2nd Visualisation in Science Conference

College of Medical, Veterinary and Life Sciences
Kelvin Hall Conference Suite

3rd December 2018
Welcome to the second College of Medical, Veterinary and Life Sciences Visualisation in Science Conference

Digital technologies play a significant role in our daily lives, and our students are increasingly turning to digital resources for educational purposes. In addition to this, many staff and students across the entire College of Medical, Veterinary and Life Sciences have been involved in many exciting ventures using digital technologies.

This is the second College wide conference entitled Visualisation in Science, which is running again due to its popularity and interest. The purpose of this conference is to bring together all members of staff and students. We want to showcase and highlight all the fantastic research, scholarship and technology enhanced learning and teaching activities that are occurring regardless of job role or subject studied.

It has been an amazing eye-opener to receive so many submissions of abstracts for this conference, from both staff and students alike. This day will truly highlight the great scope that we, as a College have, regarding digital technologies in education, healthcare and scientific research.

Digital research and applied technologies really are at the forefront of our College, and wider university activities. With the exciting changes across campus, including the new Learning and Teaching hub, we really are at a significant point in our university life. Today will showcase what all members of staff and students are currently investigating, designing and applying across the College. It enables us to see what we are all doing in the field of digital technologies applied to a variety of fields. We have an extensive programme of varied talks of truly exciting and innovative work using technology.

On behalf of the conference team, I hope you have a really enjoyable day, and thank you for all your interest, enthusiasm and contributions.

Dr Paul M. Rea
Senior Lecturer
Keynote Address

Professor Jo-Anne Murray

Professor of Educational Innovation
Assistant Vice-Principal (Digital Education)

“Digital education: fad or future?”

Professor Jo-Anne Murray will talk about the current and emerging trends in digital education, including massive open online courses, augmented/virtual/mixed reality, virtual learning environments, personalised learning and learning analytics, active learning and redesigned learning spaces, and artificial intelligence.
Conference Team

Conference Chair

Dr Paul M. Rea

Paul is a medically qualified clinical anatomist and is a Senior Lecturer and Licensed Teacher of Anatomy. He has an MSc (by research) in craniofacial anatomy/surgery, a PhD in neuroscience, the Diploma in Forensic Medical Science (DipFMS), and just finishing an MEd (Learning and Teaching in Higher Education), with his dissertation examining digital technologies in anatomy. He is an elected Fellow of the Royal Society for the encouragement of Arts, Manufactures and Commerce (FRSA), elected Fellow of the Royal Society of Biology (FRSB), Senior Fellow of the Higher Education Academy, professional member of the Institute of Medical Illustrators (MIMI) and a fully registered medical illustrator with the Academy for Healthcare Science.

Paul has published widely and presented at many national and international meetings, including invited talks. He sits on the Executive Editorial Committee for the Journal of Visual Communication in Medicine, is Associate Editor for the European Journal of Anatomy and reviews for 20 different journals/publishers.

He is the Public Engagement and Outreach lead for anatomy coordinating collaborative projects with the Glasgow Science Centre, NHS and RCPSG. Paul is also a STEM ambassador and has visited numerous schools to undertake outreach work.

His research involves a long-standing strategic partnership with the School of Simulation and Visualisation The Glasgow School of Art. This has led to multi-million pound investment in creating world leading 3D digital datasets to be used in undergraduate and postgraduate teaching to enhance learning and assessment. This successful collaboration resulted in the creation of the world’s first taught MSc Medical Visualisation and Human Anatomy combining anatomy and digital technologies. It is also accredited by the Institute of Medical Illustrators. This degree, now into its 7th year, has graduated almost 100 people, and created college-wide, industry, multi-institutional and NHS research linked projects for students. Paul is the Pathway Leader for this degree.
Dr Ziad Al-Ani

Dr Al-Ani was awarded his MSc in Prosthodontics from Manchester University in 1999. In 2004 he was awarded his doctorate from the same University; the title of his thesis was “Studies in Temporomandibular Disorders and Occlusion”. He was appointed by Manchester University as Clinical Teacher in Restorative Dentistry in 2004 as well as a Research coordinator for the TMD clinic.

In 2006, he obtained MFDS FROM THE Royal College of Surgeons, Edinburgh. In recognition of his teaching activities, he was awarded the status of Fellow of Higher Education Academy in 2010.

Dr Al-Ani was one of the two finalists in the “Teacher of the Year” (2006) as awarded by The Dental Defence Union. The award recognised excellence in dental education. He was again the Nominee for the 2007 and 2008 “Dentist Teacher of the year Award” by the Dental Defence Union after nominations made by undergraduate students at Manchester Dental School.

He was officially appointed as a Director of the IADR Prosthodontics Research Group in 2007. In the IADR meeting in Toronto 2008, he has been nominated again by Prosthodontics Research Group for the same position in 2010.

In 2008 he joined the editorial team of The Journal of Prosthodontics.

He conducted many research projects which led to several presentations at local and international meetings and publications.
I have been studying the cardiovascular system for over 30 years. My particular interest is in the autonomic (nerve-mediated) control of arteries and veins and, in particular, the interactions between the various cells of the vascular wall.

Recent work has focused on the role of fat which surrounds most of the blood vessels of the body. This perivascular fat is thought to contribute to the relationship between hypertension, obesity and diabetes.

As a course coordinator (since 2004) I have also become interested in the use of 3D animation for teaching physiology, pharmacology and autonomic neuroscience. My novel approach is to combine 3D microscopy with Pixar-style animation software.

The resulting animations are anatomically correct to within 0.1mm and are therefore not ‘artists impressions’ (unlike most physiology-based animations you will find on You-Tube). This interest has now developed into the use of Virtual Reality for teaching and research purposes.
Dr Aileen Linn

I am a University Lecturer for the Undergraduate Medical School. I have a keen interest in working in partnership with students to develop the curriculum to ensure that students acquire and are equipped with the digital skills and capabilities required to confidently work in an increasingly digital environment.

I have worked on a number of projects to utilise technology and introduce resources to develop and enhance student engagement and active participation in learning.

Recent projects I have been involved with include introducing recorded lectures to support the curriculum, working in partnership with students and Dr Rea to develop a series of Anatomy e-tutorials to support and enhance students self-directed learning and working in collaboration within students to develop a positive digital identity.
Professor Jo-Anne Murray

My background is in providing strategic leadership in developing and implementing online distance education programmes, as well as overseeing PGT programmes generally. I have run online programmes, online CPD courses and massive open online courses (MOOCs) as well as teaching on UG/PG on-campus programmes. I have experience in leading the delivery of novel teaching approaches in both UG and PG teaching, on-campus and on-line, including the development of a virtual campus in Second Life, digital feedback approaches and mobile apps to assist students with their learning.
Mrs Catherine Stalin

Kate Stalin has been a clinical veterinary neurologist at the Small Animal Hospital, University of Glasgow for 6 years following a period in private referral practice. As well as treating pets with neurological conditions she is also involved in teaching undergraduate veterinary students and delivering continued professional development courses to veterinary practitioners. She therefore has a keen interest in developing interactive and visually interesting teaching resources. Clinically, she has an interest in canine epilepsy and developing tools to help educate pet owners and improve their ability to care for their animals with this often difficult chronic disease.
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0845 – 0915  REGISTRATION

0915 – 0945  INTRODUCTION

   Key Note Speaker – Professor Jo-Anne Murray  
   Digital Education: Fad Or Future?

SESSION 1  
INNOVATIVE EDUCATIONAL RESOURCES  
Chair: Mrs Catherine Stalin

0945 – 1000  Eilidh Ferguson  
Digitising Juvenile Crania: The Creation Of A 3D Anatomy Learning Tool

1000 – 1015  Valentina Busin  
Lung Inspector: 3D Modelling Of Sheep Lung For Veterinary Teaching

1015 – 1030  Emma Bailey  
Visualisation Of Neurohistology Slides In Their Original 3D Anatomical Context – A Tool For Improving Student Comprehension?

1030 – 1045  Annabel Slater  
It’s not Disney: Designing an Effective Educational Animation

1045 – 1115  COFFEE BREAK

SESSION 2  
LIGHTNING TALKS  
Chair: Dr Ziad Al-Ani

1115 – 1120  William Pollock  
The Use Of Social Media In Anatomical And Health Professionals Education: A Systematic Review

1120 – 1125  Katie Turnbull  
What Is The Role Of Ultrasound In Anatomy Learning?
1125 – 1130  Alakina Mann
Visualising The Anatomy Of Pleasure Through 3D Interactive Visualisation

1130 – 1135  Umaiyalini Uruthiralingam
The Effectiveness Of Augmented And Virtual Reality In Anatomical Education

1135 – 1140  Louise Bennett
Enhancing Rheumatology Public Engagement with New Technologies

1140 – 1145  Rachael Ballantyne
A Game Changer: The Use of Digital Technologies in the Management of Upper Limb Rehabilitation Following Stroke

VIRTUAL REALITY

1145 – 1200  Craig Daly
Development of Virtual Reality and 3D Printable Resources for Teaching Life Sciences

1200 – 1215  Neil McDonnell
VR Teaching in MVLS: A Learning Data Revolution

1215 – 1230  Open Questions for morning speakers

1230 – 1400  LUNCH

SESSION 3
CLINICAL/PATIENT RELATED
Chair: Dr Craig Daly

1400 – 1415  Nathaniel Quail
Twine Open-Source Software as a Tool for Creating Serious Digital Games with Virtual Patient’s – Enhancing Undergraduate and Postgraduate Diabetes Education

1415 –1430  Amy Webster
The Co-Design of Hand Rehabilitation Exercises for Multiple Sclerosis using Leap Motion Hand Tracking System

1430 – 1445  Fraser Sneden
Magnetic Resonance Imaging to Assess Carotid-Brain Interactions in People with Stroke
1445 – 1500
Matthew Weldon
Using Interactive 3D Visualisations in Neuropsychiatric Education

1500 – 1515
Viveka Biswas

1515– 1545
COFFEE

SESSION 4
CREATION OF EDUCATIONAL MATERIALS
Chair: Dr Aileen Linn

1545 – 1600
Leah Marks
Student-Centred Online Teaching Resources

1600 – 1615
Orla McCorry
The Creation of an E-Tutorial to Support Learning Embryology

1615 – 1630
Michaela Pishia
Visualising Endocrine Anatomy – For Students by Students

1630 – 1645
Naomi Dunphy
Visualising Endocrine Signalling – For Students by Students

1645 – 1700
Michelle Clarkson
Making a MOOC

1700
CLOSE
Visualisation in Science Conference

2018

Abstracts
SESSION 1

INNOVATIVE EDUCATIONAL RESOURCES
Digitising Juvenile Crania: The Creation Of A 3D Anatomy Learning Tool

Eilidh Ferguson,
School of Life Sciences
Additional authors: Leyan Khayruddeen, Daniel Livingstone

Anatomical specimens can be digitised and incorporated into interactive learning applications using modern visualisation techniques. This allows for the preservation and safekeeping of original historical specimens, while at the same time facilitating much wider access to these materials. This is particularly important within a higher education setting, as interactive applications and 3D models are believed to aid student understanding of complex 3D anatomical structures in a way not conferred by the 2D textbook images of traditional teaching.

Historical specimens from the University of Glasgow’s Anatomy Museum were digitised for the creation of a 3D learning tool to help students better understand the growth and development of the juvenile cranium. The aim of this research was to assess whether interactive 3D applications could provide a useful tool for teaching Anatomy-based subjects, particularly more complex, non-static, subjects such as growth and development.

A group of 12 anatomy students trialled the application and overall feedback received was positive. The majority of participants strongly agreed that the app helped them learn more about the human skull and they positively rated the use of 3D models in understanding the position and structure of anatomical features on the juvenile cranium. Further research is required to assess if this type of interactive application provides an advantage in understanding cranial anatomy over traditional teaching methods.
Lung Inspector: 3D Modelling Of Sheep Lung For Veterinary Teaching

Valentina Busin
School of Veterinary Medicine
Additional authors: Jessica Simmonds, Noelia Yusta

Veterinary teaching currently relies on practical demonstrations, tutorials and lectures, which means opportunities for self-study and distant learning can be limited. There is also a growing pressure to ‘reduce, refine and replace’ the use of animals for teaching purposes.

Many advances in veterinary teaching have followed the examples set by human counterparts, with literature supporting the success of mobile applications and simulations as teaching and learning aids in the human medical curriculum.

This project used an extensive and well archived existing bank of images from the School of Veterinary Medicine Post Mortem facility alongside CT scans, 3D modelling and game engine software to create anatomically accurate models of healthy and diseased sheep lungs. These have been imported into an interactive app to allow veterinary students to use the models as an adjunct to traditional pathology and public health teaching.

The app developed has been tested by a group of final year veterinary students, showing that the face validity and user experience were of sufficient quality. Further testing is in progress to assess the accuracy of the modelled ovine lungs to real specimens (healthy and diseased sheep lungs), to determine whether the models are accurate enough to be used for learning and teaching and to assess the learning outcomes from including this resource in the students’ curriculum.
Visualisation Of Neurohistology Slides In Their Original 3D Anatomical Context – A Tool For Improving Student Comprehension?

Emma Bailey
School of Life Sciences
Additional authors: Jennifer Gillespie, Juman Hamza, Jessica Moran

Neuroanatomy is a complex subject and students often struggle to bridge the contextual gap when trying to mentally place 2D histology images back into the 3D physical region of the brainstem and/or spinal cord the slide came from. Teaching in this area often uses textbooks, 2D diagrams and 2D histology slides and students only have brief interactions with the 3D dissected brainstem and spinal cord – usually on a different day (if at all).

Despite advances in other anatomy fields, histology generally remains behind when it comes to interactive 3D and virtual/augmented reality applications.

Neurohistology is an even smaller niche and 3D digital representation here is lacking. We therefore developed novel 3D applications for the education of undergraduate medical/science students intended for use in Neurohistology labs by teaching staff and as a learning and revision aid by students. The interactive 3D programmes developed using Unity games engine software incorporate images of the actual slide sets students use into 3D models of the brainstem and spinal cord. In addition to providing more 3D contextual information in the lab sessions the resources also offer the same content accessible at home allowing students to learn at their own pace and revisit material.

Our ultimate aim is to evaluate the new resources using learner analytics and student feedback and assess whether creating digital visualization programs tailored to Neurohistology can improve student comprehension in this area of anatomy teaching.
It’s not Disney: Designing an Effective Educational Animation

Annabel Slater
Glasgow School of Art and School of Life Sciences

Using animation to educate can sound like a no-brainer. Animation can be dynamic, visual, and multidimensional. But while 3D animation is engaging, does this equate to educational? The medium presents its own set of considerations for both the designer and for the intended audience. In my talk I discuss the benefits and limitations of producing a 3D animation to teach about the anatomy of knife injuries. I describe the process of constructing a 3D animation using 3Ds Max and in consultation with surgeons involved in work for the charity Medics Against Violence. I present the results of testing on a target audience of teenagers from communities at risk of knife crime offences. Results show cognitive overload of the viewer is an essential consideration in designing an educational animation. Effective design includes balancing 2D and 3D components, supporting visual elements with audio, and presenting suitable temporal pacing. Showing processes through animation can also give rise to expectations of narrative and story, including elements such as protagonists, plot, and resolution, which should be carefully considered for inclusion. Finally, I discuss the ways in which 3D animation can be used to complement existing media or as a standalone resource broadly within education, and specifically in education for social change.
SESSION 2

LIGHTNING TALKS
The Use Of Social Media In Anatomical And Health Professionals Education: A Systematic Review

William Pollock
School of Life Sciences
Additional authors: Paul M. Rea

Social media is used by many students at universities, with sites such as Facebook, Twitter and YouTube being the most popular. Initially these social networking sites were mainly used for recreational purposes, but have been increasingly used in the educational setting.

Educators in the anatomical sciences have utilised many forms of technology to supplement and enhance a student’s learning. However, the true effectiveness of using social media in anatomical and health professions education has not been fully explored. It has been hypothesised that social media in anatomical education could enhance learner engagement, raise morale, relieve anxieties and improve communication. However, the evidence is limited. Therefore, the purpose of this study is to undertake a comprehensive literature review to examine the effectiveness, or otherwise, of these tools in an anatomical curriculum.

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMSA) method for reviewing the literature. By using specific key words and using Google Scholar, PubMed, ERIC and OVID, we performed an extensive literature search to examine the use of social media in anatomical education. This is part of an on-going intercalated research degree project and we will present the provisional results from this. It appears that the body of evidence in the support of using social media in anatomical education is indeed limited. However, we have found that it has been used with great effectiveness in other fields, and we shall suggest it could be adopted for those involved in anatomical education and training in the future.
What Is The Role Of Ultrasound In Anatomy Learning?

Katie Turnbull
School of Medicine, Dentistry & Nursing
Additional authors: Ourania Varsou

Ultrasound is a well-established medical imaging technique that has been routinely used in clinical practice for many years. Point-of-care ultrasound (POCUS) has become the norm with bedside and pre-hospital scanning performed by non-specialists. This is partly due to ultrasound providing real time non-invasive visualisation of anatomical structures without exposing patients to any radiation.

Ultrasound aids the diagnostic process and enables healthcare providers to perform safely invasive procedures such as central venous catheterisation and chest drain insertion. Mastering the skill of ultrasound scanning along with becoming familiar with its knobology and proficient at image interpretation requires training and takes time.

Early exposure to hands-on scanning and understanding of what constitutes ‘normal’ anatomy could be one way of allowing budding healthcare providers to enhance such skills. Research has shown that integration of ultrasound into the medical curriculum allows students to improve their knowledge. In addition to this, ultrasound teaching has helped them feel more confident about anatomy learning and students have been found to be more motivated to improve their knowledge. Student feedback has highlighted that they would like more training incorporated into the curriculum with ultrasound regarded as a valuable tool which will help them in clinical practice.

Embedding of ultrasound teaching into a curriculum requires availability of resources, that are not only limited to the machines, appropriate infrastructure including trained staff and consideration of incidental findings. More research is required into this area to better delineate the role of ultrasound in anatomy learning.
Visualising The Anatomy Of Pleasure Through 3D Interactive Visualisation

Alakina Mann
Founder, anatomyofpleasure.org
Additional authors: Kirstin Mitchell, Daisy Abbott, Paul M. Rea

The topic of sexual pleasure sits under a taboo backdating centuries, and persists today. One evidence of this taboo is seen in the discussion of female sexual pleasure and genitalia, in particular the clitoris. The clitoris’s only function is pleasure, but is rarely described in terms of this unique function and is a central organ to female sexuality. To accurately represent the anatomy of the clitoris, at least two planes of view are needed, representation as a whole, continuous organ, consistent naming conventions and contextual descriptions regarding sexual pleasure. Often these requirements are not met, not only in the clitoris but also the surrounding pleasurable anatomy.

These inconsistencies in medical literature, inform public educational materials, leaving a need for more relatable, reliable educational materials.

The visualisation project undertaken included a website with interactive 3D models of anatomy, including a detailed 3D clitoris, interactive galleries of 2D images, photographs of vulvas, paired with relevant text. This was then evaluated on how effective it was at educating the general public.

Additionally, research was undertaken around accurate imaging of clitoral and surrounding anatomy, including a study of the Journals of Helen O’Connell 1889, 2005 and 2008, as well sexology, sex therapy and pleasure to understand the experiential and psychological nature of pleasure, to appropriately contextualise this anatomy. This pairing of knowledge was essential to provide the missing description and insight in order to appropriately describe the clitoris and it surrounding anatomy.

Female sexual pleasure is undervalued, under researched and under discussed topic, but evidence shows there is an appetite for more information.
The Effectiveness Of Augmented And Virtual Reality In Anatomical Education

Umaiyalini Uruthiralingam
School of Life Sciences
Additional authors: Paul M. Rea

Recently the advancement of technology provides new ways to learn anatomy. There are a variety of ways to aid anatomical learning but this study will focus on augmented reality (AR) and virtual reality (VR). In this study, a systematic review was conducted to present a critical analysis of AR and VR in anatomical education to conclude which is better. The first keywords inserted into PubMed were “augmented reality and teaching anatomy” which provided 44 articles. This review assessed and included literature on AR and VR used to teach anatomy for undergraduates and postgraduates (residents). The articles that were excluded were systematic reviews, literature reviews, review articles, news articles, articles German and Hungarian and any literature that presents how a virtual model was created without the evidence of students testing it. The second keywords inserted into PubMed were “virtual reality and teaching anatomy” which provided 299 articles (54 articles were used). The inclusion and exclusion criteria for VR were same as AR however duplicates were excluded. This resulted in 17 AR articles remaining and were categorised into one quantitative, eight qualitative and nine for both quantitative and qualitative. The 17 VR articles were categorised into nine quantitative, four qualitative and four for both quantitative and qualitative. There are more quantitative studies for VR than AR and there are more qualitative studies for AR than VR. These results are provisional and full results will be revealed at the conference. Overall, this systemic review highlights the recent advances of both AR and VR.
Enhancing Rheumatology Public Engagement with New Technologies

Louise Bennett
Institute of Infection, Immunity and Inflammation
Additional authors: Timea Kosa, Alexa Kuismanen, Louise A Bennett, Brian Loranger, Matthieu Poyade, Daniel Livingstone, Carl S Goodyear

Rheumatoid arthritis (RA) places a heavy burden on society and has severe consequences for the individuals affected. The early diagnosis and implementation of treatment significantly increase the chance of achieving long-term sustained remission. Facilitating early diagnosis requires the general public to be aware of the early warning signs of RA, which leads to challenges in creating interesting and innovative ways of educating the public, enhancing long-term learning. Both virtual reality (VR) and augmented reality (AR) are potential tools to enhance learning and have already been successfully used as new and exciting modes of communication between the experts and the public.

This study aimed to design interactive VR and AR applications for the education of lay individuals. The VR intervention was an animated 3D model of the knee joint with a voice explanation describing, disease pathology and degradation of the joint.

The AR modality consisted of a set of printed posters about rheumatic disease, enhanced by an AR application. Results from testing show that both the VR and AR applications were easy to use, engaging and enjoyable. For VR the perceived educational value was high, with a significant mean increase of RA knowledge (p <0.05). The evaluated for the AR was conducted using a 5-point Likert scale showed that the RA intervention was also successful in raising awareness of RA.

Overall the applications were well received, and indicate that these tools could be used to enhance public engagement moving forward.
A Game Changer: The Use of Digital Technologies in the Management of Upper Limb Rehabilitation Following Stroke

Rachael Ballantyne
School of Life Sciences
Additional authors: Paul M. Rea

Hemiparesis is a symptom of residual weakness in half of the body, including the upper extremity, which affects the majority of post-stroke survivors. Current treatment interventions aim to improve motor functions, however due to increasing NHS pressure, reduction of physiotherapists and an increasing incidence of stroke with an aging population there is an urgent need for new approaches to be developed. Upper limb function is essential for daily life and reduction in movements can lead to a decline in quality of life and independence. Fortunately, a range of digital technologies have led to inclusion of new rehabilitation techniques including but not limited to robotics, leap motion, motion-capture and virtual reality.

To gain further insight, a meta-analysis literature search was carried out using the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) method. Articles were then categorized and pooled into the following groups; pro/anti/neutral for the use of digital technology. The majority of the inclusive literature is supportive of the use of digital technologies in the rehabilitation of upper extremity following stroke. Additionally, most literature is rationalised by quantitative and qualitative findings. We shall present the findings of this study.

Prevailing developments on use of these technologies highlights an evolutionary and revolutionary step into utilising digital technologies for clinical benefits including rehabilitation purposes. The influx of more commercialised and accessible devices could alter stroke recovery further.
VIRTUAL REALITY
Development of Virtual Reality and 3D Printable Resources for Teaching Life Sciences

Craig Daly
School of Life Sciences

The growth in online content delivery and eLearning is driving a need for the creation of new digital material. Relatively cheap (home based) virtual reality (VR) viewers and 3D printers make it feasible to provide suitable 3D content for undergraduate students.

However, creating this content is challenging and requires the use of complex software packages. The author has developed a workflow enabling incorporation of 3D image volumes from Confocal Laser Scanning Microscopy (CLSM) within high-end animation software (Daly et al., 2014). Recent developments have extended the workflow to include VR and 3D-printing. In addition to creating 3D animations of aspects of vascular biology, the author has also introduced the use of Google Cardboard viewers and 3D printed receptors into undergraduate (Level 3) life science classes. Within the next academic year, it is expected that VR-enhanced teaching (locally) will incorporate fully immersive HTC-VIVE equipment running in a specially designed teaching space.

The presentation will document the workflow involved in preparing a 3D CLSM data set for animation. The animations can be further enhanced by advanced rendering techniques and incorporating 3D protein structures from the Protein Data Bank (PDB). These proteins can also be processed for 3D printing and presented for VR viewing via Sketchfab. Acknowledgement: British Pharmacological Society funded the 3D printing project.
VR Teaching in MVLS: A Learning Data Revolution

Neil McDonnell
Humanities, Philosophy

Project Mobius is an Innovate UK-funded joint project between the University of Glasgow, and Sublime Digital. Mobius will build on the extraordinary possibilities afforded by using VR in teaching, and along the way will provide an unprecedented depth and richess of data about how learners learn.

Mobius will be built around ten winning ideas from our 2017 VR Teaching Competition, and four of those winners came from within MVLS. In this short talk, I will briefly outline these winning ideas, and give some insight into how we plan to transform teaching in the College through them, but my main focus will be about the extraordinary potential of the learning data we will be able to capture. Immersive technology allows us to capture minutely fine-grained movement and attention data from users, passively. It also allows us to capture task-specific information about speed, accuracy, and improvement over time. It is an unprecedented opportunity to learn about how our students, and then learners more generally, learn.

Mobius will build two teaching labs in the University, and build ten initial apps to start the VR teaching enterprise, and initiate the data stream. With MVLS apps in such a prominent position in that tranche, I will use this talk as an opportunity to showcase the work, and draw in interested parties to the discussion about what apps we build next, and what we can do with all this data.
SESSION 3

CLINICAL/PATIENT RELATED
Twine Open-Source Software as a Tool for Creating Serious Digital Games with Virtual Patient’s
- Enhancing Undergraduate and Postgraduate Diabetes Education

Nathaniel Quail
School of Medicine
Additional authors: Mary Oje, Aileen Linn, Paul M. Rea, Daniel Livingstone, Jane Nally, James Boyle

Background
Serious digital gaming, whereby clinical interactions are virtually played through by the user, is an evolving way of engaging healthcare professionals to learn in a safe environment. Using Twine open-source software, we created and piloted three games aimed at teaching undergraduates and postgraduates about diabetes acute care, which is an area of low confidence among junior doctors.

Method
Three digital games with virtual patients were developed using Twine open-source software, Wacom Intuuous Pro, Camtasia Studio, Autodesk SketchBook, and simulated patient videos. Scenarios are played from presentation to resolution, with integrated chalk-talk explanations of important concepts. The scenarios reinforce themes of multi-professional care, multi-morbidity, poly-pharmacy, and safe insulin prescribing. A prototype was piloted by a small cohort of senior medical students and junior doctors and evaluated using levels one and two of the Kirkpatrick Model.

Results
Initial pilots with undergraduates and postgraduates have demonstrated high levels of engagement, acceptability, and overall satisfaction, as well as significant improvements in confidence and knowledge (p<0.05). Building on these pilot studies will involve testing the utility of our game in a larger cohort, as well as exploring cognitive load in individual and group-based settings.

Conclusions
Our pilot testing suggests that this novel pedagogical approach is acceptable, encourages user engagement, and increases levels of confidence and knowledge in acute diabetes care. Creating a Twine blueprint for virtual patient scenarios may be a way of easily integrating them into the undergraduate and postgraduate medical curricula to create safe, engaging, and realistic learning opportunities.
The Co-Design of Hand Rehabilitation Exercises for Multiple Sclerosis using Leap Motion Hand Tracking System

Amy Webster
School of Life Sciences
Additional authors: Matthieu Poyade, Paul M. Rea, Lorna Paul

Multiple sclerosis (MS) often affects motor function and can have a devastating impact on daily living. Rehabilitation is one of the main management strategies to regain and maintain function but traditional methods in MS rehabilitation are often inaccessible, expensive and non-motivational. Virtual environments are increasing in popularity within rehabilitation research, but are rare regarding the upper limb in MS. Leap Motion (LM), a hand motion tracker, has demonstrated success in stroke research but has yet to be investigated within MS. Using a co-design method, five participants with MS discussed in a focus group their hand mobility issues, opinions of this technology and motivational factors. These results were incorporated into the game design with four upper limb rehabilitation exercises created using the gaming engine Unity, offering different hand activities using LM. Three participants returned to evaluate the developed exercises and overall, participants found them engaging, immersive and a desirable approach to rehabilitation. Participant feedback underlined the usefulness of co-creation, especially in accommodating the range of motivators and user preferences. However, the study highlighted problems with LM often losing tracking of hand movements when interacting with the virtual environment.

Participants stated they would use this approach at home if there were definite rehabilitation benefits and related more to visualising which muscle groups they were aiming to improve, which also could be incorporated into a physiotherapy regime for potential continued use. Future research should focus further refinement of the LM activities and on the long-term adherence and effectiveness of this technique.
Magnetic Resonance Imaging to Assess Carotid-Brain Interactions in People with Stroke

Fraser Sneden
Institute of Cardiovascular and Medical Sciences
Additional authors: Graeme Houston, David Alexander Dickie, Jesse Dawson

INTRODUCTION: Magnetic resonance imaging (MRI) is often used to help determine whether stroke has occurred. MRI is also routinely used in stroke patients to identify carotid artery stenosis and plaque formation. However, manual assessment of carotids can prove time-consuming and is open to inter-rater differences. Carotid stenosis has been found to significantly impair cognition, and stenosis is associated with increased white matter lesion load, but there are conflicting accounts on the size and direction of these associations.

METHODS: This project aims to develop automated tools for assessment of carotid morphology on MRI including stenosis and plaque characteristics. Firstly, we will systematically review existing methods for assessing carotid morphology. Secondly, we will evaluate relationships between carotid morphology and measures of brain structure and cognitive function. Thirdly, we will assess if allopurinol has an effect on carotid morphology as part of the XILO-FIST trial.

RESULTS: We found N=3882 articles that included assessment of brain, carotid, and/or cognition in stroke. So far N=168 stroke patients have had carotid MRI, with N=115 having had 2-year follow-up imaging. Segmentation of the carotid arteries using a semi-automated procedure that we developed is shown in the figure.

DISCUSSION: This study may provide an automated carotid artery assessment tool that may ultimately be used in clinical practice. Outputs from this tool may be used to predict structural brain damage and/or cognitive impairment should associations with carotid artery morphology be found. Finally, we will determine whether allopurinol limits pathological changes in the carotid arteries after stroke.
Using Interactive 3D Visualisations in Neuropsychiatric Education

Matthew Weldon
School of Life Sciences
Additional authors: Matthieu Poyade, Julie Langan Martin, Laura Sharp, Daniel Martin

BACKGROUND: Obsessive compulsive disorder (OCD) has a global prevalence of 2-3%. OCD can have an enormous impact on those living with the disorder. Over 50% of OCD patients experience suicidal ideation, and a significant number attempt suicide. OCD patients must therefore receive the best possible treatment. A greater understanding of the underlying pathophysiology of neuropsychiatric disorders can lead to improved treatment by clinicians. However, many medical students and clinicians experience “neurophobia”, an aversion to subjects concerning the nervous system. Research shows that using interactive 3D models can improve understanding of neural circuitry, but the use of such models in OCD education has not yet been assessed.

AIMS: To determine if an interactive 3D model of OCD pathophysiology and its treatment could be used as an educational tool for postgraduate students.

METHODS: 3D models of the cortico-striato-thalamo-cortical (CSTC) circuit were produced using 3DSMax and built into an application for Android tablet devices using Unity. The interactive models appeared alongside information from the scientific literature. The app was evaluated with 5 postgraduate students at the University of Glasgow.

RESULTS: Participants found the app both easy to use and useful in helping them understand OCD. The app also led to an increased knowledge of OCD among participants, as assessed through a pre-app and post-app quiz.

CONCLUSION: This study suggests that interactive 3D visualisations can improve neuropsychiatry education. Moving forward, efforts to construct similar apps should be made, to ensure patients experiencing neuropsychiatric disorders receive the best possible care.

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Rationale
CT perfusion (CTP) scanning enables visualisation of ischaemic brain tissue in acute stroke and aids clinical decision making. Automated software for scan processing may be less accurate than manual methods. We aimed to compare automatic and manual volume calculations for ischaemic stroke using the CTP processing software MIStar in patients who were recruited to research studies within 6 hours of stroke onset.

Methods
We performed a retrospective analysis of data from the Stroke Research Imaging database that were collected prospectively from Jan 1 2012 and Sept 7 2013. The volumes of hypoperfused brain tissue were divided into tissue at risk (penumbra, defined as delay time [DT]>3 seconds)) and tissue already irreversibly damaged (core, DT>3 secs and relative cerebral blood flow [CBF]<30% or <20%) and were calculated first by using the MIStar automatic values and then manually.

Results
A total of 97 CTP scans were analysed. For penumbra calculation, the mean difference (automatic minus manual) was 19ml with 95% limits of agreement 169 to 206. For core calculation at CBF<30% the mean difference was 3ml with 95% limits of agreement -42 to 48. For core calculation at CBF<20%, the mean difference was 3ml with 95% limits of agreement -40 to 46.

Conclusion
There is no systematic difference between automatic and manual calculation of stroke volume using the MIStar program. Attention must be paid to the quality of the CT perfusion images; extreme outliers most likely represent problems with the scanning process. In these few instances, manual calculation is preferable.
SESSION 4

CREATION OF EDUCATIONAL MATERIALS
Student-Centred Online Teaching Resources

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Both MOOCs and e-tutorials are powerful examples of the use of visualisation in teaching and learning. Many studies have demonstrated their potential in biomedical education in a variety of contexts.

However, there may remain a gap between what we, as educators, produce, and the resultant learner engagement with the resource. Mounting evidence suggests that if learners are invested in developing content, higher levels of both engagement and achievement may result. This is of particular interest within the Medical School – with prescribed learning outcomes accounting for a percentage of the curriculum, it is vital that areas allowing ‘student choice are utilized as effectively as possible.

Therefore in an attempt to increase student engagement we used a co-creation approach in the context of a 5 week SSC block within the MBChB programme. Small groups of students designed and produced visual teaching resources (MOOCs and e-tutorials) and reflected on their experiences as part of the course assessment.

In this session we will discuss the approaches used in two separate SSCs, and showcase the outcomes. We suggest that involving learners in the production of visual material has positive outcomes on both engagement and learning.
The Creation of an E-Tutorial to Support Learning Embryology

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Embryology is a complex subject that many students struggle to understand. With the advances of digital technologies, we sought to create a fully interactive e-learning resource to facilitate learning in this complex field. Therefore, the aim of this project was to create a digital resource which was created by a student, for students.

We based this e-tutorial on the embryology curriculum from the Level 3 Honours BSc degree at the University of Glasgow. We ensured all aims and objectives were incorporated into the tutorial. By using Articulate 360, we created an e-tutorial which enabled the user to explore weeks 1 – 4 of development. Novel images and cartoons were created by the author and incorporated into the tutorial. This meant that there were no copyright issues from using materials from other sources. Images were designed and created using Paint Tool Sai.

A simple interactive format was created with text related to each week of development. This linked to the intended learning outcomes, but ensured a unique presentation of resources to enhance learning. There was a fully interactive quiz at the end of each of the weeks, including hints and tips, with links back to the relevant part of the tutorial.

This e-tutorial has now been adopted into the local curriculum and has been requested by several Scottish universities and the north of England to embed into their curricula. This study has shown how a co-creation of educational resources can result in the production of a novel and interactive learning resource.
Visualising Endocrine Anatomy – For Students by Students

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Endocrine anatomy is a topic which is difficult to conceptualise for many students. As part of a Student Selected Component, we created an interactive e-tutorial on the general anatomy and histology of the endocrine organs, mapped to the ILOs of the MBChB at the University of Glasgow. The e-tutorial creation was student-led, in order to ensure that it would be targeting the needs of our students at this stage of their medical education. The e-tutorial was designed to contain as much interactivity as possible, in order to maximise student engagement with the e-tutorial and learning.

After reviewing the MBChB ILOs related to the anatomy of endocrine organs, we listed areas of particular difficulty, then simplified and organised the information. We incorporated interactivity in the form of interactive image colouring and labelling, quizzes and personalised alternate pathways. Once built, the e-tutorial was content checked by experts, its usability tested using concurrent think aloud alpha testing, and the feedback received used to make the final draft of the tutorial.

We will present a pilot evaluation of the e-tutorial, during the revision period before the end of year exams. Six students participated in the online evaluation, and the results were overwhelmingly positive. In particular, students noted that the tutorial allowed them to engage with the material using colours and images and that it provided a different approach to the topic. They also noted that it was easy to navigate, and highlighted the inclusion of interactive visual diagrams as being particularly helpful for their learning.
Visualising Endocrine Signalling – For Students by Students

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E-learning is an area of learning currently under-utilized by the medical school, but it is growing in use and has become the focus of a Student Selected Component (SSC).

This SSC seeks to support students in the creation of e-learning resources which can then be used by their peers to further their knowledge base. The students used Articulate Storyline 2 to create an e-tutorial on endocrine signaling, a topic which students often find difficult to conceptualise. The e-tutorial was specifically mapped to learning outcomes from the MBChB2 endocrinology block. The aim of the e-tutorial was to improve their knowledge and understanding of endocrinology signaling, and we felt that keeping the e-tutorial as visual as possible would help keep the students engaged. In particular, as endocrinology signaling is a large topic, it was felt that breaking the pathways down into smaller, more visual sections would be beneficial. The ability to focus on small sections of a large picture was made possible by the interactive functionalities of the software.

Visualisation tools used included animated 3D images, hovering over words to get more information, interactive buttons and animated signaling pathways.

We then employed concurrent think aloud alpha testing to assess the usability of the e-tutorial, and the feedback received was used to create the final version. We will present some of the visual functionalities utilized in our e-tutorial, and will discuss future strategies to improve visualization of endocrine signaling in the MBChB curriculum.
Making a MOOC

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Introduction
The aim of this MOOC (Massive Open Online Course) was to increase the awareness of the MSc in Critical Care at the University of Glasgow. It was developed in partnership with Futurelearn, the Digital Education Team in the College of Medicine, Veterinary and Life Sciences at the University of Glasgow, and staff from the Intensive Care Unit at the Queen Elizabeth University Hospital. This presentation will focus on the development and delivery of the 3 week MOOC ‘An Introduction to Critical Care Medicine’.

Methods
Stage 1: Development
The first step was to create a MOOC Framework using a Realtime Board. This allowed us to visualise the content of the MOOC and ensure that the types of educational materials were varied and achieved the intended learning outcomes. Once the framework was confirmed for each week the task of developing the materials was set. These included articles, videos, quizzes and discussion boards. The course was then submitted to FutureLearn for quality assurance.

Stage 2: Running the MOOC
A plan for monitoring the discussion boards was made to identify any issues and answer any questions the participants had. It also allowed us to facilitate the peer- peer learning on the platform.

Evaluation
The next intake for the MSC Critical Care will take place next Autumn, when we will be able to evaluate the efficacy of the MOOC in raising awareness of this course. Feedback from the participants from each run will be valuable in the continued improvement of this MOOC.