Cognitive Projections

Virtual Reality in the Classroom: Enhancing Education with Immersive Experiences

Festival of Teaching and Learning 2019

Centre for Teaching and Learning

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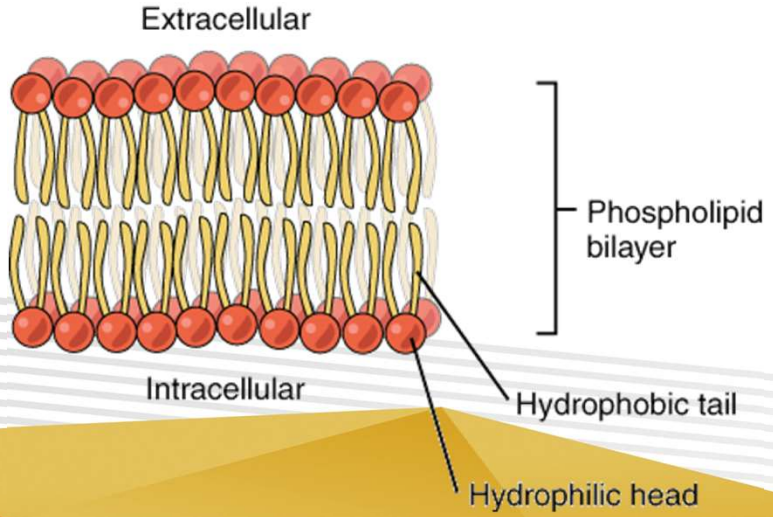
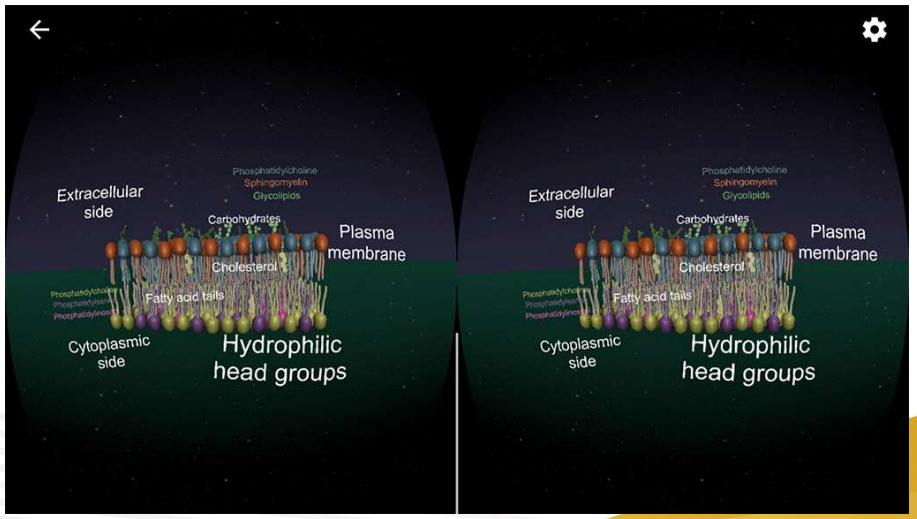
May 2, 2019

Cognitive Projections

- Learning cell anatomy knowledge
  - Current methodology
  - Proposed methodology

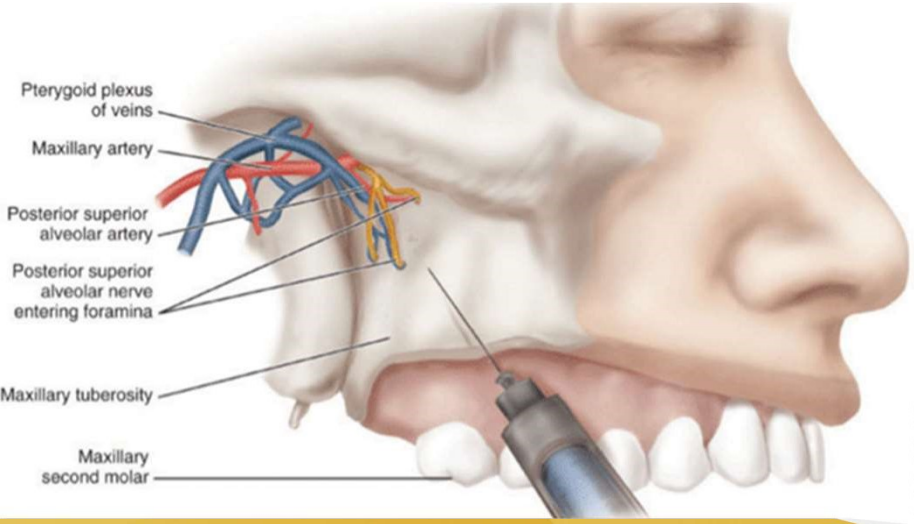


VERSUS



VR SIMULATIONS

- Learning dental anesthesia injections skill
  - Current methodology
  - Proposed methodology



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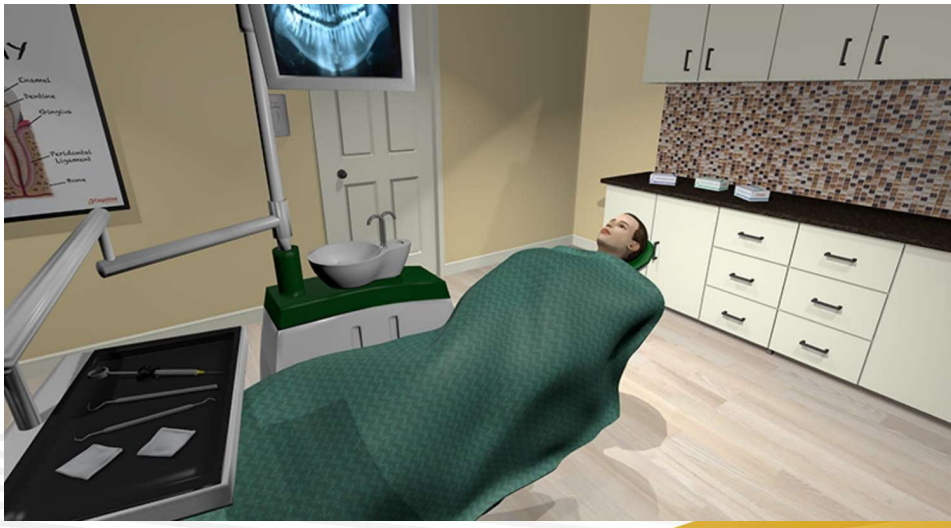


WHAT IS VIRTUAL REALITY?

- Replace your visual sense (and others) of the physical world with simulated virtual environments

TYPES OF VR

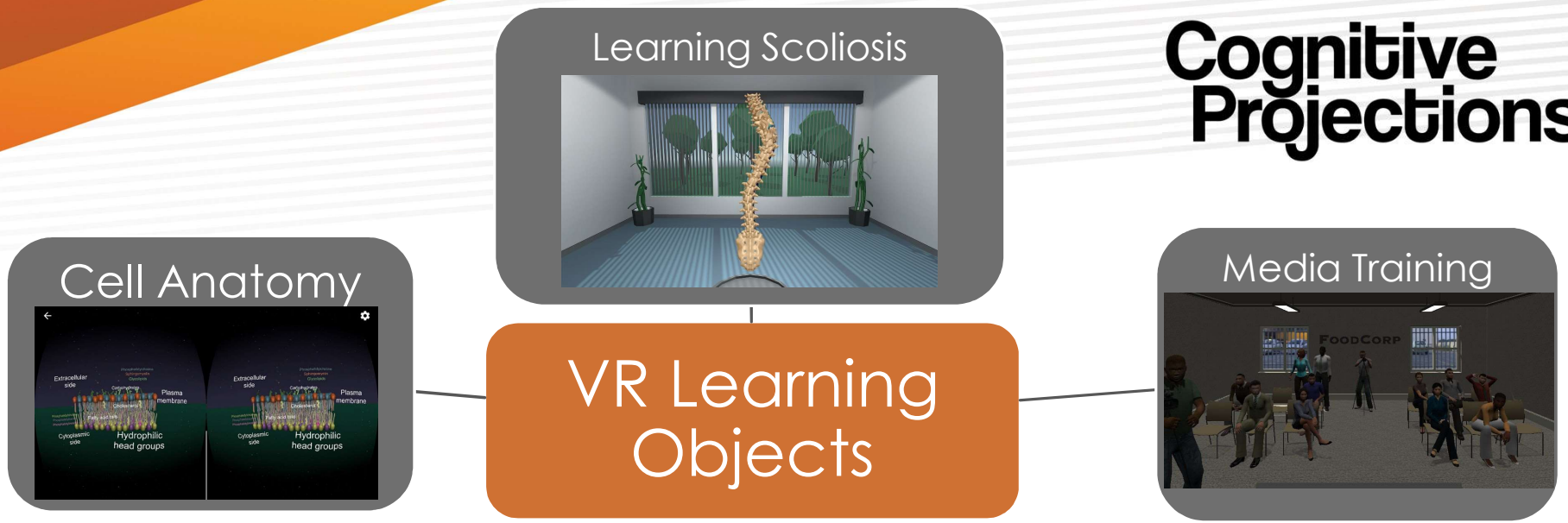
VR LEARNING OBJECTS

- Handheld VR viewers
  - Google Cardboard
- Uses phone
- View 3D objects and animations

VR SIMULATORS

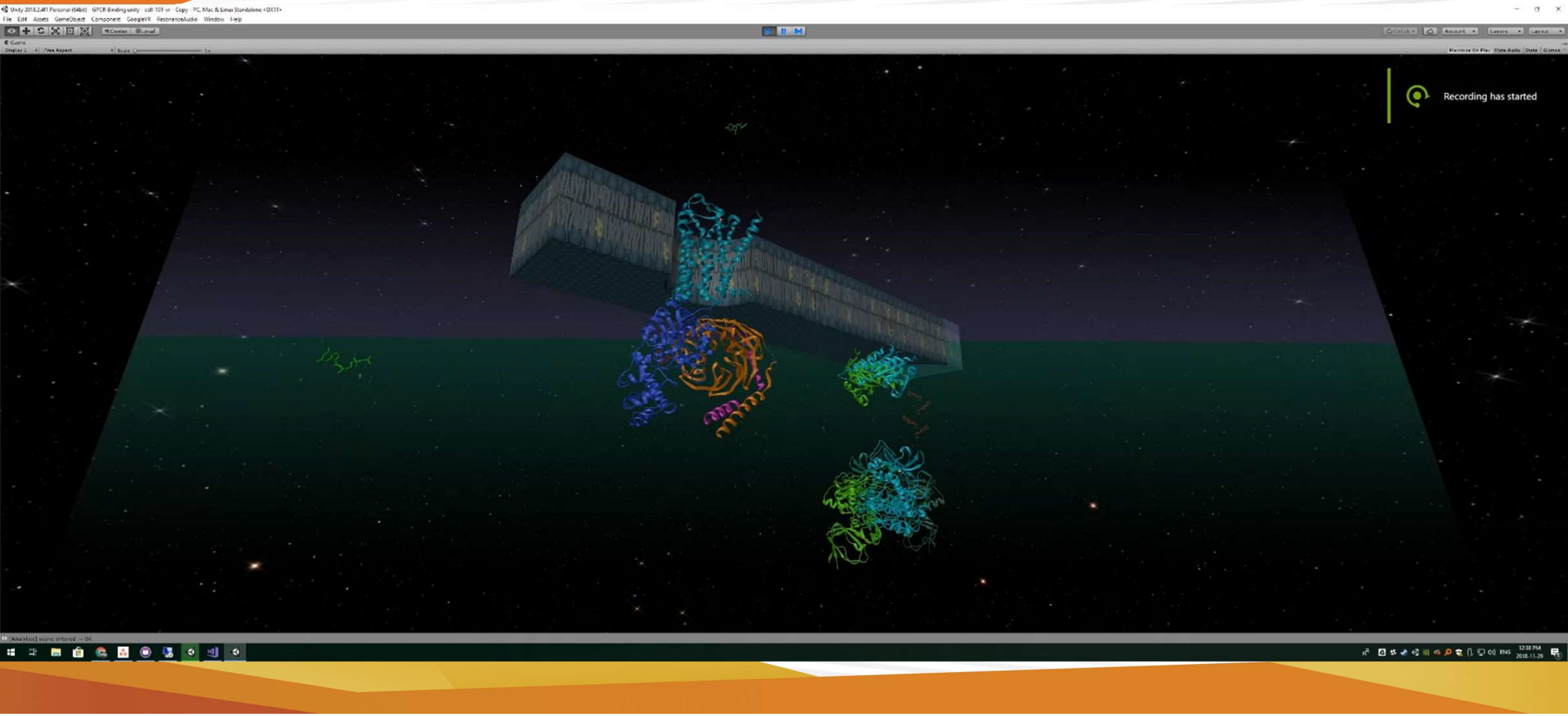
- Full Head-Mounted Displays
  - HTC Vive, Oculus Rift
- Uses high-end computer
- Fully immersive experience

Cognitive Projections



- Create phone apps to use with VR viewers
- Integrate into lesson plans or student prep activities before lecture
- Follows the *flipped* classroom model
- Bricolage XR and giving instructors the ability to create VR lessons
  - EON Creator AVR
  - Amazon Sumerian

CELL ANATOMY VR



Cognitive Projections

(5 = very helpful, 1 = Not at all helpful)

- How useful was the In-Class VR Demo for understanding the structure of a phospholipid? ***Average: 4.0***
- How useful was the In-Class VR Demo for understanding the structure of a cellular membrane? ***Average: 4.1***
- How useful was the In-Class VR Demo for understanding the fluidity of a cellular membrane (the animated model)? ***Average: 4.1***
- How useful was the In-Class VR Demo for understanding the asymmetry of a cellular membrane? ***Average: 3.8***
- How useful was the In-Class VR Demo for understanding the orientation/topology of a transmembrane protein? ***Average: 3.8***
- How useful was the VR for GPCR activation for understanding this type of signal transduction? ***Average: 4.1***
- How useful was the VR for GPCR activation for understanding how conformational changes regulate signaling? ***Average: 4.2***
- How useful was the VR for understanding how signals received outside the cell trigger changes inside the cell? ***Average: 4.3***
- Did you enjoy the VR demo? ***44 (100%) yes*** 0 (0%) no
- Did you show any elements of the VR demo to a friend who is not taking Cell 201 with you? ***27 (61%) yes*** 17 (39%) no
- Did you show any elements of the VR demo to a member of your family or household? ***26 (59%) yes*** 18 (41%) no

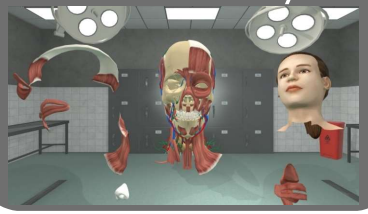
VR LEARNING OBJECTS

- Pros
  - Accessible
  - Cheap
  - Ability to view structures in true 3D
- Cons
  - Limited power
  - Limited interactivity

Cognitive Projections

Dental Anesthesia

Anatomy



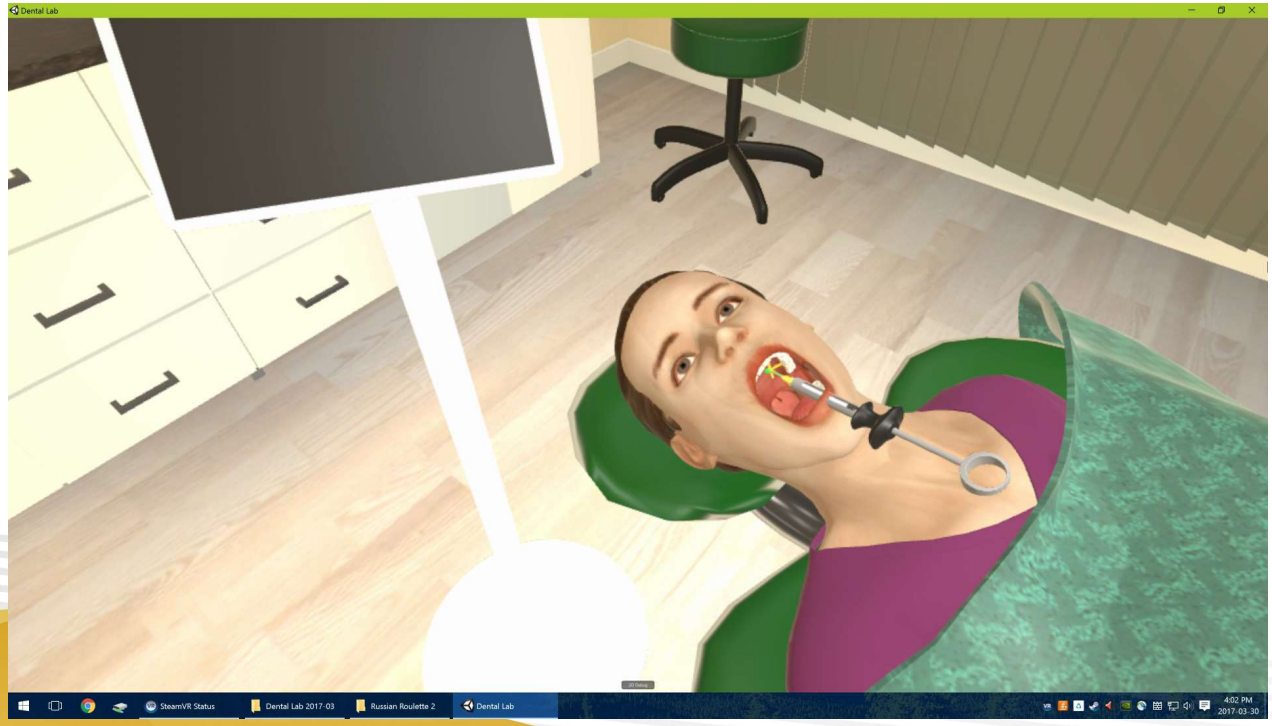
Clinical Exam

VR simulations

- Standalone module to help students learning highly complex structures
- Powerful cutting-edge VR simulation to improve training in health care and education

DENTAL INJECTIONS VR

Immersive Simulation of Dental Anesthesia Injections



VR SIMULATIONS

- Pros
  - Highly immersive
  - Highly interactive
  - Safe training
  - No supervisor needed
- Cons
  - Less accessible
  - Expensive to develop

VR IN EDUCATION

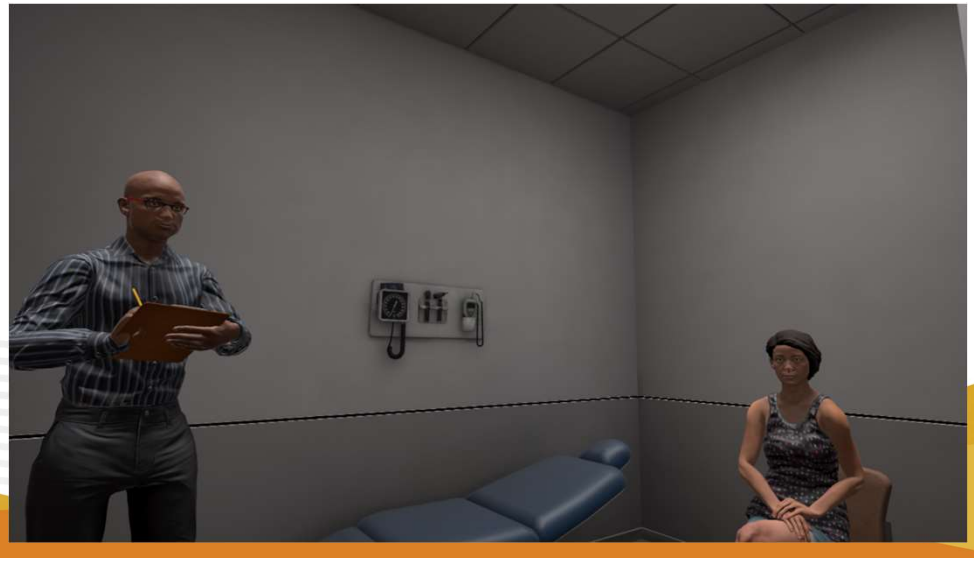
- Increased learning efficiency (Liang & Xiaoming, 2013)
- More interest and enjoyment (S. H. Lee, Sergueeva, Catangui, & Kandaurova, 2017)
- Improved engagement and immersion with the material (Moro et al, 2017)

VR IN EDUCATION

- Immersive VR improved adherence to advice taking (Chen et al, 2019 *to be submitted*)

REDUCING ANXIETY IN EDUCATION

- ~20% of university students experience mental health concerns (Auerbach, 2016)
  - VR exposure therapy reduces anxiety and other irrational fears (Carl et al, 2018)
- Anxiety among OT students
  - OSCE VR to reduce anxiety



WHAT IS COGNITIVE PROJECTIONS

- VR Development Program
  - Project Lead: ***Martin Ferguson-Pell, Ph.D. C.Phys. FRSA***
  - Technical Director: ***Nathanial Maeda, Ph.D. E.I.T.***
  - Artistic Director: ***Lucie Eliasova, DiplGD, Dipl3DAnimMod***
- Inter-Faculty Initiative in 2015
  - Rehabilitation Medicine, Medicine and Dentistry, Science, Engineering
- A UofA research program for VR/AR innovations in education
- TLEF Funding

Cognitive Projections

- Our Vision:
  - ***Empower*** educators through immersive VR/AR learning experiences and to ***better prepare*** students for their careers and daily activities
- Our Values:
  - Empowerment through VR/AR technology
  - Educational excellence
  - Interdisciplinary collaboration is the key

Cognitive Projections

Challenge in teaching complex concepts

CogPro

VR learning objects

VR simulations

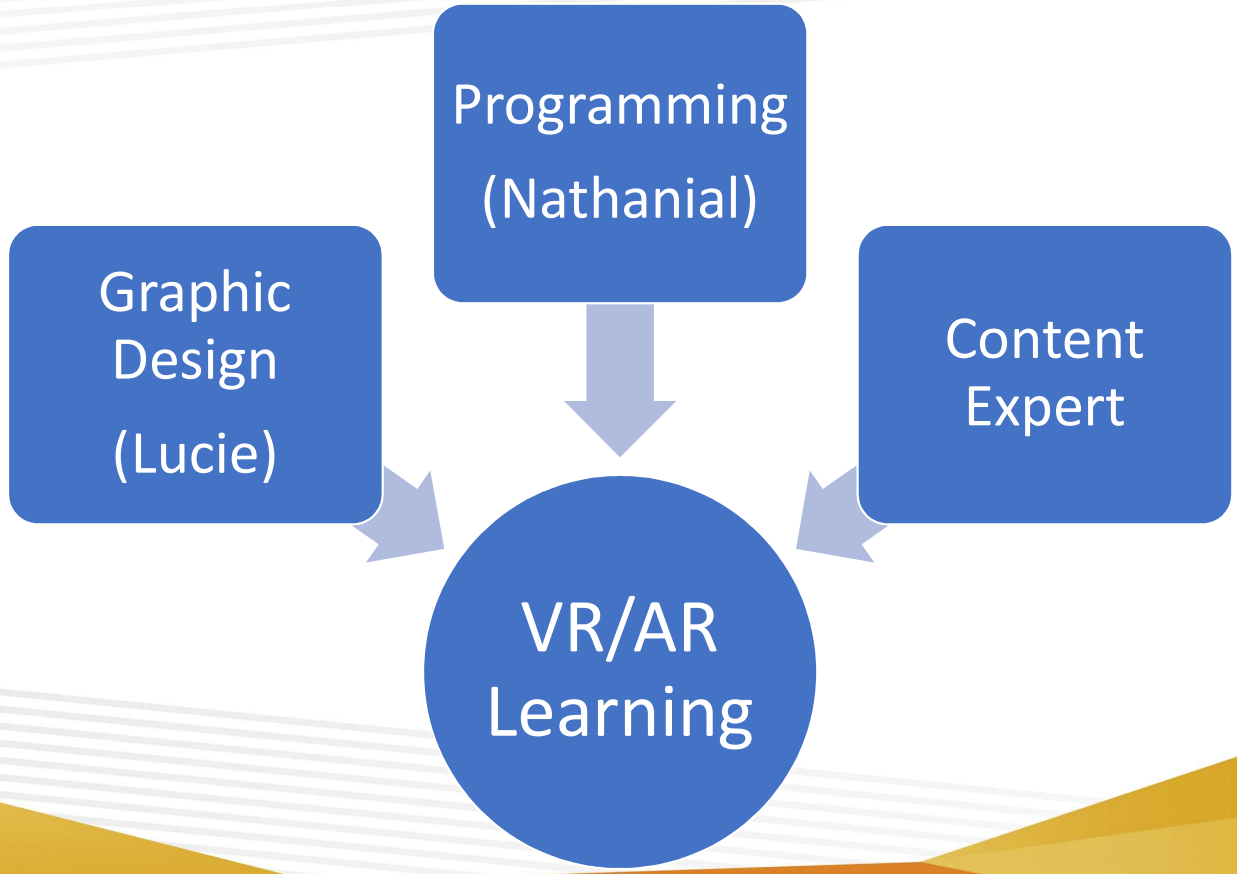
Empower instructors

Inspire and prepare students

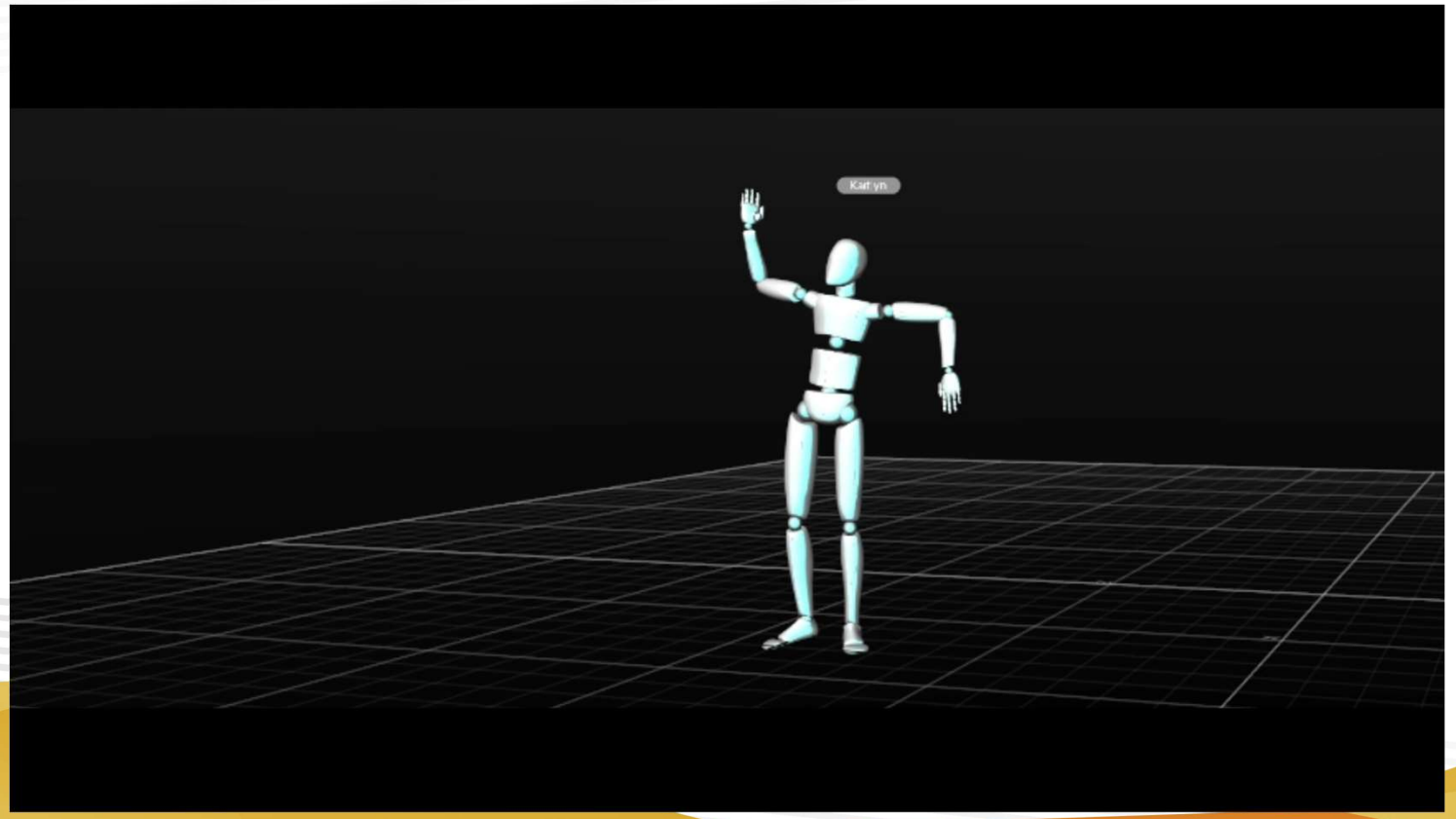
- Using low-cost VR viewers to ***visualize*** complex concepts
- Using immersive VR simulators to impart ***authentic experiences***

CREATING VR SIMULATIONS

- Co-creation process
- Highly collaborative
- Ensure realism



DEVELOPING A VR SIMULATION



WHERE WE ARE GOING
EXPANDING AI-ENHANCED VR

- Build upon current capabilities
  - Improve natural language processing
  - Include micro-expression communication pragmatics
- Expand applications
  - Science courses
  - Behavioural Psychology
  - Health care training and general safety
- Integrate into research programs
  - For example, observing people and interactions in repeatable environments

USES OF VR
WITH COGNITIVE PROJECTIONS

- Create VR learning objects
  - View ***complex structures*** in 3D
    - Chemical molecules, biological entities, nuclear physics
  - Visualize ***abstract concepts*** in 3D
    - Such as black holes, time dilation, neutron star collisions, LHC
    - Can illustrate 3D contour or vector maps (i.e. kinetics and kinematics)
- Create AR learning objects
  - Overlay information onto physical objects
  - ***Interact*** virtually with physical objects
- Create VR simulations
  - Learn/research through authentic ***experience*** in a safe, versatile, virtual environment
- **ENHANCE EDUCATION**

YOUR THOUGHTS?

- Integrating into specific courses?
- Expanding the program?
- Use within specific research programs?

- Would you be interested in a One-Day workshop?
  - i.e. creating your own content/courses/lessons using EON Creator AVR

CLOSING REMARKS

- Thank you for the opportunity
- We look forward to hearing from you
  - We hope for future collaborations
  - Contact us and come check out our lab: ECHA 2-545

- Thank you to Centre for Teaching and Learning
  - TLEF Funding


Cognitive Projections
Questions?
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