

THINK OUTSIDE THE BOOKS



360° virtual reality & augmented reality
for academic education

The Centre for Innovation is Leiden University's higher education innovation accelerator. Since 2012, the Centre has been working to identify and explore transformative trends in a digital world. We experiment with technology and working processes which may prove impactful to the goals of the university. Working in close cooperation with faculties and societal partners we create prototypes and apply new technologies and methods to meet the challenges of education. The Centre for Innovation helps explore and build the future of Leiden University.



Universiteit
Leiden



**CENTRE FOR
INNOVATION**
Leiden University



VIRTUAL REALITY AND AUGMENTED REALITY FOR EDUCATION

Virtual Reality (VR) enables you to virtually visit a different place, or experience a situation from someone else's perspective. It gives learners a sense of presence and can affect them emotionally. Aspects that are often difficult to obtain in a traditional classroom setting. Together with teachers, we develop 360° VR experiences.

Augmented Reality (AR) is an interactive experience of a real-world environment whereby the objects that reside in the real-world are 'augmented' by computer-generated images. Together with the Leiden University Medical Center (LUMC) we develop AR apps for medical education, using the Microsoft HoloLens.

In this brochure, we share our findings about the technical and educational aspects of our apps.



Universiteit
Leiden



**CENTRE FOR
INNOVATION**
Leiden University



ARCHAEOLOGICAL FIELD TECHNIQUES

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

We want our archaeology students to be well-prepared for their first excavation. But in order to learn about archaeological techniques, they have to know what goes on at a dig site. In this VR learning experience, students visit a real excavation. Students can select their position on the dig site and observe how professionals work in the field. This happens in a safe and repeatable setting, without having to worry about getting in the way or destroying archaeological finds.

WHY THIS EXPERIENCE?

Visiting an archaeological site can be dangerous, costly and confusing. Where should I go? What am I looking at? With this VR app, students are able to experience the risks and possibilities of working at a real archaeological site, without physically being there. This prepares them for the real deal.

WHAT DID WE LEARN?

- Directing a 360° video shoot proved to be challenging as everything is in view and changes constantly
- A voice-over can be too much; it can hinder the feeling of being immersed in the situation

FUTURE STEPS AND IDEAS

- Integrating extra layers of information within the drone shot
- Testing and integration into the core curriculum
- Experimenting with gaming elements (matching the right tool with the right task)



LAB SAFETY AND SECURITY

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

In this VR experience students find themselves in the lab. They learn about the hazards and risks and they learn how to behave in a responsible way. They get an introduction to the lab's safety equipment, find out about personal safety measures and experience an accident caused by a careless student. With this app, students learn the logic behind taking basic precautionary measures, how to handle in case of emergency, and many other safety rules. Above all, they learn a fundamental lesson: the impact of the choices they make.

WHY THIS EXPERIENCE?

New students have to know about safety measures before they're allowed in the lab. But to really understand the instructions, you need some lab experience. This VR application breaks through this catch-22, giving the students different lab situations in a safe, repeatable and scalable way.

WHAT DID WE LEARN?

- This VR experience is a straightforward method to expose students to risks and make them learn via virtual experience
- How to turn abstract concepts such as risk assessment and hazards vs risk into a captivating experience

FUTURE STEPS AND IDEAS

- Test the long-term effectiveness of the app and compare it with the old school instructions
- Expand from first-year students to masters and new employees



LARGE ISSUES, SMALL PLACES

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

Visual anthropology relies on the collection of visual data. An important part of this research is video-based. For this VR experience, we taught the research team how to shoot and edit 360° video in order to add these technologies to their ethnographical toolkit. These materials became a key modality within a virtual field-school experience. The experience takes students to a small mining town in Ghana, where they become acquainted with small-scale gold miners both on the surface and underground. This app exposes students to a unique ethnographic situation.

WHY THIS EXPERIENCE?

This experience teaches students about the social conditions in a small Ghanaian mining town. It also utilises a multimodal approach to simulate field-based ethnographic research, and it helps students critically evaluate the affordances and limitation of any mode of mediation, including 360° video.

WHAT DID WE LEARN?

- How to teach the research team to record and edit 360° video and spatial audio
- How to record 360° video and audio in challenging or inaccessible locations

FUTURE STEPS AND IDEAS

- Experiment with other modalities of the medium, such as a 360° video created from several 'flat' videos stitched together
- Expand the project by adding more research cases recorded in 360° VR



PER
M
JAK
BUWA
Verkoop

REMOTE SENSING

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

Why is biodiversity decreasing? Is it because of human activities or climate change? Environmental Studies and Research tries to tackle these challenging questions by using a myriad of techniques, for example multispectral imaging and LIDAR scanning. These new technologies allow the researcher to look beyond direct observations and get a more comprehensive view on the biological world. Students explore these technologies in a whole new way by experiencing these views themselves.

WHY THIS EXPERIENCE?

Students often find it difficult to connect abstract data and concepts of novel remote sensing tools to the real world. Combining 360° video footage and remote sensing metrics creates an immersive experience of nature and technology, which goes beyond the capabilities of the human eye.

WHAT DID WE LEARN?

- Linking different kinds of visual material can be a challenge
- Everyone involved in the creation of the experience needs a good understanding of how VR works and what the possibilities are
- Storytelling helps guide the student through the experience

FUTURE STEPS AND IDEAS

- Evaluating how effective this experience is in helping students understand remote sensing techniques
- Integrating more data from different methods
- Showing the results in a larger context (e.g. global)



DIVERSITY CLASSROOM

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

A classroom is a complex and dynamic environment. Good teachers can balance the content of the lesson with the interpersonal relationships and diverse backgrounds of their pupils. This balance comes from experience, which is why it's hard for first-time teachers to focus on more than just teaching. How can we train the observational skills of our teachers-to-be, before they have to face the classroom for the first time?

WHY THIS EXPERIENCE?

A real classroom with teenage pupils is not an easy training environment. With this VR experience, we want to give our soon-to-be teachers a head start. They will find themselves in the middle of busy, diverse classrooms, practicing observational skills in a safe, yet rich VR environment.

WHAT DID WE LEARN?

- It is difficult to gain consent to record in front of a real classroom
- After the experience, plenary discussion among students enables them to learn more about complex noticing skills

FUTURE STEPS AND IDEAS

- Recording the scenes with real pupils
- Building the app
- Integrating it in the core curriculum of ICLON



DEMENTIA EXPERIENCE

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

Patients suffering from dementia can display negative behavioural symptoms, such as aggression. To treat behavioural symptoms, residents need to be trained in gathering and analysing information from the secondhand account of the caregivers. This VR experience places students in the shoes of a caregiver. A family celebrates grandpa's birthday, but all the commotion quickly becomes too much for grandpa...

WHY THIS EXPERIENCE?

Using VR, we can offer resident doctors a safe, repeatable, and realistic scenario to learn from. We hope to motivate students to gain insight into patients suffering from dementia, their motivations and (unmet) needs. This helps them to come up with tailor-made solutions for complex cases.

WHAT DID WE LEARN?

- Teachers learned how to participate in the making of a VR experience: writing a storyboard, recording videos, reviewing the app and then finally the successful user tests

FUTURE STEPS AND IDEAS

- Making a second case study, situated in a nursing home
- Implementing both cases in the training programme



DYNAMIC ANATOMY

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

The ankle joint is a complicated structure. To help students better understand this joint, we created a Hologram application, in close cooperation with the LUMC. The application displays a hologram of an anatomic model of the lower leg, ankle and foot in space. Motion sensors allow students to use their own foot movements to control the hologram in real time. This makes it possible for them to both see and feel how the anatomy of their ankle joint works as they walk around, jump or run.

WHY THIS EXPERIENCE?

Understanding the way the complicated ankle joint functions from a book or computer animation can be difficult. Using this app, students can collaboratively study an anatomical model in 3D, coupled to live motions of their own body.

WHAT DID WE LEARN?

- Users reported that discussing and working together in a shared augmented experience enhances understanding
- Making the ankle tracking anatomically correct is difficult
- Different technologies employed can conflict with each other

FUTURE STEPS AND IDEAS

- Integrating exercises and testing in the app to guide students through the experience
- Integrate more real-world cases in the app, such as injuries
- Research the learning effects of the app's specific features



DYNAMIC CLINICAL PRESENTATIONS

LED SESSION > STORYBOARD & SCRIPT > SHOOTING > EDITING > APP DEVELOPMENT > ALPHA > BETA > VERSION 1.0 > EVALUATION

This augmented reality experience simulates the physical examination needed to diagnose various lung diseases. By using a real stethoscope which is positionally tracked, students can interact with a virtual anatomic model of a torso and listen to lung sounds recorded from real patients. This way, medical students can practice the full process of diagnosing lung diseases in a simulated environment. This integrates many of the affective, embodied, collaborative and multimodal components of a real-world setting.

WHY THIS EXPERIENCE?

Clinical reasoning is hard to learn. Medical students work with a wide variety of patient cases to acquire clinical reasoning skills. The app is aimed at improving these skills using lung diseases. It's a unique opportunity to actively learn in an authentic but safe environment.

WHAT DID WE LEARN?

- How to create a setup that makes it easy to enable a shared experience for multiple users
- How to incorporate breathing sounds with the 3D model that can be listened to using a virtual stethoscope

FUTURE STEPS AND IDEAS

- Testing and integration into the regular curriculum
- Adding more cases, different medical conditions
- Publishing the application in the app store for worldwide use
- Expanding the application to other parts of the human body

Our Mission is to identify and explore transformative trends in a digital world, creating innovative methods, products and solutions for Leiden University and its partners.

The Centre for Innovation applies digital technologies to education, focusing on projects for societal impact and emerging forms of education.

For information on the VR and AR apps or the broader work done by the Centre, contact c4i@sea.leidenuniv.nl.

