WHAT THE TECH?

HOW SWINBURNE IS USING NEW TECH TO TEACH 'TECH'

SWINBURNE UNIVERSITY OF TECHNOLOGY

AVR TECHNOLOGY

CRISTOBAL SIERRA
RESEARCH ASSOCIATE

INDUSTRY 4.0

Industry 4.0 is implemented across the Europe, but the Australian manufacturing sector lacks specific dissemination strategies. Australia has an implementation strategy through "Prime Minister's Industry 4.0 Taskforce," and Swinburne has partnered with the Australian Manufacturing Growth Centre (AMGC) to harness Industry 4.0 opportunities through the Manufacturing Futures Research Institute.

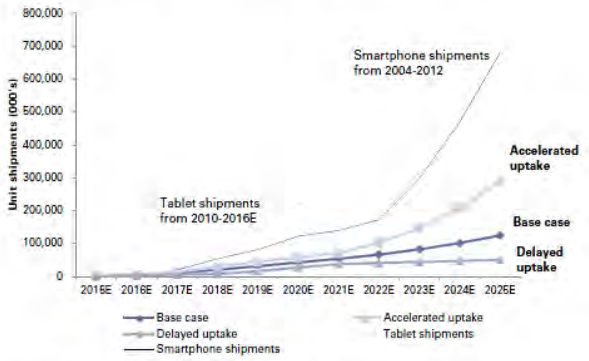
Mixed reality (XR) uses technologically innovative augmented and virtual reality (AVR) tools in order to exponentially change the manufacturing process and product in a novel ground-breaking ways. This emergence and convergence of complex new industry 4.0 constitutes–mixed reality (XR), big data analytics, advanced robotics and the internet of things (IoTs), foster the business economics in manufacturing sector.

This presentation will showcase a novel engagement model and case studies on implementation of these AVR technologies within Australian manufacturing sector.

AVR TOOLS- US$80 BY 2025

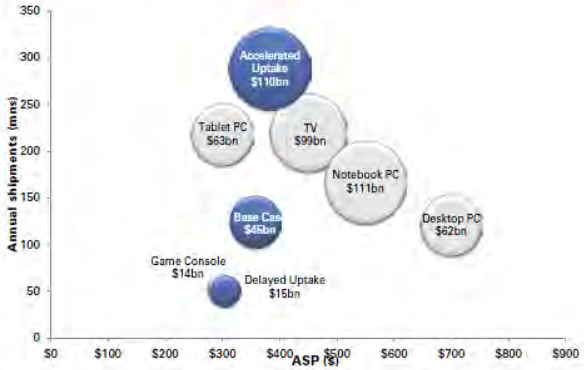
Source: Equity research Jan 13 2016
Goldman Sachs Global Investment Research
2016 Goldman Sachs.

Exhibit 1: Our VR/AR unit forecasts assume far slower adoption than smartphones or tablets



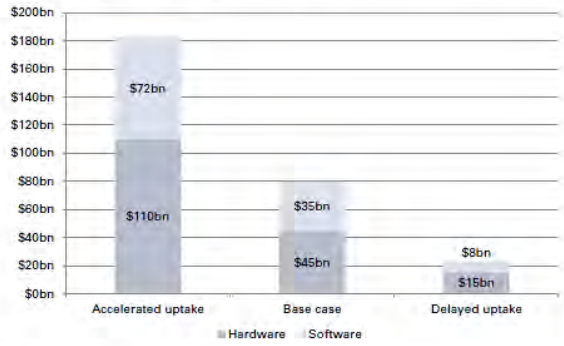
Source: Goldman Sachs Global Investment Research, IDC.

Exhibit 2: Our three scenarios for a 2025 VR/AR hardware market



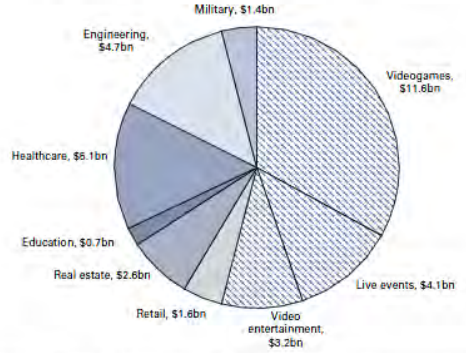
Source: Goldman Sachs Global Investment Research, IDC.

Exhibit 3: Our combined 2025 VR/AR hardware and software scenarios



Source: Goldman Sachs Global Investment Research.

Exhibit 4: Our 2025 base case VR/AR software assumptions by use case



Source: Goldman Sachs Global Investment Research.

Exhibit 5: The progression of our base case hardware and software forecasts

Exhibit 6: HMD price declines could be similar to what we've seen in the past

AVR TOOLS FOR TEACHING

We consider the use of AR and VR as an important technology enabler for Industry 4.0 and it is therefore important for us to bring this into our courses and teach students in an effective way. The students have had an overwhelmingly positive response to the AR and VR segment, and our combined AVR (Augmented and Virtual Reality) and 3D visualization studio where we have the EON Icube Mobile and a suite of other scalable AR and VR systems has also proven to be an important facility in this endeavor.”

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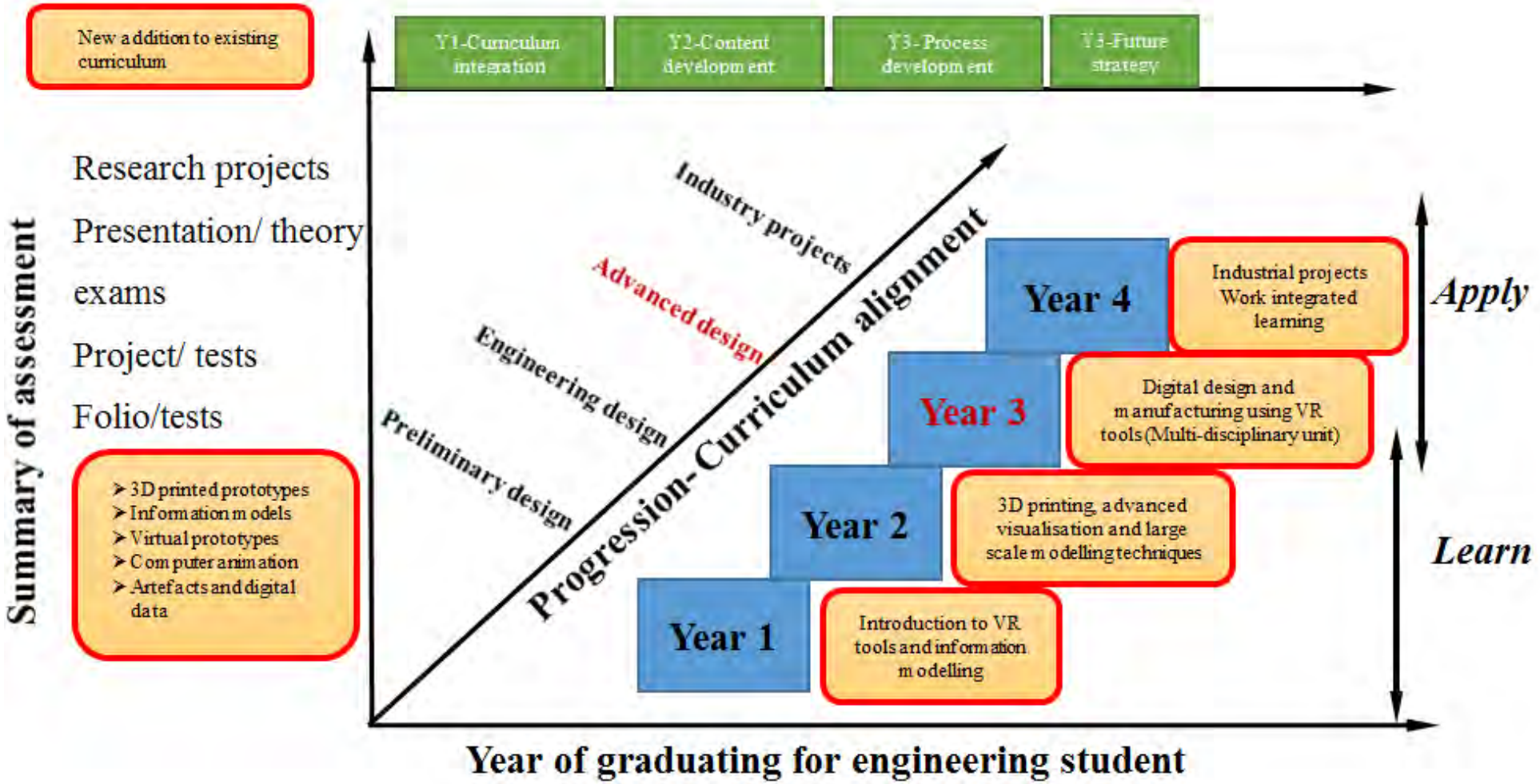
CURRICULUM DESIGN & MAPPING WITH NEW AVR TOOLS/ INDUSTRY 4.0



RAILWAY INDUSTRY - BOMBARDIER TRAMS AND VELOCITY TRAIN

Gen 1 E Class

Concept 7.3

BOMBARDIER
the evolution of mobility

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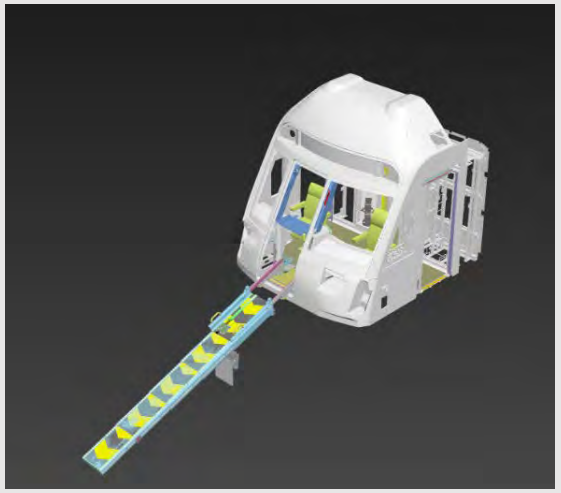
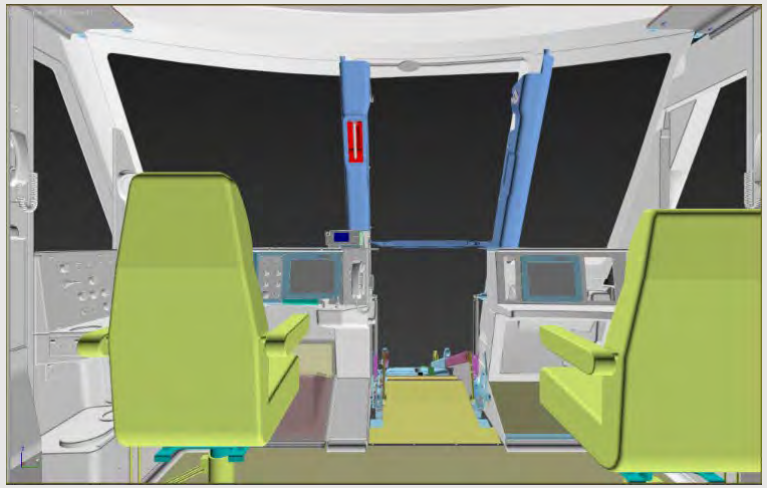
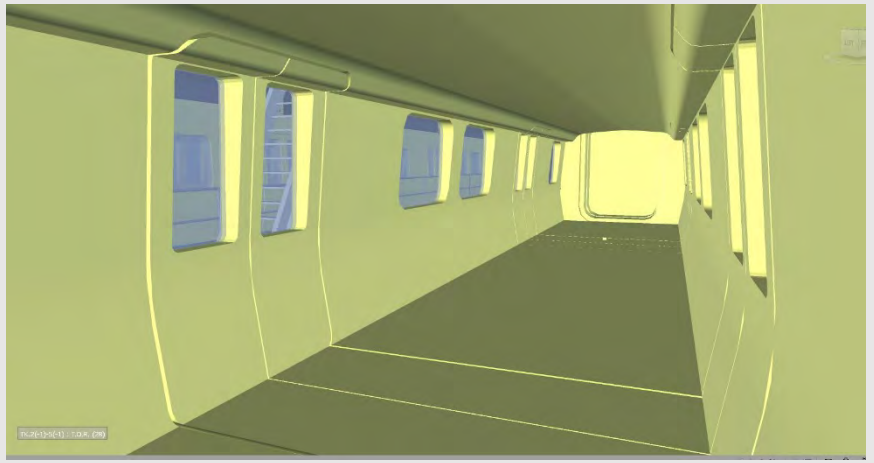
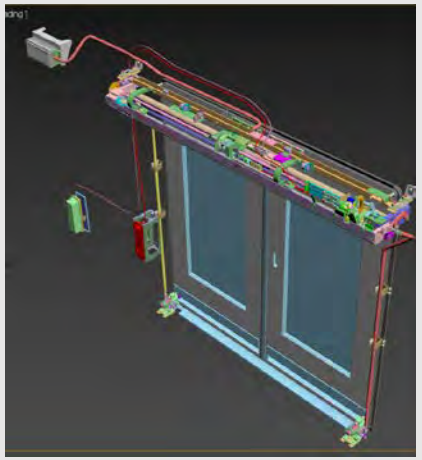
DOWNER EDI HIGH CAPACITY METRO TRAINS (HCMT) AND WARATAH VISUALIZATION PROJECT







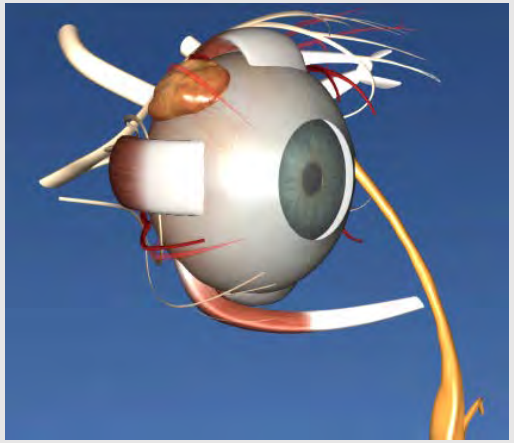


BIOMEDICAL PRODUCTS

Easy Walker

Hospital/Aged Care Bed

Eye Surgery Simulator



Swivel Seats – Aged Care

SnoreBeGone Sleep apnoea beds

SLEEP APNOEA SYSTEM
WORLDWIDE PATENT #: 2014903889

PROTECT·A·BED®
Every Mattress Needs Protection®

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PROOF OF CONCEPT

3D printed and electronic control system embedded "*Sleep Apnoea System*" prototype and its multiple configurations

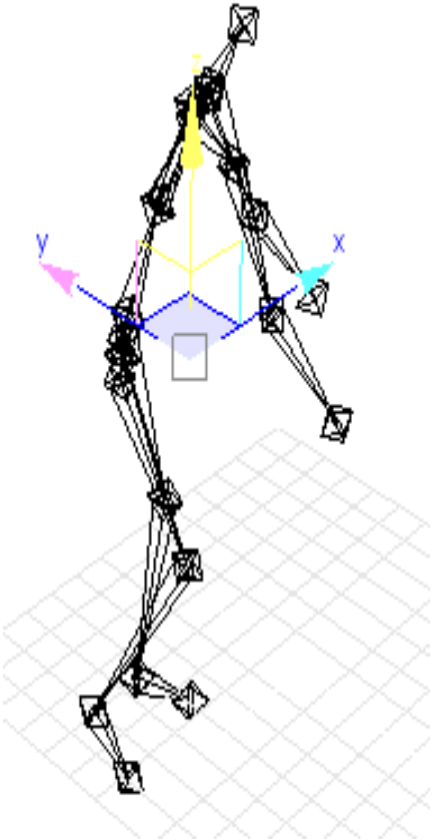
E- WALKER
COMPACT COLLAPSIBLE DESIGN FOR SPACE OPTIMIZATION

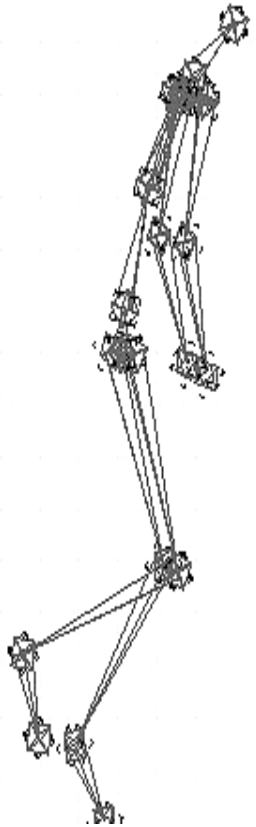
Rollator with Crutches

Transport Chair

Easily fits in to smallest production car boots such as TOYOTA Aqua, Prius C, etc.

MOTION CAPTURE STUDIES





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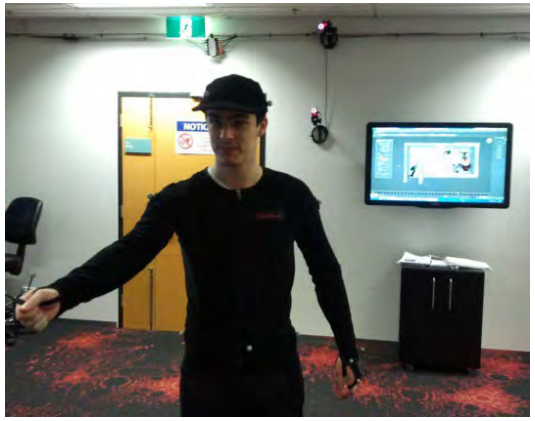
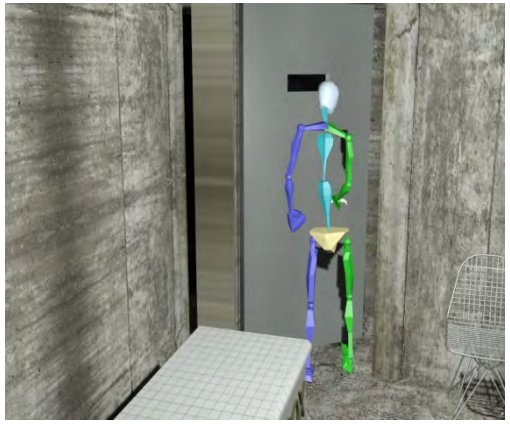
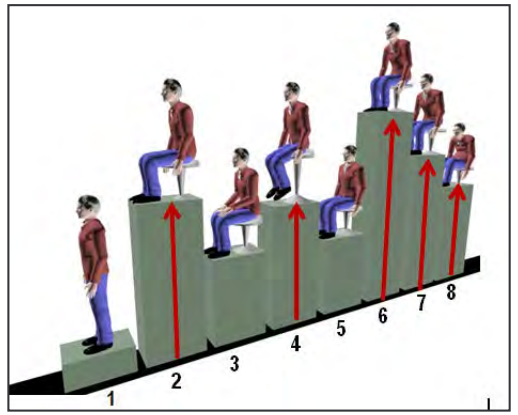
BUSHFIRE SHELTER DESIGNED WITH VR







Premiers Design Award Finalist 2012

Frankston Concrete Products

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TECH IN ARCHITECTURAL ENGINEERING

DR. GREGORY QUINN

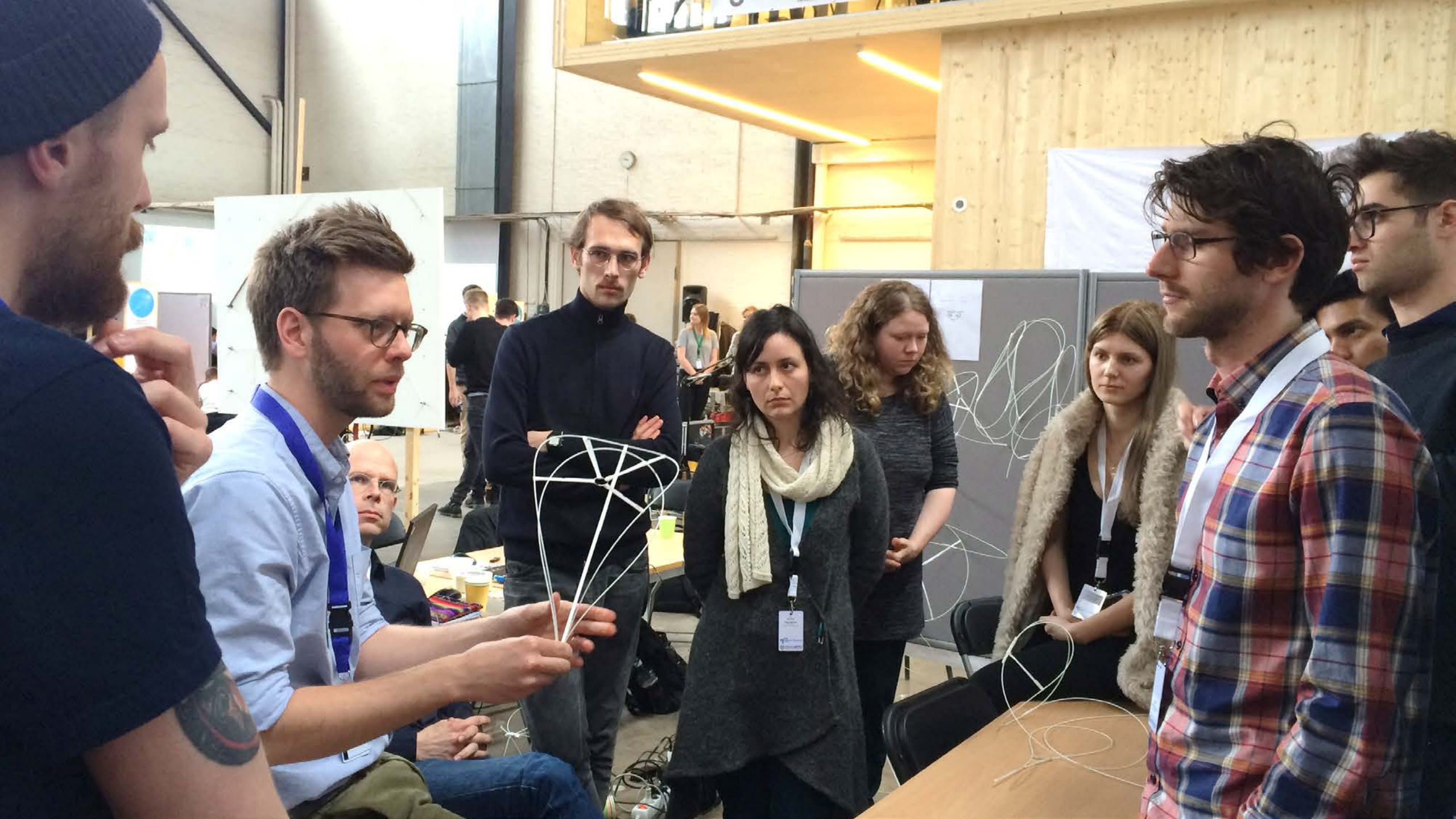
Dr Greg Quinn – Architectural Engineering

A new way to engage STEM subjects

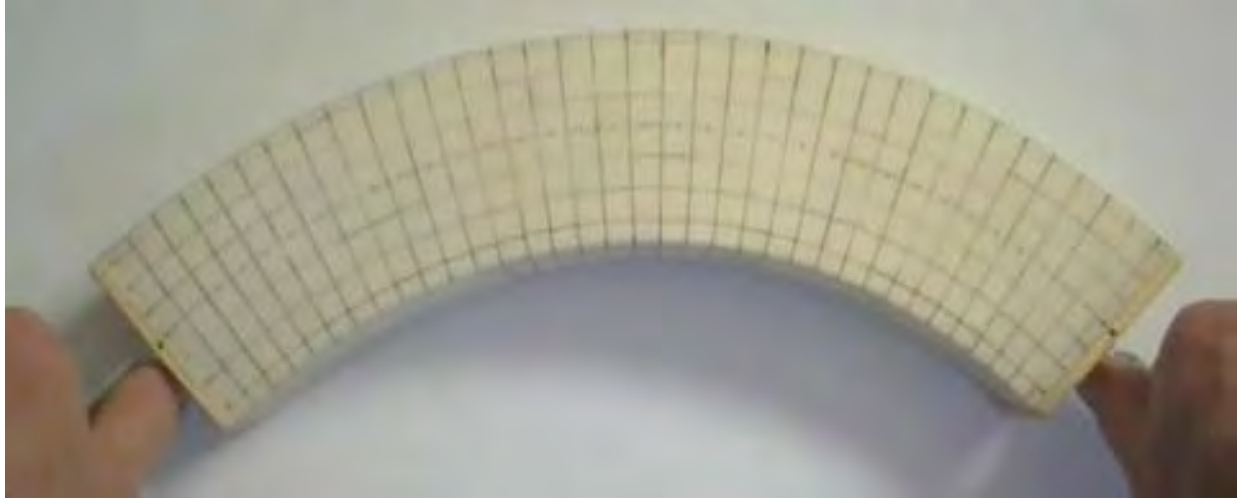
‘invisible becomes visible’

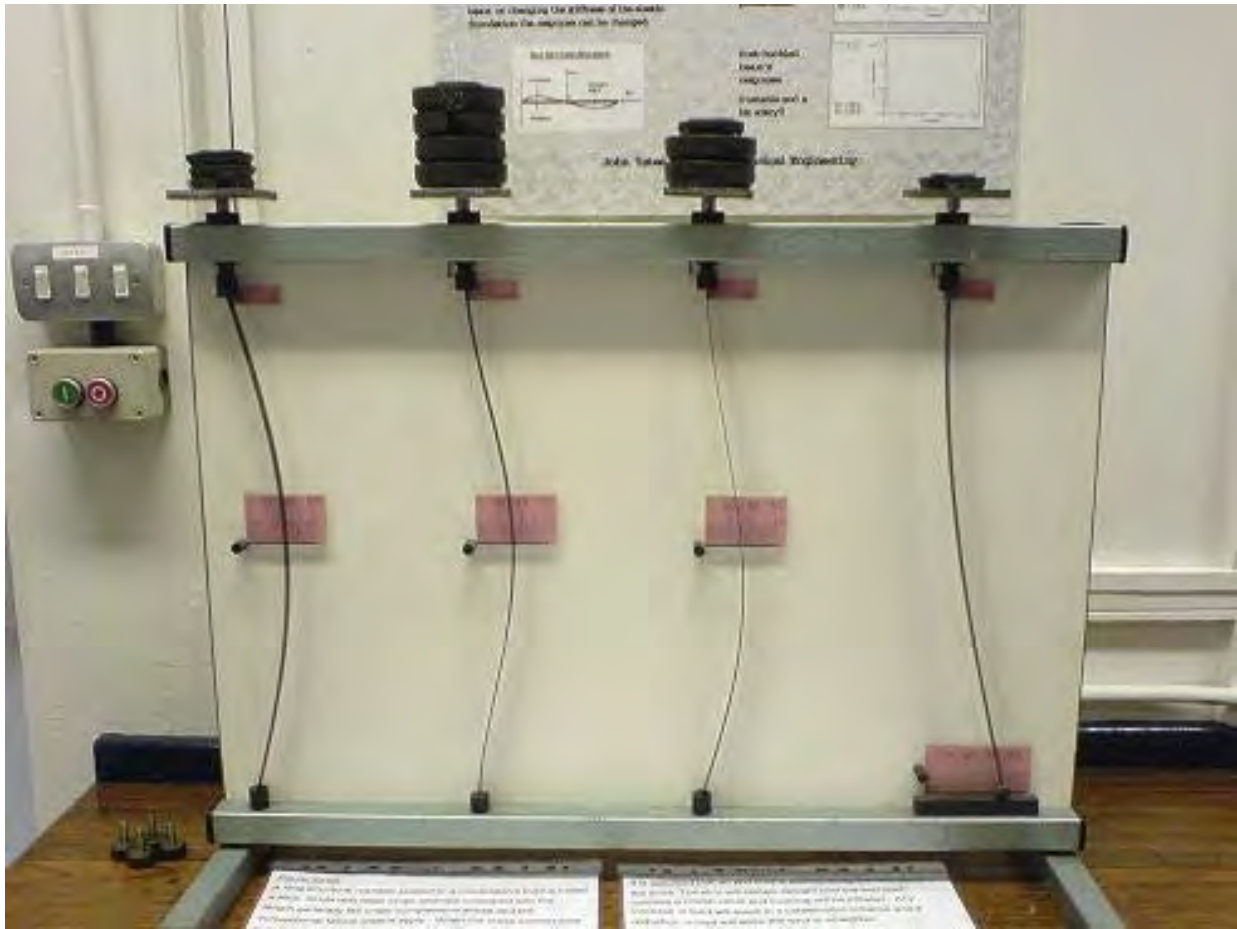
Vision:

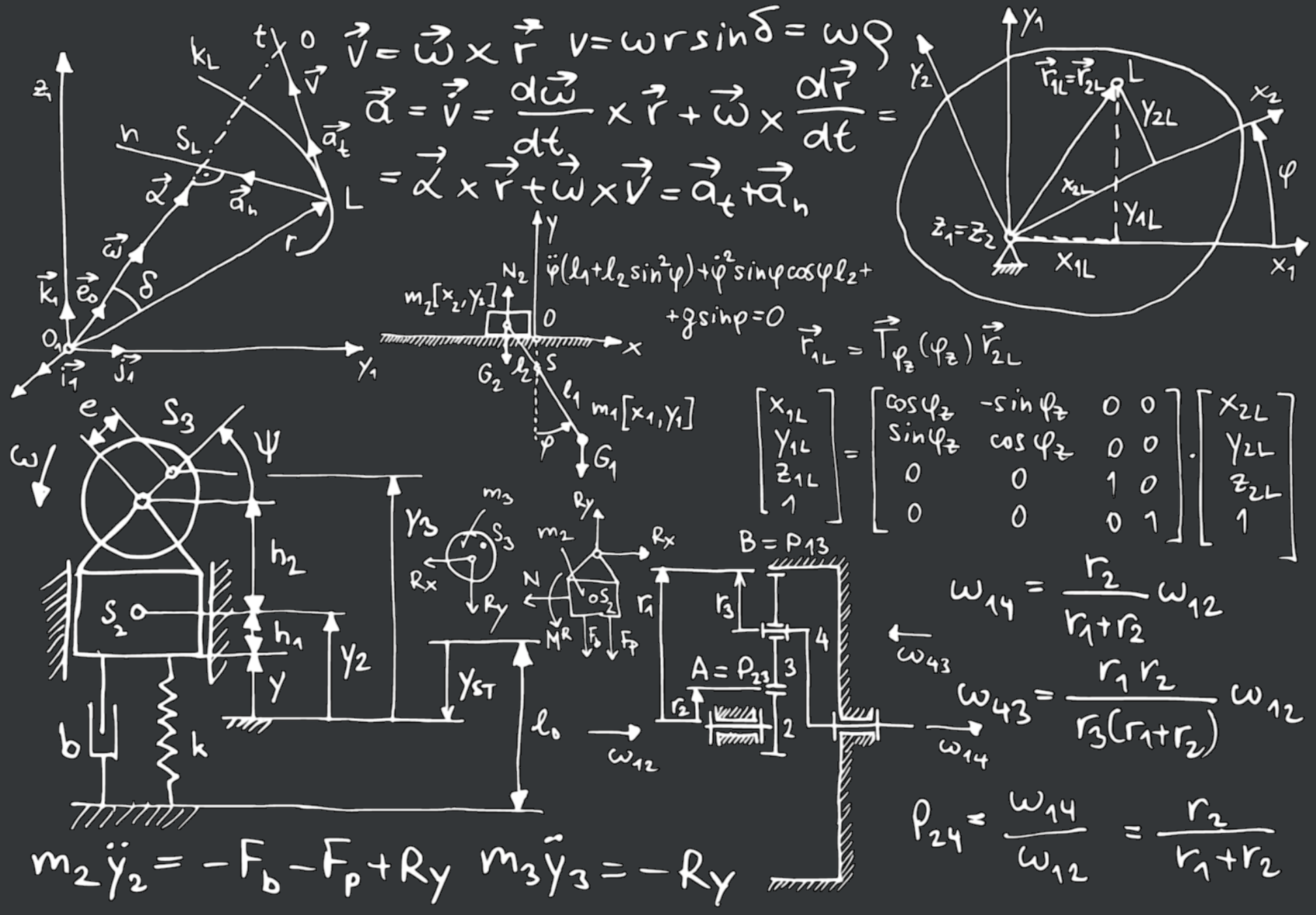
A go-to device for explaining science & engineering phenomena to all manner of people

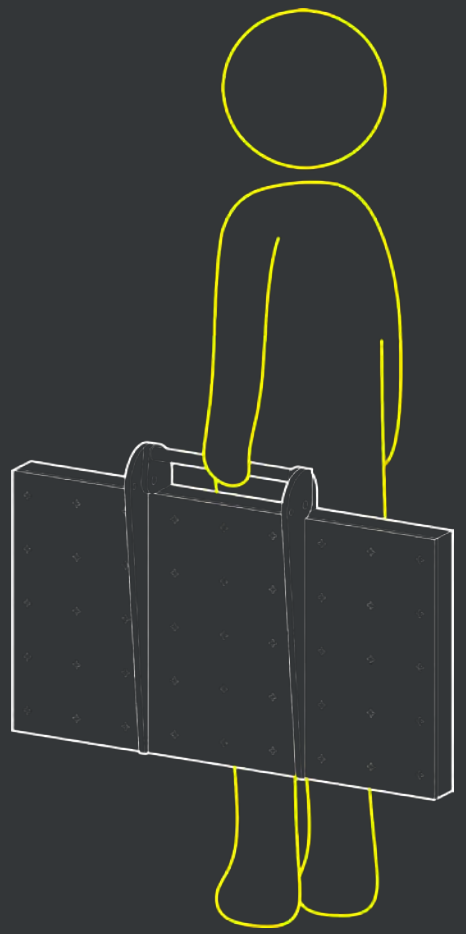


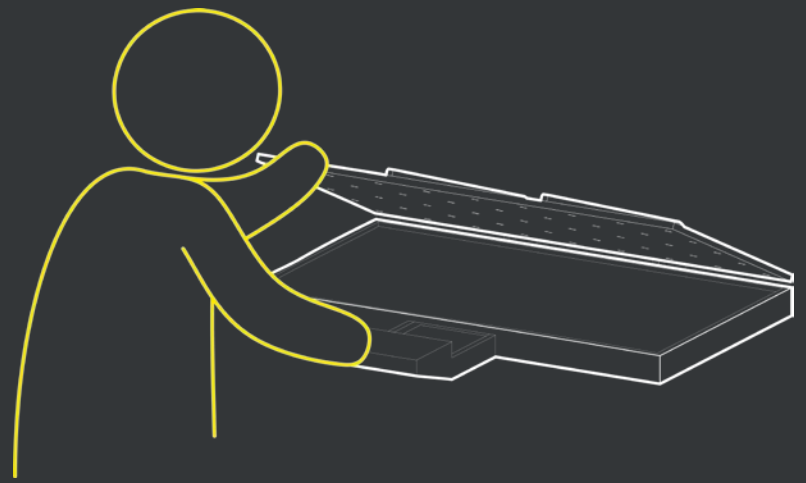
TRUSS STRUCTURE
F
F
3/2 F

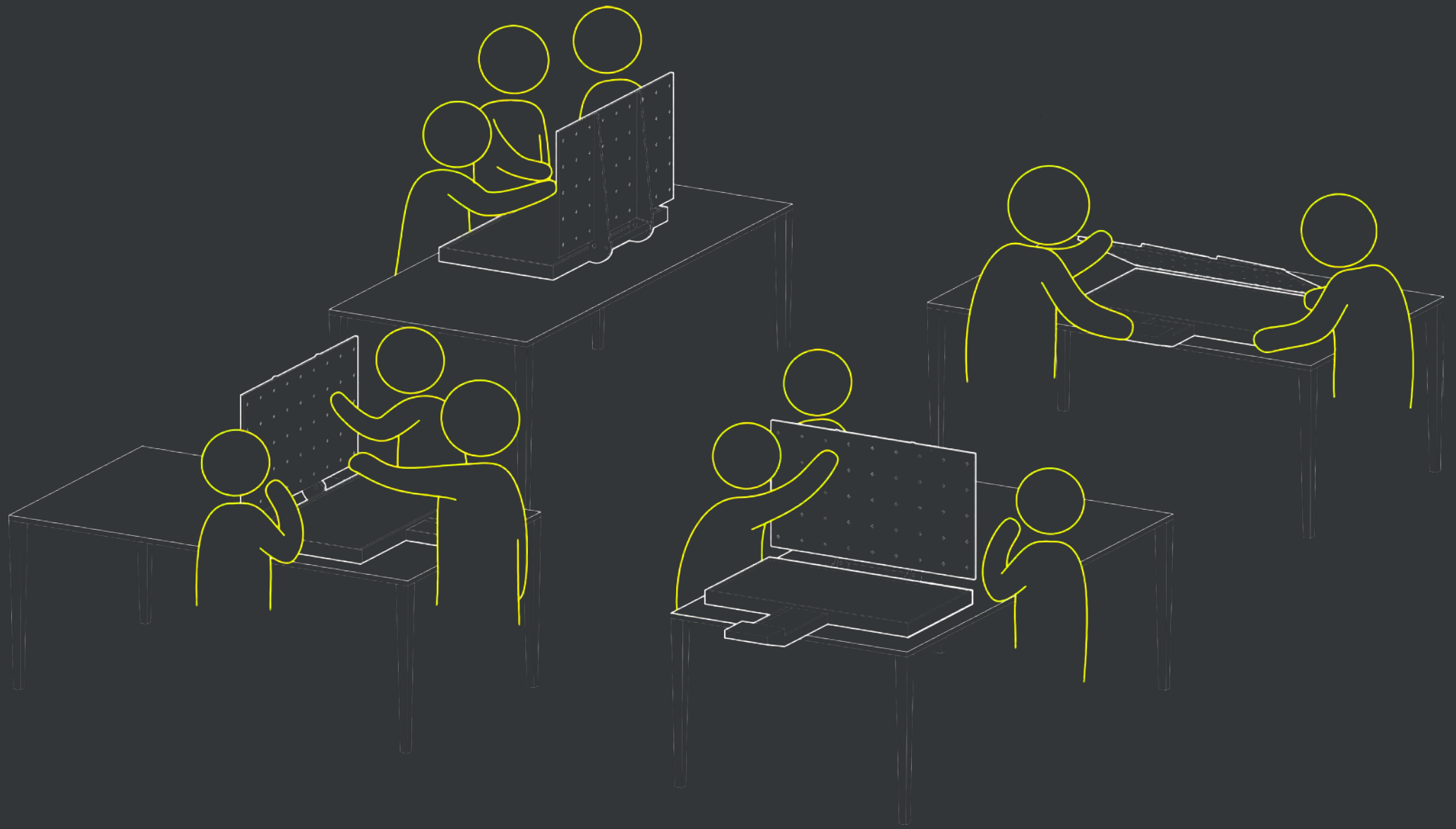





$\vec{v} = \vec{\omega} \times \vec{r}$ $v = \omega r \sin\delta = \omega\rho$
$\vec{a} = \vec{v} = \frac{d\vec{\omega}}{dt} \times \vec{r} + \vec{\omega} \times \frac{d\vec{r}}{dt} =$
$= \vec{\alpha} \times \vec{r} + \vec{\omega} \times \vec{v} = \vec{a}_t + \vec{a}_n$
$\ddot{\varphi}(l_1 + l_2 \sin^2\varphi) + \dot{\varphi}^2 \sin\varphi\cos\varphi\, l_2 + g\sin\varphi = 0$
$\vec{r}_{1L} = \vec{T}_{\varphi_z}(\varphi_z)\,\vec{r}_{2L}$
$\begin{bmatrix} x_{1L} \\ y_{1L} \\ z_{1L} \\ 1 \end{bmatrix} = \begin{bmatrix} \cos\varphi_z & -\sin\varphi_z & 0 & 0 \\ \sin\varphi_z & \cos\varphi_z & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x_{2L} \\ y_{2L} \\ z_{2L} \\ 1 \end{bmatrix}$
$\omega_{14} = \frac{r_2}{r_1 + r_2}\omega_{12}$
$\omega_{43} = \frac{r_1 r_2}{r_3(r_1 + r_2)}\omega_{12}$
$m_2\ddot{y}_2 = -F_b - F_p + R_y \quad m_3\ddot{y}_3 = -R_y$
$\rho_{24} = \frac{\omega_{14}}{\omega_{12}} = \frac{r_2}{r_1 + r_2}$
B = P13
A = P23







LEARN

CREATE

SHARE

SWINBURNE UNIVERSITY OF TECHNOLOGY

construct
AR

HOW YOU CAN BECOME AN ‘MR’ EXPERT IN 10 MINUTES

JOEL MARTIN

NEW TECHNOLOGY = NEW OPPORTUNITIES

Our innovation is either:

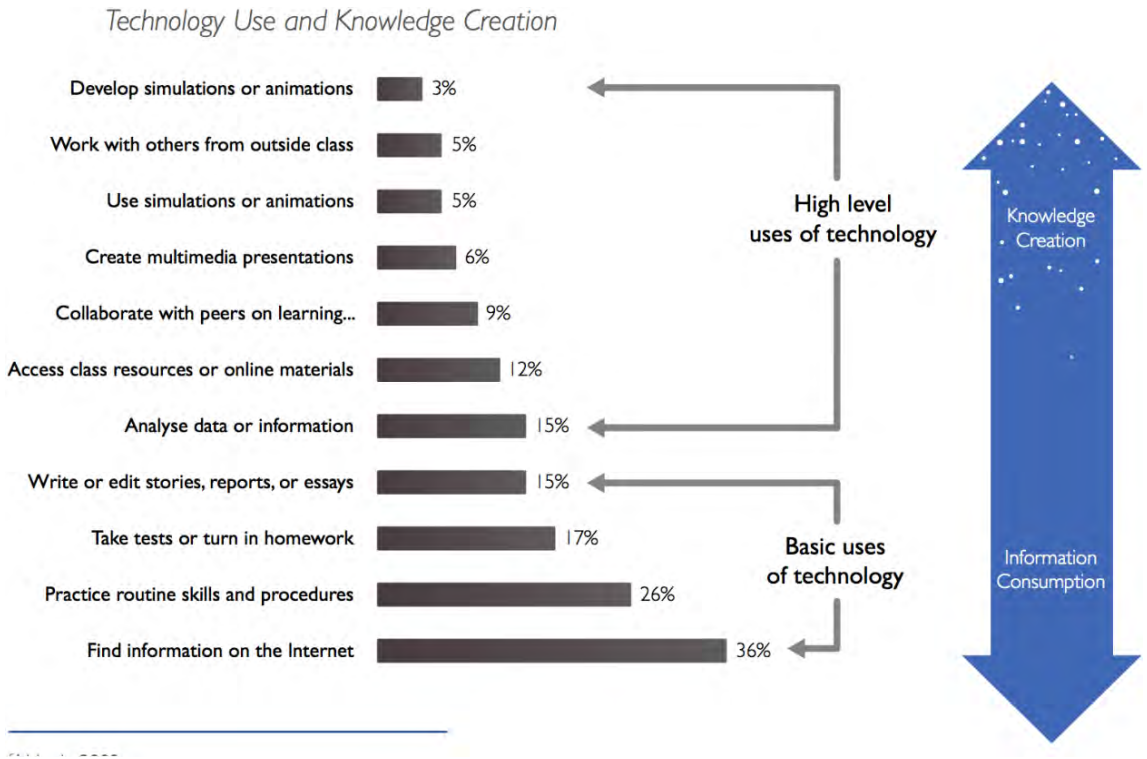
Industry-led (our students need to lead what's coming/already here)

Pedagogically led (improves learning experience, acceleration of learning, or creation of knowledge)

We aim to never introduce technology for the sake of it.

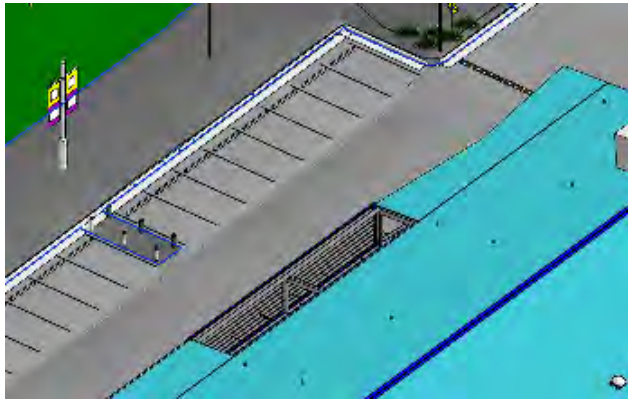
Today I'll be focusing on a specific part, and you'll all be experts by the end!

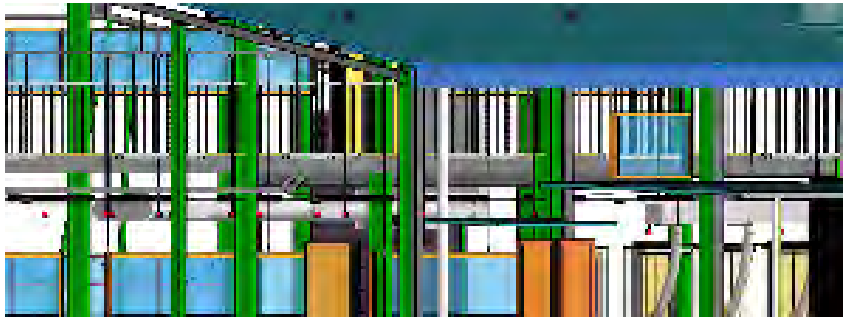
Fullan and Langworthy 2014



“MIXED REALITY”

Changing the world around us to become an entirely new canvas for you to play, learn, communicate, work and interact with.





THE MR SPECTRUM

Real Environment

- Nursing: Mental health simulations (using actors)

Augmented Virtuality

- Burgeoning growth in ACT

Augmented Reality:

- Nursing: simulated mannequins
- Engineering (I4.0): Thingworx augmentation

Virtual Reality:

- Advanced Construction Technology: VR simulations of student designs, digital twin creation

INSTANT EXPERT – WHEN GUIDING STUDENTS…

The message: Australian/global manufacturing, construction and design environments are increasingly moving into virtual environments.

- MR – Mixed reality which covers a spectrum from fully physical to fully virtual.
- VR and AR can sit in this spectrum
- We aren't talking about gaming here – but we are talking about some of this technology helping industry
- Drone pilots have become a career in 2020 – but even those functions can now be automated with more safely with better accuracy
- Students who tend to embrace this technology: not just the technically focused. As tools become easier to use, the appeal increases.

Messages for you:

- Students leaning towards design, engineering and creative fields will be using a version of this technology in their careers
- Don't worry about the names of the technology from today (its changing too fast anyway!)
- Don't worry about the jargon – again that's changing too
- MR is a nice catch-all term for now. Watch for XR (cross reality) as haptics become more affordable.

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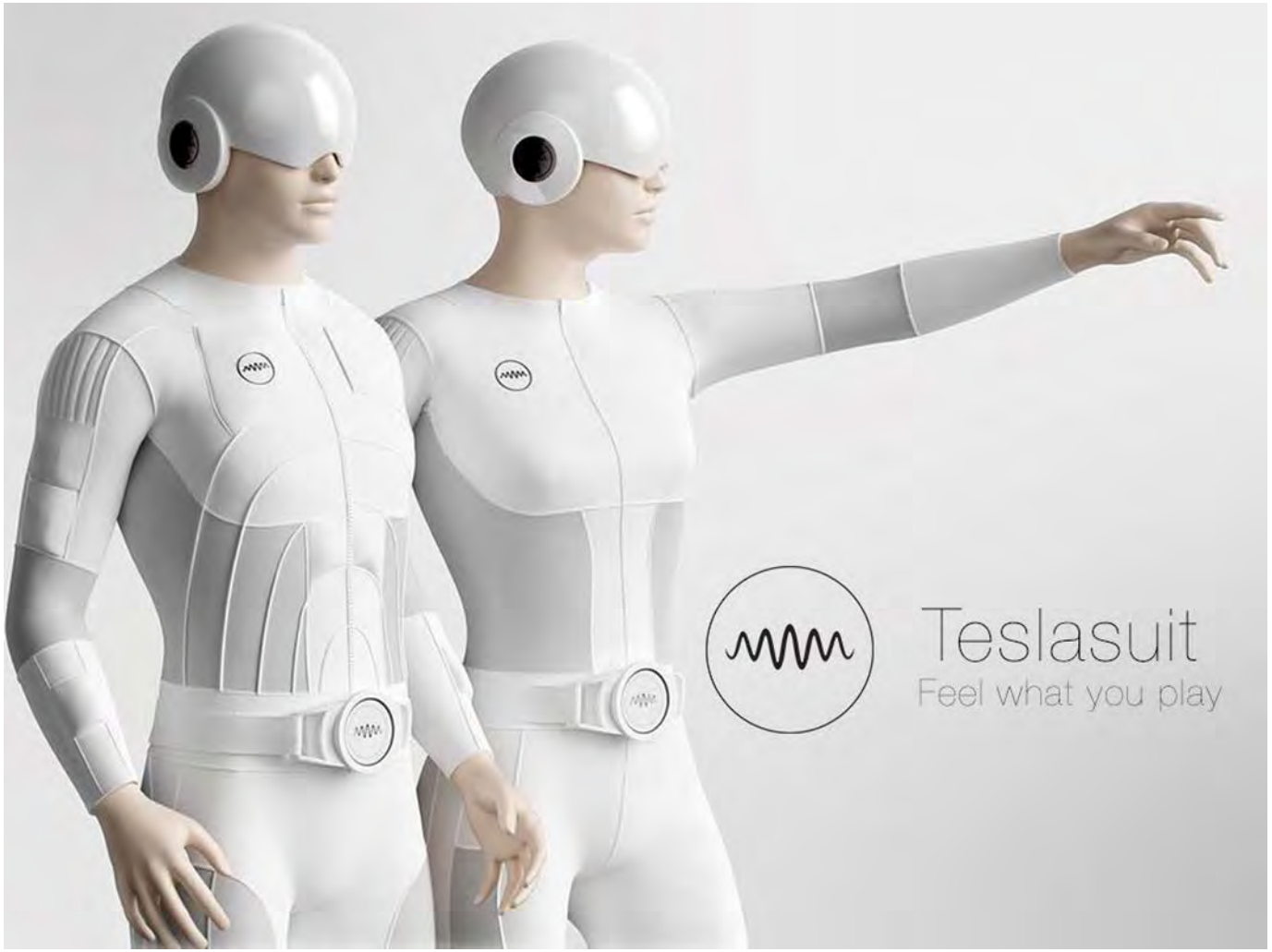
CAREER PRACTITIONERS ATTENDING THE 2030 SEMINAR



TECHNOLAB

PROF NICK HARITOS

Prof Nick Haritos – Civil Engineering

Developer of TechnoLab series

Experiential learning through ‘touch and feel’

TechnoLab has been used by students enrolled in ENG10003 Mechanics of Structures

PANEL

- CRISTOBAL SIERRA
- PROFESSOR NICK HARITOS
- DR. GREGORY QUINN
- JOEL MARTIN
- DR SHAN KUMAR,
  DIRECTOR AND PRINCIPAL
  ENGINEER, SKC ENGINEERS

TOUR

DIGITAL CONSTRUCTION LAB
WITH DR BEHZAD NEMATOLLAHI