANTOM]

Human-Scale Bimanual Haptic Interface
[Hulin et al., Enactive ’08, HUG]
https://www.dlr.de/rm/en/desktopdefault.aspx/tabid-11704

The Haptic Feedback Continuum

Passive Haptics **Active Haptics**

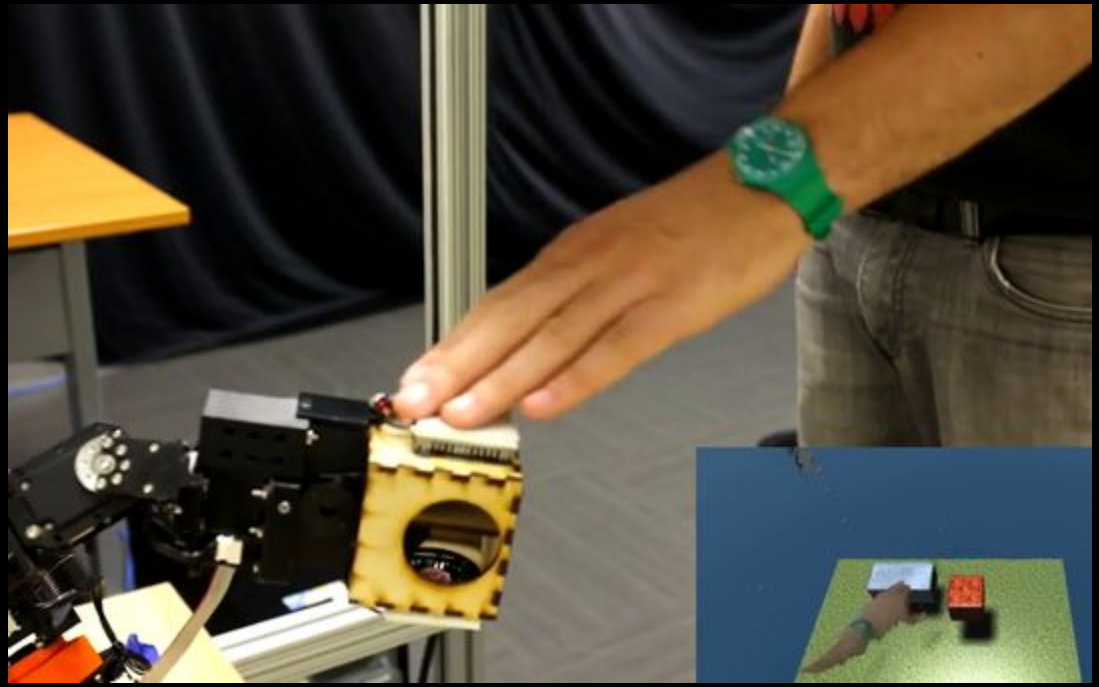
Mixed Haptics

Dynamic Passive Haptics

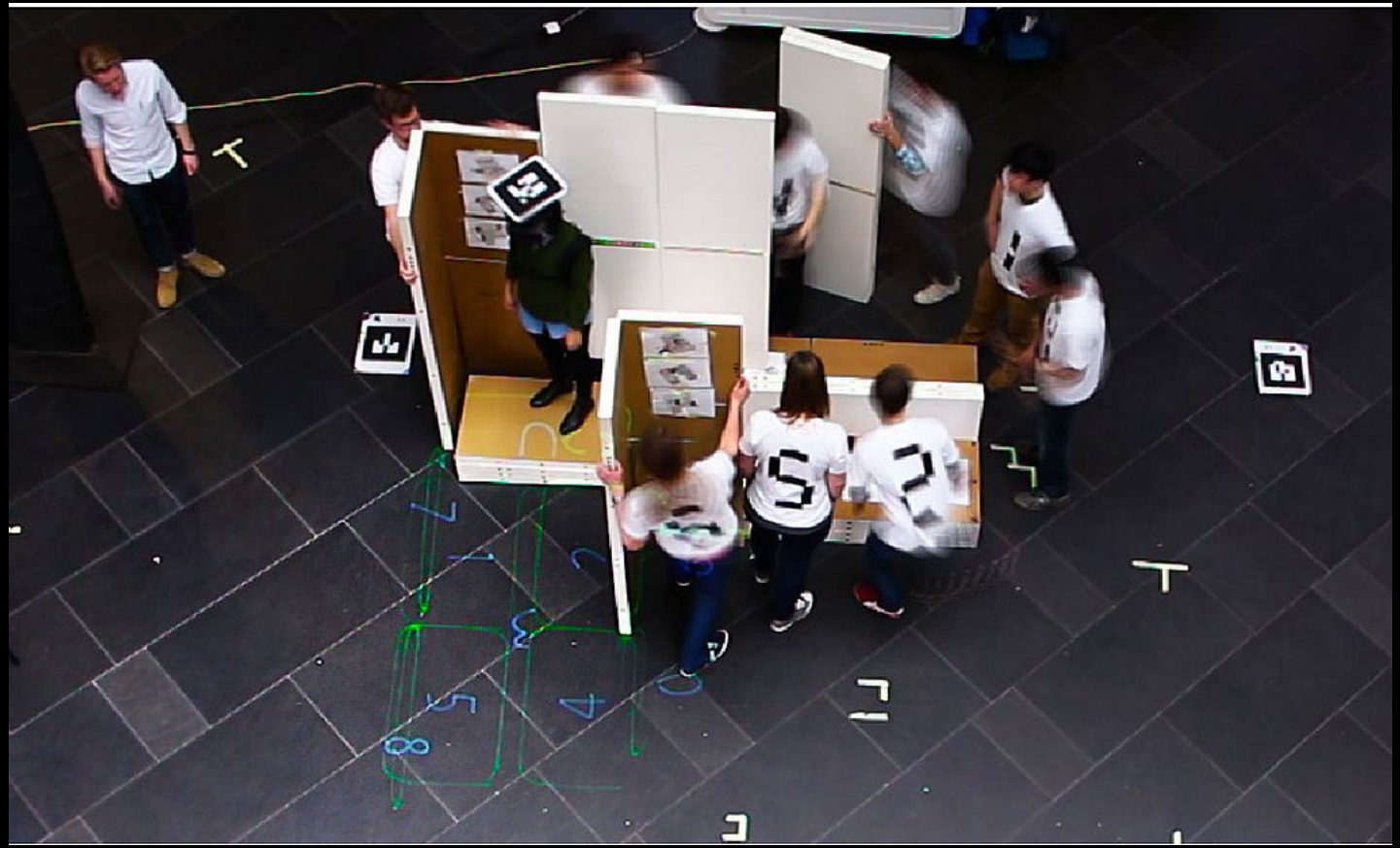
- virtual forces are **simulated**
- **actuators (e.g. vibration motors, robots, …)** actively exert forces/stimuli on the user
- users **feel stimuli/forces exerted by actuators**

- **Pros:** realistic haptics & flexibility
- **Cons:** high-complexity, expensive & limited workspace

The Haptic Feedback Continuum

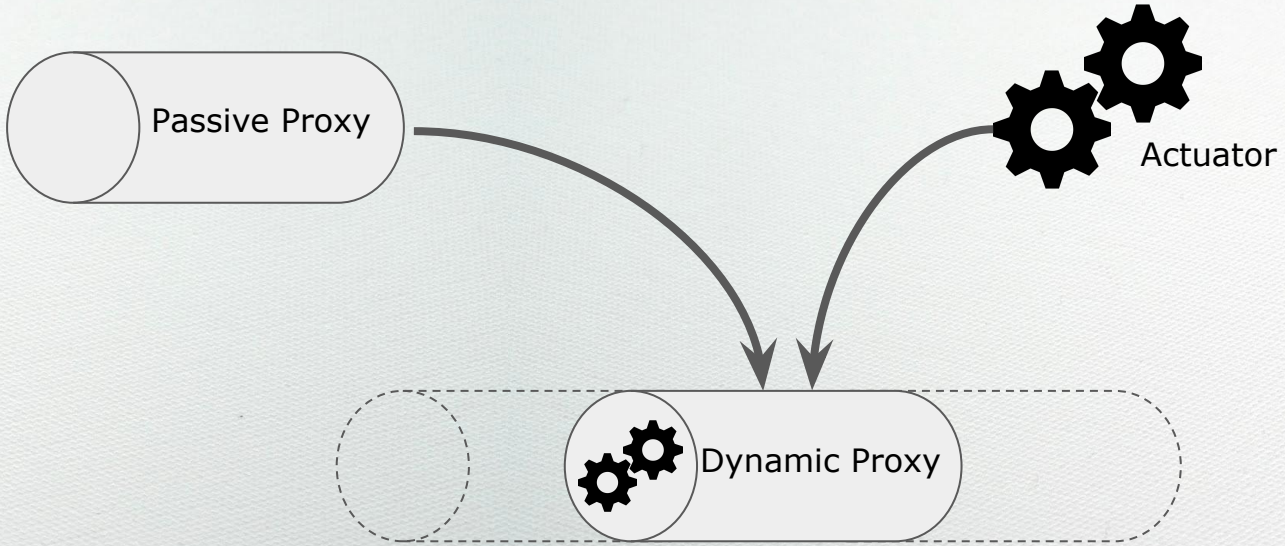


Encountered-type Haptics
[Araujo et al., TEI'16, SnakeCharmer]
https://www.youtube.com/watch?v=I3ue35F3CSg



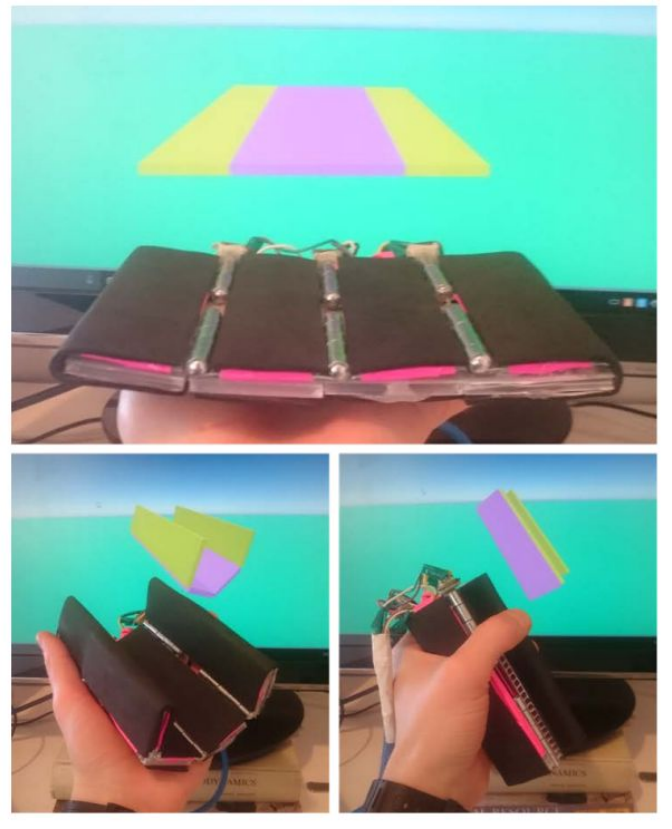
Actuation Based on People
[Cheng et al., UIST'15, TurkDeck]
https://www.youtube.com/watch?v=8ZaC_kyF6wo

Dynamic Passive Haptics (DPHF)



Dynamic Passive Haptic Feedback
[Zenner et al., TVCG'17, Shifty]
https://www.youtube.com/watch?v=1l0wKk6q_ss

Fabricated Mixed Haptic Feedback
[Whitmire et al., CHI'18, Haptic Revolver]
https://www.youtube.com/watch?v=5sRKh3rPzyA



Shape Changing Prop
[McClelland et al., SUI'17, Haptobend]
https://www.youtube.com/watch?v=-avsW_0wY7Q

The Haptic Feedback Continuum

Passive Haptics **Active Haptics**

Dynamic Passive Haptics

- **combines** passive and active feedback
- uses **props**
- uses **actuators**
- stimuli can be more passive or active (**continuum**)

- **aims to combine the Pros of both worlds**

Next Steps …

Brainstorm your own Haptic Device for VR

Getting started…
→ Explore the related work
→ Brainstorm interesting properties to simulate
→ Think about what is missing in VR
→ Think about what you (or others) find useful

Don’t restrict yourself!
→ Focus on creativity and novelty
→ Basis for further discussion

Next Steps …

Brainstorm your own Haptic Device for VR

Requirements:

1. What virtual property to communicate?
2. How to communicate the feedback?
3. Initial set of requirements
    a. Hardware
    b. Software
    c. Implementation

Next Steps …

Brainstorm your own Haptic Device for VR

Task 1:
Prepare 1 slide showcasing your idea
→ Send via email (in PDF Format!) to all advisors!

Deadline: **04.11.2018, 23:59**

Task 2:
Prepare 3 min elevator pitch
→ Present during next session
→ Monday **05.11.2018, 12:15**

Questions?

Ask now to get “feedback”