4TU. CENTRE FOR ENGINEERING EDUCATION

Mixed reality for collaboration and understanding

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TU Delft Delft University of Technology

TU/e Technische Universiteit Eindhoven University of Technology

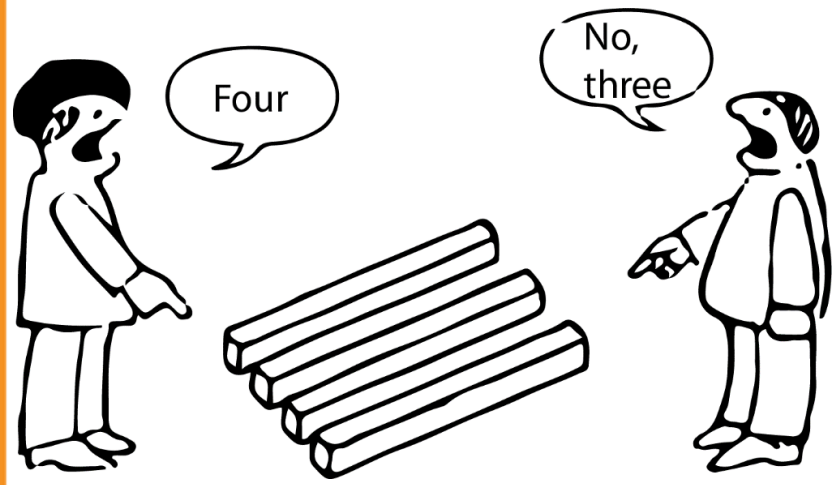
UNIVERSITY OF TWENTE.

WAGENINGEN UNIVERSITY & RESEARCH

Roy Damgrave

Background:

- BSc. Industrial Design (TU/e)
- Msc. Industrial Design Engineering (UT)
- PhD. Design Tools in Synthetic Environments (UT)



Expertise:

- Industrial Design Engineering
- Management of Product Development
- Virtual & Augmented Reality
- IoT
- Smart Industry

Current courses:

- Technical Product Modelling
- Intellectual Property in Product Development
- Advanced 3d Modelling
- Virtual Product Development
- VR & Advanced Interaction
- Business models
- Virtual Reality
- Manag. of Product Development

Virtual-Reality Lab & Smart Industry Lab


Gillette
Fusion

THE USE OF VR/AR/MR IN EDUCATION

- VR as educational subject
- VR as tool
  - for the students
  - for the lecturer

We educate the use & development of VR, but our main focus is on using VR as a design tool.

OUR VISION ON VR

Multidisciplinary design

- Combine expertise
- Share thoughts and opinions
- Understand the interdependences between expertise areas of different stakeholders
- Enable fast decision making
- Incorporating external expertise
- Collaborate with local and remote stakeholders

In order to utilize the expertise of all different stakeholders to its fullest extent, the way of mutual interaction should be as little disrupting and distracting as possible.

WHAT SHOULD VR OFFER?

- Output must be more than the sum of the inputs
  - Added significance and value
- Observation/interaction on other aggregation level than input
  - Enable communication between different expertise
  - Only show the data relevant for the stakeholder
- Support the learning process
  - Virtual model offers opportunity and reaction

VR FOR ENGINEERING

- Design Engineering
  - Management of product development
- Decision making support
- Product communication
- Product simulation
  - Assembly
  - Installation
  - Use
  - Maintenance
  - Disposal
  - … etc

Broad focus

- Augmented reality in combination with
  - Internet of Things (IoT)
  - Collaborative robots
  - Drones
  - Data management

- Understand/train/enhance
  - Products
  - Machines
  - Factories
  - User behaviour
  - ….

Goal

A set of tools and techniques providing the ability to experience …

- something you can't normally see
- locations where you can't be (now)
- something you don't dare (yet)
- modifications (before spending the money)
- risks
- interaction and interaction designs
- provided information

while saving resources

It's always about

understanding possibilities

Artificial reproduction of a potential reality or use condition that enables users to experience and/or modify and/or to interact with it

Stimulate the human to:

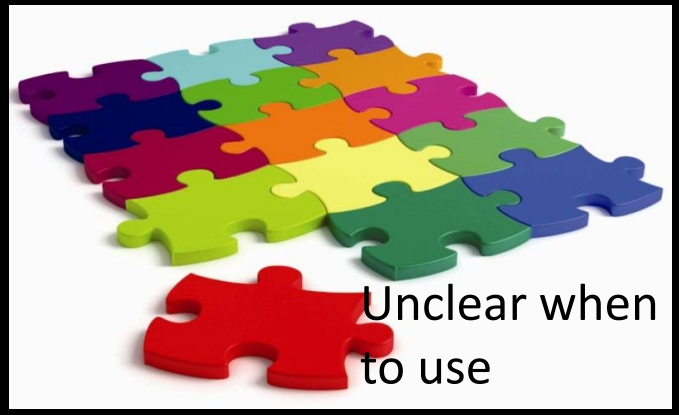
Experience	• Perception of the situation • Stimulate the senses
Modify	• Alter the situation
Interact	• Respond to the given information • Two or more objects have effect upon each other

With an envisaged reality or use condition

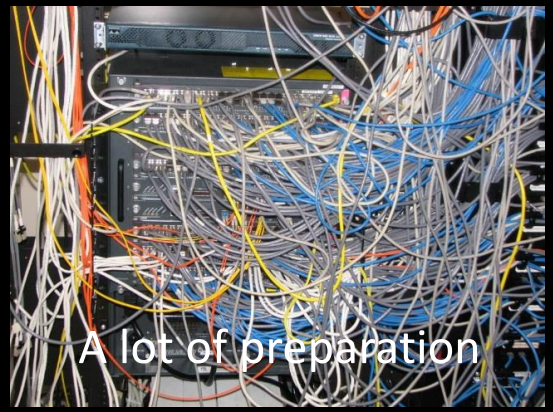
It's not the goal to win ***the game***

PREJUDICES


Expensive


Unclear when
to use


Specialistic

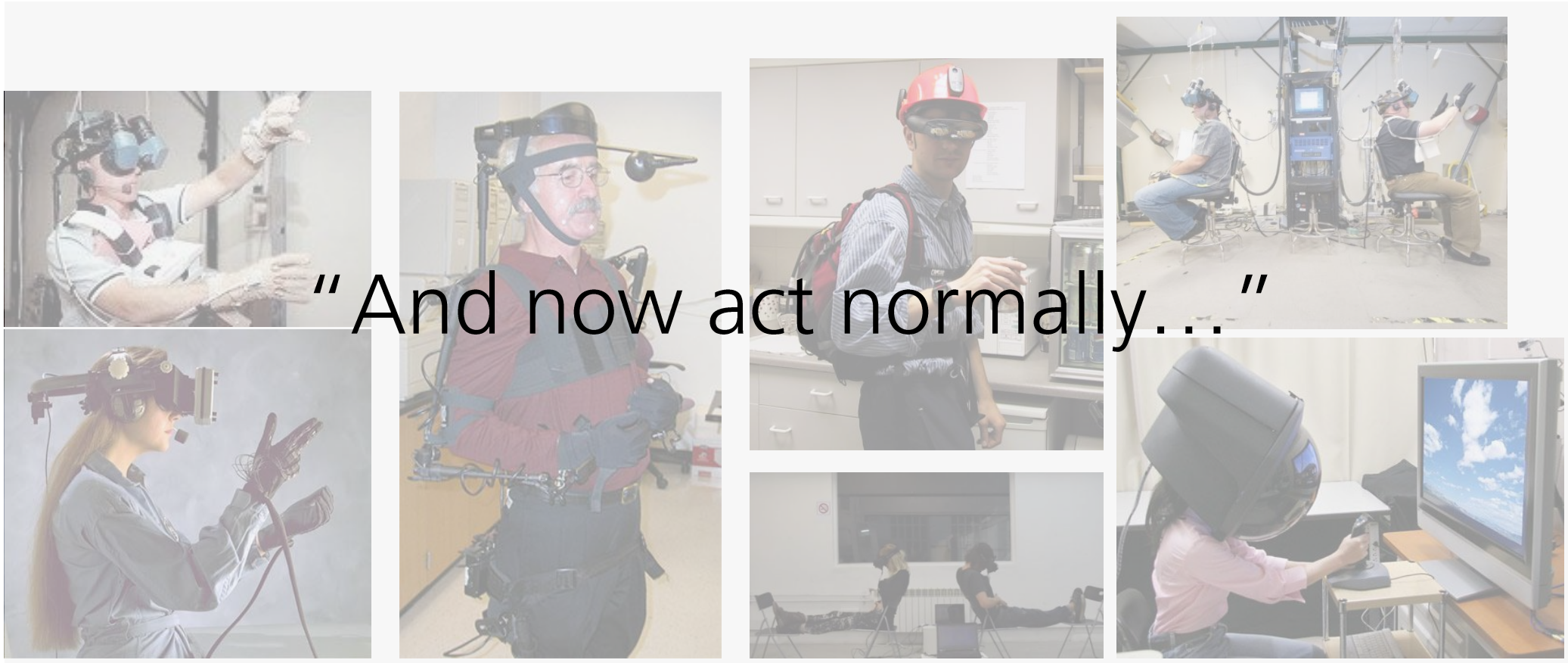

A lot of preparation


When will it
recover the costs

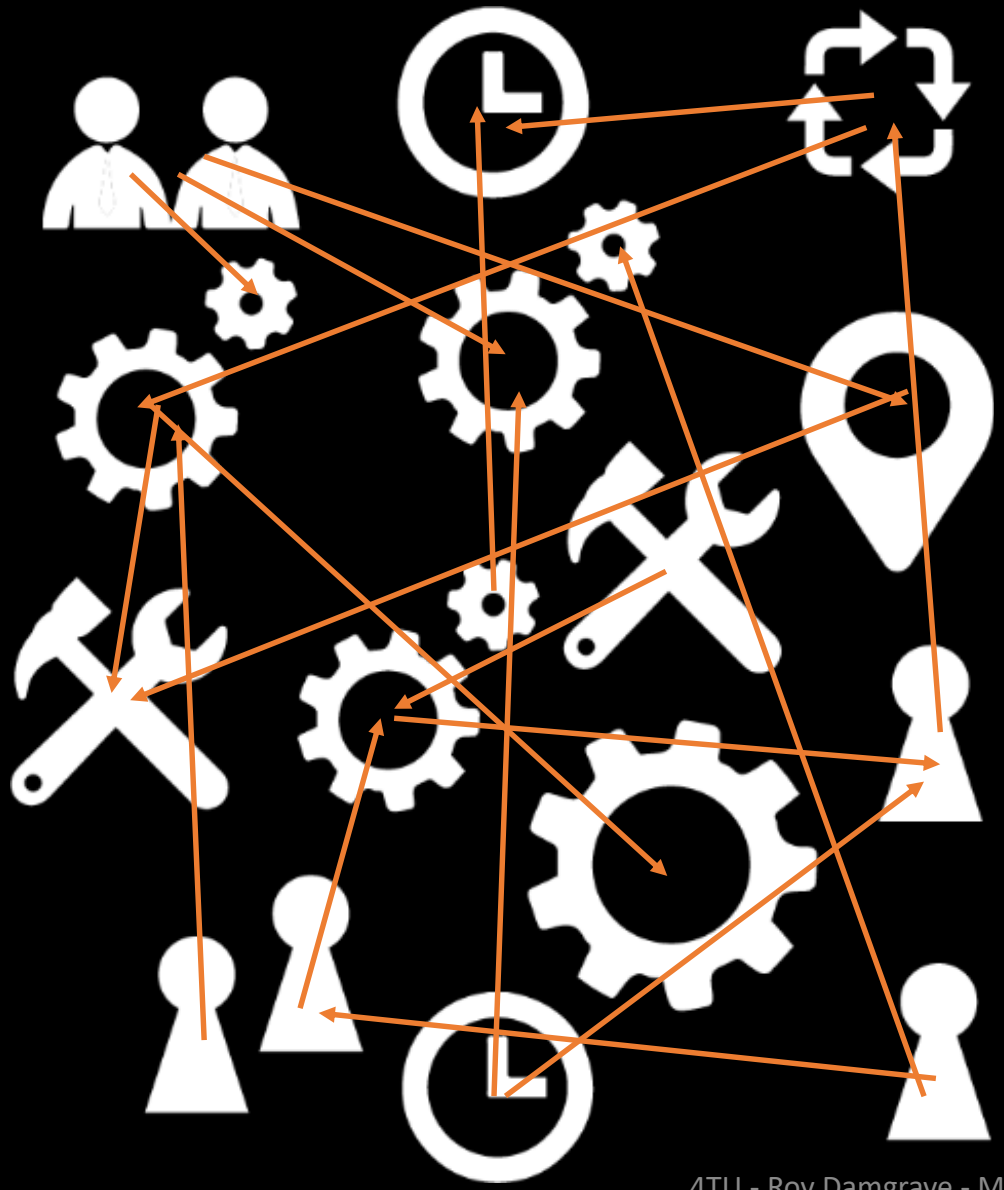

Distracting

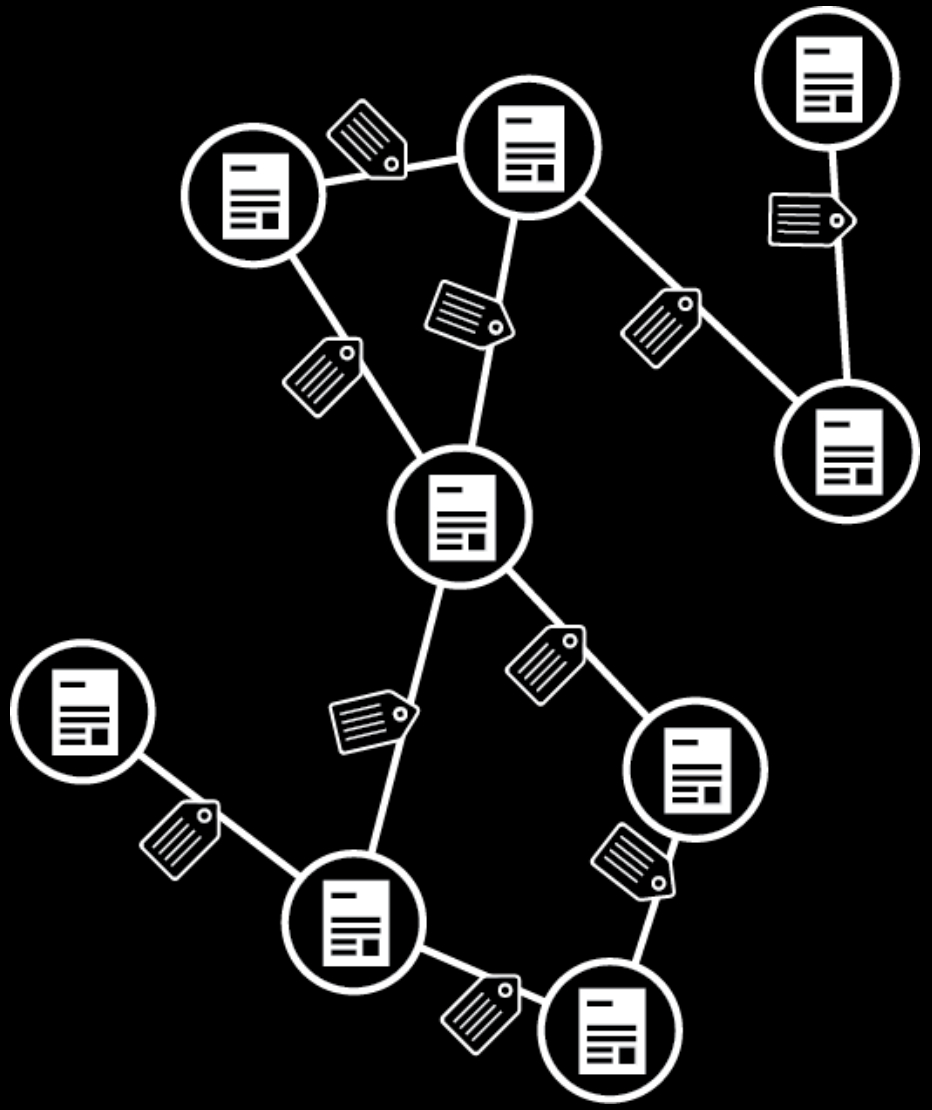
TOOLBOX

WHAT WE DON'T WANT



Know and understand relations and interdependencies





Introducing . . .

sensorama

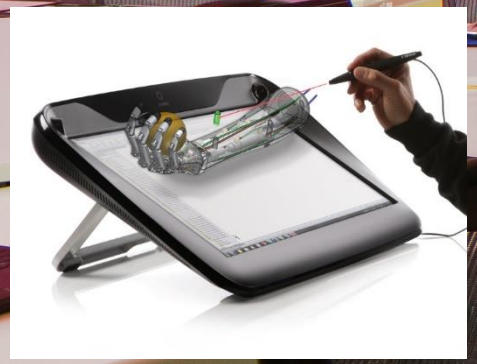
The Revolutionary Motion Picture System that takes you into another world with

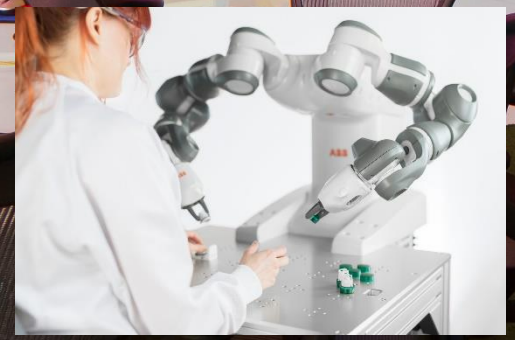
- 3–D
- WIDE VISION
- MOTION
- COLOR
- STEREO-SOUND
- AROMAS
- WIND
- VIBRATIONS

○PATENTED

SENSORAMA, INC., 855 GALLOWAY ST., PACIFIC PALISADES, CALIF. 90272
TEL. (213) 459–2162


CyclOMASTER

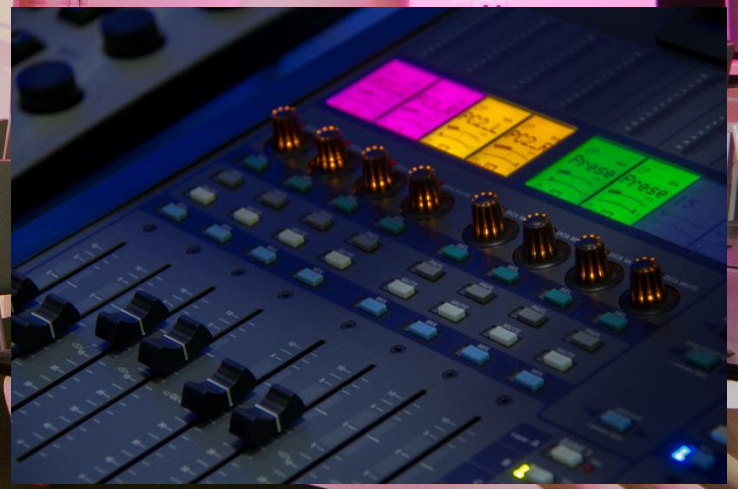





SENNHEISER
POWER
SENNHEISER
POWER


iDR-32


692.500
716.000
AUDIX
AUDIX

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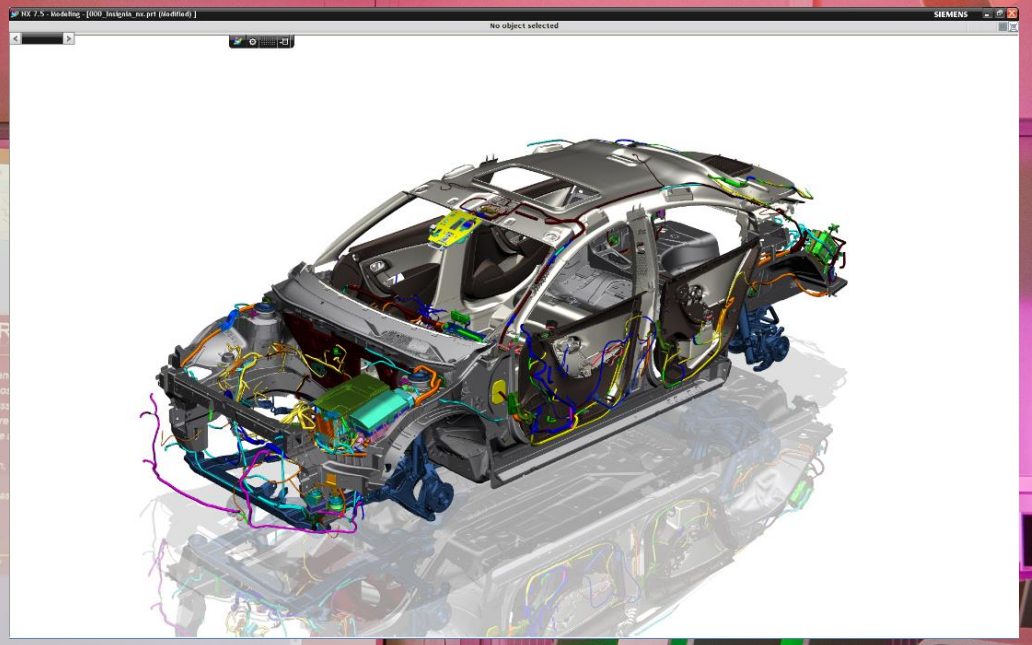
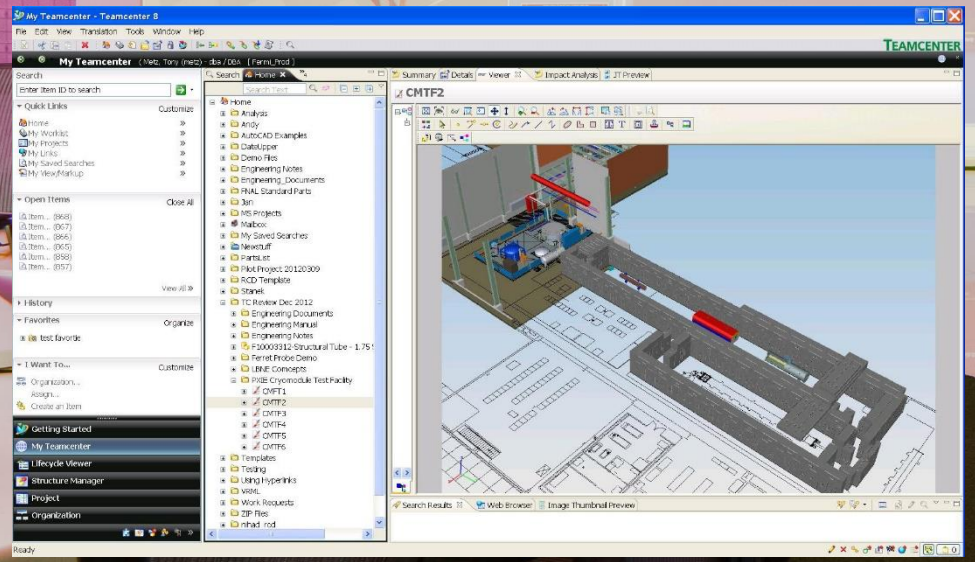



My Teamcenter - Teamcenter 8
TEAMCENTER
CMTF2

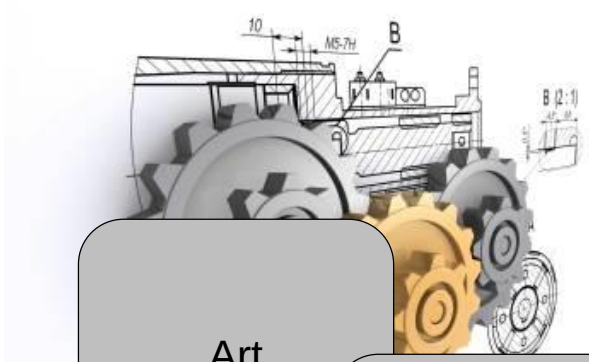

Concept
Idea Generation
Requests
Customer Pain
Market Studies
Legislation
Competitors
Key deliverables
Products concept docs
Research
Assess Market
Segment & size
Growth potential
Customer needs
Legal issues
Competition
Key deliverables
Market Research Report
Market Req. Document
Product Definition Statement
Analysis
Business Analysis
Cost/Benefit
Resources Required
Capital Expenses
Profitability/Margin
Anticipated Sales
Key deliverables
Business Case
Profitability Analysis
Product Req. Document
Develop
Product Development
Technical Specs
Prototyping
Trial Production
Testing & QA
Test Market Selling
Key deliverables
Product Dev. Schedule
Product Testing Report
Product Req. Document
Launch
Go to Market
Marketing Plan
Sales Training
Distribution Plan
Collateral Design
Set Launch Date
Key deliverables
Product Launch Plan
Product Launch Budget
Product ROI Forecast
Target Launch Date Set

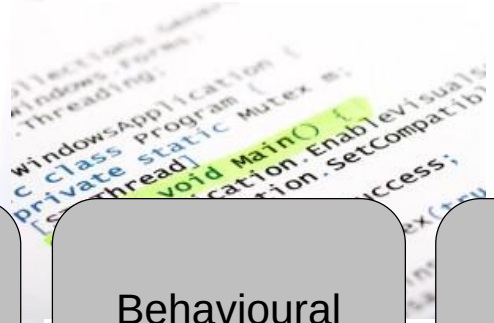
VR IN THE CURRICULUM

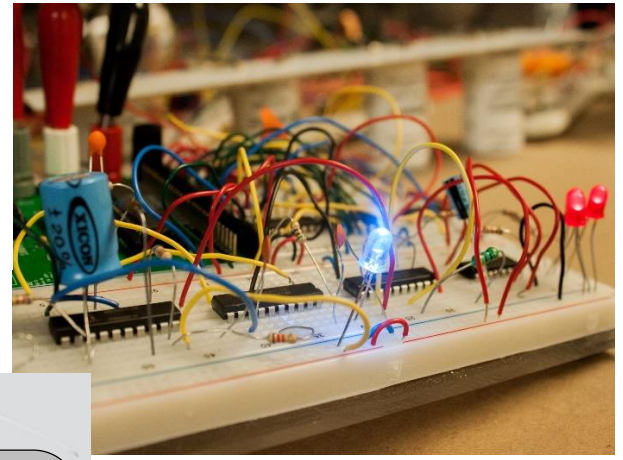
THE EDUCATIONAL PROGRAMME

Industrial Design Engineering
University of Twente

~ 100 students per year







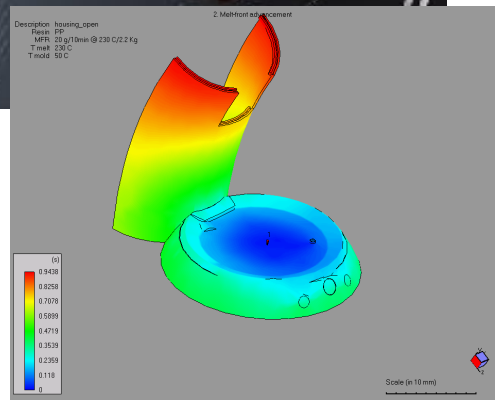
Art

‘Industrial styling’

Behavioural sciences

Business administration

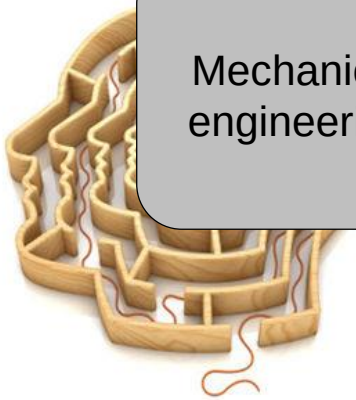
Industrial Design Engineering

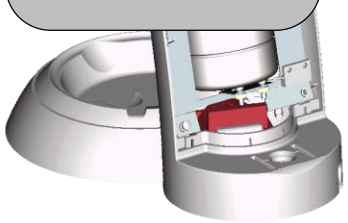


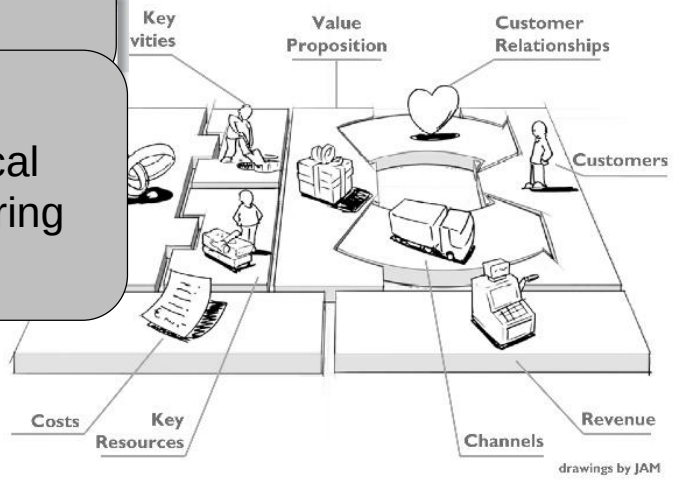
Mechanical engineering

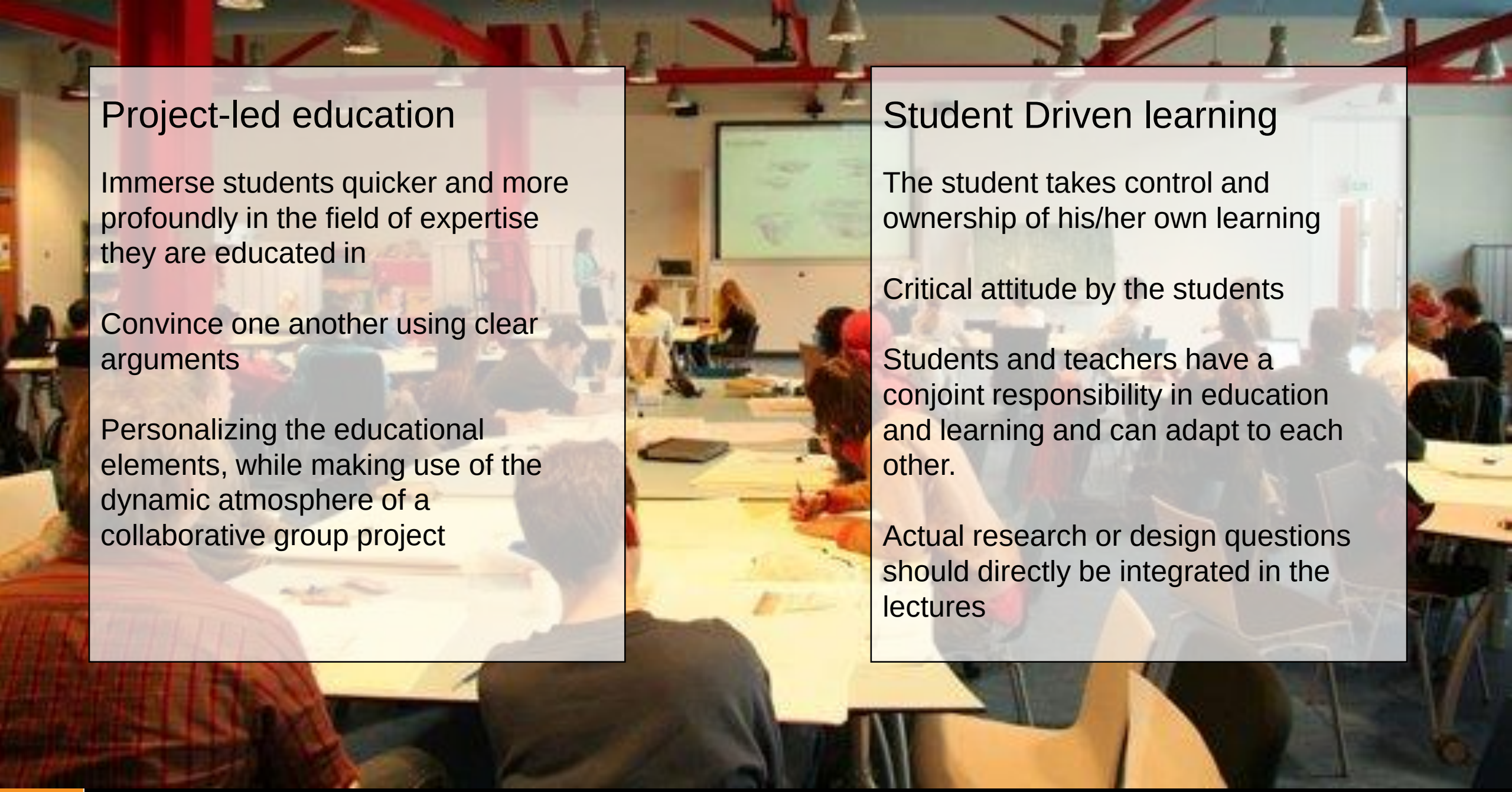
Informatics

Electrical engineering









Project-led education

Immerse students quicker and more profoundly in the field of expertise they are educated in

Convince one another using clear arguments

Personalizing the educational elements, while making use of the dynamic atmosphere of a collaborative group project

Student Driven learning

The student takes control and ownership of his/her own learning

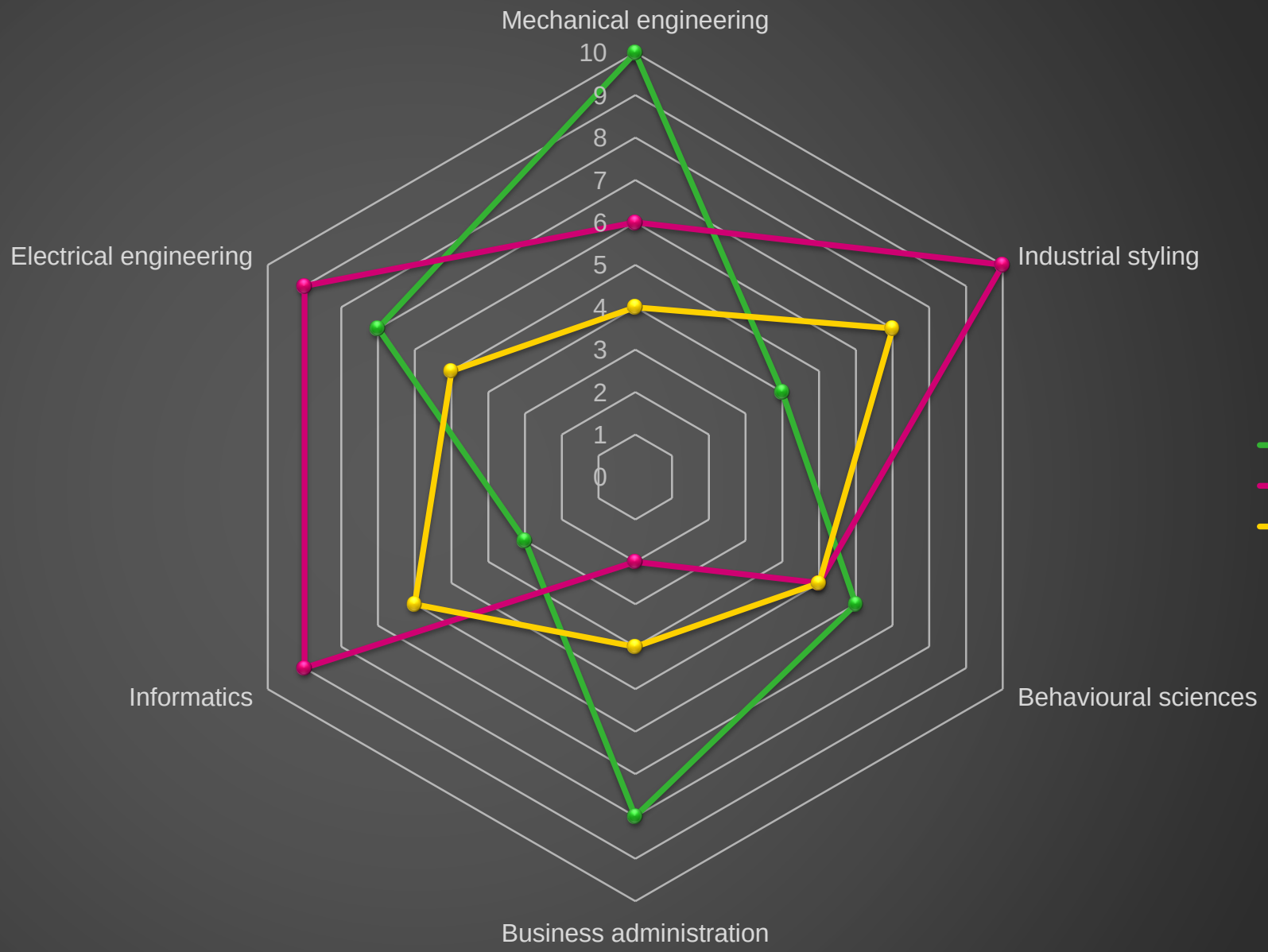
Critical attitude by the students

Students and teachers have a conjoint responsibility in education and learning and can adapt to each other.

Actual research or design questions should directly be integrated in the lectures

Each individual student may gradually discover where his/her personal interest is

→ and what the unique ‘fingerprint’ of that student will be.

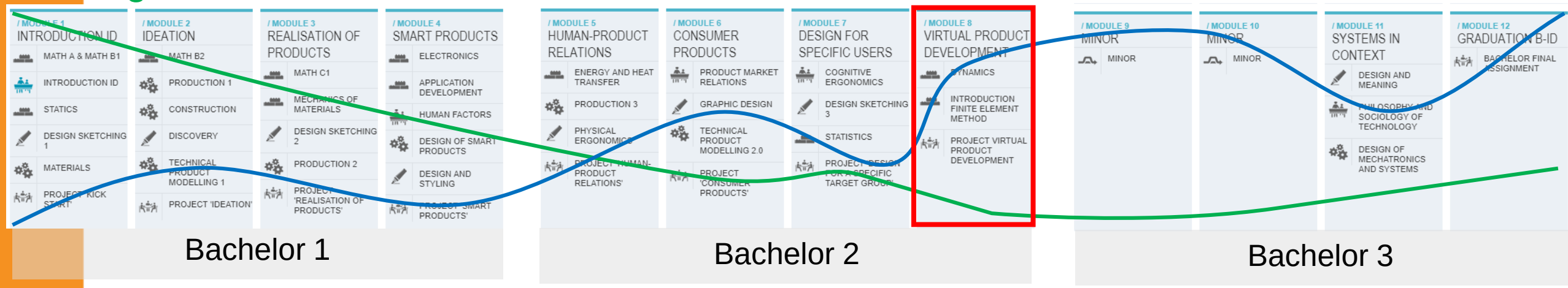


VR USE

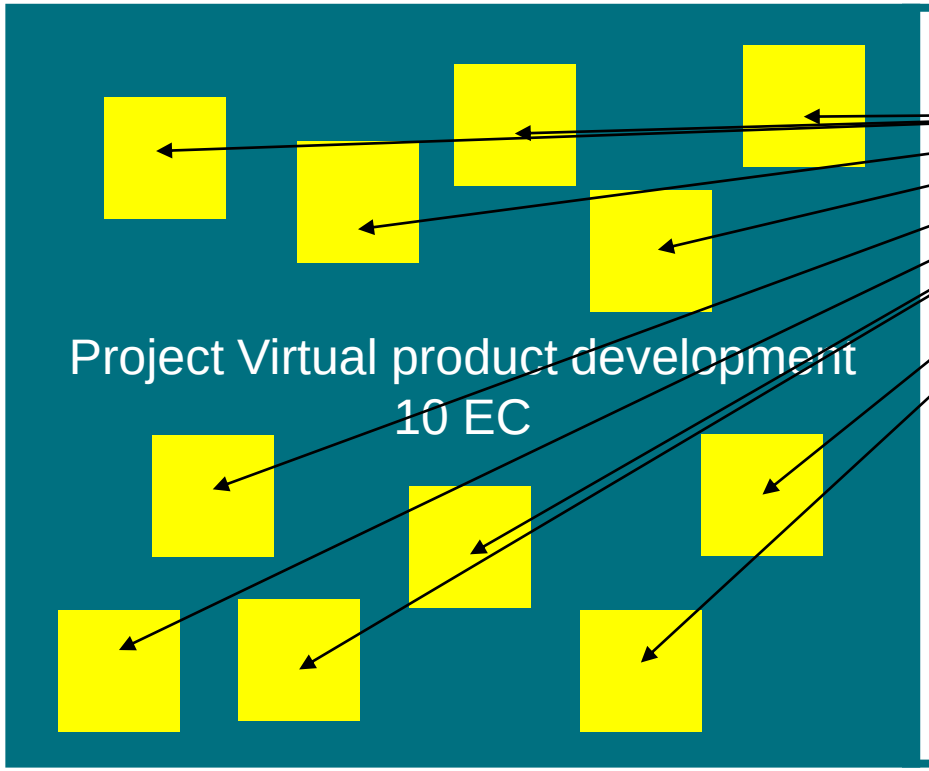
- One bachelor quartile focussed on virtual product development
  - Use of VR as design tool in multiple bachelor courses and projects
- 3 Related master course (Industrial Design Engineering)

Tutoring

Personalization



Distributed knowledge
→ Need for communication and collaboration



Toolbox

Collection of 11 small courses, each tool covers a specific subject

↳ Every student follows 6 tools

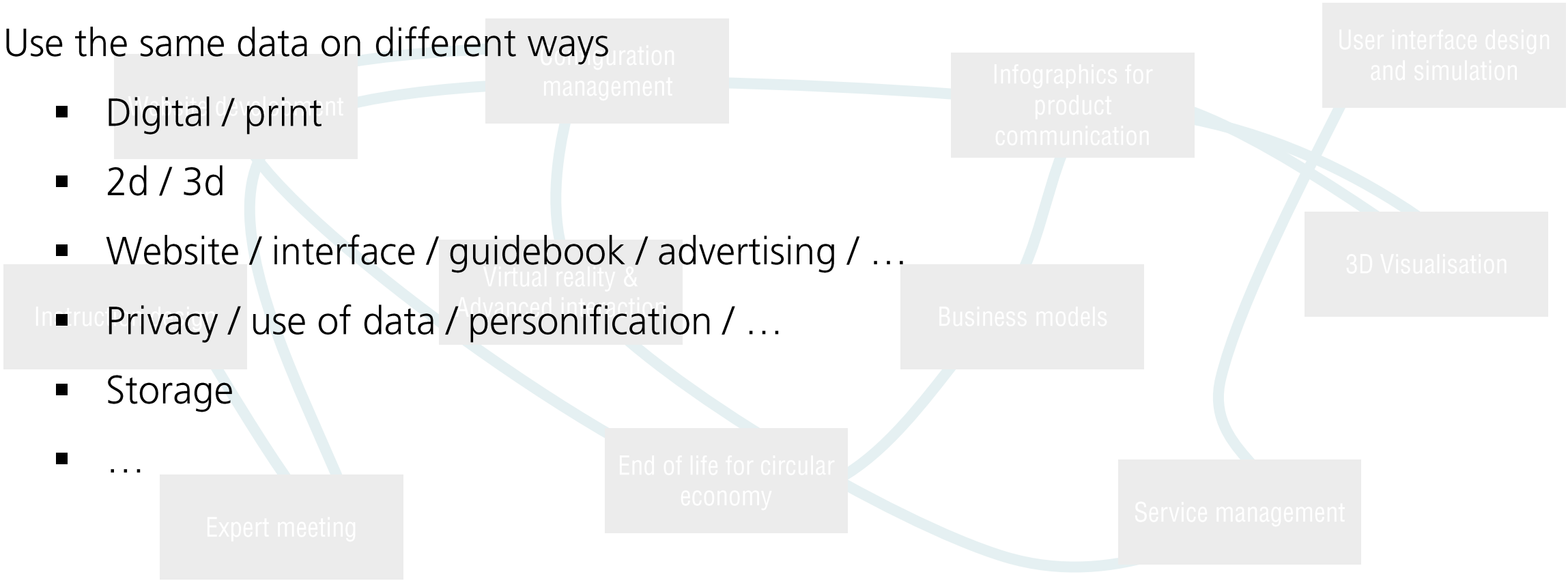
Aimed at implementing the provided knowledge directly in the project

↳ Creating deliverables relevant for the project

TOOLBOX

Use the same data on different ways

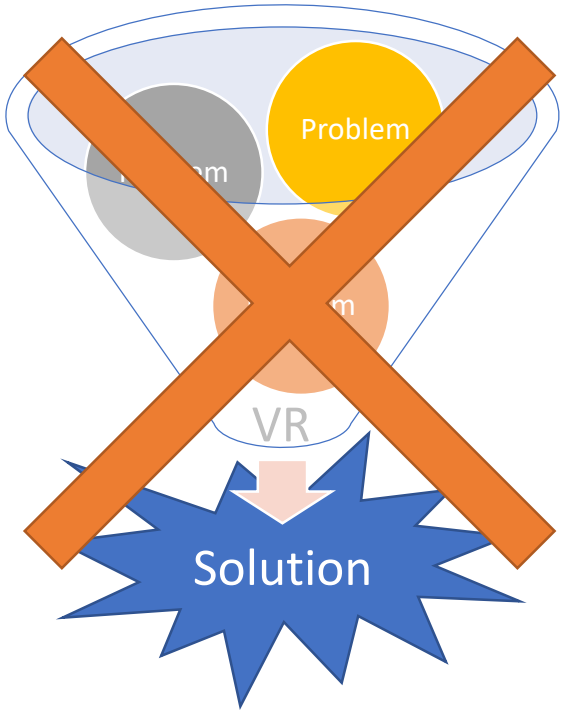
- Digital / print
- 2d / 3d
- Website / interface / guidebook / advertising / …
- Privacy / use of data / personification / …
- Storage
- …

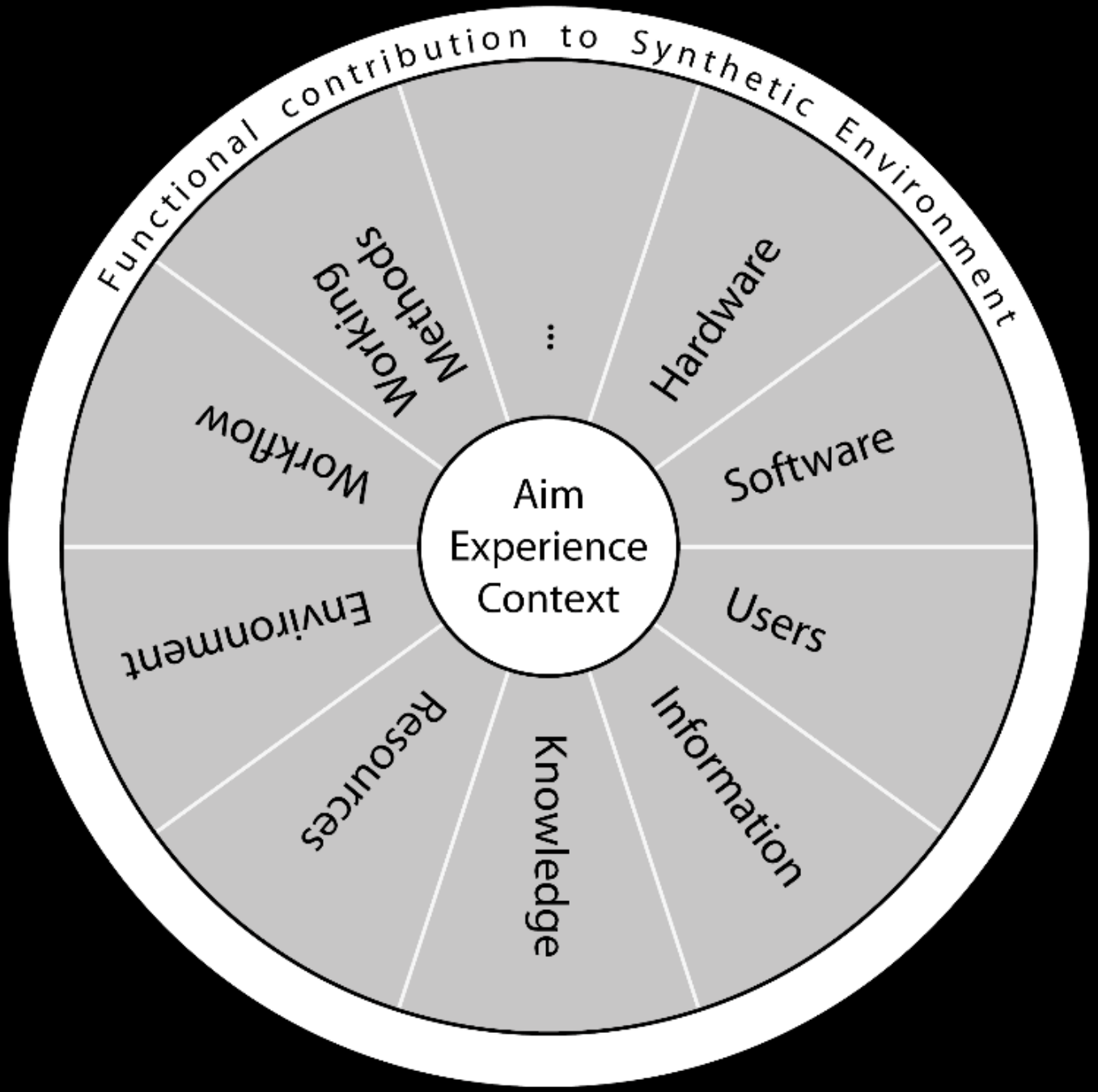


VR IS NOT A 'SOLUTION PROVIDER'

Not a device that provides a solution

- Enabler using technology
- Doesn't work automatically
  - Determine on beforehand:
    - Conditions
    - Initiations
    - Dependencies




Functional contribution to Synthetic Environment
Aim
Experience
Context
Hardware
Software
Users
Information
Knowledge
Resources
Environment
Workflow
Working Methods
...

Virtual Reality
is in a constant transition

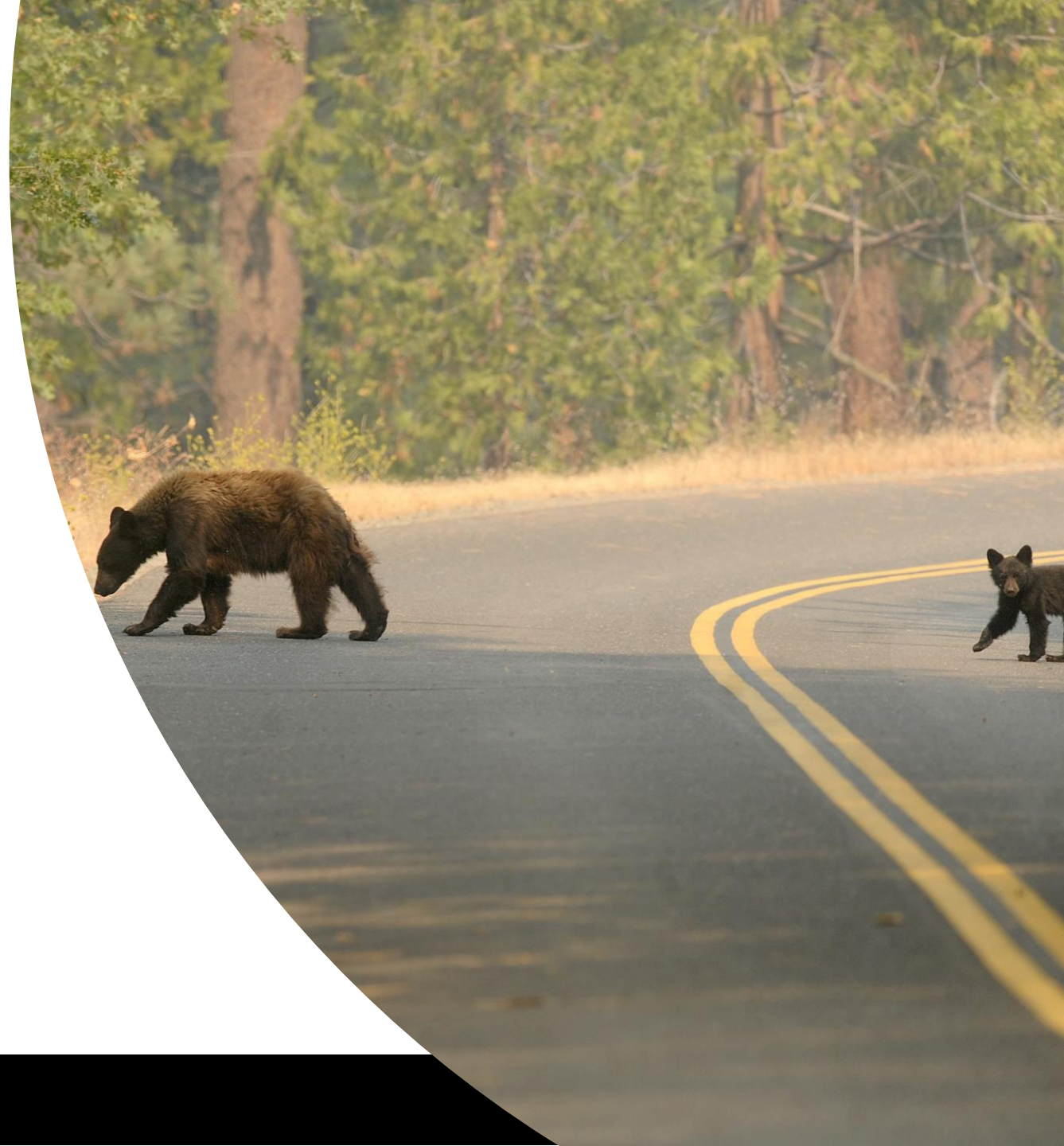
Can this transition be
- Depicted ?
- Explained ?
- Interpretated ?
- Predicted ?

if yes,
- ap
- ef
- ef
- ro
- in
- in
- op
- fle
- le
- ag

INTEGRATION OF VR IN EDUCATION

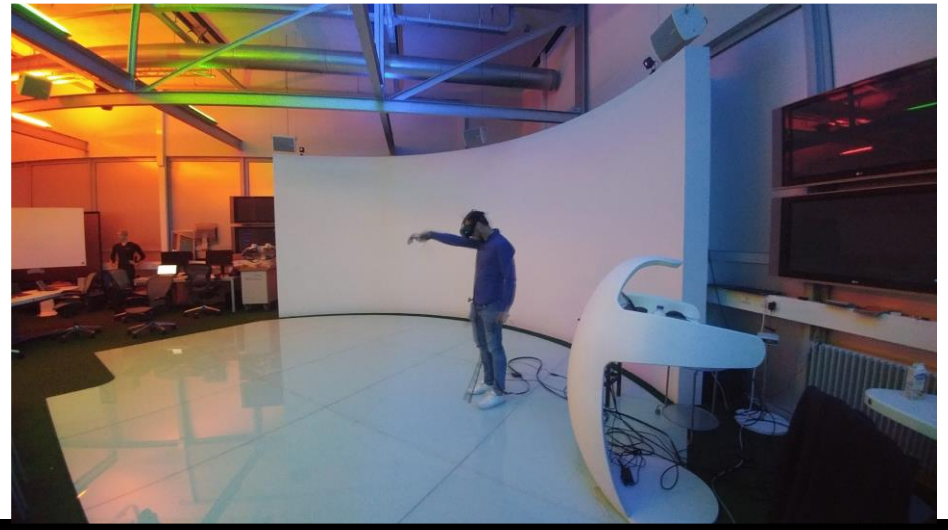
INTEGRATION OF VR IN EDUCATION

- How to make decisions, while the consequences are not clear…
  - Preconditions
  - Requirements
  - Resources
  - Achieving the learning goals
  - Long-term possibilities
  - …



INTEGRATION OF VR IN EDUCATION

- Involve students in the development of their curriculum/study/educational landscape
- Allow for more communication possibilities
- Less depending on level of extrovert



INTEGRATION OF VR IN EDUCATION

1

Communication with VR: trigger for discussion

2

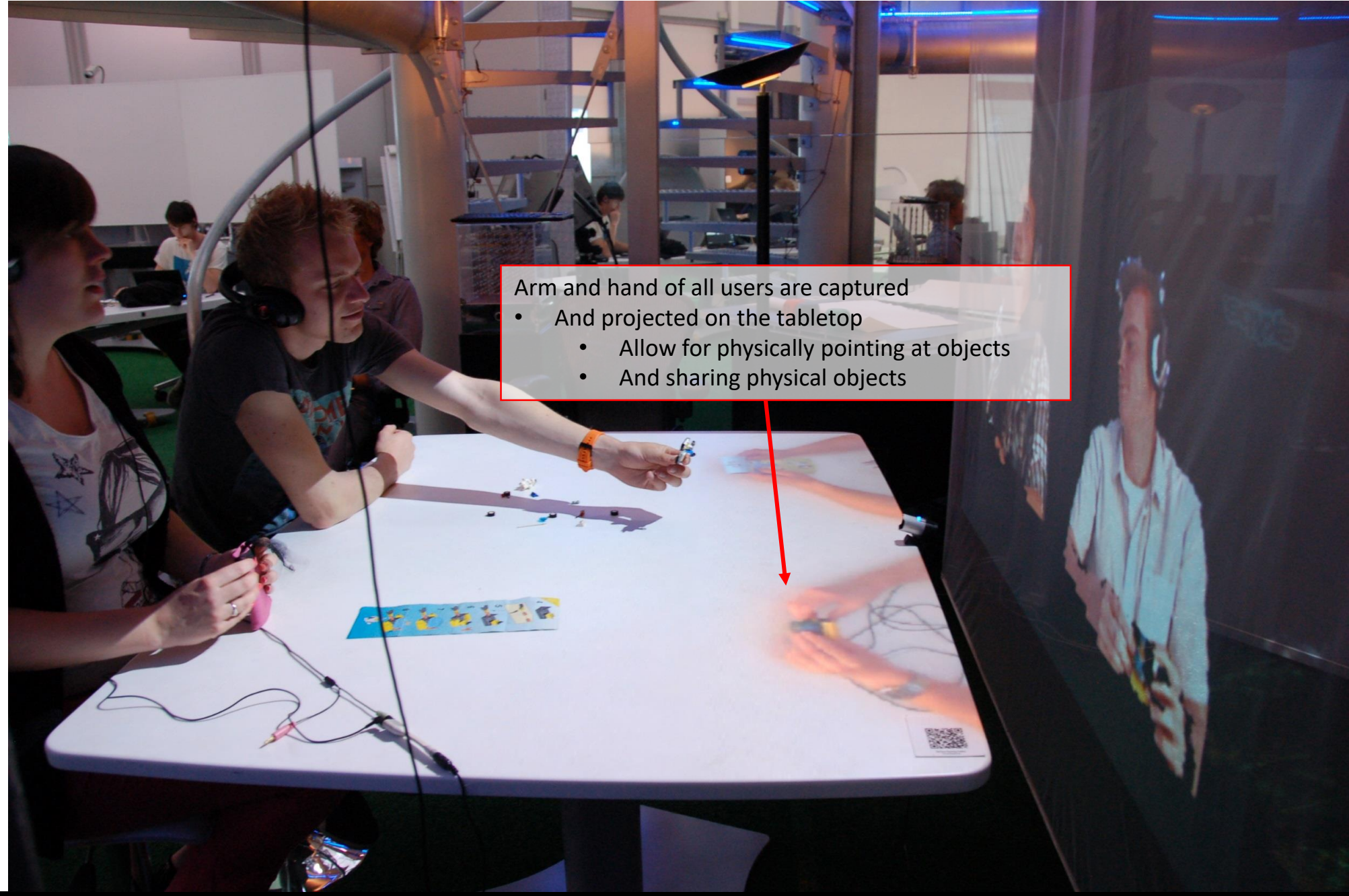
VR for expression of creativity

3

VR to try-out the future

COMMUNICATION WITH VR: TRIGGER FOR DISCUSSION

DISTANCE COLLABORATION SUPPORT ENVIRONMENT


Arm and hand of all users are captured
• And projected on the tabletop
• Allow for physically pointing at objects
• And sharing physical objects

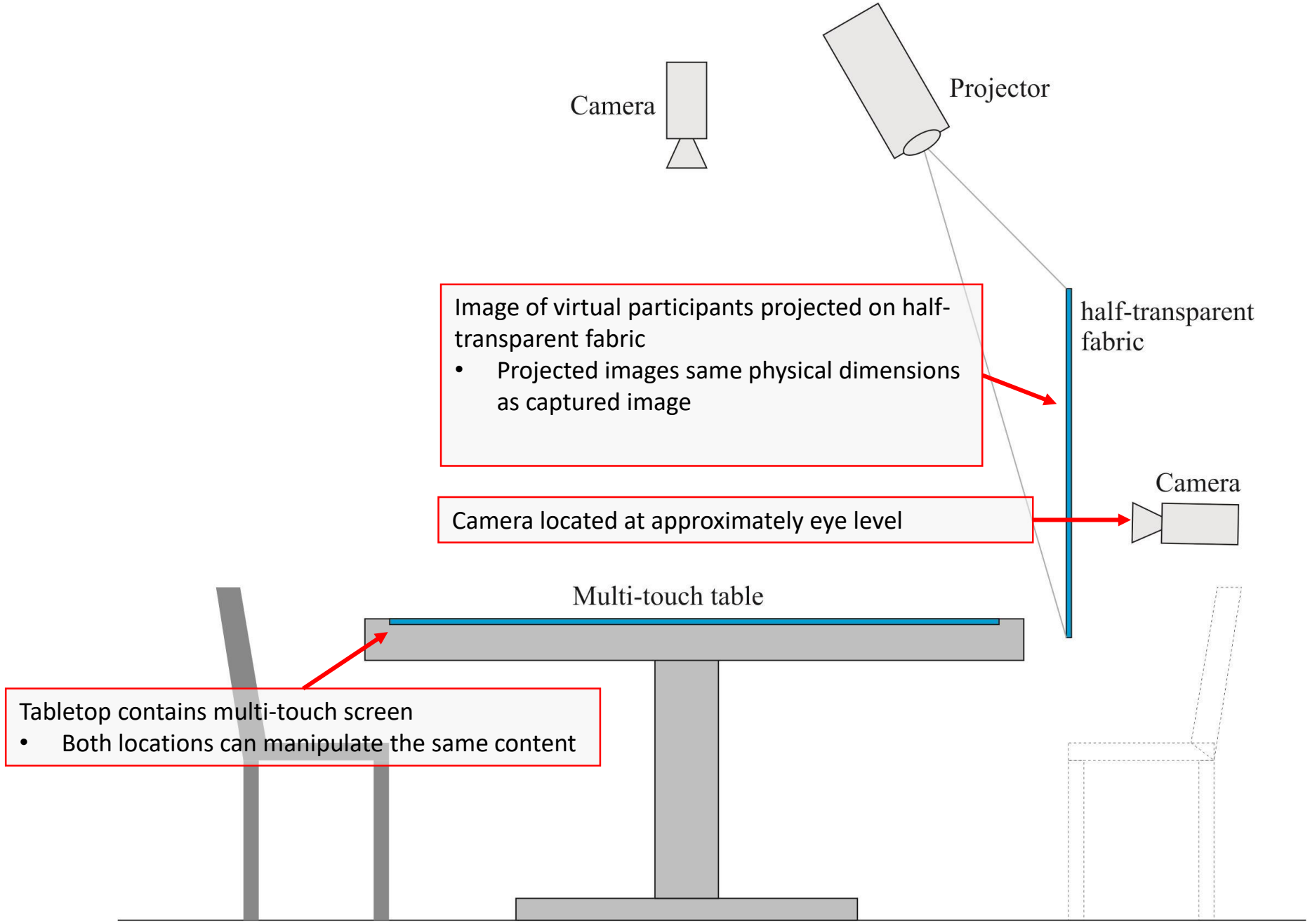


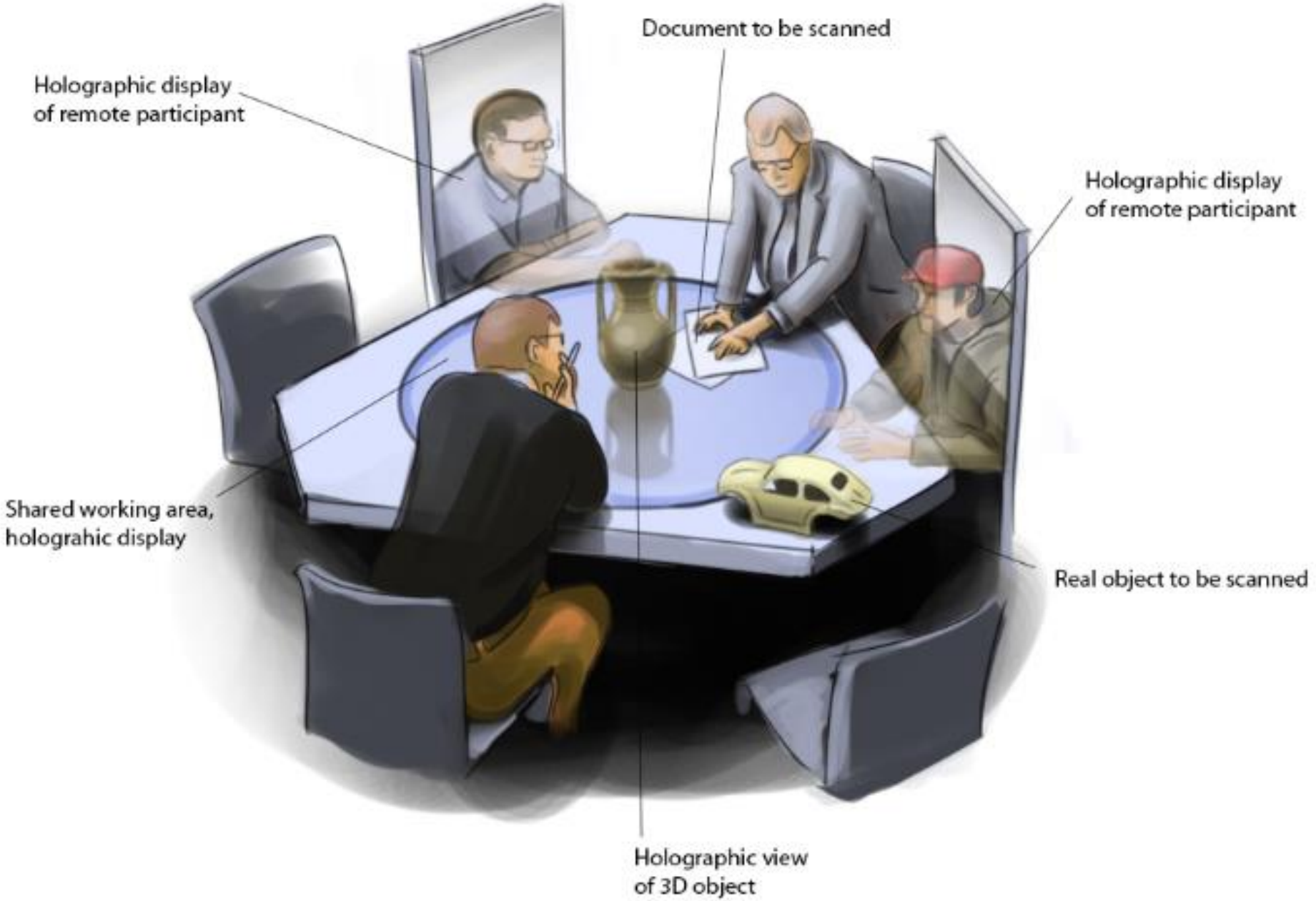
Image of virtual participants projected on half-transparent fabric

- Projected images same physical dimensions as captured image

Camera located at approximately eye level

Tabletop contains multi-touch screen

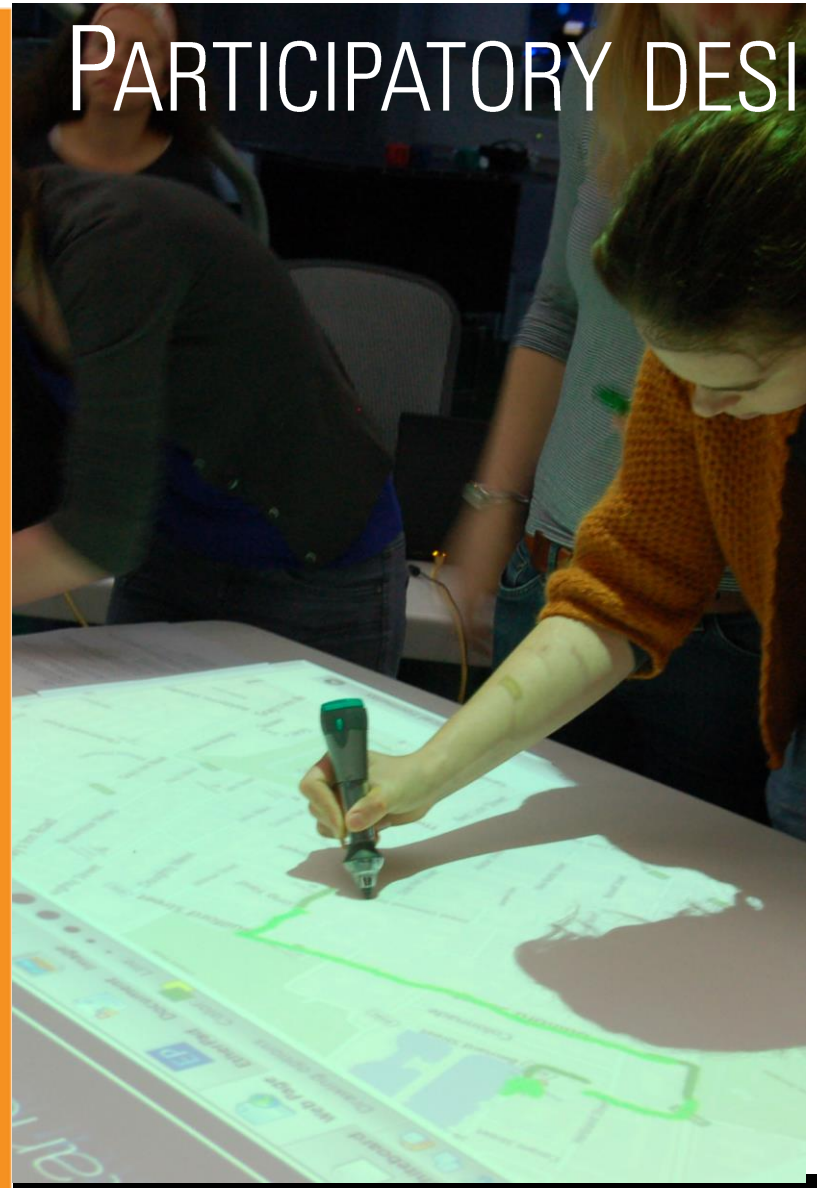
- Both locations can manipulate the same content

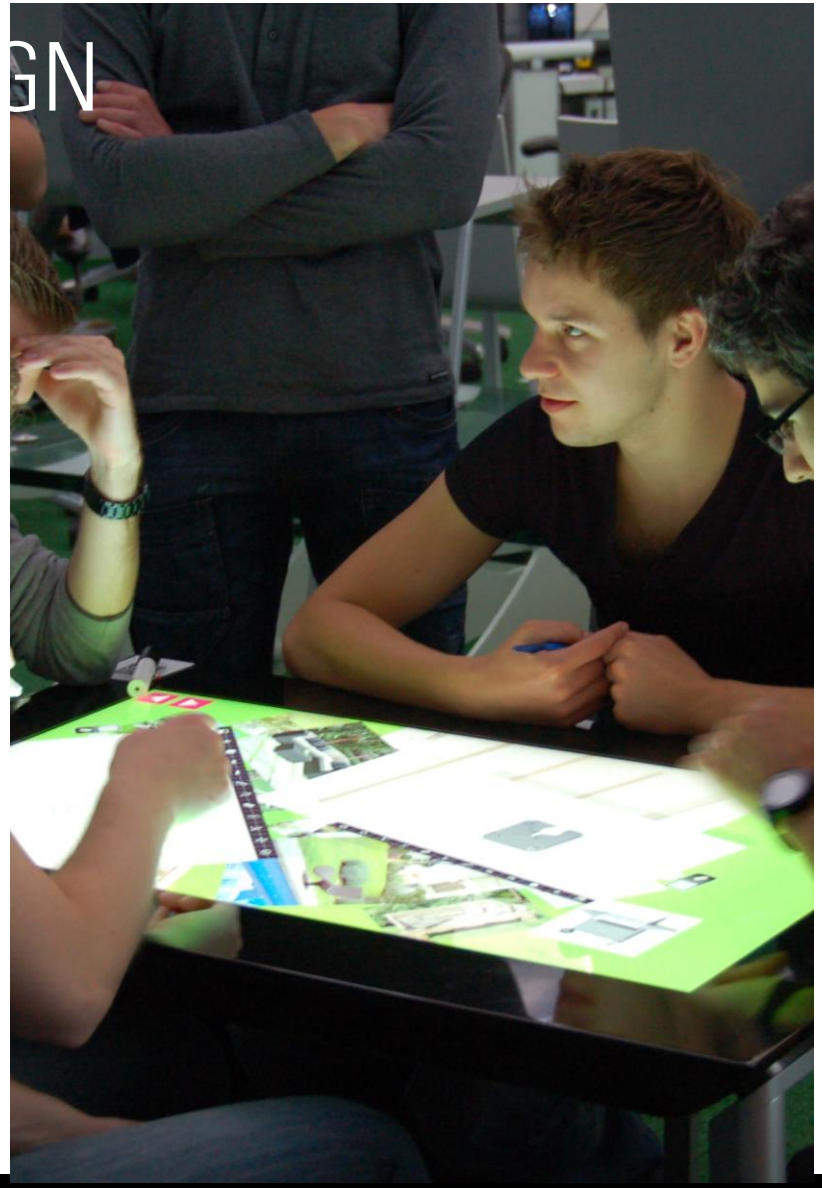

Holographic display
of remote participant
Document to be scanned
Holographic display
of remote participant
Shared working area,
holograhic display
Real object to be scanned
Holographic view
of 3D object

DISTRIBUTED PRODUCT DEVELOPMENT

- Develop and build a product, with an international team
  - 4 students UTwente – 4 students TU Berlin
  - One physical meeting on day 1
  - One physical meeting after 10 weeks
- Components build on both locations
- Product assembled during the last day
- All communication done via digital means

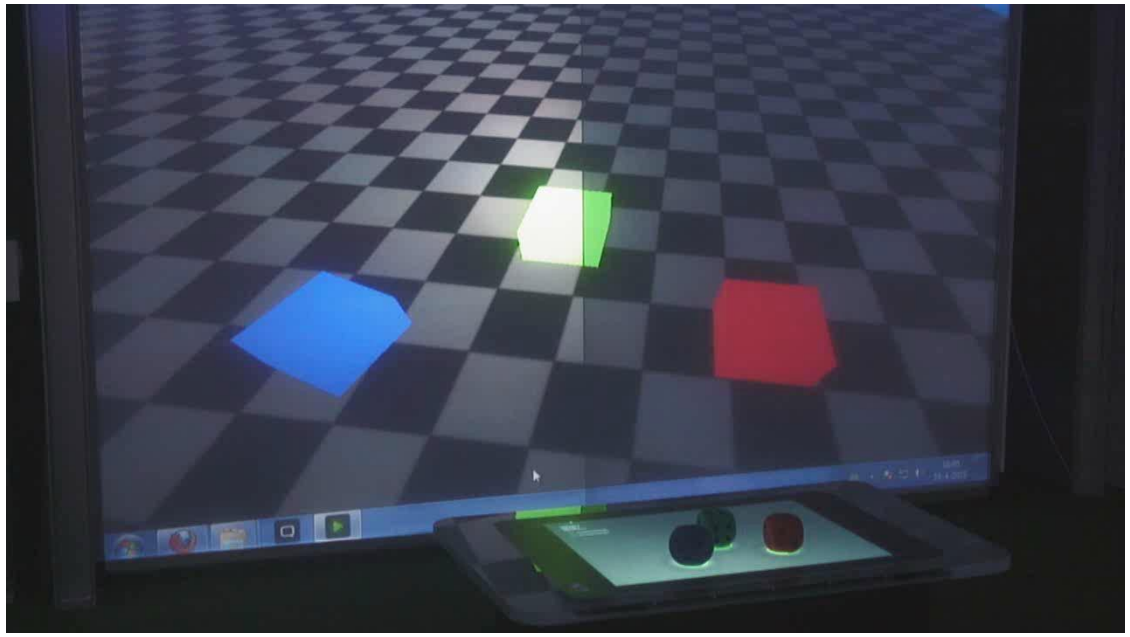
PARTICIPATORY DESIGN

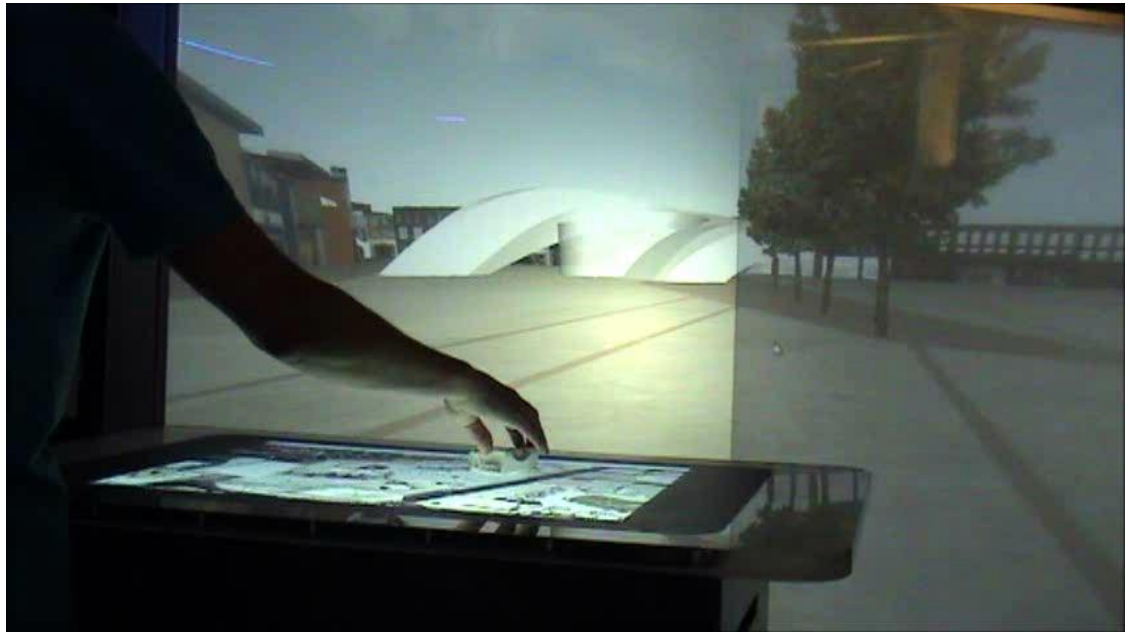


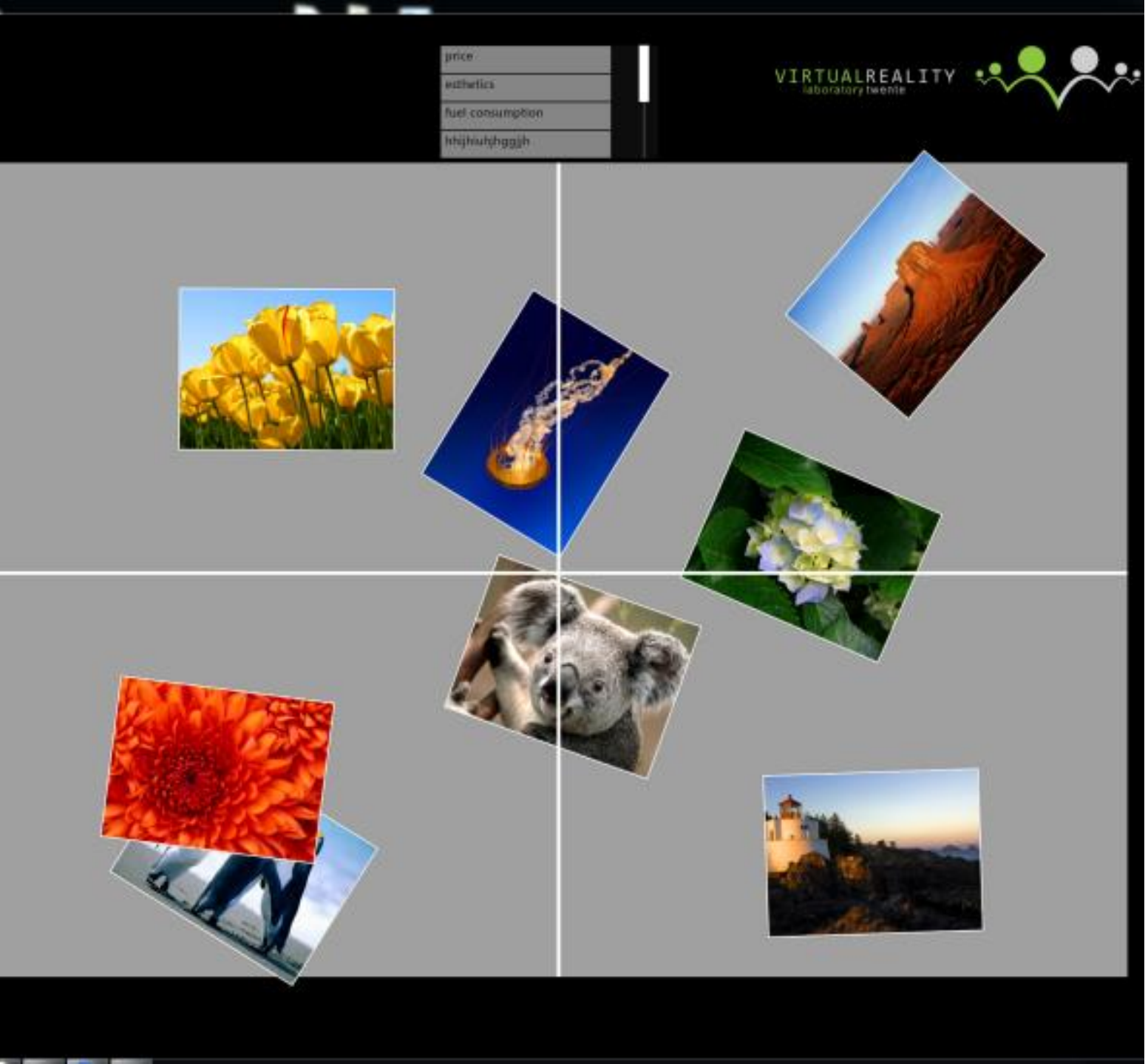


TANGIBLE INTERACTION

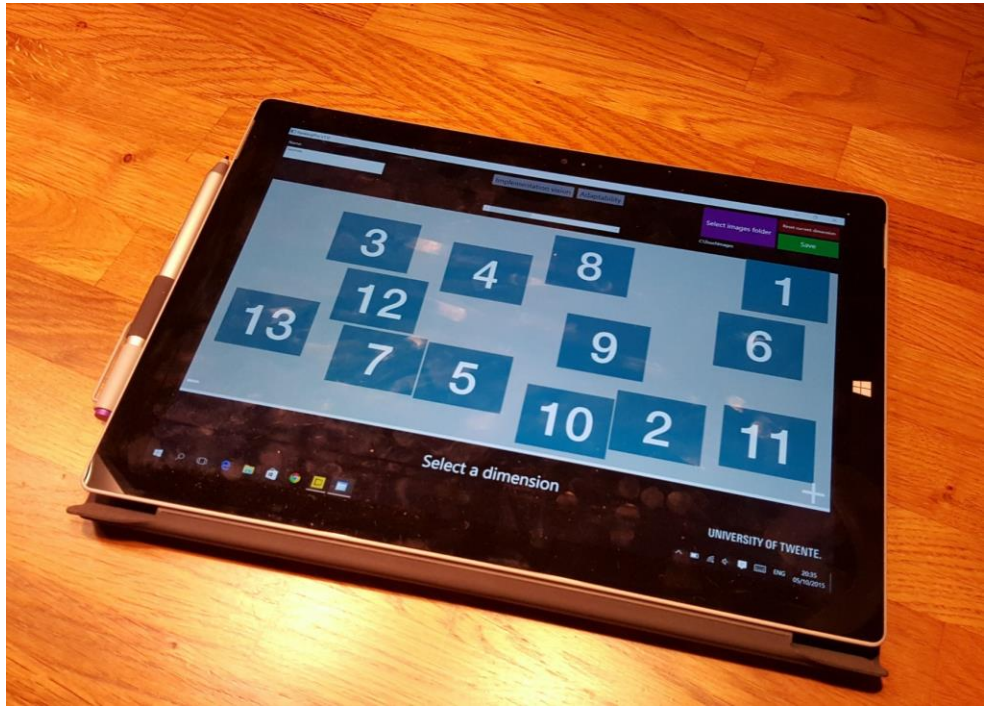
- Review configurations
- Multiple layers
  - Stakeholder dependent
- Multiple visualisations
  - 2d
  - 3d
  - VR
  - AR






price
esthetics
fuel consumption
hhjhiuhjhggjh
VIRTUALREALITY
laboratory twente


Re-load
Clear all data
VIRTUALREALIT
laboratory twente


3
4
8
1
12
13
9
6
7
5
10
2
11
Select a dimension
UNIVERSITY OF TWENTE.

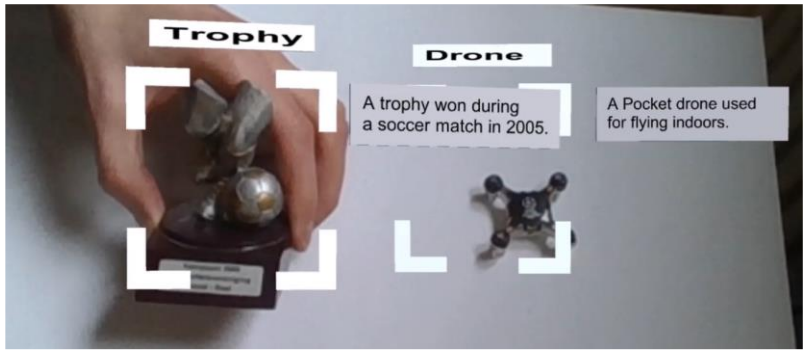
COMMUNICATION WITH VR: TRIGGER FOR DISCUSSION

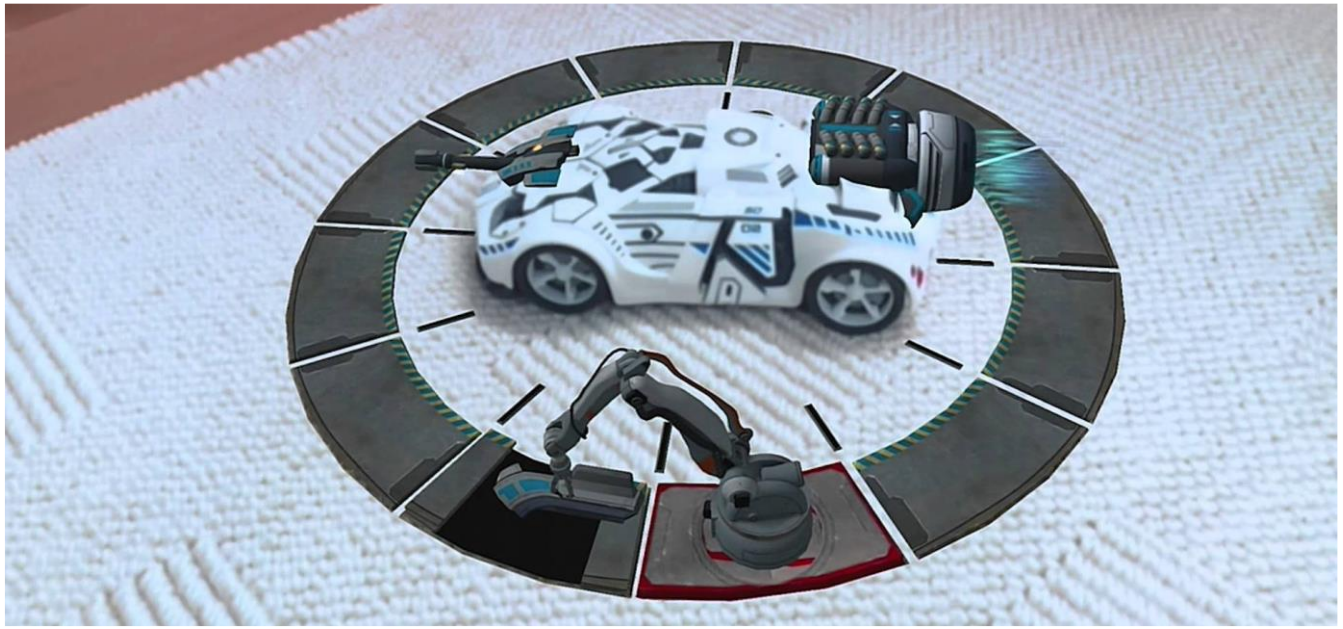
- Facilitate communication to establish collaboration
  - Do not hinder the process
- Understand each other
  - Also from different disciplines
- Overcome physical distances
- Not that much use of Head Mounted Displays
  - Too distracting
  - Hinder collaboration & communication

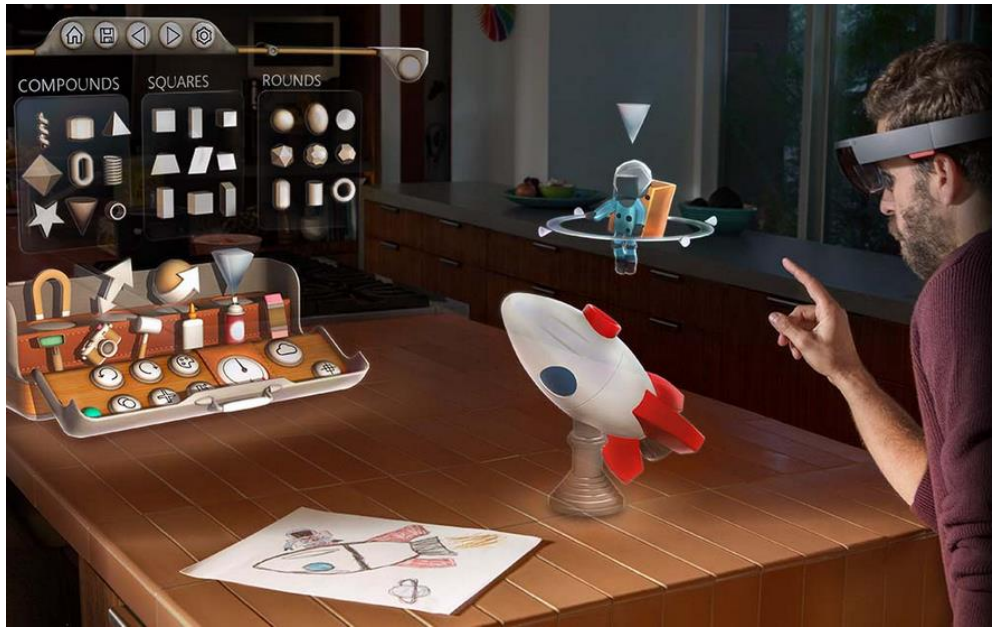
VR FOR EXPRESSION OF CREATIVITY

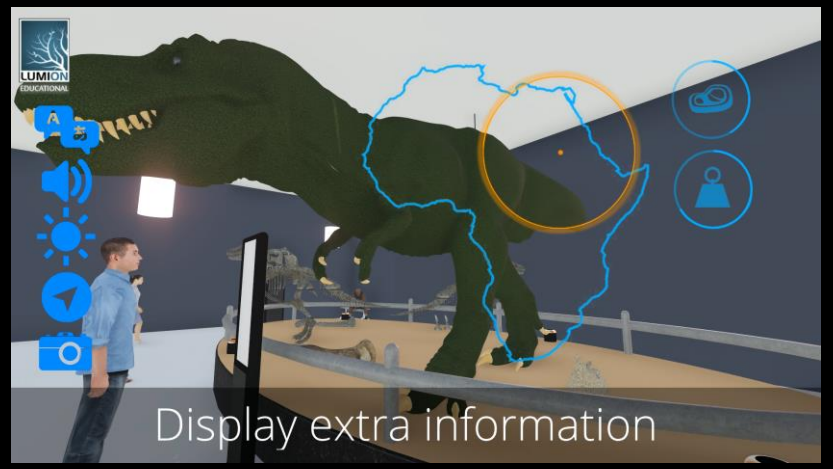
AUGMENTED REALITY

- Show new products in existing environments
- Provide additional information on existing objects

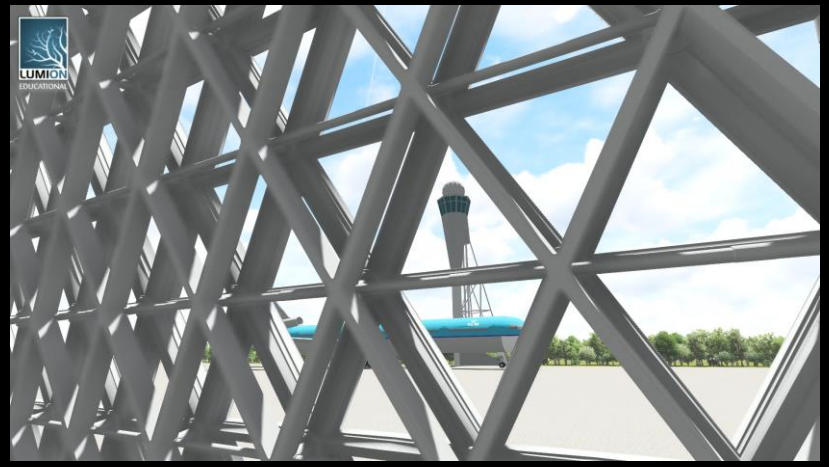







Display extra information


TANITIM PANOSU
Dropspot




airport


Opgehaald
UNIVERSITEIT TWENTE

VR FOR EXPRESSION OF CREATIVITY

- Communicate ideas
- Dare to try new things
- Accentuate (important) elements
- Possible to adjust/change the solution real-time
  - Collaborative design
  - More iterations

VR TO TRY-OUT THE FUTURE

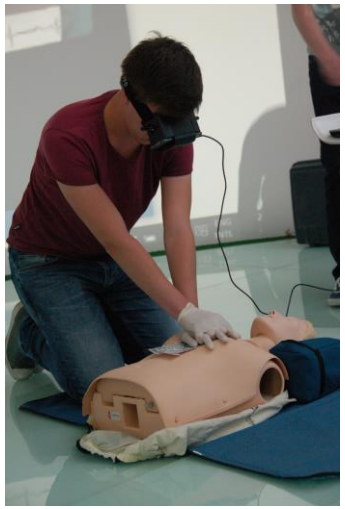
RTL ASSIGNMENT

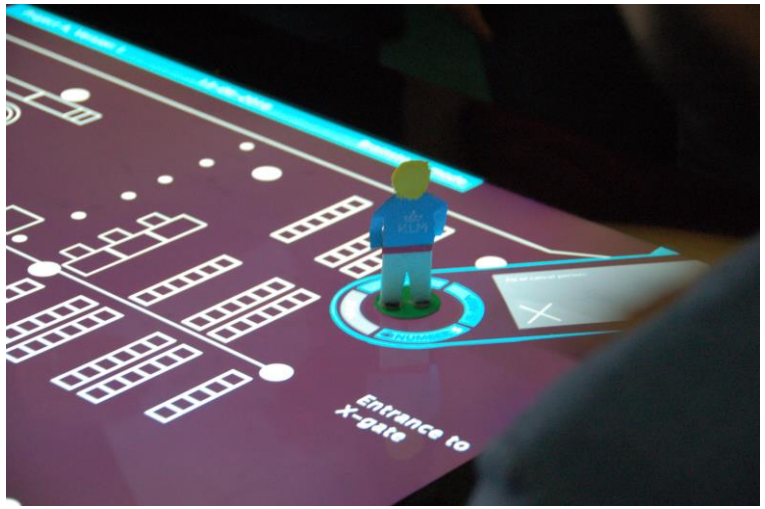
Goal RTL for 2020:
One hour of every day of every Dutchman = RTL time


VRTL Cooking
The App for Augmented Cooking Instructions
10
VRTL COOKING

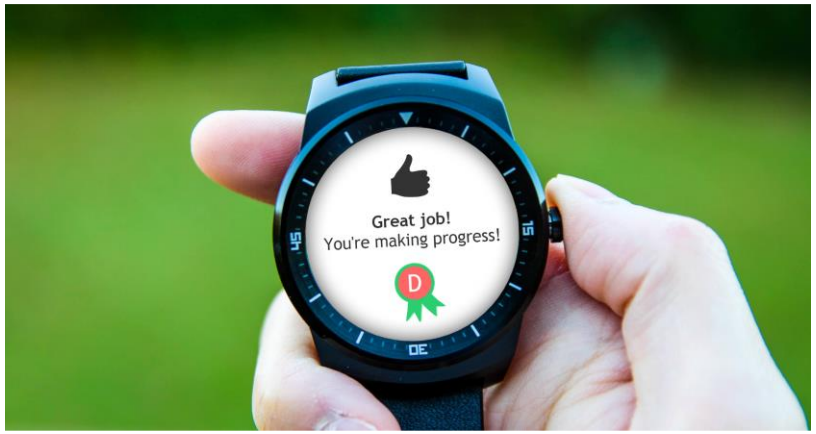

ScannAR
ScannAR logo is shown
2

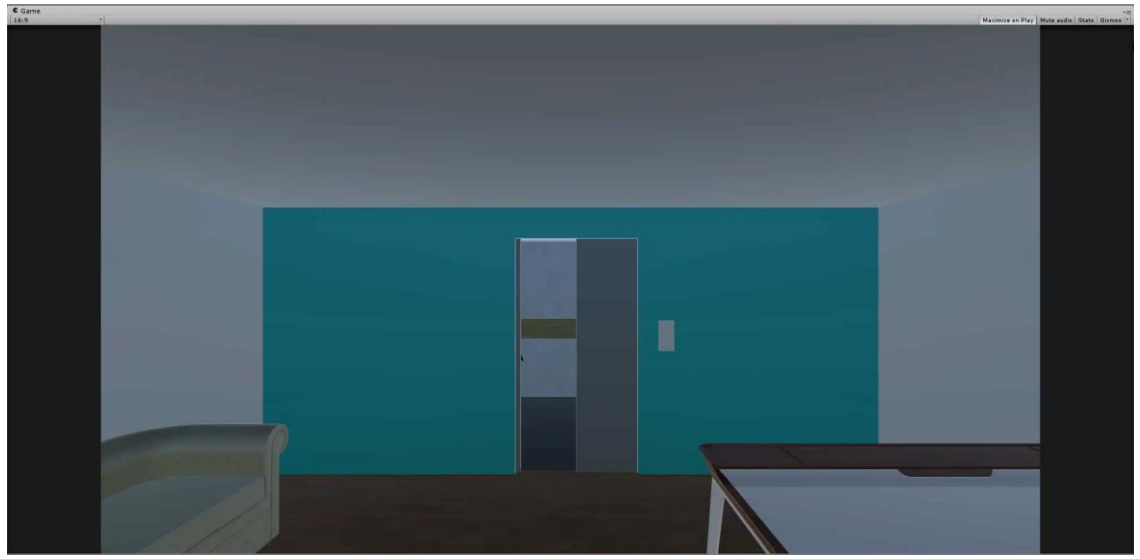
KLM ASSIGNMENT

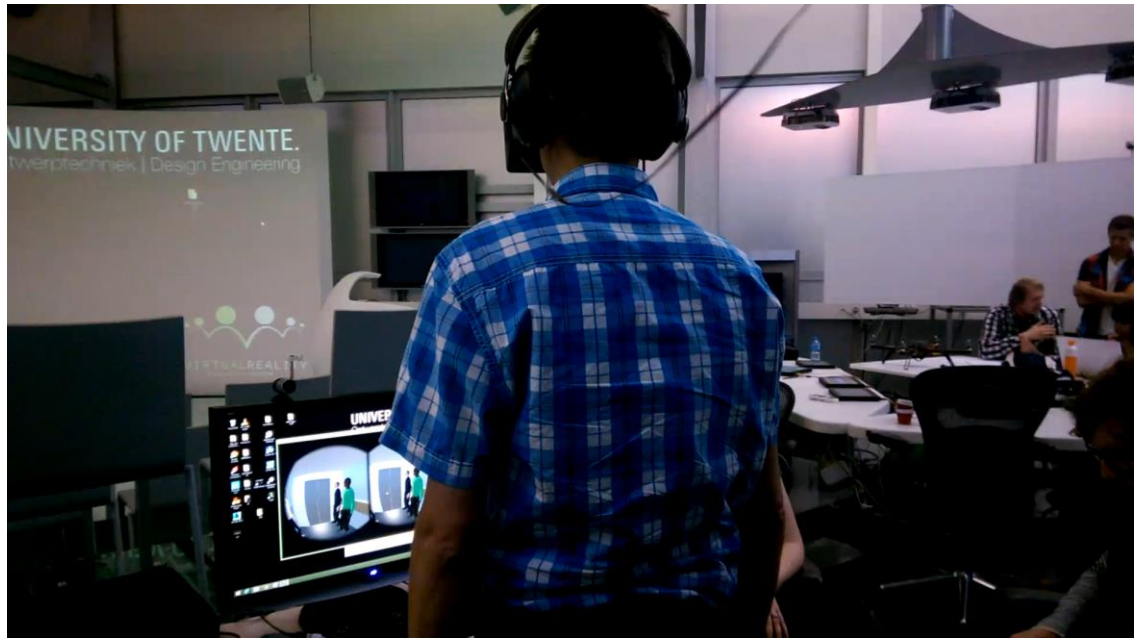




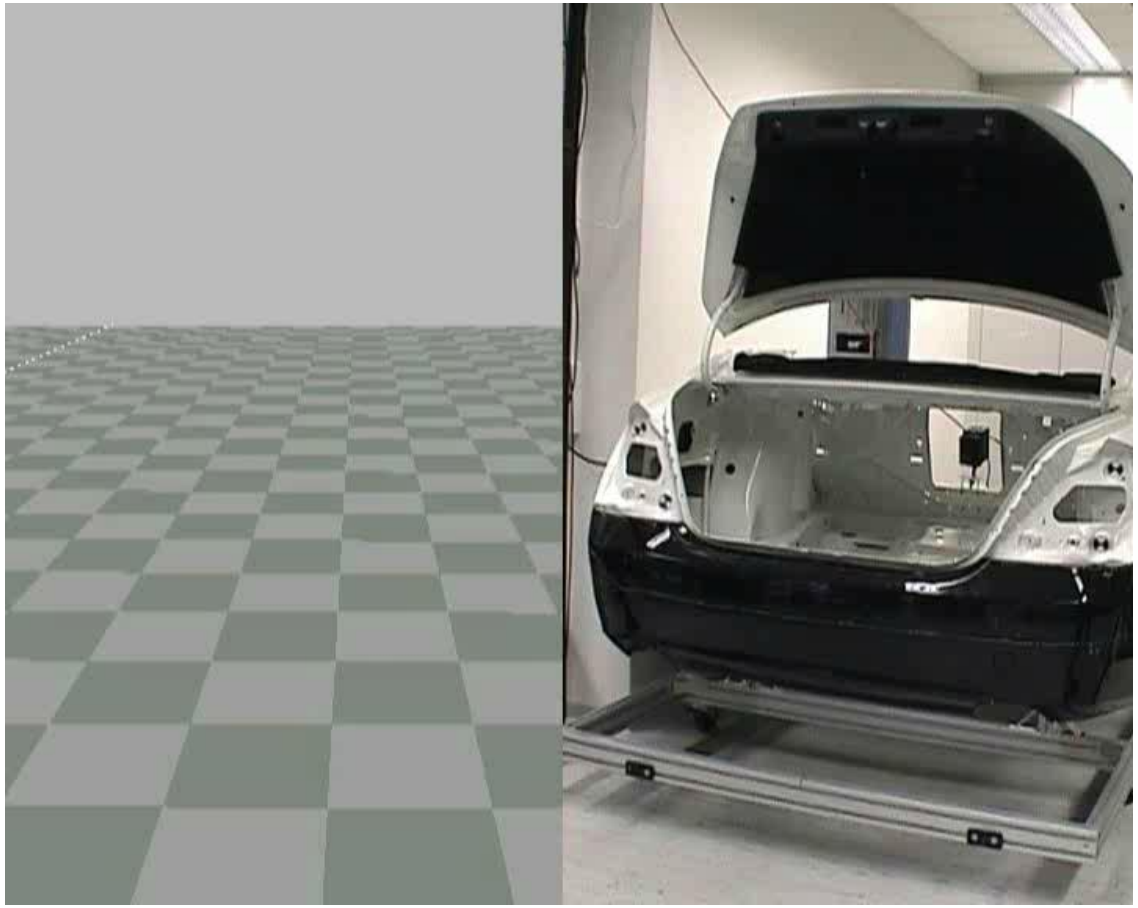
ANXIETY TRAINING

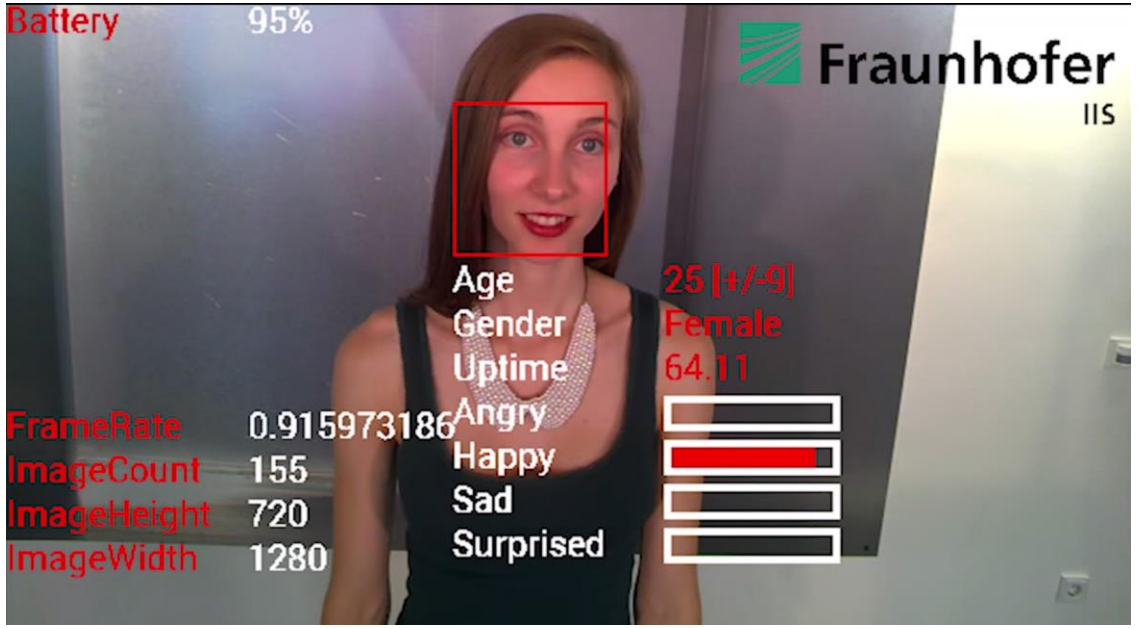






KNOW MORE FROM THE USER

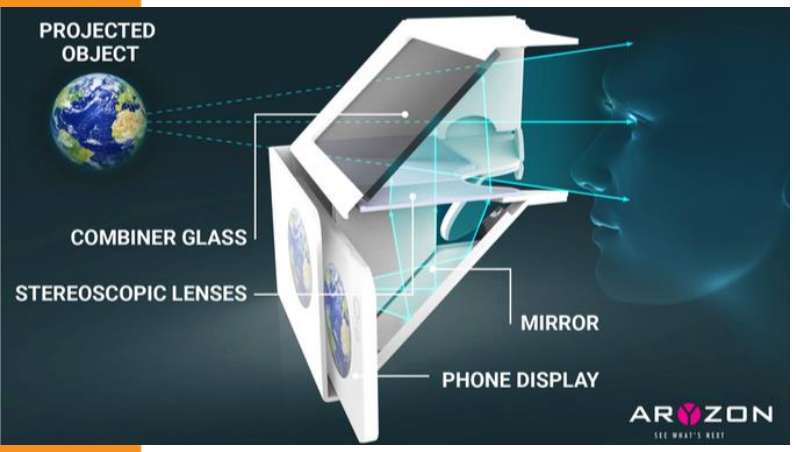




Impact of the atmosphere on the user

A Virtual Reality paradox….

With increasing cost,
usually the genericity of a VR solution diminishes.



ARYZON (SPIN-OFF)

CHARACTERISTICS OF VR IN EDUCATION

CHARACTERISTICS OF VR IN EDUCATION

- Get insight in the consequences of decisions
  - Impact on the future
  - Viewed from different perspectives
- Understand other disciplines
  - See interdependencies
- Not force the use; we also don't force the students to e.g. use a hammer
  - See it as a tool; not as a solution
- Often the use of AR is preferred compared to VR

USED APPLICATIONS

- We don't teach software
  - We show the possibilities and limitations

ADVANTAGES OF VR IN EDUCATION

- Advantages
  - Teacher
    - More interaction
    - Enhance understanding
      - Personalized information
      - Only show relevant information
    - Integration of research
  - Student
    - Additional communication tools
    - Tailored use of tools
    - Reuse data
    - Design review
    - Easier iterations
  - Organisation
    - Share results

1

Communication with VR: trigger for discussion

2

VR for expression of creativity

3

VR to try-out the future

CHALLENGES OF VR IN EDUCATION

- Challenges
  - Teacher
    - Lower the threshold for the student
    - Communicate that students don't need (that much) ICT skills to use VR
    - Assess the implementation and use of VR, not the development of it
  - Student
    - See the benefit and potential of VR use, before using it
    - Understand how it can enhance communication, collaboration and understanding
    - Know what to use for what goal
  - Organisation
    - Flexible use of resources
    - Organize and store results

CONSIDERATIONS

What is the goal of using VR?

The use itself is never the goal !

- Technically better systems don't always give a better immersion than simpler systems
  - Like reading a book vs. watching the movie based on that book
  - Like playing a board game instead of a modern 3D game
  - When the system doesn't give all the details, users must use their imagination
- Imagination and mental immersion is the most important
  - Also in VR experiences, not the technical hi-fi
- Create solutions without distracting the user
  - Less technology mounted to the body of the user

TAKE-AWAY

Don’t highlight the use of VR, make it part of everyday work

UNIVERSITY OF TWENTE.
MANAGEMENT OF PRODUCT DEVELOPMENT.

QUESTIONS & DISCUSSION

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